

BIGGER CHANGE

FASTER

**INTEGRATED DEVELOPMENT, HEALTH, AND
ENVIRONMENT ACTIONS FOR A SUSTAINABLE FUTURE**

**BRIDGE
COLLABORATIVE**



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The United Nations Development Programme (UNDP) works on the ground in about 170 countries and territories, helping to eradicate poverty and reduce inequalities while protecting the planet. We help countries develop strong policies, skills, partnerships and institutions so they can sustain their progress.

BRIDGECOLLABORATIVE

The Bridge Collaborative is a partnership of:



TABLE OF CONTENTS

Foreword	01
1. Executive Summary	03
2. Identifying Integrated Challenges for Development, Health, and Environment	09
3. Accelerating a Low-Carbon, Clean Air, and Environmentally-friendly Energy Future for All	13
4. Transforming the Global Food System for Health and Sustainability	24
5. Targeting Sanitation and Wastewater Improvements to Maximise Benefits for People and Nature	38
6. Conclusion	47
References	50
APPENDIX: Methods	56

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FOREWORD

Today's biggest development challenges are complex and interwoven. They demand holistic and integrated solutions that address multiple angles, engage diverse partners, and reach the people and places most in need. This premise is at the heart of the 2030 Agenda for Sustainable Development, its 17 Sustainable Development Goals, and the pledge to leave no one behind. It is also the impetus of *Bigger Change Faster: Integrated Development, Health, and Environment Actions for a Sustainable Future*, this joint report by the Bridge Collaborative and UNDP.

For too long, multidimensional development challenges have been considered separately, with sectoral interventions designed and implemented in isolation. This limitation has often led to inefficient use of scarce resources, and in many cases advanced results in some sectors at the expense of results in other sectors. Many siloed responses have had tangible, detrimental impacts on the planet, as well as on people's lives, opportunities, and aspirations.

The status quo will not suffice if we are to achieve the SDGs and the pledge to leave no one behind. To that end, we are proud to have collaborated on *Bigger Change Faster*. Our report examines three sustainable development challenges for which we must disrupt siloes and inclusively solve problems with integrated solutions. These are:

- **Accelerating a low-carbon, clean air, and environmentally-friendly energy future for all.** Global reliance on fossil fuels is driving climate change, and fossil and solid fuels are harming human health through air pollution. Low-carbon, renewable energy can reduce these harms, help people exit poverty, and support rising living standards. Growing impacts from energy infrastructure development on biodiversity must be proactively mitigated.
- **Transforming the global food system for health and sustainability.** Food is an essential human need. But current production and consumption patterns are straining natural resources and ecosystems, contributing to climate change, driving biodiversity loss, and falling short on the human health and nutritional needs they are meant to meet.
- **Targeting sanitation and wastewater improvements to maximise benefits for people and nature.** Poor sanitation and wastewater treatment are creating a massive burden of pollution (from human waste contaminating water supplies), undermining human health through diarrheal disease and threatening nutritional security as well as freshwater and marine biodiversity.



Multidimensional inequalities intersect these challenges—those most affected are the same populations that the pledge to leave no one behind was designed to empower. For example, over 95 percent of the nearly one billion people without access to electricity, the majority of the world’s 821 million people suffering from hunger, and most people without access to safely managed sanitation services live in Africa and Asia. Women are most impacted by lack of access to clean energy while also facing burdens from nutritional deficiencies and suffering disproportionately from inadequate sanitation. Young children bear a heavy portion of the health harms from household air pollution, undernutrition from inadequate food systems, and diarrheal diseases caused by poor sanitation.

The complexity of our many sustainable development challenges is not insurmountable and must not deter us. Given that efforts in one domain reverberate in others, we can accelerate progress on multiple goals at the same time, so long as we follow the evidence and work better together. More aligned integrated solutions will be critical to deliver the pace and scale of change needed, recognising it is not just bigger change that is needed but bigger change *faster*.

We know the recipe for success: political leadership, knowledge, partnerships, targeted investments, and integrated action at all levels. Effective cross-sector partnerships, such as that between the Bridge Collaborative and UNDP, are key. The Bridge Collaborative supports efforts to develop shared evidence, networks, and tools to deliver more effective cross-sectoral solutions. As the integrator of the UN development system, UNDP brings together partners across sectors to implement solutions to complex development challenges.

Together, the Bridge Collaborative and UNDP commit to further advancing holistic approaches to interwoven sustainable development challenges. We make this joint commitment because pursuing synergies across our shared development goals will accelerate the realisation of a better, more sustainable, and just future for people and the planet. We look forward to encouraging, empowering, and otherwise working with all key actors to do the same.

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I. EXECUTIVE SUMMARY

The United Nations 2030 Agenda for Sustainable Development (2030 Agenda) sets forth an ambitious vision for all countries to advance the well-being of people and the planet (UNGA 2015). Oriented around 17 Sustainable Development Goals (SDGs) and a pledge to leave no one behind, the 2030 Agenda provides the most formal recognition to date of the interwoven challenges across development, health, and the environment that must be overcome to realise a better world for all.

In parallel, efforts have increased to establish an evidence base on the inextricable links between human health and the natural systems which underpin it (Whitmee et al. 2015, WHO and CBD 2015). Today, environmental risks are responsible for nearly one quarter of all premature and preventable deaths globally (Prüss-Ustün et al. 2016). Climate change in particular is recognised as one of the greatest threats to human health, poverty alleviation, and broader human development in the 21st century (Rigaud et al. 2018, Watts et al. 2018). Furthermore, degraded environments and poor health are root causes of many other development challenges, from food insecurity to poverty and inequality, that limit society's ability to deliver effective solutions for people and the planet.

Delivering on the transformative vision of the 2030 Agenda and related global commitments, including the Paris Agreement, will require an unprecedented level of political leadership, knowledge, collaboration, investment, and action across local, national, and global scales. The SDGs compel actors tackling development, health, or environmental issues to work together more effectively for greater impact. SDG 17 specifically focuses on strengthening the means of implementation and revitalising the global partnership for sustainable development.

With a decade to go until 2030, the time to act is now. Decisions taken in the next few years will have a major impact on society's ability to achieve the pace and scale of change needed. Yet solutions are still largely designed and implemented in isolation, without a broader view of connections across sectors¹. Approaching and tackling interventions in siloes too often leads to inefficient use of scarce resources. Of equal importance is that siloed interventions can lead to positive outcomes for one sector at the expense of other sectors' goals. Limitations like these undermine the progress needed to achieve the SDGs and the pledge to leave no one behind.



To support the global community in achieving the SDGs by 2030, this report examines two overarching questions to unlock bigger change faster for a sustainable, better future for all:

- **Which leading global challenges facing the development, health, and environment sectors need to be prioritised and solved together to maximise and accelerate impact for the SDGs?**
- **For these integrated challenges, what are examples of cross-sector actions warranting greater investment to drive progress across the SDGs?**

Based on a multi-sector evidence review (see *Section 2* and *Appendix: Methods*), the report addresses these questions by identifying and discussing three integrated global challenges and associated actions across the development, health, and environment sectors to help realise the progress needed.

The three integrated challenges for cross-sector action are:

- **Accelerating a low-carbon, clean air, and environmentally-friendly energy future for all**
- **Transforming the global food system for health and sustainability**
- **Targeting sanitation and wastewater improvements to maximise benefits for people and nature**

Each of these global challenges represents an important area for cross-sector actions and partnerships, because a single-sector focus on any isolated element is likely to be insufficient to achieve multiple benefits (e.g. by missing a key driver) or might hinder progress on another goal (e.g. through unintended cross-sector feedbacks). Conversely, adopting a broader view and scaling up implementation of effective cross-sector actions to address these challenges can drive holistic progress across the SDGs (specific goals for each integrated challenge are identified throughout). National implementation plans for the SDGs and nationally determined contributions for the Paris Agreement present important contexts for cross-sector actions that can drive bigger change faster towards a sustainable and just future for people and the planet.

This report is not intended to examine every integrated challenge and collective action needed to adequately address the development, health, and environment nexus. Rather, the report aims to highlight three key challenges for which cross-sector solutions are essential to accelerate and maximise progress towards the SDGs, the Paris Agreement, and other commitments.



Because integration across the SDGs requires effective support from a range of actors, this report provides information and insights to assist governments, multilaterals, civil society, the private sector, and researchers in developing a clearer understanding and prioritisation of integrated challenges that need to be solved together. The report can also be used as input into further, more stakeholder-specific thematic guidance and tools. UNDP has a mandated ‘integrator’ function of the UN Development System that focuses efforts on the diagnostics of complex challenges and provision of integrated, potentially multi-institutional solutions².

The following subsections provide a brief overview of each of the integrated challenges highlighted in this report, the primary SDGs that integrated solutions could address, and cross-sector actions that warrant greater immediate attention and investment to accelerate holistic progress.

1. For this report, we use the term *sector* to refer to the broad set of actors involved in major domains of advancement and practice for development, health, and environment. We understand there are other uses of this term, including to differentiate between private entities (corporations) and public entities (governments). We define these sectors broadly, such that the *development sector* encompasses all actors (e.g. multilateral development banks, foundations, bilateral development agencies, non-profits, private development firms, etc.) working on any aspect of human development (e.g. education, gender equity, agriculture, housing, security, economic development, infrastructure, sanitation, etc.). The *health sector* encompasses all actors (e.g. research institutes and universities; insurance, pharmaceutical and other companies; public health workers and organisations; funders; etc.) working on any aspect of health. The *environment sector* encompasses all actors (e.g. non-profit organisations, research institutes and universities, funders, law firms, regulators, natural resource management firms, etc.) working on any aspect of the environment (conservation, pollution, sustainability, etc.) (Tallis et al. 2017).

2. General Assembly resolution—72/279, para 32; “Requests the Secretary-General to ensure an effective and efficient transition to a repositioned United Nations development system, ... including by giving due consideration to the role of a responsive United Nations Development Programme as the support platform of the United Nations development system providing an integrator function in support of countries in their efforts to implement the 2030 Agenda”.



INTEGRATED CHALLENGE #1: ACCELERATING A LOW-CARBON, CLEAN AIR, AND ENVIRONMENTALLY-FRIENDLY ENERGY FUTURE FOR ALL



Challenge	SDG Opportunity	Cross-sector Actions
<p>Access to modern energy is needed to reduce poverty and support rising living standards. Yet the current global reliance on fossil fuels drives climate change, and air pollution from fossil and solid fuels creates a major health burden. A rapid transition to low-carbon, renewable energy is necessary for global development, human health, and the environment. At the same time, this transition presents its own challenges. These include the need to scale-up rapidly to meet growing demand for energy services, and the need to do so in ways that avoid impacts on important habitats supporting biodiversity.</p>	<p>Rapidly expand clean, renewable energy sources to help close the gap on equitable access to modern energy services (SDG 7) and power sustainable, growing cities (SDG 11), while avoiding harm to freshwater resources and life below water and on land (SDGs 6, 14, 15). The energy transition is key to reducing greenhouse gas emissions to achieve the Paris Agreement and to strengthen resilience to climate change impacts (SDG 13), as well as improving health through reduced air pollution from energy (SDG 3). These efforts would also support pathways out of poverty (SDG 1), reduce women's workload associated with fuel collection and household cooking (SDG 5), and reduce inequalities (SDG 10)</p>	<ol style="list-style-type: none"> 1. Prioritise and incentivise modern energy services that improve equitable access to energy while avoiding habitat degradation. 2. Include health sector decision-makers and stakeholders when designing energy policies and building or retrofitting energy services to maximise joint outcomes. 3. Identify and expand adoption of low-polluting, commercially-viable, and culturally-acceptable renewable energy technologies for household cooking.



INTEGRATED CHALLENGE #2: TRANSFORMING THE GLOBAL FOOD SYSTEM FOR HEALTH AND SUSTAINABILITY



Challenge

Food is an essential human need, yet unsustainable food production and consumption is one of the greatest challenges facing people and the planet. The current global food system places pressure on natural resources and ecosystems, contributes to climate change, and is a leading driver of global biodiversity loss. At the same time, food systems are not meeting the full nutritional needs of billions of people; as a result, unhealthy diets are the leading cause of poor health globally.

SDG Opportunity

Transform the global food system to support healthy diets that ensure food and nutrition security for all (SDG 2), advance poverty alleviation (SDG 1), reduce diet-related diseases (SDG 3), strengthen gender equality (SDG 5), improve freshwater resources (SDG 6), reduce inequalities (SDG 10), advance sustainable food production and consumption (SDG 12), support climate stabilisation (SDG 13), and drive improvements for life below water and on land (SDGs 14, 15).

Cross-sector Actions

1. Establish culturally-appropriate national dietary guidelines that address environmental sustainability.
2. Systematise public and private interventions to empower smallholder women farmers.
3. Promote agricultural research and extension on sustainable intensification of food production systems that improve livelihoods, equity, and food and nutrition security, particularly for the poor.
4. Support open trade regimes to allow redistribution of crop production and movement of food in ways that improve production sustainability and access to nutritious foods.



INTEGRATED CHALLENGE #3: TARGETING SANITATION AND WASTEWATER IMPROVEMENTS TO MAXIMISE BENEFITS FOR PEOPLE AND NATURE



Challenge	SDG Opportunity	Cross-sector Actions
<p>Insufficient sanitation and wastewater treatment drive a major burden of pollution from human waste which contaminates water supplies, undermines human health due to diarrheal disease, threatens nutritional security, drives increased risk of antimicrobial resistance, and poses a leading threat to freshwater and marine biodiversity.</p>	<p>Align public and private investment in sanitation and wastewater projects to geographies and solutions that meet targets for clean water and sanitation (SDG 6), alongside leveraging positive outcomes for poverty alleviation (SDG 1), nutrition (SDG 2) and health (SDG 3) through reduced disease from pollution, education (SDG 4), gender equality (SDG 5), reduced inequalities (SDG 10), sustainable cities and communities (SDG 11), and freshwater resources and life below water (SDGs 6 and 14).</p>	<ol style="list-style-type: none"> 1. Design and finance interventions that tackle the whole sanitation problem across an entire area. 2. Integrate nature-based approaches for sanitation and wastewater treatment with conventional built infrastructure.

STRUCTURE OF THE REPORT

Section 2 provides an overview of the methods used in the multi-sector analysis from which the three integrated challenges were identified. Expanded methods information is provided in the Appendix. Sections 3-5 discuss, in turn, each of the identified challenges and associated cross-sector actions. Section 6 concludes with immediate cross-cutting steps that actors across development, health, and environment can take, individually or in partnership, to drive bigger change faster for a sustainable, better future.



2. IDENTIFYING INTEGRATED CHALLENGES FOR DEVELOPMENT, HEALTH, AND ENVIRONMENT

Understanding integrated global challenges across the development, health, and environment sectors requires drawing on diverse, often fragmented bodies of evidence which were not intentionally designed to be analysed together. Recent integrated analyses are helping shift this reality (e.g. IPBES 2019, Whitmee et al. 2015, WHO and CBD 2015), but the majority of efforts to identify global challenges or priorities remain siloed (e.g. FAO et al. 2018, IUCN 2018, UNICEF and WHO 2019). Looking across these traditional divides requires a reconciliation of different terminologies, metrics, and methods for generating and using evidence across sectors (Qiu et al. 2018).

