OVERVIEW

REBOOT DEVELOPMENT

The Economics of a Livable Planet

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1. Building a livable economy

Humanity has always relied on nature's bounty, not just to survive, but also to thrive. Early civilizations settled near rivers, depending on seasonal rains and fertile soils for their harvests. They domesticated wild animals, transformed plants into textiles for clothing, and mined forests and quarries for supplies to build shelters and other primitive infrastructure. At every turn, human progress required ingenuity and resilience to turn nature's bequest—that great manna—into the building blocks for civilization. With the aid of this great bounty, humanity has not only endured; it has flourished.

In the span of mere generations, much of the world has emerged from the shadows of poverty and hunger to an era of relative abundance. Globally, extreme poverty rates have plummeted, lifting billions into lives of greater security and opportunity (World Bank 2024a). Once an existential threat, food scarcity has given way to a world that produces a surplus of calories; enough to quell hunger, even as challenges of nutrition remain (FAO 2024). Literacy rates have soared, life expectancies have stretched decades longer, and once-deadly diseases have been vanquished through medical breakthroughs such as immunization (UNESCO 2023). Access to clean water, electricity, and modern infrastructure—luxuries for much of history—has expanded to reach communities that were once deprived (UNICEF and WHO 2024). Today, most of humanity lives more comfortably than any previous generation. Though inequality persists, and millions remain excluded from these gains, there is more economic security and opportunity than ever before.

Yet, in reshaping the world for prosperity, humanity is unsettling the foundations of progress. The very forces that have fueled economic growth—industrial expansion, energy consumption, and large-scale agriculture—now strain the planet's ability to sustain this prosperity. Air pollution shortens millions of lives each year, with consequences for productivity and employment. Water resources, once abundant, are now often overdrawn and increasingly tainted by chemical runoff and industrial waste, with economic impacts. Forests fall at staggering rates and the world's ocean, once thought inexhaustible, bears the scars of overfishing, acidification, and plastic pollution. In the pursuit of progress, humanity has destabilized the systems that make prosperity for all possible.

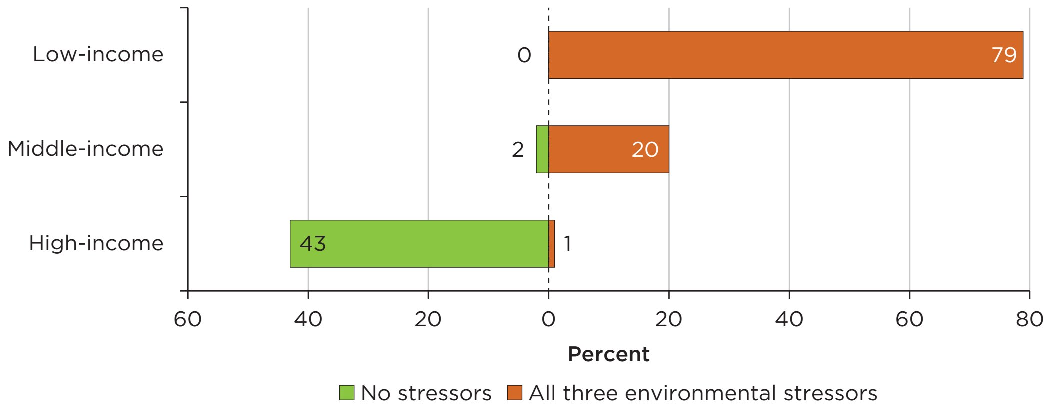
Maintaining a livable planet requires humanity to sustain environmental health and invest in both human and physical capital, to improve lives, livelihoods, and living standards for all. The livability of the planet depends on the stability, productivity, and resilience of its natural resources. Prudent use of these critical resources is thus not a constraint on development, or merely an ecological concern. Rather, it is necessary for a livable planet that makes enduring improvements possible.

2. Why we need to rethink development

Critical natural resources—clean air, abundant and safe water, and healthy and nutrient-rich soils—are fundamental to increasing living standards and reducing poverty. Clean air is essential for human health and productivity; water is a critical input for agriculture, energy generation, and industrial processes; and fertile soils are the foundation for producing nutritious food and sustaining vital ecosystem services.

Yet around 80 percent of people in low-income countries are exposed to all three environmental hazards, land degradation, unsafe air pollution levels, and water stress (figure O.1). In contrast, only 1 percent of people in high-income countries are exposed to all three environmental risks (figure O.1). However, it would be misleading to conclude that affluence automatically confers environmental immunity. Environmental degradation remains a global issue, and 90 percent of the world's population lives in areas where at least one of the three vital resources—land, air, or water—is degraded. The frequent co-occurrence of these environmental challenges, especially in low-income countries, demonstrates that environmental problems have economic consequences that act as a headwind on development. Addressing one stressor in isolation may provide limited benefits if other overlapping risks persist.

FIGURE O.1 Close to 80 percent of low-income country residents are exposed to poor air quality, unsafe water, and degraded land

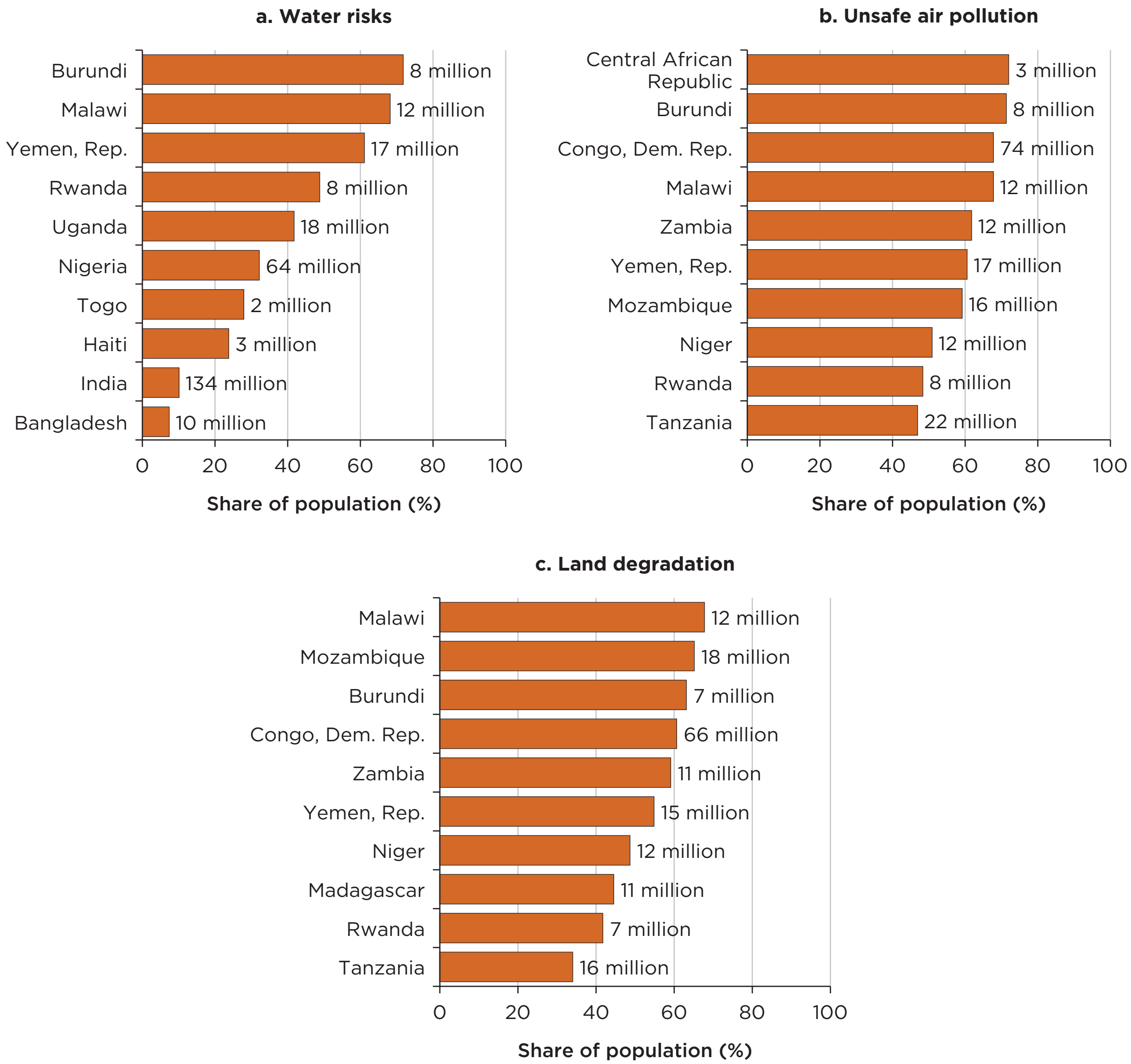


Sources: Original calculations for this report. Water risks, World Resources Institute 2023; air pollution, van Donkelaar et al. 2016; land degradation, Bai et al. 2025.

