

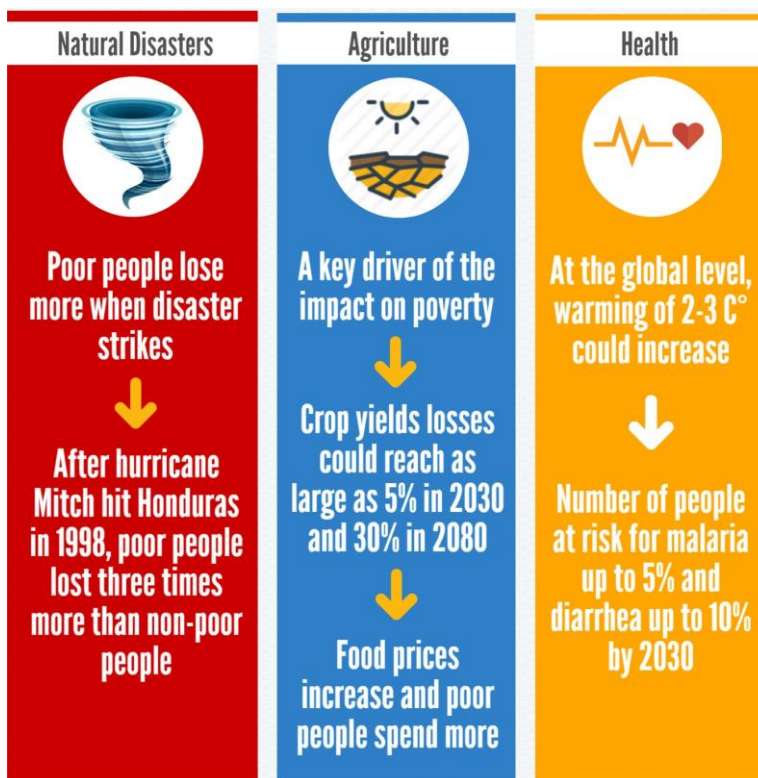


Climate Change

Definition

Global surface temperatures rose 1.0°C between 1880 and 2018¹. 2016 was the warmest year on record². Climate change has already begun affecting ecosystems, human populations, and historical weather patterns and is likely to continue to do so in years to come. The effects of climate change are likely to continue exacerbate humanitarian needs worldwide.

Key Insights



Climate change will prevent people from escaping poverty and will push more than 100 million people into extreme poverty

Climate change is a “threat multiplier” that intensifies natural resource stresses and increases the likelihood of livelihood devastation, state fragility, human displacement, and mass death. These dynamics do not always result in conflict, but they certainly represent a threat to human, national, regional, and international security. The effects of climate change will prevent people from accumulating wealth, and without rapid, inclusive and climate-smart development, combined with emissions-reductions efforts that protect the poor, there could be more than 100 million additional people in

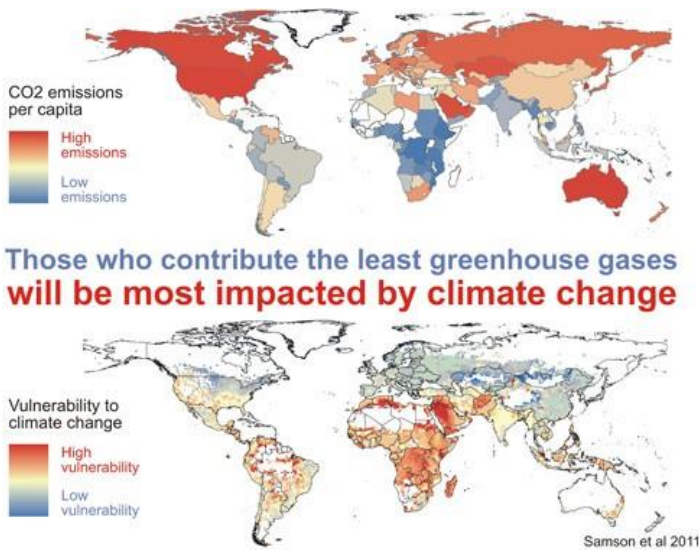
Source: The World bank, Rapid, Climate-Informed Development Needed to Keep Climate Change from Pushing More than 100 Million People into Poverty by 2030 (November 8, 2015); Web; Accessed October 17, 2016

¹ NASA (2019) [2018 fourth warmest year in continued warming trend, according to NASA, NOAA.](#)

² McGrath, M. 2017, [Climate change: Data shows 2016 likely to be warmest year yet](#), BBC News, 18 January 2017 and Carrington, D. (2016) [2016 will be the hottest year on record, UN says](#), The Guardian, 14 November 2016



poverty by 2030³. Without the same access to cheap fossil fuels and natural resources to drive industrialization and modernization as the West had, this deficit will be more difficult to overcome.



