

---

# **Geomorphology in Environmental Planning**

A dark silhouette of a city skyline is positioned at the bottom of the cover. It features several buildings of varying heights and shapes, including a prominent tall building on the right with two small windows near the top. The skyline is set against a dark, rounded horizon line.

**Edited by**

**J.M. HOOKE**

---

---

# Geomorphology in Environmental Planning

---

*Edited by*

**J. M. Hooke**

*Department of Geography  
Portsmouth Polytechnic*

John Wiley and Sons

CHICHESTER · NEW YORK · BRISBANE · TORONTO · SINGAPORE

Copyright ©1988 by John Wiley & Sons Ltd.

Chapter 14 is ©Crown copyright 1988. Published by permission of the Controller of Her Majesty's Stationery Office.

All rights reserved.

No part of this book may be reproduced by any means, or transmitted, or translated into a machine language without the written permission of the publisher

***Library of Congress Cataloging in Publication Data:***

Geomorphology in environmental planning.

(Symposia series / British Geomorphological Research Group)

Papers presented at a symposium held at the Institute of British Geographers' Conference at Portsmouth in Jan. 1987.

I. Geomorphology—Congresses. I. Hooke, J. M. (Janet M.) II. Institute of British Geographers. Conference (1987 : Portsmouth, Hampshire) III. Series: Symposia series (British Geomorphological Research Group).  
GB400.2.G444 1988 551.4 88-5557  
ISBN 0 471 91988 8

***British Library Cataloguing in Publication Data:***

Geomorphology in environmental planning.

I. Geomorphology—For environmental planning  
I. Hooke, J. M. (Janet M.) II. Series  
551.4'02471

ISBN 0 471 91988 8

Phototypeset by Dobbie Typesetting Service, Plymouth, Devon  
Printed by The Bath Press, Bath, Avon

---

# Contents

---

- ix *Series Preface*  
xi *Preface*  
xiii *List of contributors*

## **Introduction**

- 3 1 Introduction: Frameworks for Interaction  
**J. M. HOOKE**

## **Rural Land Use and Soil Erosion**

- 19 2 Upland Land Use and Land Management—Policy and Research  
Aspects of the Effects on Water  
**M. D. NEWSON**  
33 3 Public Policy and Soil Erosion in Britain  
**J. BOARDMAN**  
51 4 Soil Erosion Control: Importance of Geomorphological Information  
**R. P. C. MORGAN and R. J. RICKSON**

## **Urban Land Use**

- 63 5 Urban Planning Policies for Physical Constraints and Environmental  
Change  
**I. DOUGLAS**  
87 6 Heavy Metal Contamination in Soils of Tyneside: a Geographically-  
based Assessment of Environmental Quality in an Urban Area  
**R. J. ASPINALL, M. G. MACKLIN and S. OPENSHAW**

## **Slope Management**

- 105 7 Slope Instability, Planning and Geomorphology in the United  
Kingdom  
**D. BRUNSDEN**  
121 8 A Geomorphological Approach to Limestone Quarry Restoration  
**P. GAGEN and J. GUNN**

**River Management**

- 145 9 Channelization, River Engineering and Geomorphology  
**A. BROOKES and K. J. GREGORY**
- 169 10 Urban River Pollution in the UK: the WRc River Basin Management Programme  
**R. W. CRABTREE**

**Coastal Management**

- 189 11 Geomorphology and Public Policy at the Coast  
**A. P. CARR**
- 211 12 Coastal Erosion and Flood Control: Changing Institutions, Policies and Research Needs  
**E. C. PENNING-ROWSELL, P. M. THOMPSON and D. J. PARKER**
- 231 13 Coastal Erosion, Protection and Planning in Relation to Public Policies—a Case Study from Donderry, South-east Cornwall  
**P. SIMS and L. TERNAN**

**Policy Formulation**

- 247 14 Geomorphological Information Needed for Environmental Policy Formulation  
**D. BROOK and B. R. MARKER**

**Conclusion**

- 263 15 Conclusion: the Way Ahead  
**J. M. HOOKE**

- 267 *Index*

---

# Series Preface

---

The British Geomorphological Research Group (BGRG) is a national multi-disciplinary Society whose object is 'the advancement of research and education in Geomorphology'. Today, the BGRG enjoys an international reputation and has a strong membership from both Britain and overseas. Indeed, the Group has been actively involved in stimulating the development of Geomorphology and Geomorphological societies in several countries. The BGRG was constituted in 1961 but its beginnings lie in a meeting held in Sheffield under the chairmanship of Professor D. L. Linton in 1958. Throughout its development the Group has sustained important links with both the Institute of British Geographers and the Geological Society of London.

