

Table of Contents

Section I

EXECUTIVE SUMMARY, CONTEXT AND STRUCTURE

Executive Summary	17
Challenges for the future.....	17
Green lights: proceed with caution	17
Yellow lights: require further investigation or additional action	18
Red lights: need to be addressed urgently.....	18
Integrity of ecosystems	21
Technological change	21
De-coupling environmental degradation from economic growth.....	21
Policy action: learning from the past.....	22
Addressing the social and environmental interface	23
Policy packages.....	23
1. Context and Structure of the Report.....	27
1.1. Objectives and context of the report	27
1.2. Policy context.....	27
1.3. Sources of information and modelling.....	30
1.4. Identifying the most pressing environmental concerns.....	31
1.5. Structure and contents of the report.....	32
References	35

Section II

ECONOMIC, SOCIAL AND TECHNOLOGICAL DRIVERS OF ENVIRONMENTAL CHANGE

2. Demographic and Labour Force Developments	39
2.1. Introduction	39
2.2. Population size	40
2.3. Population structure	41
2.4. Labour force.....	42
2.5. Population distribution.....	43
2.6. Policy issues.....	44
References	45
3. Globalisation, Trade and Investment.....	47
3.1. Introduction.....	47
3.2. Developments in globalisation, trade and investment	47
3.3. Environmental implications of globalisation	52
3.4. Policy issues.....	54
References	56
4. Economic Development	57
4.1. Introduction.....	57
4.2. Assumed developments in GDP	57

4.3. Changes in the composition of production.....	61
4.4. Economic development and environmental pressures	63
<i>References</i>	65
5. Consumption Patterns	67
5.1. Introduction	67
5.2. General consumption drivers and trends	68
5.3. Environmental implications of consumption patterns.....	71
5.4. Policy issues	72
<i>References</i>	73
6. Technological Change	75
6.1. Introduction	75
6.2. Drivers of technological change.....	76
6.3. Technological change: trends and outlook to 2020.....	77
6.4. Environmental effects of technological change	78
6.5. Policy issues	81
<i>References</i>	82

Section III

PRIMARY SECTORS AND NATURAL RESOURCES

7. Agriculture	85
7.1. Introduction	85
7.2. Developments in the agriculture sector	85
7.3. Effects of agricultural production on the environment	89
7.4. Policy options and their potential effects	92
<i>References</i>	95
8. Freshwater	97
8.1. Introduction	97
8.2. Pressures on freshwater resources	97
8.3. The state of freshwater resources	102
8.4. Policy options and their potential effects	104
<i>References</i>	107
9. Fisheries	109
9.1. Introduction	109
9.2. Developments in the fishery sector	109
9.3. Pressures on fish resources.....	114
9.4. Policy options and their potential effects	115
<i>References</i>	120
10. Forestry	121
10.1. Introduction	121
10.2. Developments in the forestry sector.....	122
10.3. Environmental effects of forestry sector activities.....	125
10.4. Policy options and their potential effects	128
<i>References</i>	131
11. Biological Diversity	133
11.1. Introduction	133
11.2. Pressures on biological diversity.....	134

11.3. Changes in the state of biological diversity	137
11.4. Policy options.....	139
<i>References</i>	142

Section IV

ENERGY, CLIMATE CHANGE, TRANSPORT AND AIR QUALITY

12. Energy	145
12.1. Introduction.....	145
12.2. Developments in the energy sector.....	146
12.3. Environmental effects of energy production and use.....	150
12.4. Policy options and their potential effects.....	152
<i>References</i>	156
13. Climate Change	157
13.1. Introduction.....	157
13.2. Pressures on the environment: emissions of greenhouse gases	158
13.3. The effects of greenhouse gas emissions on climate change.....	162
13.4. Policy options and their potential effects.....	163
<i>References</i>	168
14. Transport	169
14.1. Introduction.....	169
14.2. Developments in the transport sector.....	170
14.3. Environmental effects of transport.....	172
14.4. Policy options	177
<i>References</i>	181
15. Air Quality	183
15.1. Introduction.....	183
15.2. Pressures on air quality	183
15.3. Changes in air quality	187
15.4. Policy options.....	191
<i>References</i>	193