Note: The figure shows the share of inhabitants in each income group exposed to water risks, air pollution, or land degradation. Definitions of the risks are given in the notes in map 1.1 in chapter 1.[1]

These statistics challenge the old paradigm that environmental degradation is a necessary evil that comes with industrialization, and diminishes in postindustrialized societies. In reality, many of the countries that are most affected by environmental degradation have yet to industrialize. They bear the dual burden of poverty compounded by a degraded environment, without having reaped the benefits of industrialization. Figure O.2 shows the top 10 countries with the highest percentage of population experiencing both extreme poverty and exposure to environmental stressors.

FIGURE O.2 Poverty and environmental pressures often co-occur: The 10 most-affected countries



Sources: Original calculations for this report. Water risks, World Resources Institute 2023; air pollution, van Donkelaar et al. 2016; land degradation, Bai et al. 2025.

Note: The figure shows the top 10 countries with the highest percentages of their population experiencing both poverty and exposure to environmental stressors. Extreme poverty is defined as living on less than $2.15 per day, adjusted for 2017 purchasing power parity. Definitions of the risks are given in the notes on Map O.1.[1]

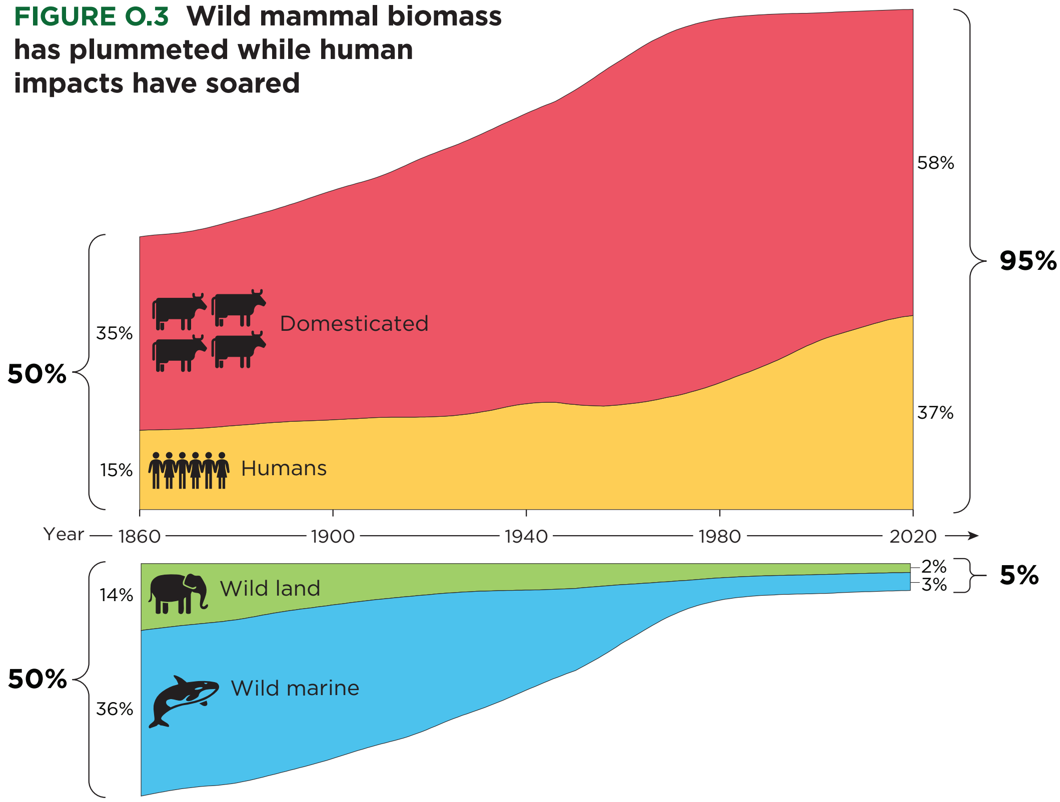
It demonstrates that in many low-income countries, particularly in Sub-Saharan Africa, large shares of the population are both poor and exposed to stressors. Inequality also runs deep within countries. Poor individuals and communities that are excluded from decision-making encounter greater environmental challenges: they are 75 percent more likely to live in areas where land is degraded and face deficits in essential services such as piped water, sanitation, and electricity (Damania et al. 2025). Without access to these essential services, they remain at a higher risk of suffering from the negative effects of poor environmental conditions.

3. Redefining normal: shifting baselines

Throughout the vastness of the cosmos, life exists in only one known place: a thin, 12-mile layer between the Earth's crust and its atmosphere, termed "the biosphere". This narrow band contains every known living thing that has ever existed and provides the essential conditions for life: air, water, fertile soil, and an enabling climate (Folke et al. 2021). Humanity's health, livelihoods, and economies are inseparable from this fragile layer.

Since the Industrial Revolution, humans have transitioned from being passive beneficiaries of the biosphere, to becoming the dominant force in its transformation. Figure O.3 illustrates this dramatic transformation. Before the Industrial Revolution, humans and their domesticated animals accounted for half of all mammalian biomass. Today, humans and livestock account for an astonishing 95 percent of total mammalian biomass, leaving wild mammals, a vanishing 5 percent (Bar-On et al. 2018). This shift underscores the profound impact of human activities on ecosystems and biodiversity, raising concerns about the stability of natural food webs and ecological functions. The dominance of human-associated life forms is not a mere statistic. Rather, it is a signal of how the economic footprint has reconfigured the entire living world.

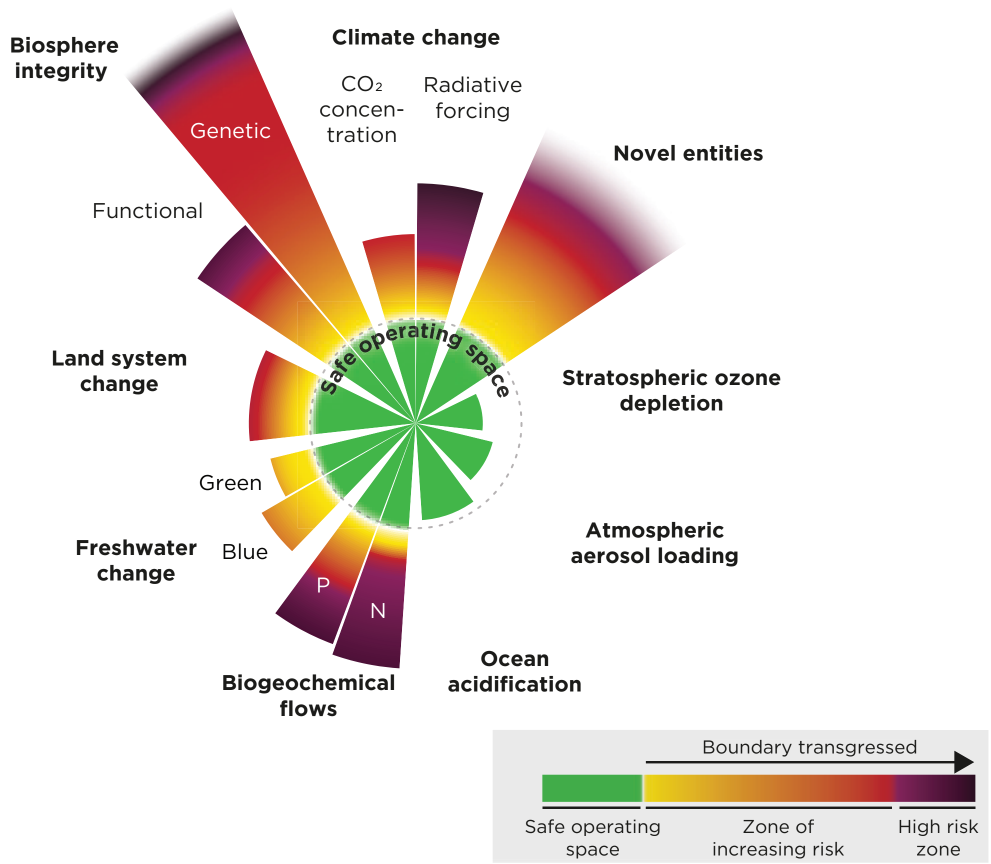
FIGURE O.3 Wild mammal biomass has plummeted while human impacts have soared



Source: Adapted from Greenspoon et al. (forthcoming)
Note: Refer to chapter 1 for details.[1]

These trends culminate in a situation where human activity is now encroaching on critical thresholds that define the stability of Earth's systems. Recent scientific advances reveal that humanity is no longer within the "safe operating space" of many fundamental processes that regulate Earth systems in ways that have enabled prosperity (Richardson et al. 2023; Folke et al. 2021). Many of these changes may be irreversible within human timescales, as lost ecosystems do not regenerate on demand. Once tipping points are crossed, feedback loops can lock in long-term damage. Figure O.4 illustrates that six of the nine planetary boundaries, which define the safe operating space for humanity within Earth's life-support systems, have already been transgressed.

FIGURE O.4 Humanity has crossed six of the nine planetary boundaries



Source: Azote for Stockholm Resilience Centre, based on analysis in Richardson et al. 2023.
Note: CO_2 = carbon dioxide; N = nitrogen; P = phosphorus.[1]

While the science behind these safe operating spaces is often expressed in terms of planetary boundaries, their impacts—and their solutions—are often local. For example, while land system change is a global problem, many of the impacts of deforestation and land degradation manifest as local problems: in the form of less productive soils, reduced rainfall, and increased flood and drought damage. Likewise, damage from biochemical flows, such as nitrogen and phosphorus runoff, impact local ecosystems, often contaminating drinking water, destroying fisheries, and degrading soils. These changes exert impacts at multiple geographic scales, from local to regional to global. Addressing these challenges calls for solutions that acknowledge spatial interactions and the well-being of local communities.