Source: Cook John, Those Who Contribute the Least Greenhouse Gases Will Be Most Impacted by Climate Change, 03/16/2011; Web; accessed October 17, 2016

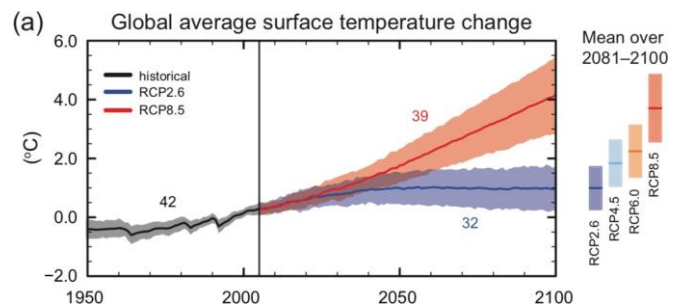
Climate change will become a new issue for human rights and justice

Climate change is a transnational issue that sits at the intersection between human and environmental evolution. As temperatures rise, the poorest people, those living in developing countries⁴ with no safety net, will be most severely affected by freak weather incidents, flooding, drought and changes in seasonal patterns. Such shocks could wipe out hard-won gains, leading to irreversible losses, driving people back into poverty, particularly in Africa and South Asia.

Changes by 2030: main trends

➤ Acceleration of climate change

In 2100 global temperatures are expected to increase by 0.3-4.8°C⁵. It is very unlikely that the international objective to cap rises at 2°C will be met. A significant reduction in emissions would be necessary in order to minimize global warming. To be exact, in 2050, there would need to be a 40%-70%⁶ reduction in emissions (as compared to the 2010 rate). The consequences of



Source: IPCC, (2013), Climate Change 2013: The Physical Science Basis, Working Group 1 contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; print.

³ Hallegatte Stephane, Bangalore Mook, Bonzanigo Laura, Fay Marianne, Kane Tamaro, Narloch Ulf, Rozenberg Julie, Treguer David, Vogt-Schilb Adrien. (2016) [Shock Waves: Managing the impacts of climate change on Poverty](#). World Bank Publications, Washington, DC

⁴ University of Colorado Boulder, Environment Center, [Climate Justice](#), retrieved September 2016

⁵ Intergovernmental panel on Climate Change (2014), [Climate Change 2014 Synthesis Report Summary for Policymakers](#)

⁶ Intergovernmental panel on Climate Change (2014), [Climate Change 2014 Synthesis Report Summary for Policymakers](#)



rising temperatures will be droughts, floods, ecosystem destabilization, species extinction and water scarcity.

➤ **Increasing vulnerabilities in low and medium income countries**

Northern regions are less vulnerable to the effects of climate change⁷, as they benefit from anticipation and management capacities which helps to limit the death toll and are able to invest in more resilient capacities. However, Sub-Saharan Africa, the Middle East, South Asia and Central America exhibit critical and escalating vulnerabilities. These regions often suffer from poor environmental management and lack the resources and policies to face climate change challenges. When considering human loss and the potential financial



ND-GAIN Vulnerability Index map (2014)
Source: Notre Dame Global Adaptation Index

damages, the Indian sub-continent, Central America and Asia-Pacific regions exhibit high levels of climate risk⁸. Densely populated countries like Pakistan, Bangladesh and Vietnam are particularly exposed.

The impact of disasters induced by natural hazards depend heavily on the characteristics of the territory, its infrastructure, the population density and the anticipation and adaptability capacities of the authorities. Vulnerability indices point to the decreasing resilience capacities of fragile countries experiencing weak governance, a lack of anticipation and adaptation plans compounded by rapid, uncontrolled urbanization⁹. Sub-Saharan Africa will be even more fragile in

⁷ Krusell, Per (2011) [Climate change affects different regions differently](#), Knut and Alice Wallenberg Foundation

⁸ Kreft Sönke, Eckstein David, Dorsch Lukas, Fischer Livia, [Global climate risk index 2016, who suffers most from extreme weather events? Weather-related loss events in 2014 and 1995 to 2014](#), briefing paper, GermanWatch, November 2015,

⁹ The [Notre Dame Global Adaptation Index](#) (ND-GAIN) is part of the Climate Change Adaptation Program of the University of Notre Dame's Environmental Change initiative (ND-ECI). The ND-GAIN Country Index follows a data-driven approach to show which countries are best prepared to deal with global changes brought about by overcrowding, resource-constraints and climate disruption.