Section V

HOUSEHOLDS, SELECTED INDUSTRIES AND WASTE

16. Households	197
16.1. Introduction.....	197
16.2. Household food consumption	198
16.3. Household energy use.....	199
16.4. Household water use.....	200
16.5. Household travel	201
16.6. Household waste generation	202
16.7. Policy options.....	203
<i>References</i>	206
17. The Steel Industry	207
17.1. Introduction.....	207
17.2. Developments in the steel sector.....	207
17.3. Environmental effects from the steel industry	210
17.4. Policy options and their potential effects.....	212
<i>References</i>	214

18. The Pulp and Paper Industry	215
18.1. Introduction	215
18.2. Developments in the pulp and paper industry	215
18.3. Environmental effects of pulp and paper production and use	218
18.4. Policy options and their potential effects	220
<i>References</i>	222
19. The Chemicals Industry	223
19.1. Introduction	223
19.2. Developments in the chemicals industry	224
19.3. Environmental effects of the chemicals industry and its products	226
19.4. Policy options and their potential effects	229
<i>References</i>	234
20. Waste	235
20.1. Introduction	235
20.2. Environmental pressures from waste	235
20.3. Environmental impacts of waste	241
20.4. Policy options	242
<i>References</i>	245

Section VI

SELECTED CROSS-CUTTING ISSUES

21. Human Health and the Environment	249
21.1. Introduction	249
21.2. Impacts of environmental degradation on human health	249
21.3. The health-related costs of environmental degradation	252
21.4. Policy issues	253
<i>References</i>	254
22. The Social and Environmental Interface	255
22.1. Introduction	255
22.2. Environmental democracy	255
22.3. Social distribution of environmental quality	259
22.4. Distributive effects of environmental policies	260
22.5. Employment implications of environmental policies	262
<i>References</i>	264
23. Resource Use Efficiency	265
23.1. Introduction	265
23.2. The effects of resource use on the environment	265
23.3. Resource use efficiency: recent trends and outlook to 2020	267
23.4. Determinants of changes in resource use efficiency	268
23.5. Policy issues	270
<i>References</i>	273

Section VII

**INSTITUTIONAL FRAMEWORKS AND POLICY PACKAGES
FOR ADDRESSING ENVIRONMENTAL PROBLEMS**

Signals of the OECD Environmental Outlook	276
24. Institutional Frameworks for the Environment	277
24.1. Introduction	277
24.2. National institutional frameworks	279

24.3. International institutional frameworks	283
24.4. Stakeholder involvement	287
<i>References</i>	290
25. Policy Packages to Address the Main Environmental Problems	291
25.1. Introduction	291
25.2. A policy package for the primary sectors and selected natural resources	293
25.3. A policy package for climate change, air pollution, and the energy and transport sectors	298
25.4. A policy package for households, selected industries, and waste	303
25.5. Assessment of a combined policy package	306
25.6. Implementing the combined policy package	307
<i>References</i>	309
Annex 1: Background Documents	311
Annex 2: Modelling Framework Used for the Reference Scenario and Policy Simulations	313
1. Introduction	313
2. Underlying assumptions	313
3. The JOBS model	314
4. The PoleStar framework	318
5. The MOVE II model	324
<i>References</i>	326

List of Boxes

3.1. Model simulations of effects of accelerated globalisation	50
3.2. Sectoral effects of increased globalisation – forestry example	51
7.1. Agriculture and food safety concerns	87
7.2. Structural changes in the agri-food industry	88
7.3. Agricultural subsidies in OECD countries	89
7.4. Agricultural soils as carbon sinks	90
8.1. Increased water use efficiency in OECD industries	100
8.2. Water conflicts and environmental security	103
8.3. Institutional frameworks for water management	103
8.4. Developments in OECD water prices	105
9.1. Excess fishing capacity and subsidies to the fishing industry	113
9.2. Trade measures and fishing activities	116
9.3. Effects of changes in the environment on the fishery sector	118
10.1. Characteristics of forest holdings in OECD regions	124
10.2. Environmental services provided by forests	127
10.3. International forestry initiatives	129
10.4. Carbon sinks and the Kyoto Protocol	130
10.5. Incentives for increasing the use of wood products	131
11.1. Difficulties in defining and measuring biodiversity	134
11.2. Perverse incentives and biodiversity loss	137
11.3. The Natural Capital Index (NCI) framework	138
11.4. Revealing the economic value of biodiversity	141
12.1. Energy sector reforms	149
12.2. Energy-related technologies	152
13.1. Ancillary benefits of greenhouse gas mitigation	163
13.2. The Kyoto Protocol and market mechanisms	164

