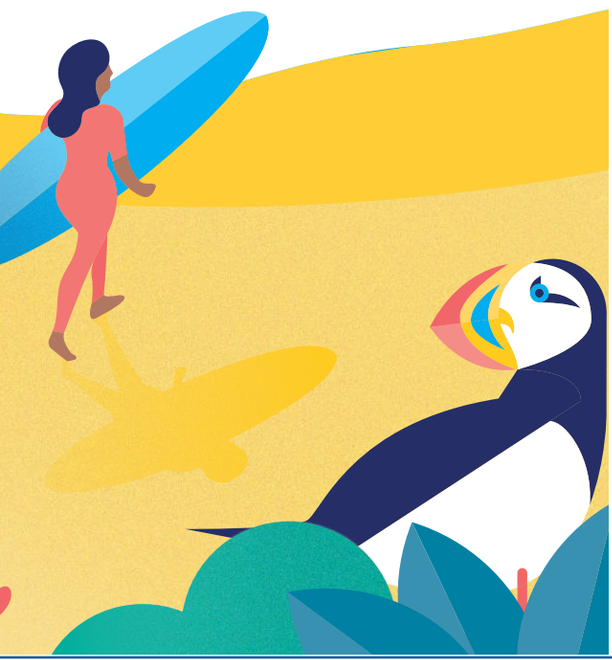
Setting the Stage



Chapter 1

Introduction and Context

Coordinating Lead Authors: Mark Elder (Institute for Global Environmental Strategies), Christian Loewe (German Environment Agency)

1.1 GEO-6: Healthy Planet, Healthy People – humanity's transformative challenge

Providing a decent life and well-being for nearly 10 billion[1] people by 2050, without further compromising the ecological limits of our planet and its benefits, is one of the most serious challenges and responsibilities humanity has ever faced. People worldwide rely on the smooth functioning of Earth's natural life-support systems, in different ways and in different contexts. A healthy planet is a necessary foundation for the overall well-being and further advancement of humanity (United Nations 2015a; Organisation for Economic Co-operation and Development [OECD] 2017a).

Under the theme of 'Healthy Planet, Healthy People,' the sixth Global Environment Outlook (GEO-6) is an integrated assessment which considers various scientific perspectives and inputs from across the world in a holistic manner. The assessment urges the world's decision makers and all citizens to apply the principles of sustainable development to help ensure that Earth's environment remains the foundation of society and of people's well-being and resilience.

GEO-6 aims to answer the following questions:

- What is the state of the global environment, how is it changing, and what are the major factors and drivers, both positive and negative, influencing these changes?
- How are people and their livelihoods affecting and affected by environmental change in terms of health, economic prosperity, social equity, food security and overall well-being?
- Are environmental benefits, responsibilities and risks distributed fairly across different regions, socioeconomic groups and genders?
- What are the main responses and policy measures that have been taken to strengthen environmental protection and governance at various levels? How effective have they been in terms of improving environmental quality, and resource efficiency?
- What are the possible pathways, critical opportunities and policies, including Multilateral Environmental Agreements (MEAs) and Sustainable Development Goals (SDGs), to transform the global human-environment system to become more sustainable and contribute to a healthy planet for healthy people? What are the likely consequences if no additional actions are taken?

The first three points above are addressed by the introductory chapters and those in Part A of this report. The chapters in Part B consider the fourth point, on policy effectiveness, and the final point, on the most promising future pathways, is covered in Part C.

GEO-6 comes at a time of great uncertainty about the current trajectory of global human development (United States National Intelligence Council 2017). One major reason is that over the last few decades, human activities, such as human-caused climate change and other human impacts on ecosystems, have transformed the Earth's natural systems, exceeding their capacity and disrupting their self-regulatory mechanisms, with irreversible consequences for global humanity (Intergovernmental Panel on Climate Change [IPCC] 2014). Humanity has already been seriously affected by ongoing systemic ecological changes, such as climate change and land use change (especially deforestation). These have reached the point that the ecological foundations of human society and natural systems that support other species and provide invaluable ecosystem services are in great danger (Millennium Ecosystem Assessment 2005).