Over the past three decades the BGRG has been highly successful and productive. This is reflected not least by BGRG Publications. Following its launch in 1976 the Group's Journal, *Earth Surface Processes* (since 1981 *Earth Surface Processes and Landforms*) has become acclaimed internationally as a leader in its field, and to a large extent the Journal has been responsible for advancing the reputation of the BGRG. In addition to an impressive list of other publications on technical and educational issues, BGRG symposia have led to the production of a number of important works including *Nearshore sediment dynamic and sedimentation* edited by J. R. Hails and A. P. Carr; *Geomorphology and Climate* edited by E. Derbyshire; *River Channel Changes* edited by K. J. Gregory; and *Timescales in Geomorphology* edited by R. Cullingford, D. Davidson and J. Lewin. This sequence of books culminated 1987 with a publication of the *Proceedings of the First International Geomorphology Conference* edited by Vince Gardiner. This international meeting, arguably the most important in the history of Geomorphology, provided the foundation for the development of Geomorphology into the next century.

This open-ended BGRG Symposia Series has been founded and is now being fostered to help maintain the research momentum generated during the past three decades, as well as to further the widening of knowledge in component fields of geomorphological endeavour. The Series consists of authoritative volumes based on the themes of BGRG meetings, incorporating, where appropriate, invited contributions to complement chapters selected from presentations at these meetings under the guidance and editorship of one or more suitable specialists. Whilst maintaining a strong emphasis on pure geomorphological research, BGRG meetings are diversifying, in a very positive

way, to consider links between geomorphology *per se* and other disciplines such as ecology, agriculture, engineering and planning. This first volume in the Series on *Geomorphology in Environmental Planning*, edited by Janet Hooke, exemplifies this new trend.

The series will contribute to advancing geomorphological research and we look forward to the effective participation of geomorphologists and other scientists concerned with earth surface processes and landforms, their relation to Man, and their interaction with the other components of the Biosphere.

Geoffrey Petts  
BGRG Publications

28 March 1988

---

# Preface

---

The interface between geomorphology and environmental planning is potentially a very exciting one. Geomorphologists can provide techniques of investigation and knowledge of the earth's surface, its forms and processes. Such information is vital to planning of the environment to prevent development in unsuitable areas, to reduce damaging consequences of activities and to predict the effects of policies.

Effective interaction requires an awareness on the part of planners and policy-makers of the expertise offered by geomorphologists and an awareness by geomorphologists of the policy frameworks, decision-makers and processes of policy-formulation. Details on each of these aspects are provided in this book and the advantages of this mutual awareness are demonstrated clearly. Strategies for involvement are suggested though the difficulties are also indicated. Policy voids and data needs are identified.

The papers included here were amongst those presented at a symposium held at the Institute of British Geographers' Conference at Portsmouth in January, 1987. The volume follows a similar format; in each major geomorphological or policy sphere a review is provided by a leading authority and this is followed by a case study of a specific application or problem.

The book is aimed at geomorphologists who wish to see their research results used more fruitfully and who wish to have a professional influence on environmental policies, and at environmental planners and policy-makers to demonstrate the value and necessity of using geomorphology to achieve sound environmental management. It encompasses issues in rural and urban areas and dynamic zones such as rivers and coasts. The papers focus on policy in the United Kingdom but draw on experience elsewhere.

I am very grateful to all who have helped in production of this volume but above all to Rob for his unerring support. In the end the gestation was longer than that of our daughter but both arrived eventually.

Janet Hooke

*Portsmouth*



---

# List of Contributors

---

**Richard Aspinall**, The Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen AB9 2QJ.

**Dr John Boardman**, Countryside Research Unit, Department of Humanities, Brighton Polytechnic, Falmer, Brighton, East Sussex BN1 9PH.

