

# Associate Paper

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## The Strategic Importance of Soil, Water and Food in the Early to Mid-21<sup>st</sup> Century

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### Key Points

- Freshwater scarcity is emerging as a critical systemic risk worldwide. While the global population has tripled over the past century, our use of water has increased sixfold.
- More than 95 per cent of humanity's present food supply is produced from the soil.
- Some 40 per cent of soil used for agriculture globally, is classed as degraded or seriously degraded – i.e. 70 per cent of the topsoil has been lost.
- The UN FAO has projected that for the planet, net land under crops may have to increase by some 700 million hectares by 2050 to meet predicted global food needs.
- The loss of food security – through climate (change?) or the loss of soil and water resources - is a major factor in people deciding to quit their homelands in search of new life, whether as economic migrants ahead of a crisis they have foreseen or as refugees fleeing a disaster.
- Food, land and water security are central to Australian security.

### Summary

Emerging scarcities of fresh water and topsoil, combined with the impact of climate change on regional food production, highlight the growing strategic significance of these primary resources for human survival, health and wellbeing as potential drivers of conflict and mass migration to 2050 and beyond. Conversely, there is mounting evidence that conflict and out-migration are far less likely in regions that are well-fed and where these primary resources are well-managed and not disputed. We argue with a global population approaching 10 billion by 2060, soil and water will be increasingly critical elements in global, regional and national security and must be factored into defence, security and sustainability planning at all levels. The role of food, land and water security in keeping the peace should be more widely understood and acted on.

## Analysis

### Water

Freshwater scarcity is emerging as a critical systemic risk worldwide. Of all the emerging global resource scarcities (oil, strategic minerals, timber, fish etc.) it is the one arriving most rapidly and universally.

To support the average citizen of Earth takes around 1,386 tonnes of fresh water a year. This 'water footprint' consists of all the water use to produce our food, consumer products, or provide the services on which we rely: our indirect use of water is many times larger than our personal use. In total, humanity uses more than nine trillion tonnes of fresh water annually. While the global population has tripled over the past century, our use of water has increased sixfold.<sup>1</sup>

Two thirds of the human population – more than four billion people – already face acute water stress at least one month a year. About half of these live in India and China.<sup>2</sup>

The combination of growing populations, rising economic demand for food, megacity and industrial water consumption and climate change mean that “The ultimate consequence is that by 2030, demand for water could be 40 percent greater than supply available,” according to a study by the UN University.<sup>3</sup>

Key elements of contemporary water scarcity are:

- The dire condition of the world's major rivers, especially in semi-arid regions. The impact of their 6,000 plus dams on downstream food and water security.<sup>4</sup>
- The drying up and pollution of lakes and inland seas worldwide.<sup>5</sup>
- Over-exploitation of groundwater (95 per cent of Earth's fresh water) in every region where it is used to grow food or support megacities and the energy sector. One third of the world's major groundwater basins are rated as 'in distress'.<sup>6</sup>
- Unprecedented decline in mountain glaciers (which supply major river systems).<sup>7</sup>
- Impact of climatic fluctuations on regional water supplies in, for example, California, Sao Paulo (Brazil)<sup>8</sup>, central India<sup>9</sup> and China<sup>10</sup>.

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<sup>1</sup> Cribb JHJ, *Surviving the 21st Century*, Springer 2015; Dry Times, pp 39-43.

<sup>2</sup> Mekonnen MM and Hoekstra AY, *Four billion people facing severe water scarcity*. *Science Advances*, 12 Feb 2016. <http://advances.sciencemag.org/content/2/2/e1500323>.

<sup>3</sup> Schuster-Wallace C.J. and Sandford, R. 2015. *Water in the World We Want*. United Nations University Institute for Water, Environment and Health, 2015. <http://inweh.unu.edu/wp-content/uploads/2015/02/Water-in-the-World-We-Want.pdf>.

<sup>4</sup> International Rivers. 2014. *The State of the World's Rivers*. August 25, 2014.

<http://www.internationalrivers.org/worldsrivers/> and Howard BC. 2016. 8 Mighty Rivers Run Dry from Overuse, *National Geographic*, <http://environment.nationalgeographic.com.au/environment/photos/rivers-run-dry/>

<sup>5</sup> Many of world's lakes are vanishing and some may be gone forever, *New Scientist*, 4 March 2016.

