

Figures

Introduction and Context

| | |
|--|----|
| Figure 1.1: Choices to be made to achieve a healthy planet for healthy people..... | 06 |
| Figure 1.2: The DPSIR approach used in GEO-6..... | 13 |
| Figure 1.3: Structure of GEO-6, with a link to its Theory of Change (see Annex 1-3)..... | 15 |

Drivers of Environmental Change

| | |
|--|----|
| Figure 2.1: World population, emissions and fertility..... | 26 |
| Figure 2.2: Emissions per capita according to demographics..... | 27 |
| Figure 2.3: Projected world population..... | 28 |
| Figure 2.4: Consumption and associated environmental pressures are unequally distributed between nations..... | 29 |
| Figure 2.5: World population distribution and composition..... | 30 |
| Figure 2.6: Contraceptive prevalence and total fertility..... | 30 |
| Figure 2.7: Female secondary education and total fertility rates..... | 31 |
| Figure 2.8: Global urban population growth propelled by cities..... | 32 |
| Figure 2.9: City growth rates..... | 32 |
| Figure 2.10: Where rapid growth faces high vulnerability..... | 34 |
| Figure 2.11: Built-up area vs. Population (1975-2015)..... | 35 |
| Figure 2.12: How growth rates in developing countries began outstripping those in developed countries..... | 37 |
| Figure 2.13: World trade growth..... | 38 |
| Figure 2.14: Milanovic's elephant curve..... | 39 |
| Figure 2.15: Industry 4.0: technological transformation of future industrial production..... | 43 |
| Figure 2.16: Mean atmospheric CO ₂ concentration..... | 43 |
| Figure 2.17: Global growth in emissions of GHGs by economic region..... | 44 |
| Figure 2.18: Emission trends in different countries from 1990-2015..... | 45 |
| Figure 2.19: The carbon crunch..... | 45 |
| Figure 2.20: Multiple independent indicators of a changing global climate..... | 46 |
| Figure 2.21: The enhanced burning embers diagram, providing a global perspective on climate-related risks..... | 47 |
| Figure 2.22: Trends in numbers of loss-relevant natural events..... | 48 |
| Figure 2.23: Relationship across the drivers..... | 50 |

The Current State of our Data and Knowledge

| | |
|--|----|
| Figure 3.1: SDGs data and knowledge framework..... | 60 |
| Figure 3.2: SDG indicator status..... | 60 |
| Figure 3.3: Environment-related SDG indicators by goal and tier..... | 61 |
| Figure 3.4: GEO-6 major data gaps organized by respective chapter..... | 61 |
| Figure 3.5: Unpaid care work..... | 65 |
| Figure 3.6: Equity questions in data and knowledge..... | 66 |

Cross-cutting Issues

| | |
|--|----|
| Figure 4.1: The economic and human impact of disasters in the last ten years..... | 80 |
| Figure 4.2: Percentage distribution of the water collection burden across 61 countries..... | 81 |
| Figure 4.3: Key competencies and performance of sustainability citizens..... | 82 |
| Figure 4.4: World urbanization trends..... | 84 |
| Figure 4.5: Global annual average temperature anomalies (relative to the long-term average for 1981-2010). Labelling designates different data sets; for explanation refer to the source..... | 85 |
| Figure 4.6: Arctic sea ice age and extent..... | 87 |
| Figure 4.7: Chemical intensification, 1955-2015..... | 88 |
| Figure 4.8: Global illegal waste traffic..... | 90 |
| Figure 4.9: West Asia non-conventional annual water resources..... | 91 |
| Figure 4.10: Example of ore grade decline over time for copper mining, showing world annual copper production and estimated tailings generated annually..... | 92 |
| Figure 4.11: Technology wedges to achieve the 2°C pathway..... | 94 |
| Figure 4.12: Ranges of levelized cost of electricity for different renewable power generation technologies, 2014 and 2025..... | 94 |
| Figure 4.13: The subglobal distributions and current status of the control variables for (A) biogeochemical flows of phosphorus; (B) biogeochemical flows of nitrogen..... | 96 |

