CHAPTER 2

Patterns and trends in human development, equity and environmental indicators

This chapter reviews patterns and trends in human development, inequality and key environmental indicators. We present new evidence of the threats to progress posed by environmental degradation and inequalities within and across countries. The most disadvantaged bear and will continue to bear the consequences of environmental degradation, even if many contribute little to the underlying causes.

Progress and prospects

Progress in many aspects of human development has been substantial over the past 40 years, as the 2010 *Human Development Report* (*HDR*) showed. But income distribution has worsened, and environmental degradation threatens future prospects.

Progress in human development

Most people today live longer, are more educated and have more access to goods and services than ever before. Even in economically distressed countries, people's health and education have improved greatly. And progress has extended to expansions in people's power to select leaders, influence public decisions and share knowledge.

Witness the gains in our summary measure of development, the Human Development Index (HDI), a simple composite measure that includes health, schooling and income. The world's average HDI increased 18 percent between 1990 and 2010 (41 percent since 1970), reflecting large improvements in life expectancy, school enrolment, literacy and income.[1] Almost all countries benefited. Of the 135 countries in our sample for 1970–2010 (with 92 percent of the world's people), only three had a lower HDI in 2010 than in 1970. Poor countries are catching up with rich countries on the HDI, convergence that paints a far more optimistic picture than do trends in income, where divergence continues.

But not all countries have seen rapid progress, and the variations are striking. People in Southern Africa and the former Soviet Union have endured times of regress, especially in health. And countries starting from the same position had markedly different experiences. China's per capita income grew an astounding 1,200 percent over the 40 years, but the Democratic Republic of the Congo's fell 80 percent. Advances in technical knowledge and globalization made progress more feasible for countries at all levels of development, but countries took advantage of the opportunities in different ways.

The 2010 *HDR* reviewed trends in empowerment—people's ability to exercise choices and to participate in, shape and benefit from household, community and national processes. For the Arab States the situation described last year—of few signs of in-depth democratization—has changed profoundly since late 2010 (box 2.1).

Has progress come at the cost of environmental degradation?

Not all sides of the story are positive. Income inequality has worsened, and production and consumption patterns, especially in rich countries, seem to be unsustainable.

To explore environmental trends, we need to decide which measure of environmental degradation to use. The conceptual challenges were considered in chapter 1. There are also data challenges, and some measures are available only for recent years. Box 2.2 discusses the important insights offered by leading aggregate sustainability measures. But to understand patterns and trends, we prefer to use specific indicators.[2]

BOX 2.1

Overcoming the democratic deficit—empowerment and the Arab Spring

Last year's *Human Development Report (HDR)* looked at the "democratic deficit" in the Arab States, seeking to understand why the region had demonstrated few signs of significant democratization.

Drawing on the *Arab Human Development Reports* since 2002, the 2010 global *HDR* pointed to the stark contrasts between actual practice and formal adherence to democracy, human rights and the rule of law. It emphasized that many democratic reforms in the region had been offset by countermeasures limiting citizen rights in other respects—including nearly unchecked concentration of power in the executive branch. Civil society, in turn, was weak: "Popular demand for democratic transformation and citizens' participation is a nascent and fragile development in the Arab countries," noted the 2009 *Arab Human Development Report* (p. 73).

Even so, in most of the Arab States long-term trends showed major progress in income, health and education, the Human Development Index (HDI) dimensions, since 1970. Five Arab States emerged among the top 10 performers—Oman, Saudi Arabia, Tunisia, Algeria and Morocco—while Libya was among the top 10 countries in nonincome HDI achievement. All these countries advanced due mainly to improvements in health and education.

Particularly striking were the changes in these countries relative to others at a similar HDI 40 years earlier. For instance, in 1970 Tunisia had a lower life expectancy than the Democratic Republic of the Congo and fewer children in school than Malawi. Yet by 2010 Tunisia was in the high HDI category, with an average life expectancy of 74 years and most children enrolled through secondary school.

The recent pro-democracy protests across the Arab States began in Tunisia and Egypt, driven in both cases by educated urban youth. Multiple and complex causes underlie any social phenomena, but the democratization movement can be considered a direct consequence of human development progress. Indeed, many analysts over the years—sociologists, political scientists and others both in and outside the region—have argued that popular demand for democracy and human rights is an integral part of broader modernization and development. As the first *Arab Human Development Report* affirmed in 2002 (p. 18): "Human development, by enhancing human capabilities, creates the ability to exercise freedom, and human rights, by providing the necessary framework, create the opportunity to exercise it. Freedom is both the guarantor and the goal of both human development and human rights."

In the long run people who have attained higher levels of education and who have experienced rising living standards are unwilling to tolerate continued autocratic rule. For example, health and education are often necessary for meaningful participation in public life. Progress in these areas often occurs through their extension to the disadvantaged and disenfranchised, and once extended, it is very hard for elites to exclude the broader population from civic and political rights. The transition in the former Soviet Union is an earlier example of this pattern.

But this progress must be placed within a broader context. Development has led to other contradictions, with rising but unfulfilled expectations often generating deep social frustrations. Inequality has increased while cellphones and Twitter™ have permitted more rapid transmission of ideas. Many analysts have pointed to high unemployment and underemployment among educated youth as a key factor driving political dissent in the region. Half the population in the Arab States is under 25, and youth unemployment rates are nearly double the global average. In Egypt an estimated 25 percent of college graduates cannot find full-time professional work—in Tunisia that figure rises to 30 percent.

Although the outcome of this year's political upheavals will not be clear for some time, the region has already profoundly changed. What was striking until recently was the juxtaposition of authoritarian rule and rising development achievement. In 2011 this "Arab democracy paradox" seemed to be coming to a sudden end, opening the door to a much fuller realization of people's freedoms and capabilities throughout the region.

Source: 2010 *HDR* (UNDP–HDRO 2010; see inside back cover for a list of *HDR*s); UNDP 2002, 2009; Kimenyi 2011.

We have drawn on a wealth of research and analysis to determine which indicators provide the best insights.

We start by looking at patterns of carbon dioxide emissions over time, a good if imperfect proxy for the environmental impacts of a country's economic activity on climate. Emissions per capita are much greater in very high HDI countries than in low, medium and high HDI countries combined, because of many more energy-intensive activities, such as driving cars, using air conditioning and relying on fossil fuel–based electricity.[3] Today, the average person in a very high HDI country accounts for more than four times the carbon dioxide emissions and about twice the emissions of the other important greenhouse gases (methane, nitrous oxide) as a person in a low, medium or high HDI country.[4] Compared with an average person living in a low HDI country, a person in a very high HDI country accounts for about 30 times the carbon dioxide emissions. For example, the average UK citizen accounts for as much greenhouse gas emissions in two months as a person in a low HDI country generates in a year. And the average Qatari —living in the country with the highest per capita greenhouse gas emissions—does so in only 10 days, although this figure reflects both consumption within the country and production that is consumed elsewhere, an issue we revisit below.

Of course, development has many dimensions. The HDI recognizes this by aggregating measures of three key dimensions—income, health and education. How do these

BOX 2.2

What can we learn from trends in aggregate measures of sustainability?

Of the aggregate measures of sustainability surveyed in box 1.2 in chapter 1, only two are available for a large number of countries over a reasonably long period: the World Bank's adjusted net savings and the Global Footprint Network's ecological footprint. What do these measures tell us?

Adjusted net savings is positive for all Human Development Index (HDI) groups, meaning that the world is (weakly) sustainable (see figure). The positive trend for low, medium and high HDI countries suggests that their sustainability has improved over time, while that of the very high HDI countries is declining over time.

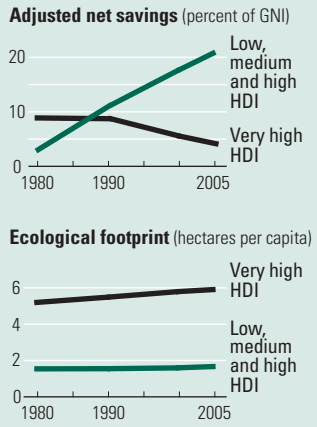
However, as reviewed in chapter 1, the concept of weak sustainability underlying adjusted net savings has been criticized for not acknowledging that sustainability requires maintaining some natural capital. Adjusted net savings also involves some other controversial methodological choices. For example, valuing natural resources at market prices can overestimate the sustainability of an economy that produces them as the resources become scarcer and thus more expensive.

Further analysis—taking into account the uncertainty embodied in greenhouse gas emissions and their monetary valuation—shows that the number of countries considered unsustainable in 2005 would rise about two-thirds—from 15 to 25—if adjusted net savings used a more comprehensive measure of emissions that includes methane and nitrous oxide as well as carbon dioxide and acknowledged valuation uncertainties. In other words, adjusted net savings may be overestimated.

The ecological footprint, by contrast, shows that the world is increasingly exceeding its global capacity to provide resources and absorb wastes. If everyone in the world had the same consumption as people in very high HDI countries and with current technologies, we would need more than three Earths to withstand the pressure on the environment.

Source: Garcia and Pineda 2011; Stiglitz, Sen and Fitoussi 2009.

Adjusted net savings and ecological footprint show different results for sustainability trends over time



Source: HDRO calculations based on data from World Bank (2011b) and www.footprintnetwork.org.

The big message from the ecological footprint is that patterns of consumption and production are unsustainable at the global level and imbalanced regionally. And the situation is worsening, especially in very high HDI countries.

The ecological footprint estimates the amount of forest that would be required to absorb carbon dioxide emissions—though this is not the only method for sequestering emissions. It neglects other key aspects of the environment, including biodiversity, and such amenities as water quality. And it focuses on consumption, so that the consumer country rather than the producer country is responsible for the impact of imported natural resources. One further issue is that most changes over time (both global and national) are driven by carbon dioxide emissions, and there is a strong correlation between the volume of carbon emissions and the value of the ecological footprint.

Another more recent measure is the environmental performance index, developed at Yale and Columbia Universities. This composite index uses 25 indicators to establish how close countries are to established environmental policy goals—a useful policy tool, built from a rich set of indicators and providing a broad definition of sustainability. But the measure's data intensity (requiring 25 indicators for more than 160 countries) inhibits construction of a time series for the analysis of trends in this Report.

dimensions interact with measures of environmental degradation?