Human activities are causing increasing amounts of pollution, to the extent that this is now recognised as the biggest single risk to human health worldwide (Landrigan *et al.* 2018). Continuing to live on the brink of or outside of ecological limits, from the global to the local, will make it dramatically more difficult to achieve prosperity, justice, equity and a healthy life for all (Crutzen and Stoermer 2000; Crutzen 2002; Steffen, Crutzen and McNeill 2007; Steffen *et al.* 2011; Steffen *et al.* 2015; Steffen *et al.* 2018). The need for humanity to remain within the planetary boundaries' safe operating space and the need to eradicate poverty and accelerate social and economic development are linked by the concept of "a safe and just space for humanity" (Raworth 2012).

To cope with this range of human-induced damages, including climate change, deforestation, desertification, loss of biodiversity, scarcity of natural resources, pollution, and the consequent natural and the associated environmental impacts, is a great challenge. While many old and new societal contradictions and conflicts have to be solved simultaneously (Beck 2009; Beck 2015; Raskin 2016), these accumulative and omnipresent challenges should be addressed as humanity's transformative challenge (Beck 2009), by creating opportunities for further human development which achieve human well-being. This would be, where the universally applied principles of sustainability govern the pathway towards 'Healthy Planet, Healthy People', with no one left behind and endeavouring to reach the furthest behind first (United Nations 2015a).

GEO-6 addresses this transformative challenge, which is taken up by the United Nations 2030 Agenda for Sustainable Development (2030 Agenda) and its 17 SDGs. Transforming human-environment interactions (and related human-human interactions), especially consumption and production patterns and lifestyles, towards sustainability requires a better information base and new, diversified knowledge of planetary systems (Steffen 2000; Schellnhuber *et al.* eds. 2004) and transformative processes within globalized social and economic systems (Schneidewind 2013). This includes the cultural dynamics and ethical foundation of human perceptions and understanding of 'nature and environmental sustainability' (Morton 2009; Lammel *et al.* 2013; Díaz *et al.* 2015; Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES] 2015; Pascual *et al.* 2017).

The increasing body of global environmental assessments undertaken by international organizations in cooperation with the global science community and UN Member States provides the knowledge to understand the vital inter-connections and accelerating dynamics of natural ecosystems, socio-ecological systems and the dependence of human life on healthy and natural ecosystems. Increasing use of Earth observation techniques, from outer space and on Earth, in combination

[1] Throughout this publication the term 'billion' refers to 1000 million.

with new tools for data analysis, disciplines like environmental accounting (e.g. Kim and Kim eds. 2016), and environmental economics (Siebert 2008; Wiesmeth 2012; Ghosh *et al.* eds. 2016), has revolutionized our ability to recognize patterns of what causes environmental change and how it impacts life (Chuvieco ed. 2008; Tomás and Li 2017; Mathieu and Aubrecht eds. 2018).

Integrated and systems-based approaches (i.e. those that consider multiple benefits at the same time) enable cross-linkages to be explored and system-wide effects to be managed, so that policies can effectively support a number of social, economic and environmental goals to support human well-being, ensuring that various preconditions for this well-being are in place. These new scientific approaches and methods, including the study of cross-cutting inter-relationships between many areas, facilitate the preparation of more appropriate, equitable and effective policy responses, including shifting investment, production, distribution and consumption towards more sustainable approaches, and the development of better governance capacities at multiple scales. The GEO-6 assessment endeavours to support the vision that equal opportunities for prosperity and well-being for all, within the Earth's ecological limits, will be possible through sustainable development pathways that are shared and pursued globally.

GEO-6 is intended to be solution-oriented, with these solutions drawing on facts and statistics. Based on multidisciplinary perspectives from various scientific fields, GEO-6 also provides an interpretative framework and tells stories, including successes, failures and aspirations, to help people, governments and the global community work to prevent and repair environmental damage and respond more effectively to environmental changes and opportunities. GEO-6 highlights existing evidence of these environmental changes and reflects on possible pathways and critical opportunities for transformation of the global human-environmental system to become more sustainable in the mid to long term (2030/2050).