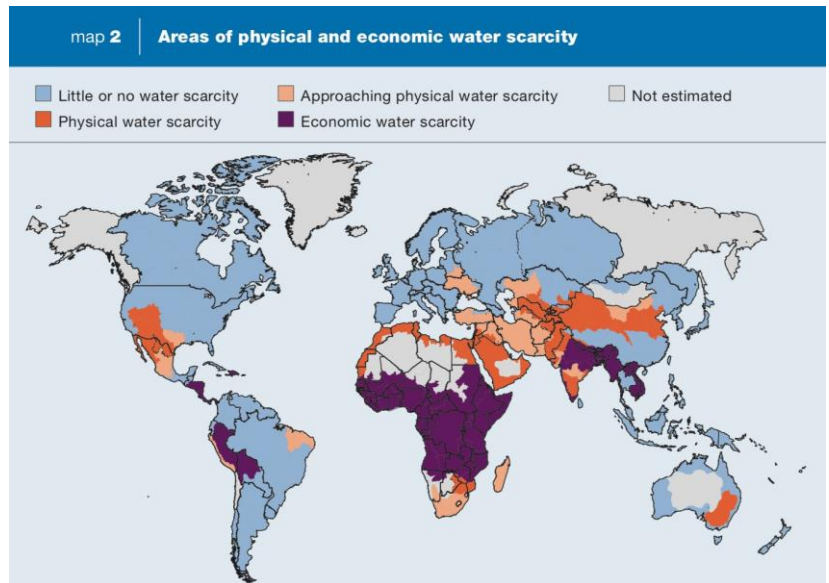


the future due to continued high levels of population growth adding demographic pressure and endemic poverty in some of the most environmentally fragile countries. The concentration of these threats in the poorest countries make issues of inequality, hunger, education, and healthcare more difficult to resolve.

➤ Increasing water scarcity

Significant improvements have been made in providing access to drinking water over the past few decades; in 2017, 90% of world population had access as compared to 76 % in 1990 ¹⁰. Nevertheless this issue remains a great challenge for many countries, especially in Asia and Africa.

Already, some 1.8 billion people¹¹ – a third of the world population – live in water-stressed countries, a figure expected to rise to 5 billion by 2025. By 2030 half of the global population will be living in areas affected by water stress¹².



Physical and economic water scarcity in the world. Source: Comprehensive Assessment of Water Management in Agriculture (2007) Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture (London: Earthscan, and Colombo: International Water Management Institute 2007); print.

Climate change combined with population growth and urbanization has resulted in worrisome levels of water scarcity in some parts of the world. Warmer temperatures increase evaporation, create more intense but less frequent precipitation patterns which undermine general water security. Regions facing the most severe levels of water scarcity will see situations worsen, particularly Africa, the Middle East and South Asia. **Average river run-off and water availability is projected to decrease by 10-30%¹³ in dry regions, and this situation is projected to worsen due to irrigation, which accounts for 69-90% of global water usage.** Water resources will

¹⁰ World health organization (2019), [Drinking-water, key facts](#), Fact sheet N°395, June 2019

¹¹ World health organization (2015), [Drinking-water, key facts](#), Fact sheet N°391, June 2015

¹² UN Water (2012), [Most population growth will occur in regions already experiencing water stress](#), 3 May 2017

¹³ Intergovernmental panel on Climate Change (2007), [Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability](#), Cambridge University press