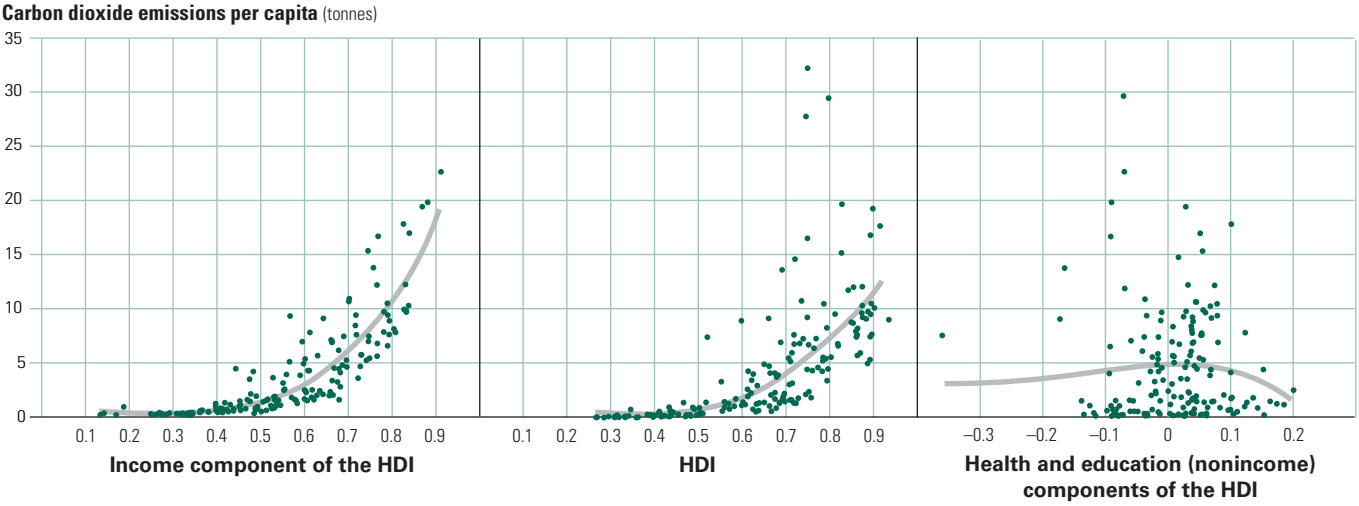
The dimensions interact very differently with carbon dioxide emissions per capita: the association is positive and strong for income, still positive but weaker for the HDI and nonexistent for health and education (figure 2.1). This result is of course intuitive: activities that emit carbon dioxide into the atmosphere are those linked to the production and distribution of goods. Carbon dioxide is emitted by factories and trucks, not by learning and vaccinations. These results also show the nonlinear relationship between carbon dioxide emissions per capita and HDI components: there is practically no relation at low levels of human development, but a "tipping point" appears to be reached beyond which a strong positive correlation between carbon dioxide emissions per capita and income is observed.

The correlation between some key measures of sustainability and national levels of development are well known. Less well known, and emerging from our analysis, is that growth in carbon dioxide emissions per capita is related to the *speed* of development. Countries with faster HDI improvements also experience a faster increase in carbon dioxide emissions per capita (figure 2.2).[5] Changes over time—not the snapshot relationship, which reflects cumulative effects—are the best guide to what to expect as a result of development today.

The bottom line: recent progress in the HDI has come at the cost of global warming. In countries advancing fastest in the HDI, carbon dioxide emissions per capita also grew faster. But these environmental costs come from economic growth, not broader gains in HDI, and the relationship is not fixed. Some

FIGURE 2.1

The association with carbon dioxide emissions per capita is positive and strong for income, positive for the HDI and nonexistent for health and education



Note: Data are for 2007.

Source: HDRO calculations, based on data from the HDRO database.

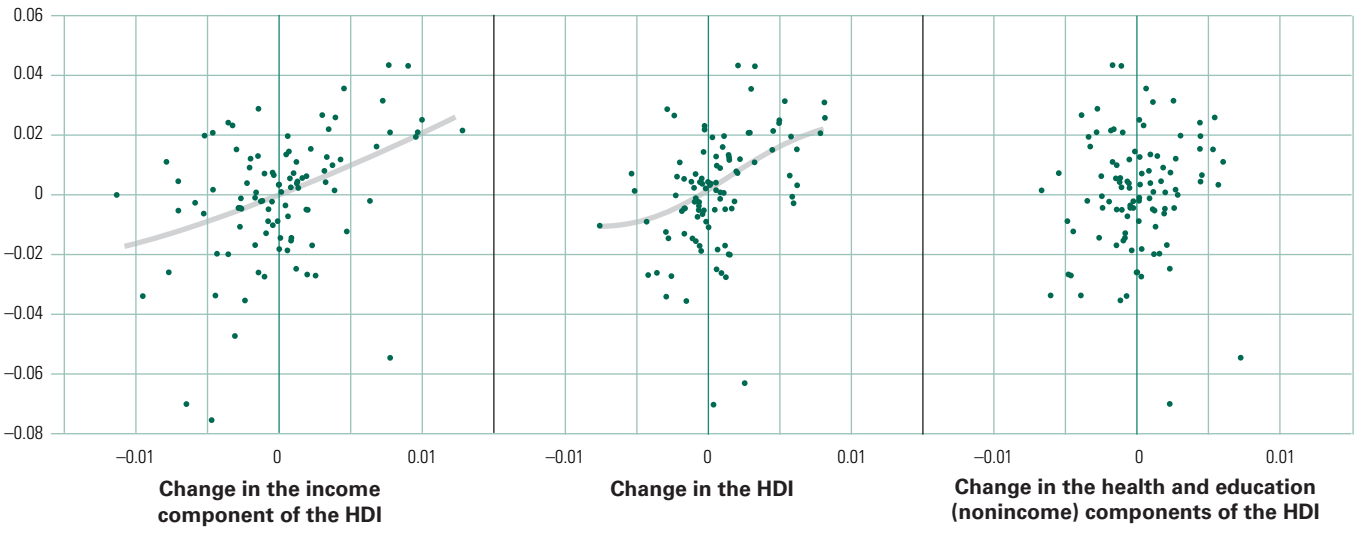
countries have advanced in both the HDI and environmental sustainability (those in the lower right quadrants of figure 2.2)—an important point investigated below.

This relationship does not hold for all environmental indicators. Our analysis finds only a weak positive correlation between levels of the HDI and deforestation, for example. Why do carbon dioxide emissions per capita differ from other environmental threats?

Research shows that some environmental threats have increased with development and others have not. A seminal study points to an inverted-U relationship for air and water pollution, showing that environmental degradation worsens then improves as the level of development rises (a pattern known as the environmental Kuznets curve).[6] This can be explained in terms of the increasing responsiveness of governments to people's desire for

FIGURE 2.2

Countries with higher growth also experience faster increase in carbon dioxide emissions per capita



Note: Data are for 2007.

Source: HDRO calculations, based on data from the HDRO database.

clean and healthy environments as countries become richer. But with carbon dioxide emissions, the damage is global and harms mostly future generations, so even very rich countries have little to gain from reining in greenhouse gas emissions unless others act too.

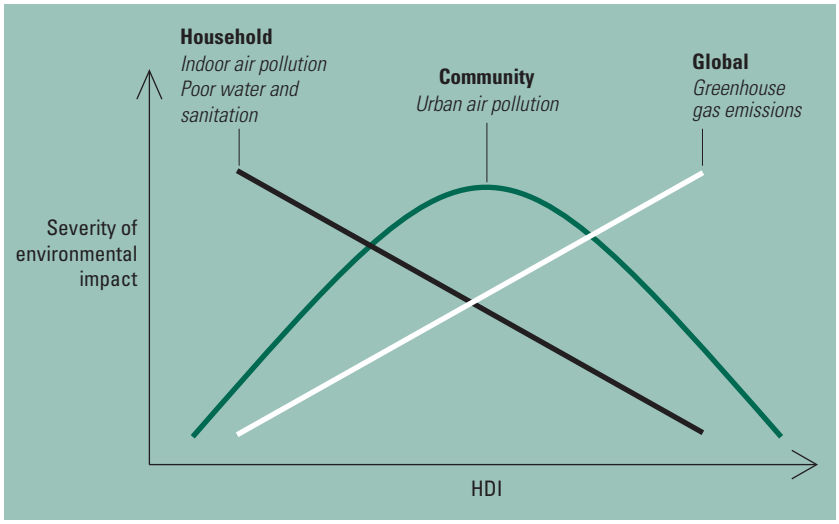
These global patterns can be seen as a series of environmental transitions and related risks for people, set against overall HDI trends. In a twist on the traditional Kuznets story, the global evidence suggests that countries address direct household deprivations first (such as access to water and energy), then community deprivations (notably pollution) and finally deprivations with global effects and externalities (namely climate change).[7] Where the link between the environment and quality of life is direct, as with pollution, environmental achievements are often greater in developed countries; where the links are more diffuse, performance is much weaker. Figure 2.3 depicts three generalized findings:

- Environmental risk factors with an immediate impact on households—such as indoor air pollution, poor water and sanitation—are more severe at lower HDI levels and decline as the HDI rises. As we show in chapter 3, within countries these threats also tend to be concentrated among the multidimensionally poor.
- Environmental risks with community effects—such as urban air pollution—seem to worsen as the HDI rises from low levels and then begin to improve beyond a certain point.[8] This is the Kuznets part of the story.
- Environmental risk factors with global effects—such as greenhouse gas emissions—tend to increase with the HDI, as shown empirically in figure 2.2.

Of course, the HDI itself is not the true driver of these transitions. Public policies are important too. Incomes and economic growth have an important explanatory role for emissions—but the relationship is not deterministic. For example, Norway's per capita carbon dioxide emissions (11 tonnes) are less than a third those of the United Arab Emirates (35 tonnes), although both have high incomes.[9] Patterns of natural resource use also vary: Indonesia deforested nearly 20 percent a year between 1990 and 2008; the Philippines, with similar per capita income, reforested 15 percent over the same period.[10] And consumption patterns are also important (box 2.3). At the international level broader forces

FIGURE 2.3

Patterns of risk change: environmental transitions and human development



Source: Based on Hughes, Kuhn and others (2011).

BOX 2.3

Consumption and human development

Runaway growth in consumption among the best-off people in the world is putting unprecedented pressure on the environment. The inequalities remain stark. Today, there are more than 900 cars per 1,000 people of driving age in the United States and more than 600 in Western Europe, but fewer than 10 in India. US households average more than two television sets, whereas in Liberia and Uganda fewer than 1 household in 10 has a television set. Domestic per capita water consumption in the very high Human Development Index (HDI) countries, at 425 litres a day, is more than six times that in the low HDI countries, where it averages 67 litres a day.

Consumption patterns are converging in some respects as people in many developing countries are consuming more luxury goods: China is poised to overtake the United States as the world's largest luxury consumer market. But even among very high HDI countries, consumption patterns vary. Consumption accounts for 79 percent of GDP in the United Kingdom and 34 percent in Singapore despite the countries' having nearly the same HDI. Among the explanations for these differences are demographic patterns and social and cultural norms, which affect savings practices, for example.

At the same time, the links with human development are often broken, as explored in the 1998 *Human Development Report:* new products often target richer consumers, discounting the needs of the poor in developing countries.

Education can be fundamentally important in tempering excessive consumption. Such efforts have been promoted by the UN General Assembly's declaration of the UN Decade of Education for Sustainable Development (2005–2014) and United Nations Educational, Scientific and Cultural Organization activities geared at encouraging sustainable consumption.

Source: Data from Morgan Stanley, as cited in *The Economist* 2008a; data from Bain and Company 2011, as cited in Reuters 2011; Heston, Summers and Aten 2009 (Penn World Table 6.3).

interact in a complex manner, changing patterns of risk—trade often allows countries to outsource the production of goods that degrade the environment, as we discuss below for deforestation. There are also outlier countries that have performed relatively well, as we show later using a broader framework of environmental risk.

The findings of the quasi-experimental analysis lend empirical weight to our argument that inequality is bad not just intrinsically but also for the environment and that weak environmental performance can worsen disparities in the HDI

Are there causal relations at play?

