Global Environmental Issues

WILEY

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Edited by

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Other Wiley Editorial Offices

John Wiley & Sons Inc., 111 River Street, Hoboken, NJ 07030, USA

Jossey-Bass, 989 Market Street, San Francisco, CA 94103-1741, USA

Wiley-VCH Verlag GmbH, Boschstr. 12, D-69469 Weinheim, Germany

John Wiley & Sons Australia Ltd, 33 Park Road, Milton, Queensland 4064, Australia

John Wiley & Sons (Asia) Pte Ltd, 2 Clementi Loop #02-01, Jin Xing Distripark, Singapore 129809

John Wiley & Sons Canada Ltd, 22 Worcester Road, Etobicoke, Ontario, Canada M9W 1L1

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Library of Congress Cataloging-in-Publication Data

Global environmental issues/editor, Frances M.A. Harris.
p. cm.
Includes bibliographical references and index.
ISBN 0-470-84560-0 (alk. paper) — ISBN 0-470-84561-9 (pbk.: alk. paper)
1. Environmental sciences. I. Harris, Frances, M.A.

GE105.G563 2004
363.7—dc22 2003058347

British Library Cataloging in Publication Data

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

ISBN 0-470-84560-0 (HB)
0-470-84561-9 (PB)

Typeset in 11/13pt Times by Integra Software Services Pvt. Ltd, Pondicherry, India
Printed and bound in Great Britain by Antony Rowe Ltd, Chippenham, Wiltshire
This book is printed on acid-free paper responsibly manufactured from sustainable forestry in which at least two trees are planted for each one used for paper production.

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This book is dedicated to the memory of Sydney G. Harris, who encouraged me to take an interest in these topics, and to Thomas Lyon and those who will share his future.

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Preface

Writing this book has coincided with the pregnancy and the birth of my first child. Writing and editing it has been a new experience and a welcome opportunity to broaden reading and research. All this has been 'supervised' by a growing child, a strong reminder of phrases such as 'intergenerational equity' and the importance of sustainable environmental management for the benefit of many future generations.

Acknowledgements

The structure of this book has been shaped by a lecture course at Kingston University. Doreen Boyd first suggested that the lecture course could be the basis of a book. Lyn Roberts, of Wiley, took up the idea and has guided me through the process of producing an edited volume. It would not have been possible without the effort of each of the contributing authors, for which I am very grateful. Claire Ivison has prepared most of the figures, and shown patience with all of us. The final stages of putting the whole together was made much easier by the assistance of Stella Bignold. Throughout, Fergus Lyon has been an excellent advisor and very supportive.

The contributors would like to thank those who have given their permission to reproduce their figures and tables.

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Human–Environment Interactions

Frances Harris

1.1 Introduction

Environmental issues have been a concern for many years. Yet somehow they are problems that we have not been able to resolve, despite research, media attention, increased public awareness about environmental problems, campaigns by environmental pressure groups and international agreements. Our environment is dynamic, constantly changing and evolving in response to stimuli. Yet in the 20th century, it became apparent that mankind is having an increasing effect on the planet's ecosystems and biogeochemical cycles, so much so that our activities are now causing environmental change which is overriding the natural dynamism of the earth. Yet despite the evidence of environmental problems such as biodiversity loss, land cover change observable from satellite imagery, records of climate change and many examples of pollution, we still pursue activities which perpetuate the problems. As the world's population increases, and the *per capita* consumption of natural resources increases, we will have an even greater effect on these environmental problems, exacerbating them further.

Why are such problems so hard to resolve? There are three broad reasons: Firstly, the science of environmental problems is complex. We are dealing with many interrelated dynamic systems, within which and between which feedback mechanisms occur. Secondly, there are many stakeholders involved in both the causes and the solutions to environmental problems. Organising all of these stakeholders to act in a co-ordinated manner is difficult. Thirdly, resolving global environmental issues will require changes in our own consumption and pollution of natural resources, which will mean changes to lifestyles. This will require commitment at the personal level, which not everyone is willing to make.

