

SEVENTH EDITION

The Human Impact on the Natural Environment

past, present and future

Andrew Goudie



 WILEY-BLACKWELL

The Human Impact

ON THE NATURAL
ENVIRONMENT

Andrew S. Goudie

St Cross College
Oxford

The Human Impact

ON THE NATURAL
ENVIRONMENT

Past, Present and Future

Seventh edition

 **WILEY-BLACKWELL**

A John Wiley & Sons, Ltd., Publication

This edition first published 2013; © 1981, 1986, 1990, 1993, 2000, 2006 by Andrew Goudie, © 2013 by John Wiley & Sons, Ltd

Wiley-Blackwell is an imprint of John Wiley & Sons, formed by the merger of Wiley's global Scientific, Technical and Medical business with Blackwell Publishing.

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

Goudie, Andrew.

The human impact on the natural environment : past, present and future / Andrew S. Goudie. – Seventh edition.

pages cm

Includes bibliographical references and index.

ISBN 978-1-118-57657-1 (cloth) – ISBN 978-1-118-57658-8 (pbk.) 1. Nature–Effect of human beings on. I. Title.

GF75.G68 2013

304.2–dc23

2012047946

A catalogue record for this book is available from the British Library.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Cover Image: Rice paddy in Longsheng, China. © iStockphoto.com/Rob Broek
Cover Design by Steve Thompson

Set in 10/13pt Palatino by Toppan Best-set Premedia Limited

CONTENTS

PREFACE TO THE SEVENTH EDITION	xi
ABOUT THE COMPANION WEBSITE	xii
PART I: THE PAST AND PRESENT	1
1 INTRODUCTION	3
Chapter Overview	3
The development of ideas	3
The development of human population and stages of cultural development	7
Hunting and gathering	11
Humans as cultivators, keepers and metal workers	13
Modern industrial and urban civilizations	20
Points for review	25
Guide to reading	25
2 THE HUMAN IMPACT ON VEGETATION	26
Chapter Overview	26
Introduction	26
The use of fire	27
Fires: natural and anthropogenic	29
Some consequences of fire suppression	30
Some effects of fire on vegetation	32

The role of grazing	32
Deforestation	34
Secondary rain forest	42
The human role in the creation and maintenance of savanna	43
The spread of desert vegetation on desert margins	46
The maquis of the mediterranean lands	51
The prairies and other mid-latitude and high-altitude grasslands	51
Post-glacial vegetational change in Britain and Europe	53
Lowland heaths	55
Introduction, invasion and explosion	56
Air pollution and its effects on plants	61
Forest decline	63
Miscellaneous causes of plant decline	65
The change in genetic and species diversity	66
Conclusion: threats to plant life	67
Points for review	68
Guide to reading	69
3 HUMAN INFLUENCE ON ANIMALS	70
Chapter Overview	70
Domestication of animals	71
Dispersal and invasions of animals	71
Human influence on the expansion of animal populations	76
Causes of animal contractions and decline: pollution	80
Habitat change and animal decline	83
Other causes of animal decline	86
Animal extinctions in prehistoric times	90
Modern-day extinctions	94
Points for review	101
Guide to reading	102
4 THE HUMAN IMPACT ON THE SOIL	103
Chapter Overview	103
Introduction	103
Salinity: natural sources	104
Human agency and increased salinity	105
Irrigation salinity	105
Dryland salinity	107
Urban salinity	108
Interbasin water transfers	108
Coastal zone salinity	109
Consequences of salinity	110
Reclamation of salt-affected lands	113
Lateritization	113
Accelerated podzolization and acidification	114
Some anthrosols resulting from agriculture and urbanization	115
Soil carbon	116
Soil structure alteration	116

Soil drainage and its impact	118
Soil fertilization	119
Fires and soil quality	120
Soil erosion: general considerations	120
Soil erosion associated with deforestation and agriculture	122
Accelerated wind erosion	126
Soil erosion produced by fire	128
Soil erosion associated with construction and urbanization	129
Soil conservation	130
Points for review	133
Guide to reading	133
5 THE HUMAN IMPACT ON THE WATERS	134
Chapter Overview	134
Introduction	134
Deliberate modification of rivers	135
Urbanization and its effects on river flow	143
Vegetation modification and its effect on river flow	145
The human impact on lake levels	148
Changes in groundwater conditions	150
Water pollution	155
Chemical pollution by agriculture and other activities	157
Deforestation and its effects on water quality	162
Thermal pollution	164
Pollution with suspended sediments	165
Marine pollution	165
Points for review	168
Guide to reading	168
6 HUMAN AGENCY IN GEOMORPHOLOGY	169
Chapter Overview	169
Introduction	169
Landforms produced by excavation	171
Landforms produced by construction and dumping	173
Sediment transport by rivers	174
Accelerated sedimentation	179
Ground subsidence	184
Arroyo trenching, gullies and peat hags	187
Accelerated weathering and the tufa decline	191
Accelerated mass movements	192
Deliberate modification of channels	195
Non-deliberate river-channel changes	195
Reactivation and stabilization of sand dunes	201
Accelerated coastal erosion	203
Changing rates of salt marsh accretion	209
The human impact on seismicity and volcanoes	210
Points for review	212
Guide to reading	212

7	THE HUMAN IMPACT ON CLIMATE AND THE ATMOSPHERE	213
	Chapter Overview	213
	World climates	213
	The greenhouse gases – carbon dioxide	214
	Other gases	216
	Ozone depletion and climate change	220
	Aerosols	220
	Global dimming and global brightening	222
	Vegetation and albedo change	222
	Forests, irrigation and climate	224
	The possible effects of water diversion schemes	225
	Lakes	226
	Urban climates	226
	Deliberate climatic modification	232
	Geoengineering	234
	Urban air pollution	234
	Air pollution: some further effects	238
	Stratospheric ozone depletion	243
	Conclusions	247
	Points for review	248
	Guide to reading	248
	PART II: THE FUTURE	249
8	THE FUTURE: INTRODUCTION	251
	Chapter Overview	251
	Introduction	251
	Changes in the biosphere	255
	Climate and geomorphology	261
	Points for review	265
	Guide to reading	265
9	THE FUTURE: COASTAL ENVIRONMENTS	266
	Chapter Overview	266
	Introduction	266
	The steric effect	268
	Anthropogenic contribution to sea-level change	268
	Reduction in lake-water volumes	268
	Water impoundment in reservoirs	268
	Groundwater mining	269
	Urbanization and runoff	269
	Deforestation and runoff	269
	Wetland losses	269
	Irrigation	269
	Synthesis	269
	Permafrost degradation	270
	Melting of glaciers and sea-level rise	270