4. The economy of a livable planet

Recognizing the magnitude of change and the associated risks, it is increasingly acknowledged that the economy is embedded in nature and cannot exist apart from it (Dasgupta 2021). Every job, industry, and supply chain ultimately relies on the stability of ecological systems. Degrading natural resources are not abstract environmental concerns, but necessary for production and human wellbeing. Treating nature's deterioration as an externality, or a mere side effect of economic activity, fails to capture the reality that economic progress cannot be fully divorced from the resources upon which it depends. This is not to detract from the importance of addressing externalities; rather, it emphasizes the importance of considering embeddedness when tackling issues with far-reaching impacts on critical natural resources.

Economic models that assume human-made capital can readily replace natural capital—known as close substitutability—fail to capture this reality. A factory can be rebuilt, but it is more difficult to restore a degraded rainforest. And there is no known substitute for water, which is necessary for both life and economic activity. Hence, water scarcity is associated with health impacts, worker absenteeism, and declining productivity, which all translate into an observable headwind on economic growth. Natural resources are both an input to be consumed and an asset that provides many irreplaceable services that underpin economic activity, such as water, clean air, and soils.

The degree of substitutability varies as natural resources become scarcer and reach critical levels due to irreversible changes. For example, the economic costs of losing a small patch of the Congo rainforest would be very different from the damage that would ensue if the entire Congo ecosystem were to perish. There may be substitutes for the services provided by a small part of the rainforest, but not for the entire forest. With poor substitution, the depletion of resources and risks of tipping points translate into giving more weight to the loss of natural capital. It is unlikely that the assumption of perfect (or close) substitutability is a useful simplification in a world where natural resources are in limited supply and experience widespread degradation. The great empirical and practical challenge is to determine the degree of substitutability across and within categories of assets.

5. Cascading and interlinked challenges

Environmental problems do not unfold in isolation; they often cascade, amplify, and reinforce one another, much as when one thread is pulled, an entire fabric begins to unravel. This report presents new research to illuminate the connections between land, water, and air, and their economic consequences, and makes the case for integrated solutions that recognize feedback loops and unintended consequences. It demonstrates that deforestation does not merely strip landscapes of trees and biodiversity, but also disrupts water cycles, impacting energy and agriculture. It shows that the loss of biodiversity has economic consequences that are not widely recognized. Air and water pollution are known health hazards that disrupt labor and agricultural productivity and deplete fisheries. These linkages explain why so much of the developing world faces multiple stressors (figure O.1). Understanding these linkages is essential to designing policies that address root causes rather than shift problems. This section describes new research on some of these interwoven challenges.

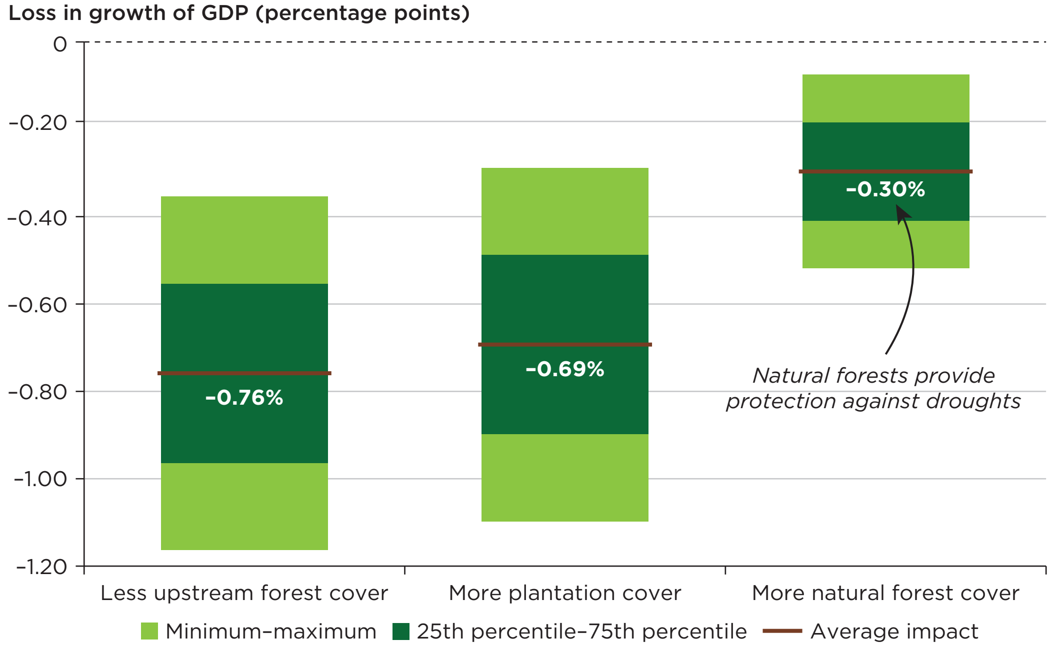
Forests: the water pumps and sponges of the planet

Forests are more than hosts for biodiversity or sources of timber and carbon sinks; they are also engines of the water cycle. Nearly half of all rainfall originates from land and is influenced by vegetation that pumps water from soil and turns it into rain clouds (De Petrillo et al. 2024). Deforestation disrupts this process, weakening local and downwind rainfall patterns. In the past two decades, forest loss in the Amazon, Congo, and Southeast Asia has triggered measurable declines in rainfall, reducing agricultural yields, straining energy production, and stifling economic growth (Araujo and Hector 2024). New results presented in this report demonstrate that the economic toll is substantial, with deforestation-induced rainfall loss costing economies more than $15 billion per year in lost economic growth. These figures are not abstract estimates; they represent lost crop harvests, diminished hydropower generation, and slowing gross domestic product (GDP) growth.

Forests do more than generate rain; they also act as sponges, storing moisture in the soil and releasing it gradually to sustain crops and ecosystems. This stored moisture, known as *green water*, is vital for buffering against droughts, especially during the dry seasons. When forests are lost, soil moisture declines, amplifying the effects of drought and triggering economic losses. New findings in this report estimate that deforestation-driven reductions in green water can lead to losses of around $379 billion, or about 8 percent of global agricultural GDP.

The protective power of forests is most apparent during dry spells. Regions with more upstream forest cover experience much smaller declines in GDP growth during droughts (figure O.5). Importantly, not all forests offer the same level of protection. Intact, natural forests are more than twice as effective as plantations in preserving soil moisture and reducing the economic toll of drought. Their ecological diversity enhances water retention, supports soil health, and boosts resilience, making them a critical safeguard for both nature and the economy. These benefits are typically overlooked, implying that natural forests are systematically undervalued and underprotected.

FIGURE O.5 Upstream forest cover buffers against droughts



Sources: Original calculations based on data from Defourny 2019; Kummu, Taka, and Guillaume 2018; Lesiv et al. 2022; and Matsuura and Willmott 2018.
Note: Refer to chapter 2 for details. GDP = gross domestic product.[1]

The web of life: land use and its impacts on biodiversity

Deforestation does not just alter landscapes; it also destabilizes ecosystems, triggering chain reactions that can disrupt economies. Many of these impacts occur through trophic cascades—ecological chain reactions where the loss or decline of one species reshapes entire food webs—that ripple through ecosystems and economies alike. For example, the collapse of vulture populations in South Asia removed a critical scavenger, leading to a surge in anthrax, rabies, and other zoonotic diseases, and ultimately costing an estimated $69.4 billion in human health damages (Frank and Sudarshan 2024).

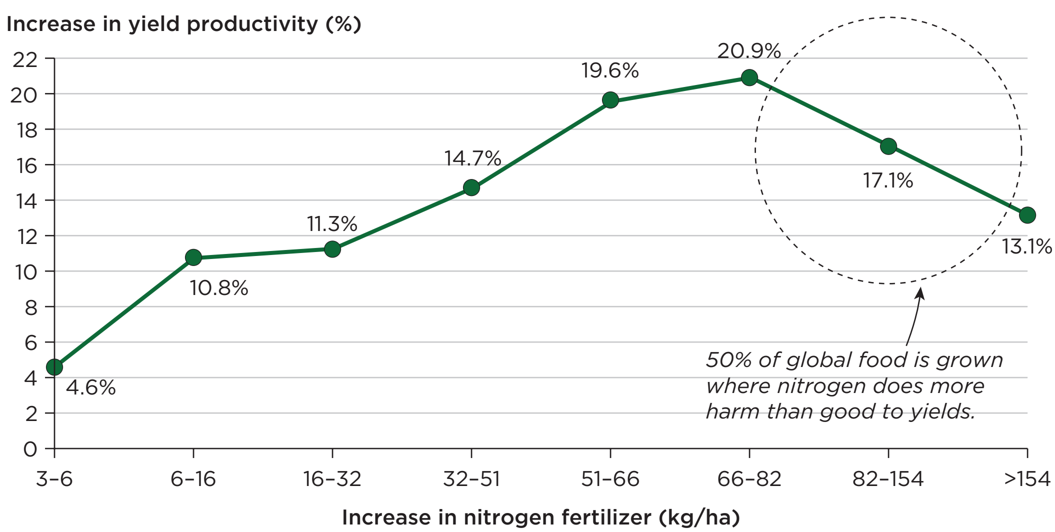
The diversity and abundance of species influence the productivity and resilience of ecosystems. Deforestation-driven declines in predator species have weakened natural pest control in agricultural landscapes, forcing farmers to increase pesticide use, raising costs, and exposing communities to harmful chemicals. The extinction of a key predator through perturbations down the food chain has transformed landscapes, changed vegetation, and even altered river flows. Many of these processes are so complex that scientists are only beginning to understand how they work and their economic consequences are yet to be assessed.