Global Environmental Issues. Edited by Frances Harris
ISBNs: 0-470-84560-0 (HB); 0-470-84561-9 (PB)

Human–environment interactions involve not only the question of resource use per person, but also our ability to understand the science of the environment, our ability to regulate our impact on the environment, our beliefs in the value of the environment, our attitudes to the future, particularly risk, and our ability to negotiate solutions at both the local and the global level. This book aims to discuss environmental issues from a scientific and socio-economic viewpoint, so that they are understood not only as contested science concerning natural resources, but also as political and social issues. In this way the reader gains a fuller understanding of the complexity of environmental issues and the challenges we are faced with in resolving them. 'The science of the environment is socially and politically situated, rather than unambiguous or separable from the subjective location of human perception' (Stott and Sullivan, 2000, p. 2).

1.2 Livelihoods and natural resources

Throughout the world, people earn their livelihoods through the use of whatever resources are available to them. Our livelihoods are ultimately natural resource dependent. Natural resources provide us with the land and water for agriculture (whether for subsistence needs or to serve a wider market), trees for firewood and timber, ocean and freshwater resources for fisheries, wildlife for meat, animal products, tourism, oil, gas and coal for energy, and also mineral resources (rocks, minerals, gems, coal . . .). Many economies are dependent on natural resources. At the household and community level, this can be in the form of agriculture or natural resource products gathered and sold (e.g. wild foods, honey). At the national level, most countries rely on their natural resource base to meet basic needs and provide the resources for economic development, for example through cash crops, forestry or mining. Globally, we rely on natural resources for ecosystem regulation.

Natural resources are irreplaceable. We have not devised a substitute for the global climate regulation mechanism. Neither can we in the short term undo all the effects of land cover change to recreate the natural environment which existed prior to land degradation and urban sprawl. Although we can save some seeds of plants, and keep some animals in zoos, recreating ecosystems is a much greater challenge. Therefore it is important to conserve the environment, both for its own sake and also because our livelihoods depend on it.

1.3 Population–environment theories

As national populations grow, and the demand for natural resources (particularly for food production and energy generation) increases, worries that we shall exceed the resources of the planet have been expressed by many over the years.

In 1798, Malthus predicted that human population growth would be checked by food supply. This argument has been further developed by several authors. Ehrlich (1968) argued that population growth rates at that time would exceed the world's resources. Furthermore, as most population growth, and also declining food production, was found to occur in developing countries, he advocated population control. However, as Bennett (2000) points out, 'there seems to be no evidence that our ability to produce food has been a lasting break on population growth'. In contrast, Dyson (1996) maintains that food production has increased and outstripped population growth in recent decades.

Such numbers-versus-resources calculations are far too simplistic because they fail to take into consideration variability in food production and food consumption across the globe. For example, Michaelson (1981, p. 3) stated that 'overpopulation is not a matter of too many people, but of unequal distribution of resources. The fundamental issue is not population control, but control of resources and the very circumstances of life itself'. Globally, sufficient food is produced to feed people. However, food shortages occur because of variations in land productivity, and also because of problems in food distribution, due to poverty, conflict and failing markets (Bennett, 2000). Problems of inequality and existing power struggles affect people's access to resources and people's entitlements to food and other natural resources (Sen, 1982; Leach, Mearns and Scoones, 1997) on which their livelihoods depend.

Numbers-versus-resources calculations also fail to consider changes in technology which can result in increased food production or more efficient use of existing resources. They assume a steady 'carrying capacity' of the earth. However, technology has changed so much since Malthus' time. As Boserüp (1965) argues, increasing populations can be the driving force for agricultural intensification, which increases food output per unit area of land. For example, the Green Revolution had an enormous impact on agricultural productivity, particularly that of rice and wheat. (Subsequently it was realised that the Green Revolution also created new social and environmental problems, as discussed in section 6.4, but its effect on the population–food debate remained.) Tiffen's work has followed on in Boserüp's line of thought. She argues 'increased population density can induce the necessary societal and technological changes to bring about better living standards' (Tiffen, 1995, p. 60). Simon (1981) also argues that more people bring positive change, as this results in more ideas, more experimentation and more technological innovation which can help resolve the problems of resource limitations.