Did changes in sustainability come before or after changes in human development? Is there a causal relation? Are increasing inequality and environmental unsustainability causally related? For example, if wealthier groups and corporations have disproportionate political and economic power and benefit from activities that degrade the environment, they may obstruct measures that protect the environment. A counter-example is how the empowerment of women often goes hand in hand with greater protection of the environment.

Our analysis of sequencing finds that in the short run the effects go in both directions for the HDI, greenhouse gas emissions and pollution. In the long run, however, a rising HDI precedes a rise in greenhouse gas emissions, so while not conclusive, the evidence is consistent with a causal relationship where rising HDI—or at least the income component—implies higher greenhouse gas emissions in the future.

What about inequality? Using quasi-experimental methods, we explored the causal relationship between inequality (measured in terms of HDI and gender disparities) and sustainability. Although country differences in environmental performance are driven by multiple contextual and other factors, it is possible to establish causality where sources of what economists call "exogenous variation" can be identified.[11] We used climate-related shocks and changes in institutional arrangements, such as the year women received full electoral rights, as sources of exogenous variation. The results are striking.

- Poor sustainability performance—as measured by net forest depletion and especially air pollution—raised inequality in the HDI.[12]
- Higher levels of gender inequality (as measured by the Gender Inequality Index) led to lower levels of sustainability—a theme explored in chapter 3.[13]

These findings lend empirical weight to our argument that inequality is bad not just intrinsically but also for the environment. And weak environmental performance can worsen disparities in the HDI. We now examine these disparities in more detail.

Equity trends

To explore what has happened to equity over time we use a multidimensional approach that goes beyond incomes. This analysis builds on the innovation in the 2010 *HDR*, the Inequality-adjusted HDI (IHDI), which discounts human development achievements by the inequality in each dimension, and so the IHDI falls farther below the HDI as inequality rises.[14] The basic idea is intuitive. Schooling and longevity (like income) are necessary to lead fulfilling lives; therefore, we care about how they are distributed between those with more and those with less. Although incomplete, especially in the neglect of empowerment, the approach provides a fuller picture than a focus on income inequality alone.

This Report takes an important step forward by presenting trends in the IHDI since 1990 for 66 countries (see statistical table 3 for the 2011 values; *Technical note 2* explains the methodology).[15]

- Worsening income inequality has offset large improvements in health and education inequality, such that the aggregate loss in human development due to inequality sums to 24 percent.[16]
- The global trends conceal widening educational inequality in South Asia and deep health inequality in Africa.
- Latin America remains the most unequal region in income, but not in health and education.
- Sub-Saharan Africa has the greatest inequality in the HDI.

Narrowing health inequalities

Health affects people's capability to function and flourish. The evidence shows a positive

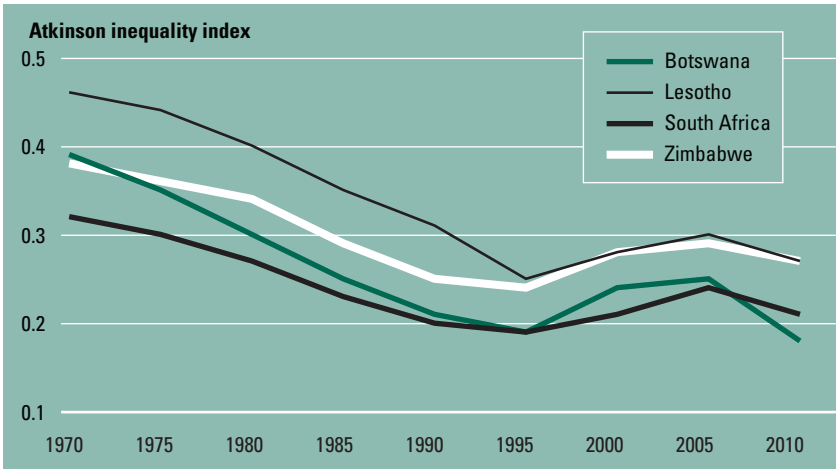
correlation between health and socioeconomic status. This has led researchers to focus on income and social inequalities as determinants of health, with recent investigations using new household data to examine trends.[17]

Our analysis suggests that the rising longevity around the world—investigated in the 2010 *HDR*—has been associated with greater equity: health inequality, measured by life expectancy, declined across the board.[18] Very high HDI countries led the way, closely followed by improvements in East Asia and the Pacific and Latin America and the Caribbean, with the Arab States not far behind. Gains were most modest in Sub-Saharan Africa, from the lowest starting levels, due mainly to the HIV/AIDS pandemic, especially in Southern Africa, where adult HIV/AIDS prevalence rates still exceed 15 percent (figure 2.4).[19]

FIGURE 2.4

High HIV/AIDS prevalence rates in Southern Africa stall improvements in health inequality

Loss in the health component of the HDI due to inequality, 1970–2010



Note: See *Technical note 2* for definition of the Atkinson inequality index. Each observation represents a five-year average.
Source: HDRO calculations based on life expectancy data from the United Nations Department of Economic and Social Affairs, Population Division, Population Estimates and Projections Section, and Fuchs and Jayadev (2011).

Improving equity in education

Progress in expanding education opportunities has been substantial and widespread, reflecting improvements in the quantity of schooling and greater gender equity and access. Not only are more children going to school, more finish.[20]

As with health, trends in the distribution of education opportunities show narrowing inequalities around the world as overall enrolments and attainment rise. For example, a study of 29 developing countries and 13 developed countries found that the power of parents' education as a predictor of their children's schooling fell substantially in most countries over the last 50 years, indicating reduced intergenerational inequality in education.[21]

Our analysis of national trends in education inequality (measured by average years of schooling) since 1970 shows improvements in most countries. In contrast with trends in income inequality, education inequality declined most in Europe and Central Asia (almost 76 percent), followed by East Asia and the Pacific (52 percent) and Latin America and the Caribbean (48 percent).

Though rising average levels of education and health attainments have generally been accompanied by narrowing inequality, the effect is not automatic. Average attainments and inequality can move in different directions and at different speeds.[22] Education inequality worsened about 8 percent in South Asia, for instance, despite a massive average increase in education attainment of 180 percent.

Widening income disparities

Income inequality has deteriorated in most countries and regions—with some notable exceptions in Latin America and Sub-Saharan Africa. Some highlights:

- Detailed studies show a striking increase in the income share of the wealthiest groups in much of Europe, North America, Australia and New Zealand.[23] From 1990 to 2005 within-country income inequality, measured by the Atkinson inequality index, increased 23.3 percent in very high HDI countries.[24] The gap between the rich and the poor widened over the last two decades in more than three-quarters of Organisation for Economic Co-operation and Development countries and in many emerging market economies.[25]
- Income has also become more concentrated among top earners in China, India and South Africa.[26] In China, for example, the top quintile of income earners had 41 percent of total income in 2008, and the Gini coefficient for income inequality rose from 0.31 in 1981 to 0.42 in 2005.

Using the same Atkinson inequality index applied to health and education and the overall IHDI, our own analysis confirms this picture and finds that average country-level income inequality increased around 20 percent over 1990–2005. The worst deterioration was in Europe and Central Asia (more than 100 percent).

Over the last decade or so, much of Latin America and the Caribbean has bucked this trend: within-country inequality has been falling, especially in Argentina, Brazil, Honduras, Mexico and Peru, with some exceptions, including Jamaica.[27] Some trace Latin America's performance to the shrinking earnings gap between high- and low-skilled workers and to the increase in targeted social transfer payments.[28] The shrinking earnings gap follows expanding coverage in basic education in recent decades, but it may run into headwinds when the poor are turned away from university education because of the low quality of their primary and secondary schooling.

Why has declining inequality in health and education not been accompanied by improved income distribution? Increased access to education may be part of the story. The returns to basic education fall as more people gain access. Completion of primary school brought smaller income gains than before, while the relative value of education to those at the top of the distribution increased. This increase in the "skill premium" resulted from a combination of skill-biased technical change and changes in policy—though country institutions and policies strongly influenced country-level effects.[29]

We might also expect financial crises to affect trends in inequality. To what extent do crises increase income inequality? Does income inequality make crises more likely? Can government policy make a difference? This Report focuses on the effects of environmental shocks, but recent research on the causes and effects of financial crises offers some parallels (box 2.4).

BOX 2.4

Sustainability, crises and inequality

Background research commissioned for this Report considered income inequality and two types of economic crisis—banking crises and collapses in consumption or gross domestic product—over the century to 2010. The analysis focused on 25 countries—some experiencing the crisis, others not—14 in North America and Europe and 11 elsewhere.

Does inequality make crises more likely? There is some support for the hypothesis that a rise in inequality is associated with subsequent crises, but high inequality is not always linked to crisis. Rising inequality preceded crises in Sweden in 1991 and in Indonesia in 1997 but not in India in 1993. Where rising inequality did precede a crisis, it could be attributed to overconsumption among some groups or underconsumption among others and to the effects of such patterns on the broader economy.

Who bears the brunt of a crisis? For 31 banking crises for which inequality data are available, there are a few cases of rising overall inequality followed by crises and then a fall in inequality, notably the 2007 Icelandic crisis—but such cases do not predominate. Inequality rose in about 40 percent of the cases, fell in just over a quarter and showed no change in the remainder.

Overall, the analysis suggests no systematic relationship between crises and income inequality, even for countries simultaneously experiencing banking crisis and economic collapse. Inequality rose in the Republic of Korea, Malaysia and Singapore as a result of the 1997 Asian financial crises but remained steady in Indonesia. While data are not yet available to allow rigorous analysis of the effects of the 2008 financial crisis, some evidence affirms the lack of a clear pattern across countries—with inequality rising in some countries and falling in others.

The effects of inequality and of crisis also reflect policy responses. For example, following crises, compensatory transfers or progressive taxation can mitigate inequality, while cutting transfers to reduce budget deficits can do the opposite. Crises have often prompted institutional change, for instance the introduction of social security in the United States in the 1930s. Following the Nordic crises of the 1990s, the welfare state and fiscal provisions seem to have been a powerful moderating force on any increase in inequality.

Source: Atkinson and Morelli 2011.

Prospects—and environmental threats

The global HDI has risen strongly in recent decades, but what does the future hold? How might HDI values change for developed and developing countries through 2050? And how severely might environmental and inequality constraints affect that advance? Given inherent uncertainties, we compare three scenarios through 2050, produced by the University of Denver's Frederick S. Pardee Center for International Futures (figure 2.5).[30]

- A *base case* scenario, which assumes limited changes in inequality, environmental threats and risks, anticipates for 2050 a global HDI that is 19 percent higher than today's (44 percent higher for Sub-Saharan Africa). The increase is less than a simple extrapolation of past trends would yield because progress in the HDI tends to slow at very high levels.[31]
- The *environmental challenge* scenario envisions intensified environmental risks at the household (indoor solid fuel use), local (water and sanitation), urban and regional (outdoor air pollution) and global levels

(especially increasing impacts of climate change on agricultural production) and inequality and insecurity.[32] The global HDI in 2050 is 8 percent lower than in the base case and 12 percent lower for South Asia and Sub-Saharan Africa.

- Under an *environmental disaster* scenario most early 21st century gains have eroded by 2050 as biophysical and human systems are stressed by overuse of fossil fuels and falling water tables, glacial melting, progressive deforestation and land degradation, dramatic declines in biodiversity, greater frequency of extreme weather events, peaking production of oil and gas, increased civil conflict and other disruptions. The model does not exhaustively consider the potential for associated vicious feedback loops, which would exacerbate these trends. Under this scenario the global HDI in 2050 would be some 15 percent below the baseline scenario.

