FutureDirections international

INDEPENDENT STRATEGIC ANALYSIS OF AUSTRALIA'S GLOBAL INTERESTS

Workshop Report

25 May 2012

International Conflict Triggers and Potential Conflict Points Resulting from Food and Water Insecurity

Global Food and Water Crises Research Programme

Introduction

FDI is to publish a Landmark Study on the potential nature and extent of global food and water crises between now and 2050. The study will seek to answer the following question:

What is the extent of a possible global food and water crisis between now and 2050, how is it likely to evolve and what impact could it have on Australia?

Over the past 18 months, workshops have been held in a number of state capitals. They have considered population issues, water availability, land availability, food demand and supply, and the role of science, technology and innovation.

In addition to the current series, which is examining the issue of potential conflicts, a final set of workshops will consider the likely impact on Australia and what we should do about it.

Before publishing the Landmark Study, we may also hold a series of public forums.

With regard to the 'conflict series', the key questions are as follows:

How might food and water security issues result in intra- and inter- state conflict?

When and where might they occur?

Workshop Participants

All Workshops

- Major General John Hartley AO (Retd), CEO and Institute, Director Future Directions International, Roundtable Chairman.
- Alyson Clarke, FDI Executive Officer
- Gary Kleyn, Manager, FDI Global Food and Water Crises Research Programme

Melbourne:

- Richard Bartlett, Director, inGov. Advisory.
- Frank Connolly, Think Quick.
- Lindsay Falvey, Professor, Fellow Clare Hall University of Cambridge, past/foundation Dean of Land and Food and Chair of Agriculture at the University of Melbourne.
- Adam Fitzpatrick, Managing Director, Seraphim Risk Management.
- Dennis Moon, Director Goulburn Murray Water, Director Campaspe Irrigation, Nuffield Scholar.
- Neil Pankhurst, Director Goulburn Murray Water.
- Sarah Scales, Director of Goulburn Murray Water in Victoria.
- Andrew Western, Professor Department of Civil and Environmental Engineering, The University of Melbourne.

Sydney:

- Chris Baker, Research Analyst, Centre for International Security Studies, University of Sydney.
- Monika Barthwal-Datta, Food Security Programme Leader, Centre for International Security Studies, University of Sydney.
- Philip Hirsch, Professor, Director Mekong Research Group, University of Sydney.
- Bill Pritchard, Associate Professor, School of Geography, University of Sydney.
- Doug Roser, Group Captain (retd), President RUSI NSW.
- Ben Shephard, Centre for International Security Studies, University of Sydney.
- Keith Suter, Foreign and International Affairs Editor, Channel 7's Sunrise, Managing Director, Global Directions.

Canberra:

- Anthony Bergin, Director, Australian Strategic Policy Institute.
- Denis Blight, Executive Director, Crawford Fund.
- Simon Bronitt, director of Centre of Excellence in Policing and Security.
- Sandy Gordon, Professor, Visiting Fellow, Regulatory Institutions Network, Centre for Excellence in Policing and Security.
- Simon Hearn, Principal Advisor, Australian Centre for International Agricultural Research.

- Alopi Latukefu, Director, Food Security and Policy, AusAid.
- Chris Ritchie, Vice Admiral, National President of the Royal United Services Institute of Australia.
- Andrew Selth, Research Fellow, Griffith Asia Institute, Griffith University.
- Jian Zhang, Senior Lecturer at the Australian Defence Force Academy, University of New South Wales.

Perth:

- Rudi Appels, Professor, Centre for Comparative Genomics, Murdoch University.
- Michael Gillan, Associate Professor, Management and Organisations, UWA.
- Terry Hill, Executive Director, Irrigated Agriculture and Diversification, DAFWA.
- Bill Hutchinson, Professor, SECUA Security Research Centre, ECU.
- Bill Kean, former Executive Director, Office of the Director General, World Health Organization, member of the Australian Institute of International Affairs.
- Leighton G. Luke, Manager, Indian Ocean Research Programme, Future Directions International.
- Peter Nixon, Nuffield.
- John Noonan, Senior Lecturer, Leader, Farm Business Resilience and Safe Quality Food Programmes, School of Management, Curtin Business School.
- Jay Vella, Research Analyst, Global Food and Water Crises Research Programme.

Key Points

- Diminishing food, water, energy and land resources, relative to demand, are likely to lead to increasing conflicts.
- Conflict is most likely to be intra-state and not inter-state.
- Existing conflicts will be aggravated by food and water shortages.
- Conflict will take the form of riots, civil unrest, democratic and autocratic breakdown, or "cold" wars
- Regions to watch are those with weak government and economic institutions, inequality and corruption.
- Africa and Asia will be the epicentres of future water and food-induced conflict.
- Historically, most disputes have been resolved without bloodshed. As the stakes become higher the incidence levels are likely to increase and become more complex in nature.
- Fish wars are likely to become more frequent until better legal frameworks are developed and administered.
- Intervention in the market will be needed to overcome market failures in providing for the world's poor.
- Of the international bodies, the G20 is the best placed to deal with the issue at a global level.
- Of the regional bodies in Asia, initiatives by the Asian Development Bank and through ASEAN provide useful models for other regions.
- Australia, with its experience across different ecological systems, has much to offer Africa and Asia.