Human–environment interactions are not just about meeting the global population's food needs, or even about meeting natural resource needs. The human population also affects the environment through what it leaves behind. The impact of the human population on the environment is seen as, among other things, land use change (forest clearance, reduced wildlife, changes in agricultural landscapes as farming systems intensify), urbanisation, pollution of water, seas and landscapes. In some cases, our impact is less visible, at least immediately, such as gaseous pollution and changing atmospheric composition. Harrison (1993) argues that it is the effect of pollution which will drive a 'third revolution' for change in the world. These arguments are summarised in the equation (Ehrlich and Ehrlich, 1990, section 9.3.3)

$$\text{Impact} = \text{Population} \times \text{Affluence} \times \text{Technology}$$

The impact of population on the environment is determined by the size of the population, its affluence (and hence consumption *per capita*) and the type of technologies used. Therefore an extremely large but poor population using low impact technology could have the same impact as a smaller but more affluent population using highly polluting technology. The impact depends not only on the size of the population, but also on whether the technology used is highly polluting or 'green' (i.e. reliant on renewable energy or non-polluting). It should also be remembered that in some cases, 'green' technology requires affluence, and hence is not necessarily associated with the developing world.

The arguments concerning population–environment theories range from debates based on numbers of people and food resources, more complex arguments concerning the effect of environment and technology on carrying capacity, to social and political factors affecting access and entitlement to natural resources. There are several important issues to bear in mind when considering the contrasting views on human–environment interactions:

- It is important to distinguish between naturally occurring long-term trends and human-induced changes in the environment. We live in a dynamic world which is constantly changing. While we need to be aware of anthropogenic and natural changes, we can only be held responsible for, and hope to reverse, anthropogenic environmental change.
- The fact that the world is dynamic means that models and predictions need to be constantly revised to match changing scenarios. We adapt to our changing environment, and this means predictions based on existing technologies or activities may become outdated or irrelevant. Population predictions are gradually being revised downwards in view of existing figures. The doom and gloom scenarios of Malthus and others have never been fulfilled (Bennett, 2000). As we increase our knowledge of the environment and develop less polluting technology, we overcome, or at least reduce, our effect on the environment (section 9.5). We should not underestimate mankind's capacity to adapt and respond to changing environmental circumstances, as argued by Tiffen, Mortimore and Gichuki (1994) and Boserüp (1965) in relation to agriculture, and by Adger (1999) (Box 2.1) in relation to climate change.
- Numbers-versus-resources calculations do not take into consideration factors which affect the choices and decisions humans make. What is a population's incentive to conserve resources and the environment? Does a

population or individual have guaranteed long-term ownership of a resource, and therefore feel certain that they can reap the benefits of environmental conservation? Are immediate needs for survival so acute that the longer term cannot be considered (e.g. land shortage precludes fallowing, even though it will result in declining yields over the longer term). In cases of shared or common property resources, environmental protection or conservation by one individual does nothing to ensure that other users rather than conserving the resources do not take advantage of the situation. This is a particular problem in the negotiation of international agreements concerning global environmental change/carbon dioxide (CO_2) emissions and pollution (section 10.5).
- The impact of people on the environment depends not only on numbers, but also on lifestyle, consumption and technology.
- Our effect on the environment in terms of pollution may be more limiting than our consumption needs (Harrison, 1993).

1.4 Ecological footprints

> The ecological footprint of a specified population or economy can be defined as the area of ecologically productive land (and water) in various classes – cropland, pasture, forests, etc. – that would be required on a continuous basis to (a) provide all the energy/material resources consumed, and (b) absorb all the wastes discharged by the population with prevailing technology, *wherever on Earth that land is located.*
>
> *Wackernagel and Rees, 1996, pp. 51–52*

As such, ecological footprints are an 'accounting tool . . . to estimate the resource consumption and waste assimilation requirements of a defined human population or economy in terms of a corresponding productive land area' (Wackernagel and Rees, 1996, p. 9).

The concept of ecological footprints was developed recently, and has caught the attention of many due to the simplicity of the basic concept and the ability of the ecological footprint tool to be used in an educational manner to highlight and compare individual, community, regional or national effects on the environment. Ecological footprints link lifestyles with environmental impact. Ecological footprints are determined by calculating the amount of land and water area required to meet the consumption (food, energy, goods) of a population in a given area, and assimilate all the wastes generated by that population (Wackernagel and Rees, 1996). Obviously, such a calculation relies on the accuracy of the data provided, and of the 'conversion factors' used in determining agricultural productivity of the land providing food, and the forest area required to meet the energy needs. Indeed, there are those who have made serious criticisms of the method, like van den Bergh and Verbruggen (1999), some of which may be