[https://www.newscientist.com/article/2079562-many-of-worlds-lakes-are-vanishing-and-some-may-be-gone-forever/?utm\\_source=&utm\\_medium=&utm\\_campaign=](https://www.newscientist.com/article/2079562-many-of-worlds-lakes-are-vanishing-and-some-may-be-gone-forever/?utm_source=&utm_medium=&utm_campaign=)

Peryman L. 2012. Unchecked industry reduces land of a thousand lakes to a struggling few, Probe International, 20 July 2012. <http://journal.probeinternational.org/2012/07/20/unchecked-industry-reduces-land-of-a-thousand-lakes-to-a-struggling-few/> Lakenet, 2015

<http://www.worldlakes.org/index.asp> 13th World Lakes Conference, Wuhan, China, 2008.

[http://www.globalnature.org/30604/EVENTS/World-Lakes-Conference/02\\_vorlage.asp](http://www.globalnature.org/30604/EVENTS/World-Lakes-Conference/02_vorlage.asp)

<sup>6</sup> NASA, Study: *Third of Big Groundwater Basins in Distress*, July 2015. <http://www.nasa.gov/jpl/grace/study-third-of-big-groundwater-basins-in-distress>

<sup>7</sup> World Glacier Monitoring Service. 2015. *Global Glacier Changes: facts and figures*.

<http://www.grid.unep.ch/glaciers/pdfs/5.pdf> Zemp M et al. 2015. Historically unprecedented global glacier decline in the early 21st century, *Journal of Glaciology*, 30 July 2015.

<sup>8</sup> *TIME*, 2015 A Megacity without Water, <http://time.com/4054262/drought-brazil-video/>

- Increasing frequency of drought in countries that seldom before experienced it, for example, New Zealand<sup>11</sup> and the UK<sup>12</sup>.
- Growing confrontation between farmers and energy corporates (coal, gas, tar sands etc.) over access to, and use of, water around the world<sup>13</sup>.

The risks of conflict over water scarcity have been flagged by many eminent figures, notably UN chiefs Boutros Boutros-Ghali and Ban Ki-Moon: “[Water scarcities] create tensions in conflict-prone regions. Too often, where we need water we find guns”.

Dr Peter H. Gleick of the Pacific Institute, maintains a timeline documenting water conflicts over the past 5000 years, noting a rise in both intensity and frequency in the 21<sup>st</sup> century. The timeline can be found at <http://www2.worldwater.org/conflict/timeline/>.



Figure 1. Markers indicate sites of water conflict during the period 2000-2010. Source: [Pacific Institute, The World’s Water: Information on the world’s freshwater resources.](http://www2.worldwater.org/conflict/timeline/)

Together these factors point to increasing scarcity of fresh water at a time of strongly rising demand, leading to potential for conflicts at various levels.

Regions where risk of water scarcity leading to mass migration Include:

<sup>9</sup> *The Economist*. 2015. Why India has a water crisis. <http://www.economist.com/blogs/economist-explains/2016/05/economist-explains-11>

<sup>10</sup> Daniel Shemie and Kari Vigerstol, *Why China has a water crisis*. World Economic Forum, 2016.

<sup>11</sup> See <http://www.climateoutcome.kiwi.nz/drought.html>

<sup>12</sup> See <http://www.telegraph.co.uk/news/2016/08/15/absolute-drought-in-southern-england-as-rainfall-plummets-below/>

<sup>13</sup> See <https://www.google.com.au/#q=farmers+v+frackers>

- The North China Plain where the aquifer that feeds 400 million people is two thirds empty and is a major factor in Chinese land-grabs in Africa and elsewhere.
- The north Indian plain, the bread-basket of India which feeds 700 million people, where groundwater levels have been falling a one metre plus each year for over a decade.
- The Middle East, where acute water scarcity is a factor in the Syrian crisis, in international disputes (e.g. between Israel and Syria), in Iraqi instability and in Saudi and UAE land-grabs in Africa.
- North Africa, where a food-basket failure on the scale of the one which brought down the Roman Empire in the Third Century, could lead to massive migration into southern Europe.
- The US central mid-west where it is estimated that water taken in the last 150 years will require 6000 years to replenish.
- Central Asia, where drought and dam-building threaten the Amu Darya and Syr Darya rivers which supply several nations.<sup>14</sup>

Water crisis ranked first in the World Economic Forum's (WEF) list of most impactful global risks for 2015, and third in 2016 having been over taken by climate change inaction and weapons of mass destruction.<sup>15</sup>

The WEF's most likely risk was "largescale involuntary migration" triggered by conflict, extreme weather events (climate change) and natural disaster.

## Land

More than 95 per cent of humanity's present food supply is produced from the soil. That may not, however, always be the case in the future.

