HABITAT LOSS

The often irreversible loss of human habitat to deserts and rising sea levels are among the most vivid effects of the change in our climate. Increasing temperatures contribute to rising sea levels and cause deserts to expand.[109] When summed up globally, today's slow, nearly undetectable changes to seashores and advances of arid lands and deserts ultimately affect millions of people. And these changes are relentless and accelerating. The poorest communities often feel the worst impact of these effects. And worst hit among them are low-lying countries, such as small island developing states, nations with large river estuaries, and communities living in arid zones or drylands.[110]

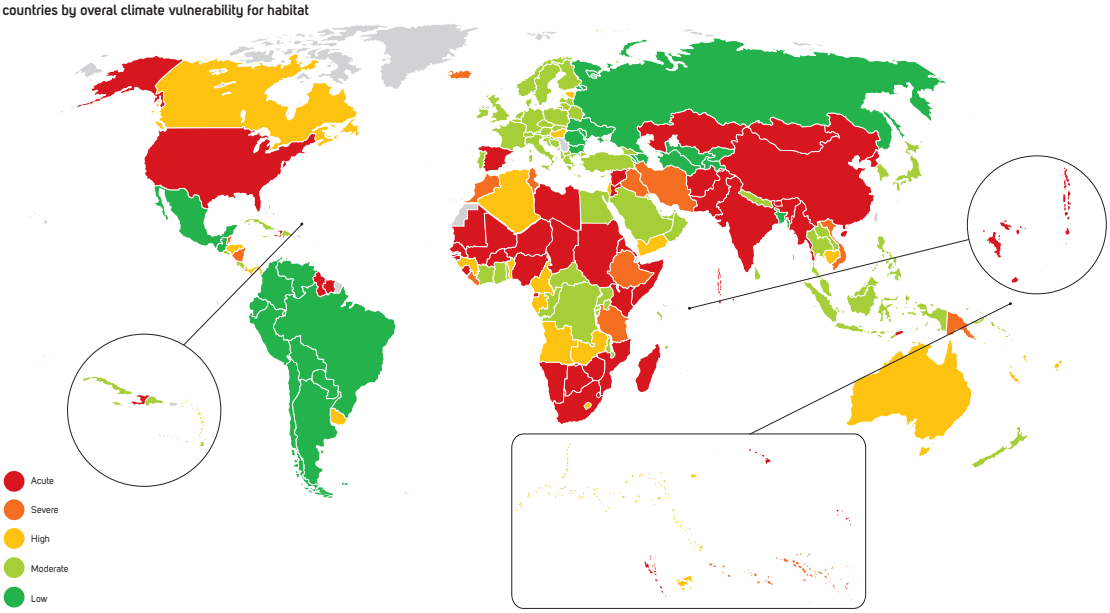
2010
CLIMATE EFFECT TODAY
3 MILLION
AT RISK FROM DESERTIFICATION
65 BILLION DOLLAR
SEA LEVEL RISE IMPACT PER YEAR

2030
CLIMATE EFFECT TOMORROW
10 MILLION
AT RISK FROM DESERTIFICATION
100 BILLION DOLLAR
SEA LEVEL RISE IMPACT PER YEAR

FINDINGS

GLOBAL VULNERABILITY TO CLIMATE HABITAT LOSS

countries by overal climate vulnerability for habitat



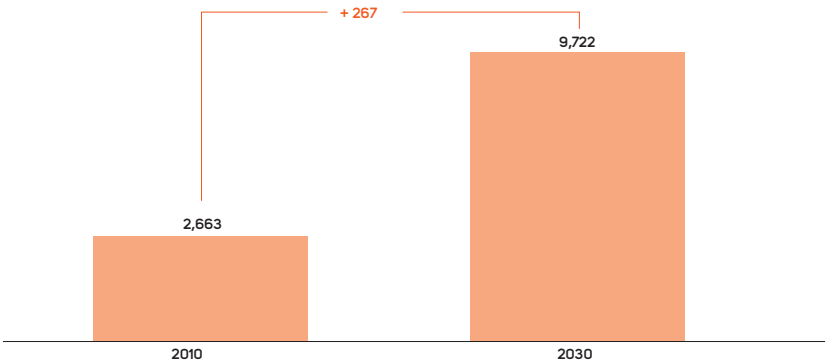
This chapter assesses the slow but devastating impact of climate change on environments where people live. The frontline of the struggle of people against damaged and vanishing lands is taking place at the borders of the world's growing deserts and on the shores of the world's rising seas.

Both desertification and sea-level rise are claiming land from people and passing on heavy costs to the communities affected. In the absence of significant countermeasures, more than 2 million people are estimated to be at risk of desertification due to climate change today. And that figure will rise to almost 10 million by 2030.

Climate change is the principal factor responsible for sea-level rise. The relentless stress caused by rising seas is systematically wearing down coastal areas and their communities in every part of the world.[111] Rising sea levels are estimated to cause USD 65 billion in losses each year today, a figure expected to rise to almost USD 100 billion in losses each year by 2030 as coastal lands are quietly flooded, degraded, or completely submerged.