GEO-6 is entitled 'Healthy Planet, Healthy People', a conceptual approach that considers the human dimensions for achieving a healthy planet. It underlines the importance of maintaining the integrity of ecosystems and recognizes their interlinkages with socioeconomic systems. It emphasizes that a healthy planet is a necessary foundation for human physical, psychological, social, economic and emotional health and well-being, and is therefore critical for achieving all the SDGs.

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Figure 1.1: Choices to be made to achieve a healthy planet for healthy people

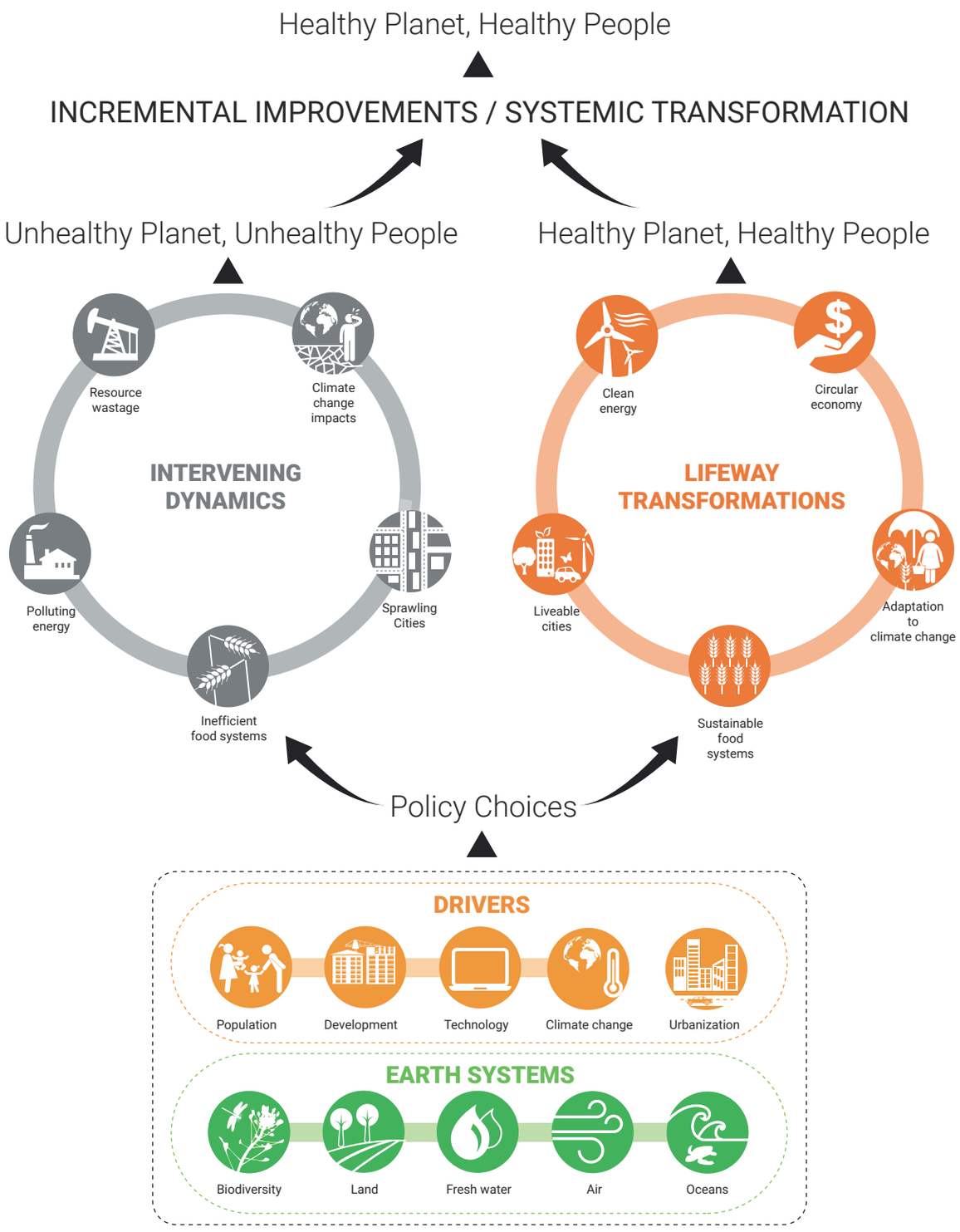

Figure 1.1 illustrates how a healthy planet contributes directly to healthier people by encouraging healthier lifestyles. Environmental degradation increases the burden of disease through exposure to harmful pollutants, as well as through reduced access to the ecosystem contributions from nature. Avoiding these problems will require protecting natural capital through detoxification, decarbonization, dematerialization and restoration of ecosystems to enhance planetary and human well-being.

A healthy planet requires protection and sustainable management of natural capital, in the form of nature's contributions to people, and human capital. People's opportunities in life are affected by humanity's ability to generate sustainable, long-term economic and social prosperity from human, physical and natural assets, the extent of environmental degradation and resource depletion, pollution and climate impacts, in addition to disparities in income and wealth.

This report recognizes that the environmental, economic and social equity dimensions are integrally linked, as they are in the SDGs with their overarching objective to 'Leave no one behind', and that all SDGs are rooted in human rights and dignity. Furthermore, many SDGs have environmental targets, some of which have equity components. Throughout GEO-6, evidence is presented of how fundamentally nature's contributions to people underpin human health and well-being. The SDGs recognize that inequality, including poverty and gender discrimination, results in a sizeable waste of human productivity and prosperity, and limits the scope for effective and accountable civic governance, quite apart from the ethical dimension of fairness and opportunity. Human resources are being underutilized and are not contributing to the sum total of human innovation required to help us live sustainably, demonstrated by the continued poverty in many parts of the world, which Agenda 2030 aims to eradicate (World Bank 2016a). The SDGs also recognize that disparities in access to resources, ecosystem services, income and wealth play an important role in shaping people's opportunities in life (Whitmee *et al*. 2015; OECD 2017), disproportionately affecting women and girls, as well as poor people.