Air

| | |
|--|-----|
| Figure 5.1: Primary linkages between pressures, state and impacts of atmospheric change..... | 109 |
| Figure 5.2: Linkages between changes in atmospheric composition and achievement of the Sustainable Development Goals..... | 110 |
| Figure 5.3: Annual emission trends from 1990 to 2014 in kilotons by pollutant, region and sector..... | 111 |
| Figure 5.3 (continued): Annual emission trends from 1990 to 2014 in kilotons by pollutant, region and sector..... | 112 |
| Figure 5.3 (continued): Annual emission trends from 1990 to 2014 in kilotons by pollutant, region and sector..... | 113 |
| Figure 5.4: Global fuel shares of electricity generation in 2015 ¹ | 113 |

| | | |
|--------------------------|--|-----|
| Figure 5.5: | World petroleum refinery output by-product (million tons)..... | 114 |
| Figure 5.6: | World electricity generation by fuel (terawatt hours) ¹ | 114 |
| Figure 5.7: | Annual average PM _{2.5} concentrations in 2016 compared with the WHO Air Quality guideline and interim targets..... | 118 |
| Figure 5.8: | Seasonal average population-weighted O ₃ concentration in 2016 for season with maximum ozone levels by country..... | 119 |
| Figure 5.9: | Annual average PM ₁₀ levels for megacities of more than 14 million inhabitants with available data for the period 2011-2015..... | 119 |
| Figure 5.10: | Model estimates of the sources of PM _{2.5} observed in several cities in each of three countries shows local PM _{2.5} concentrations are strongly influenced by secondary particles from transboundary sources. The source of emissions is divided into natural, international (emitted outside the country), national (emitted within the country but outside the urban area), urban (emitted within the city) and street (emitted within the immediate vicinity of the observation) and interim targets..... | 120 |
| Figure 5.11: | The Dust Belt..... | 121 |
| Figure 5.12: | Global distribution of annual mean gaseous elemental mercury concentration in near-surface air (top) and wet-deposition flux (bottom) in 2015 simulated by a model ensemble..... | 122 |
| Figure 5.13: | Vertical profiles of annual mean O ₃ trends over 35°-60°N averaged over all available observations (black) for the periods of stratospheric ODS increase (left) and ODS decline (right), with the corresponding modelled trends for ODS changes only (red), GHG changes only (blue) and both together (grey)..... | 123 |
| Figure 5.14: | Deaths per 100,000 people in 2016 attributable to ambient PM _{2.5} air pollution; age-standardized data..... | 126 |
| Figure 5.15: | Percentage of PM _{2.5} related deaths in a region indicated by the column due to (a) emissions produced or (b) goods and services consumed in the region indicated by the row..... | 127 |
| Figure 5.16: | Map of groupings of selected regional multilateral air pollution agreements..... | 131 |
| Biodiversity | | |
| Figure 6.1: | Schematic from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services describing the main elements and relationships linking nature, biodiversity and ecosystem services, human well-being and sustainable development. (In this diagram, anthropogenic drivers equate to the pressures as described in Section 6.3.)..... | 144 |
| Figure 6.2: | Interconnections between people, biodiversity, ecosystem health and provision of ecosystem services showing drivers and pressures..... | 146 |
| Figure 6.3: | Examples of global distribution of pressures on (a) threat intensity (H: high; L: low; M: medium; VH: very high; VL: very low) from terrestrial invasive alien species and (b) cumulative fisheries by-catch intensity for seabirds, sea mammals and sea turtles, by all gear types (gillnet, longline and trawl)..... | 147 |
| Figure 6.4: | Percentage of threatened (critically endangered, endangered and vulnerable) and near threatened amphibian, bird and mammal species by major threat class..... | 148 |
| Figure 6.5: | Map of the global human footprint for 2009 (combined pressures of infrastructure, land cover and human access into natural areas, using a 0-50 on a cool to hot colour scales) (a), and absolute change in average human footprint from 1993 to 2009 at the ecoregion scale (b)..... | 149 |
| Figure 6.6: | Impact mechanism of invasive alien species on threatened species in Europe..... | 150 |
| Figure 6.7: | Recorded number of rhinoceros poached in South Africa, 2007-2015. In 2011, the rhino population in South Africa numbered just over 20,000..... | 151 |
| Figure 6.8: | Global map showing species vulnerable to climate change..... | 152 |
| Figure 6.9: | Proportions of local animal breeds, classified as being at risk, not at risk or unknown level of risk of extinction..... | 153 |
| Figure 6.10: | Cumulative number of species with whole genome sequences (2000-2016)..... | 154 |
| Figure 6.11: | The proportion of species in each extinction risk category of the IUCN Red List of Threatened Species..... | 155 |
| Figure 6.12: | Red List Index of species survival for birds, mammals, amphibians, corals and cycads, and an aggregate (in blue) for all species..... | 155 |
| Figure 6.13: | Global Living Planet Index..... | 156 |
| Figure 6.14: | Terrestrial Biodiversity Intactness Index..... | 156 |
| Figure 6.15: | Mechanisms of ecosystem collapse, and symptoms of the risk of collapse..... | 157 |
| Figure 6.16: | Mean percentage change in each broad habitat type based on satellite imagery: (a) change from original land-cover type between 2001 and 2012; (b) vegetation productivity as measured using the Enhanced Vegetation Index between the years 2000-2004 and 2009-2013..... | 158 |
| Figure 6.17: | Global trends in the state of the world's marine stocks 1975-2015..... | 159 |
| Figure 6.18: | Extinction risk of global freshwater fauna by taxonomic group..... | 160 |
| Figure 6.19: | Capacity of mountains to provide ecosystem services..... | 163 |
| Figure 6.20: | Protected areas of the world..... | 165 |
| Oceans and Coasts | | |
| Figure 7.1: | Generalized schematic showing the drivers and pressures relevant to the marine environment..... | 179 |
| Figure 7.2: | Map showing the maximum heat stress during the ongoing 2014-17 global coral bleaching event..... | 181 |
| Figure 7.3: | World capture fisheries and aquaculture production..... | 182 |
| Figure 7.4: | Status of fish stocks and fishing mortality as influenced by various factors of science, management and governance. Higher relative scores on vertical axis reflect better stock status relative to theoretically 'ideal' management..... | 183 |