Both the environmental challenge and environmental disaster scenarios would lead to breaks in the pattern of convergence in human development across countries observed over the past 40 years. And longer term projections suggest that divergence would widen further after 2050.

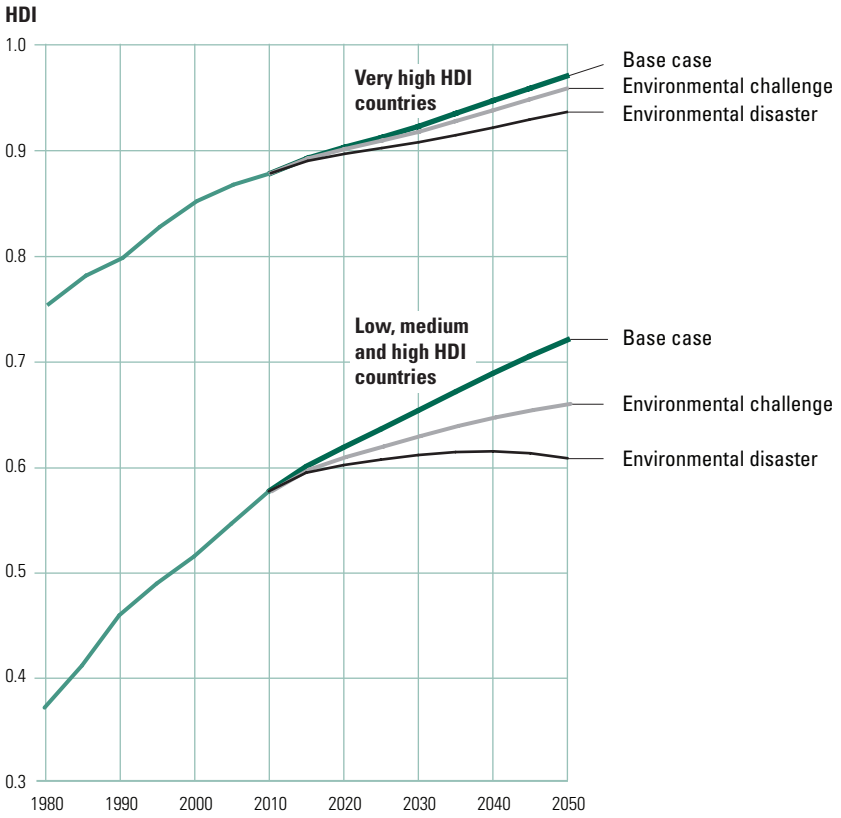
This is illustrated by projections of cross-country inequality in the HDI, using the Atkinson inequality index, which has fallen more than two-thirds over the past 40 years, reflecting the convergence trends. Under the base case, inequality among countries is projected to continue to fall over the next 40 years. But under the disaster scenario, future convergence, as measured by changes in the Atkinson inequality index, would be on the order of only 24 percent by 2050, compared with 57 percent under the baseline (figure 2.6).

Threats to sustaining progress

Past patterns suggest that, in the absence of reform, the links between economic growth and rising greenhouse gas emissions could jeopardize the extraordinary progress in the HDI in recent decades. But climate change —with effects on temperatures, precipitation,

FIGURE 2.5

Scenarios projecting impacts of environmental risks on human development through 2050

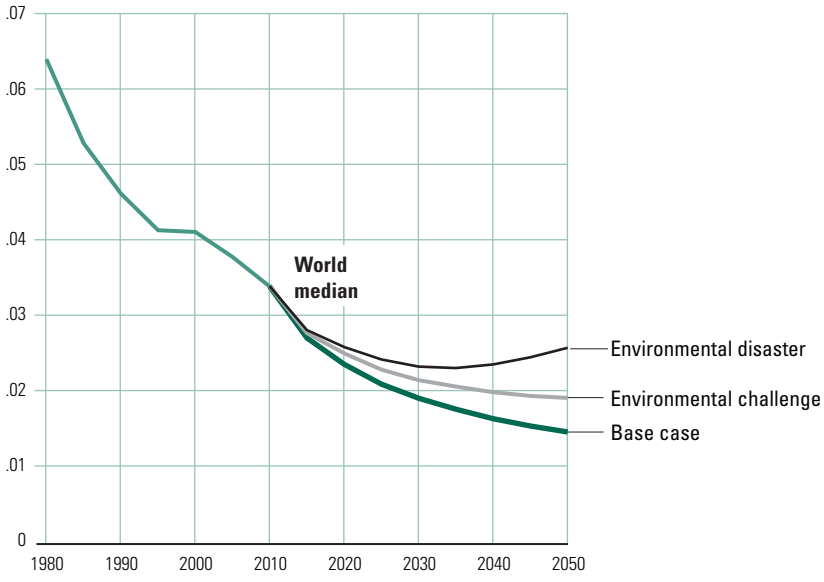


Note: See text for explanation of scenarios.

Source: HDRO calculations based on data from the HDRO database and Hughes, Irfan and others (2011), who draw on forecasts from International Futures, Version 6.42.

FIGURE 2.6

Scenarios projecting slowdown and reversals of convergence in human development due to environmental risks through 2050



Note: See text for explanation of scenarios.

Source: HDRO calculations based on data from the HDRO database and Hughes, Irfan and others (2011), who draw on forecasts from International Futures, Version 6.42.

sea levels and natural disasters—is not the only environmental problem.

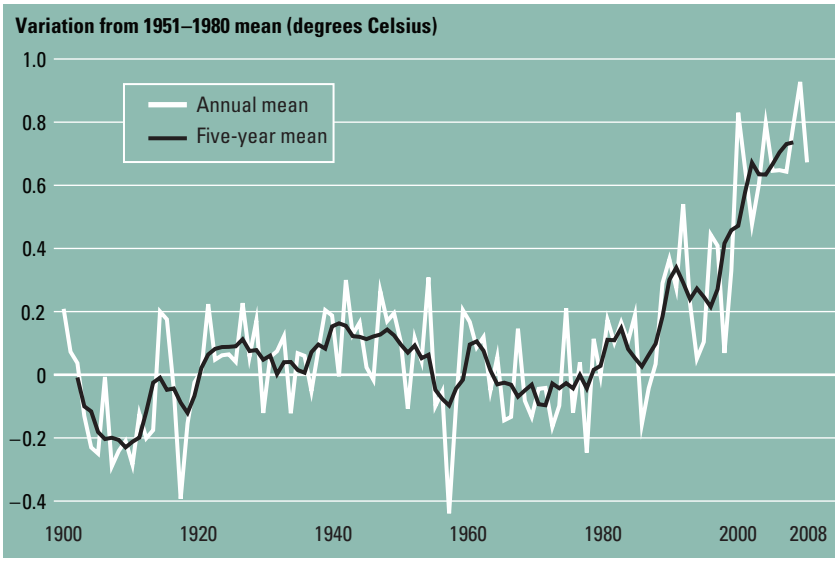
Degraded land, forests and marine ecosystems pose chronic threats to well-being, while pollution has substantial costs that appear to rise and then fall with development levels. We discuss these threats in turn, then consider which countries have performed better than their regions and the world.

Climate change

Global temperatures now average 0.75°C higher than at the beginning of the 20th century, and the rate of change has accelerated (figure 2.7). The main cause is human activity, particularly burning fossil fuels, cutting forests and manufacturing cement, which increase carbon dioxide emissions. Other greenhouse gases, such as those regulated by the Montreal Protocol, also pose serious threats. The 100-year global warming potential of nitrous oxide is nearly 300 times that of carbon dioxide and 25 times that of methane.[33] That climate change is caused by human activities is scientifically accepted,[34] though public awareness still lags, with less than two-thirds of the population worldwide aware of climate change and its causes (box 2.5).

FIGURE 2.7

Average world temperatures have risen since 1900



Note: Calculated using average temperatures in 173 countries, weighted by average population in 1950–2008.

Source: HDRO calculations based on data from the University of Delaware.

TABLE 2.1

Growth in carbon dioxide emissions and its drivers, 1970–2007 (percent)

	Growth		Percentage share of total growth[a]		
	Per capita	Total	Population	GDP per capita	Carbon intensity
HDI group					
Very high	7	42	81	233	–213
High	3	73	94	116	–111
Medium	276	609	32	82	–15
Low	49	304	72	21	7
World	17	112	79	91	–70

a. Based on an accounting decomposition of the effects on carbon growth that simplifies the Kaya identity presented in Raupach and others (2007) from four drivers to three. Values may not sum to 100 percent because of rounding.

Source: HDRO calculations based on data from World Bank (2011b).

Key drivers

Global carbon dioxide emissions have increased since 1970—248 percent in low, medium and high HDI countries and 42 percent in very high HDI countries. The global growth of 112 percent can be broken down into three drivers: population growth, rising consumption and carbon-intensive production.[35] Rising consumption (as reflected by GDP growth) has been the main driver, accounting for 91 percent of the change in emissions, while population growth contributed 79 percent. The contribution of carbon intensity, in contrast, was –70 percent, reflecting technological advances (table 2.1). In other words, the principal driver of increases in emissions is that more people are consuming more goods—even if production itself has become more efficient, on average.

Although the carbon efficiency of production (units of carbon to produce a unit of GDP) has improved 40 percent, total carbon dioxide emissions continue to rise. Average carbon dioxide emissions per capita have grown 17 percent over 1970–2007.

Patterns of carbon dioxide emissions vary widely across regions and stages of development. Some highlights:

- In very high HDI countries the carbon intensity of production has fallen 52 percent, but total emissions and emissions per capita have more than doubled and are 112 percent higher now than 40 years ago. Improvements in carbon efficiency have not kept up with economic growth.
- Emissions are more than 10 times higher in East Asia and the Pacific than in Sub-Saharan Africa.

- Emissions per capita vary from a low of 0.04 tonnes in Burundi to a high of 53 tonnes in Qatar.

Trade enables countries to shift the carbon content of the goods they consume to the trading partners that produce them. The carbon dioxide emitted in the production of goods traded internationally increased by half from 1995 to 2005.[36] Several countries that have committed to cutting their own emissions are net carbon importers, including Germany and Japan, as are countries that have not signed or ratified global treaties, such as the United States.

While very high HDI countries account for the largest share of world carbon dioxide emissions, low, medium and high HDI countries account for more than three-fourths of the *growth* in carbon dioxide emissions since 1970. East Asia and the Pacific is the largest contributor by far to the increase in these emissions (45 percent), while Sub-Saharan Africa contributed only 3 percent, and Europe and Central Asia, 2 percent (figure 2.8). For methane and nitrous oxide, we have data for a shorter period, but here too, the contribution of the East Asia and the Pacific region is pronounced.

The stock of carbon dioxide trapped in the atmosphere is a product of historical emissions—"carbon is forever."[37] Today's concentrations are largely the accumulation of developed countries' past emissions. With about a sixth of the world's population, very high HDI countries emitted almost two-thirds (64 percent) of carbon dioxide emissions between 1850 and 2005.[38] Since 1850 about 30 percent of total accumulated emissions have come from the United States. The next highest emitters are China (9 percent), the Russian Federation (8 percent) and Germany (7 percent). Very high HDI countries have generated cumulatively more than nine times more carbon dioxide per capita than low, medium and high HDI countries combined —hence the Kyoto Protocol's "common but differentiated responsibilities" for addressing climate change, explored in detail below.