1.2 UNEP's flagship assessment to deliver the environmental dimension of the 2030 agenda

Recognizing these important challenges, governments of the world have sought to better understand the interrelationships across the environmental dimension of the Sustainable Development Goals by requesting the preparation of a sixth edition of the Global Environment Outlook.

1.2.1 Mandate

Member States attending the first session of the United Nations Environment Assembly (UNEA-1) in Nairobi, June 2014, requested:

> … the Executive Director, within the programme of work and budget, to undertake the preparation of the sixth Global Environment Outlook (GEO-6), supported by UNEP Live, with the scope, objectives and procedures of GEO-6 to be defined by a transparent global intergovernmental and multi-stakeholder consultation informed by document UNEP/EA.1/INF/14, resulting in a scientifically credible, peer-reviewed GEO-6 and its accompanying summary for policy makers, to be endorsed by the United Nations Environment Assembly no later than 2018.

As requested by Member States (UNEP/EA.1/4) and based on the decision (UNEP/IGMS.2 Rev.2) made by the Global Intergovernmental and Multi-stakeholder Consultation in Berlin, 21-23 October 2014, GEO-6 builds on six regional assessments that were conducted in a similar fashion to the global GEO-6 process and launched in May-June 2016. In addition, the main messages of GEO-6 are compiled in an accompanying Summary for Policymakers, which is drafted by the authors of the main report and negotiated by the governments. See Annex 1-1 for more details on UN Environment's mandate to produce the sixth Global Environment Outlook.

More recently, recognizing that the date of the fourth session of the UN Environment Assembly (UNEA-4) would be shifted to 11-15 March 2019, Member States decided at UNEA-3 to:

> … [Request] the Executive Director to issue the sixth Global Environment Outlook report at least three months before the fourth session of the United Nations Environment Assembly;
>
> Also [request] the Executive Director to schedule the negotiations on the summary for policymakers at least six weeks in advance of the fourth session of the United Nations Environment Assembly and to present the sixth Global Environment Outlook report and its accompanying summary for policymakers for consideration and possible endorsement by the Environment Assembly at its fourth session.