| | | |
|-------------|---|-----|
| Figure 7.5: | Biomagnification and bioaccumulation of methylmercury in the food chain. | 185 |
| Figure 7.6: | Global map of potential marine plastic input to the oceans based on human activities and watershed characteristics. | 186 |
| Figure 7.7: | Plastic litter in the open ocean. | 188 |

Land and Soil

| | | |
|--------------|--|-----|
| Figure 8.1: | Different perspectives on the globalization of lands in 2007 (Exckert IV projection). | 206 |
| Figure 8.2: | Relative roles played by agricultural commodities versus manufactures and services in globalizing lands (Eckert IV projections). | 207 |
| Figure 8.3: | Estimated net impact of climate trends for 1980-2008 on crop yields by country. | 208 |
| Figure 8.4: | Changes of global forests (a) and cropland (b) 1992-2015 based on European Space Agency land cover data time series. | 209 |
| Figure 8.5: | Areas designated for extractive activities in the Andean region (South America). | 210 |
| Figure 8.6: | Global area allocation for food production. | 210 |
| Figure 8.7: | Agricultural area 2000-2014. | 211 |
| Figure 8.8: | Food supply in the world (kcal/capita per day). | 211 |
| Figure 8.9: | Soybean production in South America, 2000-2014. | 211 |
| Figure 8.10: | Production of oil palm fruit in South-East Asia. | 211 |
| Figure 8.11: | Numbers of herbivores and poultry. | 212 |
| Figure 8.12: | Numbers of pigs, 2000-2014. | 212 |
| Figure 8.13: | Permanent meadows and pastures (1,000 ha). | 212 |
| Figure 8.14: | Forest land in the world, 2000-2015. | 212 |
| Figure 8.15: | Forest area annual net change, (1990-2000, 2000-2010, 2010-2015). | 213 |
| Figure 8.16: | Natural forest area by region, 1990-2015. | 214 |
| Figure 8.17: | Coastal erosion rates at selected sites in the Arctic. | 216 |
| Figure 8.18: | Estimated coastal erosion threat in the Arctic. | 217 |
| Figure 8.19: | Potential impacts of climate change on food security. | 218 |
| Figure 8.20: | Make-up of total food waste in developed and developing countries. | 219 |
| Figure 8.21: | Share of global production volumes traded internationally in 2014. | 219 |
| Figure 8.22: | Developing countries: net cereals trade (million tons). | 219 |
| Figure 8.23: | Global forest ownership, 2002-2013 (%). | 221 |
| Figure 8.24: | Global maps of land deals, number of land deals per country (top), land deal area per country (bottom). | 222 |
| Figure 8.25: | Benefits of tenure-secure lands outweigh the costs in three Latin American countries. | 223 |
| Figure 8.26: | Distribution of agricultural land holdings: females. | 225 |
| Figure 8.27: | Fertilizer and maize prices, 2000-2010. | 226 |
| Figure 8.28: | Where should subsidies fit? | 226 |
| Figure 8.29: | The provision of ecosystem services from natural capital: linkages between ecosystem services and human well-being. | 227 |

