DESERTIFICATION

ESTIMATES GLOBAL CLIMATE IMPACT

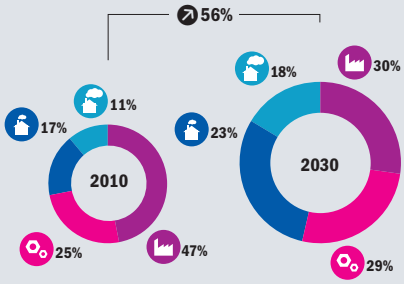
2010 EFFECT TODAY

USD **LOSS** PER YEAR **5 BILLION**

2030 EFFECT TOMORROW

USD **LOSS** PER YEAR **20 BILLION**

ECONOMIC IMPACT



CONFIDENCE **INDICATIVE**

SEVERITY

AFFECTED

INJUSTICE

PRIORITY

MDG EFFECT

- Desertification will worsen already dry areas as heat rises and rainfall declines
- Although global climate change brings more rain, most of it will fall in the far north and south, while rainfall in the tropical zones, home to much of the world's drylands, is likely to decline as heat rises
- Millions of hectares of agricultural land in these areas are experiencing an increase in aridity, compounding other degradation taking place
- Climate change in the world's drylands will further impede human development progress for some of the world's poorest groups
- Sustainable land management strategies can help prevent desertification, but restoration of already degraded lands is difficult and costly

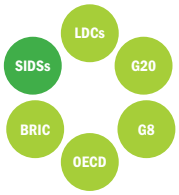
RELATIVE IMPACT

HOTSPOTS

2010 $ 2030

600	MEXICO	4,500
450	UKRAINE	2,750
500	AUSTRALIA	1,500
200	RUSSIA	1,250
450	ITALY	1,250

GEOPOLITICAL VULNERABILITY



$ Economic Cost (2010 PPP non-discounted)

Developing Country Low Emitters | Developed

Developing Country High Emitters | Other Industrialized

$ = Losses per 100,000 USD of GDP

Change in relation to overall global population and/or GDP

$ = Millions of USD (2010 PPP non-discounted)

Desertification is degradation of drylands. The UN has defined "drylands" broadly as areas of land with an aridity index—a measure of rainfall versus evaporation—below a certain low-end threshold (UN, 2011). More than half the planet's productive land is considered drylands. Covering around 40% of the earth's land surface, drylands are home to some 2 billion people, nearly all in developing countries, and are responsible for more than 40% of global food production (UNCCD, 2011). As climate change intensifies heat and limits rainfall in drylands, already rampant land degradation in these areas will worsen (Evans and Geerken, 2004; Adeel et al., 2005; Zika and Erb, 2009). The UN and Christian Aid have estimated that anywhere between 25 and 700 million people could be displaced due to expected water stress and environmental degradation, including 50 million people affected by desertification over the next decade (Christian Aid, 2007; WWAP, 2009; UNCCD, 2010). Such groups have been campaigning for greater application of sustainable land and water resource management in order to combat this alarming development.

CLIMATE MECHANISM

A range of socio-economic and environmental processes are involved in land degradation in dry areas, including declining water availability, soil erosion and nutrient depletion, among others (Geist and Lambin, 2004). Climate observations and models indicate that many of the world's dry regions are becoming hotter and drier as global warming intensifies (Hansen et al, 2007; McCluney et al., 2011). A loss in net moisture or rainfall is a key factor in the degradation of dry land (Evans and Geerken, 2004). As a result, many non-arid lands will become arid, while affected arid lands will become even drier. On the other hand, where there are substantial increases in rainfall on existing drylands, such zones will improve and become more humid. Overall, the changes will be negative, since rainfall change is more likely to degrade the world's existing dryland, especially in Africa (IPCC, 2007 and 2007b; Helm et al., 2010). Where lands degrade, agricultural productivity and livelihoods will be severely affected (Fraser et al., 2011).

IMPACTS

The impact of climate change on desertification is expected to be widespread, affecting around 40 countries by 2030. The economic impact of land degradation is estimated at 5 billion dollars a year today, increasing to some 20 billion dollars annually and a larger share of global GDP by 2030.

Climate change-driven desertification is already estimated to affect some 5 million people worldwide, doubling to 10 million by 2030.