GLOBAL CLIMATE DESERTIFICATION IMPACT BURDEN

The change in the scale of global climate-related desertification population risks from 2010 to 2030
Total additional persons at risk of desertification (1000)

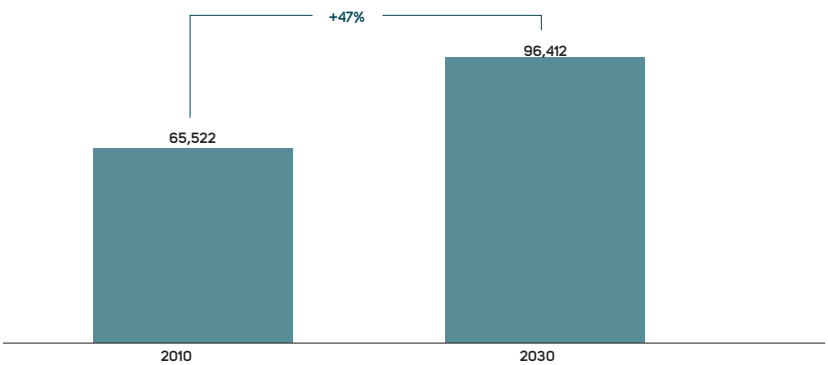


Developing countries are expected to experience the lion's share of these impacts. More than 80% of the impact of both desertification and sea-level rise is projected to hit developing countries through 2030. However, particularly in regards to sea-level rise, industrialized countries are also projected to face a significant burden in absolute terms.

Human habitats in two groups of countries are particularly vulnerable to the effects of climate change -- those in land-locked least developed countries (who face a dramatic threat of desertification) and those in small island developing states (who will be hit hard by the effects of sea-level rise).

GLOBAL CLIMATE SEA LEVEL RISE IMPACT BURDEN

The change in the scale of global climate-related sea level rise losses from 2010 to 2030
Additional losses (million USD PPP) average per year



Habitat loss here refers to human habitats. It refers to the loss of arable land due to desertification and to the loss of land for any human use as a result of sea-level rise. The serious effects of climate change on marine and other species will also impact human societies. We often use the term "habitat loss" to refer to these wider environmental concerns, but it should be noted that this report does not take the full scope of these concerns into account.

Climate change's role in desertification is quite different from its role in sea-level rise. Desertification is happening rapidly around the world. But climate is only one of many contributing factors to desertification. Overgrazing, over cultivation, exhaustion of local water resources, and deforestation are other serious drivers of the phenomenon.[112] Measures exist for stemming or even reversing desertification (such as soil conservation or reforestation) and protecting against sea-level rise (through heavy infrastructure such as sea walls). But such measures can be extremely costly per square km or mile of land saved or restored. The thought of protecting the world's 850,000 kms (550,000 miles) of coastline or the nearly 40% of the planet's land surface that are arid zones is almost overwhelming.[113] Focusing our efforts, however, could well mean relinquishing parts of the world's once habitable land for good.

IMPACT DYNAMICS

The scientific evidence for climate change and its key role in sea-level rise is well established.[114] The role of climate change in desertification is less well agreed upon due to the vast range of factors involved.[115] This chapter does not deal with the full range of human and animal habitats under threat, such as Arctic tundra lands, boreal forests, coral reefs, and tropical and temperate peat-lands. These are, however, covered to an extent in the Economic Stress section, where losses in biodiversity linked to climate pressures on these and other areas have been calculated in economic terms. Drought -- which is linked to desertification but is a separate climate phenomenon -- is covered in the health and economic sections of this report in relation to its impact on human health, agriculture, biodiversity, and water resources.

PEAK IMPACT HABITAT ▲

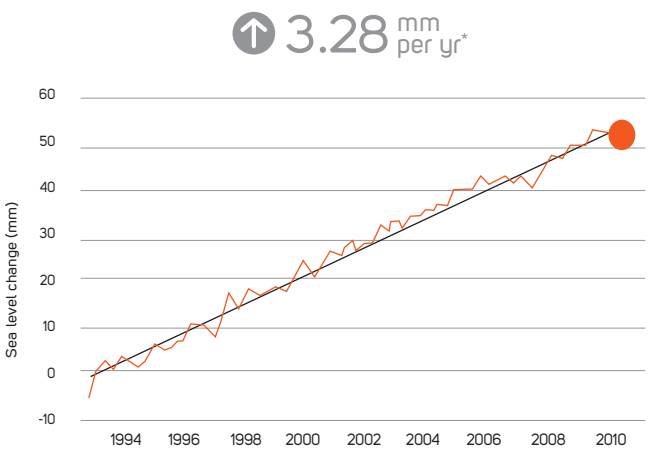
ONGOING	China- Gobi Desert	Desertification	Expanding at a rate of 3,600 km2 or 1,400 miles2 per year[116]
ONGOING	Sahel	Desertification	Expanding at the rate of 25 km2 or 9 miles2 per year[117]
1997	Tuvalu	Sea Level Rise/ Storm Surge	Cyclone destroyed an islet rendering it uninhabitable[118]
1999	Kiribati	Sea Level Rise	Lost two islets which disappeared underwater[119]
2008	Marshall Islands	Storm surge/ coastal flooding/ sea level rise	Storm surge combined with high tides caused severe flooding. 10% of population was evacuated[120]
2008	Papua New Guinea	High Seas/ Coastal Flooding	75,000 affected in low-lying islands and coastal regions in 7 provinces[121]
2010	Bangladesh (Sunderbans)	Sea level rise	South Talpatti, which was 210 km2 or 80 miles2, became the 5th island in the Sunderbans to sink[122]
2010	Thailand (Andaman Sea)	Coral bleaching event	Largest coral bleaching witnessed since 1998 - 95% of coral bleached[123]

SEA-LEVEL RISE

The world's seas have risen by 3.3mm (1/8 inch) every year over the last 15 years.[124] That amounts to one centimetre (just under a 1/2 inch) every three years, or 3-4 cm (1 inch) a decade. Over the course of the 20th century, sea levels rose by around 20 cm. This century they will continue to rise faster still.[125]

RATE OF GLOBAL AVERAGE SEA-LEVEL RISE

Satellite sea-level observations



* estimate for 1993-2010

Source: NASA CLS/Cnes/Legos"