Sydney University Professor, John Crawford stated in a 2012 *Time Magazine* interview that "a rough calculation of current rates of soil degradation suggests we have about 60 years of topsoil left". He went on to say:

Some 40 per cent of soil used for agriculture around the world is classed as either degraded or seriously degraded – the latter means that 70 per cent of the topsoil, that layer allowing plants to grow, is gone. Because various farming methods that strip the soil of carbon and make it less robust as well as weaker in nutrients, soil is being lost at between 10 and 40 times the rate at which it can be replenished.<sup>16</sup>

In contrast, the UN Food and Agricultural Organisation has projected that for the world as a whole, net land under crops may have to increase by some 700 million hectares by 2050 in order to meet predicted global food needs.

The US Geological Survey has estimated that human activity – mainly farming and land development – is causing the loss of about 74 gigatonnes of topsoil every year<sup>17</sup>. This makes it one of the largest, if not the largest, human impact on the planet.

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<sup>14</sup> See <http://thediplomat.com/2015/06/thirsty-yet-central-asias-coming-water-crisis/>

<sup>15</sup> See [http://www3.weforum.org/docs/GRR/WEF\\_GRR16.pdf](http://www3.weforum.org/docs/GRR/WEF_GRR16.pdf)

<sup>16</sup> Crawford J. 2012. What If the World's Soil Runs Out? *TIME*. 12 December 2012.

<http://world.time.com/2012/12/14/what-if-the-worlds-soil-runs-out/>

<sup>17</sup> Wilkinson BH and McElroy BJ. 2007. The impact of humans on continental erosion and sedimentation, *Geological Society of America Bulletin*, January/February, 2007, v. 119, no. 1-2, p. 140-156.

The University of Sheffield, in a 2015 paper, noted that nearly 33 percent of the world's arable land had been lost to erosion or pollution between 1975 and 2015.<sup>18</sup>

Authors such as [Jared Diamond](#) and [David Montgomery](#) have documented how soil loss contributed to the collapse of previous civilisations, including the Mayans, Greeks and Romans.

In dry land, which accounts for 44 per cent of the world's food production system (including most of Australia), "arable land loss [is] estimated 30 to 35 times the historical rate", according to the UN Convention to Combat Desertification (UNCCD)<sup>19</sup>. On average, 12 million additional hectares are being lost to desert each year. Paralleling this is a net loss in world forest cover of 6.6 million hectares each year.<sup>20</sup>

The UNCCD Executive Secretary, Monique Barbut, links land degradation with the Syrian crisis and civil war and conflict in the Sahel, Mali and Darfur: "land is so closely linked to basic human needs, such as access to food and water. If land degradation interferes with the fulfilment of these needs. It can lead to conflict over scarce land and water resources, spark food riots or turn small holder farmers into refugees".<sup>21</sup> Conversely, she notes, "the [Great Green Wall for the Sahara and Sahel Initiative](#) is bringing a coordinated and harmonised response to food security and peace".

The United Nations Interagency Framework Team for Preventive Action has noted that land conflicts tend to become violent when they are "linked to wider processes of political exclusion, social discrimination, economic marginalization and a perception that peaceful action is no longer a viable strategy for change". The Framework Team goes further, stating that "land issues readily lend themselves to conflict. Land is an important economic asset and source of livelihoods; it is also closely linked to community identity, history and culture. Communities, therefore, can readily mobilise around land issue, making land a central object of conflict".

Traditionally, famine has been viewed as a consequence, rather than a driver, of warfare. The [Oslo Peace Research Institute](#), however, challenged this perception in a paper arguing the risks of conflict were, in recent decades, much higher in regions suffering insecurity of food, land and water – and much lower in places such as Europe, North American and Australasia where those resources were secure.<sup>22</sup>

These observations, and many more beside, support a view that food, land and water will play a more critical role in global security and the risks of conflict during the middle part of the 21<sup>st</sup> century – and equally, that securing them can reduce the tensions that lead to war.

Finally, it should be noted that, while the world currently wastes up to 40 per cent of its food in the production/market chain – enough to feed three billion people – no-one has yet devised an affordable system for redistributing food from surplus regions to deficit regions that cannot afford to pay for it on the scale required to overcome hunger. The proven solution lies in enhancing local food sufficiency through care of land, water and improved and distribution production systems. Furthermore, the waste can be eliminated by recycling nutrients through the megacities in advanced, urban agriculture systems.

