



HEALTHY ENVIRONMENT, HEALTHY PEOPLE

Thematic report
Ministerial policy review session
Second session of the United Nations Environment Assembly
of the United Nations Environment Programme
Nairobi, 23–27 May 2016

This report was prepared by the United Nations Environment Programme (UNEP), in collaboration with the World Health Organization (WHO), the Convention on Biological Diversity, the Montreal Protocol on Substances that Deplete the Ozone Layer, and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants. It received contributions from other United Nations agencies and from stakeholders through an e-consultation at www.myunea.org/.

© 2016 United Nations Environment Programme

This report has benefited from the oversight:

for UNEP: Achim Steiner, UNEP Executive Director; Ibrahim Thiaw, Deputy Executive Director; Elliott Harris, Director, New York Office; Ligia Noronha, Director, DTIE; Jacqueline McGlade, Director, DEWA; Mette Wilkie, Director, DEPI; Elizabeth Mrema, Director, DELC; Munyaradzi Chenje, Director, Regional Support Office; Jorge Laguna-Celis, Secretary a.i. Secretariat of Governing Bodies; Michele Candotti, Chef de Cabinet, Executive Office;

for WHO: Maria Neira, Director, Environment and Social Determinants of Health;

for the Convention on Biological Diversity: Bráulio Ferreira de Souza Dias, Executive Secretary;

for the Basel Convention, the Rotterdam Convention and the Stockholm Convention:

Rolph Payet, Executive Secretary;

for the Montreal Protocol: Tina Birmpili, Executive Secretary.

CONTRIBUTORS

UNEP: Keith Alverson, Wondwosen Asnake, Sandra Averous, Abdourahman Bary, Sylvia Bankobeza, Butch Bacani, Patricia Beneke, Matthew Billot, Oli Brown, Tim Christophersen, Nicolas Cisneros, Ludgarde Coppens, Christopher Cox, Jan Dusik, Marisol Estrella, Fanny Demassieux, Jacob Duer, Ermira Fida, Hillary French, Valentin Foltescu, Tessa Goverse, Maaike Jansen, Abdul-Majeid Haddad, Nickas Hagelberg, Achim Halpaap, Jiří Hlaváček, Shunichi Honda, Salman Hussein, Rob de Jong, Maarten Kapelle, Tim Kasten, Joy Kim, Brenda Koekkoek, Dianna Kopansky, Arnold Kreilhuber, Pushpam Kumar, Michael Logan, James Lomax, Kaj Madsen, ,Dustin Miller, Anja von Moltke, Mara Murillo, Kakuko Nagatani-Yoshida, Desiree Narvaez, Fatou Ndoye, David Ombisi, Martina Otto, Corli Pretorius, Pierre Quiblier, Fulai Sheng, Naysán Sahba, Marieta Sakalian, Kavita Sharma, Cyrille-Lazare Siewe, Surendra Shrestha, Stefan Smith, Steven Stone, Djaheezah Subratty, Michael Stanley-Jones, Vincent Sweeney, Eisaku Toda, Elisa Tonda, Dirk Wagener, Edoardo Zandri, Cristina Zucca; **BRS:** Kerstin Stendhal, Tatiana Terekhova; **CBD:** David Cooper, Cristina Romanelli; **CCAC:** Helena Molin-Valdes; **Montreal Protocol:** Jim Curlin, Sophia Mylona; **OHCHR:** Benjamin Schachter; **UNEP-WCMC:** Lera Miles, Shena Garcia Rangel; **DESA:** Friedrich Soltau; **UNICEF:** Cristina Colon, Alex Heikens; **UNOCHA:** Emilia Wahlström; **UNDP:** Natalia Linou, Tim Scott; **UN Women:** Christine Brautigam; **WHO:** Carolyn Vickers, Bruce Gordon, Annette Prüss-Üstun, Heather Adair-Rohani; Diarmid Campbell-Lendrum, Carlos Dora; **WMO:** Joy Shumake-Guillemot. And also Richard Füller, Andy Haines, Christian Nellemann, and Montira Pongsiri.

DISCLAIMER

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.

HEALTHY ENVIRONMENT, HEALTHY PEOPLE

CONTENTS

- EXECUTIVE SUMMARY 04

- INTRODUCTION 14

- ENVIRONMENTAL CHANGE:
IMPLICATIONS FOR HEALTH AND HUMAN WELL-BEING 16

- GLOBAL CHANGES AND TRENDS 26

- VULNERABILITY 30

- MULTIPLE BENEFITS OF A HEALTHY ENVIRONMENT 32

- FRAMEWORK OF ACTIONS FOR A HEALTHY ENVIRONMENT
AND HEALTHY PEOPLE 36

- CONCLUSION AND RECOMMENDATIONS 46

- Annex 50

- Endnotes 52

Executive Summary

The 2030 Agenda for Sustainable Development highlights critical links between development, the environment, human well-being and the full enjoyment of a wide range of human rights, including the rights to life, health, food, water and sanitation. This report summarizes for Governments, policy makers and stakeholders the evidence of the linkages between environmental quality and human health and well-being,^a but also points to the broader drivers of these linkages, including inequality, unplanned urbanization, migration, unhealthy and wasteful lifestyles, and unsustainable consumption and production patterns.

Progress in a range of environmental sectors has yielded improvements in health outcomes with substantial economic, financial and social gains in the last decades. The world has met the Millennium Development Goal target of halving the proportion of people without access to improved sources of water, five years ahead of schedule. The successful phase-out of nearly 100 ozone-depleting substances means that up to 2 million cases of skin cancer and many millions of eye cataracts may be prevented each year by 2030 thanks to the healing of the ozone layer.

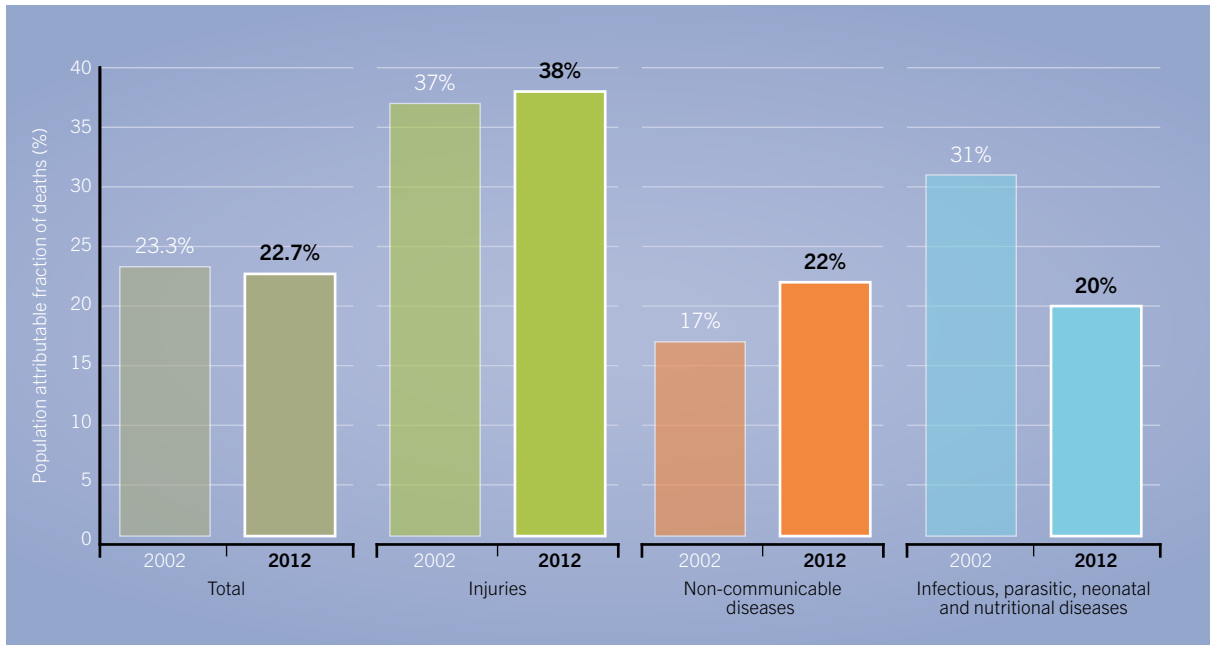
But challenges remain. In 2012, an estimated 12.6 million deaths globally were attributable to the environment. The air we breathe, the food we eat, the water we drink, and the ecosystems which sustain us are estimated to be responsible for 23 per cent of all deaths worldwide. A shift away from infectious, parasitic and nutritional diseases, owing to a higher share of people having access to safe water and sanitation, to non-communicable diseases is evident (figure ES1). The higher prevalence of non-communicable diseases

is attributable to exposure to chemicals, poor air quality and unhealthy lifestyles. While the environmental effects on health represent 23 per cent of deaths globally, the figure increases to 26 per cent for children under 5 years and to 25 per cent for adults between the ages of 50 and 75. The difference in total impact is 2 percentage points higher for men (22.8 per cent) than women (20.6 per cent), mostly as a result of occupational injuries, the employed percentage of men being globally about 50 per cent higher than that of women.

From a geographical perspective (figure ES2), the highest proportion of deaths attributable to the environment compared to total number of deaths occurs in South-East Asia and in the Western Pacific (respectively 28 per cent and 27 per cent of the total burden). Sub-Saharan Africa (23 per cent of deaths attributable to the environment) is the only region where the burden of infectious, parasitic and nutritional diseases is higher than that of non-communicable diseases, but non-communicable diseases are on the rise, exposing this region to both burdens.

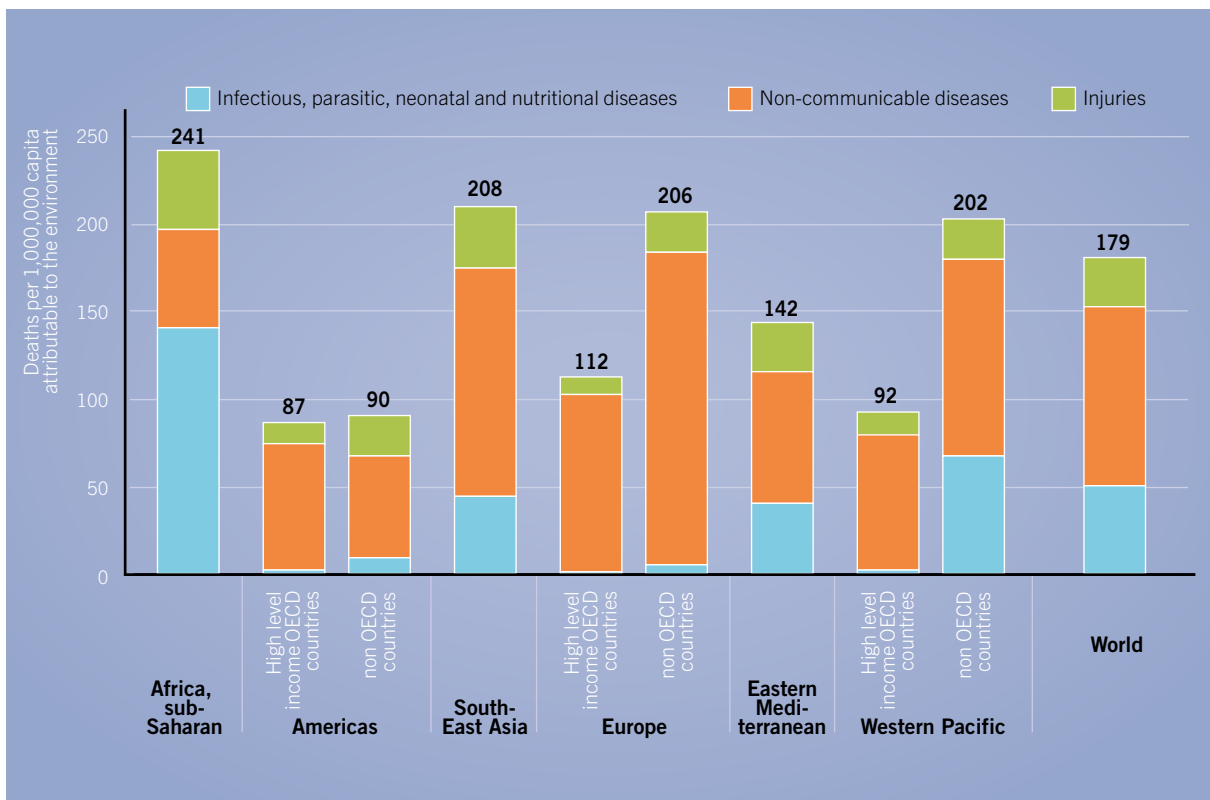
^a This report uses the broader WHO definition of health as "the state of complete physical, mental and social well-being and not merely the absence of disease".

Figure ES1 Trend in the proportion of deaths attributable to the environment by disease group, 2002 – 2012



Source: Annette Prüss-Üstün and others, Preventing disease through healthy environments: A global assessment of the burden of disease from environmental risks, WHO (2016).

Figure ES2 Deaths per capita attributable to the environment, by region and disease group, 2012



Annette Prüss-Üstün and others, Preventing disease through healthy environments: A global assessment of the burden of disease from environmental risks, WHO (2016).

The number of deaths attributable to the environment represents 22 per cent of the total number of deaths in the Eastern Mediterranean region, respectively 11 per cent and 15 per cent in the Organization for Economic Cooperation and Development (OECD) and non-OECD member countries of the Americas region, and 15 per cent in Europe.

These estimates, however, do not take into account the effects of emerging global environmental changes, which risk reversing decades of progress in health and development through the combined effects of climate change, biodiversity loss and the degradation of the natural systems that support all life.

Box ES1 The diseases with the highest preventable disease burden from environmental risks, in disability adjusted life-years:

- 1. DIARRHOEAL DISEASES:** 57 per cent because of environmental risks, 57 million years life lost or lived with disability due to poor water, sanitation, hygiene.
- 2. UNINTENTIONAL INJURIES (other than road traffic):** 50 per cent because of environmental risks, 74 million years life lost or lived with disability because of occupational risks and poor home and community safety.
- 3. ASTHMA:** 44 per cent due to environmental risks, 11 million years life lost or lived with disability because of air pollution, second-hand tobacco smoke, indoor mould and dampness, and occupational asthmagens.
- 4. MALARIA:** 42 per cent due to environmental risks, 23 million years life lost or lived with disability because of poor waste, water and environmental management.
- 5. ROAD TRAFFIC INJURIES:** 39 per cent due to environmental risks, 31 million years life lost or lived with disability because of poor road design, traffic system environments, poor land-use planning.
- 6. LOWER RESPIRATORY INFECTIONS:** 35 per cent due to environmental risks, 51 million years life lost or lived with disability as a result of household and ambient air pollution, second-hand tobacco smoke.
- 7. CHRONIC OBSTRUCTIVE PULMONARY DISEASE:** 35 per cent due to environmental risks – 32 million years life lost or lived with disability because of household air pollution, and workers' exposure.
- 8. CARDIOVASCULAR DISEASES:** 30 per cent due to environmental risks, 119 million years life lost or lived with disability because of household and ambient air pollution, second hand tobacco-smoke, exposure to chemicals.
- 9. CANCERS:** 20 per cent due to environmental risks, 49 million years life lost or lived with disability because of air pollution, management of chemicals, radiation and poor workers' protection.
- 10. MUSCULOSKELETAL DISEASES:** 20 per cent due to environmental risks, 23 million years life lost or lived with disability because of occupational stressors, poor work postures, prolonged sitting, carrying water and solid fuels for household needs.

Source: Annette Prüss-Üstün and others, Preventing disease through healthy environments: A global assessment of the burden of disease from environmental risks, WHO (2016).



A CLEAR NEXUS EXISTS BETWEEN ENVIRONMENTAL QUALITY AND HEALTH

Air pollution is the world's largest single environmental risk to health: some 7 million people across the world die each year as a result of everyday exposure to poor air quality. Who is affected depends on exposure and occupation. In some countries, simply preparing a meal is a major risk to health because of indoor air pollution with 4.3 million deaths attributed to household air pollution arising from cooking with solid fuels. Exposure is particularly high among women and young children, who spend the most time near the domestic hearth. Children, the old and those with low immunity are especially vulnerable. Lack of access to clean water and sanitation causes 58 per cent of cases of diarrhoeal diseases in low and middle-income countries. Unsafe water, inadequate sanitation or insufficient hygiene result in 3.5 million deaths worldwide, representing 25 per cent of the deaths of children younger than 14. The 50 biggest active dumpsites affect the daily lives of 64 million people. Some 107,000 people die annually from exposure to asbestos and 654,000 died from exposure to lead in 2010. Since the first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in 1995, 606,000 lives have been lost and 4.1 billion people have been injured, left homeless or in need of emergency assistance as a result of weather-related disasters.

High-risk occupations include agriculture, mining and construction – often with a relatively high proportion of children, youth or migrant workers who have substantially higher rates of fatalities and exposure to chemicals and injuries. Vulnerable groups also include those living in poverty and those at greater risk owing to certain occupations, livelihoods and locations. Widespread land and coastal degradation greatly exacerbates the effects of extreme weather, destroys livelihoods and food security, threatens health and well-being, and subsequently even forces people into migration. The social and economic groups that are vulnerable to these environmental impacts often also suggest an environmental injustice at play, as the rich reap benefits from the activities that create the degradation and it is the poor and vulnerable groups who are most affected.

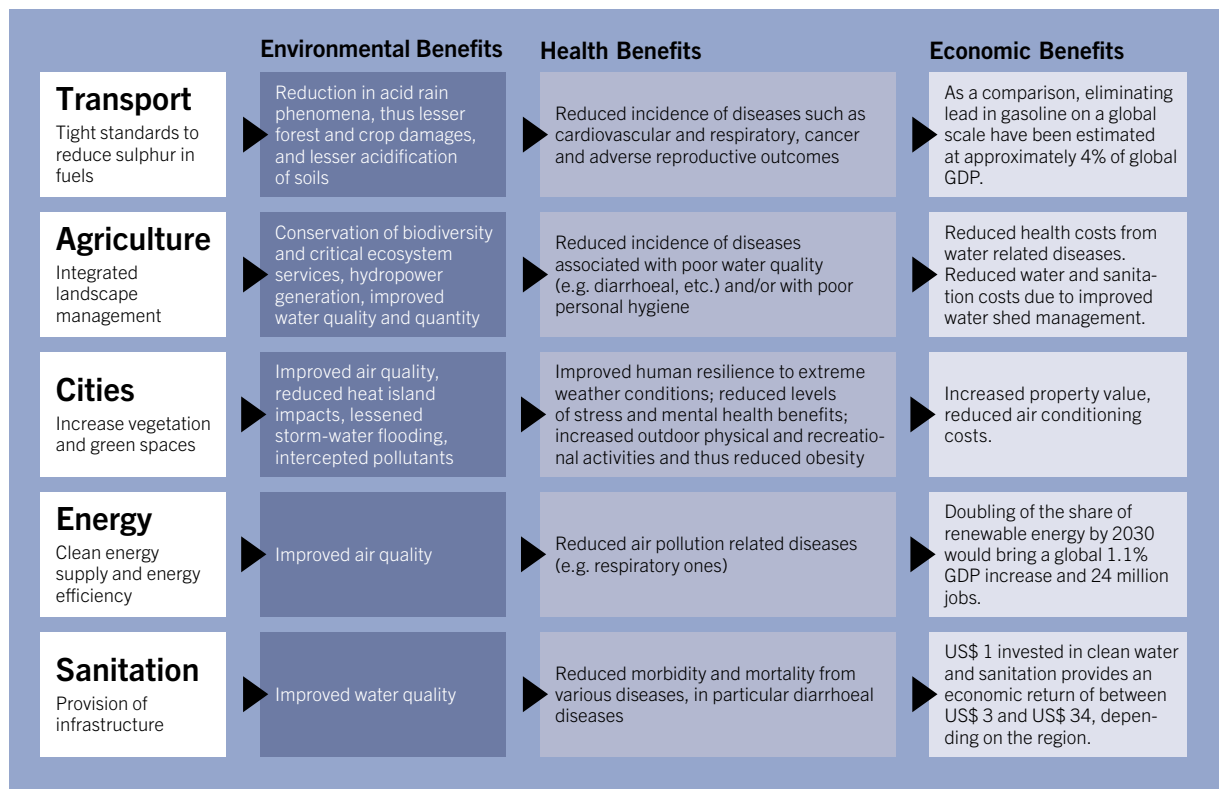
Climate change is acknowledged as a major health risk multiplier, with existing effects that are expected to increasingly affect human health, including through negative changes to land, oceans, biodiversity and access to freshwater, and the increasing frequency and higher impact of natural disasters. Cautious estimates from the World Health Organization (WHO) under a medium-high emissions scenario indicate that 250,000 additional deaths could potentially occur each year between 2030 and 2050 as a result of climate change. It may also lower the national quality of dietary intakes and worsen obesity. Environmental degradation is estimated to cause 174–234 times as many premature deaths as occur in conflicts annually. Mental health issues also rank amongst the ten largest non-fatal threats in most countries.

largest non-fatal threats in most countries.