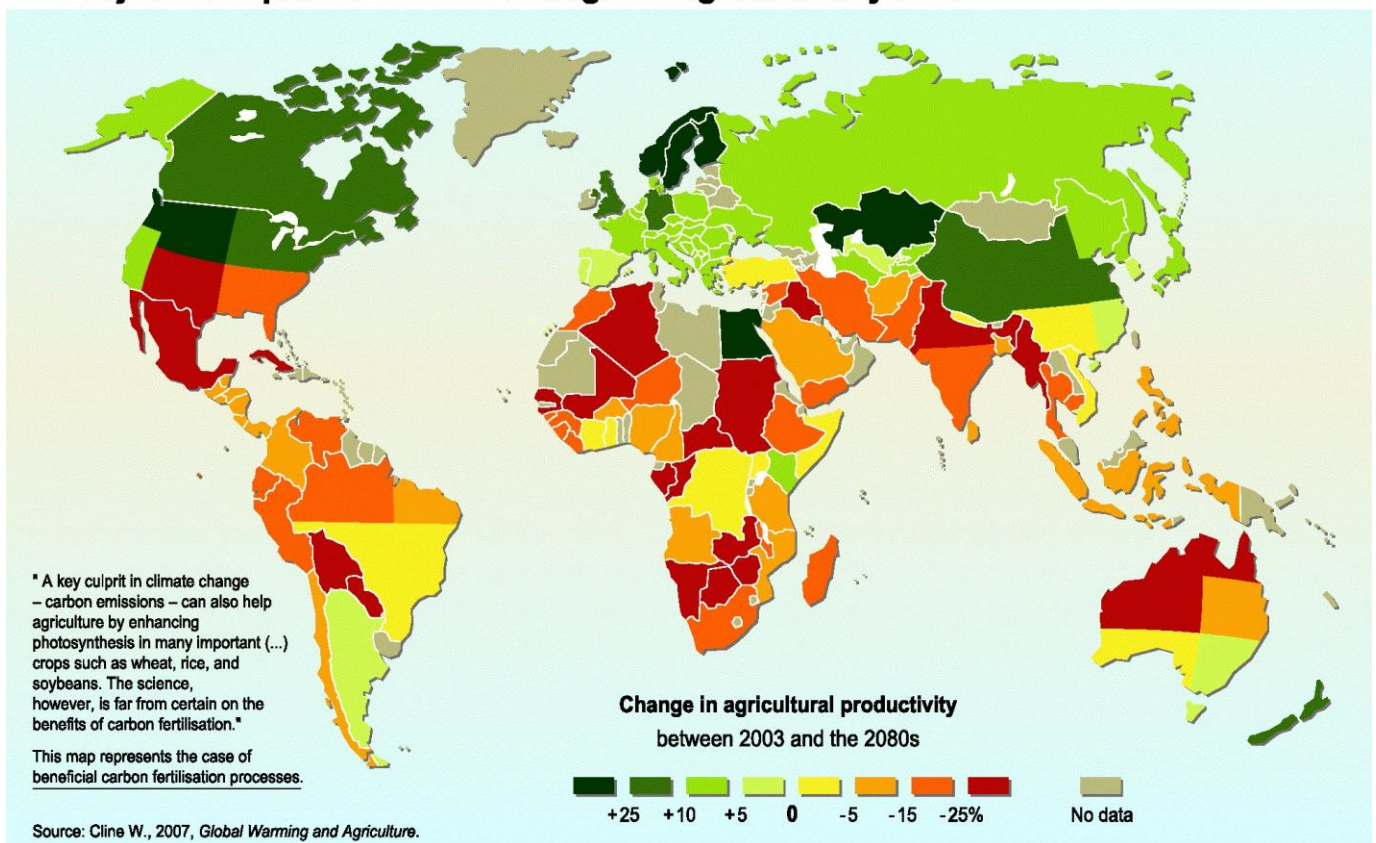


decline in areas with lessened rainfall such as Southern and Western Africa while demand will concurrently increase due changes in consumption and behavior.

➤ Reduced crop yields

As a result of the changing climate, the degradation of water sources, plants epidemics and severe weather events, climate change has already affected the agricultural sector. Crop yields have already begun decreasing globally. Maize production has decreased by 4% since 1980 and wheat by 5%¹⁴. **Without any adaptation measures by 2030 worldwide crop yields will decrease on an average of 2% by decade¹⁵.** Wheat yields could decrease by 6% with every additional degree in temperature¹⁶. This loss will be unevenly distributed geographically. **High latitude regions will see increased agricultural production due to an increase in the number**

Projected impact of climate change on agricultural yields



¹⁴ Laisney Celine & Desauay Cecile (2015) '[Impacts du changement climatique](#)' [Impacts of climate change], *Vigie alimentation report 2015*, Trend 4, Futuribles International

¹⁵ Milman, Oliver (2014) [Global warming will cut crop harvests by 2% each decade, researchers say](#). The Guardian, UK

¹⁶ Kansas State University & USAID (2015). [Study finds climate change may dramatically reduce wheat production](#), 3 May 2017



of warm days per year whilst areas that are already food insecure areas in Asia and Africa¹⁷ will see drastic reductions in crop yields¹⁸.