Sea-level rise is caused by two factors: Thermal expansion of warming water and fresh water influx due to melting land ice. The latter is estimated to be gaining momentum due to rising temperatures. Observations of the Greenland and Atarctica ice sheets indicate they are increasingly losing mass, and mountain glaciers are melting at an accelerated pace, according to observations. Estimates for the last five years indicate an 80% land-ice contribution to the observed global sea-level rise.[126] Both factors will continue to be affected and aggravated by rising temperatures even after global temperatures have stabilized, which means that sea levels will continue to rise for many centuries.[127]

With rising temperatures, large ice masses become more vulnerable. Their potential contribution to sea-level rise is enormous. The Greenland ice sheet holds enough water to raise the global sea level by up to 7 meters (23 feet). There is, however, currently no evidence from model simulations or observational data that suggests a near-complete disintegration might occur faster than on a multi-millennial time scale. Estimates of the Greenland ice sheet's maximum contribution to sea-level rise within this century amount to around 54 cm. The West Antarctic ice sheet in turn holds the equivalent of 5 meters, of which around 3 are potentially at risk of disintegration. Time scales for this amount of sea-level rise, however, are not available yet. Because the behaviour of ice sheets has not fully been understood to date and is not always accounted for in estimates of future sea-level rise, estimates vary from 18-59 cm to 215 cm of global sea-level rise by 2100.[128]

This growing rise in the world's seas affects coastlines everywhere. Higher seas have an erosion effect on coastlines, damaging shore life, property, infrastructure, and local ecosystems, all of which can be quantified. The lowest land areas can be completely submerged, in particular during high tides or brief surges in sea levels caused by heavy

ALMOST 10% OF THE WORLD'S TOTAL POPULATION LIVE IN AREAS FROM ZERO TO JUST 10 METERS ABOVE SEA LEVEL

storms.[129] Other important effects, such as salt contamination of soil and water supplies or heightened impacts from storms, due mainly to storm surge, are covered in the chapters on Weather Disasters and Economic Stress respectively. Damage to cultural assets, tourism, and transport systems are not readily quantifiable and have not been taken into account.

Almost 10% of the world's total population live in areas from zero to just 10 meters or 30 feet above sea level, including many of the world's largest cities.[130] All these populations should be considered under great pressure due to climate change. However, the most vulnerable populations are those that cannot afford to build up land or sea walls to preserve against erosion, soil and water contamination, storm flooding, and total loss of dry land to the seas.

The 200-300 million people living in the rural areas of these zones in countries with High vulnerability or above should be considered potential climate migrants or displaced people. The economic losses that these rural and urban communities incur due to climate change are used as the indicator of impact in this report. We have based our estimates on the findings of a major international collaboration called DIVA (Dynamic Interactive Vulnerability Assessment), which calculates economic impacts caused by climate-driven sea-level rise all around the world.[131]

DESERTIFICATION

While over-grazing, over-cultivation, deforestation, and unsustainable use of water supplies are well documented as the main causes of desertification, climatic factors such as higher temperatures and stronger high winds, have a clear aggravating effect on the phenomenon.[132]

In many areas, including desertification-prone lands, temperatures can be as much as a year-long average of 5 degrees Celsius (9 degrees Fahrenheit) hotter than the norm.[133]

While the higher temperatures brought by climate change will increase rainfall in general (because higher temperatures intensify water evaporation), that effect will be isolated to specific areas. Most drylands and deserts will not benefit from the increase. In fact, shifting rainfall patterns are, in many cases, making already marginal arid zones even drier.[134]

A combination of continuous and extreme heat and lack of rainfall in already marginal arid lands gradually or abruptly kills off plants, trees, and other vegetation. That can push the local ecosystem into a vicious cycle as evaporation of remaining water or rainfall deposits increases due to a lack of shade. Soil salinity rises as water leaves the ground at pace, harming any new growth prospects. Unable to block out sunlight or heat during the day, or retain heat during the night, desert-like areas are plunged into repetitive hot-cold extremes that are hostile to most life-forms and that further discourage regeneration.[135]

Some areas of the world, such as the Horn of Africa, are experiencing recurring drought, which can force millions of people into crisis as ecosystems and rain-based water supplies completely collapse.[136]

But desertification occurs when degradation takes on a permanence that defies the natural or managed ability of a land to recover from drought when rains return. Arid land becomes desert, which is both difficult and costly to restore.[137]

Where degradation of arid or semi-arid regions is extreme, desert sand dunes can advance against little resistance, carried mainly by the winds. Desert expansion in some areas, such as the Gobi Desert, has reached an explosive 15 kms per year.[138] Dust storms, which can also assist the spread of infectious diseases, such as meningitis, are another hallmark of lands under threat from desertification.[139]

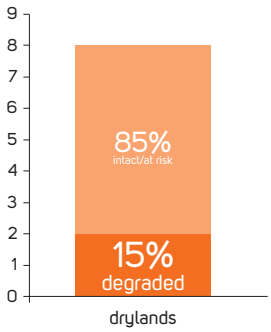
The harsh climate, ecosystem breakdown, lack of water and shade, and near irreversible degradation of land no longer fit for crops or grazing means most inhabitants have to uproot and leave.[140] More than 100 million people are living under pressure from desertification today, and that number is expected to significantly increase by 2030. These people should be considered potential climate migrants or displaced people. Not all desertified land creates migrants. It is possible for communities to persist in a desert environment, such as by benefitting from resources derived from peripheral land. But for most people, desertification implies abandonment of land and property.[141] Those who remain become even more vulnerable.

This report bases its findings on the PLACE II database (Population, Landscape, and Climate Estimates), which is managed by the Earth Institute of Columbia University, New York, and draws on US government observational information.