With these decisions, the delivery date of the embargoed version of the main report is now the week of 5 December 2018, and the delivery date of the adopted and translated version of the Summary for Policymakers is 28 January 2019.

1.2.2 Role of GEO-6

GEO-6 comes at a critical time for global development, and it will build on the knowledge and experience gained from previous GEOs. Previous GEO editions have already presented substantial evidence that environmental degradation, even within the planetary limits of the Earth's ability to support human civilization, has undermined current and future development, and threatened different aspects of human well-being (United Nations Environment Programme [UNEP] 2007; UNEP 2012a).

GEO-6 explores some issues further, attempting to show the interlinkages across environmental challenges and geo-political, economic, industrial, social, technological and cultural issues, while considering potential transformative sustainable development pathways and policies for achieving the SDGs and other Internationally Agreed Environmental Goals (IAEG). In this respect, GEO-6 aims to apply a wider scope to the discussion of global environmental security (Matthew *et al.* 2010; UNEP *et al.* 2013)

Box 1.1: Concept of Well-being

Human well-being is assumed to have multiple constituents, including:

- the basic material for a good life, such as secure and adequate livelihoods,
- enough food at all times, shelter, clothing, and access to goods;
- health, including feeling well and having a healthy physical environment, such as clean air and access to clean water; good social relations, including social cohesion, mutual respect, and the ability to help others and provide for children;
- security, including secure access to natural and other resources, personal safety, and security from natural and human-made disasters; and freedom of choice and action, including the opportunity to achieve what an individual values doing and being.

Freedom of choice and action is influenced by other constituents of well-being (as well as by other factors, notably education) and is also a precondition for achieving other components of well-being, particularly with respect to equity and fairness.

Source: Millennium Ecosystem Assessment 2005

Additionally, GEO-6 attempts to further strengthen understanding of the macro perspective of socio-ecological systems (including economics), and also to use a more people-centred approach (UNEP 2016a). GEO-6 underlines that people are part of ecosystems and depend on them, emphasizing the importance of conserving nature not only for its intrinsic value, but also because it is crucial for the well-being of humanity. Such an approach is urgently needed to help address the vulnerability and different conditions and capabilities enabling people to react to hazards and disruptions in daily life (resilience) (Millennium Ecosystem Assessment 2005). With this knowledge, it is hoped that people will be encouraged to respond to the challenge by changing their behaviour as citizens, consumers, voters, politicians, religious leaders and business leaders (UNEP 2016b).

GEO-6 highlights an updated understanding of the relationship between the environment and the economy, which is a foundation of the people-centred approach. This emphasizes nature's contribution to people, the environmental functions that support human well-being (including the benefits of environmental investments, innovations and technologies), as well as the high costs of inaction, business as usual, and stranded assets.

Furthermore, this perspective within GEO-6 helps to better inform future policy decisions by addressing complex distributional impacts and conflicts as the new baseline to design sustainable development policies and governance systems associated with implementation of the 2030 Agenda (World Bank 2016b). Creating such knowledge and its evidence base through this assessment will help to better communicate possible policies, actions and investments that could be used by governments, as well as other stakeholders and citizens, to address current and future development challenges, as well as to explain the benefits of taking such actions. How this perspective is integrated into the GEO-6 assessment is further explained in Section 1.7.

1.3 GEO-6 in a changing global context

The world is facing a wide range of economic, social, cultural and political/military security challenges (World Economic Forum 2017). Despite significant global progress in economic development and poverty reduction in some regions, a large portion of the population in many areas suffers from poverty or extreme poverty, and many people who are not impoverished are still concerned about economic security and future life opportunities. Some areas are experiencing social friction, growing inequality, poor governance, cultural erosion, reactions against globalization, political instability, large numbers of refugees, large-scale migration and violent conflicts due to these economic and social insecurities, injustices and corruption.