The range of worst affected countries is varied, with West Africa particularly hard hit. Countries such as Benin, Burkina Faso, Gambia, Guinea-Bissau, Mali, Niger, and Senegal top the list of those suffering the most extreme effects. A number of developed and industrialized countries are also affected from Australia to the Mediterranean, and Black Sea countries such as Bosnia and Herzegovina, Croatia, Russia and the Ukraine.

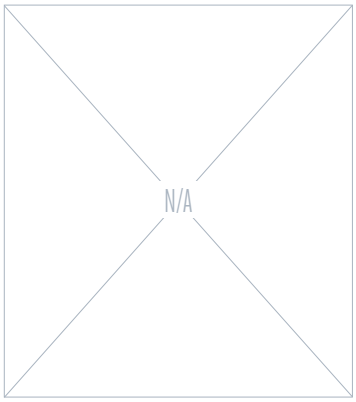
The bulk of global costs will occur in Organization for Economic Co-operation and Development (OECD) countries, including Italy, Spain and Turkey. However, Mexico is the country with the greatest total losses, reaching an estimated 5 billion dollars a year by 2030.

Countries acutely vulnerable to climate change include a large number of least developed and landlocked developing countries (LDCs and LLDCs), a particular cause for concern from a poverty/development perspective.

THE BROADER CONTEXT

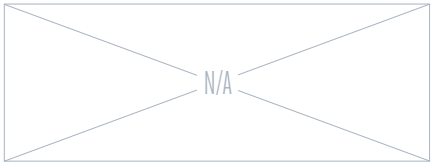
Desertification itself is a serious global concern. The Secretariat of the UN Convention to Combat Desertification has been sounding the alarm on highly damaging changes underway in many of the world's drylands. They call attention, for instance, to 12 million hectares, including 75 billion tons of fertile soil, a principal global resource, lost each year as a result of desertification and drought (UNCCD, 2010). The extent to which climate change is rendering these regions hotter and drier (or wetter) will be its main, primarily negative, contribution to an already large-scale and multifaceted concern. Aside from climate change, the most widely cited causes of desertification include land-use issues such as deforestation, overcultivation, overgrazing, and unsustainable irrigation practices (Adeel et al, 2005). Natural variability in weather regimes can also result in

BIGGER PICTURE

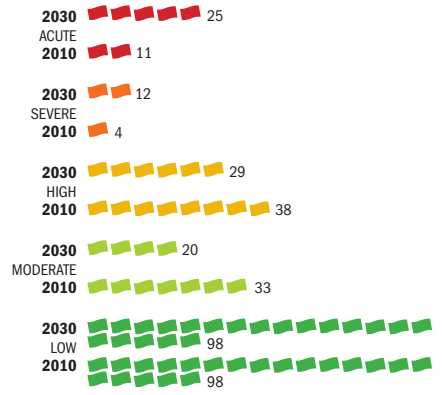


SURGE

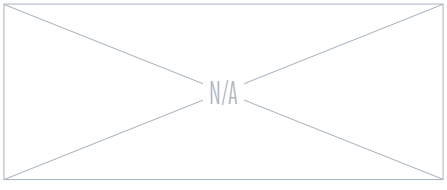
OCCURRENCE



VULNERABILITY SHIFT



PEAK IMPACT



GENDER BIAS

INDICATOR INFORMATION

MODEL: Hansen et al., 2007

EMISSION SCENARIO: SRES A1B (IPCC, 2000)

BASE DATA: FAOSTAT (land investments and gross crops production); Hoekstra et al., 2010; Kindermann et al., 2006; Portmann et al., 2010

= 5 countries (rounded)

Acute Severe High Moderate Low

large-scale short-term fluctuations in the primary productivity of drylands, both positive and negative (Hughes and Diaz, 2008).

Vulnerabilities and Wider Outcomes

Drylands exist around the world. Where they have been well managed, as in parts of southern Europe, they are fertile and productive. Where drylands are poorly managed, the opposite situation can develop as their susceptibility to degradation increases (Oygard et al., 1999). Given the overwhelming share of populated dryland areas within developing countries and LDCs or LLDCs, the capacity to promote and regulate sound policies can be an important factor in successful management (Esikuri ed., 1999). Poverty can be viewed as a driver of desertification, when communities become locked in a vicious cycle that exacerbates deforestation for lack of alternative livelihoods. It can also be viewed as an outcome of desertification when, for example, households suffer losses of land, soil, or crop productivity due to desertification. As productive possibilities decline and populations in dryland areas continue to grow, these regions will likely expand as suppliers of seasonal and/or permanent migration (Johnson et al. (eds.), 2006). Poverty and health indicators for populations living in dryland areas are low, compared to other climatic zones (Adeel et al., 2005; Verstraete et al., 2009).