Sub-Saharan Africa will be particularly affected by desertification. 2 billion people in the world currently depend on dry land ecosystems, 90% of whom live in developing countries. 12 million hectares of land become unproductive every year due to desertification and drought¹⁹. In the sub-Saharan African context of poor governance, rapid population growth, poorly functioning market systems, and insufficient food reserves, an increase in the rate of desertification and a generalized reduction in crop yields could lead severe regional food insecurity and famine.

➤ **Rising sea level impacting more populations**

Currently the sea level rises an average of 3 millimeters per year²⁰ Based on an increase of 0.3°C to 4.8°C, sea levels are projected to rise 26-98cm by 2100²¹. By 2030, sea levels are expected to rise by 5-8cm per year, which will affect coastlines, deltas and low-lying islands. More than 1 million people could be displaced in the Nile, Ganges, Brahmaputra and Mekong delta alone. Small island states of the Pacific and Indian Oceans (Marshall Islands, Kiribati, Tuvalu, Tonga) are most prone to cyclones and could disappear entirely. 40% of the global population lives within 100 kilometers of a coastline²², and many of the fastest growing megacities are located in coastal areas.²³ 60% of the world's 39 megacities with population over 5 million are located within 100 km of the coast.²⁴ The coastal areas, already extremely sensitive due to human development

¹⁷ Africa is currently experiencing an increase of crops yield but for experts, the region is only catching up with the levels of other regions.

¹⁸ Porter, J.R. and L. Xie (2014) Food security and food production systems in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 485-533

¹⁹ Secretariat of the United Nations Convention to Combat Desertification (2014) [Desertification : the invisible frontline](#)

²⁰ Alex Bastien et Gemenne François, [Impacts du changement climatique sur les flux migratoires à l'horizon 2030](#), [Impacts of climate change on migrations flows by 2030] report n°1, May 2016, Observatoire des enjeux géopolitiques de la démographie [Observatory of geopolitical issues of demography], Futuribles International and IRIS

²¹ As compared to the 1980-2000 period. Coastal systems and low-lying areas, Porter, J.R. and L. Xie (2014) Food security and food production systems in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 485-533

²² United Nations, [Percentage of Total Population Living in Coastal Areas](#), p. 170, 9 May 2017

²³ UNESCO (2015), [The UN World Water Development Report 2015: Water for a Sustainable World](#), p. 66, 3 May 2017

²⁴ IPCC (2007), [Fourth Assessment Report: Climate Change 2007, 6.2.2. Increasing human utilisation of the coastal zone](#), 3 May 2017



and urban sprawl are strongly affected by climate change impacts²⁵. This is particularly true in Asia, already the most populous continent, with the fastest rates of urbanization. Coastal vulnerability could be a significant driver of mass migrations.

Additionally, as sea levels rise salt water penetrates into fresh groundwater, making it unsafe to drink. This is projected to happen in Bangladesh where coastal water salinity is projected to increase by 26% by 2050²⁶. In situations where ground water is being used faster than it can be replenished the water table drops and is replenished with salt water. As a result, freshwater will be less available for irrigation and human consumption resulting in lower yields and heightened pressure on existing food stocks.

Relative vulnerability of coastal deltas as indicated by estimates of the population potentially displaced by current sea-level trends to 2050 (extreme: >1 million; high: 1 million to 50 000; medium: 50 000 to 5 000)



Climate Change 2007: Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Figure TS.8. Cambridge University Press.

➤ Rise of environmental migrations

Migration has increased in recent decades. Among these populations on the move, are a growing portion of environmental migrants leaving areas impacted by the effects of climate

²⁵ Damon Julien (2016) '[La métropolisation : concentration des activités et des richesses](#)' [metropolization: concentration of activities and wealth], *vigie report 2016, territories and networks chapter*, Futuribles International