Repercussions for temperature, rainfall, sea level and disaster risk

Climate change affects not only temperature but also rainfall, sea level and natural disasters.

BOX 2.5

Are people aware of climate change and its causes?

Despite overwhelming scientific evidence of the seriousness of the climate change threat and growing evidence around the world that we are already experiencing many of the effects, public awareness remains limited. The Gallup World Poll, a representative survey carried out regularly in nearly 150 countries since 2007, reveals some major gaps in public knowledge of the seriousness of the problem, its causes and even its existence (see table).

Less than two-thirds of people in the world have heard of climate change. Awareness is associated with level of development. Some 92 percent of respondents in very high Human Development Index (HDI) countries reported at least some knowledge of climate change, compared with 52 percent in medium HDI countries and 40 percent in low HDI countries.

Perceptions of other environmental issues also differ. Overall, 69 percent of people are satisfied with water quality while 29 percent are not, and 76 percent of people are satisfied with air quality while 22 percent are not. Not surprising, there is wide disparity across countries. For example, only 2.5 percent of people are dissatisfied with water quality in Denmark, compared with 78 percent in the Democratic Republic of the Congo.

Public opinions on climate change (percent agreeing)

Country group	Aware of climate change (*n* = 147)	Climate change is a serious threat (*n* = 135)	Human activity causes climate change (*n* = 145)
Regions			
Arab States	42.1	28.7	30.3
East Asia and the Pacific	62.6	27.7	48.3
Europe and Central Asia	77.7	48.2	55.0
Latin America and the Caribbean	76.5	72.7	64.8
South Asia	38.0	31.3	26.9
Sub-Saharan Africa	43.4	35.5	30.6
HDI groups			
Very high	91.7	60.2	65.3
High	76.1	61.2	60.7
Medium	51.6	29.3	38.8
Low	40.2	32.8	26.7
World	60.0	39.7	44.5

Note: n refers to the number of countries surveyed. Data are population-weighted averages and refer to the most recent year available since 2007. For details on the Gallup sample and method, see https://worldview.gallup.com/content/methodology.aspx.

Source: HDRO calculations based on Gallup World Poll data (www.gallup.com/se/126848/worldview.aspx).

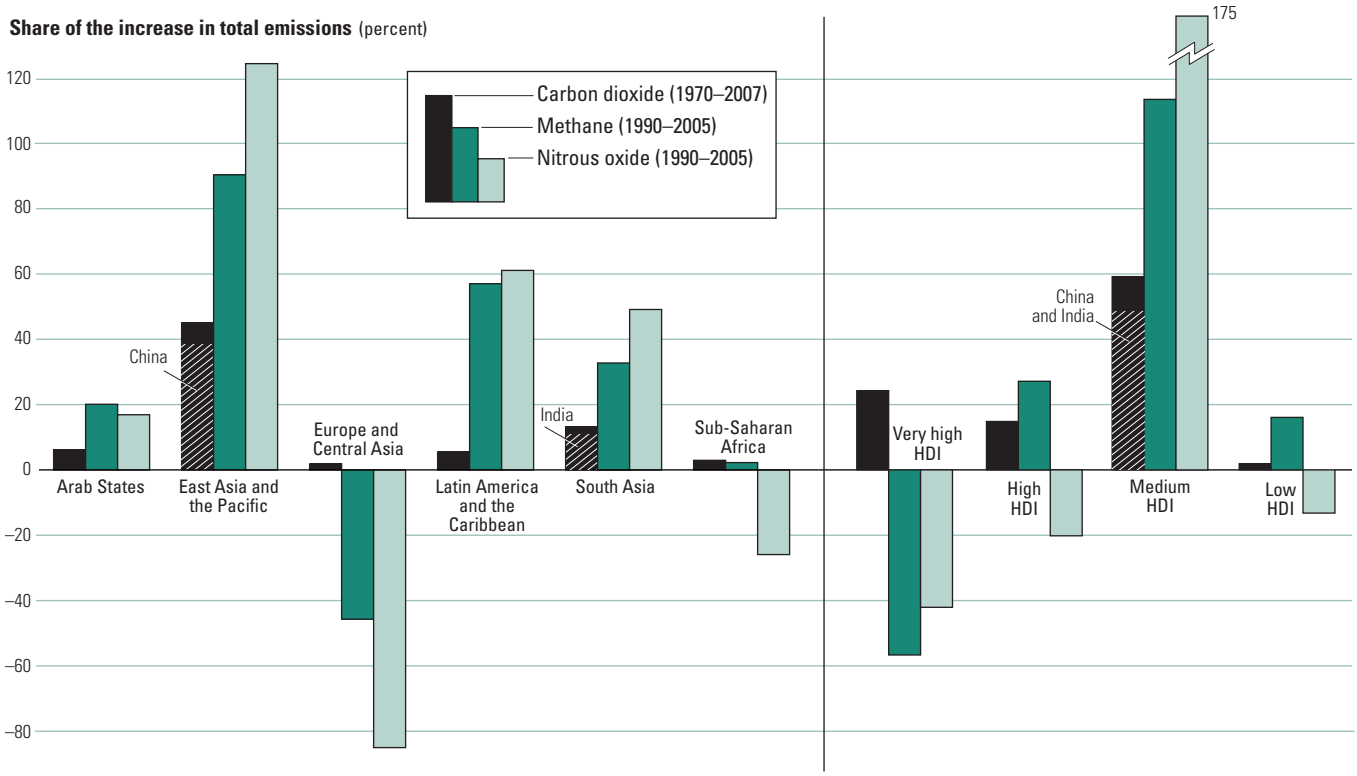
Temperature and precipitation

The past half century's most dramatic changes in temperature have been in the polar regions and at higher latitudes (map 2.1).[39] Does this mean that climate change harms high HDI countries more? Not necessarily. Countries with lower initial temperatures can better withstand temperature rises—whereas in climate-sensitive tropical areas a small rise in temperature can severely disrupt natural conditions, with adverse repercussions for water availability and crop productivity.[40]

In recent decades precipitation has fallen more than 2 millimetres (almost 3 percent)

FIGURE 2.8

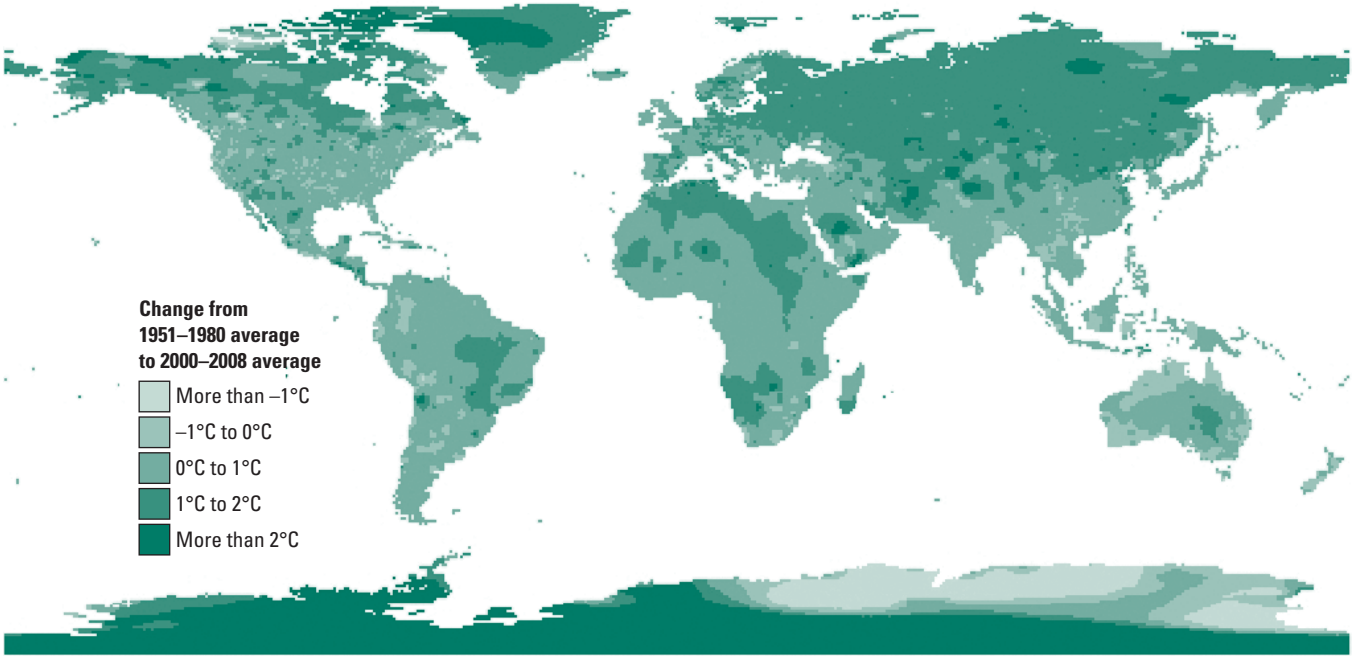
Sources of greenhouse gas growth



Source: HDRO calculations based on data from World Bank (2011b).

MAP 2.1

Temperature changes are greatest in polar regions and higher latitudes



Source: HDRO calculations based on data from the University of Delaware.

from a 1951–1980 baseline. The largest decline has been in Sub-Saharan Africa (7 millimetres, or more than 7 percent) and in low HDI countries (4 millimetres, or more than 4 percent), followed by medium HDI countries (figure 2.9).[41] Low HDI countries have also experienced the sharpest increases in rainfall variability.