The degradation of ecosystems also entails major health-related consequences. Microplastics and nanoplastics in marine ecosystems may not be biodegradable, as they can sink to the ocean floor where they are not exposed to the sunshine required for biodegradation. Excessive nutrients in fresh and coastal receiving waters from land-based activity leads to eutrophication, negatively affecting ecosystems, and freshwater and marine resource productivity, thereby having a negative impact on food security, livelihoods and health. Zoonotic diseases, linked to ecosystem disruption, such as avian influenza, Rift Valley fever and Ebola, have also become the source of major pandemics.

The outbreak of Zika, for example, is potentially exacerbated as a result of inadequate waste collection and management – the proliferation of tyres, plastics, cans, etc., in which water collects and which serve as breeding sites for the *Aedes aegypti* mosquito. Important ecosystem services are lost such as pollination, natural pest control and access to herbal and traditional medicines important for large shares of the world’s population. Furthermore, many of these ecosystems are also carbon sinks.

Figure ES3 Examples of multiple benefits of inclusive green policies



INVESTMENTS IN A HEALTHY ENVIRONMENT HAVE MULTIPLE BENEFITS

The economic cost of premature deaths from ambient particulate matter and household air pollution in the European Union in 2010 was estimated at \$1.5 trillion. For the insurance industry, the estimated cumulative cost of asbestos-related claims over decades in the United States of America alone had reached \$117 billion by 2010. Evidence exists, however, of the catalytic and multiple benefits of investing in environmental quality in terms of development, poverty reduction, resource security, reduced inequities and reduced risks to human health and well-being. Benefits from eliminating lead in gasoline on a global scale have been estimated at \$2.45 trillion per year, or 4 per cent of the global gross domestic product (GDP), preventing an estimated 1 million premature deaths per year. Implementing proven, cost-effective measures to reduce emissions of short-lived climate pollutants such as black carbon and methane are expected not only to reduce global warming by 0.5°C by the middle of the century, but also to save 2.4 million lives a year from reduced air pollution by 2030.

Clean air and water, sanitation and green spaces, and safe workplaces can enhance the quality of life of people: reduced mortality and morbidity, healthier lifestyles, improved productivity of workers and their families, improved lives of women, children and the elderly, as well as other vulnerable populations, such as indigenous communities, and are crucial to mental health. WHO estimates that investments in preventative workplace health programmes of around \$18–\$60 per worker can reduce sick leave absences by 27 per cent and that the return on investment in water and sanitation services is between \$5 and \$28 in developing countries per dollar. Inclusive green policies are known to have benefits across the spectrum – environmental, economic and social (figure ES3).

A FRAMEWORK OF FOUR INTEGRATED LINES OF ACTION IS RECOMMENDED TO ADDRESS THE NEXUS OF ENVIRONMENT AND HEALTH:

→ **DETOXIFY:** Remove harmful substances from and/or mitigate their impact on the environment in which people live and work. This will, for example, address air pollution, through reducing black carbon emitted by household and non-household sources and other pollutants, ensure that emission concentrations do not exceed WHO recommended targets for particulate matter 2.5 and carbon monoxide and reduce use of pesticides, through the promotion of integrated pest management and organic and sustainable farming systems. It will require stronger focus on the sound management of chemicals through life-cycle approaches and improved management and reduction of waste.

→ **DECARBONIZE:** Reduce the use of carbon fuels and thereby emissions of carbon dioxide (CO₂) through substitution of non-carbon energy. Over their life cycle, the pollution-related human health and environmental impacts of solar, wind and hydropower are a factor of 3 to 10 times lower than fossil-fuel power plants. Investing in green energy at household level will accrue other benefits, including more time for income-generating activities, reduced health risks from carrying heavy loads of firewood over long distances, and more leisure time available for women, among others. The nationally determined contributions (NDCs) committed under the Paris Agreement on climate change can be important vehicles for decarbonization, and consequent health and well-being improvements.

→ **DECOUPLE RESOURCE USE AND CHANGE LIFESTYLES:** Generate the needed economic activity and value to sustain the world's population with less resource use, less waste, less pollution, and less environmental destruction. Important health benefits can be gained from decoupling opportunities in the food sector, in water use, in energy consumption and through recycling and more sustainable household consumption. For example, shifts in consumption from animal to plant-based products, and improved diet composition and quality as well as increased access to urban green areas

have positive implications for health and addressing non-communicable diseases and mental health. Youth engagement, awareness-raising and education in particular need to be prioritized to achieve this.

→ **ENHANCE ECOSYSTEM RESILIENCE AND PROTECTION OF THE PLANET'S NATURAL SYSTEMS:**

Build capacity of the environment, economies and societies to anticipate, respond to and recover from disturbances and shocks through: protection and conservation of genetic diversity and terrestrial, coastal and marine biodiversity; strengthening ecosystem restoration, in particular of wetlands, dryland vegetation, coastal zones and water sheds including through reforestation as well as agro-ecosystem restoration and sustainable farming systems; reducing pressures from livestock production and logging on natural ecosystems to increase resilience and mitigate extreme weather conditions. Sustainable land and forest management, along with conservation and restoration, will protect and enhance biodiversity and ecosystem services. These restorative activities will not only ensure food security, but also nurture cultural, social and recreational activities, and bring economic growth for local populations and businesses.

Analyses of past successes reveal that these endeavours are far from trivial. They can, however, be achieved when supported by a context-appropriate mix of targeted, integrated strategies, such as:

- Strengthened multi-level governance at the nexus of environment and health;
- Integrated evidence-based policies and instruments, including legal and fiscal, that translate policy into action across sectors and industries;
- Cross-sectoral partnerships and platforms to incubate, catalyse, accelerate, and scale health-environment research, innovation, technologies, innovative financing, and practices;
- Improved individual, household, and societal knowledge, attitudes, behaviours and practices through systematic communication, awareness-raising and education interventions;
- Assessment, measurement, research and monitoring to ensure an adequate formative process, and a research framework that engenders the evidence base that all investment and action demand.

While the above framework seeks to address the nexus at a broad macro, intersectoral level, the following are leverage points requiring urgent policy attention and action based on the evidence:

- Improve indoor household and ambient air quality to enable reduction in morbidity and enhance the quality of life of local populations and across borders, including through sustainable urban design which can also contribute to increased physical activity through the provision of green spaces, to prevent and reduce non-communicable diseases and poor health;
- Replace and reduce the utilization of hazardous chemicals and generation of toxic waste, and ensure sound management of chemicals and wastes;
- Intensify progress in providing safe water, improved sanitation and hygiene services to reduce mortality, morbidity, and losses in economic productivity;
- Restore and protect degraded ecosystems and mitigate stresses to the Earth's natural systems in order to enhance ecosystem services that support human health, reduce exposure to natural disasters, enhance food security, prevent emergence of novel pathogens and disease outbreaks and contribute to the improvement of nutritional diet quality.

Figure ES4 summarizes examples of interventions to achieve the above objectives within the broad framework of actions and strategies.

In conclusion, directly tackling the interlinkages between the environment and human health can provide a common platform and multiplier effect to sustain progress across



many of the Sustainable Development Goals and deliver on the Agenda 2030 for Sustainable Development in a more cost-effective and beneficial manner. Investments in preserving, improving or restoring environmental

quality can bring about positive interactions and be catalytic, avoiding contradictions among sector strategies and delivering multiple benefits across all goals for enhanced well-being and quality of life.

RECOMMENDATIONS

The report's findings provide a strong basis for an inclusive economy for the future that is linked to ecosystem resilience, a healthy environment, and people's good health and well-being. Its main recommendations are:

1. Deliver more effectively and equitably on the 2030 Agenda for Sustainable Development by using the environment-health nexus as a cross-cutting solution through international, regional, national and local cooperation.
2. Invest in environmental sustainability and genetic diversity which can serve as an insurance policy for current and future health and human well-being.
3. Address the environment health nexus on efficiency grounds, but also for distributive justice and to address the ethical and legal obligations of States.
4. Move from a reactive to a proactive policy approach, as many environment and health emergencies can be avoided or mitigated, pre-empting crises that otherwise might cripple a country's economic, political and physical infrastructure.
5. Involve the public and private sector, researchers, relevant stakeholders and citizens to participate in partnerships which can foster innovation, clean technologies, innovative financing and disseminate good practices.
6. Take action at all levels of governance to: detoxify the environment; decarbonize the economy; decouple economic activity from current levels of resource use and ecosystem degradation and change unhealthy lifestyles; and enhance ecosystem resilience.
7. Strengthen the evidence base through better measurement and monitoring frameworks, supporting platforms on environment-health research, systematically collecting, analysing and using data disaggregated by sex, age and other relevant variables.
8. Raise awareness on major environmental and health risks and exposure, putting into place adequate communication and education strategies and policies.
9. Strengthen multilevel environmental governance, develop and implement integrated policies, international and national legislation and actions with an emphasis on city-level interventions incorporating specific measures targeting the most vulnerable, including women and children, and through them future generations.
10. Finally, call upon Governments at all levels and development and financial partners to scale up investments in platforms, initiatives and programmes that address the environment and health nexus to spearhead the achievement of the Sustainable Development Goals.

Figure ES4 Some proposed interventions to address key leverage points for policy attention and action

PRIORITY ENVIRONMENTAL AND HEALTH RISKS / STRATEGIES	STRENGTHENED GOVERNANCE	INTEGRATED POLICIES
AIR QUALITY → DETOXIFY → DECARBONIZE → DECOUPLE and ENHANCE HEALTHY LIFESTYLES		1. Develop and implement national integrated low-carbon and low emission development strategies based on the consensus around the Sustainable Development Goals and outcomes of the Paris Climate Agreement 2. Reduce the use of fossil fuels in power plants
SOUND MANAGEMENT OF CHEMICALS → DETOXIFY → DECOUPLE and ENHANCE HEALTHY LIFESTYLES	7. Accelerate the ratification process of the Minamata Convention on Mercury and develop and enhance comprehensive chemicals management legislations, policies and strategies on reducing or eliminating the use and production of persistent organic pollutants (POPs), regulating the use of chemicals of highest concern and controlling, when relevant, their international trade 8. Eliminate lead in paint	9. Develop and implement integrated pest management and integrated vector management
ACCESS TO WATER AND SANITATION → DETOXIFY	15. Adopt UNEP International Water Quality Guidelines for Ecosystems for use by countries in developing national standards, policies and frameworks for water quality in the environment	16. Invest in providing access to clean water and sanitation in schools and hospitals and city slums
SOUND MANAGEMENT OF WASTES → DETOXIFY → DECOUPLE and ENHANCE HEALTHY LIFESTYLES	18. Develop comprehensive legislation and policies to address prevention, minimization and environmentally sound management of wastes, avoid open-burning and dumping, and control international trade of wastes, such as electric and electronic wastes and mercury wastes	19. Develop action plans to reduce plastic litter in the environment
RESPONSES TO NATURAL DISASTERS → ECOSYSTEM RESILIENCE		22. Develop and implement national and local ecosystem-based disaster risk reduction strategies integrating sustainable natural resource management and landscape planning in rural, coastal and urban settings

COMMUNICATE AND EDUCATE	PARTNER	MEASURE AND MONITOR
<p>3. Promote citizen access to information on air quality (and other) standards and actual levels to contribute to the establishment and enforcement of ambient air quality standards, based on WHO guidelines</p>	<p>4. Expand access to clean and affordable domestic cooking, heating and lighting technologies and fuels</p> <p>5. Provide financial resources, invest and improve city designs to promote public and active transportation, green space, sound waste management, infrastructure and sustainable building</p>	<p>6. Establish and enforce advanced vehicle emissions and fuel standards</p>
<p>10. Label and share information on chemicals in products in a manner that is adapted and understandable by users and increase information sharing on chemicals related exposure and risks.</p>	<p>11. Promote ozone friendly refrigeration and air conditioning</p> <p>12. Accelerate efforts to eliminate polychlorinated biphenyls (PCBs) to meet Stockholm convention obligations and deadlines</p> <p>13. Implement safety measures for workers who are in contact with hazardous chemicals</p>	<p>14. Identify pollution/chemicals related hotspots (e.g. chemical stockpiles, polluted sites) to decontaminate them and minimize exposure</p>
	<p>17. Recycle nitrogen and phosphorous from waste water systems in cities, agriculture and industries</p>	
<p>20. Promote waste prevention and minimization, including food waste, for example through extended producer responsibility; where waste is produced, promote reuse and recycling into material and energy sources (e.g. stimulate industrial symbiosis, support recovery and recycling schemes)</p>	<p>21. Promote social inclusion of all stakeholders in waste management practices, including in the informal sector, giving them opportunities to formalize their operations and employ practices that minimize risks to human health and the environment</p>	
<p>23. Promote the use of traditional knowledge, in particular the use of medicinal plants</p>	<p>24. Restore degraded ecosystems</p>	<p>25. Strengthen the linkages between local and sub-national early warning, preparedness and response mechanisms</p>

Introduction

INVESTING IN A HEALTHY ENVIRONMENT IS INVESTING IN THE HEALTH AND WELL-BEING OF CURRENT AND FUTURE GENERATIONS

Addressing the links between the environment and health will be key to achieving the Agenda for Sustainable Development and the Sustainable Development Goals by 2030. These Goals place people and their well-being at the centre of sustainable development.

The vision of the 2030 Agenda is ambitious and transformational, pledging to leave no one behind. In their structure, the Sustainable Development Goals are universal, affecting everyone, everywhere. They aim to address inequalities amongst countries and all groups of the population—especially children, women and the impoverished. They address human rights and well-being (including both physical and mental health) through a common understanding that a healthy environment is integral to the full enjoyment of basic human rights, including the rights to life, health, food, water and sanitation, and quality of life.

Directly tackling the interlinkages between the environment and human health presents new and interwoven key opportunities to meet these Goals in a more cost-effective and beneficial manner. To “ensure healthy lives and promote well-being for all at all ages” (Goal 3) – which includes a specific target related to air, water and soil quality and exposure to chemicals – cannot be achieved over the long term without explicit action on terrestrial ecosystems (Goal 15), oceans (Goal 14), cities (Goal 11), water and sanitation (Goal 6), energy (Goal 7), climate change (Goal 13), sustainable consumption and production patterns (Goal 12) as well as

on equality (Goal 10), gender equality (Goal 5), education (Goal 4), peace, justice and strong institutions (Goal 16), as well as partnerships, technology and finance (Goal 17). Investments in preserving, improving or restoring environmental quality can bring out positive interactions and be catalytic, avoiding contradictions among sector strategies and delivering multiple benefits across all goals for enhanced well-being and quality of life.



Figure 1 Sustainable Development Goals and targets: deconstructing environmental sustainability for health and well-being



Environmental change: implications for health and human well being

THE HEALTH AND WELL-BEING OF CURRENT AND FUTURE GENERATIONS ARE INTRINSICALLY LINKED TO THE STATE OF OUR ENVIRONMENT AND LIFESTYLES

Poor air and water quality are among the primary environmental risks^b that affect health worldwide. Exposure to hazardous chemicals, however, through inadequate workplace and waste management, climate change,¹ ecosystem degradation, unplanned urbanization and unsustainable lifestyles also add to the burden of disease^c and adversely affect health and well-being.²

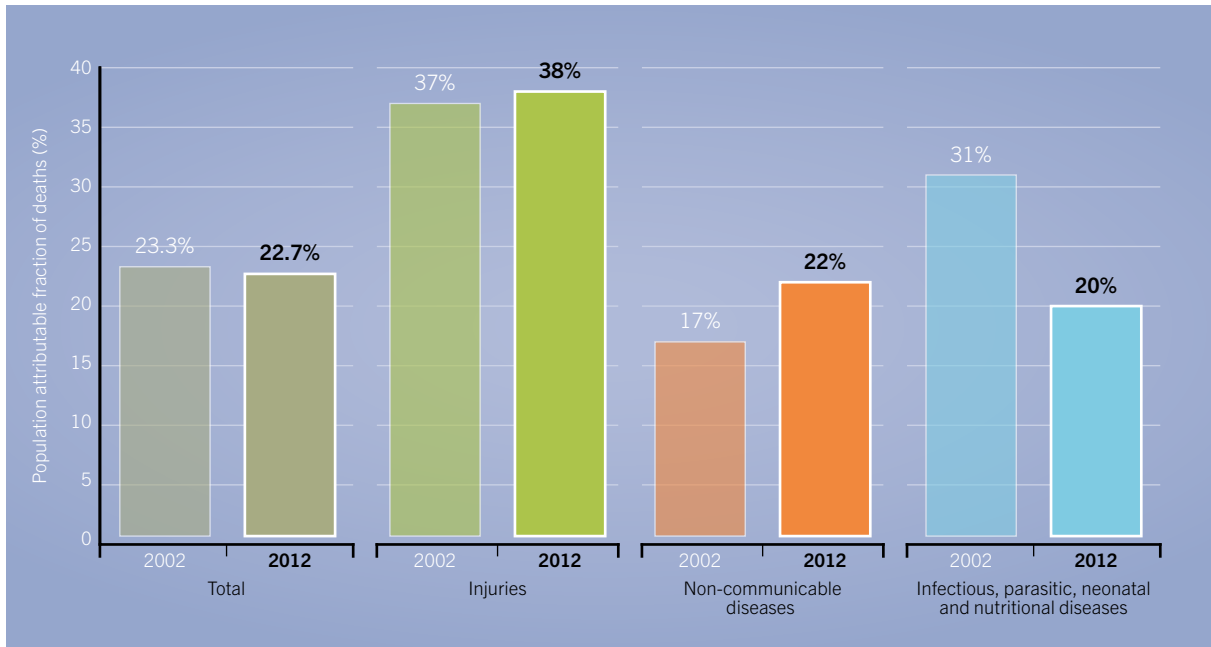
In 2012, an estimated 12.6 million deaths globally were attributable to the environment, 23 per cent of all deaths worldwide. A shift away from infectious, parasitic and nutritional diseases, as a result of a higher share of people having access to safe water and sanitation, to non-communicable diseases, is evident (figure 2). The higher prevalence of non-communicable diseases is attributable to exposure to chemicals, poor air quality and unhealthy lifestyles.

From a geographical perspective, the highest proportion of deaths attributable to the environment compared to the total number of deaths occurs in South-East Asia and in the Western Pacific (respectively 28 per cent and 27 per cent). Sub-Saharan Africa (23 per cent of deaths attributable to the environment) is the only region where the burden of infectious, parasitic and nutritional diseases is higher than that of non-communicable diseases; non-communicable diseases are on the rise, however, exposing this region to both burdens. Diarrhoeal diseases cause the most deaths with 17 per cent of the

b The definition of environmental risk used here is the "Likelihood, or probability of disease or death resulting from exposure to a potential environmental hazard" (EIONET, GEMET Thesaurus). Available from <https://www.eionet.europa.eu/gemet/concept?cp=2921&langcode=en&ns=1>.

