

Acknowledgements	17
Preface	19
Motivation	19
Contents	20
Structure	21
1. Economics and the environment. A brief introduction	23
1. Introduction	23
2. Economics, money and the physical world. A historical approach	24
2.1. Organicism	25
2.2. The physiocrats	25
2.3. Classical economics	26
2.4. Neoclassical economics	26
3. The Limits to Growth	27
3.1. The Club of Rome Report	27
3.2. The Environmental Kuznets Curve	29
4. Main paradigms in environmental economics	30
4.1. Pigou and negative externalities	31
4.2. Coase and property rights	32
4.3. Ecological economics	32
5. Summary	33
6. Questions for further discussion	33
7. Key terms	33
8. Useful web sites	35

References	36
2. Fundamental economic concepts	37
1. The science of scarcity	37
2. Economic methods and thinking	38
3. Microeconomics	40
3.1. Supply and demand	40
3.1.1. Overview	40
3.1.2. The demand and supply curves	41
3.1.3. Price elasticity of demand and supply	44
3.2. Utility, abstraction and rational behaviour	47
3.3. Consumer and producer surplus	49
3.4. Perfect and imperfect markets	50
4. Macroeconomics	51
4.1. Gross domestic product	51
4.2. Inflation	53
4.3. Input-output tables	53
5. Econometrics	54
5.1. Introduction	54
5.2. Variables and models	55
6. Summary	56
7. Questions for further discussion	56
8. Key terms	56
9. Useful web sites	57
References	58
3. Environmental decision-making	59
1. Introduction	59
2. The pollution trade-off	60
3. Methodologies for environmental decision-making	62
3.1. The Cost-Benefit Analysis (CBA)	64
3.1.1. Overview	64
3.1.2. Discount rates and intergenerational justice	65
3.1.3. Critical assessment	66
3.2. The Multicriteria Analysis (MCA)	67
3.2.1. Overview	67

3.2.2. Critical assessment	68
3.3. Cost-Effectiveness Analysis (CEA)	69
3.3.1. Overview	69
3.3.2. Critical assessment	70
4. Summary	71
5. Questions for further discussion	72
6. Selected practical applications	72
7. Key terms	72
8. Useful web sites	73
References	74
4. Environmental Valuation	75
1. Introduction	75
2. The Total Economic Value and its components	76
3. Valuation methods	79
3.1. Revealed preferences	79
3.1.1. Replacement cost	79
3.1.2. Effect on production	80
3.1.3. Travel cost models	81
3.1.4. Hedonic pricing method	82
3.2. Stated preferences	84
3.2.1. Contingent valuation	84
3.2.2. Choice modelling	86
4. Benefit transfer and meta-analysis	86
5. Summary	87
6. Questions for further discussion	87
7. Selected practical applications	87
8. Key terms	88
9. Useful web sites	89
References	90
5. Economics and Environmental Policy	91
1. Introduction	91
2. Public tools for environmental protection	92
2.1. Regulation	92
2.2. Taxes	94

2.2.1. Overview	94
2.2.2. Economics of taxes	95
2.2.3. Design issues	96
2.2.4. Social implications	98
2.3. Emissions Trading Systems	99
2.3.1. Overview	99
2.3.2. Economics of Emissions Trading Systems	101
2.4. Voluntary agreements	103
3. General conditions to formulate environmental policies	104
4. Summary	106
5. Questions for further discussion	106
6. Selected practical applications	106
7. Key terms	107
8. Useful web sites	107
References	108
6. Climate Change Economics	111
1. Introduction	111
2. Climate science and background	112
2.1. Climate change, emissions, and concentrations	112
2.2. Geopolitics of climate change and the Stern's dilemma	114
2.3. The international response	115
3. Economics of climate mitigation	116
3.1. Carbon Markets	116
3.1.1. The Kyoto Protocol and the top-down method	117
3.1.2. The European Union Emissions Trading Scheme	118
3.1.3. Voluntary carbon markets	120
3.2. Corporate carbon pricing	121
4. Economics of climate adaptation	121
5. Climate finance	123
6. Summary	124
7. Questions for further discussion	124
8. Selected practical applications	124
9. Key terms	125
10. Useful web sites	126

