

# Table of contents

Acknowledgements	vi
Secretary-General's Foreword	xxvi
Acting UN Environment Executive Director's Foreword	xxvii
Co-Chairs' Foreword	xxviii
Co-Chairs' Message	xxix

## SETTING THE STAGE



<b>CHAPTER 1: Introduction and Context</b>	<b>03</b>
1.1 GEO-6 healthy planet, healthy people – humanity's transformative challenge	04
1.2 UNEP's flagship assessment to deliver the environmental dimension of the 2030 agenda	07
1.3 GEO-6 in a changing global context	08
1.4 Environmental governance	11
1.5 The environmental dimension of the sustainable development goals, global environmental governance and multilateral environmental agreements	11
1.6 GEO-6 in the context of other environmental assessments	12
1.7 GEO-6 approach, theory of change and structure	13
<b>References</b>	<b>17</b>



<b>CHAPTER 2: Drivers of Environmental Change</b>	<b>21</b>
Executive summary	22
2.1 Introduction and context	24
2.2 Changes since the last assessment	24
2.3 Population	25
2.4 Urbanization	31
2.5 Economic development	36
2.6 Technology, innovation, and global sustainability	40
2.7 Climate change	43
2.8 Unravelling drivers and their interactions	48
<b>References</b>	<b>52</b>



<b>CHAPTER 3: The Current State of our Data and Knowledge</b>	<b>57</b>
Executive summary	58
3.1 Introduction	59
3.2 The demand for environmental statistics and data	59
3.3 History of environmental statistics	59
3.4 Better data for a healthy planet with healthy people	60
3.5 Gender and social-environment intersectionality	64
3.6 Equity and human-environment interactions	66
3.7 Existing data systems	68
3.8 Conclusion	71
<b>References</b>	<b>72</b>



<b>CHAPTER 4: Cross-cutting Issues</b>	<b>75</b>
Executive summary	76
4.1 Introduction	78
4.2 People and livelihoods	78
4.3 Changing environments	85
4.4 Resources and materials	91
4.5 Conclusions	97
<b>References</b>	<b>98</b>

## PART A: STATE OF THE GLOBAL ENVIRONMENT



<b>CHAPTER 5: Air</b> .....	<b>107</b>
Executive summary .....	108
5.1 Introduction .....	109
5.2 Pressures: emissions .....	110
5.3 State: atmospheric composition and climate .....	117
5.4 Impacts .....	125
5.5 Response: policies and governance .....	129
<b>References</b> .....	<b>134</b>



<b>CHAPTER 6: Biodiversity</b> .....	<b>141</b>
Executive summary .....	142
6.1 Introduction .....	144
6.2 Further assessments since the fifth Global Environmental Outlook (GEO-5) .....	145
6.3 Drivers .....	146
6.4 Pressures .....	146
6.5 Global state and trends of biodiversity .....	153
6.6 Impacts on the world's biomes .....	158
6.7 Responses .....	164
6.8 Conclusion .....	167
<b>References</b> .....	<b>168</b>



<b>CHAPTER 7: Oceans and Coasts</b> .....	<b>175</b>
Executive summary .....	176
7.1 Introduction .....	178
7.2 Pressures .....	180
7.3 State .....	181
7.4 Impacts .....	186
7.5 Response .....	191
7.6 Conclusions .....	193
<b>References</b> .....	<b>195</b>










<b>CHAPTER 8: Land and Soil</b> .....	<b>201</b>
Executive summary .....	202
8.1 Land resources and the sustainable development goals .....	204
8.2 Setting the stage for GEO-6: the GEO-5 legacy .....	204
8.3 Drivers and pressures .....	204
8.4 Key state and trends .....	209
8.5 Key impacts .....	217
8.6 Policy responses .....	224
<b>References</b> .....	<b>229</b>



<b>CHAPTER 9: Freshwater</b> .....	<b>235</b>
Executive summary .....	236
9.1 Introduction and priority issues .....	238
9.2 Pressures on freshwater .....	238
9.3 Water and land use .....	240
9.4 Global state and trends of freshwater .....	240
9.5 Water quality .....	244
9.6 Freshwater ecosystems .....	250
9.7 Water infrastructure .....	252
9.8 Impacts .....	255
9.9 Policy responses .....	257
9.10 Conclusions .....	263
<b>References</b> .....	<b>265</b>

