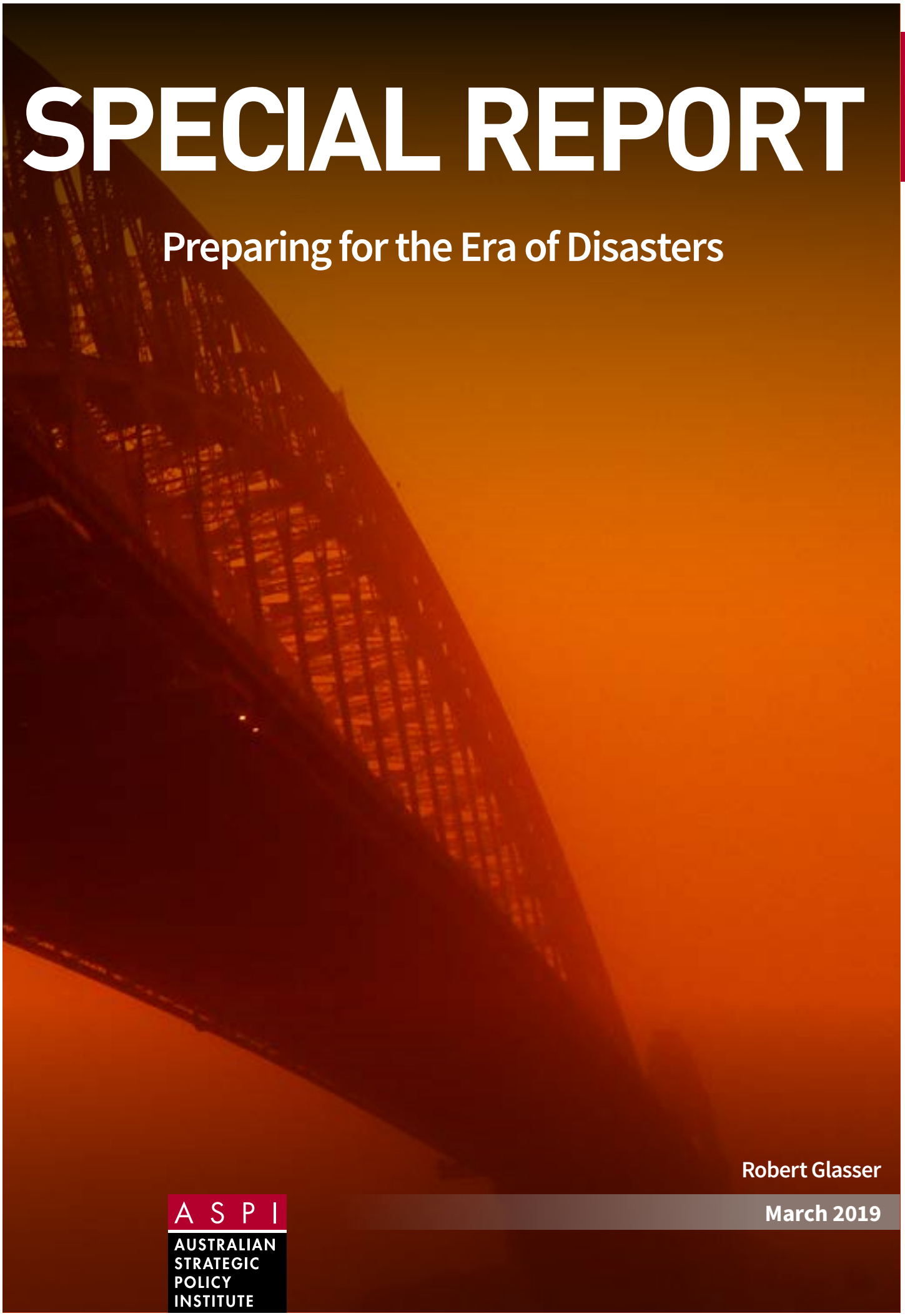

SPECIAL REPORT

Preparing for the Era of Disasters

ASPI

Robert Glasser

March 2019

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Dr Robert Glasser served as Special Representative of the UN Secretary-General for Disaster Risk Reduction and Head of the UN Office for Disaster Risk Reduction from January 2016 to March 2018.

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About ASPI

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Cover image: Sydney's skyline was dramatically altered by a severe dust storm from Australia's drought-ravaged interior that hit the east coast in September 2009: Flickr/Colin Seton.

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INTRODUCTION

We are entering a new era in the security of Australia, not because of terrorism, the rise of China or even the cybersecurity threat, but because of climate change. As the world warms 2°C beyond preindustrial levels, as now seems increasingly likely,[1] we'll enter an Era of Disasters with profound implications for how we organise ourselves to protect Australian lives, property and economic interests and our way of life. The early warning of this era is arriving almost daily in news reports from across the globe of record-breaking heatwaves, prolonged droughts, massive bushfires, torrential flooding and record-setting storms.

Even without climate change, the impact of these natural hazards is enormous. More than 500 Australians, about the same number who died in the Vietnam War, die each year from heat stress alone.[2] The annual economic costs of natural disasters are projected to increase to $39 billion by 2050,[3] which is roughly equivalent to what the Australian Government spends annually on defence.[4]

Climate change will dramatically increase the frequency and severity of many of these hazards. The number of record hot days in Australia has doubled in the past 50 years, and heatwaves have become longer and hotter.[5] The drying in recent decades across southern Australia is the most sustained large-scale change in rainfall since national records began in 1900.[6] Extreme fire weather days have increased in recent decades in many regions of Australia, especially in southern and eastern parts of the country.[7] Short and more intense rainstorms that trigger flash floods and urban flooding are also becoming more frequent,[8] and sea level has been rising at an accelerated rate since 1993.[9]

Australians are already exposed to a broad range of the hazards that climate change is amplifying.[10] Twenty per cent of our national GDP and 3.9 million of our people are in areas with high to extreme risk of tropical cyclones, and about 11% of GDP and 2.2 million people are in places with high and extreme risk of bushfire.

