

# Contents

<i>Foreword</i>	ix
<i>Acknowledgements</i>	xi
<i>Preface</i>	xiii
<b>1 Introduction</b>	<b>1</b>
The brief history of humanity	1
The origin of civilisation	2
The death of civilisations	3
Defining problems and finding solutions	6
The role of natural science, social science and philosophy	8
Integrating information from different domains	11
Systems theory	12
Sustainability Assessment Maps	13
Contents of this book	14
<b>2 General Systems Theory</b>	<b>15</b>
The nature of science	15
The problem of complexity	16
The nature of systems	18
Open and closed systems	19
Defining systems	20
Modelling systems	21
Dynamic system behaviour	22
Complex adaptive systems	23
Systems terminology	24
<b>3 Complex Adaptive Systems</b>	<b>28</b>
Evolution and adaptation	28
System thresholds and the global ecology	31
Ecological complexity and stability	33
Risk	35
Perceptions of risk	37
Non-linearity, criticality, thresholds, and transitions	38
A systems model of sustainability	42
The general implications for policy	46
Translating between systems	47
<b>4 Environmental Factors</b>	<b>49</b>
The biosphere	50
Non-extractive uses	51

Extractive uses	52	
Water	54	
The atmosphere	56	
Land use, agriculture, and soil erosion	68	
Deforestation	71	
Biodiversity and extinctions	72	
Population	74	
<b>5 Ecosystem Economics</b>		<b>76</b>
Definitions of capital	77	
Definitions of natural capital	77	
Categories of natural capital	80	
Natural capital depletion	81	
Critical natural capital	86	
Managing natural capital	87	
Carrying capacity	88	
Artificial capital	91	
Economic growth and the environment	97	
Resource uses and trade-offs	103	
<b>6 Integrating Economic and Environmental Factors</b>		<b>106</b>
Supply and demand	106	
The pricing of natural capital	107	
Economic valuation of the environment	109	
Environmental property rights	111	
Environmental quality and sustainability	112	
<b>7 Economic Policy Instruments</b>		<b>114</b>
Environmental taxes, charges, and subsidies	116	
Tradable pollution and resource use permits	118	
<b>8 Discounting and Investment</b>		<b>122</b>
Capital, investment and net productivity	122	
Reasons for discounting	123	
The discounting debate	124	
The validity of the assumptions	124	
Discounting, society and the environment	125	
Discounting and natural capital depletion	129	
Appropriate uses of discounting	131	
<b>9 The Levels of Sustainability</b>		<b>133</b>
Systems and projects	134	
Capital flow	136	
<b>10 Financing the Transition to Sustainability</b>		<b>138</b>
Financing reconstruction	138	
Financing investment from profits	139	
Financing investment from equities or borrowing	140	
Conclusion	144	
<b>11 Economic Development and the Environment</b>		<b>146</b>
Economies considered as complex adaptive systems	146	
Industrialisation and associated change	152	
Economic theories of environmental damage	154	

Strategic imperatives for sustainability	157	
Organising for sustainability	158	
Market systems	159	
Economic blocs	162	
The European Union	163	
Economic integration and the UK business sector	166	
<b>12 Socio-cultural Factors</b>		<b>168</b>
Ethics and equity	168	
Games theory	169	
Selfishness, altruism, and sustainability	171	
Implementing equity	172	
Equity and technology transfer	175	
Welfare	176	
Income and wealth	177	
Limits to neoclassical economics	180	
<b>13 A Systems Approach to Managing Sustainability</b>		<b>184</b>
Systems theory and decision-making	184	
Hard systems	185	
Soft systems	186	
Information aggregation and decision-making	189	
Composite problems	190	
Positional analysis	192	
<b>14 Assessing Sustainability</b>		<b>195</b>
Sustainability Assessment Maps	195	
Choosing axes	197	
Scaling	197	
Generating options: emissions and environmental impacts	199	
Axes	201	
<b>15 Conclusions and Recommendations</b>		<b>208</b>
The global ecological crisis	208	
Reasons for pessimism	209	
Commitment, analysis and action	211	
Models as servants, not masters	211	
The precautionary principle	212	
The goal of sustainability	214	
Global initiatives	215	
The role of government	217	
The role of industry	223	
The role of business directors and managers	224	
The role of the planner	225	
The role of the individual and the community	233	
The role of the educator	237	
The agenda for further research	238	
<b>16 Further Reading</b>		<b>241</b>
<i>References</i>		243
<i>Index</i>		249