DESERT EXPANSION IN SOME AREAS, SUCH AS THE GOBI DESERT, HAS REACHED AN EXPLOSIVE 15 KMS PER YEAR

GLOBAL DESERTIFICATION

Percentage of degraded drylands (million sq km)



Source: Millenium Ecosystem Assessment; CIA Factbook

LINKS FROM CLIMATE CHANGE TO IMPACT INDICATORS

CLIMATE CHANGE EFFECTS	PHYSICAL CHANGES	VULNERABILITIES	IMPACT INDICATORS
• Rising sea levels	• Shore retreat • Salinization • Back-water flooding	• Loss of wetlands • Loss of dry land • Protection cost • Migration cost	Impact of malnutrition • Described as deaths related to malnutrition and lower respiratory infection due to climate change
• Desertification	• Rising surface temperatures • Droughts • Water pressure	• Access to water for human and industrial use • Food – agricultural yields, species • Extreme heat • Wildfires • Conflicts (pastoral – Horn of Africa, northern Uganda and northern Kenya)	Loss of human habitat due to desertification • Described as climate change impact on the share of population living in climate zones at risk of desertification

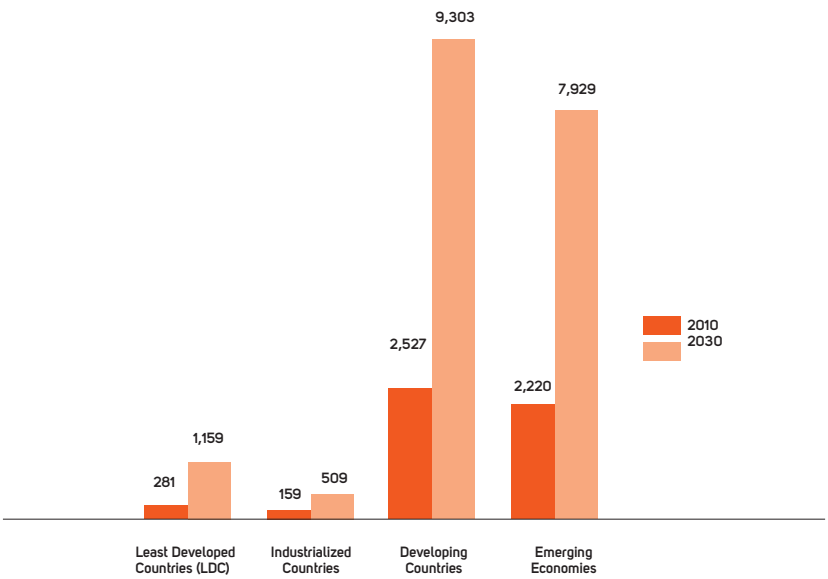
WHO SUFFERS?

Overall, the regions worst affected by habitat loss are Western Africa, Southern Africa, and the Pacific, followed by South Asia. The whole continent of Africa is among the most vulnerable.

THE SPREAD OF IMPACT: DESERTIFICATION

The distribution of climate-related desertification population risk by socio-economic group in 2010 and 2030

Additional persons at risk of desertification (1000s) average per year



The Pacific, the Caribbean, and Eastern and Western Africa are worst affected by sea-level rise.

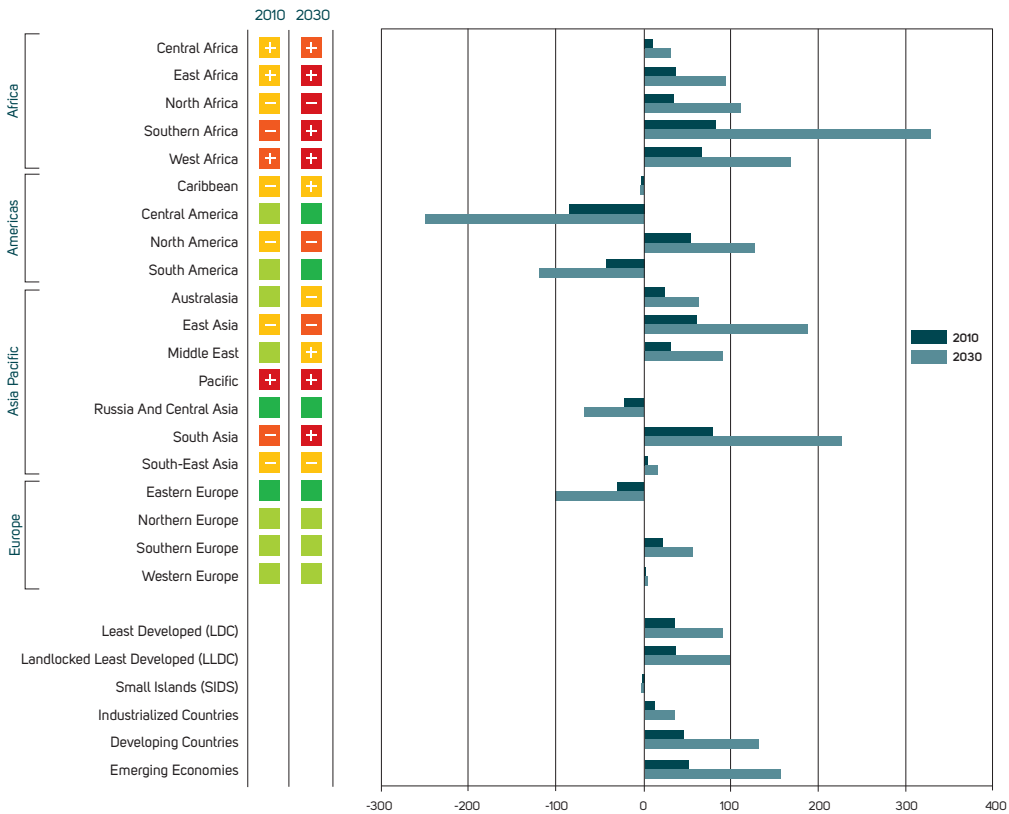
South Asia, Southern Africa, North Africa, North America, and East Asia are worst affected by desertification.

