visions of sustainability

cities and regions

hildebrand frey & paul yaneske

Visions of Sustainability

Cities and regions

Hildebrand Frey and Paul Yaneske

Taylor & Francis
Taylor & Francis Group
LONDON AND NEW YORK

First published 2007
by Taylor & Francis
2 Park Square, Milton Park, Abingdon, OX14 4RN

Simultaneously published in the USA and Canada
by Taylor & Francis Inc,
270 Madison Avenue, New York, NY10016

Taylor & Francis is an imprint of the Taylor & Francis Group, an informa business

Typeset in Galliard by
GreenGate Publishing Services, Tonbridge, Kent

Printed and bound in Great Britain by
T.J. International Ltd, Padstow, Cornwall

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
Frey, Hildebrand, 1940-
Visions of sustainability : cities and regions / Hildebrand Frey and Paul Yaneske.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-415-42647-3 (hardback : alk. paper) -- ISBN 978-0-415-42648-0 (pbk. : alk. paper) 1. Economic development--Environmental aspects. 2. Environmental policy--International cooperation. 3. Cities and towns--Environmental conditions. 4. Regional planning--Environmental aspects. 5. Sustainable development--Moral and ethical aspects. I. Yaneske, Paul. II. Title. III. Title: Cities and regions.
HD75.6.F735 2008

338.9'27091732--dc22

2007018397

ISBN-10: 0–415–42647–2 (hbk)
ISBN-10: 0–415–42648–0 (pbk)
ISBN-10: 0–203–93492–X (ebk)

ISBN-13: 978–0–415–42647–3 (hbk)
ISBN-13: 978–0–415–42648–0 (pbk)
IBSN-13: 978–0–203–93492–0 (ebk)

Visions of Sustainability

The destructive environmental impact of exorbitant levels of resource consumption, pollution and waste production, specifically in developed countries and cities, is an area of rapidly increasing concern. Efforts to find ways to generate sustainable development have intensified, with scores of research programmes and professional teams searching for viable approaches to, and strategies for, sustainable development. Political institutions, too, are in the process of developing indicators of sustainable development.

This new book examines the sustainability of cities and regions and concludes that currently sustainability is not achievable. By identifying how cities and regions in the past have maintained or lost sustainability and how cities and regions of today might achieve sustainability in the future, it

- gives a clear definition of sustainability, and an understanding of its true meaning
- provides a new conceptual framework for the assessment of the sustainability of cities and regions
- identifies research that will allow the systematic establishment of the appropriate indicators for sustainable development in cities and regions.

Drawing on ideas from the study of complex systems, the authors have developed a framework to guide and direct much needed new research in the measures needed to achieve and maintain sustainability. The book will be of considerable help to local authorities and political and government bodies responsible for establishing guidelines for the planning and monitoring of sustainable urban development. It will be of fundamental interest to ecologists, environmentalists, geographers, regional planners and urban designers, both in private practice and academia.

Hildebrand Frey is a retired senior lecturer in the Department of Architecture at Strathclyde University. He was the founder and Director of the Urban Design Studies Unit and the postgraduate urban design course.

Paul Yaneske is currently senior lecturer in the Department of Architecture at Strathclyde University. He has been a partner in an environmental design practice, Associate Dean of the Faculty of Engineering and founding director of a research Unit dedicated to sustainability and environmental management.

About the authors

Hildebrand Frey is a retired Senior Lecturer in the Department of Architecture, University of Strathclyde. He came to the department from architectural, urban design and urban planning practice in Switzerland, Germany, Austria, Australia and the United States. He was the founder and Director of the Urban Design Studies Unit and the postgraduate urban design course at the department. For many years he investigated the morphology of cities and city regions, their macro- and micro-structure, their land-use patterns, infrastructure and transport networks as well as the socio-economic profiles and environmental conditions and methods of stakeholder and community involvement in urban planning and design. He is author of many publications focusing on the link between research and research application and has studied the challenges of sustainable urban development and form for many years. He is currently co-investigator of the City Form (Sustainable Urban Form) Consortium, financed by EPSRC, and responsible for the search for ways in which (sub)urban neighbourhood areas can be transformed into sustainable communities. While dealing with issues of sustainability, he became convinced that the usual interpretation was far too narrow and needed a scientific approach. This, and very fruitful discussions with Dr Yaneske in the same department gave rise to the writing of this book.