RESPONSES

Supporting dryland communities to adapt will require offsetting the additional heat and/or loss of rainfall brought about by climate change. Degradation prevention is preferable to costly restoration projects that seek to return vegetation and environmental integrity to degraded lands, often with limited results (Puigdefaabregas, 1998). Desertification control measures have had little success and have led experts to propose developmental approaches that foster technology uptake, investment, best practice land management replication, and boosting and diversifying incomes of dryland populations to better cope with change (Mortimore, 2003). Water capture, conservation and storage, increasing vegetation through reforestation, and the control of deforestation, and prevention of overgrazing and other soil-damaging processes can all contribute to enhanced resilience of drylands and their communities (Adeel et al., 2005). Improved monitoring of drylands would also facilitate better macro policy analysis and development (Reynolds et al., 2011).

THE INDICATOR

The indicator measures the value loss (or gain) in rapidly degraded (or improving) dryland agricultural zones resulting from an increase (or decrease) in aridity, due to temperature and rainfall changes brought about through global warming (Hansen et al., 2007). It is broadly indicative of how desertification is likely to unfold as a result of climate change. The amount of new agricultural lands accruing from deforestation is also accounted for. While projections of the key variable of rainfall are uncertain, there scientists are virtually unanimous about the direction of change (wet or dry) for a number of the world's key dryland regions, such as the Mediterranean basin.