Freshwater

| | | |
|--------------|--|-----|
| Figure 9.1: | Global hydrological fluxes and storages (expressed in 1,000 km ³ per year), illustrating natural and anthropogenic cycles. | 238 |
| Figure 9.2: | Shrinkage of Lake Chad. | 239 |
| Figure 9.3: | United States water withdrawals from all sources (1950-2010). | 241 |
| Figure 9.4: | Global hydrogeological map illustrating various aquifers and groundwater resources. | 241 |
| Figure 9.5: | Global trends in increasing groundwater use. | 242 |
| Figure 9.6: | Examples of surface streams affected by acid and metalliferous drainage (AMD) and/or tailings discharges: (left) Urban stream severely affect by AMD in western Witwatersrand Basin, Johannesburg, South Africa; (right) Tailings sediment from Samarco Dam. | 243 |
| Figure 9.7: | Rivers originating in the Hindu-Kush Himalayas are among the most meltwater-dependent systems | 243 |
| Figure 9.8: | Retreat of Quelccaya ice cap in Peru between 1988 (left) and 2010 (right). | 244 |
| Figure 9.9: | Global physical and economic water scarcity. | 245 |
| Figure 9.10: | Model estimates of trends in faecal coliform bacteria levels in rivers during 1990-1992 and 2008-2010. | 246 |
| Figure 9.11: | Sources of anthropogenic total phosphorus loadings to lakes (five largest lakes by surface area in each of the five UN Environment regions), showing average percentage contributions in 2008-2010 annual loads. | 247 |
| Figure 9.12: | Model estimates of trends in biochemical oxygen demand (BOD) concentrations in rivers between 1990-1992 and 2008-2010. | 248 |
| Figure 9.13: | Source and pathways of pharmaceutical and personal care products (PPCPs) entering surface and groundwater, highlighting need for improved detection of commonly found PPCPs and their transformative products. | 249 |
| Figure 9.14: | Status and trends of the world's wetlands disaggregated by region. | 250 |
| Figure 9.15: | Taxonomic differences in threat frequency for 449 declining freshwater populations in Living Planet Index (LPI) database. | 251 |
| Figure 9.16: | Migratory fish from the Living Planet Index (LPI) exhibiting a decline of 41 per cent between 1970 and 2012, with a recent upturn, and freshwater LPI for 881 monitored freshwater species exhibiting an 81 per cent decline. | 252 |
| Figure 9.17: | Variations in trends in drinking water supply coverage across regions. | 252 |