What to expect going forward? There is no scientific consensus on the net effects of climate change on precipitation, given different patterns around the world.[42] However, some broad regional trends emerge from the climate models. Africa is expected to see higher than average warming—with less rain in North Africa and the southern and western parts of the continent but more rain in East Africa. Western Europe is expected to become warmer and wetter, while the Mediterranean will experience less rainfall. In Asia the number of hot days will increase, and the number of cold days will decrease. In Latin America and the Caribbean temperatures are likely to rise while precipitation falls. Small island developing states are expected to have lower than average temperature increases, but they will likely be hard hit by changes in the sea level, as we see further below.[43]

Sea level rise

Since 1870 the average sea level has risen 20 centimetres, and the rate of change has accelerated. If this accelerated rate holds, the sea level will be 31 centimetres higher in 2100 than in 1990,[44] with devastating impacts, especially for small island developing states, which are particularly exposed (box 2.6, table 2.2). Many face high mitigation costs relative to income, and their vulnerability risks discouraging private investors, affecting their ability to adapt.[45]

These sea-related increases will affect all coastal regions. A half-metre sea level rise by 2050 would flood almost a million square kilometres—an area the size of France and Italy combined—and affect some 170 million people.[46]

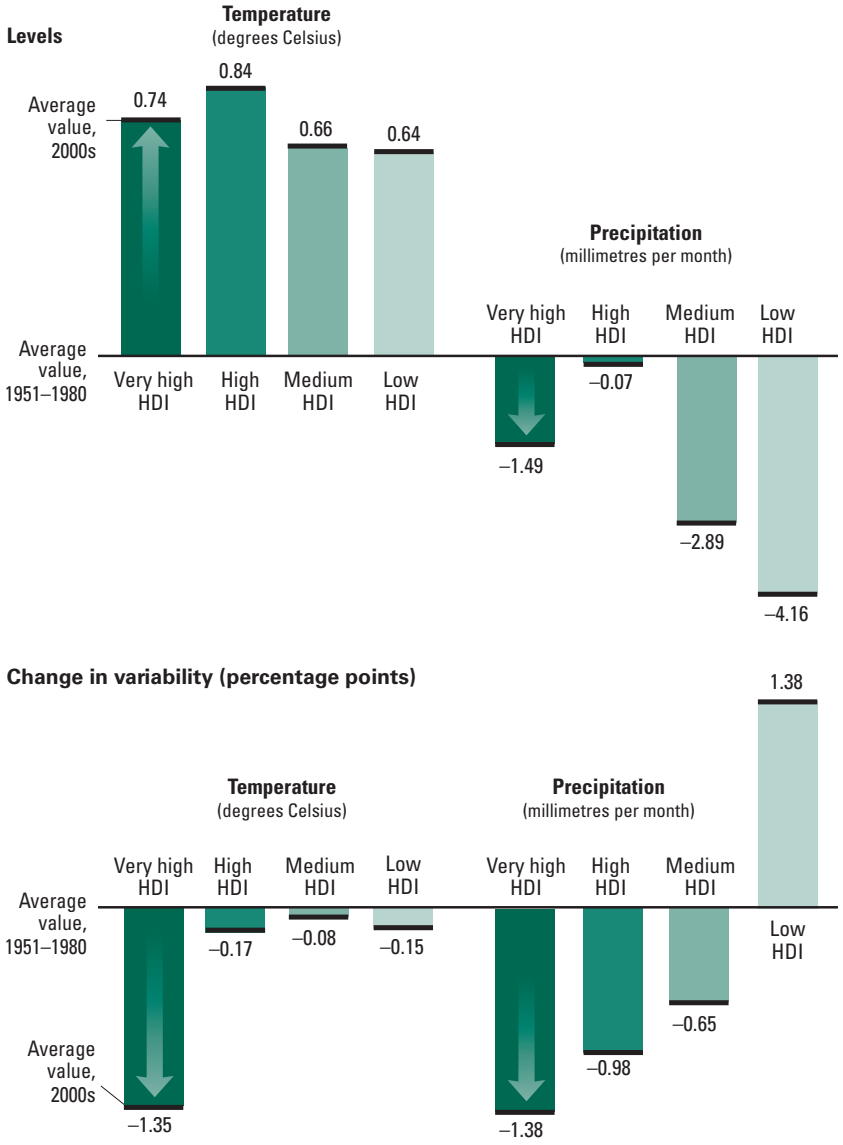
The share of people likely to be affected is largest in very high HDI countries and small island developing states, but very high HDI countries have the resources and technology to reduce the risk of losses. The Netherlands, with large, densely populated areas of low-lying land, has abated the risk of flooding and reclaimed inundated land with innovative technology and infrastructure investments.[47]

Among regions, the impact will be largest in East Asia and the Pacific, where more than 63 million people are likely to be affected (see table 2.2). The greatest economic impacts will be felt in East Asia and the Pacific and in medium HDI countries (both around

FIGURE 2.9

Rising temperatures and reduced rainfall

Levels and changes in climate variability by HDI group



Note: Change in variability is the difference in the coefficients of variation between 1951–1980 and the 2000s, weighted by average population for 1950–2008.

Source: HDRO calculations based on data from the University of Delaware.

BOX 2.6

Impacts of climate change on small island developing states

Small island and low-lying coastal countries share similar challenges, including small populations, lack of resources, remoteness, susceptibility to natural disasters, dependence on international trade and vulnerability to global developments. Their temperatures are predicted to increase 1˚–4˚C by 2100 (relative to 1960–1990), with adverse effects on people, including displacement and poorer health.

Rising sea levels will displace people and inundate cultivable low-lying lands. Island countries with a low mean elevation—such as Tuvalu (1.83 metres), Kiribati (2.0 metres) and the Marshall Islands (2.13 metres)—are seriously threatened by the possibility of a 0.18–0.59 metre sea level rise by the end of 21st century. In low-elevation coastal zones the entire population of the Maldives and 85 percent of the population of the Bahamas are at risk.

Health effects may be severe as well. Kiribati can expect a 10 percent drop in rainfall by 2050—reducing fresh water 20 percent. Moreover, salt water intrusions are increasing due to sea level rise and frequent coastal flooding, further contaminating ground water wells, the primary fresh water source for its rapidly growing population. About 19 percent of potable water in Trinidad and Tobago following heavy rainfall tested positive for cryptosporidium, a diarrhoea-causing parasite. Similarly, dengue fever has a clear association with rainfall and temperature in the Caribbean.

Small island developing states are vulnerable not only to climate change but also to natural disasters, including storm surges, floods, droughts, tsunamis and cyclones. Natural disasters are particularly frequent on small islands. Of the 10 countries suffering the greatest number of natural disasters per capita from 1970 to 2010, 6 were small island developing states. And a single disaster can cause huge economic losses. Hurricane Gilbert in 1988 cost Saint Lucia almost four times its GDP, while Hurricane Ivan in 2004 was responsible for losses in Grenada that were twice its GDP. The 2004 Indian Ocean tsunami that hit the Maldives killed more than 100 people and affected more than 27,000. By 2100, 90 percent of coral reefs that protect islands from ocean waves and storms could disappear, making natural disasters more likely still.

Constraints extend to data and statistics. We have improved coverage of the HDI in these states, from 23 last year to 32 out of 49 this year. These states have an average HDI of 0.617, compared with the global average of 0.649.

Source: www.sidsnet.org/2.html; Elisara 2008; UNDESA 2010a; Kelman and West 2009; Mimura and others 2007; Elbi and others 2006; Amarakoon and others 2008; Noy 2009; Heger, Julca and Paddison 2009; www.climate.gov.ki/Climate_change_effects_in_Kiribati.html; www.emdat.be/result-country-profile; http://pdf.wri.org/reefs_at_risk_revisited.pdf.

TABLE 2.2

Projected impacts of a half-metre rise in sea level by 2050

Country group	Number of countries	Population likely to be affected by sea level rise (millions)	Share of total population likely to be affected (percent)
Regions			
Arab States	20	8.9	2.6
East Asia and the Pacific	22	63.1	3.3
Europe and Central Asia	17	4.4	1.2
Latin America and the Caribbean	31	7.0	1.3
South Asia	6	38.9	2.4
Sub-Saharan Africa	30	10.2	1.9
Small island developing states	35	1.7	3.4
HDI groups			
Very high	41	41.0	16.0
High	42	15.0	4.5
Medium	38	84.6	0.4
Low	32	30.8	9.4
World	153	171.4	2.7

Source: HDRO calculations based on data from Wheeler 2011.

2 percent of GDP). Low HDI countries, many landlocked, will lose proportionately less (0.5 percent).[48]

Natural disasters

Climate change is increasing the likelihood of extreme weather events, such as droughts, storms and floods. The average number of such natural disasters more than doubled from 132 a year over 1980–1985 to 357 over 2005–2009.[49] Although it is hard to link any single disaster directly to climate change—given the inherent randomness in what generates these events—science links global warming to their increased incidence.[50] The frequency of high intensity tropical cyclones and associated precipitation is predicted to rise 20 percent by 2100.[51]

The growing incidence of reported natural disasters does not affect everyone equally—not only because the damage wrought by the average natural disaster may change but also because the capacity of societies to respond and protect themselves also varies.[52]

Most countries do not experience natural disasters, so patterns differ markedly by country and region. In recent years South Asia experienced the largest number, an average of almost six a year per country. Low HDI countries, while often vulnerable to drought, tend to have fewer disasters than medium HDI countries, partly because many are landlocked. Small island developing states are also highly exposed to natural disasters (see box 2.6).

These numbers, which are affected by extreme cases and may differ from the

average, can reveal how societies are marked by most natural disasters and demonstrate their resilience. The good news is that the median costs of these events (whether number of deaths, people affected or economic losses) have fallen over the past four decades globally and for all HDI groups (table 2.3). Highlights include the significant drop in the median number of deaths due to natural disasters, with the steepest declines in low HDI countries (down almost 72 percent). Natural disasters afflict many more people and are much more costly in low and medium HDI countries than in high and very high HDI countries. Medium HDI countries are particularly affected: the typical natural disaster in a medium HDI country takes 11 percent more lives and affects nearly twice as many people as a typical natural disaster in a low HDI country. Economic losses have also declined over time as a share of income, though the estimates depend on underlying assumptions.

* * *

In sum, the poorest countries bear many of the costs of climate change, and the prospect of worsening global inequality is very real. Low HDI countries are experiencing the steepest declines in precipitation and the sharpest increases in its variability. Some of the largest temperature increases are in already-hot parts of developing countries. The frequency of natural disasters is highest in low and medium HDI countries, though the good news is that the human development cost of the typical natural disaster has declined. Sea level rise has the largest direct effects on coastal developed countries, which are often better prepared to deal with them, and on small island developing states, which are far more vulnerable.

Chronic environmental threats

Climate change is not the only environmental threat. Deforestation and overexploitation of soil and waterways can threaten long-term livelihoods, fresh water availability and essential renewable resources, such as fisheries. These problems sometimes reflect imbalances in opportunities and power, as chapter 3 shows, and carry further implications such as loss of biodiversity (box 2.7).

Soil erosion, desertification and water scarcity

Agricultural output has doubled over the past 50 years, with only a 10 percent increase in cultivated land. But degradation of soil and water resources is increasing: soil erosion, reduced fertility and overgrazing are affecting as much as 40 percent of croplands.[53]

Low HDI countries are experiencing the steepest declines in precipitation and the sharpest increases in its variability

At the extreme, overexploitation can turn arable land into desert—though the overall extent of degradation is hard to quantify.[54] It affects an estimated 31 percent of total land area in low, medium and high HDI countries and about 51 percent in very high HDI countries. The lowest shares of severely and very severely degraded land in developing regions are in Latin America and the Caribbean and Europe and Central Asia, and the highest are in South Asia. Nonetheless the highest shares of people living on degraded land are in the Arab States (25 percent of the population) and Sub-Saharan Africa (22 percent) (see statistical table 7).

Water is vital for natural systems and human development. Irrigated lands produce two to three times as much as rainfed agriculture. Agriculture accounts for 70–85 percent of water use—and an estimated 20 percent of global grain production uses water unsustainably. And demand for water for food production is projected to double by 2050.[55]

TABLE 2.3

Disaster-related casualties and costs, median annual values by HDI group, 1971–1990 and 1991–2010

	Deaths (per million people)		Affected population (per million people)		Cost (percent of GNI)	
Country group	1971–1990	1991–2010	1971–1990	1991–2010	1971–1990	1991–2010
HDI group						
Very high	0.9	0.5	196	145	1.0	0.7
High	2.1	1.1	1,437	1,157	1.3	0.7
Medium	2.7	2.1	11,700	7,813	3.3	2.1
Low	6.9	1.9	12,385	4,102	7.6	2.8
World	2.1	1.3	3,232	1,822	1.7	1.0

Note: Values are for median impacts of climatological, hydrological and meteorological natural disasters.

