

Strategic Analysis Paper

16 February 2012

The Challenge of Global Degradation and Scarcity

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Key points

- Degradation and scarcity of land and water are a growing threat to sustainable food security.
- Agricultural systems are at risk throughout the world.
- There will be significant limitations on land and water resources by 2050.
- 25 per cent of global land is already highly degraded.
- The intensification of agriculture, alongside improved efficiency in irrigation, is the optimum path toward mitigating this threat and any future damage.

Analysis

Long-term degradation and increasing scarcity of land and water resources has placed agricultural systems throughout the world at risk. A worrying trend, given the stress an estimated nine billion people will put on food production systems by 2050. The challenge ahead is noted by *The State of the World's Land and Water Resources (SOLAW)*, a publication commissioned by the United Nations Food and Agriculture Organization (FAO) in 2011.

The combination of unsustainable agricultural use and demographic strains, already present, will pose a global threat to the productive capacity of these systems. Although the past 50 years have seen a significant growth in crop yields, a large portion of those increases have come at a cost, resulting in land and water degradation that places future food production at material risk. Put these changes alongside increased competition over land and water resources between and amongst urban, industrial and agricultural users, as well as the alteration to temperature and rainfall patterns that climate change could provide, and the challenge becomes acute, particularly in developing nations where these outcomes would be most damaging.

The effects these potential constraints could initiate are extremely troubling, in their possible effects on hunger and poverty. They require immediate action if substantial mitigation is to be possible.

Systems at risk

Regions afflicted by risk to their food production systems can be found right across the globe: from systems like the Murray-Darling basin, to the large plains of Central Asia, to the mountainous areas of central USA. The FAO report identifies a catalogue of systems at risk, but the following are likely to be the most vulnerable:

- Rainfed cropping (high) – Dense, well-populated highlands in poor areas, such as the Himalaya Mountains, central USA highlands and the Ethiopian plateau. Risks include erosion, reduced soil and water productivity, increasing prevalence of flood events, outbound migration, and high poverty levels.
- Rainfed cropping (semi-arid tropics) – Smallholder farming in marginal regions, such as the African savannah and south India, as well as pastoral areas in western India and the Horn of Africa. Risks include desertification, increased crop failures due to climate change and temperature, growing conflict, and outbound migration.
- Irrigated rice-based system – Much of Asia and Africa. In Asia, risks include land abandonment, increasing land conservation, and pollution-created health hazards. Risks in Africa include poor returns on investment, stagnating productivity, widespread land acquisition, and general land degradation.

Components of Degradation (Figure I)



Components (clockwise from top-left): rangeland degradation; salinisation; water erosion; desertification.