Paul Yaneske is Senior Lecturer in Building Technology and Environment within the Department of Architecture at Strathclyde University in Glasgow. He originally graduated in physics and mathematics, followed by a doctorate in civil engineering. He has variously been a partner in an environmental design practice, a university company director, an Associate Dean of the Faculty of Engineering, and founding director of a research unit dedicated to sustainability and environmental management. His commitment to seeing research carried through into practice resulted in the unit having a substantial track record in turning research ideas directly into commercial products and in a successful university spin-off company. Involvement in the environmental management of the built environment led to an interest in the sustainable design of cities and, recently, a growing interest in the particular problems associated with providing accessible environments for those who have moderate to very severe visual disability. He hopes to find his way about for some time to come.

Preface

There is no doubt that sustainability is a complex issue in general and that the sustainability of cities is a complex problem of particular urgency in today's world. This book came about because we decided to explore the challenge of complexity head-on.

Sustainability is usually described as being composed of a balance between environmental, social and economic concerns, all of which involve complex systems. In fact, we are all surrounded by and are part of complex systems even if we cannot yet exactly define what a complex system is. But that is not the point. We draw on ideas from the study of complex systems not because it offers ready-made answers but because it offers insight into new ways to look for them.

The book is divided into two parts. In the first part we look at the quest for sustainable development at international, regional and national levels. The investigation has shown that the complexity of social, economic and environmental issues of sustainability is understood, and comprehensive policy statements are developed at international level through the United Nations. However, when it comes to the translation of policy statements into sustainable development action plans, the comprehensive view is lost, as nations do what they consider best for their development with little or no coordination at regional and global level. The inevitable outcome of this is that some of the overarching parameters are compromised and that sustainability at a global level is not achieved – and under current arrangements is not achievable.

In the second part we start by bringing together some important ideas from the science of complex systems. We find we can break down sustainability into four states of complexity which correspond to lifelessness, the natural world, our world and tomorrow's world, and we explore what each of these has to tell us about sustainability. On the way, we also come across the intriguing idea of emergence and how self-organisation and structure can arise.

We then look at how the states of sustainability can be applied to understanding the fate of cities in the past and how the sustainability of a city has depended on the maintenance of a viable bioproductive hinterland and a symbiotic relationship between the city and this hinterland that has provided it with all it needs to function and enabled its inhabitants to maintain their standard of urban living. In the penultimate chapter we draw together from each of the states a number of fundamental challenges to achieving such sustainability. Finally, we review what we have learned and summarise what outstanding issues need urgent action.

As we said at the beginning, sustainability is a complex issue, and one of the biggest challenges to writing this book was the spread of disciplines that needed to be

drawn upon, each with their own conceptual frameworks and jargon. This separation of knowledge into specialisations is a real barrier to the study of complexity. It helped that one author was an architect with a systems background and the other had come to architecture from a background in hard science. It is also rather ironic and symptomatic of the problem that although we had worked in the same university in the same department in the same building for many years, it was only a chance conversation during a coffee break at a presentation of the university's Faculty of Engineering research to outside bodies that we discovered our common interest.

But then, as complex system theoreticians might say, it's a small world.

Acknowledgement

The authors would like to thank Richard Lorch, Editor of *Building Research and Information* (BRI) for his extremely helpful and encouraging comments in the development of what was originally to be an article in BRI but grew, as a result of our email correspondence, well beyond the size for the journal.

Abbreviations

ACC	Administrative Committee on Coordination (of the United Nations)
BOD	biological oxygen demand
CIS	Commonwealth of Independent States
CSD	Commission on Sustainable Development
DCLG	Department for Communities and Local Government
EFA	ecological footprint analysis
ESA	European Space Agency
ETS	Emissions Trading Scheme
FBC	Fraser Basin Council
GC	Governing Council (of the United Nations Environment Programme)
GDP	gross domestic product
GEMS	Global Environmental Monitoring System
GHG	greenhouse gas
GVRD	Greater Vancouver Regional District
HDI	Human Development Index
IEP	Integrated Evaluation Programme
IMF	International Monetary Fund
IRP	Interdisciplinary Research Programme
IRPTC	International Register of Potentially Toxic Chemicals
IRS	International Referral System
MDGs	Millennium Development Goals
NASA	National Aeronautics and Space Administration
NRTEE	National Round Table on the Environment and Economy
ODA	official development assistance
OECD	Organisation for Economic Co-operation and Development
PPG	Planning Policy Guidance
SARS	severe acute respiratory syndrome
SPM	suspended particulate matter
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNMRP	United Nations Millennium Research Project
WCED	World Commission on Environment and Development
WTO	World Trade Organization