Sea-level rise is increasing the risk of extreme flooding from storm surges. Recent research suggests that current catastrophic 1-in-100-year floods could become, by the end of the century, *annual* events for most of the world's coastlines.[11]

As the frequency of extreme events increases, we'll likely see an increase in concurrent extreme events and in events that follow in closer succession. Communities may weather the first few but, in their weakened state, be overwhelmed by those following. Large parts of the country that are currently marginally viable for agriculture are increasingly likely to be in chronic crisis from the compounding impacts of the steady rise of temperature, drought and bushfires.[12] The scale of those impacts will be unprecedented, and the patterns that the hazards take will change in ways that are difficult to predict. Australia's fire season, for example, is already getting longer,[13] and research suggests that tropical cyclones are forming further from the equator as the planet warms, shifting new areas of eastern Australia into the zone of intense storms.[14]

This emerging Era of Disasters will increasingly stretch emergency services, undermine community resilience and escalate economic costs and losses of life. The Australian Government and the state and local governments need to begin preparing now for the unprecedented scale of these emerging challenges.

This ASPI Special Report describes the evolution, attributes and consequences of the emerging Era of Disasters. It begins with a summary of the latest science on the impacts of climate change, drawing on the recently released UN Intergovernmental Panel on Climate Change (IPCC) *Global warming of 1.5°C* special report.[15] Next, it explains why the dire findings of the scientific community in that report are likely to *underestimate* the future impacts, due to the difficulty of fully integrating compounding and cascading climate effects into the research and analysis. This Special Report concludes with policy recommendations to strengthen Australia's resilience to the formidable hazards that lie ahead.

SCIENCE AND CLIMATE IMPACTS

In October 2018, the release of the IPCC's special report on the significant impacts expected from 1.5°C degree of global warming[16] (the aspirational limit that countries adopted in the Paris Agreement[17]) generated widespread media interest. Much of the commentary focused on the rapidly closing window of opportunity to achieve the aspiration and the huge scale of the societal changes needed to do so.

The report, produced at the request of countries adopting the Paris Agreement, is an authoritative and cautious document. It's the culmination of the efforts of 133 contributing authors who analysed more than 6,000 scientific studies and incorporated comments from more than 40,000 expert and government reviews.

The report determined that the planet is likely to warm by 1.5°C as early as 2030 and highlighted the enormous challenge of preventing further warming. Annual emissions of carbon dioxide would need to be halved by 2030 relative to 2016 levels, and renewable energy sources would need to supply 70–85% of global electricity demand (and coal's contribution essentially cease) by 2050. It noted that systemic changes on that scale would be historically unprecedented and require 'deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options'.

A key objective of the report was to describe how the climate-related disruptive effects at 1.5°C of warming would differ from those at 2°C (the upper limit agreed in Paris). Not surprisingly, the report notes that the stresses on human and natural systems are higher at 2°C, but it's the *scale* of the difference that's most concerning. The additional 0.5°C would, among other things:

- cause a 50% increase in the proportion of the global population experiencing water stress
- expose 420 million more people to more frequent extreme heatwaves
- expose between 184 million and 270 million more people to an increase in water scarcity
- cause a 10-fold increase (from 8 million to 81 million) in the number of vulnerable people negatively affected by changes to crop yields (jumping to a *50-fold* increase at 3°C of warming)
- cause several hundred million additional people to fall into poverty from these various climate impacts.

The difference in impacts between 1.5°C and 2°C is clearly enormous. This finding underlines the urgency of further action to reduce greenhouse gases. Even if countries fully implement all of the commitments they have made in the Paris Agreement, the planet would still warm by 3°C to 5°C by the end of the century.[18]

Turning to the effect of the 1.5°C warming that we're likely to experience as early as 2030, it's surprising that there was relatively little media coverage of one of the report's most important findings. Recent research has now determined that global warming will trigger highly harmful societal impacts at significantly lower temperatures than was previously assumed.

The IPCC's 2014 *Fifth assessment report* identified five categories of impacts and determined for each the implications of various levels of warming for people, economies and ecosystems.[19] The categories are unique and threatened systems; extreme weather events; the distribution of impacts; global aggregate impacts; and large-scale singular impacts (climate 'tipping points'). The 2018 study has determined that the 2014 assessment significantly underestimated the risks due to climate change in four of the five categories.[20]

For example, in the case of 'unique and threatened systems', the threshold for the transition from 'high' to 'very high' risk has been lowered from 2.6°C to between 1.5°C and 2°C of warming. This change reflects recent research, including analysis that has now determined with 'very high confidence' that 70–90% of coral reefs will be lost at just 1.5°C of warming (a level we may reach in only 11 years[21]) and that 2°C of warming will result in the *total* loss of coral reefs from all of the world's tropical and subtropical regions. The report grimly observes that this may create opportunities for '"last chance to see" tourism'.[22]

'Extreme weather' is the only category of impacts for which the report's finding is relatively unchanged from 2014.[23] However, as the authors point out, that's largely because '[t]he impact literature contains very limited information about the potential for human society to adapt to extreme weather events, and hence it has not been possible to locate the transition from "high" to "very high" risk within the context of assessing impacts at 1.5°C versus 2°C global warming.'[24]

Given the hugely disproportionate effect that climate change will have on less developed countries because of their levels of poverty, relative lack of financial and technical resources to build resilience and heavier reliance on climate-sensitive sectors such as agriculture, forestry and tourism,[25] there's good reason to suspect that plugging this research gap will reveal a significantly lower threshold in this major category as well.

In short, the IPCC special report suggests that climate impacts will increase rapidly; that major systemic impacts will be triggered at far lower temperature thresholds (such as 1.5°C) than was previously realised; and that limiting warming to 1.5°C or even 2°C is theoretically possible but unlikely without rapid, radical and historically unprecedented interventions.

THE COMPOUNDING AND CASCADING CONSEQUENCES OF HAZARDS

As dire as the IPCC report's findings are, they nevertheless almost certainly *underestimate* the impact that climate change will have on human systems. This is because most research, including much of the work reviewed by the IPCC, treats climate hazards as independent variables rather than in the wider context in which they interact with other climate hazards and with human systems. For example, they may focus on the impact that rising temperatures will have on agricultural productivity, but not on the compounding impacts of other hazards (flooding, drought, fires, increases of pests, saltwater inundation, cyclones, migrations of people, and so on), which may be occurring simultaneously.[26] It's analytically difficult to do this and to take account of how hazards can trigger other hazards and cause cascading impacts—and responses—in human systems.