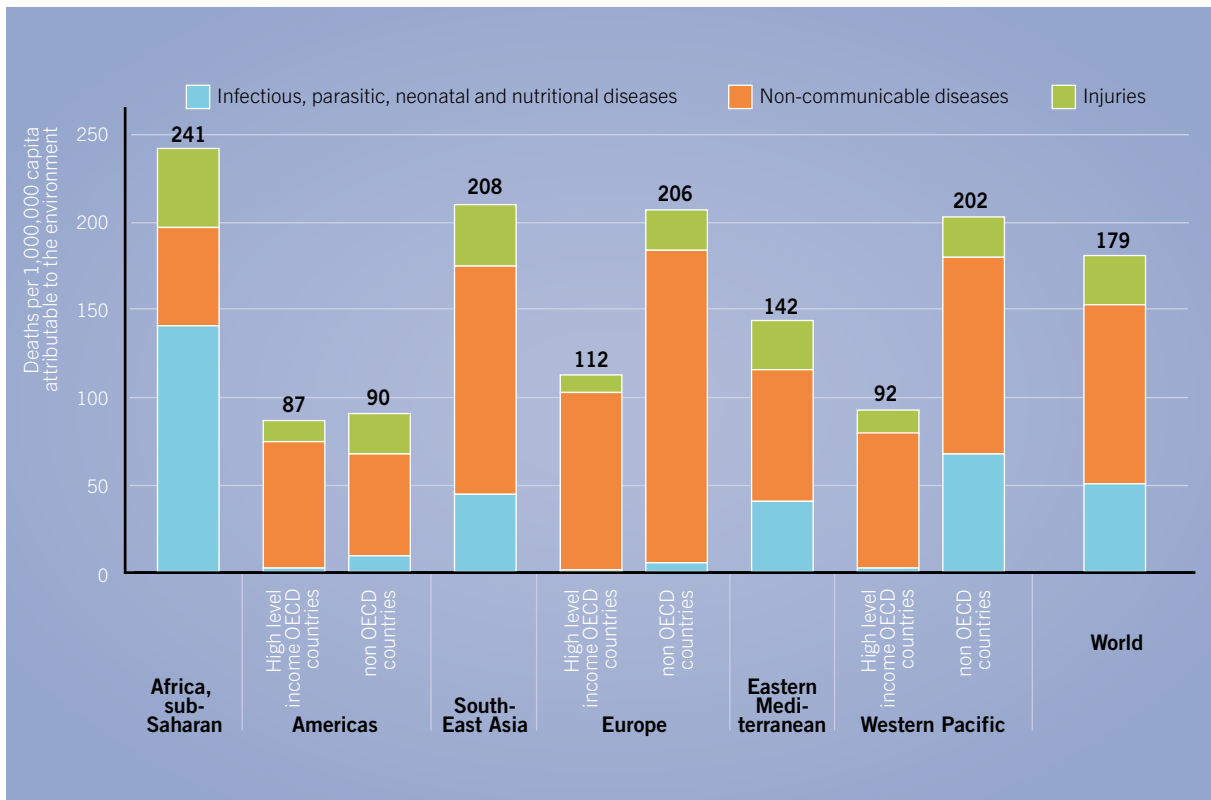
c The WHO global burden of disease measures burden of disease using the disability-adjusted-life-year (DALY). This time-based measure combines years of life lost as a result of premature mortality and years of life lost owing to time lived in states of less than full health.

Figure 2 Trend in the proportion of deaths attributable to the environment by disease group, 2002 – 2012



Source: WHO (2016) Preventing disease through healthy environments. A global assessment of the burden of disease from environmental risks

Figure 3 Deaths per capita attributable to the environment, by region and disease group, 2012



Source: WHO (2016) Preventing disease through healthy environments. A global assessment of the burden of disease from environmental risks

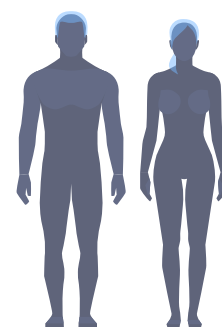
























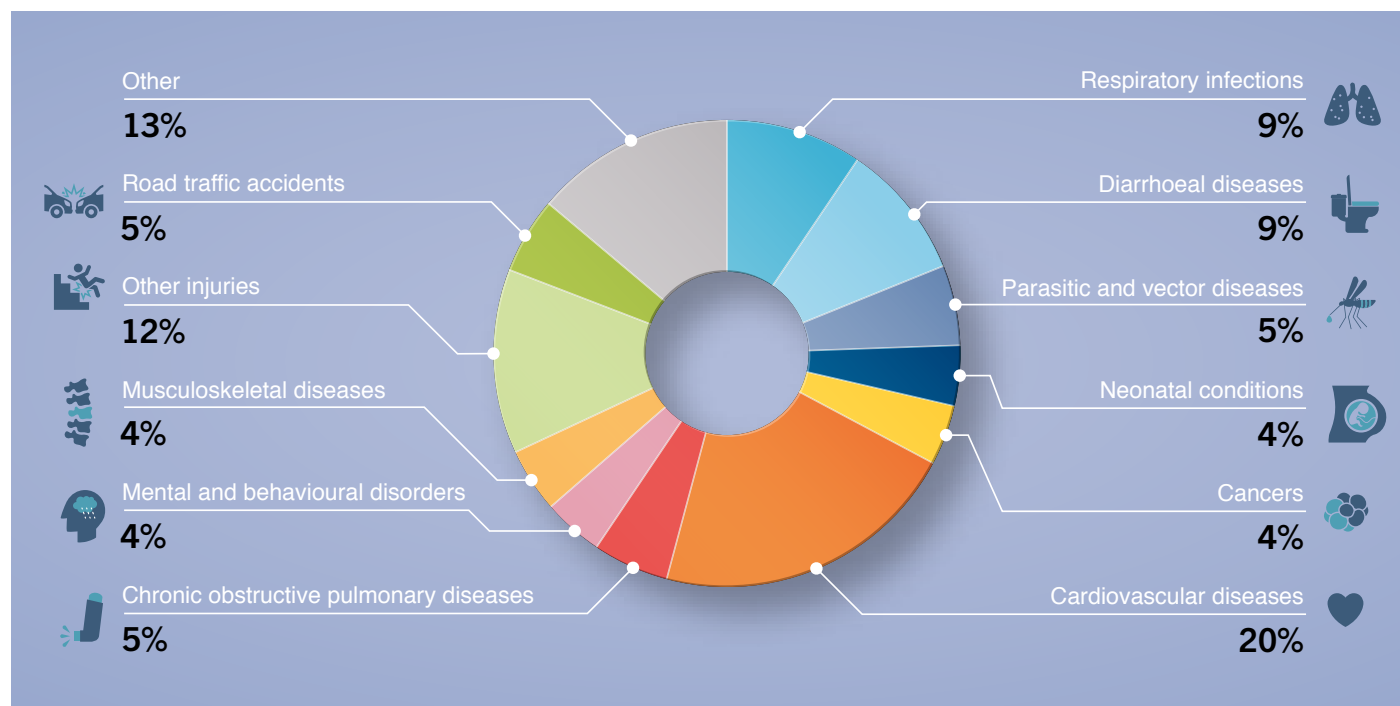


Figure 4 Diseases with the largest total annual health burden from environmental factors in terms of death, illness and disability in 2012 (Disability Adjusted Life Years – DALYs)

Disease / injury		DALYs per year because of unhealthy environmental conditions	Proportion of disease burden linked to environmental factors	Main environment risk factor
Diarrhoea diseases		57 million		Inadequate water, sanitation, hygiene
Unintentional injuries (other than road traffic)		74 million		A wide range of home, community, industrial and workplace accidents
Asthma		11 million		Air pollution, second-hand tobacco smoke, indoor mould and dampness, occupational asthmagens
Malaria		23 million		Poor water resource, housing, waste and land use management which fails to curb vector populations effectively
Road traffic injuries		31 million		Poor urban design or poor environmental design of transport systems
Lower respiratory infections		51 million		Household and ambient air pollution, housing conditions
Chronic obstructive pulmonary disease		32 million		Use of polluting fuels for cooking, ambient air pollution and exposures to workplace dusts
Cardiovascular diseases		119 million		Air pollution, lead and environmental tobacco smoke exposure, stressful working conditions.
Cancer		49 million		Exposure to air pollution, radiation, chemicals occurring in the home, the community or in the workplace
Neonatal conditions		26 million		Exposure of mothers to air pollution, tobacco smoke, pesticides and other chemicals; unsafe water and inadequate sanitation
Musculoskeletal diseases		23 million		Occupational stressors, poor work postures, prolonged sitting, carrying water and solid fuels for household needs
Unipolar depressive disorder		8 million		Occupational stress, work-life imbalance

Source: WHO

Figure 5 Main diseases contributing to the environmental burden of disease, all ages, world, 2012



Source: WHO (2016) Preventing disease through healthy environments. A global assessment of the burden of disease from environmental risks

total of environmentally attributable deaths, followed by cardiovascular diseases with 15 per cent of the total, then lower respiratory infectious diseases with 14 per cent and malaria with 11 per cent.

The number of deaths attributable to the environment represents 22 per cent of the total number of deaths in the Eastern Mediterranean region, with non-communicable diseases representing 52 per cent of the total. In the non-OECD countries of the Americas region, 15 per cent of deaths are attributable to the environment, with a proportion of non-communicable disease of 65 per cent. In South-East Asia and the Western Pacific, the proportion of non-communicable disease is also significant (respectively 62 per cent and 57 per cent). It is, however, still lower than in highly developed regions, such as the OECD countries of the Americas and of Europe, where the environmentally attributable number of deaths is 11 per cent and 12 per cent of

the total number of deaths, with non-communicable disease representing a proportion of respectively 90 per cent and 83 per cent.

HOUSEHOLD (INDOOR) AND AMBIENT (OUTDOOR) AIR POLLUTION

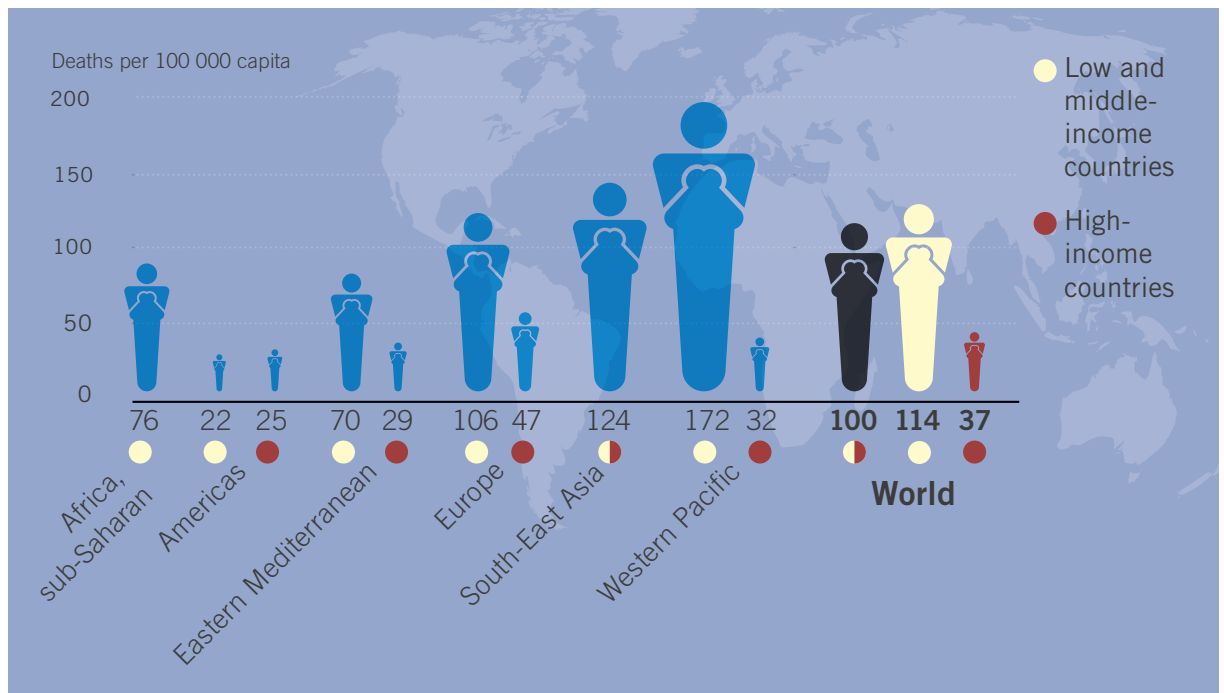
Air pollution is the world’s largest single environmental risk to health: some 7 million people³ across the world die each year because of everyday exposure to poor air quality caused by household air pollution and by emissions from power generation, transport, industrial furnaces, brick kilns, wildfires, burning of peatlands, and dust and sand storms.

In some countries simply preparing a meal is a major risk to health because of indoor air pollution.⁴ 4.3 million deaths are attributed to household air pollution arising with from cooking with solid fuels; this figure does not account for heating and lighting in homes. Nearly all of these deaths occur amongst people living in low- and middle-income countries.⁵ The primary reliance of 3 billion people, mostly in rural communities, on solid fuels (largely

biomass and coal based) paired with inefficient cooking stoves, is a major cause of this pollution, leading to respiratory and cardiopulmonary diseases, especially among women and children.⁶ For children, this is also undermining their education.⁷ In addition, the domestic demand for these products causes resource scarcity at the local level. Whilst fuelwood consumption is not typically responsible for large-scale deforestation, forest degradation occurs when harvesting is unsustainable, especially when forest landscapes have already been fragmented.⁸

Projections based on a business-as-usual emission scenario suggest that the contribution of outdoor air pollution to premature mortality could double by 2050.⁹ Over half the world’s population live in urban areas, yet only 12 per cent of cities reporting air quality data meet WHO guidelines on air pollution.^d The health consequences of outdoor air pollution are similar to household air pollution. Exposure to ozone, a trigger for asthma, further adds to this health burden. Individuals living in cities with a conglomerate of polluting sources or those affected by house-

Figure 6 Deaths per capita attributable to joint effects of household and ambient air pollution in 2012, by region



^d The World Health Organization 2014 database contains data from 1600 cities in 91 countries. Available from http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/.

hold air pollution often experience the greatest health impacts as a result of exposure and proximity to air pollution sources. Particulate matter from wildfires is also a health risk, mostly as a result of haze, as are dust and sand storms. While still difficult to quantify reliably, estimates indicate that 260,000 deaths a year¹⁰ can be attributed to smoke from forest, peat and grassland fires.

Transboundary flows of air pollution are a matter of serious concern, hindering countries as they attempt to meet their own goals on ambient environmental quality and public health. Studies suggest that the sum of the health impacts of transported pollution in foreign nations downwind of a source can sometimes be larger than the health impacts of emissions in the source region itself.¹¹

Low and middle-income countries in the Asia-Pacific Region had the largest air pollution related disease burden in 2012, with a total of 3.3 million deaths linked to household air pollution and 2.6 million¹² deaths related to outdoor air pollution. In the case of Latin America and the Caribbean, increased urbanization has also resulted in significant impacts to air quality. All regions of the world, however, are significantly affected. The high levels of air pollution which have been reported in a few places of sub-Saharan Africa are likely to be an underestimate because of the limited coverage of comprehensive air quality monitoring across the region.



LACK OF ACCESS TO CLEAN WATER AND SANITATION

Between 1990 and 2015, 2.1 billion people gained access to improved sanitation worldwide. However, fulfilling the human right to water and sanitation requires that all people have access to affordable, safe and acceptable water and sanitation. This higher standard is reflected in Sustainable Development Goal 6, which calls for States to “ensure availability and sustainable management of water and sanitation for all”. Today, 2.4 billion people are still using unimproved sanitation facilities, including 946 million people who, according to WHO, still practice open defecation.¹³ In Africa, 42 per cent of health facilities do not have access to an improved water source within 500 metres.¹⁴ Unsafe water, inadequate sanitation or insufficient hygiene result in 3.5 million deaths worldwide, representing 25 per cent of the premature deaths of children younger than 14.¹⁵ Indeed, developing countries represent more than 97 per cent of the total deaths related to poor water, sanitation and hygiene.¹⁶

Poor water quality and sanitation are linked to transmission of diseases such as cholera, diarrhoea, dysentery, hepatitis A, typhoid and polio, as well as persistent stunting as a result of subclinical bacterial infections.¹⁷ Lack of access to clean water and sanitation causes 58 per cent of cases of diarrhoeal diseases in low and middle-income countries.¹⁸ Almost 1,000 children per day die from diarrhoeal diseases because of poor sanitation, poor hygiene or unsafe drinking water: diarrhoeal diseases are the third leading cause of the death of children under 5.¹⁹ In the European region’s low and middle-income countries, about 10 people per day die from diarrhoea caused by inadequate clean water, sanitation and hand hygiene.²⁰

Sanitation is part of a growing global issue linked to wastewater management: Only 20 per cent of globally produced wastewater – domestic, industrial and from agriculture – receive proper treatment,²¹ leading to two principal water quality problems: chemical (and specifically nutrient) contamination and microbial pollution.²² Excessive nutrients in fresh and coastal receiving waters leads to eutrophication, negatively affecting ecosystems, and freshwater and marine resource productivity, thereby impacting livelihoods. High concentrations of nitrates and nitrites also affect health negatively.²³

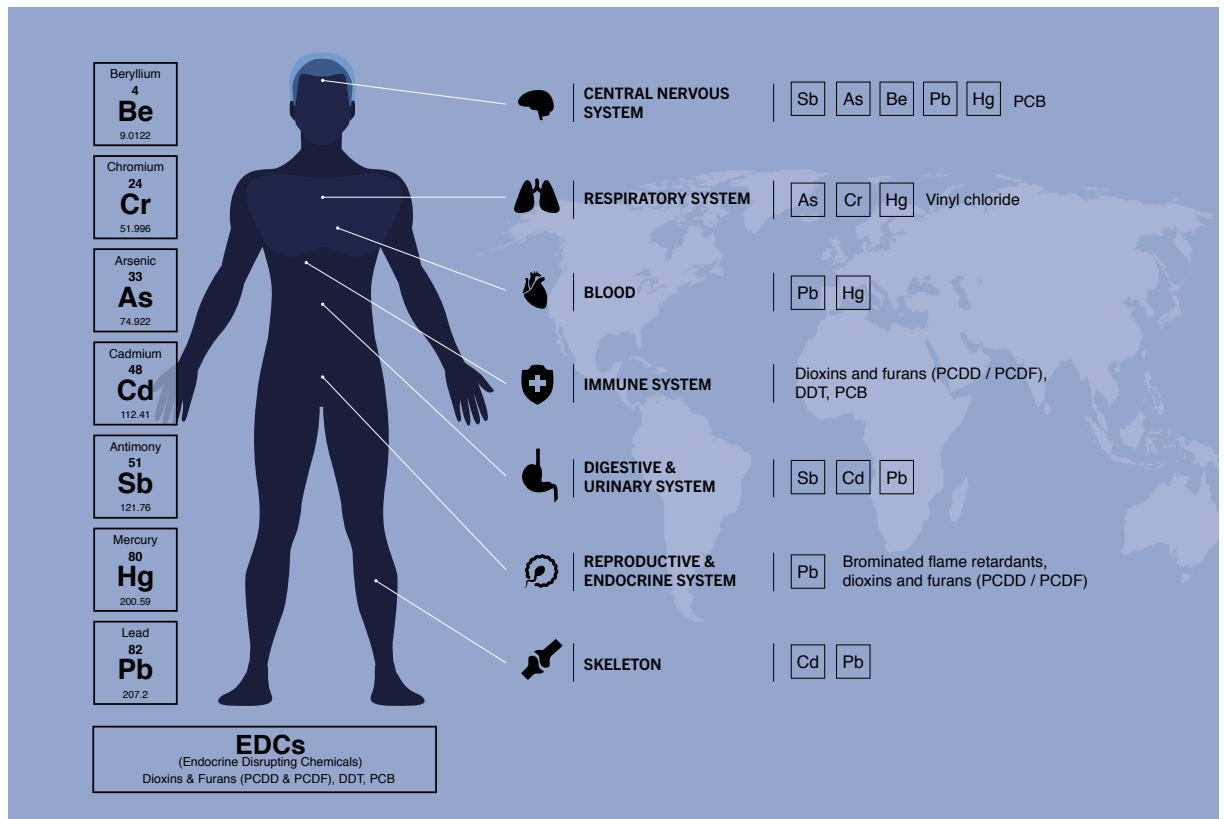
CHEMICAL POLLUTION

Chemicals are important for development and are responsible for advances in health, but certain types of chemicals, such as persistent organic pollutants (POPs), can build up to dangerous levels in humans and wildlife causing adverse reproductive, developmental, immunological, hormonal, and carcinogenic effects. Exposure to endocrine disrupting chemicals (EDCs) such as dioxins, furans, polychlorinated biphenyls (PCB), DDT and potential EDCs (phthalates, bisphenol A) can occur through food, water, dust, air and skin contact with various materials. EDCs can be found among chemical additives in electronics and electrical equipment, household cleaning products, textiles and furniture.²⁴

Although information is only available for a small number of chemical exposures, it is estimated that some 107,000 people die annually from exposure to asbestos²⁵ and 674,000 died from exposure to lead in 2010.²⁶ Lung cancers cause 1.6 million deaths per year,²⁷ out of which approximately 36 per cent – 568,000 deaths – are estimated to be linked to occupational exposure to chemicals and air pollution.²⁸

Globally, in 2013, 3.3 million cases of human poisonings were reported (it is likely that many cases were not reported) – almost the same as those injured from assaults with firearms (3.6 million).²⁹ On a yearly basis, it is estimated that excessive exposure to and inappropriate use of pesticides contribute to poisoning a minimum of 3 million people, especially impoverished rural workers.³⁰ The impacts on health from activities such as mining particularly affect vulnerable communities in Africa, Latin America and Asia.