Contents

Illustrations

Figures

Tables

Part I

The quest for sustainable development

Chapter 1

United Nations frameworks for sustainable development

Introduction

Sustainability has been an important notion far back in time, as will be made clear later in this book. One excellent example is the use and management of forest resources for a sustainable yield of timber, which is said to have begun in the sixteenth century in Germany and Japan (Wikipedia/Forestry). In Germany it came about as the result of mining of metals and salt, for which a steady supply of timber and fuelwood was essential. To guarantee supply, timber production in managed forests became an industry. It was realised that the amount of wood a forest produced is limited by the natural rate of growth of trees, and that therefore a steady supply of timber was guaranteed only if its harvesting remained within the capacity of replanting and natural regrowth. At the end of the eighteenth century, Georg Ludwig Hartig (1764–1837), a German agriculturist and writer on forestry, formulated this concept of a sustained yield in a way that anticipates the Brundtland Report's definition of sustainability, as will be seen shortly:

> All wise forest management must ... have woodland valued ... and endeavour to utilize [forest resources] as much as possible, but in such a way that later generations will be able to derive at least as much benefit from them as the present generation claims for itself.
>
> (quoted by Klose, 1985)

Moreover,

> [t]he concept of sustained yield and permanence, which was formerly applied only to the production of timber, has since been extended to cover all functions of the forest, that is to say its commercial, protective and recreational functions, and is the guiding principles for all forest measures.
>
> (University of Göttingen: Forestry)

In comparison, the contemporary concept of 'sustainable development' has been the focus of a convoluted debate that started only about 30 years ago. To gain an insight into this debate – what it has achieved or not achieved in terms of understanding what sustainable development means, or what it has achieved or not achieved in terms of translating the concept of sustainable development into practice – it is essential to investigate the major contributions to what we today understand the key characteristics of sustainable development to be:

- development and improvement of the human environment, specifically the environment in which we live and work, without irreversibly damaging the natural environment;
- preservation, management and use of non-renewable natural resources such that future generations will have the same access to them that we claim today;
- use of renewable natural resources within the producing and replenishing capacity of the biosphere.

This chapter will show that it is not such a problem to define what sustainable development is but that it seems to be extremely difficult to translate that definition into action programmes at global, regional and national levels. The chapter will therefore explore manifestations of the principles of sustainable development and attempts at their implementation at global, regional and national level. It will become clear that most of the programmes are top-down initiatives developed by the United Nations as framework for all global nations, the European Union as framework for all member states of the Union, and national governments as frameworks for all local authorities. Very few are bottom-up initiatives by non-governmental organisations. It will also become clear that the principles of sustainable development are clear and comprehensive but that many of the action programmes derived from them are vague if not blurred, and lack unambiguous targets or threshold values. As a result of this, the judgement of what is good for people and what is good for the environment is largely left to those making decisions at a local level based on assumptions, rather than knowledge and experience, driven by local needs and aspirations and, most importantly, by economic considerations.

This investigation will focus on a number of key contributions to the debate on sustainable development promoted by the United Nations. It will not be possible within the context of this book to do full justice to all UN events and programmes, to the preparatory work that led to international conferences and to the numerous UN organisations that have contributed to it. The chapter tries nevertheless to gain an understanding as to why it seems to be so difficult to translate proclamations published at such conferences into workable action programmes that would lead to sustainable development.

The report *The Limits to Growth* to the Club of Rome, early 1972

Just a few months before the hugely important UN Conference on the Human Environment at Stockholm in June 1972 that set into motion the debate on sustainable development, *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (Meadows *et al.*, 1972) was published in London. It was commissioned by the Club of Rome, a think tank of scientists, economists, businesspeople, international civil servants, and politicians from five continents, with the mission 'to act as global catalyst of change that is free of any political, ideological or business interest' (Club of Rome website, ABOUT). The research for the report

focused on five major global trends: accelerating industrialisation, rapid population growth, widespread malnutrition, depletion of non-renewable resources and a deteriorating environment. Using the method of system dynamics – which is based on the recognition that the structure of a system (the relationships among its components) is often as important as the components themselves and was at the time a significant breakthrough, as it was a non-military use of scenario forecasting – a large-scale computer model was constructed to simulate likely future outcomes of the world economy on the basis of two key characteristics: exponential growth (of global population, industrialisation, depletion of resources, pollution, etc.) and fixed limits (of non-renewable global resources and of the replenishing capacity of the biosphere). Modelling led the researchers to two conclusions:

1 If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity.
2 It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realize his individual human potential.