The IPCC acknowledges the difficulty of incorporating compound and cascading impacts in its analyses. In its special report on 1.5°C of warming, it observed that '[t]he literature on compound as well as interacting risk at warming of 1.5°C and 2.0°C is limited'[27] and that 'risks across energy, food, and water sectors could overlap spatially and temporally, creating new and exacerbating current hazards, exposures, and vulnerabilities that will affect increasing numbers of people and regions'.[28]

An important major study of climate change impacts in South Asia released recently by the World Bank illustrates this limitation.[29] It warned that more than 800 million South Asians—almost half of the region's population—reside in areas that by 2050 will become dangerous climate hotspots, with enormous economic impacts, in some locations reducing GDP by over 10%. The authors noted that their analysis did not, however, incorporate the increasing severity of storms, changes in water resources and sea-level rise, climate-induced migration and the compounding impact that multiple shocks can have on the economy and on the resilience of communities—all factors that they readily acknowledged would greatly magnify the costs and human impacts.

Climate change and compounding and cascading impacts

Climate change is increasing the likelihood of compounding and cascading impacts for at least four interconnected reasons.

First, it is increasing the *severity* of many sudden-onset hazards, such as cyclones, floods and bushfires.[30] With respect to floods, for example, warmer air holds more moisture, and that increases the likelihood of extreme rainfall. Hurricane Harvey, which in a short time dumped 1,270 millimetres (equivalent to 127 billion tonnes) of water on the US Gulf of Mexico states, is indicative of the scale of the emerging threat. The cascading impacts of the record rains were enormous: flooding impeded evacuations, caused power outages, spread dangerous pathogens from overrun wastewater treatment plants, and shut down one-fourth of US oil production in the Gulf of Mexico, raising petrol prices.[31]

Second, climate change is increasing the *frequency* of many sudden-onset hazards. As a report from the European Academies' Science Advisory Council recently pointed out:

> The number of floods and other hydrological events [has] quadrupled since 1980 and [has] doubled since 2004 … Climatological events, such as extreme temperatures, droughts, and forest fires, have more than doubled since 1980. Meteorological events, such as storms, have doubled since 1980.[32]

As the frequency of these hazards increases, the likelihood of hazards striking simultaneously or in closer succession will grow, as will opportunities for compounding and cascading impacts.

Simultaneous hazards periodically occur as part of natural climate variability, for example linked to phases of the El Niño – Southern Oscillation.[33] Scientists expect 1.5°C of warming to double the frequency of extreme El Niño events.[34] Scientists also suspect that climate change is altering the Northern Hemisphere jet stream, contributing to simultaneous extreme weather events on a global scale (such as heatwaves, droughts and fires in some regions, and floods in others).[35] The scale of the damage and potential for wider cascading impacts is greater when major hazards strike simultaneously or in close succession.

Third, climate change is altering other aspects of the *pattern* of occurrence of extreme events. An example of this is recent research suggesting that climate change is shifting tropical cyclones into new areas of eastern Australia, where many structures haven't been built to withstand intense cyclones.[36] Similarly, scientists project not only that wildfires are likely to increase, but also that the bushfire season will lengthen.[37] Storms carrying more moisture create opportunities for severe flooding to occur in new locations. More than half of the homes damaged from Hurricane Harvey's flooding, for example, were outside of the 1-in-500-year flood plain.[38] These changing patterns of hazards increase the likelihood of surprises that will overwhelm coping capacity and create opportunities for cascading impacts.

Fourth, climate change is increasing *slow-onset hazards* that can greatly magnify the impact of sudden-onset hazards. Even small increases in average global temperatures can cause temperature extremes to become much more frequent and intense. For example, analysis has shown that the percentage of the Earth's surface experiencing extremely hot temperatures jumped from 0.2% in the period from 1951 to 1980 to 10% in the subsequent three decades.[39] Rising temperatures and drought will not only gradually push places that are currently marginally viable for agriculture into chronic crisis, but also make communities more vulnerable to the outbreak of bushfires that droughts and extreme temperatures are making more likely.

Two historical examples can help illustrate the significance of these cascading and compounding impacts: the Syrian Civil War that began in 2011–12 and the international food security crisis of 2010 and 2011.

The Syrian Civil War

Scientists have determined that the severe drought that struck Syria between 2007 and 2010 was made two to three times more likely as a result of climate change.[40] The drought contributed to massive crop failures that undermined livelihoods and forced 1.5 million people to move from rural areas into cities, exacerbating existing social stresses.[41] Although the drought was clearly not the *cause* of the Syrian Civil War, it contributed to instability and to profound cascading impacts: a regional refugee crisis became a refugee crisis in Europe, which, in turn, may have tipped the balance in the UK referendum on leaving the EU.[42] Nearly 75% of prospective 'leave' voters cited immigration as the most important issue in the referendum,[43] at a time when migrants were coming to the UK at near-record levels.[44] The refugee crisis also contributed to the rise of populist right-wing governments in Europe, further undermining the EU's institutional cohesion.[45]

In this illustration, the proximate climate impact was a drought that affected agriculture, but it contributed to major cascading impacts: food insecurity, people movements,[46] a regional humanitarian crisis and a European political crisis.

The 2010–2011 food security crisis

The food security crisis of 2010–2011 is a useful illustration of both compounding and cascading hazards. In the first seven months of 2010, the Russian Federation experienced an unprecedented heatwave, which attribution analysis suggests was made five times more likely as a result of climatic warming.[47] The heatwave was associated with an intense and prolonged atmospheric blocking phenomenon over western Russia[48] that simultaneously affected the South Asian subtropical monsoon, resulting in record flooding and a humanitarian disaster that affected 20 million Pakistanis.[49] In Russia, the extremely hot and dry weather helped trigger widespread wildfires, which destroyed 20% of the Russian wheat crop.[50] Fifty thousand people died from respiratory illness and heat stress.