Hidden costs: the environmental impacts of excess nitrogen

Nitrogen fertilizers were once hailed as a miracle that could feed the world while sparing forests from the plough. But the miracle has turned toxic in some regions. Global nitrogen use has soared since the 1960s, especially in Asia, far outpacing what crops can absorb. Today, over half of all nitrogen applied to fields is wasted, leaching into water, fouling the air, and eroding soil health. The health impacts are significant, with nitrate concentration in drinking water linked to cancer, hypothyroidism, reproductive disorders, and developmental delays in children. One of the most well-documented dangers of excessive nitrogen concentrations in water is blue baby syndrome, a condition which causes an oxygen deficit and is lethal to infants.

In many regions, fertilizer use has crossed the point of diminishing returns. Instead of rising with increased nitrogen use, productivity falls. New research shows that nearly half the world's calories come from areas where nitrogen does more harm than good (figure O.6). Misguided subsidies exacerbate the situation, encouraging harmful overuse (Damania et al. 2023; Zaveri 2025). The result is a vicious cycle of degraded soils, shrinking yields, and rising dependence on chemical inputs. Meanwhile, nitrogen runoff fuels algal blooms that kill fish and poison coastlines. The annual cumulative global costs of nitrogen pollution are estimated to be as high as $3.4 trillion, reflecting the widespread damage it wreaks on public health, fisheries, infrastructure, and biodiversity (Sutton et al. 2013).

FIGURE O.6 Half of the global food supply is grown where nitrogen does more harm than good to yields



Source: Zaveri 2025.
Note: Refer to chapter 4 for details. kg/ha = kilograms per hectare.[1]

The price of pollution: the dual crises of air and water pollution

Though largely unseen, poor air and water quality are among the most damaging threats to human health and economic development. Each year, inadequate water, sanitation, and hygiene contributes to 1.4 million deaths, largely from diarrhea, acute respiratory infections, soil-transmitted helminths, and undernutrition (Wolf et al. 2023). And more than 5.7 million people die from outdoor air pollution (World Bank 2025). That is more than the number who die from all forms of war and violence. Polluted air can also diminish school performance, impair decision-making, and increase worker absenteeism (Aguilar-Gomez et al. 2022). With mounting waste, industrial discharge, traffic emissions, and poor sanitation systems, urban areas are ground zero for both these crises. As countries develop, the burden shifts from "pollutants of poverty", such as untreated waste and burning biomass, to "pollutants of prosperity", which include excess nutrients and industrial emissions. The economic cost of air pollution alone is estimated at around $8 trillion annually, or 6.1 percent of global GDP (World Bank 2025).

The nature of cities: engines of progress, epicenters of challenges

Urbanization is reshaping the planet, with nearly two-thirds of the global population expected to live in cities by 2050 (Dodman et al. 2023). Cities are hubs of innovation, production, and opportunity, driving unprecedented improvements in living standards. But they also face a range of unique challenges (Mukim and Roberts 2023). As cities attract more migrants, urban sprawl encroaches on agricultural land, pushing farming into forests and wetlands and exacerbating deforestation and habitat loss (Van Vliet 2019). While direct forest loss from urban growth is modest, displaced cropland has indirectly caused deforestation in around 318,000 square kilometers of land, an area nearly three times the size of England. At the same time, the urban heat island effect—caused by heat-trapping infrastructure and a lack of vegetation—raises local temperatures, intensifying heat stress and straining water and energy resources (Roberts et al. 2023).

Well-planned urban development can mitigate these pressures while enhancing livability and resilience. Compact cities with efficient public transportation and high-density housing are more efficient and enhance urban livability (Dodman et al. 2023). Urban green spaces are also vital in improving living standards, offering wideranging benefits, from cooler temperatures to cleaner air and better health. New research presented in this report shows that in dry, arid environments, greening policies can reduce extreme urban heat by up to 7.6°C (Avner et al., 2025). Managing these dynamics effectively will be key to ensuring that the benefits of urbanization continue to drive progress without deepening environmental risks to its residents.

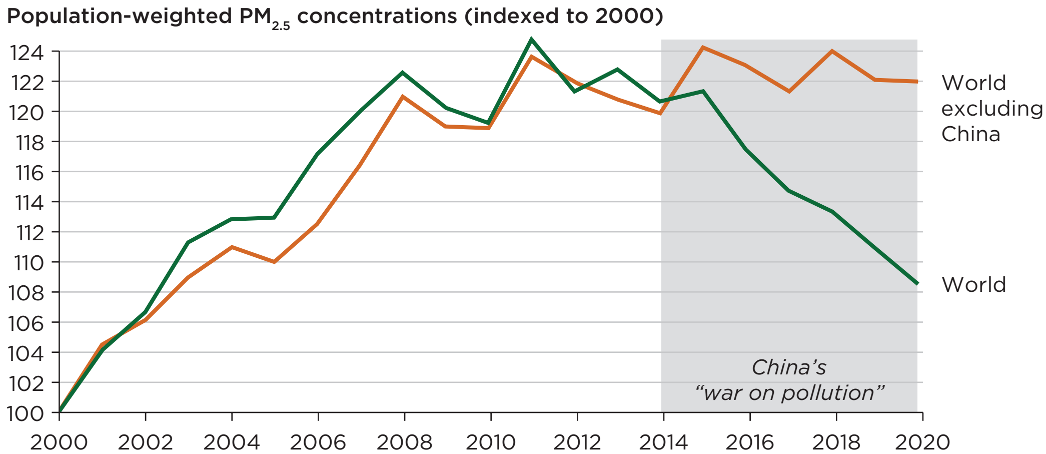
The tradeoffs: economic growth vs ecological systems

While economic prosperity and environmental protection are often seen as competing

goals, addressing the environmental impediments to a more livable planet may have surprisingly high returns. Well-designed policies have delivered benefits that outweigh costs and enhance economic productivity. On the other hand, poorly designed and ineffective policies can stifle economic activity and bring no commensurate benefits.

There are many examples of well-crafted policy interventions that yield benefits that are significantly greater than their associated costs. Implementing advanced nitrogen management practices at farm level can deliver societal benefits approximately 25 times greater than the implementation costs (Gu et al. 2023). While in India, the estimated benefits ($101.4 million/year) of the Gujarat pollution trading scheme, which uses market-based mechanisms to reduce industrial emissions, exceeds costs ($3.9 million/year) by a factor of over 25 (Greenstone et al. 2023). China's ability to significantly reduce air pollution while maintaining robust economic growth also suggests that it is possible to bend the pollution exposure curve down (figure O.7).

FIGURE O.7 It is possible to reduce air pollution ($PM_{2.5}$) while growing the economy



Sources: Original calculations using $PM_{2.5}$ data from van Donkelaar et al. 2016 and population data from CIESIN 2018.

Note: Refer to chapter 5 for details. $PM_{2.5}$ = fine particulate matter.[1]

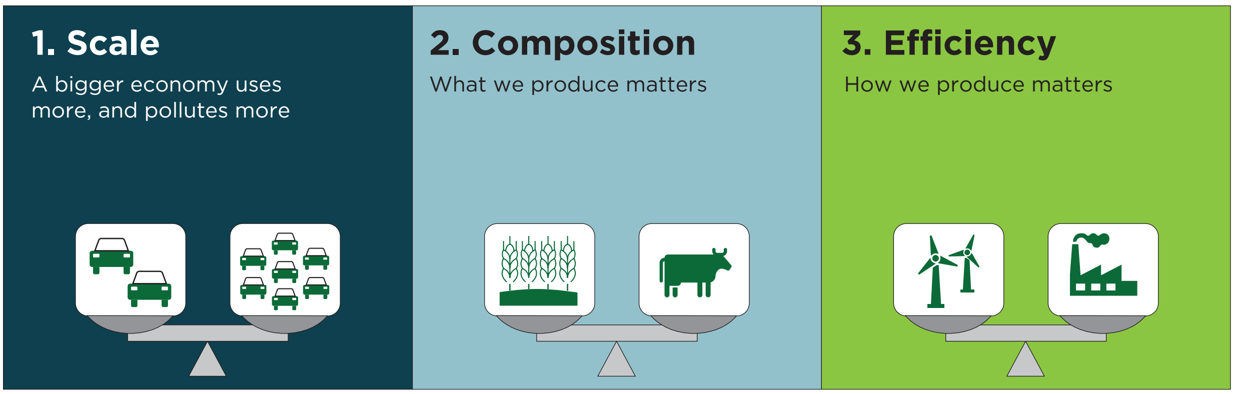
Balancing economic growth with environmental sustainability requires careful consideration of tradeoffs. When sufficient data are available, conventional cost-benefit analysis serves as a valuable decision-making tool. It can reveal that environmental remediation may not be justified, at least on economic criteria. But a comprehensive assessment can be challenging, as environmental benefits are often difficult to identify, quantify, and monetize. And when environmental benefits are super-additive—for example, when the services of a rainforest exceed the sum of its trees—sole reliance on conventional cost-benefit analysis can introduce systematic biases due to methodological limitations.