Source: Land degradation assessment, FAO.org

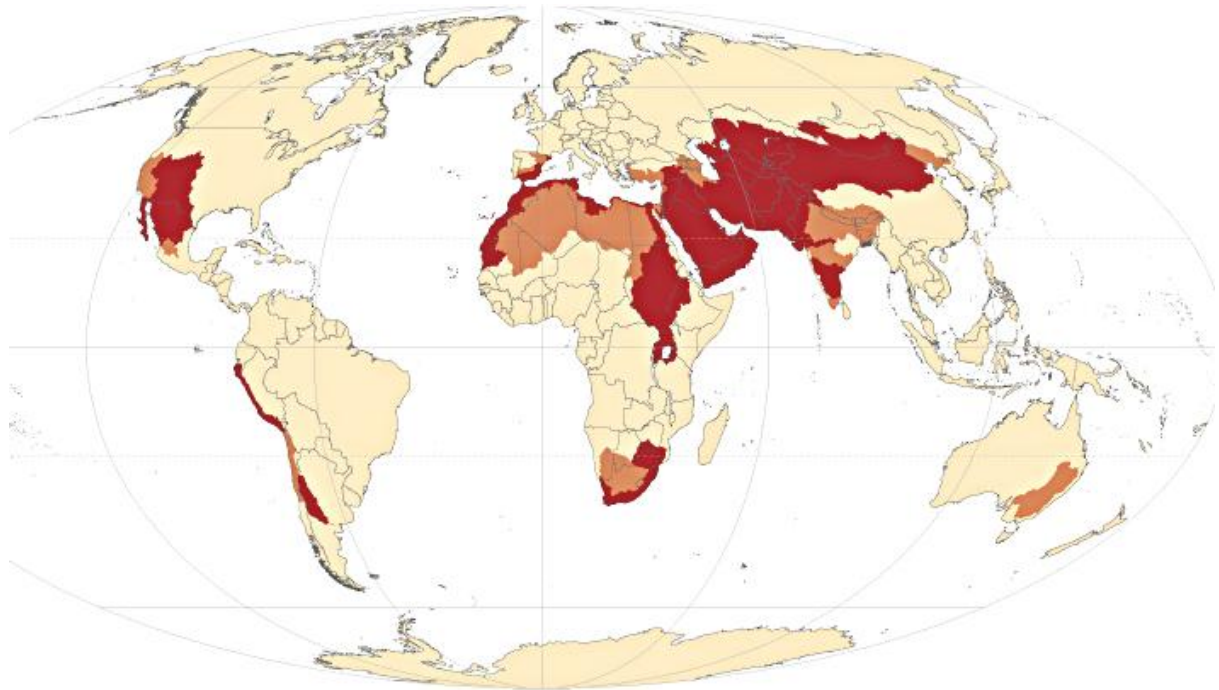
- Groundwater-dependent irrigation systems in interior arid plains – India, China, central USA, Australia, northern Africa, the Middle East and other regions. Risks include loss of agricultural land, desertification, and the reduced recharge of aquifers due to climate change in certain areas.
- Rangelands – Pastoral and grazing lands, from fragile soils in western Africa to northern Africa, to parts of Asia. Risks include desertification, outbound migration, land abandonment, food insecurity, extreme poverty, and growing conflict.
- Forests and tropical forest-cropland interface – Southeast Asia, the Amazon basin, central Africa, and the Himalayan forests. Risks include cropland encroachment, slash-and-burn cultivation leading to ecosystem devastation, and general land degradation.
- Small island states – Caribbean and Pacific islands, as well as others. Risks include the total loss of freshwater aquifers, increased cost of freshwater production, and growing climate change-related damage, from hurricanes to floods.

Forty year limits

SOLAW indicates that the number of regions reaching the limits of their productive capacity is quickly increasing. By 2050, for example, many areas of the world will no longer have water available for agricultural use. More than 40 per cent of the global rural population lives in river basins which are water scarce.

The impact of this should not be underestimated. Poor, rural-dwelling people, who depend on agriculture for income and sustenance, make up 75 per cent of the population in developing nations. Growing populations will also sharply diminish the amount of land available in the developing world, halving it to 0.12 hectare per capita by 2050.

Global Water Scarcity Distributed by Major River Basin (Figure II)