The drought struck not only Russia, but eastern China and Ukraine as well, causing major reductions in their wheat harvests. During that same period, very heavy rainfall in both Australia and Canada further diminished wheat harvests.[51] This combination of impacts[52] contributed over the course of 2010 to a 40% increase in world food prices,[53] which, in turn, led China to make a large-scale wheat purchase to secure its domestic supply and Russia to levy an export ban for the same reason. This subsequently caused a spike in food prices in Egypt[54] and elsewhere in North Africa, where it became a major factor in the Arab Spring.[55] Protesters in Tunisia brandished baguettes, while in Egypt they demanded 'bread, freedom and social justice'. By the end of 2011, governments in Tunisia, Egypt, Libya and Yemen had been swept away by popular revolts.

In this example, climate change likely contributed to simultaneous weather extremes on a large spatial and temporal scale, to cascading hazards (such as drought and extreme heat that helped trigger wildfires) and to the cascading impacts of those hazards on human systems, locally and globally.

Future impacts of climate change on food security

It's very likely that the compounding and cascading impacts of climate change will undermine food security on a far greater scale in the years ahead. For example, the 'Coral Triangle' of Indonesia, Malaysia, Timor-Leste, the Philippines, Papua New Guinea and Solomon Islands is the 'nursery' for roughly 10% of the global fish supply and an important source of food for more than 130 million people in that region.[56]

The loss of coral reefs at 2°C of warming, which is now virtually unavoidable, will therefore have enormous consequences for food security. Moreover, that loss will occur simultaneously with other profound climate change impacts that will further undermine food security. For example, scientists have determined that fish species are already moving towards the poles to escape warming waters. At 2°C of warming, this will result in a decrease of up to 60% in fisheries yield in the tropics.[57]

Increasing temperatures, sea-level rise and extreme weather, such as droughts, floods and storms, will further undermine food security. Crop yields will be diminished by rising temperatures, changes to precipitation, the expansion of the reach of crop pests (which currently account for 25–40% of all crop loss) and shifts in predators that keep crop pests in check.[58]

Flooding will disrupt livelihoods and cause large-scale population displacement. Southeast Asia, for example, is one of the world's regions most exposed to coastal flooding. In Indonesia alone, 50 million *additional* people will be affected at 1.5°C of warming.[59]

More frequent droughts and fires will compound the problem. The fires affecting Indonesia in 2015 were indicative of the potential scale of the impacts. Those fires, which burned 2.6 million hectares (an area four and half times the size of Bali), were fed by drought and exacerbated by an El Niño.[60] Tens of millions of Indonesians suffered health effects and economic disruptions. The cost to the Indonesian economy was over US$16 billion.[61]

Even without incorporating a wide range of these likely, simultaneous hazards, scientists have determined that by 2040 at 2°C of warming, Southeast Asia's per capita crop production will have declined by one-third.[62] Similar impacts occurring outside of the region will diminish the options available to countries to offset the domestic effects, such as by importing additional food, as Indonesia did on an unprecedented scale during its severe drought in 1998.[63]

A significant decrease in crop production, together with the collapse of fish stocks, major population displacement and economic shocks, will have profound cascading consequences not only for food security but also for regional political and economic stability and security.

IMPLICATIONS FOR AUSTRALIA

In late 2018, Queensland was severely affected by a major drought. At that time, a senior manager involved in coordinating the state's rebuilding efforts following Cyclone Debbie commented that his team was in the ironic situation of rebuilding from floods in a drought. The drought was making it difficult to find water to mix with gravel and to suppress the dust associated with rebuilding roads.

Less than a month later, the drought had intensified and had contributed to the outbreak of more than 140 bushfires. This was followed and exacerbated by an extreme heatwave, with temperatures in the 40s that smashed records for the month of November. Bushfire conditions in parts of Queensland were classified as 'catastrophic' for the first time since the rating scale was developed in 2009,[64] but experts observed that no bushfire in the state since 1966, when warnings were first introduced, would have been considered as dangerous. More than a million hectares of bush and farmland was destroyed—the largest expanse of Queensland affected by fire since record-keeping began.[65]

Just days later, Tropical Cyclone Owen approached the Queensland coast, threatening significant flooding and raising the risk of severe mudslides from the charred hillsides. Owen set an Australian record in dumping 681 millimetres of rain in just 24 hours—more than Melbourne usually receives in a year.[66] It did not, however, diminish the drought gripping much of the state. A few weeks later, record-setting rains flooded 13.25 million hectares in northern Queensland, killing hundreds of thousands of drought-stressed cattle.[67] As two Queensland graziers wrote at the time, 'Almost overnight we have transitioned from relative drought years to a flood disaster zone.'[68]

These consecutive, simultaneous and record-setting events are a preview of the compounding, cascading effects that lie ahead for Australia as the climate warms.

It's said that generals always fight the last war. This is the situation today with respect to climate change exposure: policymakers mistakenly base their strategies, policy assumptions, operational arrangements and funding allocations on experience of disasters in a stable climate or with the mistaken expectation that climate change impacts will increase gradually, rather than rapidly as the science suggests. The Australian Government's 2011 National Strategy for Disaster Resilience states that 'It is uncommon for a disaster to be so large that it is beyond the capacity of a state or territory government to deal with effectively.'[69] Those words, and the systems, policies and funding underpinning them, will be out of date in little more than a decade.

Policymakers need to begin preparing now for this future. A first step should be to create a compelling narrative about climate and disaster risk reduction that explicitly recognises the changing *scale* of the threat and the new aspects we're beginning to understand, such as the compounding, cascading effects that we—along with our South Pacific and Southeast Asian neighbours—are likely to experience. This is needed to lay the groundwork for more standardised, timely and frequent support from the Australian Government to the states and territories, and for changes in the posture and capability of our defence force and possibly the Australian Federal Police's International Deployment Group.