Setting the Scene

Over the next 40 years, there is a high probability of a global food and water crisis. This will result from population pressures, an increasing shortage of fresh water and a decline in access to arable land. The result will be demand exceeding supply due to competing interests, including environmental pressures, poor governance, high levels of food wastage, pre- and post-harvest losses and inadequate research.

All these factors will put upward pressure on the price of food. Unfortunately, those most affected are the least able to afford price increases.

There have been tensions between, and within, states over access and control of food and water. The signs of an impending crisis suggest these tensions will increase.

This paper summarises the conclusions reached during a series of workshops conducted by FDI over the last 18 months, including the recent workshops on conflict points held in March 2012.

Population

- Growth projections suggest the global population will be 9 billion by 2050 and will begin to decline shortly after that.
- Most significant growth will be in Sub-Saharan and southern Africa and in South Asia.
- India's growth rate will increase more slowly than other parts of South Asia; but there are significant differences between north and south India.
- China's growth rate is in decline, leading to a reduced work force, an increasing disparity between males and females and an ageing population.
- Much of the developed world will be dealing with ageing populations within the next generation.
- The developing world will follow this trend one to two generations later, but is unlikely to have in place the necessary capabilities to look after its elderly people.
- Demand for high-energy grains will double over the next 20 years.

Availability of Water

- By 2050, water scarcity could affect three-quarters of the world's population.
- Regions to watch have high population density (greater than 100/sq km), low per capita GDP (less than $765 per person), unfriendly relations with neighbouring countries, politically active minority groups, proposals for large dams or other water development projects and few, if any, water treaties.
- Increased urbanisation will create further challenges for water supply, recycling and delivery.
- By 2050, if current practices and technologies are maintained, an additional 6,000 cu km of fresh water will be required; almost double the existing availability.
- Countries will increasingly be prepared to defend their rights over freshwater sources or acquire new ones.

Decline in Arable Land

- Population growth and changing consumption habits will create a considerable degree of additional demand, which will, in turn, place pressure on arable land resources.
- The scarcity of arable land is the result of a range of human and climatic factors, including degradation, climate change, soil constraints, environmental conservation reserves and urban encroachment.
- Currently, there are some 2.7 billion hectares of land world-wide that could potentially be used for crop production. These areas are concentrated in South and Central America and Sub-Saharan Africa.
- The solutions to addressing the availability of arable land are three-fold: accessing more arable land, increasing the productive capacity of existing arable land and the conservation of arable land to prevent degradation.
- Despite more than an adequate supply of arable land to meet future demand, land availability will continue to be a major factor in meeting future food security concerns, because of the need to find a balance between competing interests and uses and finite resources.

Food Loss

- Almost one-third of food produced for human consumption—approximately 1.3 billion tonnes per year, which could potentially feed the total global population of 7 billion—is either lost or wasted.
- Overall, food loss primarily occurs in the production to retail phase of the food chain.
- Consumers in industrialised nations tend to waste significantly more food than their counterparts in developing countries.
- Post-harvest losses are mainly due to corruption, weaknesses in diagnostic and advisory services and meagre infrastructure in the developing world.
- The level of pre-harvest losses, resulting from insufficient investment, is another major factor in the developing world.
- A voluntary platform for retailers to report food waste statistics and a less conservative system of setting use-by dates, would aid in combating waste.
- An increasing world population, and progressively scarcer resources, make reduction in food losses and waste a key component in any strategy for a sustainable future global food supply.

Science and Technology

- Current food production systems rely on past research investments that are not being maintained.
- Science, research and innovation must continue across the food supply chain.
- Farmers, food distributors and plant health practitioners must work together more closely.
- All aspects of food production require integrated investigation; this includes soils, plants, animals and all related biological processes.
- Genetically modified foods are already widely used and have resulted in major reductions in pesticide use and drought resistance, for example. More needs to be done, however, to establish appropriate safeguards for the technology.
- The mechanism of climate change has been poorly communicated to the public and it has thus been easily used for political gain. Agricultural research has traditionally factored in the variations of climate change, often at rates of change in excess of those predicted in climate change models. Despite this, current investments in such research are poor shadows of past commitments, with the exception of countries such as China.

Demand

- World population will increase from about 7 billion today, to over 9 billion by 2050.
- Global urban population will increase from 49 per cent to around 70 per cent, or 6.3 billion people, in the same period.
- The demand for higher quality food will rise. By 2050, global meat demand per year will rise by an estimated 180 million tonnes, to reach 465 million tonnes.
- Demand for food is likely to increase by 70 percent between now and 2050.