| | | |
|---|--|-----|
| Figure 9.18: | Summary of global progress in providing basic drinking water services and disproportionate impact on women in areas still lacking access to basic drinking water services..... | 253 |
| Figure 9.19: | Proportion of population using improved sanitation facilities in 2015..... | 254 |
| Figure 9.20: | Location of dams and reservoirs around the world. Data include dams associated with reservoirs that have a storage capacity of more than 0.1 km ³ and may not represent large dams and reservoirs that have been constructed in more recent years..... | 255 |
| Figure 9.21: | Morbidity (total disability-adjusted life years, DALYs) from diarrheal diseases (all ages) for females (upper graphic) and males (lower graphic), globally..... | 256 |
| Figure 9.22: | Hermanus Conjunctive Use..... | 261 |
| Figure 9.23: | Supply of and demand for water, Greater Hermanus, 1971-2001 and 2002-2017..... | 262 |
| Figure 9.24: | Ramsar sites designated by year and by region..... | 263 |
| Approach to Assessment of Policy Effectiveness | | |
| Figure 10.1: | Methodological approach for assessing policy effectiveness: top-down and bottom-up approach..... | 277 |
| Figure 10.2: | Approach of assessing policy effectiveness from the bottom-up..... | 279 |
| Policy Theory and Practice | | |
| Figure 11.1: | Conceptual outline of policy effectiveness analysis..... | 285 |
| Figure 11.2: | The policy cycle..... | 286 |
| Figure 11.3: | Results of expert perspectives on European energy efficiency policies..... | 288 |
| Air Policy | | |
| Figure 12.1: | Regional allocation of cumulative CO ₂ emissions..... | 306 |
| Figure 12.2: | Population-weighted annual country-wide mean concentration of PM _{2.5} in 2016..... | 316 |
| Figure 12.3: | Ozone-depleting substance consumption in ozone depletion tons in 2016..... | 317 |
| Figure 12.4: | National total GHG emissions in 2014 in MtCO ₂ e, including land-use change and forestry sources and sinks..... | 318 |
| Biodiversity Policy | | |
| Figure 13.1: | Cumulative number of countries that have adopted the NBSAPs as of 2018..... | 325 |
| Figure 13.2: | Inshore fishing is an important source of food in Fiji, and many of these inshore areas are under traditional tenure by local communities..... | 327 |
| Figure 13.3: | National Environmental Security Taskforces are direct liaisons between national bureaucracies and the INTERPOL National Central Bureau; image showing seizure of 114kg of tiger bones..... | 329 |
| Figure 13.4: | Usage of the terms containing 'biodiversity', 'econo' and 'ecosystem services' over time in Australian Government environment portfolio media releases (n= 3,553). Error bars indicate 95 per cent confidence intervals based on the ecosystem services framing subsample (n = 516)..... | 333 |
| Figure 13.5: | The SGSV is located 100m inside a mountain on a remote island in the Svalbard archipelago, midway between mainland Norway and the North Pole, and the samples are stored at -18°C..... | 334 |
| Figure 13.6: | The City of Edmonton: the River Valley park system along the North Saskatchewan River as seen from downtown Edmonton..... | 336 |
| Figure 13.7: | Trends in national legislation relevant to the prevention or control of invasive alien species (IAS) for 196 countries reporting to the Convention on Biological Diversity (1967–2016), showing specifically the percentage of countries having a combination of: (i) IAS legislation; (ii) NBSAP targets on IAS; and (iii) IAS targets aligned with Aichi Target 9..... | 339 |
| Figure 13.8: | Percentage of countries whose institutions have a clear mandate and/or legal authority to manage IAS (a positive result is given by a Yes and is included in the overall percentage)..... | 339 |
| Figure 13.9: | The Red List Index (RLI) for 1980–2017 for mammals, birds and amphibians, showing the trends driven only by utilization (by only including utilized species)..... | 340 |
| Figure 13.10: | The world Ecological Footprint by component (land type) between 1961 and 2013, measured by number of Earths..... | 342 |
| Oceans and Coastal Policy | | |
| Figure 14.1: | Coverage of Marine Protected Areas..... | 362 |
| Figure 14.2: | Areas of predicted deep-sea vulnerable marine ecosystems..... | 365 |
| Figure 14.3: | Bottom-trawling and closed VMEs from 2006 to 2016..... | 365 |
| Land and Soil Policy | | |
| Figure 15.1: | Linkage between the land-related SDG target 15.3 and other SDGs..... | 376 |
| Figure 15.2: | The extent of the Great Green Wall in northern China..... | 381 |
| Figure 15.3: | Trends in land degradation and restoration worldwide..... | 390 |
| Figure 15.4: | Terrestrial protected area as a percentage of total land area per country (1990-2014)..... | 391 |
| Figure 15.5: | Ratio of land consumption rate to population growth rate by region and period (1990-2015)..... | 392 |
| Freshwater Policy | | |
| Figure 16.1: | Map showing location and status of all United States of America and Canadian Great Lakes Areas of Concern..... | 404 |
| Figure 16.2: | Change in global population by drinking water source, 1990-2015 (billions)..... | 415 |
| Figure 16.3: | Regional trends in proportion of national population practising open defecation, 2000-2015..... | 415 |