**Dr David Brook**, Land Stability Branch, Minerals Division, Department of the Environment, 2 Marsham Street, London SW1P 3EB.

**Dr Andrew Brookes**, Thames Water, Nugent House, Vastern Road, Reading RG1 8DB

**Professor Denys Brunsdon**, Department of Geography, King's College London, The Strand, London WC2R 2LS.

**Dr Alan Carr**, 17 Pyles Thorne Close, Wellington, Somerset TA21 8EF.

**Dr Bob Crabtree**, WRc Engineering, Frankland Road, Blagrove, PO Box 85, Swindon, Wiltshire SN5 8YR.

**Professor Ian Douglas**, School of Geography, University of Manchester, Manchester M13 9PL.

**Peter Gagen**, Department of Environmental and Geographical Studies, Manchester Polytechnic, John Dalton Building, Chester Street, Manchester M1 5GD.

**Professor Ken Gregory**, Department of Geography, University of Southampton, Southampton SO9 5NH.

**Dr John Gunn**, Department of Environmental and Geographical Studies, Manchester Polytechnic, John Dalton Building, Chester Street, Manchester M1 5GD

**Dr Janet Hooke**, Department of Geography, Portsmouth Polytechnic, Buckingham Building, Lion Terrace, Portsmouth PO1 3HE.

**Dr Mark Macklin**, Department of Geography, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU.

**Dr Brian Marker**, Land Stability Branch, Minerals Division, Department of the Environment, 2 Marsham Street, London SW1P 3EB.

**Professor Roy Morgan**, Silsoe College, Cranfield, Silsoe, Bedford MK45 4DT.

**Professor Malcolm Newson**, Department of Geography, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU.

**Dr Stan Openshaw**, Department of Geography, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU.

**Dr Dennis Parker**, Flood Hazard Research Centre, Middlesex Polytechnic, Queensway, Enfield, Middlesex EN3 4SF.

**Professor Edmund Penning-Rowsell**, Flood Hazard Research Centre, Middlesex Polytechnic, Queensway, Enfield, Middlesex EN3 4SF.

**Dr Jane Rickson**, Silsoe College, Cranfield, Silsoe, Bedford MK45 4DT.

**Dr Peter Sims**, Department of Geographical Sciences, Plymouth Polytechnic, Drake Circus, Plymouth, Devon PL4 8AA.

**Dr Les Ternan**, Department of Geographical Sciences, Plymouth Polytechnic, Drake Circus, Plymouth, Devon PL4 8AA.

**Paul Thompson**, Flood Hazard Research Centre, Middlesex Polytechnic, Queensway, Enfield, Middlesex EN3 4SF.

---

# Introduction

---



---

# 1 Introduction: Frameworks for Interaction

---

**JANET HOOKE**

*Department of Geography, Portsmouth Polytechnic*

## **INTRODUCTION**

This book examines the interaction between geomorphology and public policies. The concern is with policy areas which affect the physical landscape and the processes acting within it. It focuses not only on the impact of present policies but also on identification of policy needs and on the design and implementation of policies. The nature of environmental problems in affecting everyone means that most such policies are discussed, formulated and implemented largely within the public domain, though the response of individuals may have a profound effect on the resulting situation.

Public policies are implemented through a range of measures varying from strict legislation and regulations to vague guidelines and financial incentives. The public policies may apply at different levels from international to local though most of the basic frameworks are laid down at national level in accordance with the policies of the Government in power. Some fulfilment of the policies is overseen by government ministries but many of the policies are actually carried out by other government agencies and by local authorities. In Britain the policies of the European Community have an increasing influence.

Geomorphologists are concerned with the form and processes of the earth's surface so any activity which modifies the shape of the land, induces movement of materials or alters the quantity or quality of water and drainage, is of interest to them. Many activities may indirectly affect the earth surface properties through interaction with vegetation. Coates (1984) in discussing geomorphology and public policy says:

Since humans live, work, build and play on the earth's surface such endeavours inevitably produce changes to the land-water ecosystem. Thus it is common for geomorphologists to take a special interest in those societal activities that are designed to modify natural processes. . . . Therefore it is altogether appropriate and necessary that geomorphologists become involved with those in government who are authorized to make

decisions which may affect the character of the topography and the materials and processes that comprise it.