Supply

- Improved national, regional and global governance is needed if food is to be made available to those who most need it; including national food security plans for food-deficit nations, which implies reviews of trade barriers and subsidies.
- Food losses, both at the pre-harvest and post-harvest stages, that presently account for up to 50 per cent of production in developing countries, must be reduced.
- Food logistics, involving transport and storage, must be improved.

- Available fresh water must be husbanded and further sources developed. Meanwhile, solutions must be found to deal with the competing water demands farmers face from cities and the resources sector.
- Arable and grazing land must be protected and degraded land restored to productivity.
- The potential impact of climate change on the world food supply must be considered and suitable adaptations developed through a reinstatement of agricultural research. This should be urgently adopted in all countries.
- Development of agriculture is required, to make mega-cities more food secure.
- Scientific and technological innovation need to be revitalised.
- Education and training of food producers need to be dramatically increased.
- Farmers need a more assured and higher return for their produce.
- Aquaculture and other food sources offer new opportunities, but are unlikely to significantly increase food production. Fish stocks peaked in 2004, meaning that wild catches of fish are also liable to decrease globally, although aquaculture offers the prospect of becoming an intensive animal production industry, similar to poultry in some ways. It is already a major protein source in many Asian environments.
- Future conflict in urban areas subject to food price rises could increase emigration. Refugee crises could increase substantially as a result of food and water crises.

Food Security and Conflict

There is little dispute that conflict can lead to food and water crises. This paper will consider parts of the world, however, where food and water insecurity can be the cause of conflict and, at worst, result in war. While dealing predominately with food and water issues, the paper also recognises the nexus that exists between food and water and energy security.

There is a growing appreciation that the conflicts in the next century will most likely be fought over a lack of resources.

Yet, in a sense, this is not new. Researchers point to the French and Russian revolutions as conflicts induced by a lack of food. More recently, Germany's World War Two efforts are said to have been inspired, at least in part, by its perceived need to gain access to more food. Yet the general sense among those that attended FDI's recent workshops, was that the scale of the problem in the future could be significantly greater as a result of population pressures, changing weather, urbanisation, migration, loss of arable land and other farm inputs, and increased affluence in the developing world.

In his book, *Small Farmers Secure Food*, Lindsay Falvey, a participant in FDI's March 2012 workshop on the issue of food and conflict, clearly expresses the problem and why countries across the globe are starting to take note. .

He writes (p.36), "…if people are hungry, especially in cities, the state is not stable – riots, violence, breakdown of law and order and migration result."

"Hunger feeds anarchy."

This view is also shared by Julian Cribb, who in his book, *The Coming Famine*, writes that if "large regions of the world run short of food, land or water in the decades that lie ahead, then wholesale, bloody wars are liable to follow."

He continues: "An increasingly credible scenario for World War 3 is not so much a confrontation of super powers and their allies, as a festering, self-perpetuating chain of resource conflicts." He also says: "The wars of the 21st Century are less likely to be global conflicts with sharply defined sides and huge armies, than a scrappy mass of failed states, rebellions, civil strife, insurgencies, terrorism and genocides, sparked by bloody competition over dwindling resources."

As another workshop participant put it, people do not go to war to kill; they go to war over resources, either to protect or to gain the resources for themselves.

Another observed that hunger results in passivity not conflict. Conflict is over resources, not because people are going hungry.

A study by the International Peace Research Institute indicates that where food security is an issue, it is more likely to result in some form of conflict. Darfur, Rwanda, Eritrea and the Balkans experienced such wars. Governments, especially in developed countries, are increasingly aware of this phenomenon.

The UK Ministry of Defence, the CIA, the US Center for Strategic and International Studies and the Oslo Peace Research Institute, all identify famine as a potential trigger for conflicts and possibly even nuclear war.

While some countries are beginning to take note of the need to provide food security as the first and fundamental step towards peace and general security, many others are not aware.

This paper seeks to raise awareness of the pending crises and to provide some ideas on the way forward at an international, state and local level.

It looks at conflict in its different forms; from minor arguments between landowners to outright war between states.

Thomas Homer-Dixon, director of the Waterloo Institute for Complexity and Innovation, has gone some way towards determining what drives conflict, using an interdisciplinary framework. In his book *Environment, Scarcity and Violence*, he explains that environmental - and by extension - agricultural stress, by itself does not cause violence.

Other factors must coincide to bring about violent conflict, such as the failure of economic institutions and government. The danger exists when several negative events work together to reach a crisis point; it is just this scenario of multi-layered stresses that countries could be confronting by 2050.

Conflicts can vary in scale and complexity, covering the full spectrum from arguments between neighbours to out-right war between states. The World Food Programme has categorised these conflicts along the following lines: civil conflict, interstate war, democratic and authoritarian breakdowns, protests and rioting, and communal violence.