Figure 7 Hazardous chemicals and wastes and selected impacts on human health



Source: Basel, Rotterdam and Stockholm conventions

Meanwhile, heavy metals such as lead, chromium, and cadmium contaminate agricultural soil, entering farm operations through application of sewage sludge as fertilizer, and the use of metal-based pesticides. The agricultural sector is also the world’s largest user of antibiotics, using 70 per cent of all that is manufactured.³¹ Overuse of pharmaceutical products (antibiotics and antimicrobial agents) – both in human medicine and veterinary practice – may contribute to creating resistant strains of microbes in humans, posing serious threats to health.³²

Children are particularly susceptible to the negative health impacts of chemicals. Impacts on mental health are particularly significant. For example, mercury and lead exposure in utero and early in life can result in mental retardation, seizures, vision and hearing loss, and delayed development.³³ The consumption of fish contaminated with methyl mercury is by far the most significant source of mercury exposure in humans. About 50 per cent of global anthropogenic mercury emissions are from Asia and the Pacific, mostly from coal-burning power plants, industrial boilers and artisanal small-scale mining.^e



Box 1 – MICRO AND NANO MATERIALS ³⁴

Micro and nano materials are an emerging issue of concern. In marine ecosystems, these forms of plastics may not be biodegradable, as they can sink to the ocean floor where they are not exposed to the sunshine required for biodegradation. Typically, the impacts of microplastics on human health come from dietary exposure by means of marine foodstuffs, contaminated water and inhalation of contaminated air. Since nanomaterials are in the same size range as ultrafine particles, concerns have been raised as to whether they could have similar hazardous properties. Nanoization can also expose humans to heavy metal levels exceeding advisory limits; for example, silver nanoparticles incorporated in textiles can be released during washing. Here, raising household consumption awareness is critical.



^e In French Polynesia, where adults on average consume three times more fish than the global average, mercury concentration of fish samples tested over 1999–2011 showed levels that are much higher than those considered permissible. Dewailly, E. and others, “High fish consumption in French Polynesia and prenatal exposure to metals and nutrients”, (2008) *Asia Pacific Journal of Clinical Nutrition* 7 (3): 461–470.

POORLY MANAGED HAZARDOUS WASTE AND OTHER WASTE

Global municipal solid waste generation levels are expected to double by 2025, at different rates according to regions and countries: the higher the income level and rate of urbanization, the greater the amount of solid waste produced.³⁵ Some United Nations Human Settlements Programme (UN-Habitat) health data indicate twice as high rates of diarrhoea and six times more acute respiratory infections for children living in households where solid waste is dumped or burned in the yard compared to households in the same cities which benefit from a regular collection service.³⁶ Uncollected waste may also result in blocked drains which aggravate floods and spread infectious disease.

Uncontrolled dumpsites, and in particular the mixing of hazardous and other wastes, can cause diseases in neighbouring settlements and among waste workers, where life expectancy is significantly shorter than the rest of the population.^f The 50 biggest active dumpsites affect the daily lives of 64 million people.³⁷



Electronic waste (e-waste) is the fastest growing type of waste. Close to 42 million metric tonnes of e-waste were generated in 2014 and this figure continues to rise.³⁸ While recycling is positive, the unsound dismantling, material recovery and final disposal of e-waste, containing various hazardous contents such as heavy metals and EDCs, can result in major environmental and human health impacts through the release of hazardous substances into soil, water and air.³⁹

Further reducing the amount of transboundary movements of hazardous and other wastes is also crucial, as they represent important challenges endangering developing countries with wastes they do not have the capacity to manage safely.

NATURAL DISASTERS

Floods, droughts, windstorms and heat waves are the most frequently occurring natural hazards and they account for almost 90 per cent of the 1,000 most disastrous events since 1990.⁴⁰ Each year around 42 million human life years are lost in internationally reported disasters, a burden on human well-being comparable to diseases such as tuberculosis.⁴¹ Since the first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in 1995, 606,000 lives have been lost and 4.1 billion people have been injured, left homeless or in need of emergency assistance as a result of weather-related disasters.⁴² Children, women⁴³ and disabled populations are particularly affected. The elderly are particularly vulnerable as well, as is reflected in data from five major natural disasters that show more than half of the deaths associated with these events occurred among people aged 60 years and older.⁴⁴

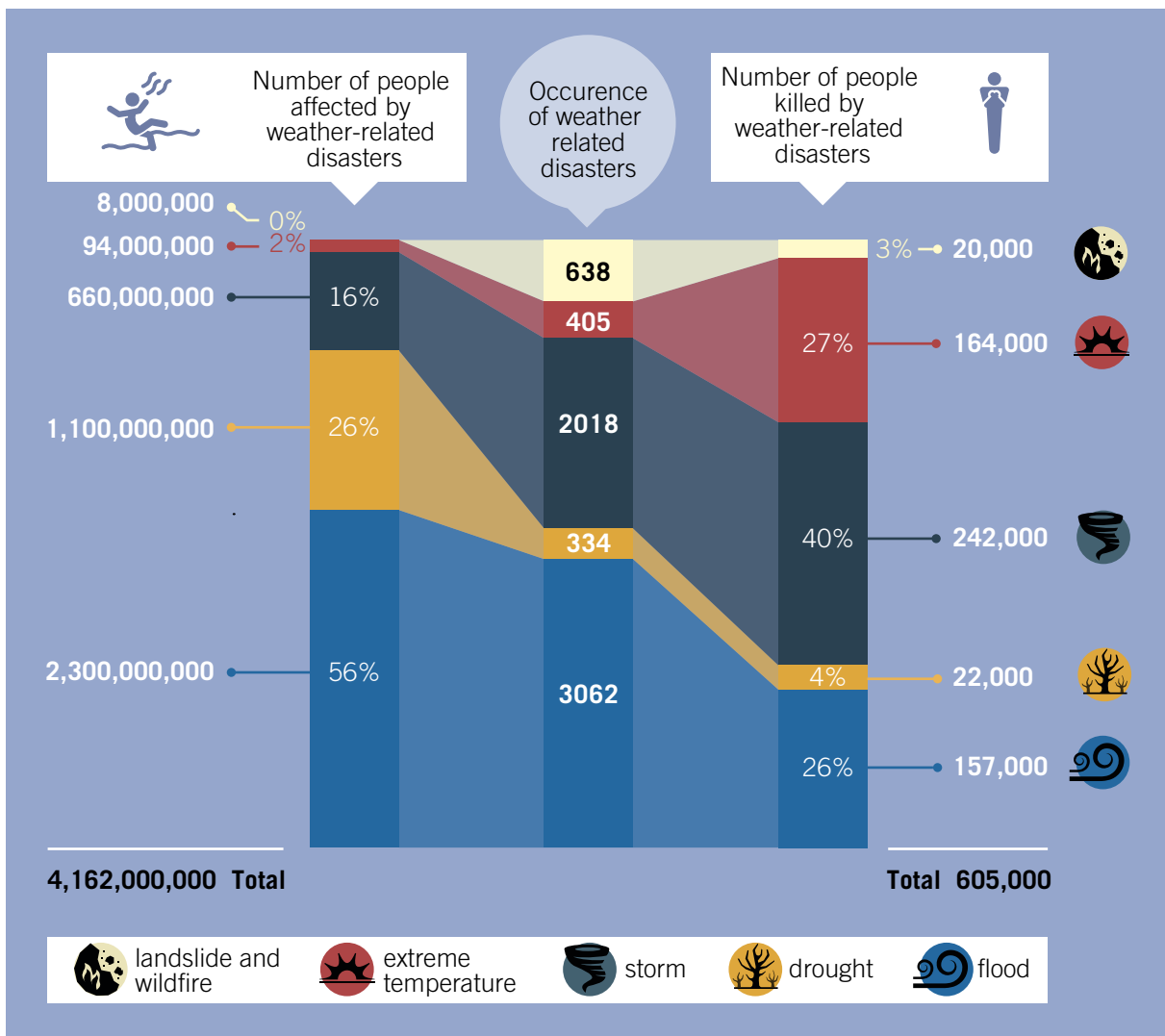
Significant psychological impacts follow disaster in terms of depression and demotivation, if disasters are recurrent, and the inability to rebuild lives. Loss of housing, reduced farm and non-farm assets, unemployment, increased under nutrition and associated poor health, forced displacement and migration all contribute to reduced social and mental well-being. It is also worth noting that natural disasters can trigger industrial accidents and accelerate pollution dispersion.

^f Data from UN-Habitat indicate, for example, that life expectancy of waste pickers in Mexico is 39 years, compared to an average of 69 years for the rest of the population. (UN-Habitat *Solid Waste Management in the World's Cities* (2009)).

Protecting and restoring ecosystems such as mangroves, wetlands, coastal vegetation, forests and coral reefs also provide highly cost-effective natural disaster mitigation in a changing climate,⁴⁵ mitigating effects of drought, floods and extreme weather.⁴⁶ While improvements in disaster risk management have led to reductions in mortality in some countries over the last decade, economic losses are now reaching an average of \$250 billion to \$300 billion each year⁴⁷ with inevitable effects on food security, health care and human well-being amongst the most impoverished.



Figure 8 Number of people affected and killed by weather related disasters 1995 – 2005



Source: UNISDR and Centre for Research on the Epidemiology of Disasters (2015) *The Human Cost of Weather Related Disasters (1995-2005)*

Global Changes and Trends

CLIMATE CHANGE

Climate change will have a detrimental effect on the environmental and social determinants of health, from the availability of clean air and water, to heat shocks, food security and shelter, and has the potential for wide-ranging systemic impacts on food availability and large-scale disasters. It has been identified as the defining issue for public health during this century⁴⁸ and the biggest global health threat of the twenty-first century.⁴⁹ Flooding events related to extremes of precipitation are occurring with growing frequency and intensity. The overall increased frequency and intensity of extreme weather events also results in health system losses and damages, as unmanageable demands are placed on already weak health systems. According to the latest figures from WHO, El Niño this year is likely to affect 60 million people, with many suffering health consequences.⁵⁰ Developing countries are particularly affected from outbreaks of cholera, malaria, diarrhoeal diseases, and increased food insecurity. Local changes in temperature and rainfall have already altered the distribution of disease vectors such as ticks, mosquitoes and sandflies, which will have a significant impact on the occurrence of disease outbreaks of malaria, dengue fever and other tropical diseases.⁵¹ Fragile ecosystems, such as small island developing States, and their populations are also particularly vulnerable as well as those living in coastal environments across the world.⁵² Women's dependence on and unequal access to land, water and other resources and productive assets, compounded by limited mobility and decision-making power in many contexts, also mean that they are disproportionately affected by climate change.⁵³

Climate change is also an accelerator of land degradation: It is estimated that 12 million hectares of productive land are already being lost annually to land degradation and desertification because of unsustainable land practices.⁵⁴ Desertification can affect human health through complex pathways, including higher threats of malnutrition from reduced food and water supplies; more water and foodborne diseases that result from poor hygiene and a lack of clean water; and respiratory diseases caused by atmospheric dust from wind erosion and other air pollutants. Cautious estimates from WHO under a medium-high emissions scenario indicate that 250,000 additional deaths could potentially occur each year between 2030 and 2050 as a result of climate change.⁵⁵



Box 2: POISONED CHALICE: TOXIC CROPS IN THE ERA OF CLIMATE CHANGE⁵⁶

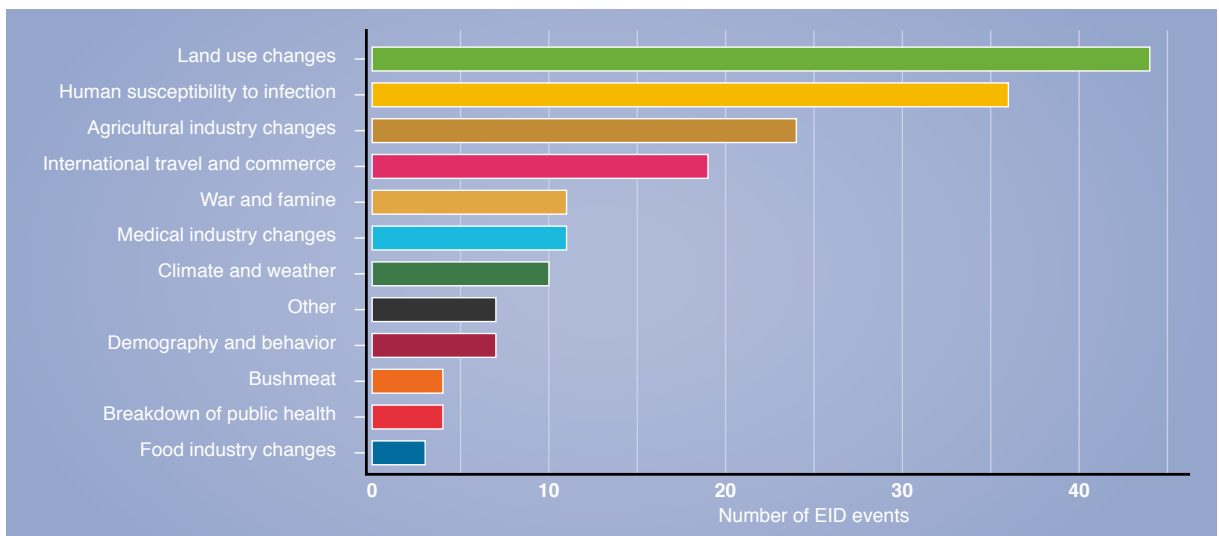
Of concern is the toxicity for humans and livestock of some drought-resistant varieties of key staple crops which may be exacerbated by climate change. When some crops become unavailable or inaccessible as a result of food prices, for example, people in low-resource settings may be forced to consume highly monotonous diets or rely heavily on drought-resilient marginal crops or wild plants. This may introduce additional health risks: extreme climatic conditions can drive the accumulation of chemical compounds harmful to human health in some of these crops or plants, such as grass pea. Worldwide, over 100,000 people suffer from paralysis caused by oxalyl diamino propionic acid.

ECOSYSTEM DISRUPTION, LAND-USE CHANGE, AND ZOOONOTIC DISEASES

15 out of 24 categories of ecosystem services are in decline, with overharvesting of resources and land-use change remaining as key pressures, and four of the nine planetary boundaries (climate change, loss of biosphere integrity, land-system change, altered biogeochemical cycles (phosphorus and nitrogen)) have been crossed.⁵⁷ Approximately 15,000 species (or 21 per cent) of global medicinal plant species are now endangered as a result of overharvesting and habitat loss.⁵⁸ Invasive alien species, likely to be exacerbated by climate change and global trade, are already posing direct threats to native and endemic species and ecosystem functioning.⁵⁹ Overharvesting, land-use change, unsustainable use of – and lack of fair access to – genetic resources, and climate change are also among the major drivers of the decline in wild plant resources, including those used commercially for food and medicinal purposes.⁶⁰

Zoonotic diseases, such as avian influenza, Rift Valley fever and Ebola, have also become the source of major pandemics (figure 9). The burden of disease from food-borne pathogens, such as Salmonella and Listeria, is now

Figure 9 Drivers of emerging infectious diseases from wildlife



Source: Loh et al. (2015) "Targeting Transmission Pathways for Emerging Zoonotic Disease Surveillance and Control" *Vecto-borne and Zoonotic Diseases*, vol. 15, number 7, quoted in WHO/CBD (2015) *ibid*.

EID = Emerging Infectious Diseases

estimated to be comparable to malaria or tuberculosis, responsible for 200,000 deaths per year, almost entirely in developing countries.⁶¹

The degradation of coastal zones and watersheds in particular exacerbate the effects of natural hazards such as floods and storms, while land degradation severely exacerbates the effects of drought and causes an increase in flash floods.⁶² When ecosystems decline or disappear not only do we lose important ecosystem services such as pollination, but also natural pest control, access to herbal and traditional medicines, which are important for large shares of the world population, and carbon sinks.⁶³ The first assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, for example, demonstrates the importance of saving bees and other insects that are crucial for pollination and crop production.⁶⁴

Box 3: THE ROLE OF THE ENVIRONMENT IN THE SPREAD OF THE ZIKA VIRUS

The Zika virus was first identified in Uganda in 1947 in rhesus monkeys. Outbreaks of Zika virus disease have since been recorded since 2007 in Africa, the Americas, Asia and the Pacific. The virus is transmitted to people through the bite of an infected *Aedes* mosquito, the same mosquito that transmits dengue, chikungunya and yellow fever. Recently in Brazil, local health authorities have observed an increase in Guillain-Barré syndrome which coincided with Zika virus infections in the general public.⁶⁵ There also appears to be rising evidence of the link between Zika outbreaks and microcephaly, although more investigations are needed.⁶⁶

The environment where these mosquitoes breed and larvae develop is a major factor in exposure to humans. The larvae thrive in stagnant water which is abundant, for example, in slum areas where open containers, tyres, barrels and drums are used for gathering rainwater for household and garden use. Improving the human environment can thus reduce both amount and exposure of these mosquitoes.

Global biodiversity is an insurance policy for human health: Genetic diversity strengthens ecosystem functioning and resilience, contributing to current and future well-being. The loss of biodiversity has a negative impact on agricultural production, pollination and pest control, the complex effects on the spread and regulation of zoonotic diseases, and human immune dysfunction because of reduced microbial diversity.⁶⁷

Box 4: THE HUMAN MICROBIOME AND THE NATURAL ENVIRONMENT

The rapidly growing body of research on the role of microorganisms in human health – the least visible yet the most ubiquitous form of biodiversity on Earth – shows that the interactions of microbes within their complex ecological communities have significant implications for human physiology and susceptibility to disease. The human microbiome, found in the gut, respiratory and urinary tracts and on the skin, is continuously linked to environmental microbial ecosystems and can contribute to, or modulate, disease risk, in particular non-communicable diseases which have become the leading cause of death worldwide. Some non-communicable diseases, including autoimmune diseases, type 1 diabetes, multiple sclerosis, allergic disorders, eczema, asthma, inflammatory bowel diseases and Crohn's disease, may be linked to depleted microbial diversity in the human microbiome owing to reduced contact of people with the natural environment. Antibiotic and antimicrobial use can alter the composition and function of the human microbiome, and limiting their unnecessary use would provide biodiversity and health benefits. Innovative designs of cities and dwellings that increase exposure to the microbial biodiversity can therefore help avoid the loss of human physiological and immune functioning.⁶⁸

Deforestation, intensive agricultural practices, and rapid population growth result in land-use change and increase the likelihood of interactions between humans and wildlife, providing conditions that are conducive to the spread of vector-borne diseases and those that can be transmitted to humans from animals (zoonoses).