The narrative should lead to the development of a National Strategy for Climate Change and Disaster Resilience that codifies the required departure from business as usual. It should bring together a substantially reworked National Strategy for Disaster Resilience with Australia's National Climate Resilience and Adaptation Strategy. It makes no sense to treat climate change adaptation and disaster risk reduction separately when 90% of major disasters are from hydrometeorological hazards (storms, droughts, floods and so on)[70]—precisely the hazards that are increasing as a result of climate change. That national-level work can also be used as the basis for engagement with our Pacific neighbours through the Boe Declaration.[71]

Late in 2017, the Coalition government established the National Resilience Taskforce within the Department of Home Affairs to develop a National Disaster Risk Reduction Framework. The department is currently finalising the framework, although the discordant voices on climate policy within the current government,[72] together with the gap between policy assumptions and the established science and emerging evidence, suggest that the framework is unlikely to embody the required sense of urgency. Nevertheless, over the longer term, it could be a useful foundation from which to significantly scale up the attention to risks in a changing climate and from which to build the broader national strategy.

An action plan emerging from the strategy should include:

1. the development of indicators of resilience at federal, state and local levels
2. the identification and implementation of incentives to promote private- and public-sector investments in resilient infrastructure and broader socio-economic and environmental resilience (for example, Suncorp has introduced discounts on insurance premiums for property owners in cyclone-prone areas who invest in strengthening homes against cyclone damage[73])
3. an assessment of the exposure of critical infrastructure and other socio-economic assets to expected and emergent natural hazards (for example, critical infrastructure resilience should be strengthened through modularity and redundancy to cope with hazards and cascading impacts for which there's no historical precedent)
4. initiatives to increase training and research (integrated across disciplines and stakeholders) at Australian universities and policy institutions into the compounding and cascading impacts of climate change, regional and subregional scale climate modelling and resilience-building[74]
5. financial support to the states for economic recovery following disasters and 'fodder banks' and 'land banks' to address the needs of communities in chronic crisis and the permanently displaced
6. the strengthening of disaster response capacity and planning at all levels, including in the Australian Defence Force (which will play an increasingly important role in the transport of firefighters and equipment, fodder drops from helicopters and the provision of shelters) and through joint taskforces to coordinate the ADF contribution, like the one established during the Black Saturday Victorian bushfires.

The strategy might also for the first time set out how Australian national efforts and capabilities might work with those of our South Pacific partners in light of the 'Pacific step-up' announced by the government in late 2018.[75]

One of the prime objectives of the national strategy should be to scale up Australia's efforts to prevent the effects of natural hazards, such as extreme weather, from becoming disasters. Currently, funding for mitigating disaster risk equates to only about 3% of what the Australian Government spends on post-disaster responses.[76] The government's new Disaster Recovery Funding Arrangements are an important initial step forward.[77] They allow states to reinvest savings from federal disaster recovery funding into measures to reduce vulnerability to future disasters. However, the arrangements need to be part of a much larger commitment at all levels of government. Ultimately, they should move from being a relatively incremental and exceptional top-up to restore damaged infrastructure to become a standardised approach. Ideally, resilience should be mainstreamed in infrastructure and other investments made across all levels of government and in the private sector.

To ensure that government bureaucracies prioritise the strategy and to oversee its development and at least its initial implementation, a National Resilience Coordination Committee should be established, led by the Department of the Prime Minister and Cabinet, comprising senior representatives from Australian Government departments, including Defence, and from the states and territories, the private sector and civil society. This should be matched by similar bodies at the state level involving heads of state agencies, senior representatives from regional councils, the private sector and civil society. To help promote the changes required, the Australian Government could establish 'climate and disaster resilience champions', drawn from leaders in all sectors of society: federal, state and local government, parliamentarians, the private sector, civil society and Indigenous leaders.

These committees and individuals could also have a role in engaging with their counterparts across our near region, and so connect Australian capability with that of our regional partners.

States may eventually need to consider establishing statutory agencies with dedicated funding and legislated authority to support reconstruction following disasters and with strong policy levers to build resilience to future disasters. A scalable model based on the Queensland Reconstruction Authority could be a useful starting point. One of the reasons Queensland has moved in this direction is that it's the most disaster-affected jurisdiction in Australia. But, as the climate warms, more severe and frequent hazards will increasingly be felt across all of Australia.

States should also ensure that flood and bushfire risk maps, building codes, planning schemes, infrastructure delivery and the supporting legislation fully embed consideration of climate change effects. Infrastructure Australia's incorporation of climate change risk in its 2018 Assessment Framework is an important step in this direction.[78]

Generally, when major hazards strike, the states activate emergency disaster management committees, chaired by their premiers, to oversee the disaster response and the immediate recovery. State governments should consider extending the life of those committees beyond the usual six months to ensure that the reconstruction efforts embed preparedness for future disasters. As the climate continues to warm, it will become increasingly important to exploit the fact that every disaster is also an opportunity to build back better.

The federal, state and local governments will ultimately need to begin coordinating 'managed retreats' from areas of increasingly chronic crisis—with all the societal, political and psychological stresses that this will involve. Financial rebuilding assistance will need to shift to buying out properties damaged by floods and other disasters in highly exposed locations and to subsidising relocations and land swaps, which will require overcoming major political hurdles, including deeply embedded expectations concerning the primacy of private property rights. There's some precedent for this. Following the Black Saturday bushfires, for example, the Victorian Government purchased 116 properties that were located in areas of unacceptable risk.[79]

As the international food security example described above suggests, the cascading impacts of climate change occurring *outside* of Australia will also profoundly affect our regional security, including by triggering people movements, unseating governments and contributing to the outbreak of conflict. Those regional impacts could overstretch our operational capacities to respond, such as by creating demands on the ADF to simultaneously support disaster relief in Australia and respond to a regional security challenge. It should be a high priority for the government to identify opportunities to mitigate these impacts.

As mentioned above, the posture of the ADF (what it's ready to do from where) will need to change so that it can be part of Australia's response to more frequent, higher impact regional natural disasters. Its capability set will also need to change so that it is equipped to operate at greater scale and in places affected by large natural disasters.

Australian development and aid programs in the Pacific and Southeast Asia are increasingly including climate resilience; however, this work can be strengthened and broadened using the approaches suggested above for improving Australia's national efforts at mitigation.