20.1. Environmental benefits of recycling	239
20.2. Effects of using economic instruments for waste management	244
22.1. Main conclusions from existing studies on the double dividend	263
23.1. Indicators of resource efficiency	266
24.1. Potential environmental security threats	279
24.2. Increasing privatisation of environmentally related services	282
24.3. Compliance and enforcement mechanisms in MEAs	284

List of Tables

1. Signals of the OECD <i>Environmental Outlook</i>	20
1.1. The evolving context of environmental policy-making	28
1.2. The array of environmental policy options used in the <i>Outlook</i>	34
6.1. Economic implications and environmental effects for selected technologies	80
7.1. Key agricultural sector statistics and projections	86
7.2. Environmental effects of agricultural subsidy removal and a tax on agrochemical use in OECD regions	93
9.1. Key fishery sector statistics and projections	110
9.2. Comparison between estimated potentials and average landings for marine capture fisheries of primary importance to OECD countries, 1990-1994 in million tonnes	112
10.1. Key forestry sector statistics and projections	122
11.1. Pressures on biodiversity	135
12.1. Key energy sector statistics and projections	146
12.2. Contribution of energy use to air pollutants and greenhouse gas emissions	150
12.3. Effects of energy subsidy removal and energy tax use in OECD countries	154
14.1. Key transport sector statistics and projections	170
16.1. Household appliance ownership for selected OECD countries, 1973-1997 (units per 100 households) ..	200
17.1. Key steel sector statistics and projections	207
17.2. Subsidy and tax policy simulations: effects on the steel industry in OECD regions and its environmental impacts	213
18.1. Key statistics and projections for the pulp, paper and publishing sector	216
18.2. Subsidy and tax policy simulations: effects on the pulp and paper industry in OECD regions and its environmental impacts	221
19.1. Key chemical industry statistics and projections	224
19.2. Effects of subsidy and tax policy shock runs on the chemicals industry and its environmental impacts ..	232
21.1. Total health expenditure in OECD countries and the environment-related share	252
21.2. Priority environment-related diseases, issues and sectors in OECD countries	253
23.1. Channels through which increases in resource efficiency can be achieved	270
24.1. Institutional framework – recent evolution and future outlook	280
25.1. Subsidies to primary sectors and natural resource use in OECD countries according to actual estimates and as reflected in the Reference Scenario, 1995 or most recent year, US\$ billion	294
25.2. Subsidies to energy and fuel production and use in OECD countries according to actual estimates and as reflected in the modelling exercise, 1998 or nearest year, US\$ billion	299
25.3. Effects of applying an <i>ad valorem</i> tax that increases by 2 percentage points each year on all chemicals use in OECD countries and removing all subsidies to manufacturing industries, difference in 2020 from Reference Scenario	305
A1. Historical and assumed levels of real GDP, 1995 US\$ billion	314
A2. Regions used in the model simulations	315
A3. Sectors used in the JOBS model	315
A4. Assumptions regarding the agricultural sectors, annual percentage changes 1995-2020	318
A5. Typical loading rates for untreated domestic sewage	319