URBANIZATION, DEMOGRAPHIC TRENDS AND LIFESTYLES

By 2050, it is expected that more than half of the world's population will live in cities.⁶⁹ More effective urban policies, especially relating to solid waste disposal, air quality, provision of safe water and sanitation, public transportation, and injury prevention combined with healthier lifestyles, will play an increasingly important role in public health and quality of life. As highlighted in the 2030 Agenda for Sustainable Development, a lack of legal access to resources and basic commodities and services, including the rule of law and repeated exposure to disasters and conflict, leads to an overall decline in both physical and mental health.⁷⁰

Urbanization can lead to dietary changes, including an increased risk of obesity and disease. Some 39 per cent of the global adult population is estimated to be overweight or obese⁷¹ with associated obesity-related health conditions rising rapidly. All age groups and regions are affected by non-communicable diseases in both urban and rural regions. Out of the 38 million people who died from these diseases in 2012, three quarters live in low and middle-income countries and 42 per cent of deaths were premature and avoidable, including 3.2 million deaths which can be attributed to insufficient physical activity and additional deaths because of unhealthy diets.⁷² The number of overweight or obese adults living in developing countries tripled from 250 million in 1980 to 904 million in

2008. All regions of the world, except sub-Saharan Africa, now have the highest environmental burden of disease linked to non-communicable diseases, compared with those of an infectious, parasitic, neonatal or nutritional nature.⁷³ As indicated above, human health depends on exposure to a healthy microbial biome and provides a strong medical rationale for increased provision of biodiversity and green spaces in modern cities.⁷⁴

Cities can be very noisy areas. Reduced sleep quality from noise or exposure to noise during the day has been identified as reducing the quality of life for a significant portion of the global population.⁷⁵ Approximately 40 per cent of the population in the European Union is exposed to road traffic noise at levels exceeding 55 decibels, and by the beginning of the twenty-first century, two-thirds of the world's population lived in areas where the night sky was classified as light polluted.⁷⁶ While the health risks of night-time exposure to both light and noise are yet to be fully understood, there is evidence that it can lead to various effects such as elevated risk of breast or prostate cancer, obesity, diabetes, depression and sleep disorders, and impacts on mental development in the young and on human well-being.



Vulnerability

Vulnerability to environment and health inequities are linked to many social and economic factors: the social and economic position of individuals, in relation to social class, age, gender and ethnicity, as well as education, occupation, livelihood and income levels. These factors determine where people live, what they eat, how and when in the life cycle they are exposed to pollution, and what options they have to change their conditions.

Poor people, children and the elderly^g are particularly at risk. The social and economic groups that are vulnerable to environmental impacts often also suggest an environmental injustice at play, as it is often the rich who benefit from the activities that create the degradation and it is the poor and vulnerable groups who are most affected. Poor air quality is especially burdensome on the poor, women, and children. Indoor air quality affects women and children as they are exposed to fumes from cooking, and outdoor air pollution affects the poor who are unable to protect themselves by moving around in cars or by means of other protection, and those who make a living on the streets such as street hawkers, auto cycle drivers and others.

Gender inequality with regards to environment-related health burdens are exacerbated by differential exposures and vulnerabilities to diseases, disabilities and injuries. Men are overall slightly more affected by the environment than women (with 22.8 per cent of male deaths, as compared to 20.6 per cent of female deaths, being attributable to the environment). Women, however, tend to bear higher exposure from household air pollution while men are more exposed to occupational risks, the employed percentage of men being globally about 50 per cent higher than women.

Children are particularly susceptible to the negative health impacts of their degraded or unsafe environment. While 23 per cent of all deaths globally are linked to

environmental factors, the share rises to 26 per cent for children under the age of 5 (figure 10). Almost one third (30 per cent) of all deaths from foodborne diseases affect children under the age of five, despite the fact that they make up only 9 per cent of the global population.⁷⁷ Diarrhoeal diseases in children because of poor sanitation result in reduced nutritional absorption, which may in turn cause stunting, cognitive setbacks and lower school performance, affecting economic earnings later in life.⁷⁸ It is estimated that a mother can pass as much as 33 per cent of her chemical body burden to her child.⁷⁹ In addition, as a result of their rapid growth and development and greater exposure relative to body weight, foetuses and children are particularly affected by exposure to chemicals and pollutants.

The world's poorest 3.5 billion people tend to rely directly on the environment for their basic needs, such as water, food and shelter. The degradations of these ecosystem services affect the poorest most as they have no alternatives. Climate change impacts add to this vulnerability, having different effects on the already endangered livelihoods and the safety of both men and women, as a result of the further reduced quantity and quality of water and sanitation, degradation of the soil, emerging and re-emerging diseases, loss of lives and properties in natural disasters, and forced or voluntary migration.⁸⁰ Over half a billion children live in extremely high flood occurrence zones, and nearly 160 million children live in areas

^g 25 per cent of the deaths of adults between the age of 50 and 75 years old are due to environmental factors (WHO (2016) *ibid*).

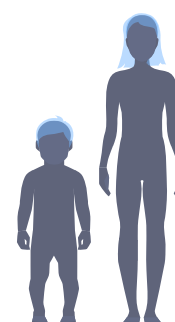








Figure 10 Environmental burden of disease in children less than 5 years of age, 2012

Disease / injury	DALYs per year as a result of to unhealthy environmental conditions:	Main environment risk factor
Diarrhoea 	34 million	Inadequate water, sanitation, hygiene
Lower respiratory infections 	52 million	Household and ambient air pollution
Malaria 	19 million	Poor water resources, housing, waste and land-use management which fails to curb vector population effectively
Neonatal conditions 	25 million	Air pollution, poor water, sanitation, and hygiene
Fire, heat and hot substances 	5 million	A wide range of home and community accidents
Drowning 	4 million	Inadequate safety measures in the home and community environment, climate change

Source: WHO (2016) *Preventing diseases through healthy environment: A global assessment of the burden of disease from environmental risks*

of high, or extremely high, drought severity.⁸¹ Many poor countries are also particularly vulnerable to climate change impacts as are some indigenous groups, peasants and pastoralists.

Communities that are dependent on degraded landscapes – including overgrazed, heavily deforested, drought prone, desertified and severely eroded lands – are exposed to famine, loss of shelter and medicinal plants and are also highly vulnerable to slow-onset disasters. The poorest can become trapped in a chronic pattern of poor well-being associated with living in degraded

environments, or be forced to migrate to rapidly urbanized areas or refugee camps. By the end of 2014, there were 56 million refugees and internally displaced people.⁸² The growing understanding of the links between environmental degradation, conflicts over natural resources, climate change and migration and well-being has now become the focus of recent policy dialogues⁸³ and is captured in the Sustainable Development Goals⁸⁴.

Multiple Benefits of a Healthy Environment

Not only does inaction on the environmental-health front have ethical implications, it also has legal and economic implications. The global economic implications of environmental risks to health are substantial. The economic loss because of the lack of access to safe drinking water and sanitation for Africa alone is estimated to be about 5 per cent of GDP. Although not all of them are related to environment factors, work-related health problems (including chemicals and injuries) result in an economic loss of 1.8–6 per cent of GDP, averaged at 4 per cent.⁸⁵ Estimates of the health cost of air pollution in 50 countries in the WHO Europe region⁸⁶ (including countries of the Caucasus, the Russian Federation, Turkey and parts of Central Asia) range widely (1–33 per cent) but can be averaged at approximately 10 per cent for the region.

Globally, it is estimated that the neurodevelopmental effects of exposure to lead cause economic losses of \$977 billion in middle-income and low-income countries.⁸⁷ For the insurance industry, the estimated cumulative cost of asbestos-related claims over decades in the United States alone had reached \$117 billion by 2010.⁸⁸ While research on the health impacts from exposure to agrochemicals is limited, evidence is starting to build. In the European Union alone, the annual health and economic costs of pesticide exposure is estimated at roughly \$127 billion.⁸⁹ The ammonium nitrate explosion in Toulouse (2001, France), resulted in costs of \$1.8 billion. The total cost of the oil storage depot explosion in Buncefield (2005, UK) was estimated at \$1.5 billion.

The transition towards a healthy environment for all can yield significant benefits in terms of development, poverty reduction and reduced risks to human health:

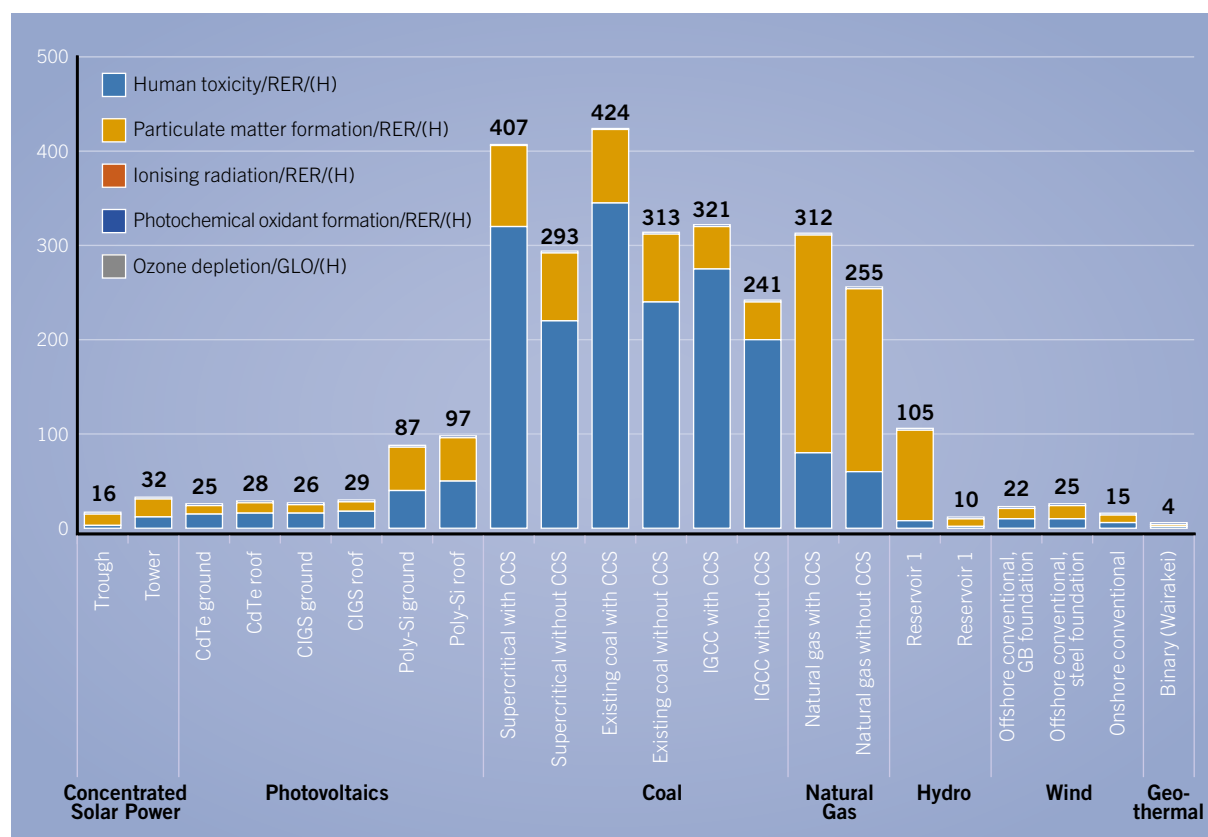
For example, benefits from the elimination of lead in gasoline on a global scale have been estimated at \$2.45 trillion per year, or 4 per cent of global GDP,⁹⁰ saving an estimated 1 million premature deaths per year. The Vienna Convention for the Protection of the Ozone Layer (1985) and its Montreal Protocol on Substances that Deplete the Ozone Layer (1987) resulted in the successful phase-out of nearly 100 ozone-depleting substances. As a result, up to 2 million cases of skin cancer and many millions of eye cataracts may be prevented each year by 2030. Moreover, by limiting the loss of stratospheric ozone, the Montreal Protocol helps to safeguard food security by reducing ultraviolet damage to crops and marine ecosystems. Cumulative estimates from 1987 to 2060 show that the global phase-out of chlorofluorocarbons (CFCs) alone will result in an estimated \$1.8 trillion in global health benefits and almost \$460 billion in avoided damages to agriculture, fisheries and materials.⁹¹

Global and national projections indicate the potential for the immense results from action addressing environment and health linkages:

- Mitigating climate change and increasing the climate resilience of key health functions⁹² would bring large health gains, and as such has been described as “the greatest health opportunity of the twenty-first century”.⁹³ For example, implementing proven, cost-effective measures to reduce emissions of short-lived climate pollutants such as black carbon and methane are expected not only to reduce global warming by 0.5°C by the middle of the century, but also to save 2.4 million lives a year from reduced air pollution by 2030.⁹⁴

- A simulation of a hypothetical air pollution abatement approach which would reduce emissions of NO_x, SO₂ and black carbon by up to 25 per cent indicates that, not taking into account the reduction in morbidity, the benefits or costs ratio of policy measures adopted is, for the world, 1.5 by 2030 and 4.1 by 2050, with a benefits or costs ratio of 10 by 2050 in Brazil, China, India, Indonesia, the Russian Federation and South Africa – the so-called BRICS group of countries.⁹⁵
- In developing countries, the return on investment in water and sanitation services is estimated at between \$5 and \$28 per dollar.⁹⁶ Investments targeted at sustainable, climate change-resilient water, sewage, and solid waste management and facilities can indeed generate important health co-benefits in terms of sanitation by decreasing risks of exposure to infectious agents and water-borne disease for local communities, relieving the burden on public health and increasing labour productivity.
- A healthy and sustainable diet could reduce global greenhouse gas emissions (by the equivalent of ca. 0.3 to 0.6 PgC/yr compared to current trends), and protect biodiversity by greatly reducing requirements to expand cropland area to feed a growing global population. Healthy diets are also generally associated with greatly reduced incidence of disease (diabetes, cancer and coronary) and mortality from all causes compared to diets rich in red meat.⁹⁷
- Investments in preventative workplace health programmes of around \$18 to \$60 per worker could reduce sick leave absences by 27 per cent.⁹⁸

Figure 11 Human health impacts (in DALYS) per unit of electricity generated (1TWh), for Europe in 2010



Source: International Resource Panel (2015) *Green energy Choices*^h

^h From calculations made at the Wairakei geothermal station in New Zealand.

The connection between green investments and public health is mutually reinforcing. On the one hand, green investment in major economic sectors reduces carbon emissions and pollution by enhancing energy and resource use efficiency, therefore improving human well-being and public health. Investing in the protection, conservation and restoration of ecosystems as what is known as “green infrastructure” is also beneficial, because, for example, terrestrial and inland water ecosystems contribute to the regulation of the quantity, quality and supply of freshwater and of flood regulation. Moreover, ecosystems such as mangroves, sand dunes and wetlands contribute to reducing disaster risk associated with cyclones and floods.⁹⁹ On the other hand, improved health reinforces economic growth and acts as an engine for transitioning toward poverty eradication and sustainable development.¹⁰⁰

A comparative assessment of human health impacts across different energy choices indicates that countries will benefit from investing in more green energy choices (figure 11). Figure 12 highlights examples of the multiple benefits of inclusive green policies, while figure 13 provides examples of action on short-lived climate pollutants (SLCPs).

Half of the emission reductions of both black carbon and methane could be achieved at net cost savings or low costs over the lifetime of the measures, taking into account climate benefits only. If all benefits are considered, all control measures are cost effective.

Figure 12 Examples of multiple benefits of inclusive green policies

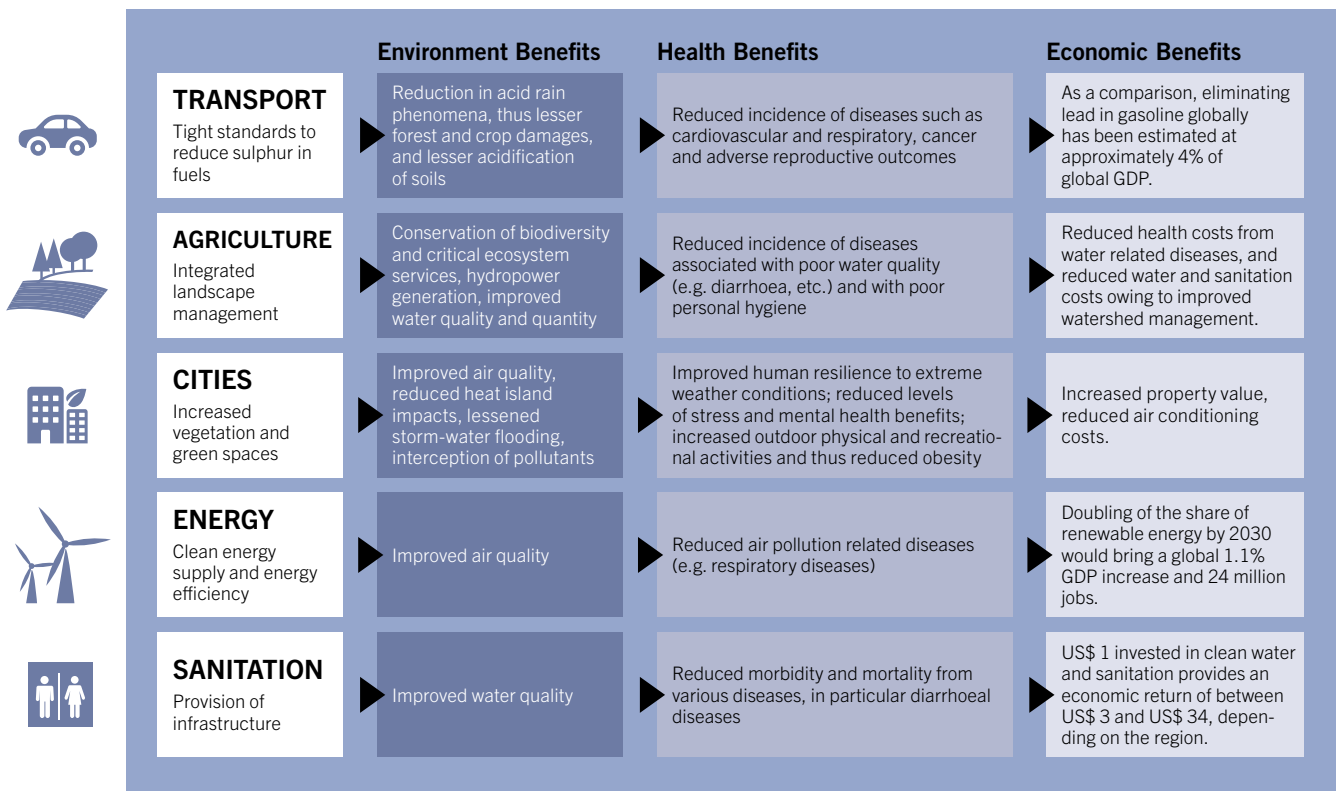








Figure 13 Cost of control measure and multiple benefits of some actions on short lived climate pollutants

Sector	SLCP mitigation action	Share of total avoided warming from SCLP reduction in 2050	Economic cost or benefit	Health benefits	Other co benefits	
RESIDENTIAL	<ul style="list-style-type: none"> Replace traditional biomass cookstoves with modern fuel cookstoves Replace traditional cooking and heating with clean-burning biomass stoves 	25%	Net savings or low cost	<ul style="list-style-type: none"> Reduced air pollution related diseases Lower violence and injury risk during fuel collection Fewer burns 	<ul style="list-style-type: none"> Crop protection 	
INDUSTRY	<ul style="list-style-type: none"> Replace traditional brick kilns with improved brick kilns 	0,5%	Net savings or low cost	<ul style="list-style-type: none"> Reduced air pollution related diseases 	<ul style="list-style-type: none"> Energy efficiency Improved quality of brick kilns 	
TRANSPORT	<ul style="list-style-type: none"> Eliminate high-emitting diesel vehicles 	6,5%	Difficult to quantify	<ul style="list-style-type: none"> Reduced air pollution related diseases 	<ul style="list-style-type: none"> Energy efficiency 	
AGRICULTURE	<ul style="list-style-type: none"> Ban open-field burning of agricultural waste 	5%	Difficult to quantify	<ul style="list-style-type: none"> Reduced air pollution related diseases 	<ul style="list-style-type: none"> Energy efficiency 	
FOSSIL FUEL	<ul style="list-style-type: none"> Pre-mine degasification and recovery and oxidation of CH4 from ventilation air from coal mines 	Recovery: 6% Oxidation: 8.5%	Moderate cost	<ul style="list-style-type: none"> Occupational safety 	<ul style="list-style-type: none"> Energy efficiency 	
WASTE MANAGEMENT	<ul style="list-style-type: none"> Separation and treatment of biodegradable municipal waste and landfill gas collection 	9.5%	Net savings or low cost	<ul style="list-style-type: none"> Reduced air pollution related diseases 	<ul style="list-style-type: none"> Improved waste management Energy efficiency Crop protection 	

Source: Climate and Clean Air Coalition

Framework of Actions for a Healthy Environment and Healthy People

Improving human health and well-being through integrated environmental sustainability (protection, conservation, restoration) and policies provides a unique opportunity for meeting the goals and targets set out in the 2030 Agenda for Sustainable Development at both the national and global levels.