Environmental changes due to human activities have taken place in the past but the rate of change and the ability of humans to alter the landscape is increasing. Also, as population increases and resources diminish the pressure on the remaining resources grows. Increasingly it is realised that there may be detrimental consequences in the environment if uncontrolled development takes place and the rate continues to accelerate. The combination of these factors together with a greater knowledge and understanding of the environment has meant an increased awareness of and concern with environmental problems. This is witnessed by the growth in numbers and membership of environmental pressure groups and environmental interest groups and by the numbers and sales of environmental publications.

The attitudes to the environment still vary considerably and are much discussed in the literature. Arguments still tend to be economically based but the need to incorporate environmental costs in evaluation of projects is realised increasingly and the subject of environmental economics is expanding. Legislation requiring Environmental Impact Assessments of projects is already in operation in the United States and guidelines are being introduced in the European Community.

The purpose of this book is to examine the geomorphological impacts of present policies and discuss the implications for future policies and policy modifications. It aims also to examine how policy formulation takes place, to demonstrate how geomorphologists can become involved in the process and to identify the areas where policy needs to be formulated. For policy-makers and landscape managers it demonstrates the value and necessity of geomorphological information in examining environmental problems and designing management strategies. The focus in this book is on Britain; however, some examples are taken from other countries whose experience may help in understanding the effects of policies and in evaluating the alternatives.

## **TYPES OF CHANGES AND PROBLEMS**

Some geomorphological changes are the result of deliberate and large-scale alteration to the earth's surface as in the case of land excavation or quarrying and mining. In other cases the most obvious results of an activity or policy may be aesthetic and ecological and the geomorphological changes are more subtle. Issues of public policy having landscape impacts can be considered in terms of major types of human activity, geomorphological zones or policy spheres.

Probably some of the most obvious changes taking place in the British landscape at present and some of the most controversial in terms of policies

are those in rural areas related to land use. The change in type of agriculture with greater emphasis, particularly in the lowlands, on increased cereal production, and the incentives for greater use of the land which have led to removal of hedges, drainage of areas and ploughing of moorlands, have all had profound effects on the appearance of the landscape and also on the amounts of soil erosion and the quantity and quality of water. The effects are manifest not only in the source areas but also downslope and downstream. Similarly, present policies of increasing forestry are controversial and the consequences of such policies need to be examined.

Although alteration of the landscape is perhaps more obvious and also less readily accepted in rural areas, the changes in the urban areas are, at least as great. These are the areas where most people live though the environment is in many ways more tightly controlled. Often the geomorphological consequences of urban development are ignored because of the assumption of control in the man-made environment and because of lack of knowledge of the natural systems and processes still operating in such areas. Suitable policies of control are indeed often lacking and public authorities are forced to pick up the consequences of private actions such as building development.

Certain activities may be either rural or urban and involve direct morphological alteration of the land. These include road and building construction and the mining and quarrying of materials. Both tend to be destructive of land but complementary activities of solid waste disposal and land reclamation may also have a significant impact on the landscape. The latter topics appear relatively neglected by geomorphologists. Waste disposal in the form of river pollution and also the interactions of acid rain have received some attention.

There are two spatial zones, rivers and coasts, which are especially dynamic geomorphologically and therefore present particular problems. Problems in these zones are also caused by lack of coordinated policies and by the proliferation of agencies involved. It is not only morphological changes which may be significant but also alterations of processes and water quality.

Geomorphological problems and policies could be examined in terms of particular types of area, as recognized by legislation, which are subject to special policy and planning treatment in the landscape. Such areas include, for example, National Parks but those are not singled out here; to a large extent the problems reflect in a more concentrated way the controversies in other parts of the landscape. Another major area of geomorphological work is that of natural hazards and interaction with policy but this is not discussed explicitly within this volume. This is partly because, compared with environments elsewhere in the world, Britain is not particularly hazardous geomorphologically. The major hazards are from river and coastal flooding and landslides and these are implicated in the other discussions. Many of the hazards now encountered in Britain are anthropogenic.