Uncertainty further complicates decision-making, particularly when the risk of irreversible or catastrophic damage looms. What may begin as gradual environmental degradation can escalate into systemic failure, imposing unpredicted costs. For example, the generous application of nitrogen fertilizer to boost agricultural yields may seem beneficial in the short term, but can ultimately trigger high environmental damage, saturating soils, contaminating water sources, harming public health, and tipping marine ecosystems into hypoxic dead zones, which in turn causes economic damage. In these cases, science-based targets and adaptive strategies offer a more economically prudent approach.

6. Pathways to rebooting development

Decoupling economic growth from environmental degradation is a key challenge facing economies. Figure O.8 describes the three effects that drive environmental change: scale, composition, and efficiency. As economies expand, the scale effect increases resource use and pollution due to the sheer increase in production and consumption. The composition effect reflects structural shifts in the economy toward more or less resource-intensive industries, worsening or improving environmental outcomes. The efficiency effect captures technological and process improvements that reduce environmental impacts per unit of output. Improving efficiency by producing more with fewer inputs can offset the impacts of scale.

FIGURE O.8 The three key drivers of environmental change



Source: Original figure for this report.

For land, air, and water resources, efficiency is the main factor offsetting the scale effect. New research shows that there is limited evidence of changes in composition reducing environmental pressures (table O.1). For example, changing the composition of production has only offset 4 percent of the increase in air pollution over a decade, while improvements in efficiency offset the scale effects of air pollution by 59 percent. This highlights the crucial role played by technological advancements, process improvements, and better resource management in decoupling economic growth from environmental degradation.

There is scope for continuing efficiency and productivity gains. Roughly 30 percent of global food production is lost or wasted, squandering not only calories but also the embedded water, energy, forests, and emissions (World Bank 2020). Similarly, more than 50 percent of nitrogen fertilizer never reaches crops, instead polluting water and air and contributing to greenhouse gas emissions (Damania et al. 2023). Just 36 percent of primary energy provides useful work or heat, as 37 percent is lost before delivery, and 27 percent at the point of use (World Bank 2024b). Water systems fare no better: globally, about 30 percent of supply, or half the Ganges River's flow, is non-revenue water, lost to leaks, theft, and metering errors (Liemberger and Wyatt 2019). These inefficiencies waste resources and forgo economic returns. Addressing them requires better incentives, smarter infrastructure, and investments in innovation.

TABLE O.1 As resource use increases, increased efficiency is the main force curbing degradation

	Water withdrawals	Land use	Air pollution ($PM_{2.5}$)	GHG emissions
Scale (Normalized)	100	100	100	100
Composition	−30	4	−4	−10
Effciency	−50	−69	−59	−52
Net change	20	35	37	38

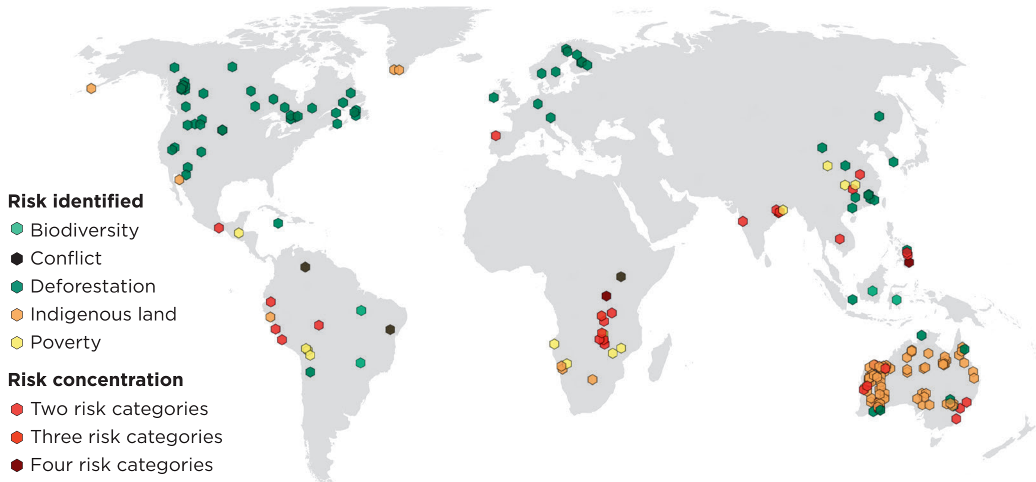
Source: Original table for this report using the GTAP 11 Data Base.
Note: Refer to spotlight 1 for details. GHG = greenhouse gas; $PM_{2.5}$ = fine particulate matter.[1]

But simply improving efficiency is unlikely to suffice, and ultimately, bending the degradation curve in a growing economy will depend not only on producing things better, but also on producing better things. When the limits of efficiency, dictated by the laws of physics, are reached, there will need to be changes in the composition of consumption and production to offset scale effects. This includes accelerating the transition away from resource- and pollution-intensive sectors, such as fossil fuels, nitrogen-intensive agriculture, and linear manufacturing toward more circular, regenerative models of growth. For example, shifting diets toward lower-impact foods, investing in public transit instead of private car infrastructure, or complementing synthetic fertilizers with integrated nutrient management strategies can reduce environmental pressure even when output continues to rise. These compositional changes require both new technologies and well-aligned policies.

Transition Minerals: The bedrock of the transition

Certain "transition minerals" such as lithium, cobalt, nickel, and rare earth elements are essential for continued innovation and a more livable planet, but strong governance is needed to manage their risks. These minerals are key inputs for batteries, renewable energy, and advanced manufacturing, making them central to the economies of the 21st century. For resource-rich countries, this demand creates opportunities for industrialization, economic diversification, and job creation. While significant reserves exist in high-income countries, a minor proportion of these co-occur in locations with risk factors, including deforestation, biodiversity loss, water contamination, and governance challenges (map O.1). New estimates presented in this report indicate that deforestation rates are higher where these transition minerals are extracted, compared with those at conventional mining sites. Good governance partly ameliorates the impact. Stronger environmental safeguards, investments in local value chains, and ensuring the transparency of supply chains will be crucial to ensure that mineral wealth enhances livability and can become a driver of inclusive growth rather than another example of the resource curse.

MAP O.1 "Transition mineral" mines registered in areas that overlap with potential risks



Source: Katovich and Rexer 2025.
Note: Refer to spotlight 6 for details.[1]

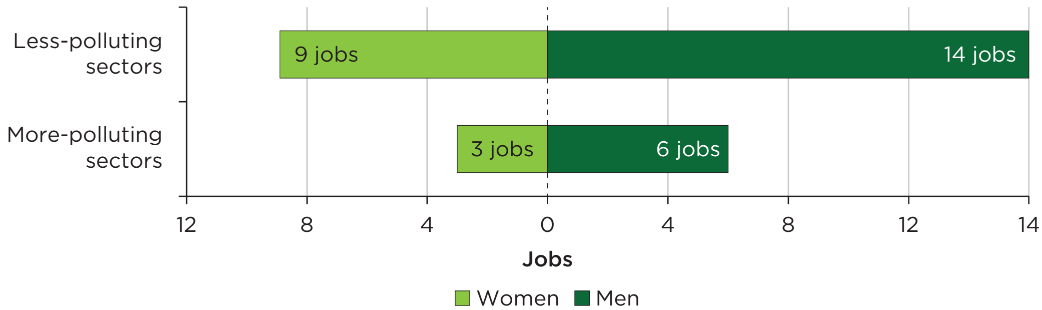
Unlocking the future: the promise of cleaner jobs

Environmental conditions shape employment and productivity. Natural resource endowments—such as fertile soils, healthy fisheries, and forests—provide the foundation for millions of jobs in agriculture, fisheries, and tourism. Globally, 3.2 billion people rely on food systems and primary production for their livelihoods, making agriculture the world's largest employment sector (Barbier 2025; Nico and Christiaensen 2023). Similarly, the fishing sector employed 61.8 million people in 2022, reflecting its role in both global food security and economic stability (FAO 2024).

Pollution, resource depletion, floods, and droughts can threaten jobs by degrading the ecosystems that sustain them and undermining human capital. Beyond ecosystem losses, pollution and environmental degradation erode human capital, impairing worker health, education, and productivity, and undermining long-term labor market resilience.