Legend: Pale/Low Scarcity – Orange/Moderate Scarcity – Red/High Scarcity

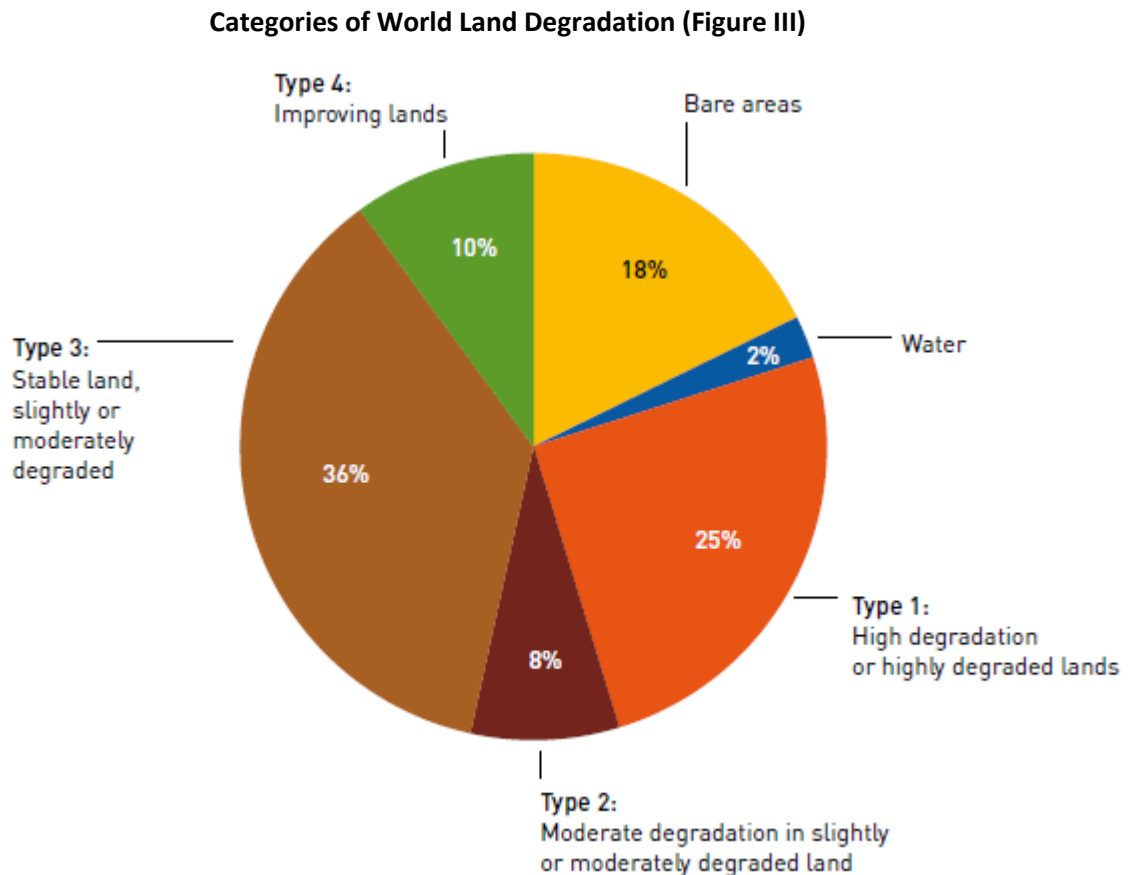
Source: SOLAW, FAO.org

Moreover, while water scarcity deepens, the salinisation and pollution of groundwater, as well as the deterioration of water-based ecosystems, is growing. A large number of rivers no longer meet their natural boundaries and wetlands are being fast reduced. Also, due to agricultural dependence, intensive groundwater withdrawals are being made to keep food production systems afloat in many areas. This is leading to a reduction in aquifer levels and a loss of groundwater buffers for local communities, thus introducing a growing risk to long-term global food production.

According to *SOLAW*, an extra one billion tonnes of cereals and 200 million tonnes of livestock products will have to be produced every year to provide adequate consumption for a growing world population. The greatest test of agricultural advancement will be in developing nations, where ensuring access to food is just as much a concern as its production. To meet this challenge, a ten per cent increase in agricultural water consumption will be needed by 2050 – a hard task for water-embattled countries, such as South Africa, that would likely struggle to reach a one per cent increase. In the end, mitigation is likely the most that can be hoped for. Even if agricultural production doubles by 2050, one person in twenty (370 million people) will remain undernourished, concentrated mainly in the developing regions of sub-Saharan Africa and Asia.

