Climate Change Research Centre

Committee Secretary
Senate Foreign Affairs, Defence and Trade References Committee
Canberra ACT 2600

Implications of climate change for Australia's national security

Dear Senator Gallacher,

Further to the inquiry on implications of climate change for Australia's national security, please find below a submission to the Standing Committee on Foreign Affairs, Defence and Trade by the Climate Change Research Centre, University of New South Wales Sydney.

The Climate Change Research Centre (CCRC) houses research expertise in the key areas of the Earth's climate: atmospheric, oceanic and terrestrial processes. The CCRC applies basic scientific principles to pressing questions on climate dynamics, global climate change and extremes of weather and climate, and works with the federal and state governments to provide planning-relevant guidance on likely future climate changes.

Projections of future climate and extreme events include many aspects that will have impacts on human and natural systems. Listed below are statements on key changes in the climate system, both in Australia and elsewhere, which will have direct consequences to Australia's national security. These changes include heatwaves, floods and droughts, sea level rise, urban climate, ocean acidification and ocean warming.

Heatwaves

Projections
Increases in the frequency, intensity and duration of heatwaves are certain as global temperature continues to increase. The most striking change is the increase in heatwave days; over Tropical Australia, an extra 50 heatwave days per season are projected by 2100 under a business as usual emissions scenario, whereas over Southern Australia increases of an extra 10-20 heatwave days per season are projected. Also under business as usual, the intensity of

Climate Change Research Centre

UNSW SYDNEY
NSW 2052 Australia

W: ccrc.unsw.edu.au
CRICOS Provider Code 00098G

heatwaves over southern Australia are likely to be 2-4^{o}C warmer by 2100 and 1-2^{o}C warmer in the tropics. While these broad projections are clear, at least currently, it is difficult to know the exact changes of heatwaves at regional and subregional scales.

Impacts on Health
Heat stress from a warming climate will profoundly affect all Australians in direct and indirect ways. Heat stress already significantly affects lifestyle and health in tropical regions, and these impacts are increasing. Unmitigated climate change (3-5^{o}C of warming) by the end of this century would likely drive heat to intolerable levels in some regions, possibly including the Top End of Australia. At least one billion people live in tropical Australasia (Indonesia, low-lying parts of southeast Asia and India) possibly leading to mass migrations or conflicts that would affect Australia. Thresholds of tolerance aren't well known, so some of these impacts could begin earlier or later than expected, but would occur eventually with no mitigation.

Floods and Droughts

Projections
Global warming is projected to alter major modes of climate variability such as El Niño – Southern Oscillation (ENSO) and the Indian Ocean Dipole, although projections remain uncertain. Any changes to these two tropical modes of variability would significantly impact Australian drought/flood cycles. To the south, the Southern Annular Mode is projected, with greater certainty, to force a contraction of the mid-latitude storm tracks further south. This would deny southern Australia of vital rains and cause an increased frequency and intensity of droughts; southwest Western Australia has likely already been impacted by this trend in the climate system. Ocean warming will also impact flooding and storm systems, with generally greater intensity rainfall events due to a more moisture laden atmosphere. Tropical cyclones are also expected to intensify due to warmer ocean surface temperatures.

Impacts on Freshwater Supply, Agriculture, Health and Infrastructure
Increases in both high precipitation extremes as well as longer dry periods between storms are predicted for most regions. This will likely translate into more frequent floods and droughts in many parts of Australia. This represents an increase in the hydroclimate variability in many parts of Australia that already experience high variability by world standards, and will present significant adaptation challenges for freshwater supply, agriculture, infrastructure and ecosystems.
As a recent example, extreme weather (storm surges) has caused some residents of coastal communities in Papua New Guinea to temporarily relocate to the northern Torres Strait Islands. Climate change is likely to exacerbate extreme weather events, and could lead to more frequent and regular incursions across Australia's only permeable international border. This issue is a significant security concern for Australia's public health. For example, in 2016, a drug-resistant tuberculosis epidemic occurred in Papua New Guinea, which included hundreds of people living on Daru. As on previous occasions, people looking for treatment came to the nearby Australian Islands in the Torres Strait, some of which are only four kilometres from Papua New Guinea.

Sea level rise

Projections
Today, sea levels are rising and further sea-level rise is inevitable, already locked in from past greenhouse gas emissions. Even with the strongest mitigation scenarios being considered, sea level will continue to rise throughout the 21st Century and beyond. Continued emissions with a 'business as usual' approach could result in a sea-level rise exceeding a metre during the 22nd century, or even late this century, if Antarctica is as vulnerable as some recent studies suggest.