One important response would be for the Australian aid program to scale up its efforts to strengthen regional resilience to climate change, but with greater focus on maritime Southeast Asia. About 80% of Australia's current $1 billion commitment to provide climate finance to developing countries is allocated to multilateral organisations and to highly vulnerable Pacific island countries; only 20% remains for Australian-led climate adaptation initiatives elsewhere in our immediate region. Recent compelling analysis suggests that helping less developed countries to adapt to climate change can reduce the likelihood of conflict and forced migration.[80] It will become increasingly critical, for both humanitarian and national security reasons, to strengthen climate resilience in pivotal states to our north as well as to support our Pacific island neighbours, for whom climate change is an existential threat.

A number of prominent climate scientists have recently published the results of a major study in the *Proceedings of the National Academy of Sciences of the United States of America*, suggesting that this new Era of Disasters is arriving more rapidly than many realise:

> Our analysis suggests that the Earth System may be approaching a planetary threshold that could lock in a continuing rapid pathway toward much hotter conditions—Hothouse Earth. This pathway would be propelled by strong, intrinsic, bio-geophysical feedbacks difficult to influence by human actions, a pathway that could not be reversed, steered, or substantially slowed … The impacts of a Hothouse Earth pathway on human societies would likely be massive, sometimes abrupt, and undoubtedly disruptive.[81]

No military alliance, deployment of troops or new weapon system will adequately protect Australia from this rapidly escalating security threat. Nevertheless, the ADF will need to move beyond its current concept of structuring for conflict and then using the resulting capabilities for all its tasks, to an approach that focuses on determining and assessing the capabilities it will need to address the profound regional impacts of climate change.

Ultimately, however, the only effective 'forward defence' is a deep and rapid global reduction of greenhouse gases. But, as the IPCC special report has demonstrated, the political process isn't delivering the necessary changes rapidly enough.

The best hope for limiting disaster effects is the remarkable global energy transformation underway from fossil fuels to renewables. The International Energy Agency recently reported that renewable energy has now surpassed fossil fuels as the main source of new electricity generation and that it will overtake coal and other fossil fuels in the overall energy mix by 2040.[82] The rapid pace of this energy transition is historically unprecedented, but it will need to accelerate if the worst of the climate impacts are to be avoided. Despite past political inability to reach consensus for ambitious climate action in numerous countries (not just in Australia), governments must set deeper greenhouse gas reduction targets; promote initiatives that use market forces to reduce emissions, such as putting a price on carbon; and take other measures to accelerate the transition to renewables.

Australia should be playing a leading role in advocating globally for urgent climate action, not just because we're especially vulnerable to the hazards that climate change is amplifying (droughts, bushfires, floods and cyclones), but also for traditional national security reasons. We're in a region of many near-neighbour, less developed countries that are highly exposed to the effects of climate change. Climate impacts that affect their food security, economic interests and political stability will rapidly undermine our own security.

Australian middle-power diplomacy has achieved remarkable successes in the past, in protecting the Antarctic environment, in building peace in Cambodia, and in the arms control and disarmament sphere.[83] It must now do the same with respect to climate change, from which the risks for Australia are far higher. Without global success on this front, even the most concerted efforts to strengthen the resilience of Australian communities will be overwhelmed by the scale of the disasters that lie ahead.

NOTES

1 Intergovernmental Panel on Climate Change (IPCC), *Global warming of 1.5°C*, special report, IPCC, 2018, online.

2 Meecham Philpott, Sophie Kesteven, 'Heat stress deaths rise following Australia Day, warns Queensland doctor', *ABC News*, 25 January 2016, online.

3 Deloitte Access Economics, *Building Australia's resilience to natural disasters 2017*, Deloitte, 2017, online.

4 Marise Payne, 'A safer Australia—Budget 2018–19 Defence overview', media release, 8 May 2018, online.

5 Will Steffen, Lesley Hughes, Sarah Perkins, *Heatwaves: hotter, longer, more often*, Climate Council, 2014, online.

6 Bureau of Meteorology (BoM), Commonwealth Scientific and Industrial Research Organisation (CSIRO), *State of the climate 2018*, Australian Government, 2018, online.

7 BoM & CSIRO, *State of the climate 2018*.

8 'Australia facing extremely intense rain storms', *Science Daily*, 30 July 2018, online.

9 Department of the Parliamentary Library, *Sea levels are rising*, Australian Government, 1 September 2009, online.

10 Insurance Australia Group (IAG), 'Natural disasters are putting billions of dollars at risk', news release, IAG, 8 November 2016, online.

11 Michalis I Vousdoukas, Lorenzo Mentaschi, Evangelos Voukouvalas, Martin Verlaan, Svetlana Jevrejeva, Luke P Jackson, Luc Feyen, 'Global probabilistic projections of extreme sea levels show intensification of coastal flood hazard', *Nature Communications*, 2018, 9(2360), online.

12 Climate Council, *Climate change and drought*, fact sheet, Climate Council, June 2018, online.

13 David Bruce, 'Prepare for extended severe weather seasons', *Fire Australia*, 2018, issue 4, online.

14 S Sharmila, KJE Walsh, 'Recent poleward shift of tropical cyclone formation linked to Hadley cell expansion', *Nature Climate Change*, 2018, 8:730–736, online.

15 IPCC, *Global warming of 1.5°C.*

16 IPCC, *Global warming of 1.5°C.*

17 UN Framework Convention on Climate Change Secretariat, *The Paris Agreement*, 22 October 2018, online.

18 Peter Hannam, 'Temperatures on track for 5-degree rise by 2100 after another hot year', *WAtoday*, 29 November 2018, online.

19 IPCC, *AR5 synthesis report: climate change 2014*, IPCC, 2014, 72–73, online.

20 IPCC, *Global warming of 1.5°C*, 253–258.

21 Yangyang Xu, Veerabhadran Ramanathan, David G Victor, 'Global warming will happen faster than we think', *Nature*, 5 December 2018, online.

22 IPCC, *Global warming of 1.5°C*, 242.

23 IPCC, *Global warming of 1.5°C*, 255.

24 IPCC, *Global warming of 1.5°C*, 181.

25 'Climate change will affect developing countries more than rich ones', *The Economist*, 9 May 2018, online.