Many of these global economic, social and political/military security challenges are related to the environment in terms of causes, impacts and possible solutions. Moreover, recent scientific concepts of environmental safeguards for society, f or example planetary boundaries (Rockström *et al.* 2009; Steffen *et al.* 2011; Steffen *et al*. 2015), explain that the environment is the foundation for human life on Earth. Current methods of generating material prosperity have undermined ecosystem health and caused massive environmental damage, crossing several of these planetary boundaries, to the point where the development of human societies and the 'safe operating space' for human life on Earth is at risk. In this planetary boundaries framework, environmental problems are considered to be inherent systemic problems of humans' deep-rooted transformation of nature and ongoing cultural dynamics, and are not seen only as collateral damage of societal development (Steffen 2000). Biodiversity is also critical for human well-being (Secretariat of the Convention on Biological Diversity [CBD] 2014), as are ecosystem services more broadly (Millennium Ecosystem Assessment 2005).

Clearly, the functions of environmental policy have expanded, and it now contributes to political/military security, economic and social policy and other development activities. Likewise, these other policy areas also have a major influence on the state of the environment. A key implication of these interlinkages is the need for an integrated approach to address environmental, economic and social problems holistically (United Nations 2015b; Jetzkowitz *et al.* 2018). GEO-6 aims to integrate the linkages between the environment, social and economic security, global justice and human well-being, to promote a new framework for sustainability to be an integral part of all aspects of global, regional and national development (United Nations Educational, Scientific and Cultural Organization [UNESCO] 2014a; Lehmann *et al.* 2015; UNEP 2016a; UNESCO 2016).

1.3.1 Environmental and economic challenges and opportunities

The environment is closely related, in both positive and negative ways, to key economic issues such as poverty, prosperity, jobs, production patterns, innovation, and resource availability/scarcity. On one hand, the economy is a major

source of environmental problems, while environmental problems are increasingly causing economic losses. Recent articles have noted that "welfare losses due to pollution are estimated to amount to US$4.6 trillion per year," which is "about 6.2 per cent of global economic output" (Landrigan *et al.* 2018, p. 462). Economically, countries are often still guided by an approach of 'grow now, clean up later'. This report will show that this is simply not sustainable in a world already crossing planetary boundaries on a number of dimensions, a situation which threatens to undermine economic growth if not addressed. In addition, this option is likely to prove far more expensive for most countries, because it is often costlier to clean up later than prevent damage in the first place; it creates stranded assets which lose their value, and is now leading to irreversible negative impacts, including on human health. This renders an economy unproductive and uncompetitive compared with a flexible and proactive approach, capable of managing the transition to a sustainable, innovative and resource-efficient economy that can take advantage of domestic and export market opportunities in fast-growing, environmentally aware markets.

On the other hand, protecting the environment, as well as preventing and mitigating the impacts of pollution, are also major sources of economic opportunity, providing jobs, reducing poverty, driving innovation and addressing resource availability/scarcity and depletion. Positive synergies between the economy and the environment are now more widely recognized (Porter and van der Linde 1995; The Economics of Ecosystems and Biodiversity [TEEB] 2010; OECD 2011; UNEP 2011a; UNEP 2011b; Hepburn and Bowen 2012; United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP] and Korea International Cooperation Agency [KOICA] 2012; Global Commission on the Economy and Climate 2014; Altenburg and Assmann 2017; OECD 2017b), compared with the view that trade-offs exist between the environment and the economy.

The global economic value of ecosystem services was estimated to be about US$ 125 trillion in 2011 (in 2007 US$[2]) (Costanza *et al.* 2014). Still, more effort is needed to communicate this message about positive synergies, as the perspective of the trade-off between the economy and the environment is still reinforced by current methods of calculating economic growth, which generally externalize environmental impacts and emphasize short-term, rather than long-term, perspectives. Especially in nations/regions where people have anxieties about jobs, wages and economic prosperity, there is a risk of weakening support for environmental protection and MEAs if the linkages among these concerns are not well understood. GEO-6 aims to contribute to a more thorough assessment of costs and benefits, as well as the cost-effectiveness of environmental policies and practices, and how they are distributed in society.