More broadly, two categories were identified in the FDI workshops: Inter- and Intra-State conflict.

Inter-State Conflict

As the name suggests, this is conflict that occurs across national boundaries and could be caused by disputes over shared resources, such as a river or other water bodies shared by both states. In other situations, it could be the lack, or loss, of arable land that might cause one state to go to war with another. Historically, inter-state conflict, which has resulted in war over food or water resources, has been limited.

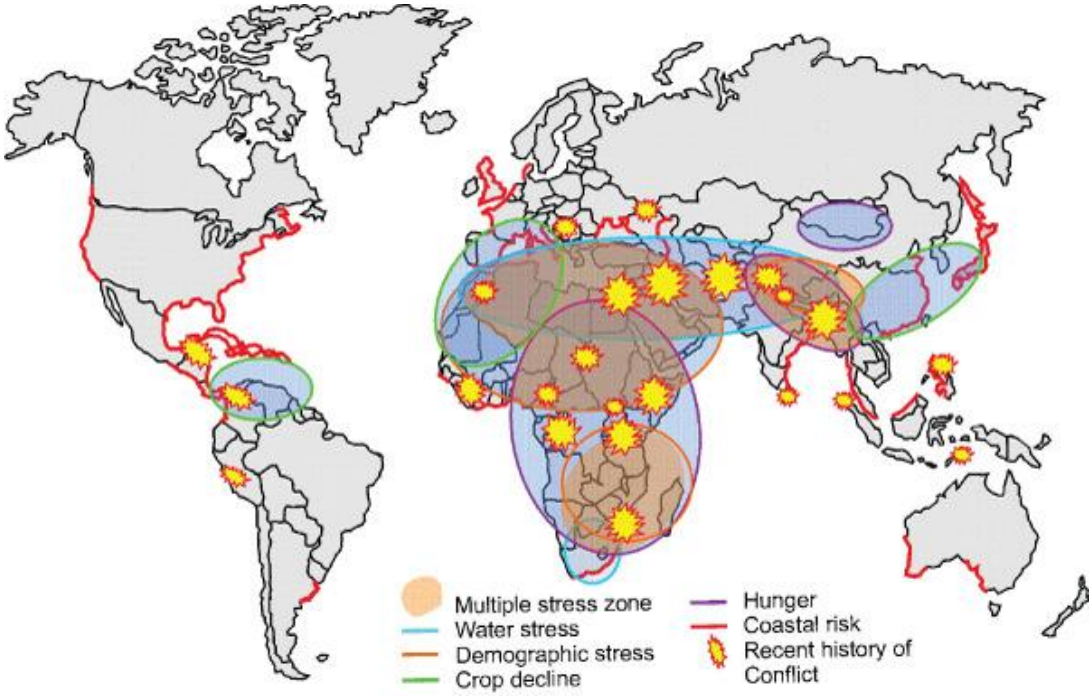
Over the next century, with population peaking at approximately nine billion, continuing urbanisation and changing weather conditions, these conditions could provide a ripe climate for an increasing number of wars. Inter-state conflict could take the form of a cold war or "tit for tat" showdown. One example of an area where a potential cold war over water resources could emerge is between China and India. Another possible conflict point could be between Egypt and its neighbouring countries, over rights for access to the Nile waters.

Intra-State Conflict

Intra-state conflicts are those that occur within a national boundary. They can take several forms, such as protests and rioting, communal violence, breakdown of government and civil conflict. Over the next century, most activity is likely to occur in the category of intra-state conflict, largely because up to 90 per cent of food is consumed within the country of origin. Intra-state conflict can be between communities, people involved in the same industry (e.g. fishing), or between industries (e.g. agriculture and mining).

A potential flashpoint for intra-state conflict is the Mekong River region. It is unlikely that the Mekong River beneficiaries will take on the might of China, should it decide to further restrict the Mekong; yet conflict could occur between communities or smaller countries, fighting over the diminishing resources downstream.

Correlation Between Water and Food Stress and Conflict.



Source: Future Directions International/UK Ministry of Defence

In recent years, the term 'protracted crises' has been used to emphasise the persistent nature of certain emergencies. It is important to evaluate what common threads exist in those areas affected by food crises. This knowledge is already being used in early warning systems and appears relatively successful in containing food crises. More importantly, understanding the characteristics of regions with a protracted crisis can provide a cursor of where conflict is likely to arise, so that preventive steps can be undertaken by the Government involved or others in the international community.

The FAO's May 2010 *Crop Prospects and Food Situation* report, indicated that, despite record or bumper 2009 cereal harvests in many low-income food deficit countries, food difficulties still persist in 29 countries. This was particularly so in Niger, Chad and other Sahelian countries of West Africa. The Sahel Region is the zone between the Sahara desert in the north and the Sudanian savannas in the south. It stretches across the north of Africa between the Atlantic Ocean and the Red Sea.