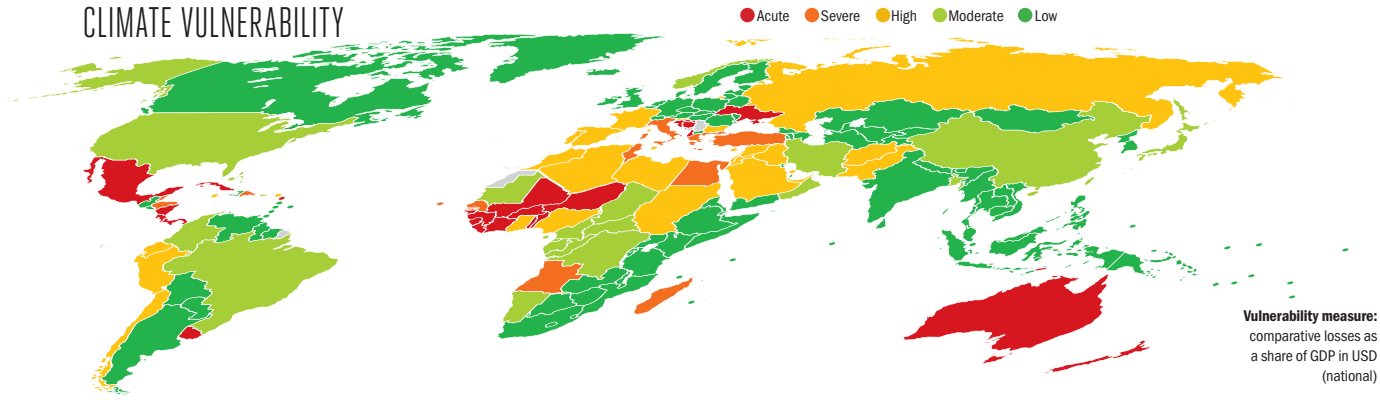
ESTIMATES COUNTRY-LEVEL IMPACT

COUNTRY	$ 2010	$ 2030	2010	2030	2010	2030
ACUTE						
Albania20	100	300	600	35,000	80,000	
Australia	500	1,500	7,000	15,000	20,000	45,000
Benin	15	100	1,500	3,000	100,000	350,000
Bosnia and Herzegovina	65	450	1,750	3,250	100,000	250,000
Burkina Faso	10	50				
Costa Rica	25	200	550	1,250	50,000	150,000
Cote d'Ivoire	15	95				
Croatia	100	800	2,000	3,750	150,000	300,000
Cuba	65	450	1,250	2,500	150,000	250,000
Dominica	1	10	20	35	1,750	3,750
Gambia	1	10				
Guinea	5	30				
Guinea-Bissau	1	5				
Liberia	1	5				
Mali	5	45				
Mexico	600	4,500	10,000	20,000	600,000	1,500,000
New Zealand	150	500	2,750	5,750	45,000	100,000
Nicaragua	15	100	550	1,000	25,000	65,000
Niger	5	30				
Panama	90	700	1,500	3,250	75,000	200,000
Sierra Leone	1	10				
Timor-Leste	25	200	650	1,250	50,000	100,000
Togo	10	45	1,250	2,500	150,000	400,000
Ukraine	450	2,750	9,000	20,000	700,000	1,000,000
Uruguay	20	150	400	800	7,750	15,000
SEVERE						
Angola	25	150	1,250	2,500	20,000	65,000
Belize	1	5	20	40	250	650
Cape Verde	1	5	50	100	6,000	15,000
Dominican Republic	30	200	650	1,250	150,000	300,000
Egypt	250	1,250	2,000	4,000	150,000	400,000
Greece	100	350	1,500	2,750	100,000	250,000
Honduras	10	75	350	750	25,000	65,000
Italy	450	1,250	6,250	10,000	1,000,000	2,500,000
Madagascar	10	45	1,000	2,000	35,000	100,000
Senegal	10	50	750	1,500	50,000	150,000
Tunisia	30	200	450	950	30,000	75,000
Turkey	350	950	6,250	15,000	600,000	1,500,000
HIGH						
Afghanistan	5	30	500	1,000	25,000	80,000
Algeria	45	350				
Antigua and Barbuda		1	5	5	750	1,750
Bahrain	5	25				
Bulgaria	10	80	150	350	10,000	20,000
Chile	40	300	700	1,500	15,000	40,000
Cyprus	5	10	40	85	5,000	10,000
Ecuador	20	150	400	850	25,000	60,000
France	400	1,250	5,250	10,000	600,000	1,500,000
Ghana	10	65	750	1,500	75,000	200,000
Iraq	15	100				
Israel	25	200				
Jamaica	1	20	65	150	15,000	40,000
Jordan	5	30				
Lebanon	5	50				
Libya	15	100				
Malta	1	5	15	30	20,000	45,000
Morocco	30	200	1,250	2,500	85,000	200,000
Nigeria	60	350	4,250	8,500	750,000	2,000,000
Pakistan	70	400	1,500	3,250	350,000	1,000,000
Peru	55	400	1,250	2,250	25,000	65,000
Portugal	30	90	450	900	55,000	100,000
Russia	200	1,250	3,250	6,250	25,000	50,000
Saudi Arabia	75	550				
Slovenia	10	75	100	250	10,000	25,000
Spain	200	600	2,750	5,500	250,000	450,000
Sudan/South Sudan	20	150				
Syria	15	95				
United Arab Emirates	30	200				
MODERATE						
Bahamas		1	1	5	70	150
Bangladesh	5	20	150	300	150,000	400,000
Brazil	70	550	2,250	4,500	50,000	100,000
Cameroon	1	10				
Central African Republic		1				
Chad	1	5				
China	75	750	2,000	4,000	300,000	600,000
Colombia	1	10	35	75	1,500	3,750
Congo	1	5				
DR Congo	1	5				
Equatorial Guinea	1	5				
Gabon	1	5				
Iran	1	20	35	70	1,500	4,000
Japan	40	100	500	950	150,000	300,000
Mauritania		1	25	50	85	250
Namibia		1	15	25	35	95
Norway	1	1	10	20	150	350
Oman						1
Sao Tome and Principe						
United States	200	700	1,750	3,500	55,000	150,000
LOW						
Argentina	-250	-2,000	-3,750	-7,500	-55,000	-150,000
Armenia						
Austria						
Azerbaijan		-1	-5	-10	-600	-1,500
Barbados						

$ Additional economic costs due to climate change (million USD PPP) - yearly average