To address these methodological challenges, we took a pragmatist research approach (e.g. Sil and Katzenstein 2010) to compile evidence from multiple sectors into a single conceptual framework. Aligned with the integrated approach of the 2030 Agenda, we conducted our analysis from the perspective of a coupled human and natural system (Liu et al. 2007). Specifically, we conducted a global-scale analysis of connections among the leading challenges facing development, health, and the environment, which are integral to the SDGs.

We identified integrated challenges through three steps as described briefly below. The *Appendix: Methods* section provides further details on each step, including a discussion of assumptions, strengths, and limitations embedded in our approach.

First, we used leading sector-focused reports and datasets to delineate the types and magnitude of global challenges identified by the development, health, and environment sectors from their own perspective (e.g. FAO et al. 2018, IUCN 2018, Stanaway et al. 2018, UNICEF and WHO 2019, and others). Challenges were ranked in common metrics used by each sector, including: *development*—number of people affected; *health*—number of deaths or disability-adjusted life years (DALYs)³; and *environment*—focusing on biodiversity related to the number of threatened or near-threatened species (*Fig. 2-1*). While these metrics are not directly comparable, they provide a means for each sector to identify its current entry points into the integrated challenges presented in this report.

Second, we conducted a multi-sector literature review to develop an understanding of human or environmental factors that are

3. Disability-adjusted life years (DALYs) are “a universal metric that allows researchers and policymakers to compare very different populations and health conditions across time. DALYs equal the sum of years of life lost (YLLs) and years lived with disability (YLDs). One DALY equals one lost year of healthy life. DALYs allow us to estimate the total number of years lost due to specific causes and risk factors at the country, regional, and global levels.” (Source: <http://www.healthdata.org/gbd/faq>).

part of evidence-based explanatory pathways connecting the leading global challenges across the development, health, and environment sectors. As factors were identified, we tracked available quantitative data, to differentiate the relative influence of different pathways connecting sector-focused challenges. This information informed decisions regarding which factors were grouped together in each integrated challenge. For example, because energy is by far the leading source of global greenhouse gas (GHG) emissions (73%; Climate Watch 2018, UNFCCC 2017), we primarily address climate change mitigation in the energy system transformation challenge below (see *Section 3*). Climate change is also an important focus of the food system transformation challenge, given that agriculture and land-use change are the next leading sources of GHG emissions (see *Section 4*). Throughout the integrated challenge descriptions below, we cite relevant quantitative evidence.

Third, we interpreted the compiled multi-sector evidence to elevate the three integrated challenges described in the report based on two criteria:

- **Importance to each sector:** each integrated challenge includes a highly-ranked challenge (defined in sector-relevant metrics, as noted above in step 1) for *each* of the development, health, and environment sectors (*Fig. 2-1*). In other words, we did not elevate challenges that, for example, just ranked high for development and health but not for environment.
- **Connections across sectors:** each integrated challenge addresses evidence-based pathways connecting sector-focused challenges related to the relatively more influential factors, as described above in step 2. Given the presence of these strong cross-sector connections, interventions not taken from an integrated, cross-sector view could unintentionally advance one sector's interests at the expense of progress for other sectors, and they may also miss opportunities to efficiently deliver co-benefits.

Recognising the challenges in evaluating evidence across sectors and the role of interpretation in our analysis, we present our results as one useful synthesis of integrated challenges that is consistent with the underlying evidence. We aimed to clarify where actors can focus to maximise cross-sector benefits and minimise conflicts in addressing the SDGs. We acknowledge that there are many more integrated challenges that warrant attention for cross-sector action. The three we focus on serve as a starting point for attention and have a high likelihood of benefitting from cross-sector actions. Furthermore, our analysis adds to the growing literature on how to advance more effective solutions for the SDGs (e.g. Cluver et al. 2019, El-Maghrabi et al. 2018, ICSU 2017, Lomborg 2015, Nilsson et al. 2016, Wood et al. 2018, and others). We encourage further work that builds on this report to advance integrated solutions.

CROSS-SECTOR ACTIONS WARRANTING GREATER INVESTMENT

For each integrated challenge, we present a targeted (rather than comprehensive) set of cross-sector actions warranting greater near-term attention and investment. Actions were identified based on the evidence review described above, our collective experience as researchers and practitioners working across sectors, and consultations with additional experts throughout iterative development of the report. Given the still limited global experience with cross-sector approaches for the three integrated challenges, these actions should be considered a strong starting place and impacts should be monitored regularly.

For each action, we provide a brief example of 'How to Act'. These examples describe a recent initiative that illustrates the type of multi-issue, multi-partner efforts required.

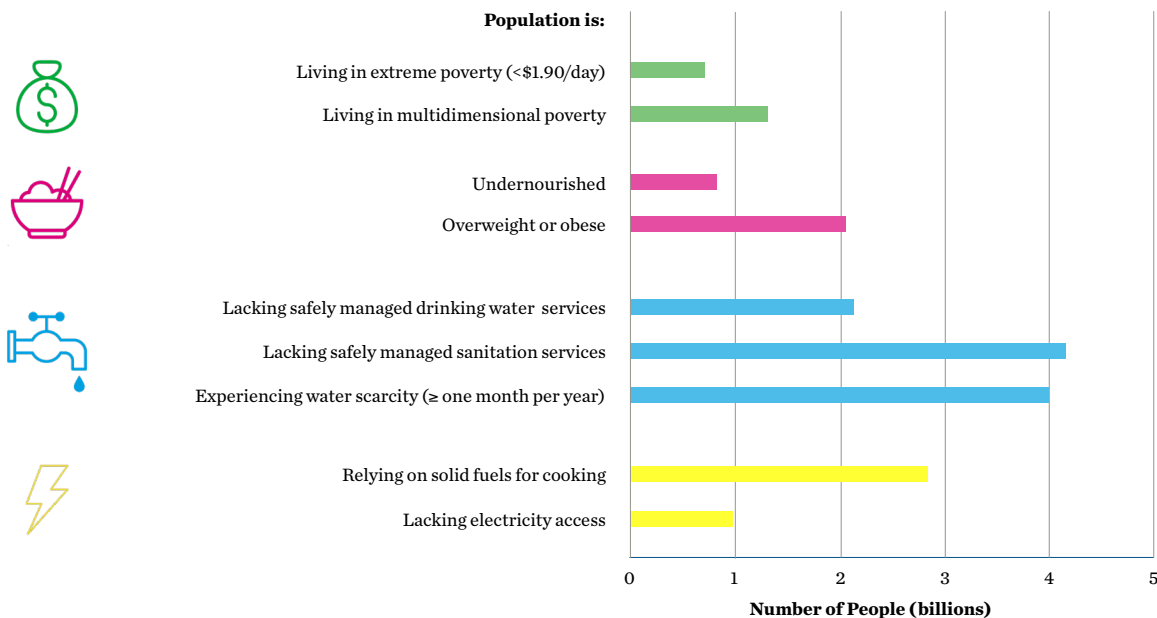


Figure 2-1A. Number of people globally facing conditions related to poverty (Oxford Poverty and Human Development Initiative 2018, World Bank 2018a), food and nutrition insecurity (Development Initiatives 2018, FAO et al. 2018), water insecurity and poor sanitation (Mekonnen and Hoekstra 2016, UNICEF and WHO 2019), and energy insecurity (IEA 2018a,b).

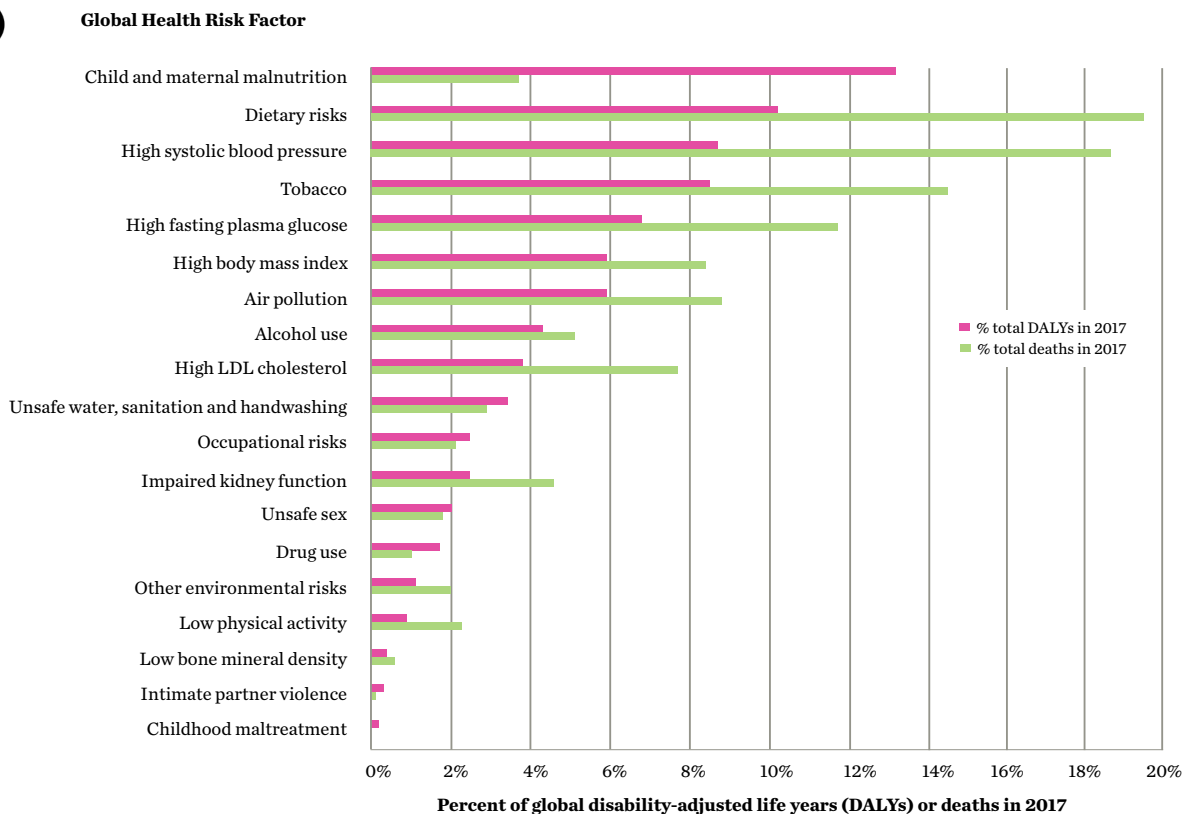


Figure 2-1B. Ranking of health risk factors based on the percent of total global disability-adjusted life years (DALYs) or deaths in 2017 for both sexes and all ages based on the Global Burden of Disease Study (Stanaway et al. 2018).

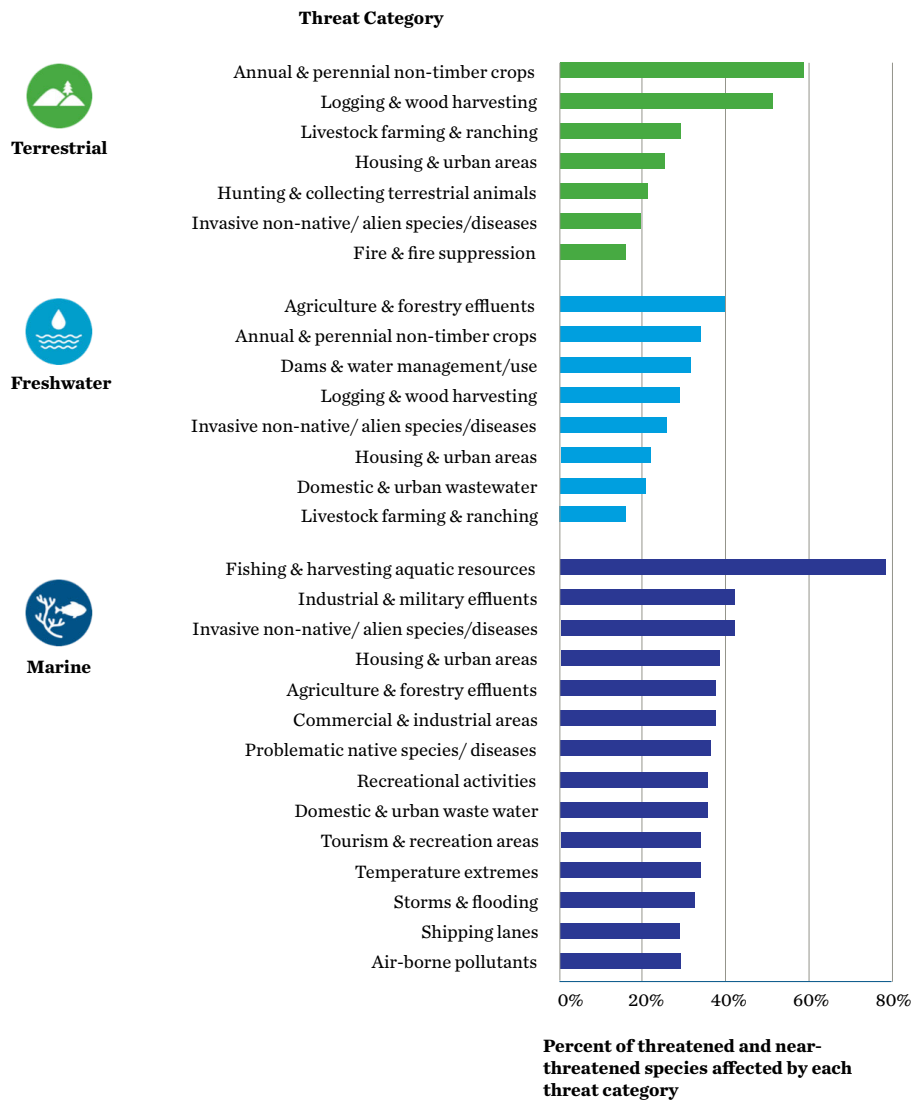


Figure 2-1C. Ranking of top challenges to threatened and near-threatened terrestrial, freshwater, and marine species based on analysis of comprehensively assessed species groups from the IUCN Red List of Threatened Species (IUCN 2018).

3. ACCELERATING A LOW-CARBON, CLEAN AIR, AND ENVIRONMENTALLY-FRIENDLY ENERGY FUTURE FOR ALL

Integrated Challenge: Access to modern energy is needed to reduce poverty and support rising living standards. Yet the current global reliance on fossil fuels drives climate change, and air pollution from fossil and solid fuels creates a major health burden. A rapid transition to low-carbon, renewable energy is necessary for global development, human health, and the environment. At the same time, this transition presents its own challenges. These include the need to scale-up rapidly to meet growing demand for energy services, and the need to do so in ways that avoid impacts on important habitats supporting biodiversity.

SDG Opportunity: Rapidly expand clean, renewable energy sources to help close the gap on equitable access to modern energy services (SDG 7) and power sustainable, growing cities (SDG 11), while avoiding harm to freshwater resources and life below water and on land (SDGs 6, 14, 15). The energy transition is key to reducing greenhouse gas emissions to achieve the Paris Agreement and to strengthen resilience to climate change impacts (SDG 13), as well as improving health through reduced air pollution from energy (SDG 3). These efforts would also support pathways out of poverty (SDG 1), reduce women's workload associated with fuel collection and household cooking (SDG 5), and reduce inequalities (SDG 10).

Cross-sector Actions:

1. Prioritise and incentivise modern energy services that improve equitable access to energy while avoiding habitat degradation.
2. Include health sector decision-makers and stakeholders when designing energy policies and building or retrofitting energy services to maximise joint outcomes.
3. Identify and expand adoption of low-polluting, commercially-viable, and culturally-acceptable renewable energy technologies for household cooking.