Source: HDRO calculations based on Centre for Research on the Epidemiology of Disasters Emergency Events Database: International Disaster Database.

BOX 2.7

Biodiversity—the accelerating loss of our ecosystems

Healthy and resilient ecosystems—and the life-supporting services that they provide—depend on the biodiversity they contain. But rapid loss of biodiversity is accelerating globally, with serious declines experienced in the last decade in fresh water wetlands, sea ice habitats, salt marshes and coral reefs. The Convention on Biological Diversity's *Global Biodiversity Outlook 3* points to "multiple indications of continuing decline in biodiversity in all three of its main components—genes, species and ecosystems." According to the report, natural habitats in most parts of the world are shrinking, and nearly a quarter of plant species are estimated to be threatened with extinction.

Environmental scientists believe that we are witnessing what may be the fastest mass extinction of species, with about half the Earth's estimated 10 million species expected to disappear this century. The biggest cause of this loss is the conversion of natural areas to agriculture and urban development; other causes include the introduction of invasive alien species; overexploitation of natural resources; pollution; and, increasingly, the effects of climate change.

Some 10–30 percent of mammal, bird and amphibian species are threatened by extinction, with more in poorer countries. This partly reflects the location of "biodiversity hotspots" (areas with the richest and most threatened resources of animal and plant life) in tropical areas.

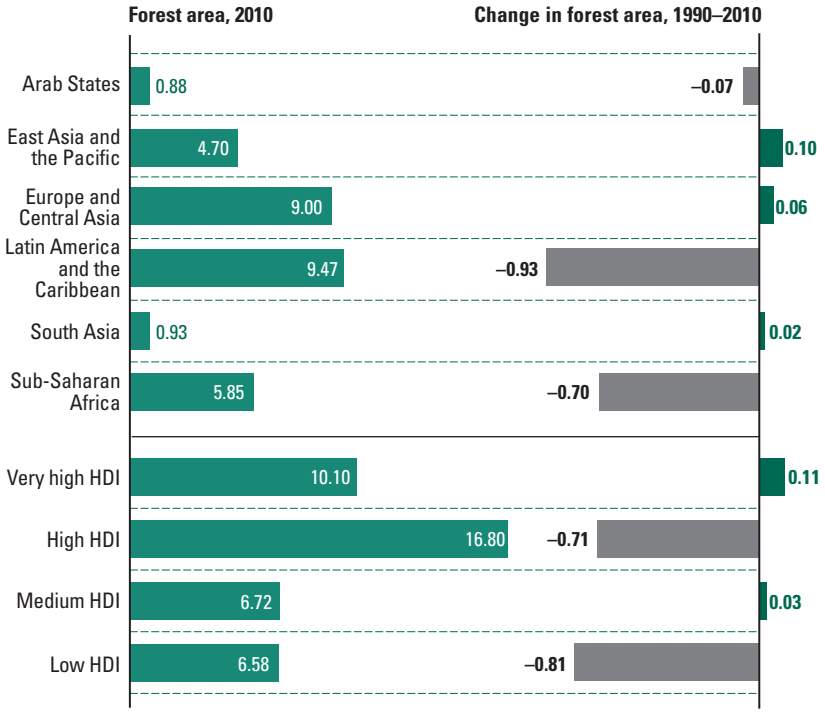
The impact of biodiversity loss on human development is severe in tropical developing countries, where poor communities rely heavily on natural resources. For example, wild foods are an important source of vitamins and minerals in the diets of many African communities. Use of wild foods can also reduce disease transmission in complex tropical ecosystems.

Source: Klein and others 2009; Myers and Knoll 2001; Rockström and others 2009; Roscher and others 2007; Secretariat of the Convention on Biological Diversity 2010.

FIGURE 2.10

Some regions deforest, others reforest and afforest

Forest cover shares and rates of change by region, 1990–2010 (millions of square kilometres)



Source: HDRO calculations based on data from World Bank (2011b).

Water withdrawals have tripled over the last 50 years.[56] Pumping from aquifers exceeds natural replenishment, so water tables are falling. The main causes: destruction of wetlands, watersheds and natural water towers to make way for industrial and agricultural use. The 2006 *HDR* documented how power, poverty and inequality contribute to water scarcity.

Deforestation

One way the demands of development appear at odds with environmental sustainability is in the loss of forest cover. This has been occurring for a long time: Earth's forest cover today is only three-fifths of what it was in prehistoric times.[57] While deforestation has often been linked to development, trends today are associated more with underdevelopment.

The average forest share is similar in very high and low HDI countries (28–29 percent), and around 23 percent in medium HDI countries.[58] And while very high HDI countries have increased total forest cover about 1 percent since 1990, low HDI countries have averaged 11 percent loss and high HDI countries 4 percent loss, while medium HDI countries have had almost no change. Latin America and the Caribbean and Sub-Saharan Africa had the greatest loss, followed by the Arab States; the other regions have seen minor gains (figure 2.10).[59]

Seven developing countries (Bhutan, China, Costa Rica, Chile, El Salvador, India, and Viet Nam) have recently transitioned from deforesting to reforesting with support from domestic and international programmes. However, there are indications that some of these countries have, in effect, shifted deforestation to other developing countries, so that for every 100 hectares of reforestation they import the equivalent of 74 hectares in wood products.[60] Simulations suggest that the European Union transfers 75 of every 100 cubic metres of reduced timber harvest to developing countries, mainly to the tropics; Australia and New Zealand, 70 cubic metres; and the United States, 46 cubic metres.[61] Understanding trends in global forestation thus requires examining consumption and trade as well as production.[62] Switzerland,

for example, consumes agricultural products equivalent to more than 150 percent of its cultivated land.[63]

A related concern is the rise of international "land grabs," as governments and corporations acquire large tracts in land-abundant and poorer countries (box 2.8).

BOX 2.8

Land grabbing—a growing phenomenon?

Private, government and public-private joint ventures, usually from capital-rich countries, are acquiring long-term leases or ownership rights to large portions of land (often more than 1,000 hectares) in developing countries. Economically powerful developing countries, such as China, India and Saudi Arabia, as well as developed countries, are joining the land grab. While sources differ, all suggest a recent acceleration, with estimates of more than 20–30 million hectares transacted between 2005 and mid-2009 and about 45 million hectares between 2008 and 2010. The rise in commodity prices appears to be motivating both government and private purchases.

Some see this phenomenon as an opportunity for long-awaited investments in agricultural modernization that will provide access to better technology, create more jobs for farmers and reduce poverty in rural areas. But others consider it a threat to local populations. A recent World Bank study supports the latter view, finding that expected benefits were not achieved. Several studies have reported human rights violations, with local populations forcibly displaced and access to local natural resources restricted. Hurt most were smallholders, indigenous people and women, who often lack formal title to the lands on which they live and farm. Environmental organizations have criticized negative impacts, including deforestation, loss of biodiversity and threats to wildlife.

Recent international initiatives seek to provide a regulatory framework to spread out the benefits and balance opportunities with risks. The challenge is to implement multilevel institutional arrangements, including effective local participation, to promote sustainability and equity in this major change in land use.

Source: Borras and Franco 2010; Deiniger and others 2011; IFAD 2011; Da Vià 2011.

Degradation of marine ecosystems

Fish are an important source of protein for hundreds of millions of people: on average, people eat 24 kilograms of fish a year in North America, 18.5 in Asia and 9.2 in Latin America and the Caribbean.[64] But fishing that exceeds the natural rate of regeneration, coupled with dredging, dumping, discharge of pollutants, coastal infrastructure and coastal tourism undermines the conditions required for healthy marine ecosystems, thereby threatening their sustainability.

The current annual fish catch of 145 million tonnes far exceeds the maximum annual sustainable yield of 80–100 million tonnes.[65] In 2008 the Food and Agriculture Organization estimated that 53 percent of known fish stocks were fully exploited, 28 percent were overexploited, 3 percent were depleted and only 15 percent were moderately exploited.[66] Although total output has not yet fallen, yields for some species, especially larger fish, have declined considerably since the 1980s.

Here again we see considerable disparity. Some 10 percent of fishing activities account for an estimated 90 percent of the total catch—mostly developed country fishers using capital-intensive methods such as technologically advanced fishing vessels with long-term storage facilities and mechanized trawls suitable for fishing in deep waters. Average annual production by fish farmers is 172 tonnes in Norway, 72 in Chile, 6 in China and 2 in India. Although 85 percent of people in the fish industry work in Asia, annual production in the region is 2.4 tonnes per ocean fisher, compared with amounts as high as 23.9 tonnes in developed regions such as Europe.[67] Large commercial fishing companies not only catch more fish but also engage in damaging practices, using high bycatch methods and bottom trawling.

Catch rates are still rising, most rapidly in some developing regions, despite government initiatives to reduce overfishing.[68] Rates more than quadrupled in East Asia and the Pacific, for example, between 1980 and 2005. Once again, this increase partly reflects high production for export to developed countries, where consumption per capita is greater.

Pollution

Recent studies suggest that pollution transitions may be more complex than those described by the environmental Kuznets curve, which asserts that pollution first rises and then falls with economic development.[69] For example, low-income cities have local, immediate and poverty-related environmental problems; middle-income cities have citywide problems related to rapid growth; and high-income cities experience the consequences of wealthy lifestyles.[70] So, while affluence reduces the "brown" pollution problems of low-income cities, such as poor water supply, sanitation and solid waste management, it replaces them with "green" ecological issues such as waste reduction, high emissions and inefficient transport systems.

Cities are at once sources of major pollution and opportunities for fostering sustainability. People in cities consume 60–80 percent of energy produced worldwide and account for roughly similar proportions of carbon emissions.[71] Cities can foster sustainability, especially when urban planning integrates environmental considerations. High population density fosters economies of scale and skill and enterprise specialization. These features make most infrastructure and public goods, such as water, sanitation and drainage, and public transportation systems, more cost efficient and provide more options for material reuse and recycling. It has been estimated that when a city doubles in population, the associated increase in infrastructure requirements is only 85 percent.[72] Per capita emissions in New York City are only 30 percent of the US average; the same holds for Rio de Janeiro and Brazil.[73] The average Manhattan resident accounts for 14,127 fewer pounds of carbon emissions annually than a suburban New Yorker, in part due to lower vehicle use.[74] The pattern appears in all US metropolitan areas.

Cities can foster sustainability, especially when urban planning integrates environmental considerations. High population density fosters economies of scale and skill and enterprise specialization, but the downside from waste generation and outdoor air pollution can be huge

But the downside of cities from waste generation and outdoor air pollution can be huge. Air pollution, which tends to be worse in urban areas, is a major cause of respiratory and cardiovascular diseases globally, while limited access to safe drinking water and proper sanitation accounts for 1.6 million deaths a year.[75] Urbanites also produce enormous quantities of waste, too often poorly managed. Areas near New Delhi and Kathmandu, for example, suffer from severe river pollution.[76] Some richer countries are exporting their waste to poorer countries, with harmful effects, despite the 1992 Basel Convention restricting such trade (box 2.9). Outdoor air pollution is generally worse in cities, as are related health effects (chapter 3). The high density of pollutants also increases cloud concentration, affecting precipitation.

High population density means that even small declines in per capita pollution emissions, water use or energy use can bring major absolute improvements. With around half the world's population living in urban areas, these potential improvements present an enormous opportunity. The relationship between equity and the density of cities is complex. But more compact neighbourhoods and affordable transport systems can enhance equity by increasing accessibility, and some evidence suggests that higher density is correlated with less social segregation.