| | | |
|--|---|-----|
| Figure 16.4: | Progress towards universal basic sanitation services (2000-2015) among countries where at least 5 per cent of the population did not have basic services in 2015. | 416 |
| Figure 16.5: | Trends in global water withdrawal by sector between 1900 and 2010 (km ³ per year)..... | 417 |
| Figure 16.6: | Proportion of total water withdrawn for agriculture. | 417 |
| Figure 16.7: | Changes in global gross crop water demand over time. | 418 |
| Systemic Policy Approaches for Cross-cutting Issues | | |
| Figure 17.1: | Climate finance on adaptation. | 430 |
| Figure 17.2: | Health and sustainability of country X's dietary intake. | 436 |
| Figure 17.3: | An illustrative energy system. | 437 |
| Figure 17.4: | Building a circular economy. | 440 |
| Figure 17.5: | Closed-loop material flow diagram of 6R elements and the four life cycle stages..... | 441 |
| Figure 17.6: | Outline of a circular economy. | 443 |
| Figure 17.7: | Domestic extraction and domestic material consumption..... | 445 |
| Figure 17.8: | Citizen engagement in sharing: the percentage of 2013 survey respondents who had engaged in a sharing scheme, either formal or informal in the previous 12 months. | 446 |
| Outlooks in GEO-6 | | |
| Figure 19.1: | Conceptual framing of the chapters in Part C of GEO-6, how they are related, and how they contribute to a holistic analysis and assessment of human-Earth systems that identifies transformative development pathways. | 468 |
| A Long-Term Vision for 2050 | | |
| Figure 20.1: | A framework for the classification and grouping of the SDGs. | 474 |
| Future Developments Without Targeted Policies | | |
| Figure 21.1: | Selected targets and their related clusters as examined in this chapter. | 490 |
| Figure 21.2: | Future projections of the global population (left) and urbanization (right)..... | 491 |
| Figure 21.3: | Future projections of total GDP per region under SSP2 (left) and global GDP under SSP2 and SSP3 (right). | 491 |
| Figure 21.4: | Future projections of global average crop yield (top left), crop production (top right), agricultural area (bottom left), and forest and other natural land area (bottom right)..... | 493 |
| Figure 21.5: | Future projections of global undernourished population..... | 494 |
| Figure 21.6: | Future projections of relative local species richness for a range of climate stabilisation scenarios and Mean Species Abundance (MSA) for SSP2 and SSP3 land-use..... | 494 |
| Figure 21.7: | Future projections of global primary energy consumption (left panel) and per energy carrier in the SSP2 marker scenario (right panel). | 495 |
| Figure 21.8: | Projected increase in global CO ₂ emissions (left) and total GHG emissions (right)..... | 496 |
| Figure 21.9: | Global mean temperature increase..... | 497 |
| Figure 21.10: | Future projections of emissions for air pollutants SO ₂ , NOx and BC..... | 498 |
| Figure 21.11: | Projected under-five mortality rate in 2030. | 502 |
| Pathways Toward Sustainable Development | | |
| Figure 22.1: | The scenarios from the Roads from Rio+20 study..... | 514 |
| Figure 22.2: | Selected measures and their related clusters as examined in this chapter..... | 515 |
| Figure 22.3: | Percentage change in non-energy crop production versus the percentage change in non-energy cropland area from 2010 to 2030 and 2050. | 517 |
| Figure 22.4: | Global CO ₂ emissions and associated global mean temperature increase for the SSP2 baseline and derived scenarios consistent with the Paris target to stay well below 2°C increase. | 521 |
| Figure 22.5: | 2010-2050 energy intensity improvement rate and the 2050 share of low-greenhouse gas technologies in total energy mix of the scenarios included in the SSP database..... | 522 |
| Figure 22.6: | Different pathways leading to a global mean temperature increase well below 2°C..... | 523 |
| Figure 22.7a: | Projected global emissions for SO ₂ , NOx and black carbon under different climate and air pollution policies..... | 525 |
| Figure 22.7b: | Differences in air pollution emissions between various climate mitigation scenarios, and the SSP2 baseline. | 525 |
| Figure 22.8: | Percentage of the population exposed to particulate matter of less than 2.5 µm in diameter (PM _{2.5}) concentrations under the WHO guideline and interim target for 2050. | 527 |
| Figure 22.9: | Quick-scan of synergies and trade-offs between selected measures and targets..... | 534 |
| Figure 22.10: | Global mean temperature increase in 2100 versus bioenergy use in various SSP scenarios. | 536 |
| Bottom-up Initiatives and Participatory Approaches for Outlooks | | |
| Figure 23.1: | Outline of how this chapter's bottom-up approaches complement the top-down findings of Chapters 21 and 22 and how together they can offer policy insights for Chapter 24..... | 551 |
| Figure 23.2: | The number of initiatives covered in a sample of platforms that feature bottom-up sustainability initiatives (see Annex 23-1 for a brief description of the platforms). | 555 |
| Figure 23.3: | The SDGs represented proportionally by how they are covered by the selected bottom-up sustainability initiative platforms. Some initiatives are narrower in scope and strictly relate to one, two or three SDGs, while others are diverse and capture a wider range of SDGs (four or more) (see Annex 23-1 for a brief description of the initiative platforms). | 555 |
| Figure 23.4: | SDGs targeted by the total workshop seeds and the total Climate CoLab proposals..... | 556 |
| Figure 23.5: | Actor types represented by total seeds and total Climate CoLab proposals. | 557 |