3.1 INTEGRATED CHALLENGE

A fundamental sustainable development challenge facing countries around the world is determining **which energy sources can power rising energy demand and close the gap on access to modern energy services, while protecting the health of people and the planet?**

How countries and other actors invest in modern energy services will disproportionately determine whether society is able to achieve the climate targets of the Paris Agreement, reduce air pollution as a leading driver of the global burden of disease, decouple economic growth from environmental degradation, advance sustainable cities, and support efforts aligned with poverty alleviation and gender equality (*Fig. 3-1, Fig. 3-2*).

3.1.1 Development Context

SDG 7 sets a global goal to ‘ensure access to affordable, reliable, sustainable and modern energy for all’ by 2030 (UNGA 2015). At the heart of this goal is the need to transition 2.7 billion people, primarily in Asia and Africa (1.7 and 0.9 billion, respectively), from highly-polluting solid fuels to modern, clean energy sources (IEA 2018a; *Fig. 2-1A*). Solid fuels include wood fuels as the primary source, as well as agricultural residues, dung, and coal. Furthermore, 992 million people lack access to electricity, also concentrated in Africa (603 million) and Asia (351 million) (IEA 2018b). Energy development in these areas has the potential to overtake high-polluting options to directly expand renewable energy sources.

Expanding modern energy access is integral to raising people out of poverty, expanding educational opportunities, improving agricultural productivity and nutrition, increasing access to health systems, reducing inequalities, and improving standards of living, particularly in low and middle-income countries (LMICs) (Nerini et al. 2018). Women, who bear primary responsibility in many parts of the world for household cooking and fuel collection, are most impacted by the time burden of these activities and, along with

children, suffer a disproportionate health burden from household air pollution (IEA 2017).

Fossil fuels are the dominant global energy source (81%, IEA 2018c), and their continued widespread use is in direct conflict with SDG 13 (‘climate action’) and the Paris Agreement. Energy from fossil fuels is by far the largest source (73%) of global greenhouse gas (GHG) emissions causing anthropogenic climate change (Climate Watch 2018, UNFCCC 2017). Fossil fuel emissions in absolute terms come predominantly from high-income countries, as well as China and India. Yet, many LMICs face a disproportionate burden of climate vulnerabilities, despite lower historical and current GHG emissions (Althor et al. 2016).

Fossil fuels are projected to remain the dominant energy source under business-as-usual future scenarios (IEA 2017). Yet preference for their use does not reflect the full negative costs to society from climate change and poor health outcomes from energy-related air pollution. The implications of this are formidable, since current commitments to reduce GHG emissions are not sufficient to achieve the Paris Agreement’s target of limiting global warming to well below 2°C by the end of this century and to pursue a limit of 1.5°C (IPCC 2018).

Climate impacts are projected to most strongly affect the world’s poorest countries, adding to other difficult challenges that must be addressed to eliminate poverty and leave no one behind (King and Harrington 2018). Notably, if sufficient climate action is not taken, more than 100 million people could be forced into extreme poverty by 2030 (Hallegatte et al. 2015). Furthermore, in addition to acute shocks, more gradual shifts caused by climate change will become key drivers of migration through factors such as negative impacts on agriculture (e.g. lower water availability and crop productivity) and harm to existing settlements (e.g. sea level rise and storm surges). By 2050, an estimated 143 million people in sub-Saharan Africa, South Asia, and Latin America may need to secure new places to live in their own countries due to climate change (Rigaud et al. 2018).

3.1.2 Health Context

Progress on SDG 3 ('Healthy lives and well-being for all at all ages') will be greatly limited without changes to the global energy system that substantially reduce human health impacts from air pollution and climate change.

Air pollution is the leading environmental cause of death and the fifth largest cause of death among all global health risks (HEI 2019; *Fig. 2-1B*). Specifically, air pollution is linked to approximately 5-7 million deaths every year across ambient (i.e. outdoor) and household air pollution sources (primarily from inefficient cooking practices using polluting stoves paired with solid fuels and kerosene) (HEI 2019; WHO 2018a). Deaths from household air pollution are concentrated in Asia and Africa and most strongly affect the poorest households (HEI 2019). For ambient air pollution, fossil fuel burning is the dominant source, linked to approximately 65% of premature deaths. Two-thirds of these deaths occur in just three countries: China, India, and the United States (Lelieveld et al. 2019). Higher GHG emissions scenarios causing greater levels of global

warming are expected to increase air pollution-related mortality (Silva et al. 2017). Notably, interlinked air pollution and climate change challenges are among the leading health threats identified by the World Health Organization (WHO 2019).

Beyond disease from energy-related air pollution, climate change is expected to be one of the greatest health threats of the 21st century (Watts et al. 2018). The impacts of climate change are already being felt through direct and indirect pathways, and impacts are projected to worsen under continued warming scenarios. Examples of key health concerns are as follows, with often disproportionate impacts on the poor: increased exposure to extreme heat events and associated illness; reductions in the nutritional quality of foods which could undermine food and nutritional security; shifts in vector-borne diseases, including expansion into new areas or areas where vectors have previously been eradicated; and negative impacts on mental health from climate-influenced disasters or other stressors (Berry et al. 2018, Haines and Ebi 2019, Springmann et al. 2016, Watts et al. 2018).



3.1.3 Environment Context

Tackling climate change is a critical step to protecting the environment and meeting targets for freshwater, marine, and terrestrial biodiversity (SDGs 6, 14, 15). Marine ecosystems, including highly at-risk coral reefs, are already strongly affected by climate change, including through temperature extremes, storms and flooding, and ocean acidification (Halpern et al. 2015, IUCN 2018). Beyond currently observable effects, unmitigated climate change is projected to significantly disrupt ecological processes across all natural systems, requiring species to migrate to find suitable habitat, and placing forests and other natural ecosystems at greater risk from native pests, invasive species, catastrophic fire, and other challenges (IPCC 2018).

Nature-based solutions related to protecting, restoring, and improving management of natural and agricultural systems provide an additional, cost-effective strategy to mitigate GHG emissions. Collectively, these approaches have the potential to contribute approximately 37% of needed global emissions reductions by 2030 (Griscom et al. 2017). By reducing the likelihood of more severe warming scenarios, adoption of low-carbon energy sources and natural climate solutions are critical to conserving biodiversity and ecosystems, which are already under threat from multiple non-climate anthropogenic stressors, such as overharvesting, agriculture, pollution, and invasive species (IUCN 2018).

As renewable energy expands, it is important to consider that poorly planned siting and operation of renewable energy services could lead to substantial loss and degradation of natural habitats on lands and in waters. This can occur, for example, through habitat loss or degradation for solar or wind farms or disruption of river flows from hydropower dam construction. This is an underrecognised environmental risk that must be addressed to ensure holistic progress for energy, climate, and biodiversity.

Hydropower is an important renewable energy source. However, dams for hydropower and other uses are already a top stressor affecting 32% of threatened and near-threatened freshwater species (IUCN 2018; *Fig. 2-1C*). Installed hydropower capacity is projected to nearly double globally by 2050, highlighting the importance of mitigating conflict between low-carbon energy and freshwater ecosystems (Opperman et al. 2015). The top five countries in rank order of projected capacity expansion are China, Brazil, Pakistan, Democratic Republic of Congo, and India (Zarfl et al. 2015).

Projections of land-based renewable energy expansion alongside continued fossil fuel extraction suggest that future impacts from energy development could be on par with top biodiversity stressors like agriculture (Lambin and Meyfroidt 2011; Oakleaf et al. 2015). This would represent a shift from relatively small current global biodiversity losses attributed to land-based energy infrastructure (IUCN 2018). Projected expansion of ocean energy production raises as yet spatially unquantified concerns about future global impacts to marine biodiversity (Firth et al. 2016).

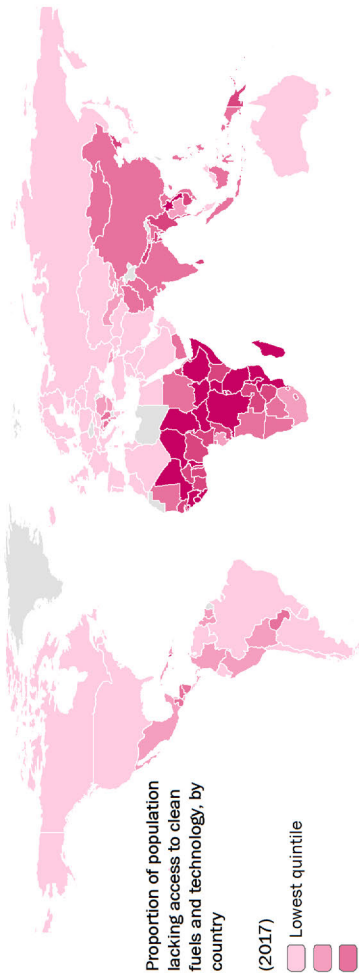
The expected rapid growth of renewables raises multiple additional issues that need to be addressed to mitigate potential harms. First, biofuels and solar infrastructure generally require more land area per unit energy production than other energy sources, implying greater habitat loss if poorly sited (McDonald et al. 2009). Second, biofuel production is highly water intensive and can create significant freshwater pollution. Furthermore, demand for land to grow biofuel crops may conflict with food and nutrition security, of concern particularly in LMICs (Renzaho et al. 2017). Third, in places where there are already concerns over land and resource rights, energy developments that displace people or impact livelihoods could exacerbate conflict and inequities.



Figure 3-1. Decisions by countries about which energy sources are used to close the gap on modern energy access and power the global economy (SDG 7) as well as support sustainable human settlements (SDG 11) will be a major determinant in advancing, or limiting, progress on poverty (SDG 1), health (SDG 3), gender equality (SDG 5), freshwater resources (SDG 6), inequalities (SDG 10), climate (SDG 13), and life below water and on land (SDGs 14, 15). Data sources: Climate Watch (2018), Hallegatte et al. (2015), HEI (2019), IEA (2018a), IUCN (2018), Lelieveld et al. (2019), Oakleaf et al. (2015), UNFCCC (2017), WHO (2018a).

OVERLEAF: Figure 3-2. Geographic context for several indicators (displayed in quintiles based on country values) of the energy transformation integrated challenge related to (A) proportion of population lacking access to clean fuels and technology [SDG Indicator 7.1.2; UNSD 2019], (B) attributable deaths from air pollution [Stanaway et al. 2018], (C) greenhouse gas emissions [Climate Watch 2018, UNFCCC 2017], and (D) natural habitats at risk from future energy development [based on intersection of ‘low’ human modification lands from Kennedy et al. (2019) and all energy development potential layers from Oakleaf et al. (2019)]. The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined, and the final status of Jammu and Kashmir has not yet been agreed upon by the parties.

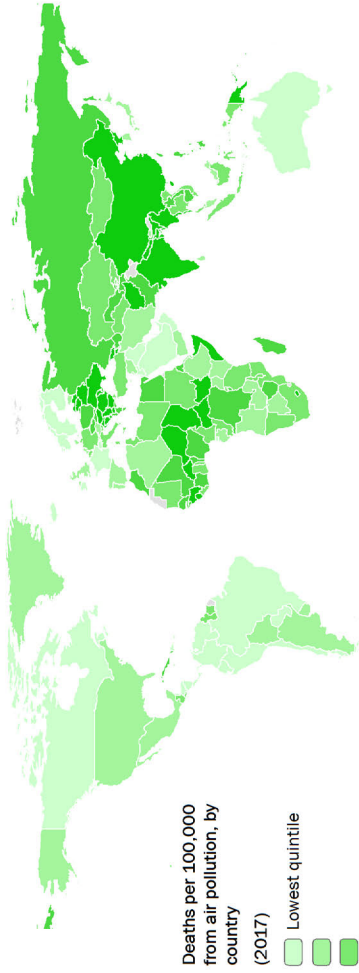
(A)



Proportion of population lacking access to clean fuels and technology, by country (2017)



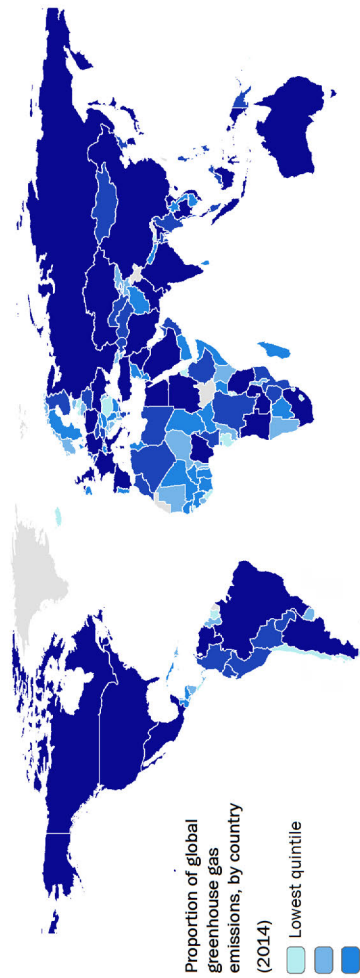
(B)



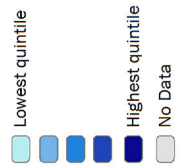
Deaths per 100,000 from air pollution, by country (2017)



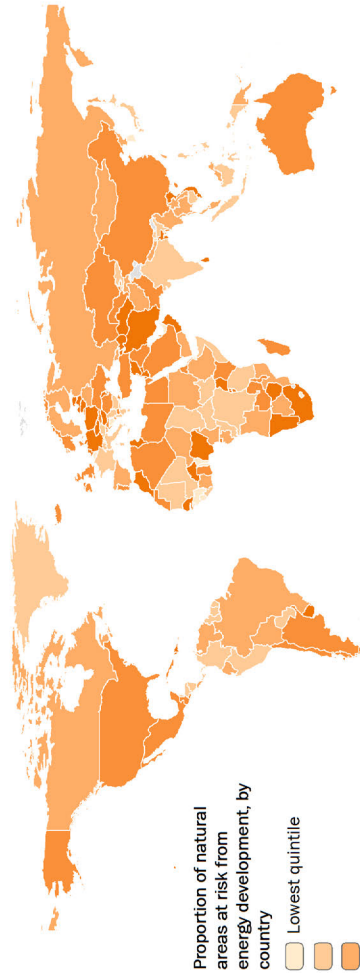
(C)



Proportion of global greenhouse gas emissions, by country (2014)



(D)



Proportion of natural areas at risk from energy development, by country



3.2 CROSS-SECTOR ACTIONS WARRANTING GREATER INVESTMENT

Here, we present three cross-sector actions warranting greater attention and investment to accelerate progress on a low-carbon, clean air, and environmentally-friendly energy future for all. These actions suggest ways to meet modern energy access targets at the scale needed while preventing unintended negative consequences to other targets (e.g. biodiversity, health).

Action #1: Prioritise and incentivise modern energy services that improve equitable access to energy while avoiding habitat degradation

SDG 7 highlights the need to drive energy development in ways that prioritise renewables and provide clean energy for all. However, it does not directly address the paradox of potential habitat impacts from the development of renewable energy, which requires explicit attention to avoid harm. Encouragingly, there are considerable options for expanding renewable energy on already converted lands that are consistent with most countries meeting their commitments under the Paris Agreement (Baruch-Mordo et al. 2019).