The shift toward a cleaner economy can create new economic opportunities. Investing in renewable energy, sustainable agriculture, and circular economy sectors often generates more employment per dollar invested than investing in more polluting sectors. Sectors that generate less PM2.5 pollution per unit output create significantly more jobs investment. For example, forestry leads the way, generating on average more than 38 jobs per $1 million. Less-polluting industries, such as fishing, health, and education, also exhibit high employment multipliers (figure O.9). The figure also highlights gender distribution within each sector, showing that less-polluting industries provide more diverse employment opportunities and are therefore more conducive to a balanced distribution of employment between males and females. Other issues to consider include the sustainability of resource use, the need to retrain, upskill, or reskill workers from legacy industries to meet these evolving demands, and the need for safety nets and other forms of support for workers in transition to ensure they are not left behind.

FIGURE O.9 Less-polluting sectors create more jobs



Source: Original calculations based on data from Taheripour et al. 2022.
Note: Refer to chapter 9 for details.[1]

Getting the policies right

Getting the policies right is a necessary condition for improving livability while enhancing economic opportunity. Well-designed policies can generate the incentives needed to shift behaviors toward more efficient and sustainable production and resource use. Achieving this will require: accurate and timely information; enabling policies to incentivize the shift to a smarter development path that transcends sector silos; and the evaluation of policies to improve adaptivity and response.

Information

Information is the foundation of effective policy, shaping both demand for change and the ability to act on it. Environmental transformations succeed when they garner widespread and enduring public support. Public awareness of risks—whether through air pollution, water pollution, or deforestation—creates citizen pressure for action. A challenge is that those risks are not always visible. Digital technologies offer unprecedented opportunities to close these information gaps, improving environmental monitoring, supply chain transparency, and access to knowledge.

Conversely, misinformation distorts public debate, slowing necessary reforms and entrenching harmful policies. Without accurate information, even well-designed policies risk failing due to a lack of public buy-in or poor implementation. Digital technologies may offer an opportunity to overcome governance deficiencies and capacity constraints in a variety of settings (box 1). Innovations in real-time monitoring enable effective tracking of environmental challenges, while technologies like blockchain facilitate the corruption-free enforcement of regulations.

BOX 1:
Smart systems for environmental enforcement

Digital technologies are opening new frontiers for environmental governance, particularly where regulatory capacity is weak. One promising innovation is the use of blockchain-based smart contracts to enforce environmental regulations transparently and automatically. Smart contracts are lines of code embedded in a blockchain that execute predefined actions when specific conditions are met. For example, when pollution levels detected by sensors exceed a legal threshold, a smart contract could trigger a fine, a tax adjustment, or a payment to affected communities. Because transactions on blockchains are secure and tamper-proof, this approach reduces opportunities for corruption and builds trust among stakeholders. When combined with real-time monitoring systems, smart contracts can help close the gap between regulation and enforcement, especially in low-capacity settings where traditional oversight mechanisms fall short (Damania et al. 2019).

These technologies are already being piloted in real-world applications. For example, a Wastewater Reuse Certificate system developed in Maharashtra, India, uses Internet of Things meters to record freshwater intake and wastewater recycling outputs, and stores verified data entries on a blockchain ledger, ensuring transparent compliance and incentivizing efficient and circular water reuse through a tradable credit mechanism (2030 Water Resources Group 2021). In the United States, a pilot project in California's Solano County integrated blockchain technology with Internet of Things sensors and satellite data to monitor groundwater usage, enabling transparent water trading among farmers and ensuring compliance with sustainable groundwater management practices (Barber 2019). In Queensland, Australia, the Water Ledger project launched a pilot to evaluate the potential of blockchain in improving water rights trading to enhance the efficiency and transparency of the country's water markets (Skevington and Bacina 2020). These examples demonstrate the potential of digital tools in enhancing regulatory transparency, reducing corruption, and enforcing environmental norms more effectively.

Better information is needed to ensure policies are designed using data-driven insights that are grounded in science. Environmental data enhance public awareness and enable governments to design more effective, locally-tailored policies. A robust data infrastructure—combined with transparent and accountable institutions—is essential for building adaptive policy systems that learn and evolve over time. But information must be interpreted through a scientific lens. The Earth's systems operate within natural boundaries, or thresholds beyond which human pressures can trigger irreversible damage. Even amid uncertainty of where those safe thresholds lie, staying within science-defined boundaries is far less costly than recovering from ecological collapse.

Enabling policies

Effective policies require a systems approach with complementary strategies. This is essential for three fundamental reasons. First, policies must address interconnections across sectors, geographies, and time. For example, a land-use policy aimed at reducing deforestation in one region may lead to increased agricultural expansion in another, a phenomenon known as "leakage". Second, a systems approach is crucial for achieving multiple objectives while minimizing unintended consequences. This is termed the Tinbergen Principle, which holds that achieving multiple objectives typically requires multiple policy instruments (Tinbergen 1952). For example, pricing scarce natural resources would improve allocative efficiency but may exacerbate inequality and poverty. And third, policies must tackle interacting constraints and externalities that impede effective solutions. For example, innovation is typically path-dependent, implying that there is inertia to adopting newer technologies, even if these are more profitable (Acemoglu et al. 2012; Aghion et al. 2019). In such settings, policy interventions must correct not just environmental externalities, but also technology adoption constraints. In sum, a systems approach ensures that policies are more effective and mutually reinforcing, aligning social, economic, and ecological objectives.

For reforms to succeed, they must be not just well-designed, but also politically feasible (box 2). This calls for deeper analysis of stakeholder interests, power dynamics, and institutions to craft policies that are implementable. Who stands to gain or lose from a policy matters just as much as the policy itself. Vested interests—whether in government, industry, or local communities—can block or distort implementation if not adequately engaged. Crafting implementable reforms means aligning incentives, sequencing changes strategically, and identifying champions within the system who can navigate resistance (World Bank 2017).

BOX 2:
Collective action, inequality, and incentivizing shared solutions

Addressing complex environmental challenges—such as deforestation, emissions, open-access fisheries, and biodiversity loss—requires coordinated collective action. Yet such cooperation is often elusive in the presence of heterogeneous preferences, when differences in how groups value outcomes, or trust institutions, or perceive environmental risks hinder agreement on shared solutions (Besley and Persson 2011). These differences can be cultural or political, but they are often rooted in economic inequality.

Inequality compounds the challenge. In societies marked by large disparities, wealthier groups may be insulated from environmental harm and less motivated to support collective action. Meanwhile, poorer and more vulnerable populations often face the harshest consequences of environmental degradation but lack the resources to meaningfully influence policy. This asymmetry erodes trust and weakens the social contract, undermining both local and global cooperation.

Solutions must address these coordination failures. The global nature of some environmental threats means that countries often bear local costs while benefits accrue regionally or globally, inviting freeriding and underinvestment. As part of the World Bank Group Evolution, new mechanisms such as the International Bank of Reconstruction and Development's Framework for Financial Incentives, which include the Livable Planet Fund, and the International Development Association Global and Regional Opportunities Window, aim to correct these misaligned incentives. By offering larger volumes, longer maturities, or reduced borrowing costs for initiatives that address air pollution, emissions, or transboundary resource management, such mechanisms reduce the short-term tradeoffs associated with global public goods, paving the way for long-term collective gains.

Evaluation

Evaluation is essential for adaptive policy in a changing world. In an era of economic uncertainty, geopolitical shifts, and rapid technological change, fixed policy designs are a liability. What works today may fail tomorrow, and vice versa. Policy evaluation provides the evidence and feedback needed to recalibrate programs as contexts evolve. Through real-time learning and post hoc analysis, evaluation helps identify what is working, for whom, and under what conditions. It also ensures that successful initiatives are recognized and scaled, particularly in complex policy areas where results may take time to manifest. Rigorous evaluations are not a luxury, but a form of institutional memory that makes policy smarter, more resilient, and more accountable over time. Box 3 provides examples of policy successes and summarizes lessons that can be learned from them.

BOX 3:

Lessons from success: managing land, water, and air

Land management: restoring soils, protecting forests, and linking people to places
Land restoration efforts are most effective when they integrate ecological renewal with economic opportunity. China's Loess Plateau rehabilitation is a landmark example: once degraded by erosion and overgrazing, the region was transformed through coordinated zoning, terracing, afforestation, and grazing bans. These efforts doubled vegetation cover, slashed sediment runoff into the Yellow River, and tripled household incomes (World Bank 2007). In Africa, the nonprofit African Parks has shown how conservation and economic growth can go hand in hand, reviving wildlife populations through protected area management while boosting nature-based tourism and reinvesting revenues (Denny, Englander and Hunnicutt 2024). Across Latin America, granting Indigenous communities formal land rights has been shown to be an effective strategy for biodiversity protection and reducing deforestation (Blackman and Veit 2018; Walker et al. 2014).

Water management: paying to save, not pump
Groundwater irrigation sustains hundreds of millions of people globally, but in some regions, water is being depleted faster than it can be replenished (Rodella, Zaveri and Bertone 2023). Generous electricity subsidies eliminate the marginal costs of pumping groundwater. To address this, a program in Gujarat offered farmers cash for reducing electricity from pumping, relative to a past baseline (Hagerty and Zucker 2024). By providing rewards instead of imposing charges, the program established politically feasible incentives. Conservation became a source of income, resulting in a 24 percent reduction in irrigation hours without affecting yields (Hagerty and Zucker 2024). Savings were achieved with modest payments at levels feasible for real-world policy, offering a promising path for managing groundwater in water-stressed regions worldwide.