The global map shown above, gives an indication of where future pressure points might occur, based on historical or protracted crises. The map clearly shows Africa and Asia as the epicentres of future conflicts.

Regions to Watch

A basic yard stick developed by the FAO, provides a pointer to geographical areas that will likely face conflict. The trigger points are characterised by:

- non-existent or weak public institutions;
- weak informal institutions;
- state control that is challenged by the lack of resources and institutional failure;
- externally, the legitimacy of the state is contested;
- a strong black market economy;
- existence of, or a high susceptibility to, violence;
- forced displacement;
- the deliberate exclusion of sectors of the population from enjoying basic rights;
- livelihoods being highly vulnerable to external shocks; and
- widespread poverty and food insecurity.[1]

Considering these characteristics, the greatest potential for conflict is in Africa. This is also borne out in the map above. Somalia, Niger, Mozambique, Sudan, South Sudan, Madagascar, Liberia, Kenya, Guinea, Ethiopia, Eritrea and northern African countries will face more conflict as a result of water and food insecurity.

A country that will face increased uncertainly is Egypt, not only because of its political instability but also because of its reduced capacity for agricultural output. The Nile is also becoming a source of increased tensions, as countries upstream siphon off more of the water for their energy and agricultural needs, taking advantage of the power vacuum that exists in Egypt.

The Middle East also faces a strain on its resources and is becoming increasingly dependent on external sources for its food. Other countries to watch are Afghanistan, Bangladesh, Burma, Iraq, Lebanon, Mongolia, Pakistan, India, the Philippines, and China. Land tenure issues, a depleting water supply as in parts of India, Pakistan and China, and food distribution problems will make these countries vulnerable to both intra- and inter-state conflict.

Selected Areas Where Food Issues May Lead to Dispute or Conflict

Region	Sub Region	Affected Areas	Possible Threats
Africa	East Africa	Sudan, South Sudan, Kenya, Ethiopia, Eritrea.	Water shortages and lack of reliable rain. Political instability.
	North Africa	Egypt, Tunisia, Libya	Pressure for additional

			access, pollution, governance, rising populations.
	Southern Africa	Mozambique, Zimbabwe	Drought, access to water, governance.
	Western and Central Africa	All countries in the Sahel, Guinea and Niger.	Governance, lack of rain, political instability.
Middle East	Middle East	Gulf States, Syria, Israel, Palestine.	Political instability, depletion of arable land and water resources.
Asia	Central Asia	Pakistan, India, Mongolia, Afghanistan and Bangladesh.	Cross border fighting in Pakistan and Afghanistan. Presence of land mines.
	East and South East Asia	China.	Urbanisation, population and demographic concerns. Reductions in water and arable land.

Water Security and Conflict

Water shortages can cause conflicts of varying intensity and scale. UN-Water, in its March 2012 report *Managing Water Under Uncertainty and Risk*, states (p.10) that "although conflicts may appear localised, they present challenges to the broader context of peace and security. Conflicts over water resources can also turn into, or fuel, ethnic conflicts – as ethnic conflict is most commonly fuelled by collective fears for the future, one can see how water scarcity could play into such fears."

The report says that drivers that directly impinge upon water stress and sustainability are governance, politics, ethics and society, and climate change.

In March 2010, Future Directions International undertook a study, *"Water Crises: International areas at risk"*, which took an historical and contemporary view of conflicts and cooperation over fresh water sources across the globe. The paper considered the prevalence of conflict over water resources and determined what warning signs can assist in identifying potential conflicts.

Some countries, by virtue of their location and topography, have access to the sources of freshwater; other countries are dependent on the goodwill of their neighbours to ensure

that the waterways, basins and rivers flow unobstructed past their boundaries. Egypt is an obvious example of a country that depends for its water on the goodwill of the countries upstream on the River Nile.

There are 263 international basins that cross the political boundaries of two or more countries. These basins cover approximately half of the earth's surface area; they account for an estimated 60 per cent of the global freshwater flow and accommodate 40 per cent of the world's population.

Historically, evidence shows that despite the complexity of many water disputes, the majority have been handled diplomatically, rather than through military means. In the past 50 years, 37 acute disputes involving violence have been reported; while, conversely, 150 treaties were signed. According to the FAO, more than 3,600 treaties related to international water resources have been drawn up since 805 AD.

Indo-China, Cambodia, Laos, Thailand and Vietnam have managed to cooperate since 1957, within the Mekong River Commission, sometimes even in the presence of other political conflicts. Likewise, Israel and Jordan have held regular talks about sharing the Jordan River, while the Indus River Commission, involving India and Pakistan, continues to operate. In 1999, a framework involving ten countries was agreed for the Nile River Basin.