One quarter of global land highly degraded

Degradation is not simply the degradation of soil and water, but the term also includes other aspects of the affected resources' environmental integrity, including loss of biodiversity. On that scale, 25 per cent of the world's land is currently highly degraded, which is a substantial absence of usable crop-bearing land. As seen in Figure III, the FAO study also suggests that eight per cent is moderately degraded, 36 per cent is stable or slightly degraded, ten per cent is improving in quality, and the final 20 per cent is either bare or covered by water.



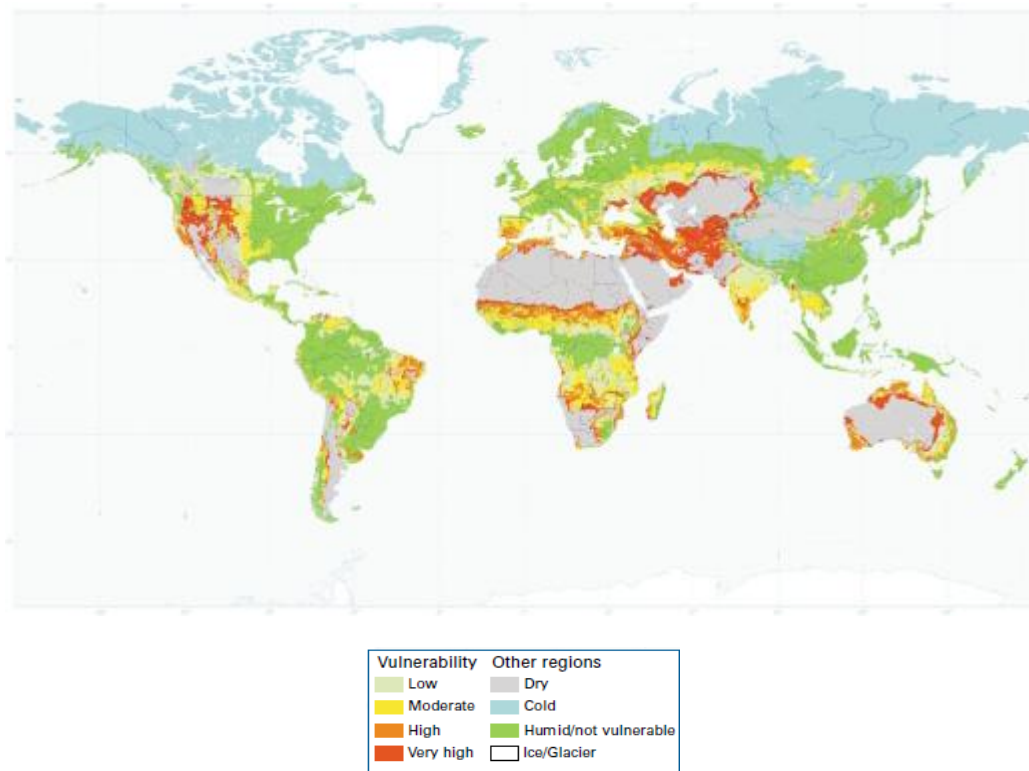
Source: SOLAW, FAO.org

The land being used to grow the world's best crops falls within the ten per cent regarded as improving. This does not stop the cycle of degradation starting in substantial portions of this land, due to agricultural practices that result in erosion and topsoil loss, as well as salinisation and other forms of pollution. Moreover, land degradation has become a universal experience, with particularly high rates of incidence across the entirety of Asia and the west coast of the Americas, throughout the Mediterranean region of North Africa and Southern Europe, and down the Horn of Africa – the greatest cause being declining soil quality, alongside decreasing water resources and diminishing biodiversity.

Unsustainable agricultural approaches are the main cause of this widespread degradation. This is supported by a 2008 study conducted by the FAO, which found that poor land management is the primary driving factor. For instance, fertiliser overuse in countries such as Bangladesh and China, where governments heavily subsidised its sale, resulted in serious detrimental impacts on groundwater quality. Another example can be found in the policies of Brazil’s pre-1990s government, which encouraged the land-clearance of the Amazon, at the cost of permanent losses to the forest ecosystem, for overwhelmingly inefficient crop production.