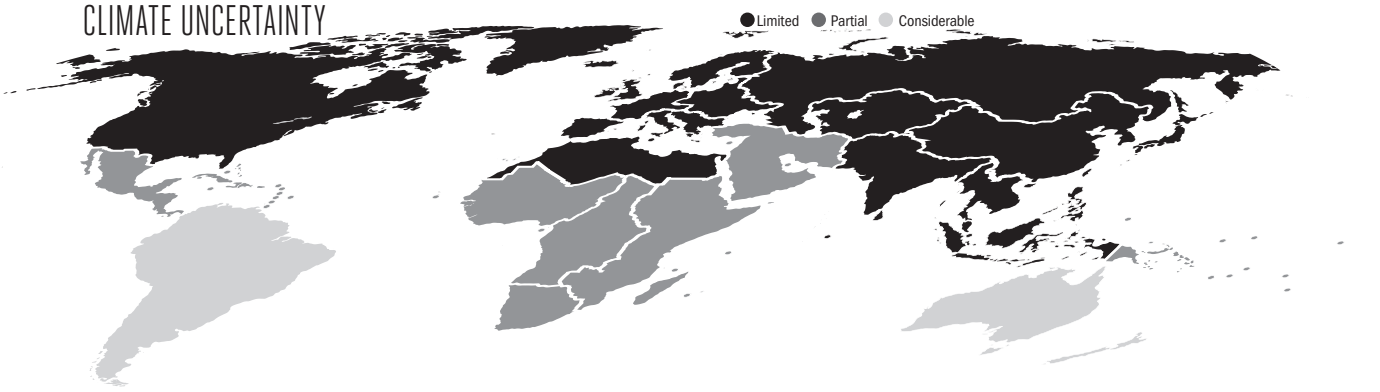
Additional land degraded due to climate change (km^2) - yearly average

CLIMATE VULNERABILITY



Vulnerability measure: comparative losses as a share of GDP in USD (national)

CLIMATE UNCERTAINTY



COUNTRY	$ 2010	$ 2030	2010	2030	2010	2030
Belarus						
Belgium						
Bhutan						
Bolivia						
Botswana	-5	-25				
Brunei						
Burundi	-1	-1				
Cambodia						
Canada	-5	-10	-35	-70	-100	-250
Comoros		-1	-75	-150	-30,000	-90,000
Czech Republic						
Denmark						
Djibouti		-1				
El Salvador						
Eritrea	-1	-1				
Estonia						
Ethiopia	-10	-65				
Fiji						
Finland						
Georgia						
Germany						
Grenada						
Guatemala						
Guyana						
Haiti						
Hungary						
Iceland						
India	-40	-300	-1,750	-3,500	-650,000	-1,500,000
Indonesia	-5	-50	-400	-750	-50,000	-100,000
Ireland						
Kazakhstan	-5	-45	-150	-300	-950	-2,000
Kenya	-10	-50				

COUNTRY	$ 2010	$ 2030	2010	2030	2010	2030
Kiribati						
Kuwait						
Kyrgyzstan						
Laos		-1	-15	-30	-400	-1,000
Latvia						
Lesotho		-1	-15	-30	-1,000	-2,000
Lithuania						
Luxembourg						
Macedonia						
Malawi	-1	-10				
Malaysia						
Maldives						
Marshall Islands						
Mauritius	-5	-40	-90	-200	-55,000	-150,000
Micronesia						
Moldova						
Mongolia						
Mozambique			-5	-10	-150	-350
Myanmar	-5	-35	-650	-1,250	-50,000	-100,000
Nepal						
Netherlands						
North Korea	-1	-10	-100	-200	-20,000	-45,000
Palau						
Papua New Guinea						
Paraguay						
Philippines						
Poland						
Qatar						
Romania						
Rwanda	-1	-10				
Saint Lucia						
Saint Vincent						

COUNTRY	$ 2010	$ 2030	2010	2030	2010	2030
Samoa						
Seychelles		-1				
Singapore						
Slovakia						
Solomon Islands						
Somalia			-1	-5	-20	-75
South Africa	-5	-25	-90	-200	-3,750	-7,000
South Korea	-250	-1,750	-2,000	-4,000	-1,000,000	-2,000,000
Sri Lanka						
Suriname						
Swaziland	-5	-20	-150	-300	-10,000	-25,000
Sweden						
Switzerland						
Tajikistan						
Tanzania			-1	-5	-150	-400
Thailand	-80	-650	-2,000	-4,000	-250,000	-600,000
Tonga						
Trinidad and Tobago						
Turkmenistan				-1	-1	-10
Tuvalu						
Uganda	-5	-30				
United Kingdom						
Uzbekistan						
Vanuatu						
Venezuela						
Vietnam	-80	-850	-3,500	-7,250	-950,000	-2,000,000
Yemen	-1	-1	-30	-55	-1,250	-5,250
Zambia	-1	-15				
Zimbabwe	-1	-10				

Additional persons affected due to climate change - yearly average