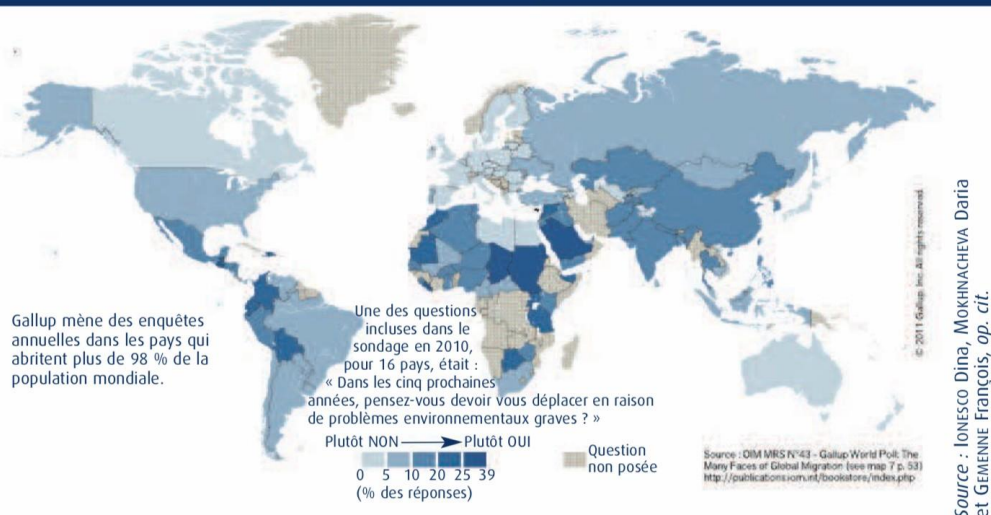
²⁶ The World Bank (2015), [Salinity Intrusion in a Changing Climate Scenario will Hit Coastal Bangladesh Hard](#), Feature story, Story highlights, 17 February 2015



change²⁷. Rural parts of developing countries are seeing the highest rates of people leaving due to scarce or unproductive land, land degradation and the economic pull towards cities.

In these countries, often facing high rates of population growth, poor governance and land management practices, migration is a necessary safety valve. **Widely accepted estimates suggest that in 2030, 100 million people will be on the move and in 2050, that figure will have doubled²⁸. South to South migrations are likely to stay stable, whereas South to North migrations are likely to continue increasing.** Migratory movements are likely to continue to originate in regions most affected by climate change -- Sub-Saharan Africa, Asia, and Central America.²⁹ However, whether destination countries will remain the same through to 2030 remains to be seen as the wealth of migrants, the journey they make, and the policies of host countries change.

Carte 7. Probabilité de déplacement en raison de problèmes environnementaux en 2010



Displacement probability in link with environmental troubles in 2010

Source: Observatoire des enjeux géopolitiques de la démographie, Impacts du changement climatique sur les flux migratoires à l'horizon 2030

²⁷ Alex Bastien et Gemenne François (May 2016) [Impacts du changement climatique sur les flux migratoires à l'horizon 2030](https://www.futuribles.com/fr/document/rapport-vigie-2016-futurs-possibles-a-lhorizon-2030/les_flux_migratoires_à_l'horizon_2030), [Impacts of climate change on migrations flows by 2030] report n°1, may 2016, Observatoire des enjeux géopolitiques de la démographie [Observatory of geopolitical issues of demography], Futuribles International and IRIS for DGRIS

²⁸ International Organization for Migration (IOM) (2009): [Migration, Climate Change and the environment](#). Policy Brief, reparation programmes, July 2009

²⁹ Alex Bastien et Gemenne François (May 2016) [Impacts du changement climatique sur les flux migratoires à l'horizon 2030](#), [Impacts of climate change on migrations flows by 2030] report n°1, may 2016, Observatoire des enjeux géopolitiques de la démographie [Observatory of geopolitical issues of demography], Futuribles International and IRIS for DGRIS