Governmental efforts to incentivise a clean energy transition should include the creation and/or enforcement of strong environmental safeguards, supportive institutions, and governance systems to avoid habitat loss or degradation. Carbon taxes, streamlined approval processes, infrastructure incentives, and other mechanisms to drive the renewable energy transition can all include mechanisms to ensure that new energy infrastructure is focused in already converted areas, and managed to reduce environmental harms (e.g. hydropower facilities established with environmental flow requirements). Doing so is key to avoiding adverse environmental outcomes that work against the progress needed for SDGs 6, 13, 14, and 15.

The best option for avoiding environmental losses is to direct new energy development away from intact natural habitats, while also avoiding important food production areas. For example, closed coal mines can be repurposed as solar or wind farms where these sites are in areas of high renewable energy intensity. When this is not feasible, best practices exist to help ensure environmental harms are minimised and compensated for (e.g. mitigation hierarchy; Tallis et al. 2015). While this action focuses on the need to decouple renewable energy development from biodiversity loss, full consideration must also be given to social safeguards that ensure appropriate engagement with communities, respect for tenure rights, and other factors (FAO 2012). Furthermore, advancing integrated environment-health impact assessments (e.g. UNDP 2017) and associated mitigation efforts would help address larger issues presented by this integrated challenge.



How to Act

The Magdalena River Basin in Colombia is one of the most biologically diverse regions in the world, and it is also the country's 'social and economic heart'. The basin is home to 80% of Colombia's population, provides 38 million people with drinking water, and accounts for 86% of the country's GDP, and 75% of agricultural production. Since 2001, Colombia has enacted energy laws, reforms and resolutions to advance low-carbon and renewable energies. The majority of Colombia's planned hydropower is in the Magdalena River Basin, which already accounts for 70% of national hydroelectric energy and 90% of thermo-electric power.

Upstream dams can harm health, productivity, and wildlife by altering the flow regime and patterns of connectivity between the river and wetlands. New infrastructure projects are generally evaluated on a case-by-case basis but doing so limits an understanding of cumulative effects across the entire basin. Integrated basin-wide planning and management, however, has been constrained by insufficient data, tools, and the need to coordinate across multiple jurisdictions (basin and sub-basin responsibilities span 734 municipalities, 13 states, and at least 13 federal agencies).

In response, the Colombian government, with The Nature Conservancy and other partners, has initiated multi-year, multi-purpose, and multi-stakeholder planning to promote integrated river basin management. These efforts consider the economy, human well-being, and conservation more holistically through new planning approaches and tools (see resources below). For example, from a baseline including existing and under-construction dams, modelling of alternative scenarios of where to place new hydropower capacity has demonstrated that taking a comprehensive basin view can enable energy targets to be met while greatly reducing impacts on river connectivity.

See:

- The Nature Conservancy. Stories in Colombia: Magdalena River Basin. Available at: <https://www.nature.org/en-us/about-us/where-we-work/latin-america/colombia/stories-in-colombia/magdalena-river/>
- The Nature Conservancy. 2015. The Power of Rivers: Finding balance between energy and conservation in hydropower development. Available at: <https://www.nature.org/media/freshwater/power-of-rivers-report.pdf>



Action #2: Include health sector decision-makers and stakeholders when designing energy policies and building or retrofitting energy services to maximise joint outcomes

Rapidly increasing the global proportion of energy from renewable sources is a necessary step to deliver energy for all that is consistent with the Paris Agreement. The energy transition also presents a major strategic opportunity to improve human health and strengthen health systems, given the pervasive exposure of people around the world to poor air quality and the growing health impacts of climate change (Haines and Ebi 2019; HEI 2019; WHO 2019). Notably, the economic case for such actions is becoming well-established (e.g. World Bank and IHME 2016).

The health sector can play an instrumental role in conducting health impact assessments and building stronger constituencies to prioritise and invest in clean, renewable energy services that maximise displacement of fossil and solid fuels in areas where associated air pollution health risks are highest. Health actors can also help ensure that health risks from renewables are addressed, such as exposure to lead pollution (e.g. in places without safe recycling facilities for solar panel batteries) or increased exposure to infectious diseases (e.g. in areas of high malaria risk where hydropower reservoirs could provide expanded vector breeding habitat). As such, it is important for government energy ministries and energy developers to include health-sector decision-makers, stakeholders, and affected communities when designing energy policies, developing energy master plans, and retrofitting energy services to maximise joint outcomes. In pursuing such efforts, appropriate governance models are needed to facilitate interactions, including minimising transaction costs and potential institutional frictions.

How to Act

The Healthy Energy Initiative, led by Health Care Without Harm, recognises the strong relationship between energy use choices and human health. The Initiative is mobilising and empowering the health sector to play a central role in advocating for health-enabling renewable energy options, away from health-harming fossil fuels. The Initiative is backed by a strong network of partners from around the world including health professionals, health organisations, and research institutions. It has a global operational presence, including in Australia, China, Europe, India, the Philippines and South Africa.

The Healthy Energy Initiative supports research on the health impacts of energy choices, develops educational materials for health professionals and the general public, promotes health sector divestment from coal, and advocates for energy policies at the local, national, and global levels that promote public health. It supports key stakeholders across the health, energy, and environment sectors to engage in regular, structured dialogue and collaboration. For example, HCWH-Asia worked with health sector leaders and organisations in the Philippines to launch the Paris Platform for Healthy Energy, which calls on governments and international institutions to take urgent action to limit GHG emissions – thereby demonstrating the type of cross-sector action needed to align agendas for health, climate, and energy.

See:

- Health Care Without Harm. 2019. The Healthy Energy Initiative. Available at: <http://www.healthyenergyinitiative.org/>

Action #3: Identify and expand adoption of low-polluting, commercially-viable, and culturally-acceptable renewable energy technologies for household cooking

A major barrier to achieving universal access to modern energy (SDG 7.1) without impeding progress on other goals is the reality that a universally acceptable alternative to solid fuels for household cooking is not yet widely available in many LMICs. Evidence on acceptance, adoption, and air pollution reduction benefits of improved cookstoves remains mixed (Ezzati and Baumgartner 2017). Adoption can be low when alternatives are less culturally appropriate or more difficult to use. Previous efforts have documented a common household practice of ‘fuel stacking’ in which traditional solid fuels and cooking equipment are still used alongside cleaner, alternative stoves and fuels, thereby limiting the realised health and environmental benefits of the latter (Quinn et al. 2018).

Liquid petroleum gas (LPG) is currently the most viable alternative to solid fuels in many locations, but continued reliance on a fossil fuel is in tension with the urgent need to reduce GHG emissions (Rosenthal et al. 2018). Still, in the short term, LPG has a role to play as a transition energy source. Evidence has shown that a shift to LPG does not increase GHG emissions when accounting for reduced emissions from unsustainable wood fuel harvest and the efficiency gains of less fuel needed for the same energy/heat output as compared to biomass (Bailis et al. 2015, IEA 2017). Determination of the best approach should also consider the lifetime of alternative energy systems, in light of the need to rapidly shift to non-fossil fuel sources.

There is a need for greater public and private investment in low-polluting, renewable household energy solutions for cooking in LMICs that supports energy, climate, and health goals. As women are the primary users of cooking technologies, new energy solutions need to be designed to meet women’s needs and preferences, and priced and disseminated in such a way to facilitate women’s adoption of these technologies (Hart and Smith 2013).



How to Act

Lack of access to clean energy is a major health and environmental challenge in rural Asia. Thailand's Alternative Energy Development Plan (2012-2021) targets 25% use of renewable energy sources in total energy consumption by 2021. To support this national policy and translate the national target to local-level action, UNDP with the Global Environment Facility collaborated with the Government on promoting renewable energy in Mae Hong Son (MHS) province. The project supported the local population to reduce household air pollution and health hazards by promoting the use of improved cooking facilities powered by renewables such as micro-hydropower and solar home systems. The project strengthened institutional and social capacity to integrate the use of renewables in local development plans, developed financially sustainable renewable energy systems, built capacity to provide technical support for renewable energy applications, and advanced policies to scale-up and replicate renewable energy services across Thailand.

As part of broader efforts to operationalise financially sustainable renewable energy in MHS province, the project supported 42 villages spanning three ethnic groups to cumulatively use 415 units of improved cookstoves (ICS) from a baseline of no villages trying or using an ICS. The project evaluation found ICS to “have a real impact at village and household levels, since they are inexpensive, tangible, simple to use, and they address the needs of all of the 65% of MHS households who use cookstoves.” It further stated, “ICS contribute strongly to the quality of women and children's lives, they reduce by 30-50% the labour (primarily undertaken by women) needed for firewood collection, and at the same time ICS significantly and directly reduce firewood collection pressure on [surrounding]

natural forests.”

See:

- UNDP. Promoting renewable energy in Mae Hong Son province 2010-2016. Available at: www.th.undp.org/content/dam/thailand/docs/others/Promoting%20Renewable%20Energy%20in%20Mae%20Hong%20Son%20Final.pdf
- UNDP. Terminal Evaluation (TE) Thailand: Promoting Renewable Energy in Mae Hong Son Province (MHS-RE) UNDP-GEF Project. Available at: <https://erc.undp.org/evaluation/evaluations/detail/8843>

4. TRANSFORMING THE GLOBAL FOOD SYSTEM FOR HEALTH AND SUSTAINABILITY



Integrated Challenge: Food is an essential human need, yet unsustainable food production and consumption is one of the greatest challenges facing people and the planet. The current global food system places pressure on natural resources and ecosystems, contributes to climate change, and is a leading driver of global biodiversity loss. At the same time, food systems are not meeting the full nutritional needs of billions of people; as a result, unhealthy diets are the leading cause of poor health globally.

SDG Opportunity: Transform the global food system to support healthy diets that ensure food and nutrition security for all (SDG 2), advance poverty alleviation (SDG 1), reduce diet-related diseases (SDG 3), strengthen gender equality (SDG 5), improve freshwater resources (SDG 6), reduce inequalities (SDG 10), advance sustainable food production and consumption (SDG 12), support climate stabilisation (SDG 13), and drive improvements for life below water and on land (SDGs 14, 15).

Cross-sector Actions:

1. Establish culturally-appropriate national dietary guidelines that address environmental sustainability.
2. Systematise public and private interventions to empower smallholder women farmers.
3. Promote agricultural research and extension on sustainable intensification of food production systems that improve livelihoods, equity, and food and nutrition security, particularly for the poor.
4. Support open trade regimes to allow redistribution of crop production and movement of food in ways that improve production sustainability and access to nutritious foods.





4.1 INTEGRATED CHALLENGE

Global food production and consumption has complex and cascading impacts on the ability to achieve a large number of sustainable development ambitions. A central question is **how can agriculture and food systems be transformed to end hunger and improve nutrition, while also serving as a positive force for poverty alleviation and livelihoods, gender equality, and environmental sustainability?**

How countries, corporations, farmers, and other actors address this challenge will determine the degree to which the global community can simultaneously deliver food and nutrition security for all while avoiding unintended negative impacts on human health and the environment and promoting progress on other connected aspects of sustainable development (*Fig. 4-1, Fig. 4-2*).

4.1.1 Development Context

SDG 2 is a global goal by 2030 to ‘end hunger, achieve food security and improved nutrition and promote sustainable agriculture’ (UNGA 2015). The global food system and economic development drove substantial improvements in food and nutrition security and poverty reduction from 1990 to 2015, while the global population grew by 2 billion people (UN

2015). Yet, nearly 821 million people currently experience hunger, primarily in Asia and Africa, and this number has increased in recent years (FAO et al. 2018). Beyond hunger, micronutrient deficiencies and overweight/obesity affect billions of people globally. Challenges related to under- and overnutrition often occur side-by-side within countries, communities, families, and even individuals (Development Initiatives 2018). Malnutrition is a major drain on the global economy, with aggregate impacts to individuals, communities, and countries estimated to be as high as US\$3.5 trillion per year (Global Panel 2016).

Adequate food and nutrition are the foundation of human development and prosperous societies, as they support conditions that enable positive outcomes for education, livelihoods, health, security, and other goals. More than a quarter of the global population is employed in agriculture, and the share is much higher in low-income countries where 68% of the population was engaged in agriculture during 2014-16 (World Bank 2018b). Thus, efforts to support smallholder farmers are integral to poverty reduction. Lack of tenure security for land and other resources is a common challenge facing smallholder farmers and indigenous communities, limiting progress in poverty alleviation, sustainable livelihoods, broader economic development, and adoption of environmentally-beneficial agricultural practices (Robinson et al. 2018, World Bank 2011).

Fish consumption provides about 3.2 billion people with close to 20% of average per capita animal protein intake (FAO 2018). Furthermore, fisheries and aquaculture employ 60 million people globally (FAO 2018). However, the ability of fisheries to meet human nutritional needs (particularly for those in low-income populations) and growing consumer demand is threatened by unsustainable fishing practices and environmental degradation. Unsustainable practices could place at least 10% of the global population at risk of micronutrient and fatty-acid deficiencies over the coming decades, with potential impacts largest in LMICs near the equator where fish is an important dietary component (Golden et al. 2016).

Food loss and waste are also important concerns. In high-income countries, waste primarily occurs at the retail and end user segments. In low-income countries, waste is largely due to weaknesses in the supply chain, including lack of cold storage, post-harvest processing, and transportation infrastructure; this situation exacerbates food insecurity, ill-health, and environmental harms (Rosegrant et al. 2015).

4.1.2 Health Context

Unhealthy diets are the leading cause of poor health globally, accounting for 11 million preventable deaths from non-communicable diseases. Leading risk factors contributing to this situation are high intake of sodium, low intake of whole grains, and low intake of fruits (Afshin et al. 2019). High intakes of sugar and any amount of trans-fats are also of concern. Currently, foods needed for health and well-being are often out of reach for lower-income populations, while unhealthy food products are more affordable, accessible, and marketed. Given current dietary trends and population growth, the health burden from diet-related diseases is projected to increase (Willett et al. 2019).

All forms of malnutrition are associated with ill-health and higher levels of mortality. Particularly vulnerable to undernutrition are young children, adolescent girls, pregnant and

lactating women, older people, people who are ill or immunocompromised, indigenous people, and people in poverty. Furthermore, groups migrating or displaced due to conflicts, natural disasters, famines, or land tenure disputes are also at risk. Lack of access to adequate micronutrients (such as vitamin A, iron, iodine, and zinc) is a challenge, especially in low-income countries, while non-communicable diseases stemming from unhealthy diets and high body-mass index are rising rapidly in all countries (Development Initiatives 2018). Furthermore, obesity, undernutrition, and climate change are recognised as three concurrent pandemics representing ‘The Global Syndemic’ which must be comprehensively addressed to improve the health of people globally (Swinburn et al. 2019).

Agricultural practices that cause adverse health outcomes are also an important consideration. For example, fertilizer and livestock ammonia emissions cause approximately one out of every five ambient air pollution deaths annually (Lelieveld et al. 2015). Agricultural emissions (particularly nitrous oxide and methane) also contribute to climate change, which itself is an escalating threat to human health and food security (Haines and Ebi 2019, Wheeler and von Braun 2013). Furthermore, water pollution from agrochemicals is an important, albeit understudied contributor to poor health (Evans et al. 2019).