The countries projected to face the worst impacts of desertification are Botswana, Namibia, and Senegal. Namibia is the only country that is among the worst-affected by both desertification and sea-level rise.

The countries projected to face the most overwhelming impacts of sea-level rise are all small island developing states and countries in Africa. Guinea-Bissau is the country most vulnerable to sea-level rise. The river delta nation bordering on the Western Sahara Desert is projected to suffer extreme stresses. The losses that these countries are projected to incur correspond to a large share of their GDP each year. Large archipelagic countries, such as the Philippines, have not registered vulnerability as high as would be expected. This is because, statistically speaking, we calculate a lower vulnerability for countries with a lower ratio of coastline to overall land area than, for example, nations with proportionally more land area close to the sea, or higher levels of population and infrastructure clustered in low-lying coastal areas, such as the Maldives or Guinea-Bissau.

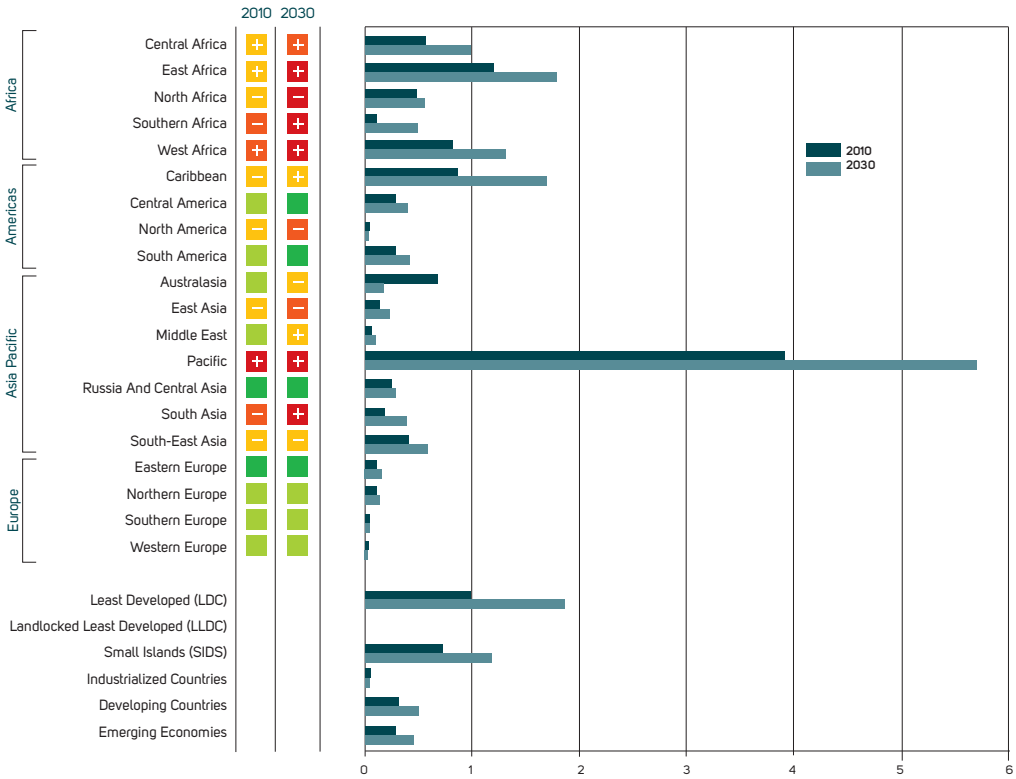
IMPACTS AROUND THE WORLD: DESERTIFICATION

The regional and socio-economic distribution of climate-related additional persons at rist of desertification relative to population in 2010 and 2030
Additional persons at risk per 100.000



IMPACTS AROUND THE WORLD: SEA-LEVEL RISE

The regional and socio-economic distribution of sea-level rise costs relative to gdp in 2010 and 2030
Additional losses (percent of GDP)



By evaluating impacts in these relative terms, we are best able to make comparisons across countries and points in time. And because these impacts are assessed in relation to local populations and levels of income, they are not skewed by different sizes of populations and levels of economic activity. Relative indications of economic losses are also more comparable between poor and wealthy countries because they take into account a country's underlying per capita income level. However, this "equity weighted" expression of economic impacts does not go as far as some indices in expressing the high vulnerabilities of the poorest communities around the world.

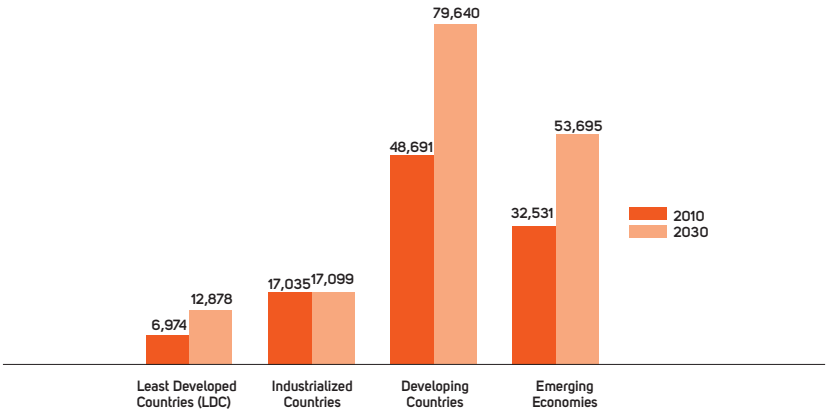
It is also important to note that estimates of absolute impact in 2010 and 2030 may increase both due to increases in climate change impacts and due to population and economic growth.

In absolute terms, 80% of the excess persons at risk due to desertification in 2030 are projected to live in China and India. The 10 countries with the largest populations at risk to desertification due to climate change bear almost the entire global burden. Among developed countries, the United States and Spain are the worst-affected in absolute terms.