26 BoM & CSIRO, *State of the climate 2018*, 8. See also IPCC, *Global warming of 1.5°C*, 236–237.

27 IPCC, *Global warming of 1.5°C*, 245.

28 IPCC, *Global warming of 1.5°C*, 12.

29 World Bank, *South Asia's hotspots*, World Bank, 28 June 2018, online.

30 Quirin Schiermeier, 'Droughts, heatwaves and floods: how to tell when climate change is to blame', *Nature*, 30 July 2018, online.

31 Annie Sneed, 'The next climate frontier: predicting a complex domino effect', *Scientific American*, 27 December 2018, online.

32 'New data confirm increased frequency of extreme weather events', *Science Daily*, 21 March 2018, online.

33 National Ocean Service, *What are El Niño and La Niña?*, National Oceanic and Atmospheric Administration, US Department of Commerce, 26 June 2018, online.

34 Guojian Wang, Wenju Cai, Bolan Gan, Lixin Wu, Agus Santoso, Xiaopei Lin, Zhaohui Chen, Michael J McPhaden, 'Continued increase of extreme El Niño frequency long after 1.5°C warming stabilization', *Nature Climate Change*, 20127(7):568–572, online.

35 Stefan Rahmstorf, 'Climate change and extreme summer weather events—the future is still in our hands', *Real Climate*, 31 October 2018, online.

36 Sharmila & Walsh, 'Recent poleward shift of tropical cyclone formation linked to Hadley cell expansion'.

37 Chelsea Harvey, ClimateWire, 'Here's what we know about wildfires and climate change', *Scientific American*, 13 October 2017, online.

38 David Hunn, Matt Dempsey, Mihir Zaveri, 'Harvey's floods', *Houston Chronicle*, 30 March 2018, online.

39 James Hansen, Makiko Sato, Reto Ruedy, 'Perception of climate change', *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, 6 August 2012, online.

40 Colin P Kelley, Shahrzad Mohtadi, Mark A Cane, Richard Seager, Yochanan Kushnir, 'Climate change in the Fertile Crescent and implications of the recent Syrian drought', *PNAS*, 2 March 2015, online.

41 Peter H Gleick, 'Water, drought, climate change, and conflict in Syria', *Weather, Climate, and Society*, 1 July 2014, online.

42 Guy J Abel, Michael Brottrager, Jesus Crespo Cuaresma, Raya Muttarak, 'Climate, conflict and forced migration', *Global Environmental Change*, January 2019, 54:239–249, online.

43 Jon Cohen, John Lapinski, 'Poll: voters split on Brexit but think EU exit vote will fail', *NBC News*, 17 June 2016, online.

44 Costas Pitas, 'As EU vote looms, migration to Britain nears record high', *Reuters*, 26 May 2016, online.

45 Adam Withnall, 'EU failure to cope with refugee crisis "threatens its very survival"', *The Independent*, 25 February 2016, online.

46 Abel et al., 'Climate, conflict and forced migration'.

47 Stefan Rahmstorf, Dim Coumou, 'Increase of extreme events in a warming world', *PNAS*, 1 November 2011, 108(44):17905–17909, online.

48 Kevin E Trenberth, John T Fasullo, 'Climate extremes and climate change: the Russian heat wave and other climate extremes of 2010', *Journal of Geophysical Research: Atmospheres*, 5 September 2012, online.

49 Nathanial Gronewold, ClimateWire, 'Is the flooding in Pakistan a climate change disaster?', *Scientific American*, 18 August 2010, online.

50 UN Environment Programme, *Satellite images record how wildfires have destroyed one million hectares of forests in western Russia*, UN, September 2010, online.

51 Reuters, 'Australia wheat quality slumps in bittersweet harvest', *Canadian Cattlemen*, 4 January 2011, online; Foreign Agricultural Service, *Global durum production falls in 2010/11 marketing year*, US Department of Agriculture, 22 December 2010, online.

52 Ines Perez, ClimateWire, 'Climate change and rising food prices heightened Arab Spring', *Scientific American*, 4 March 2013, online.

53 Andrew Holland, *The Arab Spring and world food prices*, American Security Project, November 2012, online.

54 Joshua Keating, 'A revolution marches on its stomach', *Slate*, 8 April 2014, online.

55 Annia Ciezadlo, 'Let them eat bread: how food subsidies prevent (and provoke) revolutions in the Middle East', *Foreign Affairs*, 23 March 2011, online.

56 Annabelle Cruz-Trinidad, Porfirio M Aliño , Rollan C Geronimo, Reniel B Cabral, 'Linking food security with coral reefs and fisheries in the Coral Triangle', *Coastal Management*, 2014, 42(2):160–182, online.

57 University of Cambridge, Sustainable Fisheries Partnership, *Climate change: implications for fisheries and aquaculture: key findings from the Intergovernmental Panel on Climate Change Fifth Assessment Report*, 2014, online.

58 Sara G Miller, 'Climate change is transforming the world's food supply', *Live Science*, 16 February 2017, online.

59 IPCC, *Global warming of 1.5°C*, 231.

60 World Bank, *The cost of fire: an economic analysis of Indonesia's 2015 fire crisis*, World Bank, February 2016, online.

61 World Bank, *Indonesia's fire and haze crisis*, World Bank, 25 November 2015, online.

62 IPCC, *Global warming of 1.5°C*, 259.

63 Vijendra K Boken, Arthur P Cracknell, Ronald L Heathcote (eds), *Monitoring and predicting agricultural drought: a global study*, Oxford University Press, 2005.

64 Ben Smee, 'Bushfires in the tropics: Queensland faces terrifying new reality', *The Guardian*, 4 December 2018, online.

65 Mingzhu Wang, Lucinda Coates, Thomas Mortlock, 'Queensland bushfires 2018', *Risk Frontiers*, 10 December 2018, online.

66 Ben Domensino, 'Tropical Cyclone Owen's rainfall legacy', *WeatherZone*, 18 December 2018, online.

67 Wyatt Bechtel, 'Flooding kills estimated 300,000-plus cattle in Australia', *AgWeb*, 12 February 2019, online.

68 Jacqueline Curley, Kate Hunter, '"We have death and devastation at every turn": the flood massacre of Queensland cattle', *The Guardian*, 13 February 2019, online.