Impacts on Infrastructure and National Security
Australia's population is centred at the coast. Globally, about a 100 million people live on land less than one metre above the current high water level. We know these coastal regions are vulnerable to changing sea levels and extreme events (coastal flooding, storm surges, waves and coastal erosion). The impacts of rising sea levels will be felt through extreme events, resulting in major disasters to which Australia may have to respond and long term loss of land. One of the adaptation measures that is likely to occur in deltaic regions in countries like Vietnam and Bangladesh, and also Pacific Island countries, is retreat from the changing coastline. Retreat would mean the displacement of millions of people, both within and across national borders, causing major social disruption and security risks. Cyclone generated storm surges could cause major disruption on Australia's east coast as sea levels rise.

Marine warming and acidification

Projections
The oceans will continue to warm and to acidify. Ocean warming leads to mass movement of marine species towards the poles and towards greater depth in a bid to escape the heat. These migrations are projected to become an order of magnitude faster by the end of the century and will have significant impact on the distribution of ecosystems and associated fisheries. Coral reef bleaching events will become more frequent and more intense as the oceans continue to warm and their effects will be amplified by changes in water chemistry associated with ocean acidification. Ocean acidification will also impact other marine calcifiers, some of which are at the bottom of the marine food chain.

Impacts on fisheries
Marine ecosystems underpin a variety of Australian industries including fisheries and tourism and many of our developing neighbours (for example Pacific Island states) depend on fisheries and aquaculture for livelihoods, food security and economic development. However many ecosystems are coming under increasing pressure from over-use and climate change. Some recent examples include marine heatwaves in western Australia (2011) and the Tasman Sea (2016), which had devastating and permanent effects on marine species and the industries that rely on them.
Coral reefs form the basis of marine ecosystems and coastal fisheries across northern Australia and much of the tropical oceans. Over one-third of the world's coral reefs have disappeared over the past 30 years and it is projected that by mid-century all reefs will experience severe thermal stress, regardless of mitigation scenarios. For example, in 2016 the combination of long-term global warming together with a spike in regional temperatures due to

an El Nino event caused an unprecedented bleaching event that wiped out almost one quarter of the Great Barrier Reef in a single year. Business as usual approaches will lead to more significant and rapid impacts.

Urban climate

Eight-nine percent of Australia's, and 52 percent of the world's, population live in urban areas. Urban residents face not just the impact of global climate change, but also the impact of local changes to climate due to the urban heat island. Urban areas are also the greatest contributors to greenhouse gas emissions, and the areas greatest affected by ambient air pollution. The technology and knowledge is available to build, or retrofit, cities to mitigate and adapt to these impacts and to make these cities more resilient to major disasters.

In light of the specific terms of reference, the above can be summarized as:

a. the threats and long-term risks posed by climate change to national security and international security, including those canvassed in the *National security implications of climate-related risks and a changing climate* report by the United States Department of Defense;

Rising sea levels, increasing heat stress, and potential full-scale agricultural failure are likely to lead to millions of climate refugees, with the potential for failed states and broad-scale security issues.

b. the role of both humanitarian and military response in addressing climate change, and the means by which these responses are implemented;

Requirement of international disaster assistance. International disasters are likely to become more frequent and more severe. Implications for large numbers of refugees fleeing to Australia.

c. the capacity and preparedness of Australia's relevant national security agencies to respond to climate change risks in our region;

No comment

d. the role of Australia's overseas development assistance in climate change mitigation and adaptation more broadly;

A thorough knowledge of climate change impacts in neighbor countries will be essential to assist in mitigation and adaptation measurements. Appropriate planning and financial assistance based on this knowledge is essential in supporting mitigation and adaptation to minimize the impacts both in our neighbouring nations and in Australia.

e. the role of climate mitigation policies in reducing national security risks;

Mitigation can greatly reduce risks, but it is not possible to avoid all risks. Given that some future climate change is already locked in from past changes, action on mitigation is urgent.

f. any other related matters.

No comment

Yours faithfully,

Associate Professor Katrin Meissner, Director

Professor John Church

Professor Matthew England

Associate Professor Jason Evans

Associate Professor Donna Green

Dr Melissa Hart

Dr Sarah Perkins-Kirkpatrick

Dr Alexander Sen Gupta

Professor Steven Sherwood

Dr Andrea Taschetto