China and India are also the countries projected to face the largest absolute economic losses due to sea-level rise. Other countries in Asia and Latin America, as well as the United States and Russia are also projected to suffer significant losses. Overall, the 10 worst-affected countries in absolute terms bear about half of the global economic losses caused by sea-level rise.

THE SPREAD OF IMPACT: SEA-LEVEL RISE

The distribution of climate-related sea-level rise losses by socio-economic group in 2010 and 2030
Additional economic losses (million USD PPP) average per year



A number of countries are protected from the habitat loss impacts described in this chapter because they are neither on the sea nor have dryland areas. In Asia, examples of these countries are Laos and Nepal; in Africa, Burundi and Rwanda; in Europe, Austria, Belarus, Czech Republic, Slovakia, and Switzerland.

The least-affected countries are in regions where a reversal of desertification trends is projected. These projections suggest that there are countries in Central Asia and Latin America that could experience benefits in terms of desertification.

THE IMPACT TOMORROW: 2030

Roughly 20 countries are severely or acutely impacted by habitat loss today, and that number is set to rise to 25 by 2030 (note that a number of small island states are not included among the 184 countries covered in this report due to a lack of data in a number of areas). Some of the lowest-lying areas are found in wealthy countries such as the Netherlands or the United States. North America, Australia, and parts of Mediterranean Europe are also home to some of the world's most arid regions. However, the key measure of vulnerability is whether a country must suffer through the changes as opposed to fending them off through significant investments. This is why wealthier nations are rated as less vulnerable than poor countries even where they may face similar impacts.

The regions projected to face the worst habitat losses between 2010 and 2030 are North Africa and the Middle East. In that same time period, South Asia and Southern Africa both move from High to Acute factors.

Several countries will experience a significant acceleration of exposures to habitat loss impacts between today and 2030. The deterioration in these countries, mainly in Asia and Africa, is primarily driven by desertification.

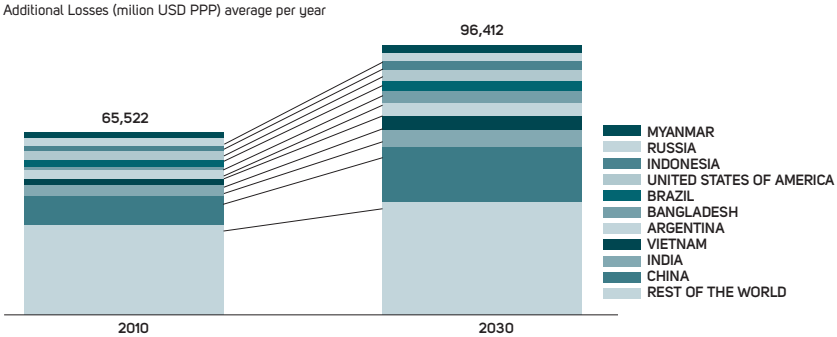
WORST HIT AND LEAST HIT (2030)

The top 10 countries worst and least affected by habitat loss related to climate change in 2030 relative to their size

WORST	LEAST
GUINEA-BISSAU	AZERBAIJAN
NAMIBIA	TAJIKISTAN
KIRIBATI	VENEZUELA
MARSHALL ISLANDS	TURKMENISTAN
MALDIVES	UZBEKISTAN
BOTSWANA	MEXICO
SOLOMON ISLANDS	KYRGYZSTAN
SENEGAL	PERU
TUVALU	COLOMBIA
SOMALIA	UKRAINE

HOTSPOTS: SEA-LEVEL RISE

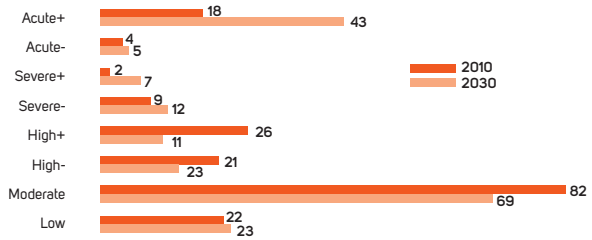
Countries with the largest total climate-related sea-level rise losses
Additional Losses (milion USD PPP) average per year



VULNERABILITY SHIFT

The change in the number of countries by each Vulnerability Factor between 2010 and 2030

Number of Countries by Vulnerability Factor

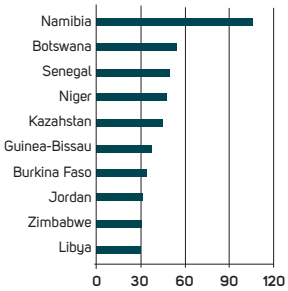


A group of already-vulnerable Western and Southern African countries are projected to be among the worst-affected by incremental habitat loss due to climate change between 2010 and 2030. Countries with large populations living in drylands outside Africa will also face accelerating stresses, including Kazakhstan, Jordan, and Libya.