**PART B: POLICIES, GOALS, OBJECTIVES AND ENVIRONMENTAL GOVERNANCE:  
AN ASSESSMENT OF THEIR EFFECTIVENESS**

	<b>CHAPTER 10: Approach to Assessment of Policy Effectiveness</b> .....	<b>273</b>
	10.1 The Context .....	274
	10.2 Environmental policy and governance .....	274
	10.3 Policy instruments .....	275
	10.4 Policy mixes and coherence .....	275
	10.5 Methodology adopted to assess policy effectiveness .....	277
	10.6 Top-down evaluation methodology .....	278
	10.7 Bottom-up evaluation methodology .....	279
	10.8 Content of Part B .....	280
	<b>References</b> .....	<b>281</b>
	<b>CHAPTER 11: Policy Theory and Practice</b> .....	<b>283</b>
	Executive summary .....	284
	11.1 Introduction .....	285
	11.2 Policy design .....	285
	11.3 Policy integration .....	289
	11.4 Effectiveness of international and multilevel governance .....	294
	11.5 Conclusions .....	296
	<b>References</b> .....	<b>297</b>
	<b>CHAPTER 12: Air Policy</b> .....	<b>301</b>
	Executive summary .....	302
	12.1 Introduction .....	303
	12.2 Key policies and governance approaches .....	303
	12.3 Indicators .....	315
	12.4 Discussion and conclusions .....	319
	<b>References</b> .....	<b>320</b>
	<b>CHAPTER 13: Biodiversity Policy</b> .....	<b>323</b>
	Executive summary .....	324
	13.1 Introduction .....	325
	13.2 Key policies and governance approaches .....	326
	13.3 Indicators: Biodiversity policy .....	338
	13.4 Conclusions .....	342
	<b>References</b> .....	<b>344</b>
	<b>CHAPTER 14: Oceans and Coastal Policy</b> .....	<b>349</b>
	Executive summary .....	350
	14.1 Introduction .....	351
	14.2 Key policies and governance approaches .....	351
	14.3 Indicators .....	362
	14.4 Discussion and conclusions .....	366
	<b>References</b> .....	<b>367</b>
	<b>CHAPTER 15: Land and Soil Policy</b> .....	<b>373</b>
	Executive summary .....	374
	15.1 Introduction .....	376
	15.2 Key policies and governance approaches .....	377
	15.3 Indicators .....	389
	15.4 Conclusions .....	393
	<b>References</b> .....	<b>394</b>
	<b>CHAPTER 16: Freshwater Policy</b> .....	<b>399</b>
	Executive summary .....	400
	16.1 Introduction .....	401
	16.2 Key policies and governance approaches .....	401
	16.3 Indicators (link to SDGs and MEAs) .....	412
	16.4 Discussion and conclusions .....	419
	<b>References</b> .....	<b>420</b>



<b>CHAPTER 17: Systemic Policy Approaches for Cross-cutting Issues</b> .....	<b>425</b>
Executive summary .....	426
17.1 Cross-cutting policy issues and systemic change .....	428
17.2 Key actors, policies and governance approaches .....	428
17.3 Adapting socioeconomic systems to be more resilient to climate change .....	429
17.4 Creating a sustainable agrifood system .....	432
17.5 Decarbonizing energy systems .....	436
17.6 Towards a more circular economy .....	439
17.7 Conclusions .....	446
<b>References</b> .....	<b>448</b>



<b>CHAPTER 18: Conclusions on Policy Effectiveness</b> .....	<b>453</b>
18.1 Overview of the outcomes .....	454
18.2 Connections to future policy .....	456
18.3 Gaps in knowledge .....	456
18.4 Key lessons from the analysis .....	457
<b>References</b> .....	<b>458</b>

## PART C: OUTLOOKS AND PATHWAYS TO A HEALTHY PLANET WITH HEALTHY PEOPLE



<b>CHAPTER 19: Outlooks in GEO-6</b> .....	<b>463</b>
Executive summary .....	464
19.1 Introduction .....	465
19.2 Important elements of future-oriented environmental outlooks .....	465
19.3 A new framework for combining top-down and bottom-up analysis methods .....	466
19.4 The role of scale .....	467
19.5 Roadmap for Part C of GEO-6 .....	467
<b>References</b> .....	<b>469</b>