(Pestel, 1972, p. 1)

The researchers acknowledge that the model they had constructed is, like any model, imperfect, oversimplified and unfinished, but they feel that it is already sufficiently developed to be of some use to decision makers and that the basic behaviour modes that they have observed in the model are so fundamental and general that they do not expect the broad conclusions to be changed substantially by future revisions (ibid.).

It is clear that at least the first conclusion of the report would be very controversial. During the 1950s and 1960s both the Western and the Communist worlds had had a period of immense economic growth, albeit with little if any attention being paid to its environmental impact. There was a strong belief that the market and technology would solve all problems for which human action is responsible (Suter, 1999, p. 2). The warning that we would run out of resources within the next 100 years if current growth trends were to continue was classified by both political systems as alarmist and a threat to stable government (ibid.). The Yale economist Henry Wallich labelled the book 'a piece of irresponsible nonsense'. He stated that there was insufficient evidence for many variables in the model and that 'the quantitative content of the model comes from the authors' imagination' (Wallich, 1972, p. 86). Unfortunately, the detailed model of *The Limits to Growth* team was not published until 1974 in the book *Dynamics of Growth in a Finite World,* so Wallich's complaint had merit at the time (Wikipedia, *Limits to Growth*). Other criticism highlighted the

weak database and the loading of the authors' case by distinguishing between exponential growth of population, capital and pollution and incremental growth of technologies for expanding resources and controlling pollution (Suter, 1999, p. 2).

It is symptomatic that only four years later a book entitled *The Next 200 Years: A Scenario for America and the World* (Kahn *et al.*, 1976) presented an optimistic vision of the future. The authors expect future population growth not to be exponential but to decline steadily and come to a halt at the end of the 200-year period. The vision is, furthermore, largely based on the continuing evolution of technology, which serves to push back and even overcome natural limits: better irrigation systems, better farming techniques, development of new hybrid seeds, growing food with hydroponics, new solar technologies, nuclear power, ocean thermal power, and so on, technologies that will be developed as they are needed (ibid., pp. 4–11).

Kahn, a member of the Rand Corporation think tank, and his colleagues were right regarding the slowdown of the global population growth, as we now know, and the new technologies they talk about are either already available or in the process of being developed. Fuelled by the growing success of space exploration and the huge technological advances that made it possible, the widespread belief that technology would solve the problems of shrinking resources makes it perhaps understandable that politicians on both sides of the Iron Curtain simply ignored *The Limits to Growth.* However, the report had shown that changing the parameters of the computer model, for instance by slowing down population growth, might only delay the most probable outcome of the trends they investigated, should other growth trends continue. Already in the 1960s and early 1970s, some of those behind the promotion of extraordinary technological utopias, specifically some members of Archigram, started to question the belief in the incorruptibility of technology. In *The Shock of the Old,* David Edgerton (2006) seriously questions whether future technological revolutions can continue to address our problems, and indeed whether existing technologies will continue to deliver benefits without significant negative trade-offs.

The study by Meadows *et al.* did have some limitations, primarily as the result of the use of computer modelling, the success of which depends on the quality of data and the data-processing capacity of the computer. The book's latest updated and expanded version was published in 2004 under the title *Limits to Growth: The 30-Year Update* (Meadows *et al.*, 2004). The message has not changed and remains valid. By now it has become clear that we are already in a period of reduced production of non-renewable global resources, with oil and natural gas among the most obvious. The threat of diminishing oil and natural gas reserves and rising prices has led the energy supply sector in the United Kingdom to import gas from Norway, and the use of coal in fuel-powered electricity generators grew from 39.6 million tonnes in 1999 to 50.9 million tonnes in 2003 (DUKES, 2005). In continental Europe, similar trends can be observed. Sufficient resources are said to be available for another 40 or so years, but by 2040 or 2050 they are expected to be getting scarcer (Stern, 2007), and most European governments have acknowledged the possibility of an energy crisis. In the United Kingdom, as elsewhere in Europe, the expansion of nuclear power is being seriously investigated, as it is unlikely that alternatives will be found in the near future (DTI, 2006).[1]