HIGH SURGE VULNERABILITY

Countries with the fastest growing climate-related habitat loss between 2010 and 2030

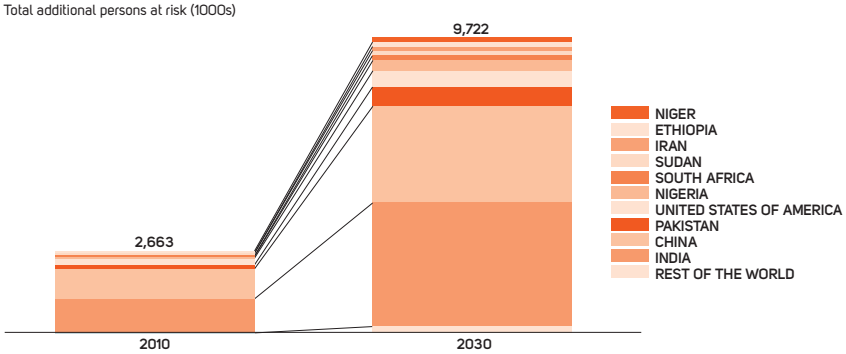
Percentage increase in climate-related habitat loss



HOTSPOTS: DESERTIFICATION

Countries with the largest total climate-related desertification population risk

Total additional persons at risk (1000s)



SPOTLIGHT: MULTIPLE HABITAT STRESS

Most countries are either affected by sea-level rise, or by desertification, or by neither. Desertification is usually a continental problem, since the centres of landmasses are less regulated by the constant temperatures of the sea, and can experience greater hot and cold extremes. In fact, many countries badly affected by desertification are landlocked states like Botswana, Niger, or Kazakhstan. Sea-level rise, of course, only stresses coastal areas. Nevertheless, a handful of countries, mainly in Africa, are badly affected by both sea-level rise and desertification -- in particular, Eritrea, Mauritania, Mozambique, Senegal, and Somalia. Outside of Africa, countries like Myanmar and Australia are also suffering from both stresses.

Countries affected by sea-level rise and desertification are fighting a battle on two fronts. Each of these stresses has quite different effects and requires very different responses, although both can involve the temporary or permanent disappearance of human habitats, and either could lead to displacement and migration of people to higher, more protected or less stressed lands. Sea-level rise particularly affects the economy through lost investment opportunities. Investments are instead spent on maintaining costly coastal infrastructure and protecting lands and communities at risk from inundation. Desertification reduces the land area available for agricultural purposes or human habitation. Most of the African countries suffering both types of impacts have low-lying coastlines and territories that back onto the Sahara Desert. Australia is a continent unto itself containing deserts and one of the largest coastlines in the world, which make it highly vulnerable to both those effects.

The compounded growth of this double pressure could sap significant economic and environmental potential from the affected countries, and so demands an intensive coordinated response. If no action is taken, people and communities will be increasingly endangered or forced to relocate. Either way, in the absence of external support, these pressures will very likely hold back socio-economic progress in some of the world's poorest countries. In the case of Somalia, this dual threat adds further complex stresses to its extreme fragility.

THE ASSESSMENT

The Monitor assesses loss of human habitat through climate-change driven desertification, or the degradation of dryland areas, via satellite-based mapping of land degradation evident (from the PLACE II database)[142] and a climate model (called IMAGE) that ascertains a likely aggravating role of climate change.[143] The indicator used is the population at risk from desertification. The indicator is fairly robust, since countries with a high factor of vulnerability will all have relatively large land-degradation problems verified by satellite imagery, and we can assess where this degradation appears to be worsening due to the effects of climate change. The Monitor assesses populations at risk relative to total population and assesses economic costs of sea-level rise proportional to total GDP to take into account the relative importance of these impacts for a given country.

The Monitor assesses loss of human habitat through sea-level rise via a complex global satellite-based model, DIVA, that calculates the cost burden on communities in coastal areas around the world.[144] Since it is based on satellite imagery, the indicator is fairly robust in conveying physical vulnerabilities. The model then weighs in the scale of exposure and costs of ongoing stress to communities in different coastal areas as lost GDP potential.

Despite its robustness, some results are surprising. Countries of the Arabian Peninsula, for example, such as Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, and Yemen, all share Moderate factors of vulnerability. None are deemed to be suffering impacts of desertification, since their environment is either already classed as desert or as urban or otherwise, but not as dryland-facing-degradation. Neither do any of these countries register any significant sea-level rise vulnerabilities.