Many businesses around the world now understand that environmental problems pose major challenges to their operations, and that addressing them presents significant business opportunities, for example through circular economy business practices (see Chapter 17), in the context of sustainable consumption and production (Lacy and Rutqvist 2015; Ghisellini, Cialani and Ulgiati 2016; Murray, Skene and Haynes 2017; Hopkinson, Zils and Hawkins 2018, see section 17.5 of this report), as well as enabling increases in productivity and profitability (at least in the initial stages of waste reduction and efficiency improvements). It also avoids major liabilities and burdens for future generations. Prominent business groups, such as the World Business Council for Sustainable Development and UN Global Compact, promote environmental sustainability at all levels of society and decision-making.

Environmental protection and environmental business can also be major sources of jobs (International Labour Office [ILO] 2016). In the global energy sector, renewable energy sources are growing much faster than expected, and global annual investment in these systems is now greater than investment in fossil fuels (Renewable Energy Policy Network for the 21st Century [REN21] 2018). It is suggested that 'clean' energy (renewable and low-carbon energy) and energy efficiency may have more job creation potential than coal and natural gas (Wei, Patadia and Kammen 2010; Garrett-Peltier 2017; International Renewable Energy Agency [IRENA] 2018; Yihdego, Salem and Pudza 2017). Most recently, in the United States of America, the solar industry accounts for more than twice as many jobs as coal (United States Department of Energy 2017).

Still, many economic trends pose challenges for addressing environmental problems. Many governments face challenges in raising revenue, and deregulation initiatives often focus on weakening environmental standards/regulations (Castree 2008; Steinebach and Knill 2017). The Addis Ababa Action Agenda, which addresses the means of implementation for sustainable development in general, including the SDGs, suggests ways to help governments strengthen their domestic financing capacity (United Nations 2015c).

Globalization has been an overall trend for several decades, and its possible environmental effects have been a major research focus. However, the linkages between economic development and the environment are very complex and difficult to summarize. Some aspects of globalization may worsen environmental problems, while others may be beneficial (Boyce 2004; Gallagher 2009; Clapp and Dauvergne 2011; Newell and Roberts eds. 2016). Identifying such trade-offs and synergies is a major element of the GEO-6 assessment (see chapters 4 and 17).

1.3.2 Environment and social challenges and opportunities

Environmental issues are closely related to social issues such as hunger, consumption patterns, health, education, inequality, gender gaps, waste and sanitation, refugees, migration, conflicts and intolerance. For example, hunger and food, addressed in SDG 2, are linked to agriculture, which in turn is linked to the environment, especially SDG target 2.4 on sustainable agriculture. Environmental pollution harms agriculture, while a cleaner environment will help to improve agriculture, nutrition and health (Landrigan *et al.* 2018).

Education promotes a healthier environment and vice versa (UNESCO 2014b; UNEP 2017a). Environmental pollution, biodiversity loss and climate change are important causes of health problems and environmental diseases, which in turn can negatively affect education and learning, especially

2 Readers should assume that all values in this report are nominal market values, unless it is stated to the contrary.

among children; they can also be a hindrance to employment among adults (Mohai *et al*. 2011; Zhang and Zhang 2018). In contrast, cleaning up, avoiding pollution, and protecting and restoring habitats are major opportunities to improve health, which in turn helps people lead fuller and more productive lives. Diseases related to air pollution caused 9 million premature deaths in 2015, accounting for 16 per cent of all deaths globally (Landrigan *et al.* 2018) while in some countries, hazardous air pollution has forced schools to close (Sastry 2002; Li *et al*. 2014; British Broadcasting Corporation [BBC] 2016; Reuters 2017).

The environment is also related to growing social inequality, including gender inequality, in many ways that may put burdens on poor or socially disadvantaged people. These can include unequal access to resources (e.g. land, water, food, seeds), uneven distribution of the impacts of environmental degradation (e.g. the health impacts of climate change and waste), job creation and loss due to shifting consumption and production between geographic areas, and uneven distribution of responsibilities with respect to addressing environmental challenges. Children are particularly susceptible to the negative health impacts of chemicals, due to their rapid growth and development and greater exposure relative to body weight.