List of Figures

1. Resource and material intensity of OECD economies, total use and intensity of use relative to GDP, 1980-2020.....	22
2. Effects in 2020 of removing subsidies, applying a fuel tax and a chemical use tax in OECD regions.....	24
1.1. Regions used in the OECD Environmental Outlook.....	30
1.2. The OECD Pressure – State – Response (PSR) framework.....	32
2.1. Total population, 1980-2020.....	41
2.2. OECD age pyramids, 1995 and 2020.....	42
2.3. Persons aged between 15 and 64 years, 1980-2020.....	43
2.4. Urban and rural populations, 1980-2020.....	44
3.1. World exports, foreign direct investment and GDP, current US\$, 1970-1998.....	48
3.2. World exports, 1995-2020.....	49
3.3. Change in exports in 2020 under globalisation policy scenarios, compared to the Reference Scenario...	51
4.1. Real GDP, 1980-2020.....	58
4.2. Average annual change in real GDP, 1980-2020.....	59
4.3. Real GDP per capita, 1980-2020.....	60
4.4. Average annual changes in real GDP per capita, 1980-2020.....	61
4.5. Composition of value added in OECD regions, 1995-2020.....	62
4.6. Composition of value added in non-OECD regions, 1995-2020.....	63
5.1. Private and government consumption per capita, 1980-2020.....	68
5.2. Change in household expenditure, 1995-2020.....	69
7.1. Agricultural production, 1995-2020.....	87
7.2. Changes in environmental effects of the agriculture sector, 1995-2020.....	90
8.1. Water withdrawals per capita, 1980-2020.....	98
8.2. Water withdrawals by sector, 1995-2020.....	99
8.3. Emissions of water pollutants by sector, 1995-2020.....	101
9.1. World fish production by region and production type, 1950-2020.....	111
9.2. Global fleet capacity and catch rate, 1970-1989.....	113
10.1. World industrial wood production, 1970-2020.....	123
10.2. Demand for primary fibre inputs by type of use, 1995-2020.....	124
10.3. Change in forested area by forest type, 1995-2020.....	126
11.1. Changes in OECD land use, 1995-2020.....	136
12.1. Total final energy consumption (TFC), 1995-2020.....	147
12.2. Fuel shares in energy mix of OECD countries, 1995-2020.....	148
13.1. Greenhouse gas emissions by gas in OECD countries, 1998.....	158
13.2. Projected CO ₂ emissions from OECD countries, 1990-2020.....	160
13.3. Greenhouse gas emissions by sector in OECD countries, 1998.....	161
14.1. Motor vehicle kilometres travelled (VKT), 1990-2020.....	171
14.2. Global passenger air travel, 1990-2030.....	172
14.3. Global CO ₂ emissions from motor vehicles, 1990-2020.....	173
14.4. Motor vehicle emissions, GDP and population, 1995-2020.....	174
14.5. Externalities from transport in Europe, 1995.....	176
15.1. Air emission shares by region, 1995.....	184
15.2. Emission sources for selected air pollutants in OECD regions, 1997.....	186
15.3. Urban sites exceeding the WHO guidelines in the OECD region, 1993.....	187
15.4. Exceedence of critical levels for ozone in Europe, 1990 and 2010.....	189
15.5. Exceedence of critical loads for sensitive ecosystems in Europe, 1995-2010.....	190
16.1. Apparent food consumption in OECD countries, 1974-2020.....	198
16.2. Electricity demand by households, 1995-2020.....	200
16.3. International tourist arrivals worldwide.....	202
17.1. Steel production, 1995-2020.....	209
18.1. Production flow in the pulp and paper industries, 1998.....	216

18.2. Production in the pulp, paper and publishing sector, 1995-2020.....	217
19.1. Chemicals production, 1995-2020	225
19.2. CO ₂ emissions from fuel combustion in OECD countries, 1997.....	227
19.3. Production of CFCs for selected countries and regions, 1986-1997.....	228
20.1. Municipal waste generation, GDP and population in OECD countries, 1980-2020	236
20.2. Municipal waste generation, 1995-2020	237
20.3. Composition of total waste generated in the OECD region, mid-1990s.....	238
20.4. Recycling rates in selected OECD countries, 1980-1997	240
20.5. Municipal waste management, 1995-2020	241
21.1. Total burden of disease, with estimated environment-related share, mid-1990s.....	250
21.2. Patterns of disease burden with estimated environment-related shares, mid-1990s.....	251
23.1. Resource and material intensity of OECD economies, total use and intensity of use relative to GDP, 1980-2020	267
23.2. Indices of real primary commodity prices, 1980-1998	269
25.1. Effects in 2020 of removing subsidies to primary sectors and applying a tax to agrochemicals in OECD regions	295
25.2. Effects in 2020 of removing energy subsidies and applying a fuel tax in OECD regions.....	300
25.3. Effects in 2020 of removing subsidies, applying a fuel tax and a chemical use tax in OECD regions	307
A1. Nested structure of production in the JOBS model	316