Over a billion people, primarily farmers and rural communities, are directly dependent on land which is degrading. According to a 2005 report by the World Meteorological Organization (WMO), lands vulnerable to further degradation encompass around 33 per cent of the global land surface – and the gross income loss produced by the process of desertification in these areas amounts to about US\$42 billion per annum. As seen below in Figure IV, while a considerable 25 per cent of land in Asia is vulnerable, the semi-arid and lesser areas of Africa are particularly so, with their fragile soils, low-input agriculture and highly dense populations. These are trends severe enough to cause a yield reduction across 16 per cent of agricultural lands in Africa and Central America. In sub-Saharan Africa alone, estimates indicate that degradation-caused productivity losses are at around 0.5 to one per cent per annum. This suggests a loss in crop productivity of at least 20 per cent over the last 40 years.

Areas Vulnerable to Land Degradation (Figure IV)



Source: US Department of Agriculture, Natural Resources Conservation Service, nrcs.usda.gov

This degradation could pose a very significant threat to Africa's future agricultural productivity; 46 per cent of the continent's land is vulnerable, accounting for a population of over half a billion residents. It is also a matter of serious concern for Australia, with almost 70 per cent of its land already degraded, primarily by wind and water erosion. But, as noted in FDI's "[The Future Prospects for Global Arable Land](#)", Australia is in the fortunate position of possessing, according to the FAO, the highest availability of arable land per capita in the world, at 2.67 hectares per capita. Other countries are not so fortunate. China, for instance, has 0.08 hectares of land available per capita, while our close neighbour Indonesia has less than one per cent of land that is not degraded. Once more the cause is poor agricultural practices, such as ill-advised rampant deforestation.

Future prospects

To cover these risks, more than four-fifths of production gains will need to occur primarily on existing agricultural land. According to *SOLAW*, these gains have to be embedded in an agricultural approach concerned not only with the appropriate management of land and water resources, but also the broader biodiversity of these food production systems and the external danger climate change will pose to long-term food security. Unfortunately, there is no current international platform for sustainable land and water practices to be formally adopted.

Agricultural land for expansion will still be available by 2050, but half of it will be in the following countries: Brazil, Democratic Republic of Congo, Angola, Sudan, Argentina and Colombia. Seventy per cent of this land will have potential constraints on crop yields, from toxicity to ecological fragility, to low fertility and poor infrastructure. No spare land for expansion will exist in the Middle East, east and south Asia, or northern Africa - places accounting for most of the world's population.

Although there are evident signs of global land degradation, there is some debate as to the extent of the world's loss of arable land. As noted by FDI's [Global Land Limitations](#), projected levels of water scarcity, in particular, provide concerns over how much land can be made arable through irrigation in the future. The need to protect existing farmable land should thus be clear.

Certain improvements are needed if this challenge is to be faced. For one, increasing the efficiency of irrigation systems worldwide will be crucial, as most currently perform below capacity. Improved management, efficient local investment, and modernising practices, technology and training, could greatly enhance efficiency in this area. New farming methods that seek to expand production efficiently while limiting environmental impact, such as integrated crop-livestock or irrigation-aquaculture systems, are also worth the effort.

Another primary area of focus would be an increase of investment in agricultural development. The FAO report suggests a US\$1 trillion investment requirement for irrigation water management systems in developing nations over the period 2007 to 2050. It also suggests a US\$160 billion investment in soil conservation, land protection and development,

and flood control across the same time-frame. But even if made available, this largesse could not be properly utilised without national policymakers ensuring the modernisation of their relevant institutions. It would also require the capacity for inter-regional collaboration in tackling this unprecedented challenge to land and water resource management.

Any opinions or views expressed in this paper are those of the individual author, unless stated to be those of Future Directions International.

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