4.1.3 Environment Context

Current global agricultural production and food consumption practices are highly resource intensive and have led to widespread environmental degradation, including biodiversity loss, habitat conversion, water stress, water and air pollution, and climate impacts. Clearing forests and other natural habitats for agriculture is a leading threat to terrestrial ecosystems and biodiversity (SDG 15), with 60% of terrestrial threatened and near-threatened species affected by cropland conversion (making it the top terrestrial threat) and 29% affected by conversion and management for livestock (*Fig. 2-1C*; IUCN 2018). Deforestation and other habitat loss

from agriculture is expected to continue, with net cropland expansion by 2050 in developing countries projected to occur primarily in sub-Saharan Africa (48%) and Latin America (46%) (Alexandratos and Bruinsma 2012).

Agriculture, and in particular livestock production, is the second largest source of GHG emissions (11%). It is on par with related emissions from land-use change and forestry (11%), though both are well behind energy (73%) (Climate Watch 2018, UNFCCC 2017). As such, agriculture and food systems are an important area of focus to ensure that global GHG emissions are consistent with pathways to achieve the Paris Agreement and SDG 13 ('climate action').

Agricultural practices are a central concern for water security, given that agriculture is the largest source of freshwater withdrawals globally. Agriculture is also a large contributor to water pollution, particularly from nitrogen, phosphorus, pesticides, and sediment from soil erosion (Vörösmarty et al. 2010, WWAP 2017, Xie and Ringler 2017). Water consumption for irrigation is of particular concern in China, India, Pakistan, and the United States, which collectively account for 72% of global irrigation consumption for 17 major crops (West et al. 2014). For fertilizer use across these same crops, China, India, and the United States account for 63% of global excess nitrogen application and 66% of excess phosphorus, with excess defined as the "difference between rates of nutrient input versus nutrient removal from plant harvesting" (West et al. 2014, p.326). Other regions (particularly sub-Saharan Africa) are projected to need large additional water and nutrient inputs to close yield gaps, improve food and nutrition security, and support smallholder livelihoods (Mueller et al. 2012).

While animal-source foods are an important source of nutrients, particularly in the early years of life and for those suffering from undernutrition (Grace et al. 2018, Headey et al. 2017), global consumption has risen substantially in recent decades and is projected to further increase with a growing and more affluent population. Between 2010 and 2050, global food demand is projected

to grow by 60%, with a relatively faster increase (66%) projected for meats (IFPRI 2018). This is a nexus area of concern, as unsustainable livestock practices are a global stressor for biodiversity, climate, and water. There are also linked human health risks from overconsumption of animal-source foods, particularly for red and processed meats (Godfray et al. 2018). Furthermore, the majority of antibiotics used globally are for livestock, contributing to risks from antimicrobial resistance. If unaddressed, by 2050, antimicrobial resistance is expected to contribute to an estimated 10 million deaths globally per year from untreatable infections (O'Neill 2016). Also by 2050, production of livestock and other resource-intensive foods could result in agriculture accounting for approximately 70% of allowable GHG emissions relative to a 2°C warming target (Searchinger et al. 2013).

Finally, fisheries also play an important role in food and nutrition security. Yet, unsustainable fishing practices are major threats to freshwater and marine life. These unsustainable practices affect 78% of marine threatened and near-threatened species (causing the top marine threat) and 14% of freshwater species (*Fig. 2-1C*; IUCN 2018). Aquaculture production is projected to surpass wild capture harvest in the near future (FAO 2018), emphasising the importance of steering aquaculture to support nutritional targets while minimizing impacts on the environment (e.g. habitat degradation, invasive species, pollution, disease spread).



Lea Hironaka



Jason Houston

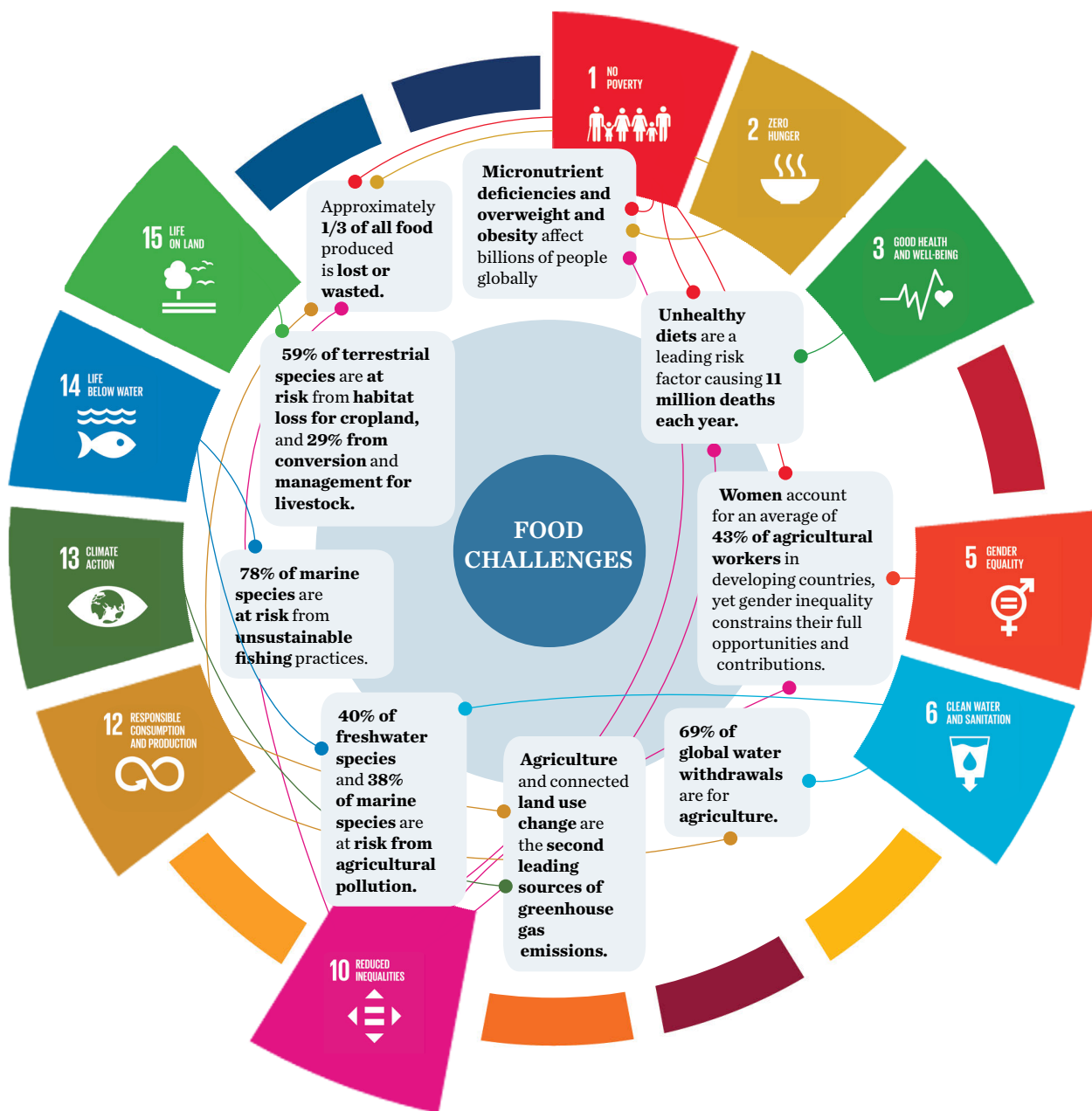
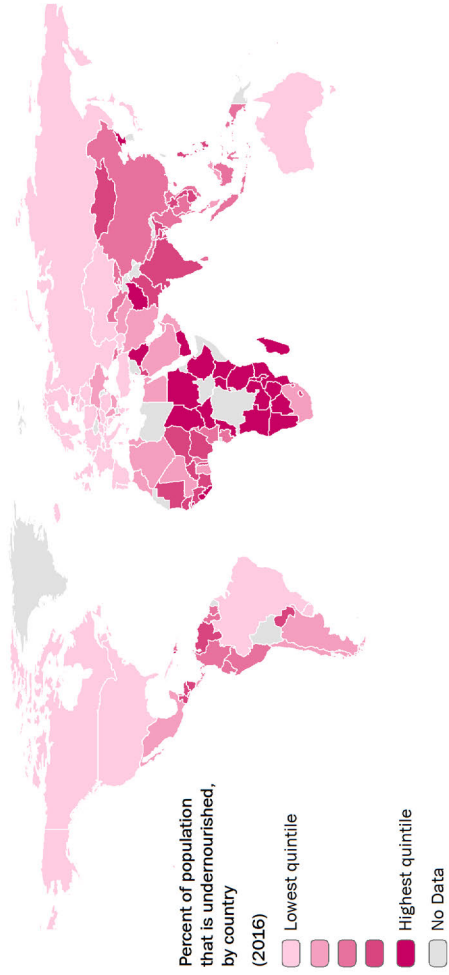


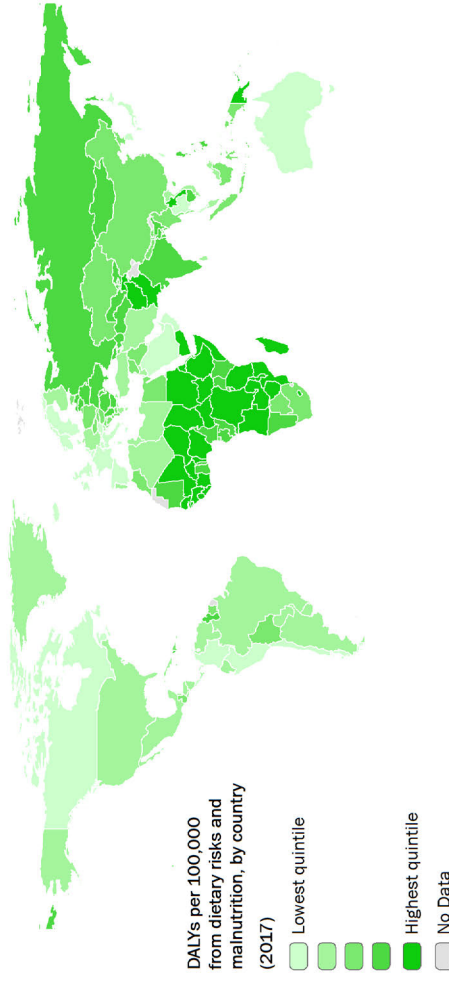
Figure 4-1. The composition of global diets and the practices used to produce and distribute food will be instrumental in advancing, or limiting, progress on food and nutrition security (SDG 2), poverty (SDG 1), health (SDG 3), gender equality (SDG 5), freshwater resources (SDG 6), inequalities (SDG 10), sustainable consumption (SDG 12), climate (SDG 13), and life below water and on land (SDGs 14, 15). Data sources: Afshin et al. (2019), Climate Watch (2018), Development Initiatives (2018), FAO (2011a), FAO (2016), FAO (2018), FAO et al. (2018), IUCN (2018), UNFCCC (2017).

OVERLEAF: Figure 4-2. Geographic context for several indicators (displayed in quintiles based on country values) of the food systems integrated challenge related to (A) prevalence of undernourishment [FAO et al. 2018], (B) health burden from dietary risks and child and maternal malnutrition [Stanaway et al. 2018], (C) irrigation water use in agriculture [Robinson et al. 2015], and (D) natural habitats at risk from future cropland conversion [based on intersection of ‘low’ human modification lands from Kennedy et al. (2019) and cropland development potential layer from Oakleaf et al. (2019)]. The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined, and the final status of Jammu and Kashmir has not yet been agreed upon by the parties.

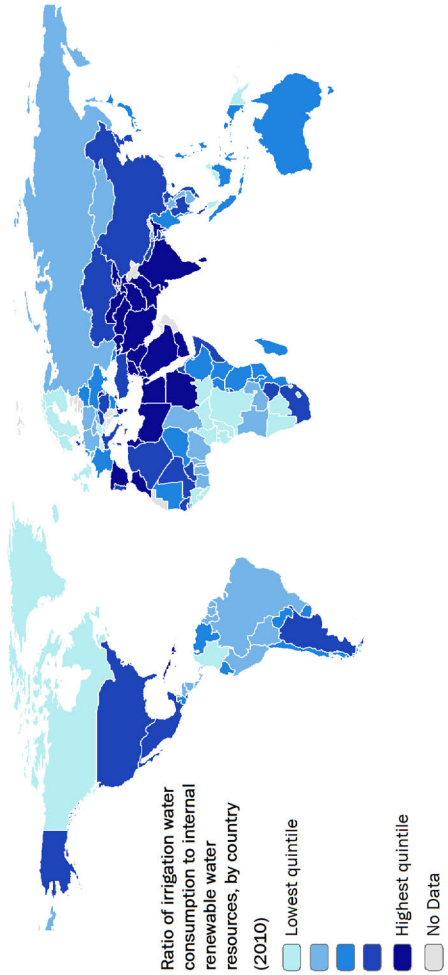
(A)



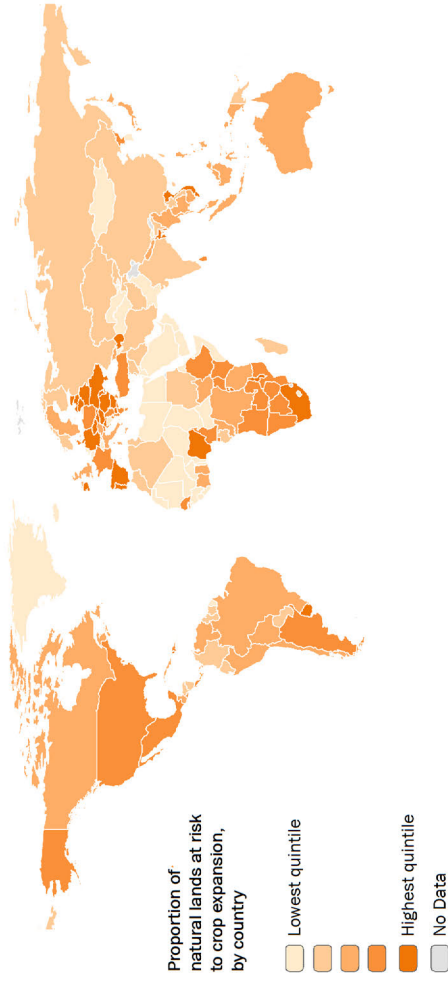
(B)



(C)



(D)



4.2 CROSS-SECTOR ACTIONS WARRANTING GREATER INVESTMENT

A narrow approach to achieving SDG 2 will limit, if not void, society's ability to meet multiple connected development, health, and environmental goals. A bold commitment by governments, companies, farmers, and other key actors could transform the global food system toward producing healthy, sustainable food for all while supporting agricultural livelihoods, particularly for poor and marginalised communities (Willett et al. 2019). Such a transformation would entail massive changes across all levels and actors in the food system. Many groups are advancing necessary solutions towards this shift. As such, our aim is to focus on contexts in which actions remain siloed in ways that could undermine holistic progress on the SDGs. To advance a healthy, sustainable food system, we propose greater attention to four cross-sector actions.

Action #1: Establish culturally-appropriate national dietary guidelines that address environmental sustainability

Diets affect both health and environmental outcomes. While dietary guidelines are one important component of health and nutrition policies, in their current form, they rarely address environmental concerns. Integration of environmental sustainability into dietary guidelines could simultaneously help to address malnutrition alongside climate change, habitat loss, and other environmental stressors. To support adoption, such guidelines must be sensitive to regional, national, and local differences including cultural practices, food preferences, and availability.

Brazil (2014) and Sweden (2015) are examples of countries that have led the way in establishing such guidelines. Furthermore, for the first time, the 2019 EAT-Lancet Commission provides a science-based adult reference diet that aims to improve human health while minimising environmental damages (Willett et al. 2019).