In many cases, people's environmental impacts are related to their income levels (Moser and Kleinhückelkotten 2017). Wealthier people are more able than poor people to insulate themselves from environmental problems, while they have more potential to contribute to solutions through their greater resources and scope for lifestyle changes (UNEP 2016b). This is also related to the geographic, economic and social distribution of areas affected by environmental problems.

The drivers and pressures of environmental change, as well as its state and impacts, have people-centred aspects that need to be taken into account in order to develop effective and just policies in an Agenda 2030 world. This approach is needed to help address the vulnerability and different conditions and capabilities of people to react to hazards and disruptions in daily life (resilience) (Millennium Ecosystem Assessment 2005). People – poor and rich, women and men – affect and are affected differently by environmental changes and related risks. These differences play a major role in related political decisions (Serret and Johnstone eds. 2006; UNEP 2016b). Using this perspective, GEO-6 attempts to interpret how environmental 'equity' will be experienced by different people, so it can inform future policy decisions by addressing complex distributional impacts and conflicts. This perspective provides a new baseline to design sustainable development policies and governance systems for implementing the 2030 Agenda (World Bank 2016).

In Agenda 2030, the sustainable use of the environmental and natural resources is now understood to be complementary and necessary to "end poverty in all its forms everywhere" (SDG 1). Approximately 70 per cent of the world's poor people depend directly on natural resources for all or part of their livelihoods, particularly women and girls, as well as other marginalized groups. Efforts to eradicate poverty and ensure prosperity are directly linked to improving the management of both the environment and natural resources in an integrated way (TEEB 2010).

1.3.3 Environment and political/military security challenges and opportunities

Environmental problems such as land degradation (United Nations Convention to Combat Desertification [UNCCD] 2017) and resource scarcity and depletion, especially water, energy, food and biodiversity, have the potential to be major sources of conflict, security problems and migration (Homer-Dixon 1991; Homer-Dixon 1999; Barnett and Adger 2007; Gupta, Dellapenna and Heuvel 2016). Political/military security problems may be amplified by climate change effects. Water security is being compromised by pollution and unsustainable use, as well as demand exceeding sustainable supply, climate variability, droughts, flooding, etc. Climate change, including related weather extremes, and environmental degradation are already having a range of complex effects, especially in fragile states and ecosystems. For example, they worsen the problems of migrants and refugees (both within and between countries), which in turn contribute to increasing political uncertainty and instability worldwide. Environmental refugees displaced by environmental degradation may also suffer from health problems and difficulties maintaining their livelihoods.

Wars and conflicts are major sources of pollution, especially air, water and soil pollution, waste, greenhouse gases and land degradation. Likewise, addressing environmental problems may provide important opportunities to help address political/military security problems (Brown, Hammill and McLeman 2007; UNEP *et al*. 2013), including by helping to secure livelihoods and reduce the necessity for migration. International funding to war-torn states may be productively aimed at addressing environmental problems through development of sustainable infrastructure, including natural infrastructure and ecosystem restoration, and services such as waste, wastewater and resource management.

1.3.4 Resource availability and scarcity

Resource availability and scarcity problems clearly illustrate the tight interlinkages between economic, social, human, political/military security and environmental issues (Qasem 2010; UNEP 2011a; Pereira 2015). Resources have significant negative environmental and social/health impacts in their production and/or use, for example through mining or other extraction processes.

At the same time, they are important inputs to environmental solutions. Resources are important economic inputs and sources of jobs, and are used in products and services supporting human well-being. This is not just related to the key resources of water, energy and food, which have been extensively researched as 'nexus' issues (UNESCAP 2013; Food and Agriculture Organization [FAO] 2014; International Resource Panel 2015). Phosphorus (Cordell and White 2015) is a key input for food production and other important scarce resources including materials such as rare earth metals (Gupta and Krishnamurthy 2004; Abraham 2015; Graedel *et al*. 2015), are used in many industrial applications including key environmental technologies such as wind and solar energy as well as advanced batteries. These materials, and the many products made from them, also have important military applications. On the negative side, in addition to the environmental damage caused by their production, these