| | |
|---|-----|
| Figure 23.6a: Regions covered by Climate CoLab proposals. | 557 |
| Figure 23.6b: Regional breakdown of Climate CoLab proposals. | 557 |
| Figure 23.7: How each theory of change is represented by the total seeds and proposals. | 558 |
| Figure 23.8: Heat map of workshop seeds, showing pairings of specific measures/interventions and SDGs. | 561 |
| Figure 23.9: Heat map of Climate CoLab proposals showing pairings of measures/interventions and SDGs. | 562 |
| Figure 23.10: Inter-cluster pairings across the seeds and Climate CoLab proposals. | 563 |
| Figure 23.11: Total number of workshop seeds and Climate CoLab proposals addressing each intervention in the agriculture, food, land and biodiversity cluster (seeds and proposals are double counted when they meet multiple measures). | 564 |
| Figure 23.12: Total number of workshop seeds and Climate CoLab proposals addressing each intervention in the energy, climate and air cluster (seeds and proposals are double counted when they meet multiple measures). | 565 |
| Figure 23.13: Total number of workshop seeds and Climate CoLab proposals addressing each intervention in the combined clusters for freshwater and oceans (seeds and proposals are double counted when they meet multiple measures). | 565 |
| Figure 23.14: Total number of workshop seeds and Climate CoLab proposals addressing each intervention in the human well-being cluster (seeds and proposals are double counted when they meet multiple measures) | 566 |
| Figure 23.15: The interventions highlighted by the outlook chapters of the GEO Regional Assessments. | 567 |
| Figure 23.16: Number of regions emphasizing interventions within the clusters identified in Chapter 22. | 569 |
| Figure 23.17: Seeds and proposals by cluster. | 570 |
| Figure 23.18: Count of the number of pairings of "other" measures with at least one intervention from a main cluster group. | 571 |
| Figure 23.19: Conceptual framework for mutually beneficial feedbacks between top-down and bottom-up approaches to generating sustainable scenarios. | 575 |
| The Way Forward | |
| Figure 24.1: Different policy approaches. | 583 |
| Future Data and Knowledge Needs | |
| Figure 25.1: Some of the benefits of citizen science. | 599 |
| Figure 25.2: Levels of citizen science by increasing depth of the participation. | 600 |
| Figure 25.3: An example of citizen science that demonstrates how it is needed and can be replicated. | 601 |
| Figure 25.4: GLOBE Students in St. Scholastica Catholic School in Nairobi collecting and recording the amount of precipitation for the GPM Satellite Mission field campaign. | 602 |
| Figure 25.5: Citizen scientists collecting environmental data. | 603 |
| Figure 25.6: The PPSR-Core data-model framework. | 604 |
| Figure 25.7: Characteristics of big data and the role of analytics. | 605 |
| Figure 25.8: Forecasting air quality for Indian districts. | 607 |
| Figure 25.9: Comparing indigenous/traditional knowledge and Western science. | 609 |
| Figure 25.10: Recognition of indigenous peoples in the 2030 Agenda for Sustainable Development. | 611 |
| Figure 25.11: Lands/territories of indigenous peoples are the base of their knowledge. | 611 |
| Figure 25.12: Indigenous peoples as stewards of the environment. | 612 |
| Figure 25.13: The evolution of the data landscape. | 614 |
| Annexes | |
| Figure A.1: Theory of Change of GEO-6. | 623 |
| Figure A.2: The four-box model for the qualitative communication of confidence. | 625 |
| Figure A.3: Likelihood scale for the quantitative communication of the probability of an outcome occurring. | 626 |
| Figure A.4: Relative progress on SDG indicators. | 630 |
| Figure A.5: Environmental Dimensions of the SDGs – Score Card. | 631 |