## EXISTING FRAMEWORKS

Policy can be enacted at a variety of levels and in a number of different ways, exerting different degrees of control varying from binding legislation to vague guidelines and incentives for certain practices to be adopted. Park (1986) identifies three policy mechanisms—moral persuasion, direct (legal) regulation, and economic incentives. The national context generally provides the overall framework in which the general aims of the policy are identified and the instruments of implementation articulated. This level may now be influenced by international pressure as is seen in the case of air and marine pollution, and even by legislation, particularly from the European Community in the case of Britain. As pressure on resources becomes greater, so the need for legislation appears to be increasing. Environmental policies have now become election issues.

### Legislation

Present environmental legislation is covered by a number of different Acts in Britain but the main ones of concern encompass planning in both urban and rural areas, agriculture and forestry, special areas such as National Parks, mineral development, rivers and coasts, and wildlife and countryside. In rural areas there appear to be three main areas of legislation—urban development pressures, resources and conservation (Gill, 1986; Open University, 1985) and these are now outlined. It is impossible here to give details of all relevant legislation; information on frameworks relating to individual policy areas are given in the chapters that follow.

The Town and Country Planning Act provided the basic framework of controls in 1947 by requiring planning permission to be granted for various developments to take place. It tried to identify non-conflicting land use zones. The 1971 Act provided the present basis for both creation of plans and development control. This required Structure Plans to be prepared by County Councils and Local Plans to be drawn up by District Councils. Development control implemented by planning permission is exercised at local level. Public Inquiries can be held into issues of national or regional importance or outside the scope of local planning authorities (Gill, 1986). Three special areas in which development should be controlled have also been identified; these are green belts, National Parks and Areas of Outstanding Natural Beauty. In these areas planning permission is harder to obtain. However, in the latter two legislation does not cover agriculture and forestry and in recent years pressure for development of these activities, particularly in the uplands, has led to severe conflict, for example in ploughing of moorlands on Exmoor. Mineral working is covered by planning legislation.

In terms of resources, particularly of the countryside, the main areas of legislation and controls are in agriculture, forestry, rivers and coasts.



Agricultural policy has been aimed at maximizing production of food in Britain and minimizing the need for imports. The Common Agricultural Policy (CAP) of the European Community now provides the framework for farming practices. There are two areas of operation influencing farming; (a) guarantee section in which prices are assured to the farmer and excess production is taken into store, (b) guidance section in which grants and incentives are provided for particular activities and in particular areas. It is under this section that the Less Favoured Areas are recognized which as Newson shows (Chapter 2) has affected the British uplands. The philosophy underlying forestry policies has also been one of expansion. The policies of expansion of agriculture and forestry are now being questioned partly because of the cost and morality of unused agricultural surpluses and partly because of the effects on the landscape.

Under the 1973 Water Act the Water Authorities were created in England and Wales and were given responsibilities for water supply, sewerage and sewage disposal, recreation and some conservation. They also have a responsibility for sea defences to prevent coastal flooding. Legislative and institutional frameworks for coastal management are rather more disparate as indicated in the papers by Carr (Chapter 11) and Penning-Roswell, Thompson and Parker (Chapter 12) and responsibility for coast protection has recently transferred from the Department of the Environment (DOE) to the Ministry of Agriculture, Fisheries and Food (MAFF).

In terms of conservation the relevant legislation at present is the Wildlife and Countryside Act of 1981. Since agriculture is not subject to planning controls unlike other developments, the aim was to reduce conflict between agricultural and conservation interests by providing some protection for SSSIs (Sites of Special Scientific Interest) and to allow for management agreements to be entered into with landowners. One of the major problems has been lack of enough money to pay compensation for development foregone, but in several areas farmers have agreed to retain or revert to grazing land and to use more traditional agricultural techniques.

### **Organizations and Agencies**

Policy-formulation, national decision-making and legislation in Britain is in the hands of the Government and Parliament. Gilg (1986) outlines the hierarchy of government and Park (1986) indicates a hierarchy of scales of concern from local through national and transfrontier to international. Executive and advisory agencies may both give advice and be responsible for implementation and management. Policy formulation is now also influenced by pressure groups.

There are a number of bodies which are international in scope and organization some of which have influenced environmental policies and have certainly been responsible for implementation and coordination of policies. These include the United Nations and its various agencies and the World Bank.