The Institute of Water and Watershed at Oregon State University in the United States, has published detailed accounts of historical and current international conflicts over water, as part of its Basins at Risk study. The university has developed a database of fresh water rivers and basins that lists a number of places where highly conflictive events have occurred. These include: the Amur and Aral Sea (internal drainage); and the Ganges-Brahmaputra- Meghna, Jordan, Karnaphuli, Kura-Araks, Nile, Orange, Senegal, the Tigris and Euphrates rivers. Jordan tops the list, with 29 events involving conflict between it and its neighbours over access to the waters of the Jordan River.

At the other end of the spectrum, the Institute's research shows that the Danube enjoys high cooperation between states, as do some sections of the Ganges.

The same report, which considers water cooperation and conflict from 1948 to 1999, found that there was overwhelming cooperation over water in some areas, including water quantity, quality, joint management and hydropower. Conflictive events tended to relate to quantity and infrastructure concerns.

During the period studied, there were 1,831 events, affecting 124 countries.

Events can be anything from a formal declaration of war, political or military hostile actions, through to strategic alliances or treaties. Out of the 1,831 events, 28 per cent involved conflict, 67 per cent featured cooperation and the remaining five per cent were neutral or had no significance.

Water quality, infrastructure, joint management and hydropower dominated these issues. The majority of events were associated with basins in North Africa and the Middle East, sub-Saharan Africa and Eastern Europe, followed by Southeast and South Asia and South

America. The Middle East and the North African region show the lowest level of cooperation, while Western Europe had the highest.

Regions to Watch

Water Basins experiencing both high population density and low average per capita Gross Domestic Product are shown below:

Selected Areas Where Water Issues may Lead to Dispute or Conflict

Region	Water System	Affected Areas	Possible Threats
Central America	Grijalva River system	Guatemala, Mexico, US	Flooding, pollution, public access to water, potential migration, damage to Malpaso dam
	Río Grande/Rio Bravo	Mexico, US	Drought, access to water
South America	Amazon River Basin	Brazil, South America	Drought, water shortages, deforestation, potential migration
	Mamoré and Beni Rivers	Bolivia, Brazil	Hydro-electric potential, instability
	Paraná River	Brazil, Paraguay, Argentina	Dam-induced water shortages
Europe	Danube River	Hungary, Slovakia	Flooding, pollution, potential migration
Middle East	Sea of Galilee and Jordan River	Syria, Israel, Lebanon, Jordan	Water scarcity
Africa	Lake Chad	Chad, Niger, Nigeria, Cameroon	Shrinking lake, diminishing fishing industry, water shortages
	Nile River	Egypt, Northeast Africa	Pressure for additional access, pollution
	Okavango River Basin	Botswana, Namibia	Drought, access to water

Asia	Balkhash Watershed	China, Kyrgyzstan, Kazakhstan	Cross border water pollution, water shortages
	Kura-Araks River system	Georgia, Azerbaijan, Armenia	Downstream pollution, water shortages in Azerbaijan
	Syr and Amu Darya systems	Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, Afghanistan	Glacial melt leading to flooding, water shortages, potential migration
	Ganges Delta, Ganges and Jamuna Rivers	India, Bangladesh, China	Public access to water, threat to biodiversity
	South Himalayas	South Asia	Glacial melt leading to flooding, water shortages, potential migration
	Mekong River	China, Cambodia, Vietnam, Thailand, Laos	Chinese development policies, access to water
	Salween River	Thailand, Myanmar, China	Hydro-power potential
	Yangtze and Huang He Rivers	China	Flooding, pollution, public access to water

Source: The 2008 Chart of Conflict, The International Institute of Strategic Studies

The sophisticated data collection of water conflicts and cooperation being developed at Oregon State University is making it easier to identify potential future flashpoints. History also shows that countries have demonstrated a surprising degree of restraint and cooperation in the sharing of freshwater, even among countries that are at war over other matters of contention. As the stakes become higher as a result of concerns such as climate change and increasing populations, the globe may see a marked change in the way that countries are prepared to defend, or acquire, rights over freshwater sources.

Ecological Water Conflict Hotspots

River Systems

Transboundary river systems will be the source of increased conflict, as countries compete for the resources and test existing water sharing arrangements. River systems to watch over the next decades, particularly because of the large populations dependent on them for their livelihood, are the: Nile, Euphrates, Tigris, Mekong, Niger, Ganges and Jamuna Rivers. Under vastly different circumstances, the Rhine River in Europe is a positive example of countries working together to achieve environmental outcomes.

Deltas

River deltas are often home to large agrarian populations attracted by the fertile growing conditions. These populations will not only be under pressure because of upstream water conflicts, but there is also concern about rising salinity levels through encroachment of sea water, if climate change increases the volume of warm water. Areas that could face problems in the future, include the Nile, the Ganges-Brahmaputra river delta in Bangladesh and the Mekong Delta.