Natural disasters affecting cities can be especially devastating, as with Hurricane Katrina in New Orleans in the United States. Cities need investments in infrastructure and systems to manage these vulnerabilities. Rio de Janeiro uses sophisticated modelling techniques to predict natural disasters and take pre-emptive measures.

Global trends tell a more optimistic story. Pollution measurement has been a subject of vigorous debate, but outdoor concentrations of particulate matter suggest declines around the world over the past two decades.[77] Sub-Saharan Africa has seen more rapid decline, though from a higher level. In very high HDI countries pollution has fallen almost one-third. Even so, average concentrations of particulate matter in urban areas are 2.3 times higher in low, medium and high HDI countries than in very high HDI countries.[78] Richer countries have tougher air quality regulations and measures targeting air pollution, such as control systems on power plants and industrial facilities, catalytic converters on vehicles and cleaner fuels.[79]

* * *

This section on trends in key environmental indicators and their threats to human development has shown deterioration on several fronts, but not on all. Remarkable progress in curbing air pollution, for example, suggests that some dimensions of the environment can improve with development. Of greatest concern is that the poorest countries experience the most serious consequences of environmental degradation. The next chapter confirms that this pattern also holds within countries. We now explore how countries have broken these patterns to achieve sustainable and equitable progress in human development.

BOX 2.9

Hazardous waste and the Basel Convention

As public concern about hazardous waste mounted in developed countries in the 1970s and 1980s, many governments passed restrictive legislation. An unexpected result was a massive increase in exports of hazardous waste—including asbestos, mercury, ash, heavy metals, clinical waste and pesticides—to developing countries. Economic inequalities made the prospect of accepting hazardous waste attractive to some countries. In the 1980s a coalition of European and US companies offered Guinea-Bissau $600 million—about five times its gross national product—to accept shipments of toxic waste, an offer it ultimately refused because of international pressure.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal regulates such exports, requiring informed consent about the nature of the waste. Today, 175 countries are parties to the Basel Convention; the United States is among those that are not. A 1995 amendment prohibits all exports of hazardous waste, but it has not yet been ratified by the necessary three-quarters of participants. The convention recognizes the urgency of the problem, but an adequate international regulatory framework has not yet been established.

Exposure to hazardous waste in developing countries remains serious. In 2006 a Dutch company dumped 500 tonnes of toxic waste in 16 sites in Abidjan, contaminating the city's drinking water, soil and fisheries; killing at least 10 people; and affecting more than 100,000 people. Such cases reflect not only weaknesses in the Basel Convention but also the economic reality in many developing countries. The convention assumes that developing countries have the technical and administrative capacity to assess the risk of accepting waste shipments and the good governance necessary to resist monetary inducements, not always the case.

Electronic waste (e-waste), the fastest growing sector of global waste, is hazardous to human health and the environment. E-waste from China, India, Thailand, the United States and the European Union over 2004–2008 totalled 17 million tonnes a year; the United Nations Environment Programme estimates global e-waste at 20–50 million tonnes a year. Only a small share of e-waste is recycled. For example, in 2007 the United States recycled less than 20 percent of e-waste from obsolete televisions, cell phones and computer products. The rest was disposed in landfills, mostly in developing countries such as China, India and Nigeria. Nevertheless, e-waste recycling has become a dynamic economic sector, particularly in China and India, where recovering, repairing, and trading materials from discarded electronic devices provide an important livelihood for poor people. But the lead, mercury and cadmium in these products are highly toxic. While precautions can be taken, many people are unaware of the risks.

Source: Andrews 2009; Sonak, Sonak, and Giriyan 2008; Widmer and others 2005; Robinson 2009; UNEP/GRID-Europe 2005; GreenPeace 2009; UNEP and UNU 2009; www.epa.gov/international/toxics/ewaste.html; http://toxipedia.org/display/toxipedia/Electronic+Waste+%28E-Waste%29.

Success in promoting sustainable and equitable human development

How can we best interpret these contrasting patterns? Can we identify the better performing countries in human development, sustainability and equity? The task is difficult, not least because no single indicator captures sustainability well. But we illustrate a potentially useful approach to assessing joint progress towards these objectives and review a range of indicators that provide interesting insights into promising policy approaches. The findings synthesize much of the evidence we have accumulated so far and provide a bridge to the community and household analysis in the next chapter. We propose a method, identify some instances of positive synergies, where countries have promoted sustainable human development with equity, and discuss the main policy implications.

How can we identify positive synergies? Our framework reflects both local and global dimensions of sustainability that we highlighted in figure 2.3. The local aspects, which we will explore in greater depth in the next chapter, relate to the immediate human impacts of household-level deprivation in terms of access to water and indoor air pollution. These variables are gauged relative to regional medians of achievement. We need to account for regional differences—otherwise only very high HDI countries would be deemed successful, which would shed little light on the range of circumstances facing people around the world.

The global environmental aspects of sustainability—those that pose wide-ranging threats—are measured by greenhouse gas emissions, deforestation and water use, in a normative manner, each relative to global norms reflecting good practice. Following the same logic, we identify countries with a better record on the HDI and inequality than the median of their region. Applying this multidimensional filter enables us to identify a shortlist of countries with relatively better performance in responding to both localized and global environmental threats, as well as with respect to the HDI and equity. The results are illustrative, owing to patchy data and other issues relating to comparability. Nonetheless, for the indicators that we are able to assemble,

they suggest some promising approaches that have the potential to promote relatively equitable and environmentally sustainable policy as well as human development more broadly.

Table 2.4 illustrates the application of the joint lens described above to identify countries that have performed better than the global threshold (for global threats) and better than the regional median (for local impacts, HDI and HDI losses due to inequality).[80] A few countries perform well on at least four of the five environmental fronts considered. Costa Rica stands out for good performance on all five criteria. Germany and Sweden, two very high HDI countries, perform well in deforestation, water use, water access and indoor air pollution but less well in greenhouse gas emissions. The Philippines is an interesting case particularly with respect to afforestation, because the increase in forest area has been supported by community-based social forestry programs. Also, indoor air pollution in the Philippines is only 48 percent of the regional median, and broad access to schooling and healthcare offsets traditionally high income inequality. Box 2.10 highlights the experiences of Costa Rica and Sweden.

Of course, this picture is incomplete. Data limitations have already been hinted at. And, an obvious shortcoming, it does not include any indicators of political freedom and empowerment or performance on gender equality and women's empowerment (as captured by the GII, for example, which is explored in the next chapter). All four countries are democracies and do well relative to their HDI group in terms of gender equality.

Exploring trends over time also gives a more mixed picture. Of the four countries we identify here as relatively strong performers, only Germany and Sweden improved on all dimensions. Since the 1990s all countries on the list have reduced air pollution and maintained or improved the share of the population with access to water, and all but

BOX 2.10

Positive synergies in Sweden and Costa Rica

The performance of countries identified as doing well on environmental, human development and equity fronts can offer insights and development lessons. Here we focus on environmental performance in Sweden and Costa Rica.

Sweden is currently seventh in the Human Development Index (HDI), sixth best in human development loss due to inequality and first in the Gender Inequality Index. Its per capita emissions were the sixth lowest for very high HDI countries, and air pollution rates were the lowest for very high HDI countries and the fourth lowest globally. Sweden's performance appears to be rooted in its strong environmental awareness and a tradition of egalitarian and democratic policy. For example, the Committee for Research into the Preservation and Utilization of Natural Resources, established in 1957, worked to raise public awareness of environmental issues and served as a powerful pressure group. Other early clues include a 1969 survey indicating majority support for both slower economic growth to prevent environmental deterioration and for higher local taxes to fight water pollution, reflecting a willingness to pay for better environment quality. The right to common access is rooted deeply in the Swedish social psyche and in centuries-old customs. Contemporary awareness is reflected in Gallup Poll results showing that 96 percent of Swedes are aware of climate change and almost half regard it as a serious threat. Sweden's achievements in equity and education might translate into stronger political voice, partly explaining why popular environmental awareness and sensitivity are reflected in environmentally friendly policies.

Successive governments in Costa Rica have implemented policies and built institutions with environmental objectives in mind. In 1955 Costa Rica established the Institute for Tourism to protect the country's natural resources. But it was the forestry legislation of the late 1980s that really launched its environmental policy. The law defines the environmental services of forests as carbon sequestration, biodiversity protection, water flow regulation and scenery. It was also the foundation for introducing payments for environmental services as a financial mechanism to protect forests. By the mid-1990s environmental rights were enshrined in the Constitution, and Costa Rica had become a pioneer in selling carbon reduction credits (to Norway). Active participation by civil society, the population's pride in the country's beauty, biodiversity and natural resources, and investment opportunities related to sustainable practices in sectors such as tourism have also contributed.

Source: UNDP Costa Rica Country Office, Observatorio del Desarrollo and Universidad de Costa Rica 2011; Kristrom and Wibe 1997; Lundqvist 1972.

TABLE 2.4

Good performers on the environment, equity and human development, most recent year available

	Global threats			Local impacts		Equity and human development	
Country	Greenhouse gas emissions	Deforestation	Water use	Water access	Air pollution	HDI (percent of regional median)	Overall loss (percent of regional median)
Costa Rica	✔	✔	✔	✔	✔	104	77
Germany		✔	✔	✔	✔	103	91
Philippines	✔	✔		✔	✔	103	89
Sweden		✔	✔	✔	✔	102	70

Note: These countries all pass the criteria of absolute thresholds for global threats as defined in note 80, perform better than the median of their respective regional peers both in the human development and inequality dimensions and perform better than the regional median for local impacts.

the Philippines have reduced greenhouse gas emissions.[81] Multidimensional inequality also fell in these top countries except in Costa Rica, which nevertheless still has lower inequality than its regional median.[82]

Many developing countries also demonstrate successful, scalable, sectoral models for transition to a green economy. Some examples:[83]

- The city of Curitiba in Brazil has successfully implemented innovative approaches to urban planning, city management and transport to address the challenge of rapid population growth. The city now has the highest rate of public transport use in Brazil (45 percent of all journeys) and one of the country's lowest rates of air pollution.
- Kenya's Ministry of Energy adopted a feed-in tariff in 2008 to supply and diversify electricity generation sources, generate income and employment and reduce greenhouse gas emissions. The tariff covers biomass, geothermal, small hydroelectric, solar and wind power.

In sum, it is possible to identify countries that have promoted sustainable and equitable human development through a higher HDI, lower inequality and performance on a set of environmental indicators that reflect global sustainability and local threats. While data constraints preclude presenting a complete ranking of countries, we offer some illustrative results and suggest that the method offers a valuable means of demonstrating that countries in different regions, with very different structural characteristics and levels of development, can adopt policies consistent with more sustainable and equitable human development.

* * *

This chapter has considered key patterns and trends in human development and the environment and provided evidence of major cross-country disparities as well as new findings about positive synergies. In many cases the poorest countries bear the brunt of environmental deterioration, even though they contribute only a small share to the problem. But greater equality—both across and within countries—is consistent with better environmental performance.

The analysis underlines the potential pay-offs from development models that both promote equity and less lopsidedly favour economic growth, themes that we explore in subsequent chapters.