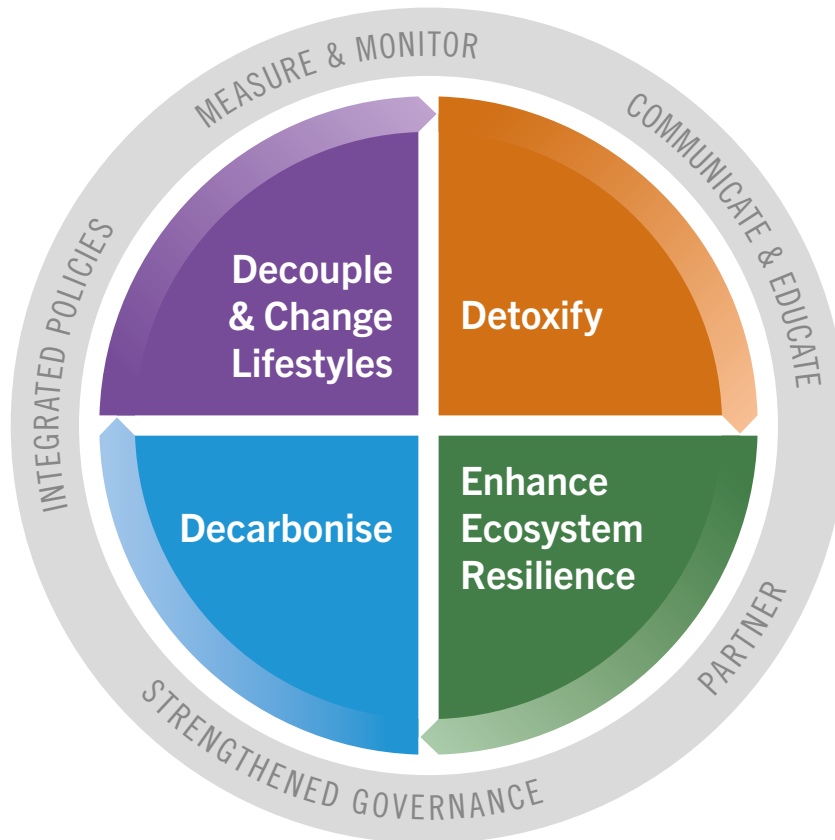
Based on the evidence of the linkages between poor environmental quality and health, this report identifies the following as leverage points, among others, for urgent policy attention and action based on the evidence:



- Improve indoor household and ambient air quality to enable reductions in morbidity and enhance the quality of life of local populations and across borders, including through sustainable urban design which can also contribute to increase physical activity through the provision of green spaces, to prevent and reduce non-communicable diseases and poor health;
- Replace and reduce the utilization of hazardous chemicals and generation of toxic waste, and ensure sound management of chemicals and wastes;
- Intensify progress in providing safe water, improved sanitation and hygiene services to reduce mortality, morbidity, and losses in economic productivity;
- Restore and protect degraded ecosystems and mitigate stresses to the Earth's natural systems in order to enhance ecosystem services that support human health, reduce exposure to natural disasters, enhance food security, and prevent the emergence of novel pathogens and disease outbreaks and contribute to the improvement of nutritional diet quality.

Climate change is exacerbating the scale and intensity of these environmentally related health risks.

Figure 14 A framework of four integrated lines of actions is recommended to address the nexus of environment and health



DETOXIFY: Remove harmful substances from and/or mitigate their impact on the environment in which people live and work. This will, for example, address air pollution, through reducing black carbon emitted by household and non-household sources and other pollutants, and ensure that emission concentrations do not exceed WHO recommended targets for particulate matter 2.5 (PM2.5) and carbon monoxide¹⁰¹ or the reduction of pesticides use, through the promotion of integrated pest management and organic and sustainable farming systems. It will require a stronger focus on the sound management of chemicals and waste and on implementing a life-cycle approach to chemicals and waste management.

DECARBONIZE: Reduce the use of carbon fuels and thereby emissions of carbon dioxide (CO₂) through substitution of non-carbon energy. Over their life cycle, the pollution-related human health and environmental impacts of solar, wind and hydropower are a factor of 3 to 10 times lower than fossil-fuel power plants.¹⁰² Investing in green energy at household level will accrue other benefits, including more time for income-generating activities, reduced health risks from carrying heavy loads of firewood over long distances, and more leisure time available for women, among others. The nationally determined contributions (NDCs) committed to under the Paris Agreement on climate change can be important vehicles for decarbonization, and consequent health and well-being improvements.



DECOUPLE RESOURCE USE AND ENVIRONMENTAL IMPACTS AND CHANGE LIFESTYLES:

Use fewer resources per unit of economic output produced and reduce the environmental impacts of production and consumption activities.¹⁰³ This is about generating the needed economic activity and value to sustain the world's population with less resource use, less waste, less pollution and less environmental degradation. Important health benefits can be gained from decoupling opportunities in the food sector, in water use, in energy consumption and through recycling and more sustainable household consumption. For example, shifts in consumption from animal to plant-based products,¹⁰⁴ and improved diet composition and quality as well as increased access to urban green areas have positive implications for health and addressing non-communicable diseases and mental health. Youth engagement, awareness-raising and education in particular need to be prioritized to achieve this.



ENHANCE ECOSYSTEM RESILIENCE:

Build the capacity of the environment, economies and societies to anticipate, respond to and recover from disturbances and shocks through: protection and conservation of genetic diversity, terrestrial, coastal and marine biodiversity; strengthening ecosystem restoration, in particular of wetlands, dryland vegetation, coastal zones and watersheds including through reforestation as well as agro-ecosystem restoration and sustainable farming systems; reducing pressures from livestock production and logging on natural ecosystems to increase resilience and mitigate extreme weather conditions of storms, drought and floods. Sustainable land and forest management, along with conservation and restoration, will protect and enhance biodiversity and ecosystem services. This will lead to improved absorption of rainwater into the soil, increased water storage and availability, more biomass, and greater food security, thus reducing malnutrition. These restorative activities will not only ensure food security, but also nurture cultural, social and recreational activities, and bring economic growth for local populations and businesses.

The five economy-wide strategies proposed to support these actions are highlighted below. UNEP ongoing and proposed further activities to address the five main environment and health linkages are summarized in an annex.

STRENGTHENED ENVIRONMENTAL GOVERNANCE AROUND THE ENVIRONMENT-HEALTH NEXUS AT THE GLOBAL, REGIONAL, NATIONAL AND LOCAL LEVEL

The link between environment and health is recognized in a number of the United Nations human rights treaties.ⁱ In addition, the right to a clean¹⁰⁵ and healthy environment has been explicitly included in or interpreted as a fundamental component of many regional human rights agreements and more than 100 national constitutions, resulting in greater participation in environmental decision-making and accountability. The Paris Agreement on climate change has a reference to human rights, including the right to health, in its preamble.

At the global level, the WHO *International Health Regulations* entered into force in 2007 and are legally binding on the 194 Member States of WHO. Through the guidelines on air quality and drinking-water quality, WHO provides the scientific basis for regulation and standard setting to address key environmental health issues. In May 2015, the World Health Assembly passed a resolution on mitigating the health effects of air pollution. The resolution requests the WHO secretariat to strengthen its technical capacities to support Member States in taking action on air pollution,¹⁰⁶ a resolution complementary to the United Nations Environment Assembly June 2014 resolution on air quality.¹⁰⁷ These agencies are now working together to enhance the technical and policy capacity of Member States to address air pollution.

A number of multilateral environmental agreements also contribute to both environmental and human health and well-being.¹⁰⁸ Hazardous chemicals are addressed through synergies among the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

and the Stockholm Convention on Persistent Organic Pollutants, but stronger links to the WHO international health regulations are needed. In addition to legally binding global instruments, the Strategic Approach to International Chemicals Management (SAICM) promotes chemical safety around the world. Life cycle management of chemicals is crucial to avoid significant and increasingly complex risks to human health and the environment. The world's most recent multilateral environmental agreement, the Minamata Convention on Mercury, will offer significant opportunities for the protection of human health and environment once it enters into force.¹⁰⁹ The Paris Agreement on climate change, adopted in December 2015, strengthens the ongoing global response and collective action to address the threat of climate change in the context of sustainable development and poverty alleviation. The focus on improving human health, through decarbonization and detoxification, will also help to deliver the climate targets by reducing emissions of black and short-lived air pollutants.

The objective of sustaining a healthy planet to deliver life-sustaining benefits essential for all people is embedded in both the vision and mission of the Strategic Plan for Biodiversity 2011–2020, adopted under the Convention on Biological Diversity, and in other biodiversity-related conventions. Achievement of the associated Aichi Biodiversity Targets will address many of the drivers of ill health and biodiversity loss. For example, Aichi Biodiversity Target 5 (to half the rate of habitat loss and degradation by 2020) will contribute not only to biodiversity conservation but also to reducing the risk of infectious diseases, and to protecting ecosystems that provide vital services. Target 14 addresses ecosystems and ecosystem services that contribute to human health, livelihoods and well-being, with an explicit focus on the needs of women, indigenous peoples and local communities and the poor and vulnerable groups that tend to be particularly and directly dependent on natural resources.

At the regional level, regional conventions contribute to more effective legislation and institutional capacity on environment and health and direct indisputable major improvements. The reflection of the Economic Commission for Europe (ECE) Convention on Long-Range Transboundary Air Pollution in national legislation has led to large reductions in sulphur and nitrogen emissions across Europe, and can be replicated in other regions with similar successes.¹¹⁰ Examples of regional policy action include the WHO European Ministerial Conference

on Environment and Health which meets regularly to determine common policy actions, the Regional Forum on Health and Environment in Southeast and East Asian countries, or the Forum of Ministers of Environment of Latin America and the Caribbean, which established the Regional Intergovernmental Network on Atmospheric Pollution in 2008, working on the implementation of the Regional Plan of Action which provides a guide for the development (and eventual harmonization) of national policies to reduce air pollution. Regional sanitation conferences such as Africasan have spurred political commitments, for example by establishing public sector budget allocations for sanitation with the aim of spending 0.5 per cent of GDP on sanitation.¹¹¹

At the national level, it is crucial for countries to develop and strengthen the implementation of national environmental legislation linking environmental sustainability (protection, conservation, restoration) to improving health, including the required judicial and binding legal framework for actual implementation and enforcement. There is a need to consider health-environment linkages in both environment and health-impact assessments and in strategic assessments. There is also a need to strengthen national monitoring capacities and data collection, including integrated surveillance capacities and early warning systems, that enable health systems to anticipate, prepare for and respond to public health threats resulting from ecosystem degradation. Regional and local governments also play a key role as they can hold exclusive or shared competencies on crucial areas for addressing the environment-health nexus and are closer to the needs of the population. Stakeholder involvement at all levels of decision-making is also conducive of more inclusive policies and preventive actions.

Partnerships on specific legislation and related measures where significant impacts can be attained are a successful way to accelerate measures; this can be seen in the successes of the Partnership for Clean Fuels and Vehicles, which has facilitated the almost complete phasing out of lead in petrol (gasoline) in developed and transition countries.¹¹² Governments and stakeholders have partnered in the Global Alliance to Eliminate Lead in Paint to introduce legal limits on lead in paint by 2020.¹¹³ So far 59 countries have such legislation, including recent new laws and regulations in Nepal, the Philippines and Sri Lanka.



EVIDENCE-BASED INTEGRATED POLICIES TO INCENTIVIZE THE ABOVE ACTIONS

The evidence linking environmental sustainability with health gains provides a strong foundation for designing, adopting and implementing integrated policies on the national scale (figure 15). The importance of evidence-based policies is that they have the promise of substantial benefits at relatively small costs.¹¹⁴ There can, however, be a considerable lag between science and policy action, even when a sufficient degree of certainty in light of the risks has been reached.¹¹⁵

Integrated environmental and health policies require institutional arrangements whereby all sectors take responsibility for reducing health inequities, through intersectoral cooperation mechanisms and actions to effectively integrate environment and health linkages and risks – including climate risks – in financial and development choices.^j The implementation of the Libreville Declaration on Environment and Health, adopted by African countries, demonstrates that the basis of integrated policymaking is already in place in some countries and regions. Environment and health forums in other regions also provide solid platforms to stimulate and accelerate change and need to be supported further. In Asia and the Pacific, the Asia Pacific Clean Air

j For example, promoting “health-in-all policies” helps to develop effective policies with clear and measurable outcomes that build accountability for the determinants of health and related health inequities.

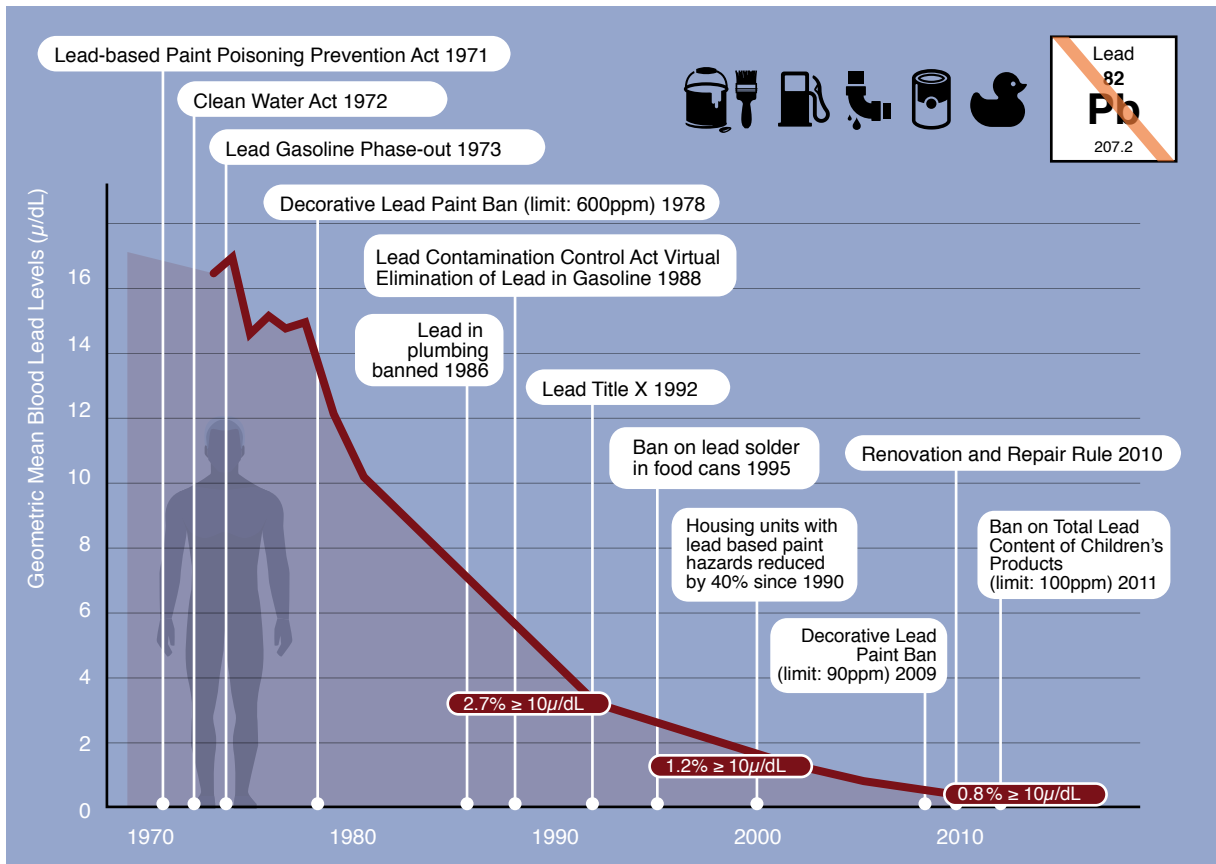
Partnership (APCAP) was formed, aiming at providing support to countries in the region in managing their air pollution concerns through an integrated approach.

Market and financial instruments and public regulation are also vital for incentivizing improved environmental and health policies. Taxes and civil penalties for polluters, combined with subsidies reform, can promote cleaner investments, along with energy price reforms.^k Interventions that can greatly improve energy efficiency of water use include the correct pricing of water, improved technologies for storage and treatment, and appropriate choice of crops. Governments can blend public sector financial instruments to leverage private investments in clean and green development choices by sharing risks and reducing costs. Financing mechanisms are required to mobilize private capital and philanthropy to address global and local environmental and health challenges.^l More healthy living can be addressed by

promoting balanced diets to reduce obesity, and support local markets and organic and sustainable agriculture. Finally, the implementation of these integrated national policies can often be made through investments in green infrastructure and green technology, generating jobs and livelihoods.

- ^k Energy subsidies are estimated to represent \$4.9 trillion (6.5 per cent of global GDP), with approximately half representing expenditures treating the victims of air pollution and the income lost because of ill health and premature death. Coady D. and others, "How Large are Global Energy Subsidies?" International Monetary Fund, Working Paper n°15/105 (2015).
- ^l See, for example, the Zero gap portfolio of Rockefeller Foundation. Available from <https://www.rockefellerfoundation.org/ourwork/initiatives/innovative-finance/>.

Figure 15 Preventing lead poisoning through environmental legislation and policies in the United States



Source: Centers for Disease Control and Prevention (United States)

PARTNERSHIPS

Global multi-stakeholder partnerships have been shown to be an effective mechanism in bringing together Governments, industries and other stakeholders in order to develop and implement voluntary solutions to some of the world’s environment and health challenges. Through the Strategic Approach to International Chemicals Management (SAICM), for example, industries around the world have conducted over 172 projects to build capacity in developing and transition economies and published over 5,000 safety summaries on chemicals through its Global Product Strategy. While emphasis has long been placed on such global partnerships, the consolidation or emergence of national and local private sector entities throughout countries call for public–private partnerships which can best share risks and rewards in finding common, collaborative and effective solutions to national or local problems. Businesses and local communities can build meaningful partnerships to address linkages, for example for prevention of and preparedness to natural and industrial disasters. The engagement of financial institutions can also help integrate environmental risks into investment decision-making and help finance greener choice making.