Pollution management: act early, integrate solutions, and work together
Effective pollution management rests on two pillars: information and integrated strategies. Smart nitrogen policies have delivered major wins in curbing nitrogen pollution. China has implemented multiple policies that have contributed to a decline in fertilizer use without compromising grain production (Ji, Liu and Shi 2020; Cui et al. 2018). For air pollution, the Gothenburg Protocol helped Europe cut sulfur dioxide emissions by 83 percent and nitrogen oxides by 47 percent (Heo et al. 2023). These examples show that with the right mix of science, incentives, and cooperation, pollution is a solvable challenge.

Tailoring policy reforms to capacity

Countries need to tailor reforms to fit their institutional context. In low-capacity settings, priorities include keeping reforms simple and incentive-compatible; framing policies around development co-benefits; empowering local institutions; leveraging technologies to leapfrog enforcement gaps; and sequencing reforms. In high-capacity countries, complementary levers include layering complex policy instruments; supporting breakthrough innovations; enabling global technology diffusion; and unlocking new markets.

Prosperity through stewardship

The wealth of nature is not a constraint; rather, it is the foundation for long-term prosperity. Protecting ecosystems is essential, not only for planetary stability, but also for improving the competitiveness and resilience of local economies. Seizing this opportunity requires aligning economic incentives with environmental stewardship to ensure growth enhances, rather than erodes, natural capital. Countries that leverage their comparative advantages in green production, invest in circular economies, and build industries that thrive within ecological limits will be the ones that prosper. From sustainable cities and cleaner industries to well-managed resource economies, the path forward is clear: economic transformation must work with, not against, nature.

[1] Damania, Richard, Ebad Ebadi, Kentaro Mayr, Jason Russ, and Esha Zaveri. 2025. *Reboot Development: The Economics of a Livable Planet*. Washington, DC: World Bank. doi:10.1596/978-1-4648-2271-1. License: Creative Commons Attribution CC BY 3.0 IGO

References

2030 Water Resources Group. 2021. *Wastewater Reuse Certificates as Tradeable Permits : A Handbook for Roll-out*. Washington, D.C. : World Bank Group. https://documents1.worldbank.org/curated/en/321971634109366996/pdf/Wastewater-Reuse-Certificates-as-Tradeable-Permits-A-Handbook-for-Roll-Out.pdf.

Acemoglu, D, Aghion, P, Bursztyn, L and Hemous, D. 2012. "The Environment and Directed Technical Change." *American Economic Review 102*(1): 131–166.

Aghion, P, Hepburn, C, Teytelboym, A and Zenghelis, D. 2019. "Path Dependence, Innovation and the Economics of Climate Change." In *Handbook on Green Growth*, pp. 67–83. Edward Elgar Publishing.

Aguilar-Gomez, S., Dwyer, H., Graff Zivin, J. and Neidell, M., 2022. "This is air: The "nonhealth" effects of air pollution." *Annual Review of Resource Economics 14(1):* 403-425.

Araujo, R and Hector, V. 2024. "Deforestation, Rainfall, and Energy: Mapping the Impacts of Deforestation on Rainfall and Hydropower Generation." Background paper for this report.

Avner, P., E. Blanc, A. Castillo Castillo, M. Demuzere, and M. Roberts. 2025. "Twice Exposed? Do Welfare and Thermal Inequalities Overlap? Evidence From a Global Sample of Cities." Background paper for this report.

Bai, Z, Russ, J, Mayr, K and Dent, D. 2025. "How is Gaia Doing? Trends in Global Land Degradation and Improvement." *Ambio, 1-37*

Bar-On, Y. M., Phillips, R., & Milo, R. 2018. "The biomass distribution on Earth." *Proceedings of the National Academy of Sciences, 115*(25), 6506-6511.

Barber, G. 2019. "How the Blockchain Could Protect California's Aquifer." *Wired*, April 26. https://www.wired.com/story/how-blockchain-could-protect-californias-aquifer

Barbier, E B. 2025. "Greening Agriculture for Rural Development." *World Development* 191: 106974.

Besley, T and Persson, T. 2011. *Pillars of Prosperity: The Political Economics of Development Clusters*. Princeton University Press.

Blackman, A and Veit, P. 2018. "Titled Amazon Indigenous Communities Cut Forest Carbon Emissions." *Ecological Economics* 153: 56-67.

CIESIN. 2018. Gridded Population of the World, Version 4 (GPWv4): Population Count, Revision 11. Center For International Earth Science Information Network, Columbia University. https://data.nasa.gov/dataset/gridded-population-of-the-world-version-4-gpwv4-population-count-revision-11

Cui, Z, Zhang, H, Chen, X, Zhang, C, Ma, W, Huang, Zhang, W, Mi, G, Miao, Y, Li, X, Gao, Q, Yang, J, Wang, Z, Ye, Y, Guo, S, Lu, J, Huang, J, Lv, S, Sun, Y, Liu, Y, Peng, X, Ren, J, Li, S, Deng, X, Shi, X, Zhang, Q, Yang, Z, Tang, L, Wei, C, Jia, L, Zhang, J, He, M, Tong, Y, Tang, Q, Zhong, X, Liu, Z, Cao, N, Kou, C, Ying, H, Yin, Y, Jiao, X, Zhang, Q, Fan, M, Jiang, R, Zhang, F and Dou, Z. 2018. "Pursuing Sustainable Productivity with Millions of Smallholder Farmers." *Nature* 555(7696): 363–366.

Damania, R, Balseca, E, de Fontaubert, C, Gill, J, Kim, K, Rentschler, J, Russ, J and Zaveri, E. 2023. *Detox Development: Repurposing Environmentally Harmful Subsidies*. Washington DC: World Bank. http://hdl.handle.net/10986/39423.

Damania, R, Desbureaux, S, Rodella, A S, Russ, J and Zaveri, E. 2019. *Quality Unknown: The Invisible Water Crisis.* Washington DC: World Bank. https://hdl.handle.net/10986/32245.

Damania, R, Ebadi, E, Mayr, K, Rentschler, J, Russ, J and Zaveri, E. 2025. *Nature's Paradox: Stepping Stone or Millstone?* Washington DC: World Bank. http://hdl.handle.net/10986/42610.

Dasgupta, S P. 2021. *The Economics of Biodiversity: The Dasgupta Review – Abridged Version.* London: HM Treasury. https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review.

De Petrillo, E, Fahrländer, S, Tuninetti, M, Andersen, L S, Monaco, L, Piemonte, T, Ridol, I L and Laio, F. 2024. "Reconciling Tracked Atmospheric Water Flows to Close the Global Freshwater Cycle." *Preprint.* EarthArXiv.

Denny, S, Englander, G and Hunnicutt, P. 2024. "Private Management of African Protected Areas Improves Wildlife and Tourism Outcomes but with Security Concerns in Conflict Regions." *Proceedings of the National Academy of Sciences* 121(29): e2401814121.

Dodman, D, Hayward, B, Pelling, M, Castán Broto, V, Chow, W, Chu, E, Dawson, R, Khirfan, L, McPhearson, T, Prakash, A, Zheng , Y and Ziervogel, G. 2023. "Cities, Settlements and Key Infrastructure." In: *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H-O Pörtner, D C Roberts, M Tignor, E S Poloczanska, K Mintenbeck, A Alegría, M Craig, S Langsdorf, S Löschke, V Möller, A Okem and B Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 907–1040, doi:10.1017/9781009325844.008.

FAO. 2024. *The State of World Fisheries and Aquaculture 2024 – Blue Transformation in Action.* Rome: Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/cd0683en.

FAO, IFAD, UNICEF, WFP and WHO. 2024. *The State of Food Security and Nutrition in the World 2024 – Financing to End Hunger, Food Insecurity and Malnutrition in All its Forms*. Rome: FAO. https://doi.org/10.4060/cd1254en.

Folke, C, Polasky, S, Rockström, J, Galaz, V, Westley, F, Lamont, M, Scheffer, M, Österblom, H, Carpenter, S R, Chapin III, F S, Seto, K C, Weber, E U, Crona, B I, Daily, G C, Dasgupta, P, Gaffney, O, Gordon, L J, Hoff, H, Levin, S A, Lubchenco, J, Steffen, W and Walker, B H. 2021. "Our Future in the Anthropocene Biosphere." *Ambio, 50*: 834–869.

Frank, E and Sudarshan, A. 2024. "The Social Costs of Keystone Species Collapse: Evidence from the Decline of Vultures in India." *American Economic Review* 114(10): 3007–3040. www.doi.org/10.1257/aer.20230016.

Greenspoon, L., N. Ramot, U. Moran, U. Roll, R. Phillips, E. Noor, and R. Milo (in press). "The Global Biomass of Mammals Since 1850." Nature Communications.

Greenstone, M, Pande, R, Sudarshan, A and Ryan, N. 2023. *Can Pollution Markets Work in Developing Countries? Experimental Evidence from India.* Coventry, UK: Department of Economics, University of Warwick.