Oceans

Oceans cover 71 per cent of the earth's surface and contain 97 per cent of the planet's water. According to the United States' National Oceanic and Atmospheric Administration, the oceans support nearly 50 per cent of all species on earth and provide 20 per cent of the animal protein and 5 per cent of the total protein in the human diet. The ocean is the new terrain for countries that are facing land-based food and land constraints; a terrain where fish numbers are depleting. As it is a new terrain, international legal frameworks and policing mechanisms still need to be adopted and adhered to in many parts of the globe. Particular areas of possible future conflicts and fish wars are the South China Sea, the western coast of Africa, the Southern Ocean and the Arctic region.

Water Bodies

Water bodies, whether subterranean or surface water, will be the focus of greater inter- and intra-state conflict. Lake Victoria and the Caspian Sea have the potential for increased conflict between and within states, as do Egypt, Sudan, Chad and Libya, over sharing arrangements for the Nubian Sandstone Aquifer system – the world's largest known fossil water aquifer. Likewise, in the Middle East, Israel will compete with its neighbours for its above- and below-ground water bodies.

Who Can Do Something?

The central questions dealt with by FDI in its reports and workshops were: what needs to be done, and who needs to do it? The response from workshop participants was mixed, with some believing in strong government intervention, while others believed greater gains could still be achieved through market mechanisms and free trade.

Most participants did agree that at least some degree of intervention was required, but disagreed on where the intervention should occur. Views varied from the development of a world government organisation that could intervene in food supply and security, to achieve the greatest impact. Others had a more cautious approach and felt more could be achieved by means of local, relatively small scale, projects. Yet, the case for who is responsible need not be an either/or scenario. An appropriate mixture of high and low level intervention and assistance is likely to achieve the greatest impact.

Multilateral bodies

- United Nations

The United Nations, which was formed in the wake of World War 2, is not seen as a useful vehicle for dealing with global food and water crises. The organisation is viewed with cynicism and as ineffectual in bringing about lasting changes to the developing world.

- Food and Agricultural Organization

The FAO, formed in 1945 as part of the United Nations, has a "mandate to raise levels of nutrition, improve agricultural productivity, better the lives of rural populations and contribute to the growth of the world economy."(Source: FAO website, April 2012) Like its 'mother' organisation, the FAO is not seen as an effective organisation in tackling food and water security, to avert conflict. That said, the FAO is useful in collating information from the countries involved, which can be used by those that are dealing with food and water security. The FAO is viewed as somewhat constrained in its operations, because it does not have the funding mechanisms to support its policy work.

- The World Bank

The World Bank was mooted by one of the workshop participants as a possible vehicle for change in dealing with food and water security. The reasons include the ability of the bank to self-fund the projects it supports, rather than seeking funds from an external source. The World Bank was seen as flexible and able to adapt and reinvent itself more easily than other multinational organisations. Within the bank there are five organisations: The International Bank for Reconstruction and Development; the International Development Association; The International Finance Corporation; the Multilateral Investment Guarantee Agency; and the International Centre for Settlement of Investment Disputes. The five agencies have a lot of scope to put plans into action in the developing world. The greatest impediment to its success is the perception that it is an organisation run by the West (and specifically the United States), which has the chief aim of passing on America's economic and social ideals to other countries. It is in favour of free trade and views capitalism as the means to achieve its objectives. Consequently, it is viewed with some suspicion as a neo-colonialist body by the developing world. In addition, with the rise of China with its own funding organisations, the World Bank has lost its dominance in funding development aid. To regain its former relevance it would have to show it is truly international.

- IMF

The International Monetary Fund, is, in some ways, the European sister organisation to the World Bank. It therefore faces the same scepticism in the developing world, as an organisation that furthers the aims of the "West". It is an organisation with 187 member countries, but is dominated by the larger economies through its quota membership system. Like the World Bank, it was formed in 1944 as part of the Bretton Woods agreement. For the IMF to work, its membership and governance structure would have to change, to give developing and emerging countries greater say in the organisation.

- G8

The Group of Eight (G8) is a forum for the eight largest economies in the world. Originating in 1975, its members are France, Germany, Italy, Japan, The United Kingdom, the United States, Canada and Russia. Like the World Bank and IMF, its weakness is the perception that it is a Western organisation, which seeks to further the interests of its small but powerful membership. It is North American and European centric and does not have representation from Africa, Asia or South America. Some attempt has been made to reach out to other nations, with the development of the "Outreach Five" or "Plus Five", which includes countries that can be invited as guests to its meetings. These "Plus Five" countries are Brazil, China, India, Mexico and South Africa. Any influence that the G8 might have had in dealing with global food and water crises, may have been lost with the relatively recent emergence of the G20.

- G20

The Group of 20 consists of the largest economies in the world. It was formed in 2008 and has representation from every continent. Member countries are: South Africa, Canada, Mexico, the United States, Argentina, Brazil, China, Japan, South Korea, India, Saudi Arabia, Russia, Turkey, European Union, France, Germany, Italy, The United Kingdom and Australia. Because of its widespread membership, it is not viewed as promoting the United States or European agendas. Each country has an opportunity to chair the meetings on a rotating basis. The early signs are positive, with the G20 making significant progress in seeking common ground to deal with global food and water security. In June 2011, the G20 agricultural ministers met in Paris, to consider volatile food prices and ways to ensure food security. The next meeting of the G20, in June 2012, has food security high on the agenda. The G20 might be the multinational organisation that can offer the best solutions for dealing with pending food and water crises.