A key change needed to make dietary guidelines more sustainable is to expand consumption of nutrient-rich, low environmental impact protein sources. Both plant and animal protein sources play an important role in human nutrition. However, growing consumption of animal-source protein by well-nourished adults takes a significant toll on the planet's fragile natural resources. Decoupling environmental impacts from nutritional outcomes can be realised, in part, through improved production techniques, reduced food loss and waste, and expansion of diets with a greater proportion of protein from plants and other nutrient-rich, more sustainable sources (The Lancet Planetary Health 2019, Willett et al. 2019).

How to Act

Brazil's 'Dietary Guidelines for the Brazilian Population 2014' include as a core principle the "interdependence between healthy diets and the social and environmental sustainability of the food system". The guidelines recognise the importance of personally- and culturally-resonant diets that sustain health and well-being, while using natural resources sustainably and protecting the environment. The guidelines recommend that consumers base their diets on natural or minimally processed foods mainly of plant origin, while presenting the societal and environmental benefits of reducing animal-source food consumption, where consistent with nutrition and health.

The guidelines specifically cite and are grounded in environmental considerations including – but not limited to – soil conservation, control of pests and diseases, reduced use of antibiotics, production and treatment of wastes and residues, conservation of forests and biodiversity, and the amount of water and energy consumed. Brazil's Ministry of Health led the development of these guidelines with



the Center for Epidemiological Research in Nutrition and Health of the University of São Paulo, with support from the Pan American Health Organization. Other government departments, civil society, and the general public were also consulted. Beyond Brazil, countries such as Germany, Qatar and Sweden have also incorporated sustainability considerations into their national dietary guidelines. The 2019 EAT-Lancet Commission reiterates the need for increased commitments from national governments and support from international bodies to implement dietary guidelines for healthy people and a sustainable planet (Willett et al. 2019).

See:

- Ministry of Health Brazil. 2014. Dietary Guidelines for the Brazilian Population. 2nd edition. Available at: http://bvsms.saude.gov.br/bvs/publicacoes/dietary_guidelines_brazilian_population.pdf
- FAO. Food-based dietary guidelines—Brazil. Available at: <http://www.fao.org/nutrition/education/food-based-dietary-guidelines/regions/countries/brazil/en/>

Action #2: Systematise public and private interventions to empower smallholder women farmers

Women are key actors in food production, marketing food along the value chain, and purchasing and preparing food for their families. In addition, women contribute to rural economies through income generation and entrepreneurship, and they manage natural resources such as forests, water, fisheries, and soils. Additionally, women bear the brunt of unpaid work that is essential for household health and well-being, including caring for infants, young children, and the sick; collecting water and fuel; and ensuring household hygiene and sanitation.

Yet, gender inequality and exclusion in the agricultural sector make this work particularly challenging and sometimes even risky for women, ultimately constraining the extent of their contribution. Furthermore, in some countries, land tenure and patriarchal systems stymie women's rights to land ownership. Indigenous women in many parts of the world are also subject to short-term labour contracts, contributing to job insecurity (UNDP 2019). Closing the gender gap in agriculture could increase women's agricultural productivity by 20-30%, raising total agricultural output in LMICs by 2.5-4.0% and reducing the number of hungry people by 12-17% (FAO 2011b).

We note four focal areas to empower smallholder women farmers in creating a nourishing and sustainable food system, recognising that these areas are also relevant to broader empowerment of women beyond agriculture. First, it is critical to strengthen women's statutory and customary property rights by improving land tenure laws, jointly registering land in the names of both husband and wife, expanding access to legal services and knowledge of rights, and ensuring that family and inheritance law protects women's rights to property.

Second, to lead the sustainable transformation of the food system, women's relative workload and time allocation must be considered. Investments in labour-saving technologies related to water infrastructure, fuelwood collection, post-harvest processing, and other areas can help women secure more time. Another important approach to equalise time poverty along gender lines is to encourage men to participate more in care work.

Third, ensuring women's control over their own bodies and health is another basic component of empowering women that is aligned with efforts to improve the food system. This includes delaying marriage, increasing access to family planning and reproductive and other health services, and preventing gender-based violence. Women and girls' well-being carries intergenerational impacts (Martorell and Zongrone 2012), so investments in their rights, health, and nutrition today will help ensure that current and future generations thrive and support their role as critical actors in food system transformation.

Fourth, from a broader perspective, it is critical to increase women's decision-making power. When women have more of a say in their households (including and beyond agriculture), they can nudge family decisions to invest more in children's education and health (Quisumbing and Maluccio 2003). This includes increased access to agricultural information and services, access to agricultural inputs such as irrigation technologies, and also shared access to profits generated from agricultural production. Outside the home, it is important to include women in institutions at all levels

of governance, such as farmer organisations or water user groups, and to support women-led organisations. Engaging men and traditional leaders in advancing women's empowerment is also essential.

How to Act

In cocoa-growing communities, women make less money relative to men and have less access to training, economic empowerment, land ownership, and decision-making power. This is not only inherently unfair but also a missed opportunity for sustainable development, as women are drivers of change and essential for cocoa communities to thrive. The Cocoa Life Training Programme, launched in 2012 by Mondelez International in partnership with UNDP, supports cocoa farmers and community members in six countries – Brazil, Côte d'Ivoire, the Dominican Republic, Ghana, India, and Indonesia – to ensure cocoa farming is prosperous, to increase farmers' incomes, and to protect land and forests while maintaining ecosystems.

Women's empowerment, at individual, household, and community levels, is central to the programme. Action plans for women's empowerment are in place for Côte d'Ivoire, Dominican Republic, Ghana, and Indonesia. These plans were developed based on local experience with insights from international as well as in-country partners. Actions include: increasing women's access to farm inputs, land ownership, and membership in farmer organisations; promoting leadership positions for women as part of Community Development Committees and Community Action Plan processes including a target of 30% of women representatives; ensuring participation of 50% of young women (age 15+) in youth-oriented programming; and helping women improve their livelihoods through access to finance and entrepreneurial skills.

The programme has impacted women in over 1,000 cocoa communities. Women have greater access to and control over household and productive resources, with stronger ability to lead. Benefits have accrued to not just the women but their entire communities. Each year Cocoa Life provides 50,000 women with access to finance to fund education and encourage entrepreneurship. Through 2018, 74,318 community members have been trained in gender awareness to change perceptions, attitudes, and behaviours to help address gender inequalities. More broadly, by 2022, Cocoa Life aims to empower at least 200,000 cocoa farmers and reach one million community members.

See:

- Mondelez International. 2019. Cocoa Life. Available at: <https://www.cocoalife.org/>
- Mondelez International. 2019. Cocoa Life – Empowering women for more sustainable cocoa communities. Available at: <https://www.cocoalife.org/the-program/womens-empowerment>

Action #3: Promote agricultural research and extension on sustainable intensification of food production systems that improve livelihoods, equity, and food and nutrition security, particularly for the poor.

Increased food production has reduced food prices and increased incomes, resulting in decreased hunger and malnutrition globally (Hoddinott et al. 2013; Ruel et al. 2013). Key mechanisms for this increase have been scientific and technological advances, as well as greater external input use, which have increased crop and livestock yield per unit of land. These advances have contributed to reducing poverty by approximately 2.3 million people annually (Alene and Coulibaly 2009).

Finding agricultural solutions that work for the environment and livelihoods is critically needed, given growing threats from climate change and other environmental degradation. Doing so will take sustained focus and funding for agricultural research and extension services to develop and support adoption of integrated approaches. Most past efforts have focused on improving seed technologies or ensuring that farmers are provided with a set of inputs that can increase yields. This focus remains important but needs to be combined with increased emphasis on evidence-based, climate-smart, environmentally-beneficial, and nutrition-sensitive practices to drive holistic progress.

To support more sustainable production systems, there is a need to expand use of site-specific agroecological approaches that increase production, conserve natural resources, and are tailored to specific human and environmental conditions. Such approaches include: development and selection of appropriate crop varieties; appropriate diversification of agricultural activities at the household and landscape levels; integrated soil fertility management; alternate wetting and drying of rice land and direct seeding of rice; on-time water delivery and micro-irrigation coupled with monitoring of water use; increased fertilizer use efficiency; and ways to reduce the use of antibiotics. Research



and extension approaches should consider the social dimensions of different practices, including how the costs and benefits of new technologies and practices are distributed across different social identities based on gender, age, ethnicity, and other factors.

It is important to go beyond agricultural production to assess the implications along the entire value chain of climate and environmental change, as well as water, land, and energy policies and investments. Water and energy efficiency should be increased in the processing and retail sectors as well; and transportation, transaction, and trade costs of the final product should be factored into land intensification plans, as well as new land development (von Grebmer et al. 2012).

How to Act

The increase in droughts, floods, and other extreme weather events poses challenges for the production of and access to sufficient food for populations in vulnerable areas. The Drought Tolerant Maize for Africa project, started in the early 1990s, is now supporting more than two million farmers across 13 sub-Saharan African countries to acquire and grow more than 200 drought-tolerant maize varieties. These drought tolerant hybrids and open-pollinated maize lines are capable of yielding grain even during times of drought or low soil nitrogen, doing so with reduced or no chemical fertilizer inputs.

Drought-tolerant maize also supports farmers' livelihoods. An analysis in Zimbabwe found that farmers who grew drought-tolerant maize varieties produced over 600 kg more maize per hectare compared to farmers who grew maize that was susceptible to drought. The additional maize generated US\$240 in extra income per hectare, equivalent to nine months' worth of additional food security at no extra cost, thus saving household resources for other needs.

This innovative and transformational work has received support from a range of philanthropic and public sources. The most recent phase of the project aims to expand the reach of drought-tolerant maize by producing 68,000 tons of certified seed annually for use by approximately 5.8 million households and benefitting more than 30 million people.

See:

- UNDP. With a maize called “camel”, an old investment pays off. Available at: <https://www.undp.org/content/undp/en/home/ourwork/ourstories/with-a-maize-called-camel--an-old-investment-pays-off-.html>
- Lunduka RW, Mateva KI, Magorokosho C, Manjeru P. 2019. Impact of adoption of drought-tolerant maize varieties on total maize production in south Eastern Zimbabwe. *Climate and Development* 11(1):35-46.
- FAO. The International Symposium on Agricultural Innovation for Family Farmers: 20 Successes of Agricultural Innovation from the Innovative Fair. Available at: <http://www.fao.org/3/CA2588EN/ca2588en.pdf>





Action #4: Support open trade regimes to allow redistribution of crop production and movement of food in ways that improve sustainability of production and access to nutritious foods

Enhanced regional and international trade can help make production more efficient and ensure that agricultural products are produced in those countries where natural conditions are most suitable, and inputs most abundant or available affordably. As an indication of what is possible with enhanced trade, Tallis et al. (2019) project that cropland extent in 2050 relative to 2010 could be reduced by more than 200 million hectares globally by relocating the same crop types in each major global growing region to better match growing conditions, with changes in the analysis conservatively limited to no more than 25% of cropland in each country.

Trade in agricultural commodities has been identified as a key buffer to food insecurity caused by extreme climatic events, helping to protect millions from health damage due to hunger or malnutrition (Nelson et al. 2009, Wiebe et al. 2015). In advancing trade, care must be taken to avoid harming human health through policies and subsidies that facilitate trade and consumption of nutrient-poor foods and beverages, as well as tobacco and

alcohol, which increase the burden of non-communicable diseases (Cowling et al. 2018).

Increasingly, transnational agricultural trade presents opportunities for consumers to influence corporate behaviour. Adoption of sustainability standards and branding by producers and supply chain purchasers can reduce environmental impacts of agricultural production. Sustainability standards developed through multi-stakeholder platforms can establish clear guidelines for taking action, provide financial incentives for compliance, and develop accountability mechanisms for the production and availability of healthy, environmentally-friendly food.

To address major environmental threats, such standards should focus on eliminating habitat loss from supply chains (including supply chain commitments on zero deforestation), reducing excess fertilizer and other chemical inputs, increasing water efficiency within the context of lowering total water use, and reducing GHG emissions. To ensure social sustainability and avoid supply chain disruptions, standards should cohere with international labour standards and recognise local communities' resource rights that may be directly or indirectly affected. Corporate supply chain commitments are notably increasing, though continued and strengthened accountability is needed to ensure delivery on these commitments (Donofrio et al. 2017).

How to Act

With food demand increasing most rapidly in Africa, and with processed food imports to Africa having increased in recent years, there is a substantial opportunity to strengthen economic development and nutrition through improved intracontinental trade. As of April 2019, 52 African governments have signed the initiative to establish an Africa Continental Free Trade Area (AfCFTA). AfCFTA seeks to create an integrated market accounting for US\$3 trillion in GDP and covering 1.3 billion consumers. FAO is working with the African Union Commission and other partners to supplement AfCFTA with other efforts to enhance agriculture and food trade, which will deliver benefits across the SDGs, stimulate greener practices throughout the food system, and deliver healthier and safer food to consumers. Health-sensitive agro-industrialisation can support, for example, year-round preservation of previously seasonal fruits and vegetables, not only increasing economic opportunities for African food producers and processors but also potentially reducing dependence on processed, unhealthier food items.

See:

- FAO. 2018. More regional trade in agricultural products can lift Africa's economies. Available at: <http://www.fao.org/news/story/en/item/1154392/icode/>
- Tralac. 2019. AfCFTA Questions and Answers. Available at: <https://www.tralac.org/documents/resources/faqs/2377-african-continental-free-trade-area-faqs-june-2018-update/file.html>



5. TARGETING SANITATION AND WASTEWATER IMPROVEMENTS TO MAXIMISE BENEFITS FOR PEOPLE AND NATURE



Integrated Challenge: Insufficient sanitation and wastewater treatment drive a major burden of pollution from human waste which contaminates water supplies, undermines human health due to diarrheal disease, threatens nutritional security, drives increased risk of antimicrobial resistance, and poses a leading threat to freshwater and marine biodiversity.

SDG Opportunity: Align public and private investment in sanitation and wastewater projects to geographies and solutions that meet targets for clean water and sanitation (SDG 6), alongside leveraging positive outcomes for poverty alleviation (SDG 1), nutrition (SDG 2) and health (SDG 3) through reduced disease from pollution, education (SDG 4), gender equality (SDG 5), reduced inequalities (SDG 10), sustainable cities and communities (SDG 11), and freshwater resources and life below water (SDGs 6 and 14).

Cross-sector Actions:

1. Design and finance interventions that tackle the whole sanitation problem across an entire area.
2. Integrate nature-based approaches for sanitation and wastewater treatment with conventional built infrastructure.



5.1 INTEGRATED CHALLENGE

Water pollution from untreated human, municipal, and industrial waste is a massive global problem, most acutely affecting LMICs and poorer populations. The impacts of this pollution are widespread and cause poor health, undermine poverty alleviation and other development outcomes, and substantially harm freshwater and marine biodiversity (*Fig. 5-1, Fig. 5-2*).

The presence of a shared risk to the development, health, and environment sectors creates an opportunity for synergistic action around the following question: **how can progress on sanitation and wastewater treatment be strategically advanced to reduce exposure to pollution, and thereby assist in efforts to reduce poverty and improve nutrition, health, gender equality, biodiversity, and other benefits?**

5.1.1 Development Context

SDG 6 is a global goal to ‘ensure availability and sustainable management of water and sanitation for all’ by 2030 (UNGA 2015). Here, we focus specifically on the targets related to closing the gap in access to safely managed sanitation services (SDG 6.2) and improving adequate wastewater treatment (SDG 6.3).