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<sup>18</sup> Cameron D, Osborne C, Horton P and Sinclair M. 2015. *A sustainable model for intensive agriculture*, University of Sheffield. 2 December 2015. <http://grantham.sheffield.ac.uk/wp-content/uploads/2015/12/A4-sustainable-model-intensive-agriculture-spread.pdf>

<sup>19</sup> See <http://www.unccd.int/en/programmes/Event-and-campaigns/WDCD/Documents/DLDD%20Facts.pdf>

<sup>20</sup> UNFAO, 2015. *Global Forest Resources Assessment 2015*. How are the world's forests changing? 7 September 2015 <http://www.fao.org/3/a-i4793e.pdf>

<sup>21</sup> See [http://newsbox.unccd.int/imgissue/UNCCDNews6\\_1.pdf](http://newsbox.unccd.int/imgissue/UNCCDNews6_1.pdf)

<sup>22</sup> De Soysa I and Gleditsch NP. 1998. *To Cultivate Peace: Agriculture in a World of Conflict*, PRIO, 1999.

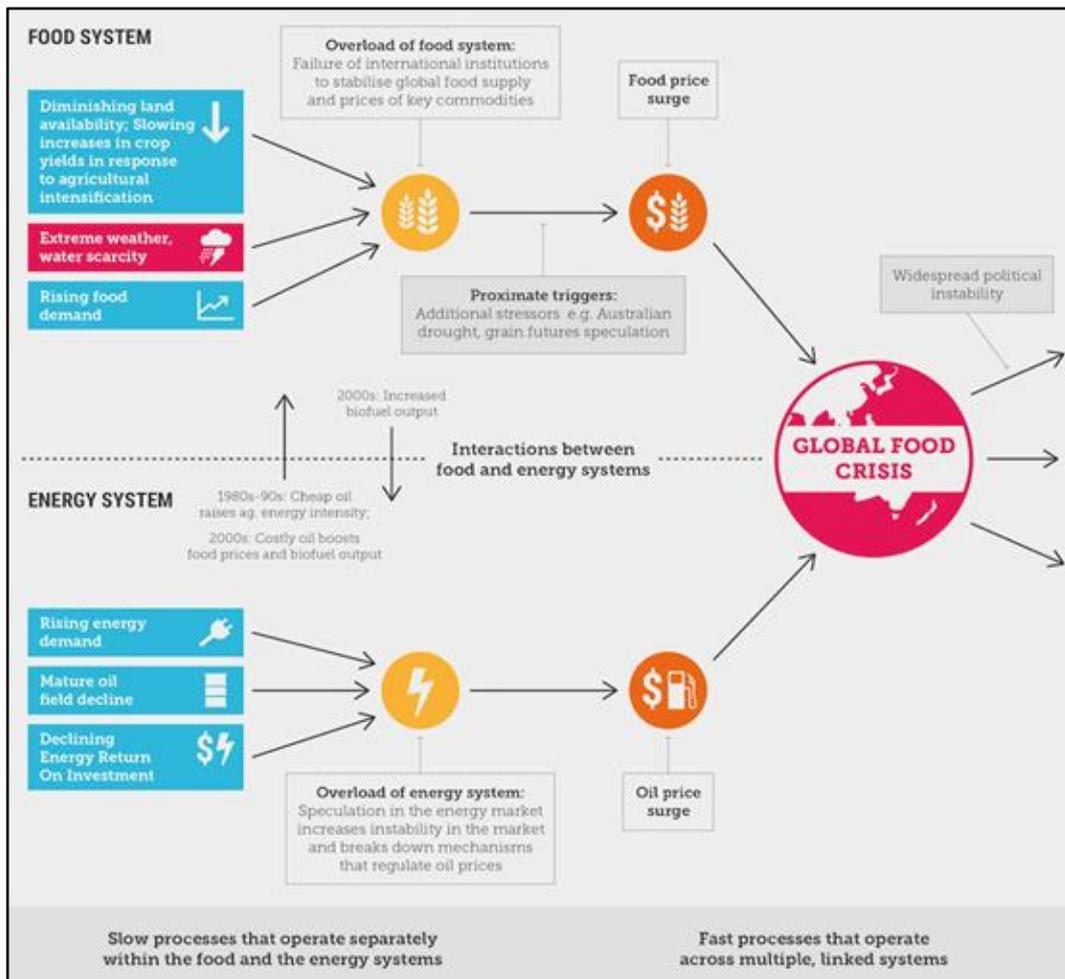


Figure 2. Climate Threat Multiplier. Source: [W Steffen. Climate change: the ultimate threat multiplier, in ASPI, The Strategist, 18 Nov 2015.](http://www.aspi.org.au/steffen-w-climate-change-the-ultimate-threat-multiplier)

Climate has a major influence on geopolitical security and the risk of conflict in the 21<sup>st</sup> century, primarily through its impact on the food chain.