Endorsed by the Secretary-General and insurance industry chief executive officers worldwide, the UNEP Finance Initiative’s Principles for Sustainable Insurance (PSI), the largest collaborative initiative between the United Nations and the insurance industry, is playing a key role in harnessing the risk management expertise and financial capacity of the global insurance industry for sustainable development. Insurers are responding to a wide range of sustainability issues – including climate change, natural disasters, chemical pollution and health risks – through risk research, risk modelling and analytics, risk prevention and reduction, risk transfer solutions (such as insurance), and sustainable investments.¹¹⁶

Partnering on research and technology to address environment and health linkages and

communications and education to induce social and behavioural change can be transformative, help increase knowledge about environment and health linkages and provide practical solutions. Collaborative transdisciplinary research on environment and health is key to improved environment and public health outcomes,^m as evidenced by ecohealth research practice,¹¹⁷ several recent reports,¹¹⁸ programmesⁿ and the design of more effective responses to disasters. Bringing together environmental and health professionals into decision-making processes also serves to improve communication with citizens, communities and decision-makers.^o Civil society organizations can contribute through expertise, knowledge-sharing and outreach.

The Sanitation and Water for All¹¹⁸ global partnership has regularly brought together ministers of finance from developing countries and ministers of development Cooperation from developed countries. A wide range of collaborative initiatives have been created to support the development and diffusion of environmentally sound energy technologies, such as the Global Solar Alliance with some 120 countries, the Sustainable Energy for All (SE4All) initiative supporting the widespread adoption of energy efficiency through its Global Energy Efficiency Accelerator Platform, the Climate and Clean Air Coalition (CCAC), the Global Partnership on Waste Management and the Global Wastewater Initiative.

The Global Framework for Climate Services, a partnership of Governments, the United Nations and development partners, is working to build local and regional capacity that can harness science-based climate information to improve local decision-making and understanding about the influence of climate and climate extremes on risk management and sustainable development, including environmental management that may underpin food security, water, health, energy and disaster risk reduction.

The Technology Facilitation Mechanism, established in 2015 to support the Sustainable Development Goals, can foster greater support for addressing the nexus between environmental quality and health.



- m This research needs to focus on individuals but also on communities to understand event exposure levels, the pre-existing burden of disease; status of immune system; pregnancy and nutritional status; existing psychological status; gender; social status; age; initial endowments and resources; individual, communal, family and social security systems; and also health systems, support services and ICT.
- n The Wellcome Trust “Our Planet, Our Health” funding opportunities are aimed at supporting transdisciplinary programmes of research that investigate novel aspects of – and build evidence for – how complex changes in our environment affect our health. Available from www.wellcome.ac.uk/Funding/Strategic-funding/Our-planet-our-health/Funding-opportunities/index.htm. Attention is also drawn in this context to the Health and Environment Linkages Initiative (HELI), a WHO and UNEP partnership on environment and health. Available from www.who.int/heli/en/.
- o For example, the Health and Environment Alliance (HEAL) is a not-for-profit organization addressing how the environment affects health in the European Union. Composed of more than 70 health and environmental groups, HEAL brings expertise and evidence to different decision-making processes to strengt-hen European environment policies to improve people’s health.

COMMUNICATION AND EDUCATION

Environmental and health education and communication is key to social and behavioural change and to incentivize more sustainable lifestyles. Communication and education strategies need to be put into place in order to equip people of all ages and at all levels, including in schools, graduate studies, professional associations, tertiary curricula, as well as vocational and industrial training, for example, with the opportunity to acquire the knowledge, skills, values and attitudes which empower them to interpret scientific evidence and to contribute to improving the quality of the environment and of their lives. This needs to be at various levels. Scientific evidence needs to be transformed into common knowledge and accessible tools, and the message has to target actors at different levels of interest, time horizons and abilities to act or change behaviour.

More data platforms on environmental pollutants can be useful for informing and empowering citizens, as well as policy planning. Better informed citizens can better participate^p and contribute to the implementation of environment-health public policies, and adjust their own behaviour to protect themselves from risks and enjoy and contribute to a better quality of life.

Broad public awareness campaigns, such as on air quality in big cities, can help influence behavioural change and contribute to making lifestyle aspirations and public investments to promote a cleaner environment mutually supportive. In other areas, such as food waste, the combination of policies, commitments from supply chain actors and citizens' awareness and education demonstrate encouraging results in some countries.^q

Citizens need to be informed about the potential risks of the release of pollutants into the air that they breathe, the water that they drink and the soil that their houses are built on or that they grow their crops in. Communities

need to be made aware of the related safety measures to be adopted. Companies also have the responsibility to inform their employees of the risks involved in some of the products they may be handling, on necessary safety measures and provide adapted equipment and training so that such measures can be implemented. Sharing information, in language that is accessible, and in ways that reach the most vulnerable is crucial; the most vulnerable groups are known to suffer most from lack of information, evidenced by the number of poisonings because of mismanagement of pesticides in poor rural communities^r or by the vast health impact of unsafe e-waste dismantling and recycling.

Box 5: VOICES OF YOUTH DIGITAL MAPPING

Through the “Voices of Youth Maps” (digital mapping) initiative by UNICEF, young people conduct digital mapping on climate change and environmental challenges locally, and use the map and complementary child and youth-produced media for local advocacy with government, business and community. The global map now has over 800 reports from hundreds of young people who have been contributing since 2014.

Source: UNICEF



^p Principle 10 of the Rio Declaration sets out three fundamental rights: access to information, access to public participation and access to justice, as key pillars of sound environmental governance. These access rights have proved to be very important in promoting transparent, inclusive and accountable environmental governance.

^q In the United Kingdom of Great Britain and Northern Ireland, avoidable household food waste was cut by 21 per cent between 2007 and 2012, saving almost £13 billion over five years (WRAP (2013), *Household food and drink waste in the UK 2012*).

^r Through direct and indirect exposure, an estimated 20,000 unintentional deaths occur every year as a result of pesticide poisoning (WHO, *The World Health Report 2003 – shaping the future, Geneva (2003)*).

MEASURING, MONITORING AND REPORTING USING BOTH HEALTH AND ENVIRONMENTAL INDICATORS.

The new global indicator framework for monitoring the Sustainable Development Goals has been designed to help national and local institutions and citizens alike identify trends and monitor progress towards meeting the vision of the 2030 agenda.¹²⁰ There is, however, a need for enhanced cooperation and systems for monitoring national and global environmental conditions and change, including atmospheric, oceanic and hydrological systems, to be taken into account in particular in improved social and environmental impact assessments. Mechanisms that stimulate what is known as “citizen science” – including through the collection of information on air pollutants, water quality, waste, etc. – and help feed into global platforms are also increasingly helping to improve access to knowledge.¹²¹

Critical to the success of reducing exposure to risk in both human populations and ecosystems are policies that (i) strengthen community-based early warning systems, tailored to local conditions; (ii) support greater engagement of citizens, including young people, in environment and health awareness programmes, through purpose-designed citizen science programmes; (iii) enable the adoption of legislation enshrining the idea of precaution, ethical standards, sustainable development and ecosystem and health-risk assessment of new products and technologies; (iv) improve national statistical capacities to provide disaggregated data by sex and age, in particular on demographic patterns of exposures to environmental pollutants and climate-related hazards, and map high-risk areas for remediation or population protection from exposures; (v) support programmes on early-warning science and systems of environmental-related extreme events, including the capacity-building of young researchers; and (vi) include the regular assessment of policy coherence across the environment and health domains, taking into account climate change.

Box 6: GLOBAL PLATFORM ON AIR QUALITY AND HEALTH

The WHO-led Global Platform on Air Quality and Health, established in January 2014, is a broad collaborative effort that aims to ensure access to and quality of information on human exposure to air pollution in the indoor and outdoor environment. It brings together a wide range of international institutions and experts engaged in air quality monitoring, including data from satellite remote-sensing, ground-level monitoring systems, air quality transport models, emissions inventories, and household surveys. Partners include United Nations agencies (i.e. the World Meteorological Association (WMO), UNEP, WHO, the United Nations Statistics Division, the Economic Commission for Europe, the World Bank and national institutions like the United States Environmental Protection Agency, the National Aeronautics and Space Administration (NASA), the Japan Aerospace Exploration Agency (JAXA), as well as top research institutions on air pollution. The Platform members meet annually to identify challenges on data quality and access, and work in task forces to tackle those challenges. A web interface is being developed for this Platform to ensure wide availability to relevant information on air quality and health and access to relevant international databases.¹²²

Source: WHO





Conclusion and Recommendations

Human health and well-being are cross-cutting themes in the 2030 Agenda for Sustainable Development. There is substantial evidence that environmental degradation has a direct bearing on human health through mortality, morbidity and well-being, including mental health, with disproportionate impacts on women and children. Current global environmental trends risk reversing decades of progress in health and development through the combined effects of climate change, biodiversity loss and the degradation of the earth's natural systems that support human health. In order to meet this challenge, actions to address critical environment and health linkages are key. Moving from a reactive to a proactive policy approach will mitigate risks that could otherwise develop into full-scale environment and health emergencies, limiting and even preventing crises that could cripple a country's economic, political and physical infrastructure.

The degradation of our environment has been estimated to be responsible for at least 23 per cent of all deaths globally, but these estimates do not take into account the effects of emerging global environmental changes. This report highlights critical areas of improvement including reducing indoor and outdoor air pollution, improving water safety further, reducing exposure to hazardous chemicals, addressing lifestyle-related health threats and improving ecosystem resilience to floods and droughts. It also offers proven successes of policies, implementation and tools. These are essential not only for improving health, but for human well-being, mental health and ultimately the grounds for the happiness of children and families across the world.

Protecting the environment and investing in the protection, conservation and restoration of biodiversity and ecosystems can provide a platform and tools to improve human health and well-being, including that of women and girls who, facing persistent inequalities, are disproportionately affected by damages to the environment and the ecosystem, and is key to successfully meeting the Sustainable Development Goals and targets.

In conclusion, addressing the nexus between the environment and human health by delivering on environmental sustainability can provide a common platform for meeting many of the Sustainable Development Goals. Through multiplier effects that can accelerate and sustain progress across multiple Goals, investing in environmental sustainability can serve as an insurance policy for health and human well-being. It is important on efficiency grounds, but also for distributive justice, and to address the ethical and legal obligations of States.



RECOMMENDATIONS

The report's findings provide a strong basis for an inclusive economy for the future that is linked to ecosystem resilience, healthy environment, good health and well-being. Its main recommendations are:

1. Deliver more effectively and equitably on the 2030 Agenda for Sustainable Development by using the environment-health nexus as a cross-cutting solution through international, regional, national and local cooperation.
2. Invest in environmental sustainability and genetic diversity which can serve as an insurance policy for current and future health and human well-being.
3. Address the environment health nexus on efficiency grounds, but also for distributive justice and to address the ethical and legal obligations of States.
4. Move from a reactive to a proactive policy approach, as many environment and health emergencies can be avoided or mitigated, preempting crises that otherwise might cripple a country's economic, political and physical infrastructure.
5. Involve the public and private sector, researchers, relevant stakeholders and citizens to participate in partnerships which can foster innovation, clean technologies, innovative financing and disseminate good practices.
6. Take action at all levels of governance to: detoxify the environment; decarbonize the economy; decouple economic activity from current levels of resource use and ecosystem degradation and change unhealthy lifestyles; and enhance ecosystem resilience;
7. Strengthen the evidence base through better measurement and monitoring frameworks, supporting platforms on environment-health research, systematically collecting, analysing and using data disaggregated by sex, age and other relevant variables;
8. Raise awareness on major environmental and health risks and exposure, putting into place adequate communication and education strategies and policies;
9. Strengthen multi-level environmental governance, develop and implement integrated policies, international and national legislation and actions with an emphasis on city-level interventions incorporating specific measures targeting the most vulnerable, including women and children, and through them future generations;
10. Finally, call upon Governments at all levels and development and financial partners to scale up investments in platforms, initiatives and programmes that address the environment and health nexus to spearhead the achievement of the Sustainable Development Goals.

Figure 16 Some proposed interventions to address key leverage points for policy attention and action

PRIORITY ENVIRONMENTAL AND HEALTH RISKS / STRATEGIES	STRENGTHENED GOVERNANCE	INTEGRATED POLICIES
AIR QUALITY → DETOXIFY → DECARBONIZE → DECOUPLE and ENHANCE HEALTHY LIFESTYLES		1. Develop and implement national integrated low-carbon and low emission development strategies based on the consensus around the Sustainable Development Goals and outcomes of the Paris Climate Agreement 2. Reduce the use of fossil fuels in power plants
SOUND MANAGEMENT OF CHEMICALS → DETOXIFY → DECOUPLE and ENHANCE HEALTHY LIFESTYLES	7. Accelerate the ratification process of the Minamata Convention on Mercury and develop and enhance comprehensive chemicals management legislations, policies and strategies on reducing or eliminating the use and production of persistent organic pollutants (POPs), regulating the use of chemicals of highest concern and controlling, when relevant, their international trade 8. Eliminate lead in paint	9. Develop and implement integrated pest management and integrated vector management
ACCESS TO WATER AND SANITATION → DETOXIFY	15. Adopt UNEP International Water Quality Guidelines for Ecosystems for use by countries in developing national standards, policies and frameworks for water quality in the environment	16. Invest in providing access to clean water and sanitation in schools and hospitals and city slums
SOUND MANAGEMENT OF WASTES → DETOXIFY → DECOUPLE and ENHANCE HEALTHY LIFESTYLES	18. Develop comprehensive legislation and policies to address prevention, minimization and environmentally sound management of wastes, avoid open-burning and dumping, and control international trade of wastes, such as electric and electronic wastes and mercury wastes	19. Develop action plans to reduce plastic litter in the environment
RESPONSES TO NATURAL DISASTERS → ECOSYSTEM RESILIENCE		22. Develop and implement national and local ecosystem-based disaster risk reduction strategies integrating sustainable natural resource management and landscape planning in rural, coastal and urban settings

COMMUNICATE AND EDUCATE	PARTNER	MEASURE AND MONITOR
<p>3. Promote citizen access to information on air quality (and other) standards and actual levels to contribute to the establishment and enforcement of ambient air quality standards, based on WHO guidelines</p>	<p>4. Expand access to clean and affordable domestic cooking, heating and lighting technologies and fuels</p> <p>5. Provide financial resources, invest and improve city designs to promote public and active transportation, green space, sound waste management, infrastructure and sustainable building</p>	<p>6. Establish and enforce advanced vehicle emissions and fuel standards</p>
<p>10. Label and share information on chemicals in products in a manner that is adapted and understandable by users and increase information sharing on chemicals related exposure and risks.</p>	<p>11. Promote ozone friendly refrigeration and air conditioning</p> <p>12. Accelerate efforts to eliminate polychlorinated biphenyls (PCBs) to meet Stockholm convention obligations and deadlines</p> <p>13. Implement safety measures for workers who are in contact with hazardous chemicals</p>	<p>14. Identify pollution/chemicals related hotspots (e.g. chemical stockpiles, polluted sites) to decontaminate them and minimize exposure</p>
	<p>17. Recycle nitrogen and phosphorous from wastewater systems in cities, agriculture and industries</p>	
<p>20. Promote waste prevention and minimization, including food waste, for example through extended producer responsibility; where waste is produced, promote reuse and recycling into material and energy sources (e.g. stimulate industrial symbiosis, support recovery and recycling schemes)</p>	<p>21. Promote social inclusion of all stakeholders in waste management practices, including in the informal sector, giving them opportunities to formalize their operations and employ practices that minimize risks to human health and the environment</p>	
<p>23. Promote the use of traditional knowledge, in particular the use of medicinal plants</p>	<p>24. Restore degraded ecosystems</p>	<p>25. Strengthen the linkages between local and sub-national early warning, preparedness and response mechanisms</p>

ANNEX

ONGOING AND PROPOSED FURTHER UNEP ACTIVITIES TO ADDRESS ENVIRONMENT AND HEALTH LINKAGES

Note: proposed further activities are shown **in bold**.

CLIMATE CHANGE	<ul style="list-style-type: none"> • Reduction of SLCP emissions • Promotion of clean collective transportation and overall reduced emissions in the transport sector • Implementation of ecosystem based adaptation in coastal zones in cities, in small island developing States and in agriculture dominated landscape for food security • Provision of clean energy access • REDD-plus • Electric collective and active mobility • Provision of health related impacts of UNEP climate mitigation and adaptation activities
DISASTERS AND CONFLICTS	<ul style="list-style-type: none"> • Implementation of eco-disaster reduction projects • Assessment of conflict or crisis affected areas because of environmental degradation • Integration of better environmental management in humanitarian action • Capacity-building and technical assistance on institutional and legal frameworks to improve national preparedness to conflicts and disasters
HEALTHY AND PRODUCTIVE ECOSYSTEMS	<ul style="list-style-type: none"> • Valuation of environmental degradation • Improved water management • Implementation of ecosystem management projects to sustain ecosystem services in terrestrial, coastal and marine systems • Assessing and addressing marine litter • Promoting integrated landscape management • Inclusion of health in the ecosystem valuation and accounting • Assessing and addressing pollution from wastewater and nutrient loading • Promoting biodiversity conservation including consideration of medicinal and edible plant materials • Promoting biodiversity, nutrition and health synergies to enhance ecosystem resilience and improve sustainable land and forest management, food production and health • Reducing impact of invasive alien plant species on human health and food security
ENVIRONMENTAL GOVERNANCE	<ul style="list-style-type: none"> • Capacity-building and technical support to the development of regulations and institutional measures that integrate environment and health, in relation to air quality and pollution • Good practices on human rights and the environment
CHEMICALS AND WASTES	<ul style="list-style-type: none"> • Strengthen institutional capacities and policy instruments, including regulatory frameworks • Consolidate scientific evidence (POPS global monitoring, mercury, cadmium and lead) • Improve the mainstreaming of chemicals and waste management in health and other sectors and in poverty reduction strategies and development plans • Develop and strengthen multi-stakeholder partnerships • Raise awareness of emerging chemical issues posing a risk to human and environmental health • Undertake community sensitization and education activities • Provide the secretariat to the Minamata Convention on Mercury and support governments towards its ratification • Assist governments in addressing open waste burning and dumping • Promote green and sustainable chemistry • Assess the linkages between chemicals, waste and air quality and their combined impacts on the environment and health • Raise the profile of endocrine disrupting chemicals, highly hazardous pesticides, environmentally-persistent pharmaceutical pollutants • Provide guidance and capacity-development to countries to research the health impact of pollution and identify hot spots • Support ministries of environment and health to develop joint strategies to include pollution and chemical issues in national and sectoral policymaking • Have a global survey on the state of chemical risk management by the insurance industry • Build the capacity of mid-level officials from the environment and health sectors

RESOURCE EFFICIENCY AND SUSTAINABLE CONSUMPTION AND PRODUCTION	<ul style="list-style-type: none"> • Provide understanding on resource flows and trends linked to demographics, urbanization, and lifestyle changes • Promote life-cycle management • Advance resource efficiency in business practices. • Improve resource efficiency of buildings and cities, food systems and tourism • Food waste prevention and reduction • Promote sustainable public procurement, consumer information • Raise awareness on sustainable lifestyle changes • Inclusion of health in the green economy modelling • Inclusion of health and well-being as a cross-cutting monitored issue of the 10YFP • Research on the links between primary prevention of environmental hazards, health risks and insurance • Global risk map of environmental and health risks and insurance coverage
ENVIRONMENT UNDER REVIEW	<ul style="list-style-type: none"> • Access to data on air pollution exposure, climate change and health • Thematic assessments on emerging environment-health related issues • Provide affordable air quality monitoring tools to countries • Provide thematic environment-health assessments and further develop capacity and monitoring tools