In 2017, over half (55%) of the global population lacked access to safely managed sanitation services, with the greatest gaps for people living in sub-Saharan Africa and South Asia (UNICEF and WHO 2019). Conditions are most severe for the approximately 9% of the global population that openly defecates (UNICEF and WHO 2019).

Globally, rural areas have lower rates of access to safely managed sanitation services than urban areas (43% versus 47%, respectively); the disparity is greater when considering the lower standard of access to basic services (59% rural compared to 85% urban) (UNICEF and WHO 2019). In urban areas, the challenge is most pressing in informal settlements, which already contain one billion people and are projected to contain two billion by 2050 (UN Habitat 2013).

Inadequate sanitation has substantial economic costs, estimated at between 0.5% and 7.2% of a country’s gross domestic product (WHO 2013). It also undermines efforts to raise people out of poverty by contributing to childhood stunting and disease (World Bank 2017).

The impacts of inadequate sanitation fall heavily on women, who often manage household sanitation and hygiene, and care for the sick. In the absence of accessible and safe sanitation facilities, women’s health, safety, education, and economic opportunities are restricted, as they may face infections, opt out of activities outside the house, or risk defecating outdoors at night despite safety concerns (O’Reilly 2016, Ray 2007, UN Women 2018).

Given historic numbers of people who are forcibly displaced, addressing water, sanitation, and hygiene (WASH) needs for displaced populations is a growing concern. In host regions, the rapid influx of people can overwhelm existing infrastructure. Even when infrastructure is available, displaced peoples may be denied access due to social discrimination or lack of financial resources. As a result, inequities are created with lower WASH access for displaced than host communities, although there are also examples of the reverse where displaced communities receive newer, improved services (WWAP 2019).

Pollution from poor sanitation is compounded by widespread, inadequate treatment of municipal and industrial wastewater. Globally, an estimated 80% of wastewater discharge is not being adequately treated (WWAP 2017). This figure varies greatly by country based on income status. In high-income countries, approximately 30% of wastewater is untreated, compared to 62% in middle-income countries, 72% in lower middle-income countries, and 92% in low-income countries (Sato et al. 2013). Across sanitation and wastewater, only 26% of urban and 34% of rural services are safely managed in the context of preventing contact with human waste along the entire processing chain (WWAP 2017).



5.1.2 Health Context

Insufficient access to sanitation services and infrastructure, along with poor hygiene, are major causes of poor health. Without substantial progress in closing these gaps, health targets are at risk of not being met.

There are important interconnections between infectious disease and malnutrition, with young children in low-income countries most affected. Additionally, insufficient sanitation services or infrastructure (with people not using toilets, or excreta poorly stored or insufficiently treated) leads to contamination of living environments and water bodies. This can lead to increased incidence of diarrheal disease and contribute to the spread of vector-borne diseases. These health impacts reinforce poverty and perpetuate social inequalities—women mostly care for the sick and sickness among children prevents children from attending school and progressing their education.

Notable progress has been made since 1990 in lowering the global health burden from unsafe WASH (WHO 2018b). This progress is

largely due to improved treatment of diarrhea cases, such as with oral rehydration therapy. Even when treatment occurs, individuals often remain in high-risk environments for repeat infections. Overall, unsafe conditions cause an estimated 0.8 to 1.6 million deaths every year (Stanaway et al. 2018, WHO 2018b). For young children, incidence of diarrheal disease increases risk later in life for undernutrition and mortality from infectious disease (Checkley et al. 2008). When acute and long-term health impacts are combined, diarrhea rises to the third-leading cause of DALYs for children under five (Troeger et al. 2018), surpassing malaria and highlighting the devastating impacts of continued gaps in access to safe sanitation, as well as clean water.

Widespread use of antibiotics has allowed for increased control of infections arising from unsafe sanitary and hygiene conditions, but it has also led to the growing threat of antimicrobial resistance, especially because of the misuse of antibiotics in animals. Without adequate attention to waste management, the risk of antimicrobial resistance is exacerbated (UNEP 2017).

5.1.3 Environment Context

Water pollution from poorly treated sanitation and wastewater is among the leading global threats to freshwater and marine biodiversity. This pollution is a key stressor for approximately one-third of threatened and near-threatened freshwater and marine species (*Fig. 2-1C*; IUCN 2018). Vörösmarty et al. (2010) rank organic loadings as amongst the top sources of pollution threatening freshwater biodiversity, as well as for human water security. Furthermore, 93% of coral reefs, which are particularly diverse marine ecosystems under rapid decline, are known to be stressed by sewage pollution, with direct ocean discharge a particularly strong concern (Wear and Thurber 2015). Degradation of corals and other coastal ecosystems can in turn increase risks from storms and flooding to people and assets living in exposed areas (e.g. Das and Vincent 2009, Ferrario et al. 2014).

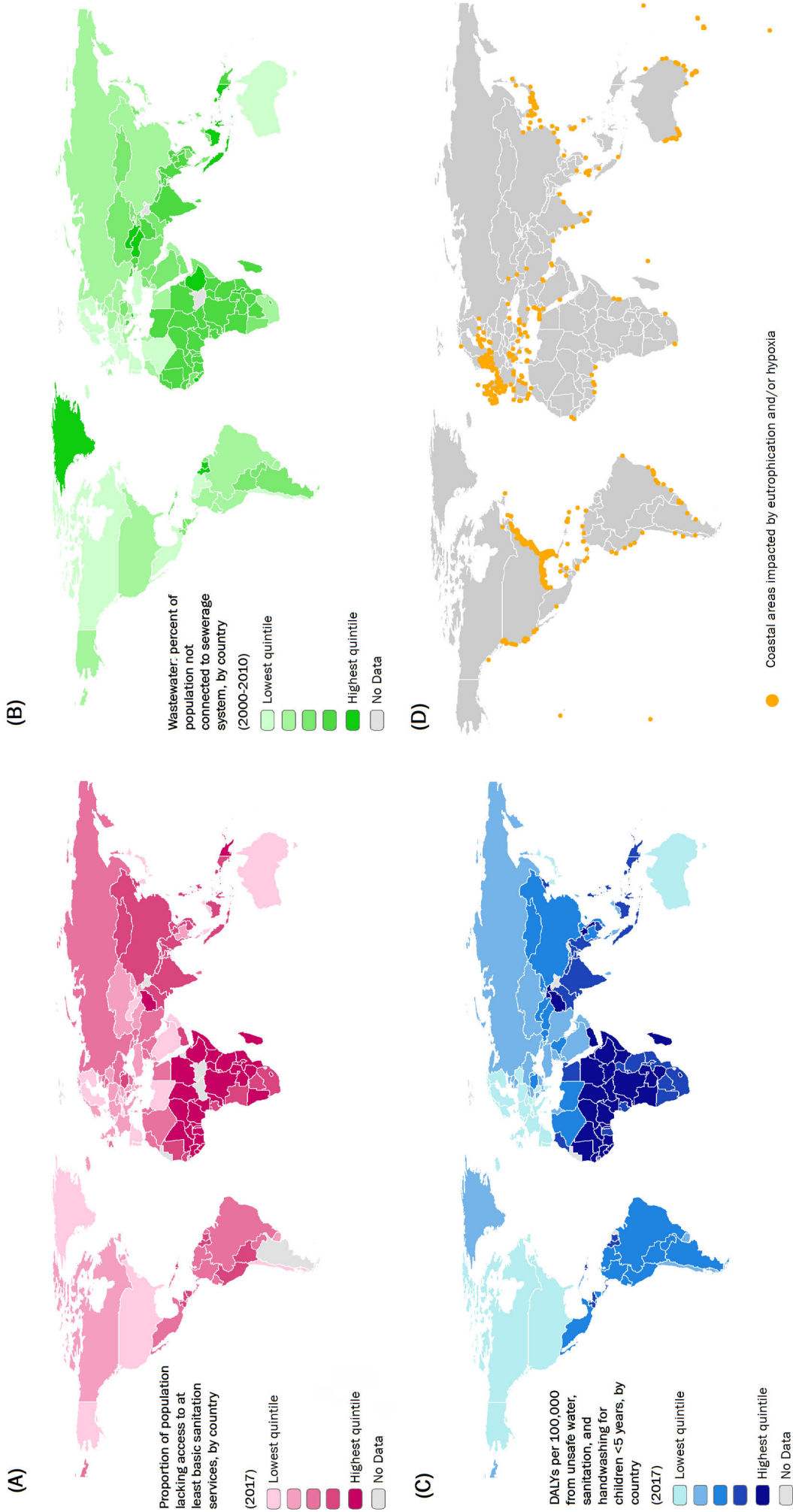
Investments in improved sanitation and wastewater treatment systems are recognised as having beneficial returns-on-investment. Yet persistent limited progress in LMICs can be attributed to many factors, including high upfront capital expenditure costs, limited political focus, and cultural practices that make it difficult to sustain behaviour change (Cairncross et al. 2010, Cole 2018, WWAP 2017). Finding better ways forward, amidst the realities of climate change and fiscal constraints, will require new approaches using both conventional ‘hard’ and nature-based infrastructure to deliver these critical services for people and nature (Rozenberg and Fay 2019).





Figure 5-1. Progress by countries on sanitation (SDG 6.2) and wastewater treatment (SDG 6.3) is critical in addressing pollution from human, municipal, and industrial waste, which undermines progress on poverty (SDG 1), nutrition (SDG 2), health (SDG 3), education (SDG 4), gender equality (SDG 5), inequalities (SDG 10), sustainable cities and communities (SDG 11), and protection of freshwater resources and life below water (SDGs 6, 14). Data sources: IUCN (2018), Stanaway et al. (2018), Troeger et al. (2018), UNICEF and WHO (2019), WWAP (2017).

OVERLEAF. Figure 5-2. Geographic context for several indicators of the sanitation and wastewater integrated challenge related to (A) proportion of population lacking access to at least basic sanitation services [UNICEF and WHO 2019], (B) proportion of population not connected to the sewerage system [compiled by IFPRI and Veolia (2015) from Baum et al. 2013, Van Drecht et al. 2009, Williams et al. 2012], (C) health burden for children under five from unsafe water, sanitation, and handwashing [Stanaway et al. 2018], and (D) coastal areas impacted by eutrophication and/or hypoxia [WRI 2013]. Data are displayed in quintiles by country, except for panel (D) which displays geographic point data. The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined, and the final status of Jammu and Kashmir has not yet been agreed upon by the parties.





5.2 CROSS-SECTOR ACTIONS WARRANTING GREATER INVESTMENT

Targets across at least nine SDGs have a shared root challenge related to poor sanitation and wastewater treatment. This situation highlights the potential for aligned action across development, health, and environment interventions to be much more efficient and impactful. Below, we elevate two actions that have potential to advance more effective solutions to benefit people and nature.

Action #1: Design and finance interventions that tackle the whole sanitation problem across an entire area

Evaluations of sanitation projects have shown that partial expansions in coverage may not be sufficient to reduce disease burden, nor are they likely to be sufficiently effective for the environment (Clasen et al. 2014, Wear 2019). There is a need to design and finance total sanitation coverage across an entire community, city, watershed, or other appropriate area to deliver robust outcomes for people and nature.

While scale is key, costs are an important consideration for achieving the ambition of SDG 6.3 to provide safely managed services for all. Rozenberg and Fay (2019) analysed a range of scenarios for achieving full WASH coverage and estimated that the cost would be 1.1-1.4% of GDP per year in LMICs; this range is inclusive of costs for new capital expenditures, replacement of outdated infrastructure, and

ongoing operations and maintenance. Securing the necessary funding remains challenging but is bolstered by analyses that show positive net social benefits for WASH investments in terms of avoided health impacts and other benefits (Bartram and Cairncross 2010).

In most countries, sanitation, health, and environment ministries operate in separate units. Therefore, enabling this action at the appropriate scale will require coordinating lines of communication, implementation plans, and monitoring programmes to track progress towards multiple outcomes. While not unique to this action, public and private funding sources that intentionally support an integrated approach can streamline the process of working at scale for joint outcomes. Ensuring that the poorest communities are served will take sustained political and financial commitment.

How to Act

Vietnam is one of the fastest urbanising countries in Southeast Asia, adding to the challenges facing cities to provide adequate infrastructure for liquid and solid wastes, and drainage. The “Coastal Cities Environmental Sanitation Project”, funded by the World Bank, provided drainage, wastewater collections, and treatment plants in the cities of Dong Hoi, Quy Nhon, and Nha Trang. This effort also included the establishment of solid waste management facilities and a comprehensive capacity building

programme. The project used an integrated and innovative approach by, for example, promoting efficient institutional and regulatory arrangements at the local level, initiating an information-education-communication programme to include community participation and drive behavioural change, and establishing environmental learning centres.

The project also strengthened local environmental monitoring capacities and played a catalytic role in the establishment of legal frameworks that strengthen the institutional setup of environmental sanitation in Vietnam, with clear mandates, source of revenue, and instruments for enforcement. As a result, more than 800,000 citizens enjoy improved solid waste management services, 250,000 benefit from reduced flooding, 66,500 students have better school sanitation facilities, and 8,452 poor families benefit from upgraded toilets.

See:

- World Bank. 2015. Improving Environmental Sanitation in Coastal Cities in Vietnam. Available at: <http://www.worldbank.org/en/results/2015/07/27/improve-environmental-sanitation-in-coastal-cities-in-vietnam>



Action #2: Integrate nature-based approaches for sanitation and wastewater treatment with conventional built infrastructure

Sanitation and wastewater projects rely extensively on engineered solutions (e.g. toilets, piping systems, treatment plants) that have well-established technical specifications and evidence bases. These approaches are an essential focus for future investments, yet they are capital intensive and can be difficult to finance, particularly in an era of increasing fiscal constraints (Muller et al. 2015, Rodriguez et al. 2012). Because they are fixed in location and capacity, they may also be less able to adapt to changing climate conditions (Wertz-Kanounnikoff et al. 2011).

In this context, there is a growing number of experiments with nature-based infrastructure approaches—using natural or constructed wetlands, forests, or other ecological systems in active ways to treat waste and remove pollutants. Natural infrastructure can also deliver multiple benefits—such as wildlife habitat, recreational opportunities, carbon storage, and flood mitigation. In addition, natural infrastructure can be more cost-effective and climate resilient, though within the limits of the system’s ability to adapt (Vogl et al. 2017).

The greatest opportunities for cross-sector progress in this area are likely from integrating human built and natural infrastructure approaches in the same project area, since their strengths and limitations are largely complementary. Such approaches are being championed by several global entities (e.g. United Nations, World Bank) and national governments (e.g. China, Peru). Because this is a relatively new approach, there is a need to build the evidence base through rigorous monitoring and evaluation, analysis of return-on-investment, and documentation of best practices for design and operations.

How to Act

To improve health and well-being and maintain ecological diversity, Revitalising Informal Settlements and their Environments (RISE) is working at the nexus of health, environment, and water and sanitation in 24 informal settlements across Makassar, Indonesia and Suva, Fiji. This action-research programme, funded by the Wellcome Trust and the Asian Development Bank, collaborates with communities, governments, local leaders, and partner institutions to co-design location-specific solutions. These solutions integrate natural infrastructure, such as constructed wetlands, to strengthen the whole-of-life water and sanitation cycle. They focus on supporting communities to: recycle their own wastewater; harvest rainwater; create green space for water cleansing and food cultivation; restore natural waterways to support biodiversity; and reduce vulnerability to flooding and climate change. The programme will run from 2017-2022.