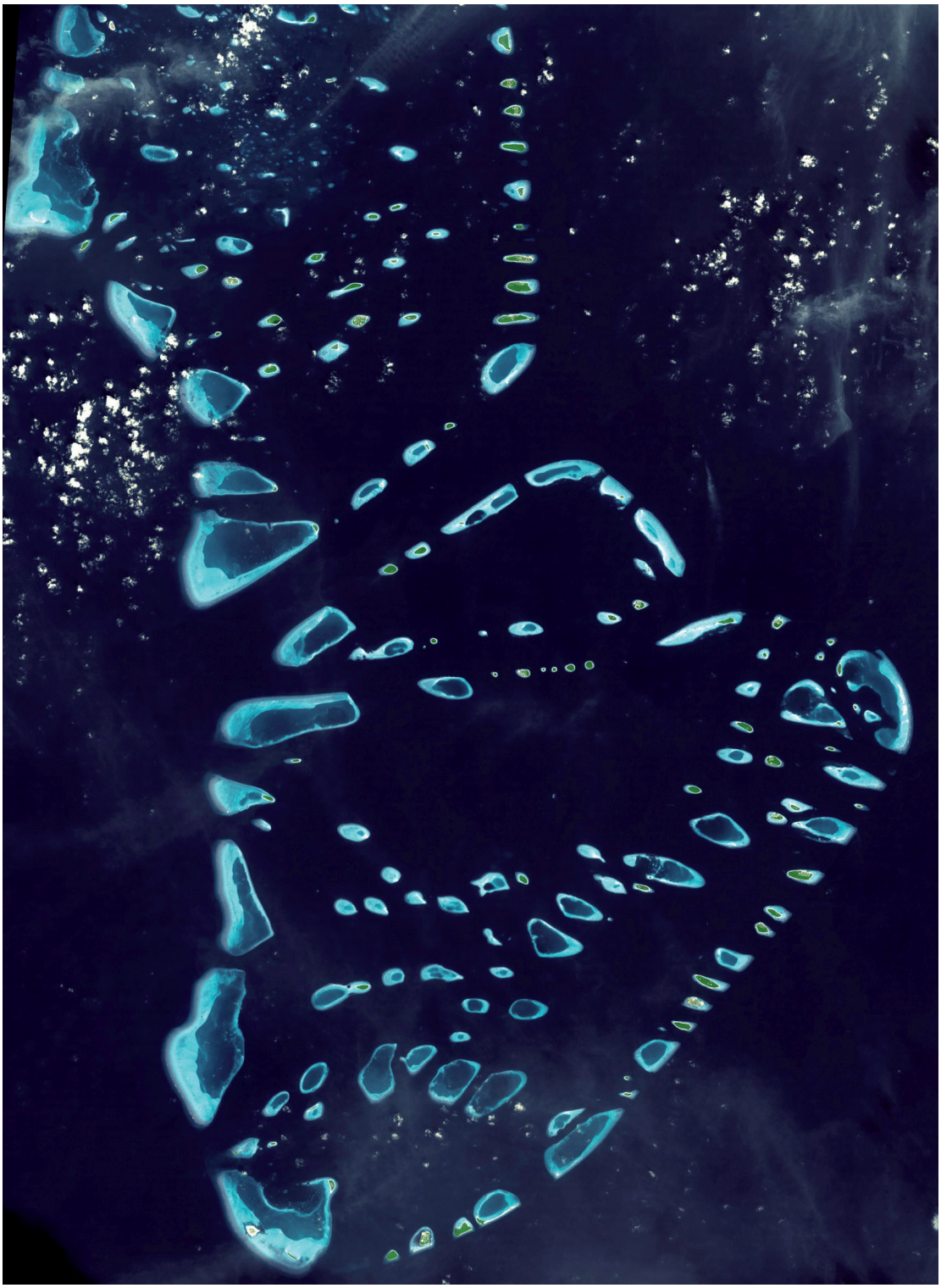
Bangladesh (Moderate/Moderate) is well known for its populous, low-lying coastal delta, but it is far less vulnerable than many other countries for reasons of scale. Bangladesh's coastline is just 580 kilometres or 360 miles long. Less than 15% of the country's population of more than 160 million people live in coastal areas below 5 metres (16 ft) altitude.[145] This compares with 100% for more vulnerable countries like Kiribati, Maldives, and Tuvalu. Bangladesh is also almost 500 times larger than Maldives in terms of total land area, with most of its territory well inland from the sea.[146] Similar rules apply to the Philippines (Moderate/Moderate). Despite having the fifth largest coastline on the planet, the Philippines has much less of its population in coastal areas below 5m/16ft than Bangladesh. Meanwhile, Canada (Moderate/Moderate) has similar vulnerability to Bangladesh and Philippines by virtue of possessing by far the largest coastline in the world (some 30 times that of the Philippines or more than 15,000 times that of Bangladesh), despite the fact that it has minimal populations living in low-elevation coastal zones.[147]

Scale also plays a role in comparative vulnerability to desertification. So when a compact country like Bhutan (High+/Acute+), which is roughly the size of Switzerland, suffers from growing degradation of its savannah and steppe-type lands, proportional pressure on its inhabitants is much higher than in huge countries like Algeria (Moderate/Moderate), where populations are far less concentrated around at-risk areas.

In Africa, the Central African Republic (Moderate/Moderate) has already suffered limited desertification but does not suffer from water stress extremes and should continue to receive more rainfall as a result of climate change (as will much of Central Africa).[148] Neighbouring Cameroon (Moderate/High-), however, is worse off, particularly where its northern border once met the now almost completely vanished Lake Chad. And heavily-populated Sudan (High+/Acute+) is set to suffer increasing degradation of its dryland regions along the margins of the Sahara Desert as temperatures continue to rise.

Four highly-developed countries register high factors of vulnerability to habitat loss: Australia, due mainly to desertification; Iceland, due to sea-level rise alone; Spain, due exclusively to desertification; and the United States, also due in particular to desertification. Iceland (High-/High+) has quite a small population (around 300,000) but a long coastline, similar in size to Argentina's. Almost all of its inhabitants live within 100 kilometres (60 miles) of the sea, which amplifies socio-economic vulnerabilities to growing coastal stress. In Spain (High-/Acute+), existing stresses on water supplies run headlong into less rain and more heat brought by climate change. While Australia (Moderate/High+) and the United States (High-/Acute-) are home to some of the largest dryland areas on the planet, both of which are becoming hotter and dryer as the planet warms up. Parts of the US, in particular, key areas of Southern Florida, are of very low elevation, so local vulnerability to rising seas is high. Nationwide, however, the US does not suffer sea-level rise impacts compared to those experienced by island nations or countries like Guinea-Bissau whose geographies are dominated by large river deltas.

Netherlands (Moderate/Moderate), one of the lowest lying countries in the world -- Half of the country lies below 1 meter (3ft) above sea levels including one eighth of the country lying below sea level -- has a surprisingly low levels of vulnerability to habitat loss /sea level rise. Netherlands, however, is also one of the best prepared countries in the world in dealing with sea level rise through robust protective measures such as dams, polders, dykes and dunes. The low-lying geography of the Netherlands has long dominated the country's development, with key infrastructure already long in place to allow for the productive use of below-sea-level coastal zones. The Netherlands does therefore not have to yet react to the same degree to protect its resources from coastal erosion or the dangers of sea level rise to any significant extent when compared with other seriously affected countries. Adaptation to sea level rise for the Netherlands may only imply in most cases an incremental reinforcement of existing infrastructure. Nevertheless, the total costs of this adaptation can be very large in absolute terms, but are small in size when compared with the overall scale of the Dutch economy -- one of the 20 largest economies in the world.



The Maldives archipelago, seriously affected by sea-level rise. Source: NASA/GSFC/METI/ERSDAC7JAROS, and U.S./Japan ASTER Team