ANNEX

ONGOING ACTIVITIES FROM THE BASEL, ROTTERDAM AND STOCKHOLM CONVENTIONS

BASEL CONVENTION	<ul style="list-style-type: none"> • Facilitate entry into force of the Ban Amendment towards a ban of transboundary movements of hazardous and other wastes from developed to developing countries • Prevent and minimize generation of hazardous and other wastes through the implementation of the Cartagena Declaration on the prevention, minimization and recovery of hazardous wastes and other wastes • Develop, update and revise technical guidelines on the environmentally-sound management of priority waste streams (e. g. e-waste, POP wastes, mercury waste) • Facilitate, promote and monitor the implementation of and compliance with the obligations under the Basel Convention through the work of the Compliance Committee • Service public-private partnerships with business and industry, including the Partnership for Action on Computing Equipment and the newly established Partnership on Household Wastes
ROTTERDAM CONVENTION	<ul style="list-style-type: none"> • Support countries to take informed and responsible decisions on the import and use of chemicals that represent a danger to the environment and to human health • Promote increased information exchange on the characteristics of chemicals subject to national ban or severe restriction and severely hazardous pesticide formulations, requiring use of up-to-date safety data sheets and proper labelling
STOCKHOLM CONVENTION	<ul style="list-style-type: none"> • Assist countries in undertaking monitoring activities as part of the global monitoring plan on POPs

ENDNOTES

- 1 European Environment Agency, Are we ready for climate change? (2015).
- 2 European Environment Agency, Late Lessons from Early Warnings: Science, Precaution, Innovation (2013).
- 3 World Health Organization (2014a), Burden of Disease from the Joint Effects of Household and Ambient Air Pollution for 2012.
- 4 World Health Organization (2014c), Indoor Air Quality Guidelines: Household Fuel Combustion, Geneva. Available from http://www.who.int/indoorair/guidelines/hhfc/IAQ_HHFC_guidelines.pdf?ua=1&ua=1.
- 5 The World Health Organization (2014b), Burden of disease from Household Air Pollution for 2012.
- 6 <http://www.who.int/mediacentre/factsheets/fs292/en/>.
- 7 Miller, S., "The effects of air pollution on educational outcomes: evidence from Chile", Inter-American Development Bank Working Paper Series 468 (2013). Available from <https://publications.iadb.org/bitstream/handle/11319/4756/The%20Effects%20of%20Air%20Pollution%20on%20Educational%20Outcomes%3a%20Evidence%20from%20Chile.pdf;jsessionid=309B6F343B9A4023D24DE31674EF29D3?sequence=1>.
- 8 Food and Agriculture Organization of the United Nations, Criteria and indicators for sustainable woodfuels (2010). Available from <http://www.fao.org/docrep/012/i1673e/i1673e00.htm> and Hosonuma N. and others, An assessment of deforestation and forest degradation drivers in developing countries (2012), Environmental Research Letters, 7(4), 044009.
- 9 Lelieveld, J. Evans, JS., Fnais, M., Giannadaki, D. and Pozzer, A., The contribution of outdoor air pollution sources to premature mortality on a global scale (2015), Nature 525, 367–371.
- 10 Johnston F. H., and others, Estimated global mortality attributable to smoke from landscape fires (2012), Environmental Health Perspectives, 120(2), 695–701.
- 11 United Nations Economic Commission for Europe Hemispheric Transport of Air (2010), Task Force on Hemispheric Transport of Air Pollution acting within the framework of the Convention on Long-range Transboundary Air Pollution, Air Pollution Studies n° 17. Available from http://www.htap.org/publications/2010_report/2010_Final_Report/EBMeeting2010.pdf.
- 12 World Health Organization (2014a) *ibid*.
- 13 World Health Organization/United Nations Children's Fund Progress on Sanitation and Drinking Water – 2015 update and MDG assessment (2015).
- 14 World Health Organization/ United Nations' Children's Fund Water, sanitation and hygiene in health care facilities (2015).
- 15 Prüss-Üstün Annette and others, Safer water, better health: costs, benefits and sustainability of interventions to protect and promote health (2008), (WHO, Geneva).
- 16 Prüss-Üstün Annette and others, (2008) *ibid*.
- 17 World Health Organization, "WHA Global Nutrition Targets 2025: Stunting Policy Brief", (2014). Available from http://www.who.int/nutrition/topics/globaltargets_stunting_policy_brief.pdf.
- 18 World Health Organization, Preventing diarrhoea through better water, sanitation and hygiene: exposures and impacts in low- and middle-income countries (2014).
- 19 World Health Organization/United Nations Children's Fund, Joint Monitoring Programme for Water Supply and Sanitation – 2015 Fact sheet (2015).
- 20 WHO (2015), *ibid*.
- 21 United Nations Environment Programme Sick Water - The Central Role of Wastewater Management in Sustainable Development (2010). Available from (<http://www.grida.no/publications/rr/sickwater/>).
- 22 UN-Water, A Post-2015 Global Goal for Water: Synthesis of key findings and recommendations from UN-Water (2014).
- 23 European Environment Agency, Late lessons from Early Warnings: Science, Precaution, Innovation (2013).
- 24 European Environment Agency (2013), *ibid*.
- 25 World Health Organization.
- 26 Lim, S. S., and others, A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the (Global Burden of Disease Study 2010 (2012) Lancet 380(9859): 2224–2260.
- 27 World Health Organization Global Status Report on Non Communicable Diseases 2014 (2014).
- 28 WHO (2016), *ibid*.
- 29 Global Burden of Disease Study 2013 Collaborators (2015), "Global, regional, and national incidence, prevalence, and years lived with disability for 301 Acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013", The Lancet, Vol. 386, No. 9995, p743–800. Available from <http://www.thelancet.com/globalburden-of-disease>.
- 30 Jeyaratnam, J., "Acute pesticide poisoning: a major global health problem" World health statistics quarterly. Volume:43 Issue: 3 Pages: 139–44 (1990). More recent data for some countries can be found at the World Health Organization, Acute pesticide poisoning: a proposed classification tool (2008), Bulletin of the World Health Organization, vol 86:3.
- 31 Mellon and Fondriest, "Hogging it: estimates of animal abuse in livestock" (2001), Nucleus, 23:1-3, Cited in (2015) TEEB for agriculture and food: Towards a global study on the economics of eco-agri-food systems, (United Nations Environment Programme, Geneva).
- 32 World Health Organization, Antimicrobial resistance: global report on surveillance (2014) Geneva, cited in TEEB (2015), TEEB for agriculture and food: Towards a global study on the economics of eco-agri-food systems, (United Nations Environment Programme, Geneva).
- 33 European Environment Agency(2013), *ibid*.
- 34 GESAMP (2015), Sources, fate and effects of microplastics in the marine environment: a global assessment (Kershaw, P.J., ed.) (IMO/FAO/UNESCOIOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 90, 96p.
- 35 Hoornweg Daniel, Bhada-Tata Perinaz, What a Waste – A Global Review of Solid Waste Management, (2012) The World Bank, Urban Development Series Knowledge Paper, March 2012, No. 15.
- 36 United Nations Human Settlements Programme, Solid Waste Management in the World's Cities (2009).
- 37 United Nations Environment Programme, Global Waste Management Outlook (2015).
- 38 Baldé CP and others, The global e-waste monitor-2014 (2015), United Nations University, IAS-SCYCLE, Bonn, Germany.
- 39 Planet RE: think 2012. Available from <http://planetrethink.com/>.
- 40 United Nations, Water and Disaster Risk. A Contribution by the United Nations to the consultation leading to the Third UN World Conference on Disaster Risk Reduction (2014). Available from http://www.preventionweb.net/files/38763_water.pdf.
- 41 United Nations Office for Disaster Risk Reduction, Making Development Sustainable: The Future of Disaster Risk Management. Global Assessment Report on Disaster Risk Reduction (2015), Geneva.
- 42 United Nations Office for Disaster Risk Reduction and Centre for Research on the Epidemiology of Disasters, The human cost of weather-related disasters 1995–2015 (2015).
- 43 World Health Organization, "Gender, Climate Change, and Health" (Geneva, 2011); Gender equality and the empowerment of women in natural disasters, Report of the Secretary-General (E/CN.6/2014/13).
- 44 World Health Organization, World Report on Ageing and Health (2015), Geneva.

- 45 United Nations Office for Disaster Risk Reduction, Global Assessment Report on Disaster Risk Reduction (2011).
- 46 United Nations Environment Programme, High mountain glaciers and climate change - Challenges to human livelihoods and adaptation (2010); United Nations Environment Programme, The PSI Global Resilience Project: Collaborating for resilience : Partnerships that build disaster-resilient communities and economies. Part three of a research series by the UNEP FI Principles for Sustainable Insurance Initiative (2015).
- 47 UNISDR (2015). Ibid.
- 48 Chan, M. Address to the 2007 David E. Barnes Global Health Lecture, (Bethesda, 2007). Available from http://www.who.int/dg/speeches/2007/20071211_maryland/en/.
- 49 Watts and others, Health and climate change: policy responses to protect public health, (2015). *The Lancet*, 386:1006, 1861-1914.
- 50 World Health Organization El Niño and Health (2016).
- 51 World Health Organization/Convention on Biological Diversity, Connecting Global Priorities: Biodiversity and Human Health. A State of Knowledge Review (2016).
- 52 Hauer E. Mathew and others, "Millions projected to be at risk from sea-level rise in the continental United States" *Nature Climate Change* (2016).
- 53 United Nations Development Programme, Human Development Report 2011: Sustainability and Equity: A Better Future for All, (New York, 2011).
- 54 United Nations Convention to Combat Desertification, Land Matters for Climate. Reducing the Gap and Approaching the Target (2015).
- 55 Hales S, Kovats S, Lloyd S., Campbell-Lendrum D., Quantitative risk assessment of the effects of climate change on selected causes of death, (WHO, 2014).
- 56 Yan, Y.E. and others, "Lathyrus sativus (grass pea) and its neurotoxin ODAP" *Phytochemistry*, 67, 107–121, (2006).
- 57 Steffen and others, Planetary Boundaries: Guiding human development on a changing planet. *Science* Vol. 347 no. 6223, (2015); Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC; G.M. Mace and others. (2014) Approaches to defining a planetary boundary for biodiversity. *Global Environmental Change* 28, 289–297.
- 58 Schippmann and others, "A comparison of cultivation and wild collection of medicinal and aromatic plants under sustainability aspects" in Bogers R.J. and al. (eds) (2006) *Medicinal and Aromatic Plants: Agricultural, Commercial, Ecological, Legal, Pharmacological and Social Aspects*, Wageningen UR, vol. 17.
- 59 World Health Organization/Convention on Biological Diversity (2015) *ibid*.
- 60 Hawkins 2008; Ford and others, 2010, quoted from WHO/Convention on Biological Diversity (2015) *ibid*.
- 61 Havelaar and others, WHO Global Estimates and Regional Comparisons of the Burden of Foodborne Disease (2015).
- 62 United Nations Environment Programme, High mountain glaciers and climate change - Challenges to human livelihoods and adaptation (2010).
- 63 United Nations Environment Programme, Blue Carbon (2009).
- 64 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production (2016).
- 65 World Health Organization, Fact sheet Zika Virus (2016). Available from <http://www.who.int/mediacentre/factsheets/zika/en/>.
- 66 Ventura, C.V. and others, Ophthalmological findings in infants with microcephaly and presumable intra-uterus Zika virus infection, (2016) *Arquivos Brasileiros de oftalmologia* 79 (1): 1–3.
- 67 WHO/Convention on Biological Diversity (2015), *ibid*.
- 68 WHO/Convention on Biological Diversity (2015), *ibid*.
- 69 United Nations Department of Economic and Social Affairs, World Urbanization Prospects: the 2014 Revision, Highlights (2014).
- 70 World Health Organization, Risks to Mental Health: an overview of vulnerabilities and risk factors (2012) Background paper by WHO secretariat for the development of a comprehensive mental health action plan. Available from http://www.who.int/mental_health/mhgap/risks_to_mental_health_EN_27_08_12.pdf.
- 71 World Health Organization, Global Status Report on Non Communicable Diseases (2014).
- 72 World Health Organization, *ibid*.
- 73 World Health Organization Preventing disease through healthy environments (2016).
- 74 WHO/Convention on Biological Diversity (2015) *ibid*.
- 75 World Health Organization/JRC, Burden of disease from environmental noise. Quantification of healthy life years lost in Europe (2011).
- 76 Lytymäki J., "Towards eco-efficient and enjoyable lighting", UNDESA (2015).
- 77 World Health Organization, WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007–2015 (Geneva, 2015). Available from http://www.who.int/foodsafety/publications/foodborne_disease/fergreport/en/.
- 78 United Nations Children's Fund, Sustainable development starts with safe, health and well-educated children (2013).
- 79 United Nations Development Programme/GEF, Chemicals and waste management for sustainable development (2015).
- 80 Alan M (2015). Available from <https://giwps.georgetown.edu/sites/giwps/files/Women%20and%20Climate%20Change.pdf>.
- 81 United Nations Children's Fund, Unless we act now. The Impacts of climate change on children (2015).
- 82 Office of the United Nations High Commissioner for Refugees, www.unhcr.org (2015)
- 83 Internal Displacement Monitoring Centre, Understanding the root causes of displacement: towards a comprehensive approach to prevention and solutions (Briefing Paper, 2015).
- 84 The target on responsible migration policies is reflected in Goal 10, target 7.
- 85 Nenonen and others, Global Estimates of Occupational Accidents and Fatal Work-Related Diseases in 2014 (2015).
- 86 World Health Organization, Economic cost of the health impact of air pollution in Europe: Clean air, health and wealth (2015).
- 87 Attina T., Trasande L., "Economic costs of childhood lead exposure in low- and middle-income countries", *Environmental Health Perspectives*, Vol. 121, issue 9 (2013).
- 88 Aon Benfield, Insurance risk study: Sixth edition (2011).
- 89 Trasande L. and others, "Estimating burden and disease costs of exposure to endocrine-disrupting chemicals in the European Union", *Journal of Clinical Endocrinology and Metabolism*, 100(4), 1245–1255 (2015).
- 90 United Nations Environment Programme, Global Chemicals Outlook (2012).
- 91 United Nations Environment Programme, The Montreal Protocol and Human Health. How global action protects us from the ravages of ultraviolet radiation (2015).
- 92 World Health Organization, WHO Operational Framework for building climate-resilient health systems (Geneva, 2015).
- 93 Watts N, and others, (2015) *ibid*.
- 94 Shindell D, and others, "Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security" *Science*. 335 (183–189) 2012.
- 95 Organization for Economic Cooperation and Development, OECD Environmental Outlook to 2050, p. 298, (2012).

- 96 World Health Organization, Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level (2004).
- 97 Tilman D, Clark M, "Global diets link environmental sustainability and human health" *Nature* 515:518 (2014).
- 98 World Health Organization, "Protecting workers' health" fact sheet 389 (2014).
- 99 United Nations Environment Programme, The PSI Global Resilience Project: Building disaster-resilient communities and economies (2014), first part of a research series by the UNEP FI Principles for Sustainable Insurance Initiative, and UNEP (2015), The PSI Global Resilience Project: Collaborating for resilience: Partnerships that build disaster-resilient communities and economies, Third part of the research series.
- 100 These guidelines have been accepted as the definition of clean fuel and technologies for Sustainable Development Goal 7.1.2 indicator. (WHO Indoor Air Quality Guidelines: Household Fuel Combustion (Geneva, 2014)).
- 102 United Nations Environment Programme Green Energy Choices: the benefits, risks, and trade-offs of low-carbon technologies for electricity production (2015). Report of the International Resource Panel.
- 103 United Nations Environment Programme Decoupling Natural Resource Use and Environmental Impacts from Economic Growth (2011). A Report of the Working group on decoupling to the International Resource Panel. Available from http://www.unep.org/resourcepanel/decoupling/files/pdf/decoupling_report_english.pdf, and Ivanova, D., and others, "Environmental Impact Assessment of Household Consumption", *Journal of Industrial Ecology*. 18 DEC 2015, DOI: 10.1111/jiec.12371 (2015).
- 104 Tilman D., Clark M, "Global Diets link Environmental Sustainability and Human Health", *Nature*, 515, 518–522 (2014).
- 105 As part of the Sustainable Development Goal Interface Ontology (UNEP Live SDG Portal) the definition of clean environment is available from <http://purl.bioontology.org/ontology/RCD/Ua0ms>.
- 106 World Health Organization Health and the Environment: Addressing the health impact of air pollution (2015), WHA resolution available from http://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_ACONF2Rev1-en.pdf.
- 107 http://www.unep.org/unea/UNEA_Resolutions.asp.
- 108 WHO/Convention on Biological Diversity (2015) *ibid*.
- 109 Giang A. and Selin N.E, Benefits of mercury controls for the United States (2016), *PNAS*, 113:2, pp. 286–291. Available from <http://www.pnas.org/content/early/2015/12/22/1514395113.full.pdf>.
- 110 See Long-term strategy for the Convention on Long-range Transboundary Air Pollution and Action Plan for its implementation, ECE/EB.AIR/106/Add.1.
- 111 See <http://www.africasan.com/>.
- 112 Available from <http://www.unep.org/transport/new/pcfiv/> Lead additives are used in only three remaining countries.
- 113 See <http://www.unep.org/chemicalsandwaste/hazardous-substances/LeadCadmium/PrioritiesforAction/LeadPaints/tabid/6176/Default.aspx>.
- 114 See Greenstone, M and others, "Lower pollution, longer lives" *Economic and Political weekly*, vol. 50, No. 8, p. 45 (2015).
- 115 United Nations (2015), Global Sustainable Development Report.
- 116 More information on the UNEP Finance Initiative's Principles for Sustainable Insurance is available from www.unepfi.org/psi.
- 117 Charron D. (ed) (2012), *Ecohealth Research in practice*. IDRC. Available from <http://idl-bnc.idrc.ca/dspace/bitstream/10625/47809/1/IDL-47809.pdf>.
- 118 Whitmee S. and others, Safeguarding human health in the Anthropocene epoch: report of the Rockefeller Foundation – Lancet Commission on planetary health, *The Lancet*, vol. 386, issue 1007, 1973–2028 (2015) and WHO/Convention on Biological Diversity (2015) *ibid*.
- 119 See <http://sanitationandwaterforall.org/>.
- 120 United Nations Statistical Commission (2016), forty-seventh meeting. Available from <http://unstats.un.org/unsd/statcom/47th-session/documents/>.
- 121 www.uneplive.org.
- 122 Available at http://www.who.int/phe/health_topics/outdoorair/en/.

PHOTO CREDITS

- page 07 left: dreamstime, © Jorg Hackemann, HongKong
right: dreamstime, © Subbotina
- page 10 shutterstock, © Vilainecrevette,
Caribbean sea, Panama, Central America
- page 14 shutterstock, © Purino
- page 21 dreamstime, © Gnanamclicks,
Indien, Chennai
- page 23 above: shutterstock, Asbestos chrysotile fibers that can
cause lung disease, © farbled
below: shutterstock, © ittipon
- page 24 dreamstime, © Dimaberkut, Bali
- page 25 dreamstime, © Lunamarina
Cancun
- page 26 dreamstime, © Sjors737,
Bangladesh, Charburhan, Golf von Bengal
- page 29 left: dreamstime, © Dabldy, Rio de Janeiro
right: shutterstock, © ixpert,
Japan and Korea, elements furnished by NASA
- page 36 shutterstock, © Kostenko Maxim
- page 38 left: dreamstime, © Garudeya,
Karanganyar, Java, Indonesien
right: shutterstock, © Fotoyukha
- page 40 shutterstock, © Gencho Petkov
- page 41 shutterstock, © YanLev
- page 44 dreamstime, © Goodluz
- page 45 above: dreamstime, © Francoisroux,
New York, Chelsea, Manhattan
below: shutterstock, © TZIDO SUN,
Vietnam, mam xoi of mu cang chai district,
Yenbai province, northwest of Vietnam
- page 46 shutterstock, © The Len

Design Caren Weeks
Munich

www.unep.org

United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel: ++254-(0)20-762 1234
Fax: ++254-(0)20-762 3927
E-mail: unep@unep.org



HEALTHY ENVIRONMENT, HEALTHY PEOPLE

This report was prepared by the United Nations Environment Programme (UNEP), in collaboration with the World Health Organization (WHO), the Convention on Biological Diversity, the Montreal Protocol on Substances that Deplete the Ozone Layer, and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants. It received contributions from other United Nations agencies and from stakeholders through an e-consultation at www.myunea.org/