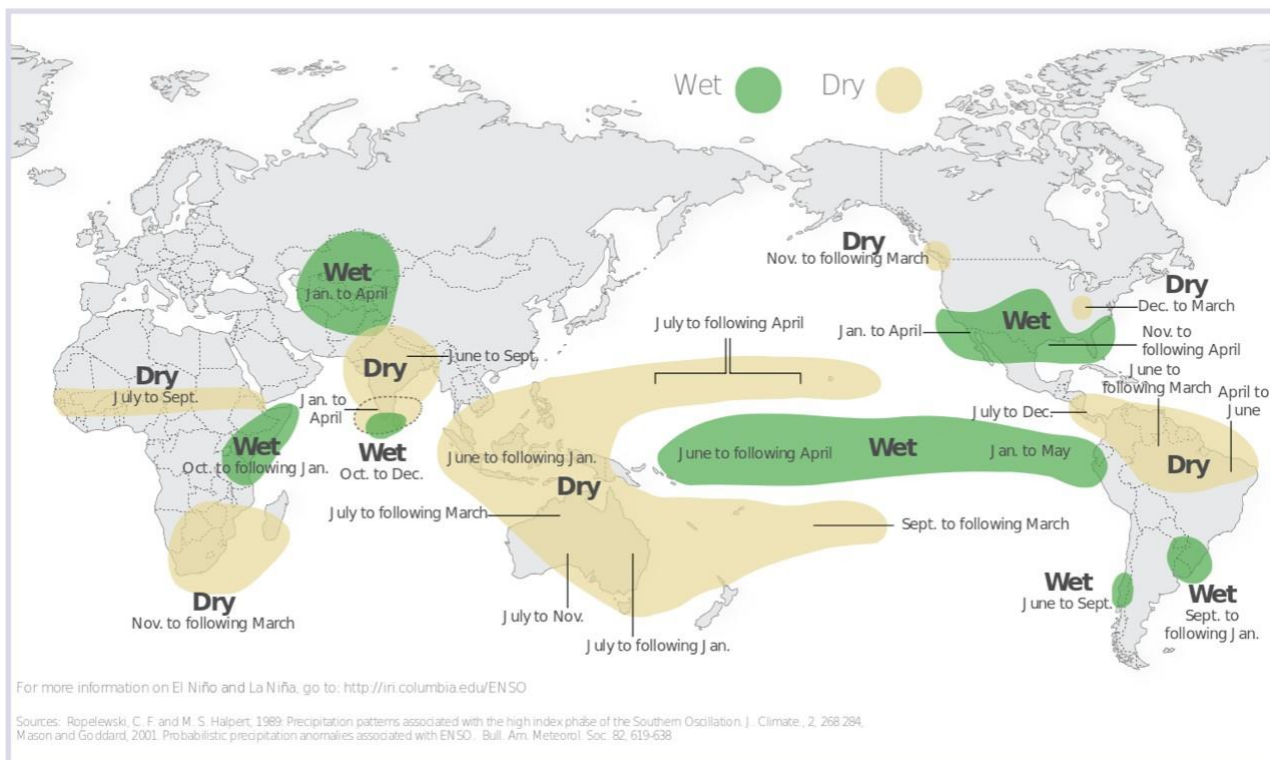
Uncertainties

Impacts of El Niño/ La Niña

The El Niño Southern Oscillation is “a periodic fluctuation in sea surface temperature and the air pressure of the overlying atmosphere across the equatorial Pacific Ocean”³⁰. El Niño is known to be a cyclical phenomenon, appearing every 2 to 7 years and lasting approximately 12 months. Though its occurrence is still relatively hard to predict³¹, the effects of El Niño are well known, and they seem to be getting more extreme: some scientists hypothesize that climate change may be causing these 'super El Niños', but there is no general consensus in the scientific community.³² Still, changes in weather patterns are being seen globally – winds are weakening in places and gaining momentum in others, wet regions of Western South America, the Pacific Ocean and Central Asia are becoming even wetter and dry regions becoming dangerously drier in Northern South America, the Indian subcontinent, and in Sub-Saharan and Southern Africa –

El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one El Niño to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



³⁰ National Centers for Environmental Information, , National Oceanic and Atmospheric Administration

³¹ National Centers for Environmental Information, , National Oceanic and Atmospheric Administration

³² Pearce, F. (2016) [El Niño and Climate Change: Wild Weather May Get Wilder](#), Yale Environment 360, 9 May 2017.



increasing the occurrence and severity³³ of natural disasters such as floods, storms, or drought and depleting fish stocks and crop yields. La Niña³⁴ events may also be increasing in frequency though this is yet to be conclusively proven³⁵.

³³ Yeh Sang-Wook, Kug Jong-Seong, Dewitte Boris, Kwon Min-Ho, Kirtman Ben P. & Jin Fei-Fei (2009) " *Letter, Nature journal*, 24 September 2009

³⁴ La Niña phenomenon, although less frequent, is often considered as the penchant of El Niño phenomenon bringing almost exactly the opposite precipitation pattern but scientific disagree on the correlation between the two.

³⁵ Cho Renee, " *State of planet, earth institute blog*, Columbia University, 2 February 2016