69 Council of Australian Governments, *National Strategy for Disaster Resilience: building our nation's resilience to disasters*, Commonwealth of Australia, February 2011, online.

70 UN Office for Disaster Risk Reduction, *The human cost of weather related disasters, 1995–2015*, UN, November 2015, online.

71 Pacific Islands Forum Secretariat, *Boe Declaration on Regional Security*, September 2018, online.

72 'Turnbull says climate change has become a "third rail" for Liberal Party', *The Guardian*, 17 November 2018, online.

73 National Climate Change Adaptation Research Facility, *Synthesis summary 3: Cyclones and windstorms*, Department of the Environment and Energy, Australian Government, 2016, online.

74 Yangyang Xu et al., 'Global warming will happen faster than we think'.

75 Department of Foreign Affairs and Trade, *Stepping-up Australia's Pacific engagement*, Australian Government, November 2018, online.

76 IAG, 'Natural disasters are putting billions of dollars at risk'.

77 Australian Government, *Disaster recovery funding arrangements 2018*, online.

78 Infrastructure Australia, *Assessment framework for initiatives and projects to be included in the Infrastructure Priority List*, Australian Government, 2018, online.

79 National Climate Change Adaptation Research Facility, *Synthesis summary 4: Bushfire*, Department of the Environment and Energy, Australian Government, 2016, online.

80 Abel et al., 'Climate, conflict and forced migration'.

81 Will Steffen, Johan Rockström, Katherine Richardson, Timothy M Lenton, Carl Folke, Diana Liverman, Colin P Summerhayes, Anthony D Barnosky, Sarah E Cornell, Michel Crucifix, Jonathan F Donges, Ingo Fetzer, Steven J Lade, Marten Scheffer, Ricarda Winkelmann, Hans Joachim Schellnhuber, 'Trajectories of the Earth system in the Anthropocene', *PNAS*, 6 August 2018, online.

82 International Energy Agency, *World energy outlook 2018*, November 2018, online.

83 Carl Ungerer, 'The "middle power" concept in Australian foreign policy', *Australian Journal of Politics and History*, December 2007, 53(4), online.

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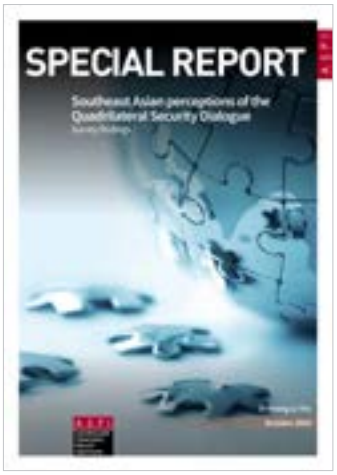

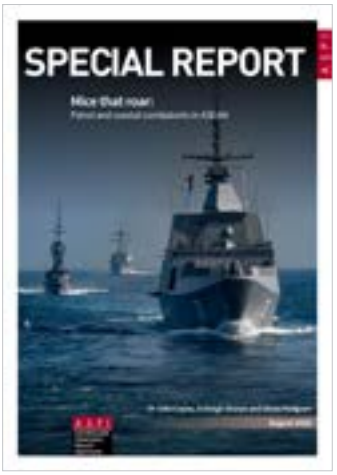

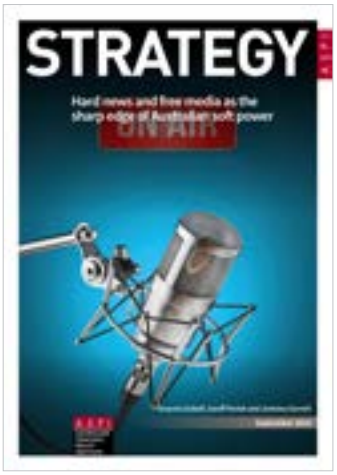

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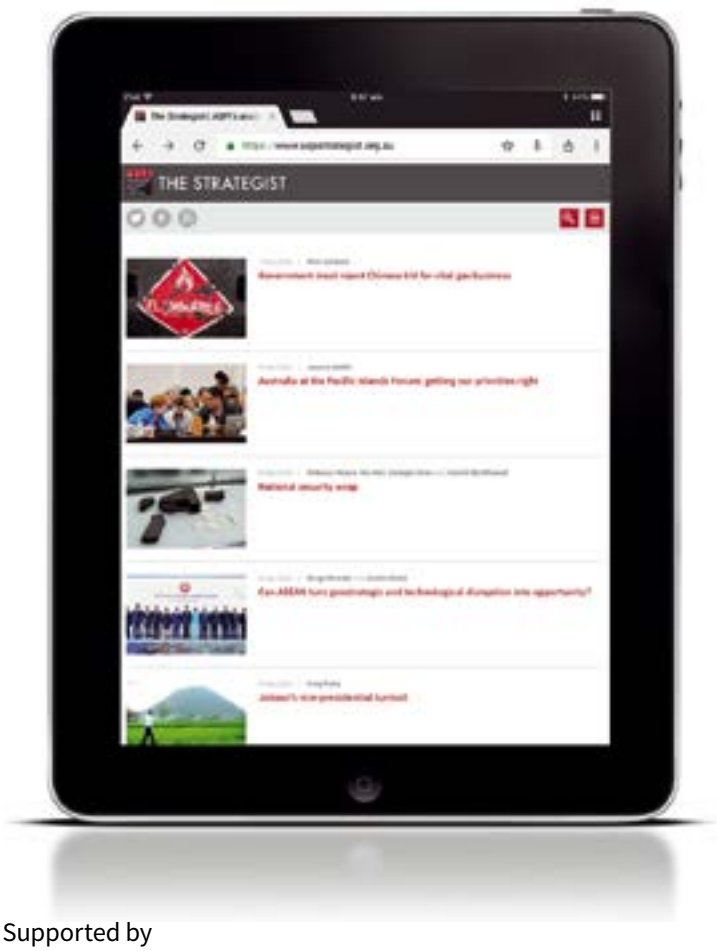

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