See

- Revitalising Informal Settlements and their Environments (RISE). Available at: <https://www.rise-program.org/>



Hardi Tanong



6. CONCLUSION

Meeting the ambitious targets of the SDGs will require unprecedented leadership, partnership, governance, and investment to deliver solutions that improve the lives of all people while safeguarding the planet. The time to act is now, as decisions taken in the next few years will have a major impact on society's ability to achieve the pace and scale of change needed.

The three integrated challenges described in this report tie together leading concerns for the development, health, and environment sectors. Yet, despite clear evidence of these interconnections, many actors still largely define problems and implement solutions narrowly within their own sectoral siloes. There are steps that all actors can take now to build greater momentum for cross-sector solutions (see Box: *Driving Bigger Change Faster for the SDGs: Initiating Cross-Sector Actions*, p 49.) and opportunities to leverage national development plans currently being refined and rolled out. Implementation plans for the SDGs and nationally determined contributions for the Paris Agreement present

important contexts to drive holistic, cost-effective solutions to integrated challenges (WHO and UNDP 2018). Ensuring coherence and pursuing synergies across goals is a critical step to empower cross-sector solutions and avoid unintended consequences.

Cross-sector solutions are not going to solve all problems, but they do represent a prerequisite approach to achieve the SDGs. To advance cross-sector efforts where appropriate, actors need to collectively build the evidence base for what works (and what does not) to drive bigger change faster (Kuruville et al. 2018). Amongst many needs, we highlight the following:

- Evaluate the institutional, cultural, economic, and ecological enabling conditions in which single-sector actions versus multi-sector collaboration will be feasible and the most impactful approach to deliver joint outcomes. Towards this, synthesise best practices to be shared widely for each approach.



- Conduct experiments within existing programmes to test and gather data on different ways of structuring cross-sector approaches. To build experience and confidence, an implementer could initially allocate a small budget to test new approaches and expand the budget as confidence and impact emerges.
- Engage funders as catalytic partners and mobilise their willingness to take on a higher risk threshold for returns from cross-sector experiments. Through this, build these funders' experience to move beyond their own single-sector programmes when appropriate to deliver impact (Panorama and Bridge Collaborative 2018).
- Gather data on situations where cross-sector solutions will deliver greater return-on-investment, and promote these solutions for widespread adoption in appropriate contexts, doing so by managing and minimising transaction and friction costs inherent within a whole of society approach. In conducting such analyses, we note the importance of considering all social, health, and environmental impacts of a project (i.e. internalising externalities). Such analyses should also address impacts on equity, as well as consider assumptions inherent in the practice of discounting.

By emphasising actionable connections across the development, health, and environment sectors, we aim to inspire and guide more holistic problem solving. Through greater awareness of cross-sector linkages, actors can work from places of greater leverage to deliver on the promise of the 2030 Agenda and the pledge to leave no one behind.

In the face of great challenges and ambitious goals, we see a compelling call to action for greater cross-sector partnership and investment in solutions that can drive bigger change faster towards a sustainable and just future for people and the planet.

DRIVING BIGGER CHANGE FASTER FOR THE SDGs: INITIATING CROSS-SECTOR ACTIONS

Acting on the three integrated challenges outlined in this report will require a greater focus by governments and all relevant actors on cross-sector objectives and solutions. Below, we provide five recommendations that can catalyse action, whether through steps individual actors take on their own or through partnerships, which are the focus of SDG 17 ('partnerships for the goals').

1. Define the right problem to solve. Today's most urgent global challenges cut across sectors, yet most actors operate primarily within their sectoral siloes. Recognising this, the first step is to answer the following question as part of strategic planning: how do our objectives intersect with leading concerns and objectives from other sectors? By diagnosing problems from a holistic, cross-sector perspective, actors will better understand connected issues to address in designing solutions to maximise joint impact.

2. Value community knowledge and perspectives. Affected populations are essential experts and partners in finding solutions that work. Organisations pursuing cross-sector solutions need effective strategies for continuous, iterative engagement with individuals, households, and communities to inform problem diagnosis and guide the design, testing, and refinement of solutions that align with their needs and strengths.

3. Commit to proactively resolving potential conflicts with other sectors. Because no single sector can solve all problems on its own, actors should commit to better understanding the tradeoffs with other sectors' objectives and intentionally work to reduce conflicts through open communication, changes in accountability and incentive structures, and other approaches to maximise shared impact.

4. Embrace partnerships. Cross-sector partnerships can take many forms, as long as they are grounded in an intentional commitment to design, implement, and evaluate solutions toward joint outcomes. Such partnerships recognise that cross-sector solutions are critical to unlock the pace and scale of change needed. They also provide a platform to consider social and environmental factors that, while conventionally outside the purview of any individual sector, need to be addressed to create conditions for change (Kuruville et al. 2018). Where knowledge gaps are present, partnerships between policymakers and researchers (and other relevant actors) can generate information for evidence-based policies. Partnerships should be evaluated based on their relative costs and benefits towards achieving their desired outcomes (Stibbe et al. 2018).

5. Act on your own if needed. When cross-sector partnerships are not readily feasible, sector-focused actors can still take steps now, on their own, to advance cross-sector solutions (Kuruville et al. 2018). In particular, organisations can ensure that strategic planning processes ask questions about how potential solutions might positively or negatively affect other sectors' goals. They can also ask questions about where the most impactful solutions may originate, being open to the possibility of other sectors' solutions. By answering these questions, even on their own, teams will be better situated to identify the most impactful solutions. They will also be prepared to understand how their actions may impact other sectors' goals and how factors outside their sector may affect their ability to deliver on their primary focus.

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APPENDIX: METHODS

The following sections describe the steps in the methodology to (1) identify prioritised global challenges identified by the development, health, and environment sectors from their own perspective; (2) conduct a multi-sector literature review to elucidate evidence-based conceptual pathways connecting the leading global challenges facing the development, health, and environment sectors; and (3) interpret the compiled multi-sector evidence to identify the three integrated challenges described in this report.

STEP 1: IDENTIFYING PRIORITISED GLOBAL CHALLENGES FOR EACH SECTOR

As the first step in our analysis, we used leading sector-focused reports and datasets to delineate the types and magnitude (to allow relative ranking) of global challenges identified by the development, health, and environment sectors from their own perspective. Each of these sectors produces its own prioritisations of global challenges based on relevant data and analyses that guide important decisions and actions taken by policymakers, funders, and practitioners.

We focused on prioritised challenges set by key actors with a global mandate, and which are directly relevant to countries making progress on the SDGs, Paris Agreement, and other global agreements. As such, our analysis intentionally began with established sector-defined challenges, rather than seeking to create a new, separate set of challenges (e.g. through a systematic review) that would not already have the support of key actors. Using sector-defined priorities as entry points to the integrated challenges has the additional benefit of using frameworks and terminologies that will be familiar to sector-focused actors. From this, we aim for individual actors to contextualize how

their problems and goals relate to those from other sectors.

We used the following primary sources to identify prioritised global challenges for each sector, and we corroborated the appropriateness of the challenges identified through review of additional literature. We relied on these same sources to determine the relative magnitude of impact from the most recent appropriate data sources. Challenges were ranked in common metrics used by each sector, including: *development* – number of people affected; *health* – number of deaths or disability-adjusted life years (DALYs); and *environment* – focusing on biodiversity related to the number of threatened or near-threatened species. The highest-ranking sector-focused challenges were used as the prioritised set for the analysis to identify integrated, cross-sector challenges (*Fig. 2-1*).

To identify prioritised challenges and their magnitude of impact to global health, we used the Global Burden of Diseases, Injuries, and Risk Factors Study 2017 to obtain quantitative information on the contribution of risk factors to the burden of disease. Specifically, we used results for ‘Level 2’ risk factors from the global dataset for both sexes and all ages in relation to the number of attributable deaths or disability-adjusted life years (DALYs) (Stanaway et al. 2018).

To identify prioritised challenges and their magnitude of impact to human development, we focused on reports from leading United Nations agencies and other appropriate groups that conduct regular monitoring of conditions related to challenges affecting human wellbeing. For example, for food security, we used reports from the United Nations Food & Agricultural Organization (e.g. FAO et al. 2018); for water security and sanitation, we drew on the Joint Monitoring Programme of the World Health Organization and the United Nations

Children's Fund (e.g. UNICEF and WHO 2019). The primary areas investigated were food and nutrition security, water security, sanitation, energy security, human settlements (urban and rural), and poverty and livelihoods. All of these aspects of human well-being were considered in the context of current and projected future conditions, given important trends such as population growth, urbanisation, rising standards of living, and climate change. Additional elements of human development included in the SDGs (e.g. education, gender equality, peace and security) were integrated into the analysis as connections were identified through the literature review in Step 2 (described below). Key references from the literature review are cited in *Sections 3-5* for each integrated challenge.

To identify prioritised challenges and their magnitude of impact to the environment, we used the IUCN Red List of Threatened Species, a global dataset assessing the status of and threats to diverse forms of life (IUCN 2018). While biodiversity is only one component of the environment, we chose this focus to ensure that biodiversity was explicit in our analysis given its importance to SDGs 6 ('clean water and sanitation'), 14 ('life below water'), and 15 ('life on land'), and because of the well-established connections between biodiversity and human well-being (Roe et al. 2019, IPBES 2019, WHO and CBD 2015).

While the above are respected sources of prioritised global challenges for each sector, each source has recognised limitations. For example, the IUCN Red List of Threatened Species only addresses species and does not represent dominant challenges for other aspects of biodiversity or the environment more broadly (e.g. habitat extent or quality, biogeochemical processes, air and water quality). The IUCN Red List also has shortcomings within its focus on species. In particular, the data are not equally representative of species across regions or across natural systems, potentially biasing it towards priority challenges that affect the species represented (Hayward 2009, Maxwell et al. 2016).

The Global Burden of Disease 2017 dataset used to identify prioritised health challenges also has shortcomings, including two factors pertinent to our analysis. First, current methods and data allow attribution of risk factors to only 61.0% of total global deaths and 48.3% of total global DALYs (Stanaway et al. 2018). Second, the definition of risk factors and methods for assessing attribution are continually changing to overcome recognised methodological limitations; notably, Stanaway et al. (2018) identified the need to include meteorological conditions as a new risk factor pertinent to climate change, and efforts are already underway to include this in future studies.

Finally, the development literature has its own shortcomings that pose limitations in identifying prioritised global challenges. For example, data remain limited in understanding how a given development target is connected to others (e.g. food security analyses that take into consideration the condition of natural resources or women's empowerment). A second example is that the development field is commonly challenged by incomplete economic analyses that generally focus on those development areas that can be monetised (e.g. change in labour use or increased profit or gross domestic product). Areas that are more difficult to include in economic analyses, such as environmental externalities (e.g. air or water pollution, or water depletion), are often inadequately considered, which can influence understanding of challenges and actions to address them.

The above limitations are recognised shortcomings and not considerations that are unique to our use of these data. Rather, they point towards challenges faced within and across the development, health, and environment sectors in moving towards a stronger, more complete evidence base to advance sustainable development and leave no one behind.

STEP 2: MULTI-SECTOR LITERATURE REVIEW TO ELUCIDATE PATHWAYS CONNECTING SECTOR-FOCUSED CHALLENGES

The second step in the analysis was to conduct a multi-sector literature review to develop an understanding of human or environmental factors that are part of evidence-based explanatory pathways connecting the leading (i.e. highest ranking) global challenges across the development, health, and environment sectors (as described above for Step 1).

The literature review included a diverse range of sources across development, health, and the environment. We began by compiling an initial set of papers related to leading sector peer-reviewed publications and reports related to understanding the nature of global challenges (e.g. FAO et al. 2018, IEA 2017, IUCN 2018, Stanaway et al. 2018, UNICEF and WHO 2019, and others). From this initial set, we used a snowball method and targeted outreach to experts in each sector and distributed globally to identify additional synthesis papers, sector-focused progress reports, global modeling analyses, and analyses of global datasets. We used results from the literature to identify explanatory or mediating factors that related to connections across the development, health, and environment challenges. As we iteratively developed our conceptual understanding of connection pathways, we were able to identify additional areas to cover in the literature review to obtain a sufficiently complete understanding of the full system.

We reviewed over 250 scientific publications and technical reports, and global datasets within them. The literature review was considered complete when new papers corroborated information already compiled rather than adding new insights. It was beyond our scope, however, to conduct a systematic review across the expansive body of literature pertinent to all connections across development, health, and the environment.

As factors connecting challenges across sectors were identified from the literature review,

we tracked quantitative information, when available, to differentiate between relatively more versus less influential connection pathways. This information informed decisions regarding which factors were grouped together in each integrated challenge. For example, because fossil fuels are by far the leading source of global GHG emissions (73%; Climate Watch 2018, UNFCCC 2017), we primarily address climate change mitigation in the energy system transformation challenge (see *Section 3*). Climate change is also an important focus of the food system transformation challenge, given that agriculture and land-use change are the next leading sources of GHG emissions (see *Section 4*).

STEP 3: INTERPRETATION OF MULTI-SECTOR EVIDENCE TO IDENTIFY INTEGRATED GLOBAL CHALLENGES

The literature review revealed a large number of interconnections among prioritised global challenges for development, health, and the environment. Our aim was to identify three clusters of sector-focused challenges that have evidence-based connection pathways and have a high likelihood of benefitting from cross-sector action. Towards this, we interpreted the compiled multi-sector evidence based on two criteria to define the three integrated challenges discussed in this report:

- **Importance to each sector:** each integrated challenge includes a highly-ranked challenge for each of the development, health, and environment sectors. In other words, we did not elevate challenges that, for example, just ranked high for development and health but not for environment. Ranking of sector-focused challenges was done based on commonly used metrics in each sector, as noted above in Step 1 (and see *Fig. 2-1*). For development, we considered challenges that affect at least approximately 10% (0.7 billion) of the global population. For health, we considered challenges in the 'Level 2' Global Burden of Disease Risk Factors that are attributed to at least 3% of global deaths or DALYs (with the lower

cutoff value being in relation to the highest risk factor attributed to 20% of deaths and 13% of DALYs). For the environment, we considered challenges that affect at least 15% of species in decline.

- **Connections across sectors:** each integrated challenge addresses evidence-based pathways connecting sector-focused challenges related to the relatively more influential factors, as described above in Step 2. Given the presence of cross-sector connections, interventions not taken from an integrated, cross-sector view could unintentionally advance one sector's interests at the expense of progress for other sectors, and they may also miss opportunities to efficiently deliver co-benefits. For example, the food systems integrated challenge captures important pathways connecting leading sector-focused challenges related to agriculture as a leading driver of species decline, unhealthy diets as a leading health burden, and hunger and malnutrition as leading development challenges. Agricultural water use is an important factor that connects these challenges: for example, it is integral to crop and livestock production, yet it also contributes prominently to species decline and impacts human use of water for other purposes. In looking at the global proportions of water used by sector (69% for agriculture compared to 19% for industrial and 12% for municipal; FAO 2016), the methodology led to water quantity risks being primarily emphasised in the food systems integrated challenge.

We present our results as one useful synthesis of integrated challenges that is consistent with the underlying evidence, and oriented pragmatically towards clarifying where actors across sectors addressing the SDGs and other global agreements can focus their efforts to maximise synergies and minimise conflicts.

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