As United States Secretary of State, John Kerry observed in February 2014: “In a sense, climate change can now be considered another weapon of mass destruction, perhaps the world’s most fearsome weapon of mass destruction”. In 2015 a Pentagon study found climate change is a security risk, “because it degrades living conditions, human security and the ability of governments to meet the basic needs of their populations”.<sup>23</sup> More recently, the UK Climate envoy, Rear Admiral Neil Morisetti, said it posed as grave a threat to Britain’s security and economic resilience as terrorism and cyber-attacks.<sup>24</sup>

Climate change is, in effect, a threat multiplier of the risks already generated through insecurity of the primary resources of food, land and water.<sup>25</sup>

### Mass Migration

Food insecurity was a factor in the mass migration of 10 million Bangladeshis to India in the 1970s. Drought and failing agricultural systems are thought to have driven 1.5 million Syrians out of rural areas and into

<sup>23</sup> See <http://www.defense.gov/News/Article/Article/612710>

<sup>24</sup> See <https://www.theguardian.com/environment/2013/jun/30/climate-change-security-threat-envoy>

<sup>25</sup> Steffen W. Climate change: the ultimate threat multiplier. 2015. <http://www.aspi.org.au/steffen-w-climate-change-the-ultimate-threat-multiplier/>

cities in the build-up to a civil conflict that led to 11 million Syrians fleeing their country. While scarcities of food, land and water seldom, of themselves, directly trigger conflicts – Darfur, Rwanda and Somalia may be exceptions – they are potent drivers in the background. As farmer and former US President Jimmy Carter said: “there can be no peace until people have enough to eat. Hungry people are not peaceful people”.<sup>26</sup>

Likewise, the loss of food security – through climate or loss of the necessary soil and water resources – is a major factor in people deciding to quit their homelands in search of new life, whether as economic migrants ahead of a crisis they have foreseen or as refugees fleeing a disaster. The exceptions to this were the Russian and Chinese famines of the mid-20<sup>th</sup> century when, it may be argued, people chose to die where they were rather than move to foreign, largely unknown countries and cultures. In the 21<sup>st</sup> century with its ubiquitous mass culture of the media, internet and social media, people are aware they have a choice of seeking food and security elsewhere.

This poses the undoubted risk of migration events numbering in the tens, possibly even hundreds of millions. In 2016 sixty-five million people are already displaced by famine and conflict. The recent experience of Europe, from crises in Africa and the Middle East, is a case in point.

It is important to understand that such disasters are preventable, with sufficient recognition of the driving factors and suitable preventative strategies.

In the 21<sup>st</sup> century, we argue, the risk of mass migration events and conflict driven by insecurity of food, land and water is very much higher than in any previous age of human history. Food, land and water must therefore, be viewed as strategic elements of defence and international security as essential as naval fleets, air power or armies. Neglecting them will raise the risk of conflict and mass migration sharply – while preventing them will yield a peace dividend by removing an important *casus belli*.

It is time to recognise food, land and water as fundamental strategic elements in Australia’s future defence and border protection policies.

## Conclusion

### What Australia should do:

Australians are world experts in the management of drought and a harsh climate. Our agriculture maintains high levels of productivity even in the worst droughts. We have a body of knowledge, technology and expertise that the world needs – urgently.

Australia made major contributions to global food security in the Green Revolution that fed a hungry world in the 1970s and 80s. We need to repeat the miracle based on our skills in farming dry landscapes, in conservation farming, agricultural and water technology and through exemplary individuals already practicing world leadership in this regard. This is potentially both a major new export opportunity worth billions of dollars, and a peace initiative that can mitigate the worldwide risk of famine, conflict and mass migration to our region.

Australian also needs to acknowledge its soil and water as key strategic resources, of absolute priority to our ability both to sustain our economy and to defend ourselves.

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<sup>26</sup> Carter J, First step to peace is eradicating hunger. *International Herald Tribune*. June 17, 1999. <http://www.nytimes.com/1999/06/17/opinion/first-step-toward-peace-is-eradicating-hunger.html>

A policy of 'stop the boats' could not be maintained in the face of the mass migration of tens of millions of people from, for example, India or China in the event of severe food, land and water collapses that might ignite a migratory crisis. However, forestalling this is feasible through careful planning, good science, practical technology and the world-leading expertise which already exist within our agricultural and scientific communities and by strong relations with countries most likely to be affected by food, land and water crises.

Furthermore, failure on Australia's part to act decisively to prevent global warming also feeds the threat multiplier of climate change. From a strategic standpoint, neglect of policies to reduce greenhouse emissions will increase the risks of regional instability, conflict and migratory invasion. It follows that effective climate policy which mitigates carbon dioxide emissions is a pivotal element in any effective security and defence policy for Australia in the 21<sup>st</sup> Century.

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