Gu, B, Zhang, X, Lam, S K, Yu, Y, van Grinsven, H J M, Zhang, S, Wang, X, Bodirsky, B L, Wang, S, Duan, J, Ren, C, Bouwman, L, de Vries, W, Xu, J, Sutton, M A and Chen, D. 2023. "Cost-effective Mitigation of Nitrogen Pollution from Global Croplands." *Nature 613*(7942): 77–84.

Hagerty, N. and Zucker, A.D., 2024, "Price Incentives for Conservation: Experimental Evidence from Groundwater Irrigation". Working Paper IND-22167, International Growth Centre.

Heo, S W, Ito, K and Kotamarthi, R. 2023. "International Spillover Effects of Air Pollution: Evidence from Mortality and Health Data." Working paper 30830. National Bureau of Economic Research.

IEA. 2023. "Now is the Time to Climate-proof Europe's Economy." International Energy Agency, November 24. https://www.iea.org/commentaries/now-is-the-time-to-climate-proof-europes-economy.

Ji, Y., H. Liu, and Y. Shi. 2020. "Will China's Fertilizer Use Continue to Decline? Evidence from LMDI Analysis Based on Crops, Regions and Fertilizer Types." *PLoS One* 15 (8): e0237234.

Katovich, E., and J. Rexer. 2025. "Critical Mining Contributes to Economic Growth and Forest Loss in High-Corruption Settings." Available at SSRN 5291760. Background paper for this report.

Liemberger, R and Wyatt, A. 2019. "Quantifying the Global Non-revenue Water Problem." *Water Supply* 19(3): 831–837.

Mukim, M. and Roberts, M. 2023. *Thriving: Making cities green, resilient, and inclusive in a changing climate*. Washington DC: World Bank. https://openknowledge.worldbank.org/entities/publication/7d290fa9-da18-53b6-a1a4-be6f7421d937

Nature-based Solutions Initiative. (n.d.). "Community-led Mangrove Restoration and Sustainable Fishing." https://casestudies.naturebasedsolutionsinitiative.org/casestudy/connecting-the-dots-biodiversity-adaptation-food-security-and-livelihoods-mangrove-restoration-by-the-pred-nai-community-in-thailand.

Nico, G and Christiansen, L. 2023. “Jobs, Food and Greening: Exploring Implications of The Green Transition for Jobs in The Agri-Food System.” Washington DC: World Bank.

Richardson, K, Steffen, W, Lucht, W, Bendtsen, J, Cornell, S E, Donges, J F, … and Rockström, J. 2023. “Earth Beyond Six of Nine Planetary Boundaries.” *Science Advances* 9(37): eadh2458.

Roberts, M, Deuskar, C, Jones, N and Park, J. 2023. *Unlivable: What the Urban Heat Island Effect Means for East Asia’s Cities*. Washington DC: World Bank. https://www.worldbank.org/en/region/eap/publication/unlivable-what-the-urban-heat-island-effect-means-for-east-asia-s-cities.

Rodella, A-S, Zaveri, E, Bertone, F. 2023. *The Hidden Wealth of Nations: The Economics of Groundwater in Times of Climate Change*. Washington DC: World Bank. https://www.worldbank.org/en/topic/water/publication/the-hidden-wealth-of-nations-groundwater-in-times-of-climate-change.

Skevington, T and Bacina, M. 2020. “The Taps Turn on for Water Ledger Pilot Project.” *Bits of Blocks, Blockchain, Law and Regulation,* May 15. https://www.bitsofblocks.io/post/water-ledger-pilot-project-goes-live.

Sutton, M A, Bleeker, A, Howard, C M, Bekunda, M, Grizzetti, B, de Vries, W, van Grinsven, H J M, Abrol, Y P, Adhya, T K, Billen, G, Davidson, E A, Datta, A, Diaz, R, Erisman, J W, Liu, X J, Oenema, O, Palm, C, Raghuram, N, Reis, S, Scholz, R W, Sims, T, Westhoek, H and Zhang, F S. 2013. *Our Nutrient World: The Challenge to Produce More Food and Energy with Less Pollution*. Edinburgh: NERC/Centre for Ecology & Hydrology.

Taheripour, F, Chepeliev, M, Damania, R, Farole, T, Gracia, N L and Russ, J D. 2022. “Putting the Green Back in Greenbacks: Opportunities for a Truly Green Stimulus.” *Environmental Research Letters* 17(4): 044067.

Tinbergen, J. 1952. *On the Theory of Economic Policy*. Amsterdam: North-Holland.

UNESCO. 2023. *Global Education Monitoring Report 2023: Technology in Education – A Tool on Whose Terms?* Paris: United Nations Educational, Scientific and Cultural Organization.

UNICEF and WHO. 2024. *Progress on Household Drinking Water, Sanitation and Hygiene 2000-2022: Special Focus on Gender*. World Health Organization and United Nations Children’s Fund.

van Donkelaar, A, Martin, R V, Brauer, M, Hsu, N C, Kahn, R A, Levy, R C, Lyapustin, A, Sayer, A M and Winker, D M. 2016. “Global Estimates of Fine Particulate Matter using a Combined Geophysical-Statistical Method with Information from Satellites, Models, and Monitors.” *Environmental Science & Technology* 50, 3762–3772. https://doi.org/10.1021/acs.est.5b05833.

Van Vliet, J. 2019. “Direct and Indirect Loss of Natural Area from Urban Expansion.” *Nature Sustainability*, *2*(8): 755–763.

Wolf, J, Johnston, R B, Ambelu, A, Arnold, B F, Bain, R, Brauer, M, Brown, J, Caruso, B A, Clasen, T, Colford, J M, Esteves Mills, J, Evans, B, Freeman, M C, Gordon, B, Kang, G, Lanata, C F, Medlicott, K O, Prüss-Ustün, A, Troeger, C, Boisson, S and Cumming, O. 2023. “Burden of Disease Attributable to Unsafe Drinking Water, Sanitation, and Hygiene in Domestic Settings: A Global Analysis for Selected Adverse Health Outcomes.” *The Lancet* 401(10393): 2060–2071.

World Bank. 2007. “Restoring China’s Loess Plateau.” Feature story, March 15. World Bank. https://www.worldbank.org/en/news/feature/2007/03/15/restoring-chinas-loess-plateau.

World Bank. 2017. *World Development Report 2017: Governance and the Law*. Washington DC: World Bank. https://www.worldbank.org/en/publication/wdr2017.

World Bank. 2020. *Addressing Food Loss and Waste: A Global Problem with Local Solutions*. Washington, D.C.: World Bank Group. https://openknowledge.worldbank.org/entities/publication/1564bf5c-ed24-5224-b5d8-93cd62aa3611.

World Bank. 2021. *Developing Human Capital in Egypt through Energy Subsidy Reforms: A Case Study*. Washington, D.C.: World Bank Group. https://openknowledge.worldbank.org/server/api/core/bitstreams/684a9603-758d-5113-ad5c-df4507114f29/content.

World Bank. 2024a. Poverty, Prosperity, and Planet Report 2024: Pathways Out of the Polycrisis. © Washington, DC: World Bank. http://hdl.handle.net/10986/42211 License: http://creativecommons.org/licenses/by/3.0/igo CC BY 3.0 IGO.

World Bank. 2024b. Power more with less: Energy efficiency for a secure and affordable transition (Approach Paper). Energy and Extractives Global Knowledge Unit, Infrastructure Vice Presidency. https://openknowledge.worldbank.org/handle/10986/41957.

World Bank, 2025. *Accelerating Access to Clean Air for a Livable Planet (English)*. Washington, D.C.: World Bank Group. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099032625132535486.

WRI. 2023. "Aqueduct Water Risk Atlas." World Resources Institute. https://www.wri.org/applications/aqueduct/water-risk-atlas.

Zaveri, E. 2025. "Fixing Nitrogen: Agricultural Productivity, Environmental Fragility, and the Role of Subsidies." Washington DC: World Bank. http://hdl.handle.net/10986/42737.

Reboot Development: The Economics of a Livable Planet explores how the foundational natural endowments of land, air, and water—long taken for granted—are under growing threat, putting at risk the very progress they helped create. For generations, natural resources have powered development, supporting health, food, energy, and economic opportunity. Today, strains on these resources are intensifying. This report argues that failing to maintain a livable planet is not merely a distant environmental concern, but a present economic threat. Drawing on new data, the report shows that over 90 percent of the world is exposed to poor air quality, degraded land, or water stress. Loss of forests cuts rainfall, dries soils, and worsens droughts, costing billions of dollars. The nitrogen paradox emerges—fertilizers boost yields but overuse in some regions harms crops and ecosystems. Meanwhile, air and water pollution silently damage health, productivity, and cognition, sapping human potential. The report warns that these hidden costs are too large to ignore.

Yet the message is not one of constraint but of possibility. Nature, when wisely stewarded, can drive growth, create jobs, and build resilience. The report shows that more efficient resource use—like better nitrogen management and forest restoration—yields benefits that far exceed the costs. It also urges a shift to cleaner sectors and producing “better things,” noting that these provide new sources of growth, creating more jobs per dollar invested. The findings are clear: Investing in nature is not only good for the planet, it is smart development.

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