Regional Bodies

- African Union

The African Union would need to undergo a significant transformation for it to be an effective tool in dealing with food and water security issues and inter- and intra-state conflicts within the region. Within the African Union, the Border Programme would be the best mechanism to deal with inter-state food and water-induced conflict.

- ASEAN

The 2008 food riots and food price volatility appear to have injected new enthusiasm into the task of finding a regional solution to food and water security. For the past decade, it has run the Food Security Information System, which provides an early warning for impending crises and gives information and advice on the outlook for various commodities. The Food Security Information System is run by the ASEAN Food Security Information and Training Center. The ASEAN Integrated Food Security Framework is an example of cooperation to achieve national and regional security objectives. The ASEAN Plus Three Emergency Rice Reserve has been set up as a means of ensuring that enough rice is available in the event of supply shocks.

- Asian Development Bank

Established in 1966, the bank has $US17.5 billion in approved finance and works, in partnership with member countries, independent specialists and other financial institutions. Among its achievements is the improvement of 1.8 million hectares of land by providing irrigation, drainage and flood management and it has installed 17,800 kilometres of water supply pipes. It is proving to be a meaningful organisation, which contributes to food security in the region.

- African Development Bank

Perhaps underutilised, the African Development Bank is currently preparing a 10-year long-term strategy, which will cover the period to 2022. In the period 2008-10 it approved loans of $US15.5 billion. Central to its new strategy should be projects that enhance food and water security on the continent.

Local Action

- Country Aid

Some workshop participants felt that it was at the small scale, local level that most could be achieved in dealing with food and water security and alleviating conflict. Providing funding by means of government aid, through, for example, AusAid and the Australian Centre for International Agricultural Research, is one method that could provide small, but tangible benefits. Funding pilot projects minimises risk and can produce a lot of upside benefits if the project is successful. Governments should also seek to be self reliant. One way of achieving this, is through the development of national food and water security plans. It could provide a useful method of identifying the problems where shortfalls exist in research and infrastructure, and determining ways to address them.

- NGOs/think tanks and commercial entities

Non-Government Organisations and commercial entities have the capacity to develop research and apply it across national boundaries. Those with an international reach are able to apply what they have learned in one country to other countries. Multinational grain

traders and researchers, fuelled by economic returns, can play an important role in providing food and water security.

Conclusion

In the future, government could be dealing with a 'perfect storm' of contributing factors, as outlined in this report, which will lead to crises from time to time. With all the signs pointing to increasing conflict over food and water, countries should act now to avert such crises in the future. Not only is taking action now economically more prudent, but it will also curtail the fall-out from any conflict. For this to occur, countries will first need to recognise that there is a problem. Second, they will need to find ways to address the problem and finally, determine who is best placed to deal with it. Part of the solution is trying to find the ingredients to sustain productivity growth, as experienced during the 1980s and 1990s, remembering that there can be a 20-year gap between investment in research and productivity gains.

Yet that is only part of the solution.

Understanding the economics of food and water supplies, and recognising the shortcomings of the existing economic frameworks, will be paramount. Capitalism has its place and can provide many of the solutions, but where it fails is in the areas of price and distribution. Here, the government could play a greater role. It means thinking about food and water not as commodities that are subject to the same pressures as other commodities, but as fundamental necessities that should be protected by governments. In some instances, the Government needs to step in to ensure food is grown, stored and distributed where market failure exists.

We need to recognise, however, that Governments also have significant failings and will not be always in a position to provide suitable solutions. The private sector is still the largest player in the food supply chain, particularly small farmers in developing countries. Hence, while innovation can come from government or not-for-profit organisations, its adaptation and adoption by suppliers in the food chain will only come about if it is seen to offer better profits than existing practices.

Of the existing international agencies, perhaps the one with the most to offer is the G20. At the regional level, ASEAN and the Asian Development Bank each offer a useful framework that may be applied to other regions. The African Development Bank, which is reviewing its long term strategy, needs to increase its focus on food security and cooperation between African nations.

Participants made the point that in Australia foreign aid needs to better match our foreign policy objectives. Whereas our foreign policy has a global perspective, aid is focused predominately in the Indo-Pacific region.

Nevertheless, the need to do something is clear. By 2050, the demand for food is expected to increase by 70 per cent. Population growth, urbanisation and an ageing population, combined with reduced availability of water and land resources, will place a strain on future generations, with ramifications also for Australia.

Areas requiring further study:

- River Deltas
- Ocean-Fish wars
- River Systems
- Fresh Water Bodies
- International and National Mechanisms to deal with food and water conflict

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