References	127
7. Natural resource economics	131
1. Introduction	131
2. Sustainable development and resources	132
2.1. Quantifying sustainability	132
2.2. Modelling natural resources	134
3. Game theory, property rights, and resource management	135
3.1. Access to resources	135
3.2. Game theory and natural resources	137
4. Applied natural resource economics	138
4.1. Non-renewable resources: mineral economics	138
4.2. Renewable resources: fisheries	140
5. Summary	142
6. Questions for further discussion	142
7. Selected practical applications	142
8. Key terms	143
9. Useful web sites	144
References	145
8. Environmental Accounting	147
1. Introduction	147
2. What economics should measure	148
3. Public environmental accounting	150
3.1. The problem with national accounts	150
3.2. Defensive expenditure system	151
3.3. Natural resources accounts	151
3.4. Satellite accounting systems	152
3.5. Eco-integrated approach	154
4. Private environmental accounting	155
4.1. Introduction	155
4.2. Monetary systems of private environmental accounting	156
4.3. Physical systems of environmental accounting.	158
5. Summary	159
6. Questions for further discussion	160
7. Selected practical applications	160

8. Key terms 161
9. Useful web sites 161
References 163

Index of figures

Economics and the environment. A brief introduction	
Figure 1. Shape of a typical EKC.	29
Fundamental economic concepts	
Figure 1. Typical demand curve.	41
Figure 2. Upwards shift of the demand curve.	42
Figure 3. Typical supply curve.	43
Figure 4. Shift of the supply curve.	43
Figure 5. Supply and demand equilibrium.	44
Figure 6. Elastic demand curves (named after their PED).	46
Figure 7. Inelastic demand curves (named after their PED).	46
Figure 8. Elastic supply (named after their PES).	48
Figure 9. Inelastic supply curves (named after their PES).	48
Figure 10. Consumer and producer surplus.	49
Figure 11. GDP components and methods.	52
Environmental decision-making	
Figure 1. Examples of representative damage functions.	61
Figure 2. Examples of representative marginal abatement cost curves.	62
Figure 3. Socially efficient level of pollution.	63
Figure 4. Impact of discount rates in the long term.	65
Figure 5. Example of marginal abatement cost curve.	70
Environmental Valuation	
Figure 1. Components of the Total Economic Value.	77
Figure 2. Valuation methods.	78

Figure 3. Costs and benefits of restoration.	80
Figure 4. Declining rate of environmental improvements.	83
Economics and Environmental Policy	
Figure 1. Marginal abatement cost curve of a producer and tax.	96
Figure 2. Marginal abatement cost curve of many producers and tax.	97
Figure 3. Tax impacts on supply and demand.	99
Figure 4. Aggregated MAC curve and emissions trading.	102
Climate Change Economics	
Figure 1. Evolution of CO2 Emissions.	113
Figure 2. Spot price of EUA over time.	119
Natural resource economics	
Figure 1. Stock growth, sustainable catches, and benefits.	141
Environmental Accounting	
Figure 1. Diagram of satellite accounting systems.	152
Figure 2. Diagram for an Eco-Integrated Approach.	155
Figure 3. Synthetic view of the ABC method.	157

Index of tables

Economics and the environment. A brief introduction	
Table 1. Some projections of the World 3 Model.	29
Fundamental economic concepts	
Table 1. Example of an IOT.	54
Environmental decision-making	
Table 1. Summary of methodologies.	71
Natural resource economics	
Table 1. Classification of goods by Ostrom.	136
Environmental Accounting	
Table 1. Technical differences between NAMEAs and the approach by the 1996 Guidelines of the Intergovernmental Panel on Climate Change (IPCC).	154