<b>CHAPTER 20: A Long-Term Vision for 2050</b> .....	<b>471</b>
Executive summary .....	472
20.1 Introduction .....	473
20.2 The environmental dimension of the SDGs .....	473
20.3 An integrated view on the SDGs .....	473
20.4 A long-term vision: selected targets and indicators .....	476
20.5 Conclusions .....	481
<b>References</b> .....	<b>482</b>



<b>CHAPTER 21: Future Developments Without Targeted Policies</b> .....	<b>485</b>
Executive summary .....	486
21.1 Introduction .....	488
21.2 Global environmental scenarios .....	488
21.3 The achievement of SDGs and related MEAs in trend scenarios .....	490
21.4 Are we achieving the targets? .....	502
<b>References</b> .....	<b>506</b>



<b>CHAPTER 22: Pathways Toward Sustainable Development</b> .....	<b>511</b>
Executive summary .....	512
22.1 Introduction .....	514
22.2 Pathways definition .....	514
22.3 Pathways towards achieving the targets .....	514
22.4 An integrated approach .....	532
22.5 Conclusions and recommendations .....	537
<b>References</b> .....	<b>539</b>



<b>CHAPTER 23: Bottom-up Initiatives and Participatory Approaches for Outlooks</b> .....	<b>545</b>
Executive summary .....	546
23.1 Introduction .....	548
23.2 Integrating global assessments and bottom-up analyses .....	548
23.3 Sub-global assessments in a multilevel context .....	549
23.4 Bottom-up futures based on existing local practices .....	550
23.5 Methodological rationale and approach .....	550
23.6 Investigating the broad landscape of bottom-up initiatives .....	551
23.7 GEO-6 participatory initiatives .....	552
23.8 GEO-6 Regional Assessments .....	553
23.9 Findings from a bottom-up approach .....	553
23.10 GEO Regional Assessment synthesis .....	566
23.11 Regional outlook interventions and bottom-up initiatives .....	570
23.12 Enabling conditions for transformations .....	572
23.13 Key messages .....	573
23.14 Key interventions and a critical need to recognize distributive justice given global inequities and inequality .....	576
<b>References</b> .....	<b>577</b>



<b>CHAPTER 24: The Way Forward</b> .....	<b>581</b>
Executive summary .....	582
24.1 Approaches for environmental policy: strategic and transformative .....	583
24.2 Transformative change .....	584
24.3 Building blocks for transformation .....	584
24.4 Healthy planet, healthy people: challenge and opportunity .....	587
<b>References</b> .....	<b>590</b>

## PART D: REMAINING DATA AND KNOWLEDGE GAPS



<b>CHAPTER 25: Future Data and Knowledge Needs</b> .....	<b>597</b>
Executive summary .....	598
25.1 Introduction .....	599
25.2 Emerging tools for environmental assessment .....	599
25.3 Environmental monitoring for the future .....	612
25.4 Conclusion: challenges, gaps and opportunities .....	615
<b>References</b> .....	<b>618</b>



<b>ANNEXES</b> .....	<b>619</b>
Annex 1-1: Mission of the sixth Global Environment Outlook .....	620
Annex 1-2: Range of integrated environmental assessments which the sixth Global Environment Outlook draws from ..	621
Annex 1-3: Theory of Change for the sixth Global Environment Outlook (GEO-6) .....	623
Annex 1-4: Structure and rationale for confidence statements used in the sixth Global Environment Outlook .....	625
Annex 4-1: Towards monitoring the environmental dimension of the SDGs .....	629
Annex 6-1: The principal biodiversity-related Conventions .....	637
Annex 9-1: Water contaminants and occurrences .....	638
Annex 13-1: Biodiversity conservation and International Environmental Agreements (IEAs) .....	641
Annex 13-2: Overview of key policy developments and governance responses at a global level .....	642
Annex 23-1: Bottom-up Initiative platforms and results .....	643



<b>THE GEO-6 PROCESS</b> .....	<b>661</b>
Timeline .....	664
Partnerships and collaboration .....	665
Review process .....	665
GEO-6 Advisory bodies .....	666
Consultation process .....	666
Appendix .....	668
Acronyms .....	670
Contributors .....	675
Glossary .....	687