Chapter 7: Health, Wellbeing, and the Changing Structure of Communities

Coordinating Lead Authors: Guéladio Cissé (France/Mauritania), Robert McLeman (Canada)

Lead Authors: Helen Adams (United Kingdom); Paulina Aldunce (Chile); Kathryn Bowen (Australia); Diarmid Campbell-Lendrum (World Health Organization); Susan Clayton (USA); Jeremy Hess (USA); Cunrui Huang (China); Qiyong Liu (China); Glenn McGregor (United Kingdom/New Zealand); Jan Semenza (Italy); Maria Cristina Tirado (USA/Spain)

Contributing Authors: Nicola Banwell (Australia); Katrin Burkart (USA), Marlies Craig (South Africa); Kris Ebi (USA); Michael Davies (United Kingdom); Susan Elliott (Canada); John Ji (China); Saori Kitabatake (Japan); Krishna Krishnamurthy (Mexico); Ronald Law (Philippines): Wei Ma (China); Amina Maharjan (Nepal); Gerardo Sanchez Martinez (Spain); Júlia Alves Menezes (Brazil); Naho Mirumachi (Japan); Virginia Murray (United Kingdom); Jacques Andre Ndione (Senegal); Revati Phalkey (India); Joacim Rocklöv (Sweden); Andrea Rother (South Africa); Amiera Sawas (United Kingdom); Daniel Schensul (USA); Marco Springmann (Germany); Jeff Stanaway (USA); Janet Swim (USA); Sam Sellers (USA); J.L. Vivero-Pol (Italy).

Review Editors: Bettina Menne (Italy/Germany); Sergey Semenov (Russia); Jean-François Toussaint (France)

Chapter Scientists: Christopher Boyer (USA), Nikhil Ranadive (USA)

Date of Draft: 4 December 2020

Notes: TSU Compiled Version

Table of Contents

Executive Summary

Climate change affects health, wellbeing and changes in community structure through direct and indirect pathways and their interconnections (*very high confidence*). Major exposure pathways through which climatic influences are experienced include: direct impacts from extreme events, such as heat waves, floods, storms, droughts, and fires, and longer-term changes in temperature, precipitation, and sea levels; and indirect impacts through the consequent disruptions to water resources, food systems, ecological systems, healthcare structure, human habitations, pathogens survival and distribution, and chemical fate and transport (high confidence). {7.1}

Climate change is projected to increase the global burden of climate-sensitive health outcomes, with specific outcomes dependent on future development pathways (*high confidence*). At current global population growth rates, later this century an additional 1.6 to 2.6 billion people could be living in regions with high exposure to climate-sensitive water-borne, vector-borne, and other communicable diseases (very high confidence). {7.3}

Extreme weather and climate events (e.g., heat waves, storms, dust storms, and floods) can cause a wide range of non-communicable diseases, injuries, and risks for mental health, maternal and child health, and malnutrition (high confidence). Extreme events increase the risks of transmission of a variety of respiratory tract infections (high confidence). Extreme heat affects wellbeing, life satisfaction, interpersonal / intergroup aggression, cognitive performance (high confidence) and labour capacity (very high confidence). Heat events are associated with excess cardiovascular deaths in older individuals (high confidence). Children and pregnant women are very likely to experience disproportionate adverse health and nutrition impacts from extreme events, with potentially lifelong consequences (very high confidence). {7.2}

Increased malarial mosquito vectorial capacity in endemic areas of Sub-Saharan Africa, Asia, and South America should be expected *(high confidence)*. Dengue risk will grow and its range will spread in Asia, Europe, and sub-Saharan Africa under RCPs 6 and 8.5, potentially putting another 2.25 billion people at risk *(high confidence)*. Higher incidence rates of Lyme disease in the northern hemisphere *(high confidence)* and increased *Schistosoma mansoni* transmission in eastern Africa are likely *(high confidence)*. Higher temperatures and more frequent heavy rainfall events are very likely to lead to increased rates of diarrheal diseases in many regions *(high confidence)*. {7.3}

Climate change is projected to increase the burden of chronic diseases *(high confidence)*. It is very likely that excess deaths will increase, especially among older individuals during extreme heat events, mostly cardiovascular in origin, and mortality rates will grow under higher levels of warming even with adaptation *(high confidence*). The burden of non-communicable respiratory disease associated with aeroallergens will rise substantially (*high confidence*), as will disease associated with ozone (*high confidence*). There will also be increased risks of food and water-related contamination by mycotoxins and marine toxins (*high confidence*) and additional releases of organic pollutants and metals such as methylmercury in certain environments (*medium confidence*) {7.3}

Extreme climate events have severe consequences for food security and malnutrition in low-income countries (*high confidence*). Between 2015 and 2019, an estimated 166 million people in 26 countries, primarily in Africa and Central America, required humanitarian assistance due to climate-related food emergencies. {7.2}

Climate change is projected to increase dietary risk factors and related non-communicable diseases globally, as well as undernutrition, stunting, and related childhood mortality, with greatest impacts in Africa and Asia (*high confidence*). Climate impacts on food availability have potential to increase food prices and increase the risk of hunger for people in low-income countries, slowing progress towards eradication of undernutrition (*high confidence*). A growing challenge by 2050 will be providing nutritious and affordable diets (*high confidence*). {7.4}

Climate change is projected to affect mental health through multiple pathways (*very high confidence*), including psychic trauma associated with exposure to extreme weather events and longer-term adverse impacts of rising temperatures. Vulnerability to mental health effects of climate change varies across demographic and cultural groups, with some evidence that Indigenous communities, women, children and adolescents, particularly girls, and members of minority groups will likely experience greater impacts (*medium confidence*). Those with existing mental disorders and physical injuries, conditions and disabilities are at higher risk of mental illness (*high confidence*). {7.2, 7.3}

The COVID-19 pandemic and interventions implemented to reduce transmission had significant detrimental impacts on the most vulnerable (*high confidence*). Studies to date on possible associations between weather/climate variability and COVID infection and transmission rates are inconsistent. Although greenhouse gas emissions declined during the first wave of interventions, projections suggest limited consequences for longer-term emission pathways (*high confidence*). {Cross-Chapter Box COVID}

The COVID-19 pandemic demonstrated the value of coordinated planning, safety nets, and other capacities in societies to cope with a range of shocks and stresses (*high confidence*). The response to COVID-19 has demonstrated some societies' ability to take rapid and extensive action in the face of emerging risks. Investments for economic recovery from COVID-19 offer opportunities to promote climate-resilient development (*high confidence*), but the financial costs and political will for managing the pandemic could come at the expense of meeting climate ambitions *(high confidence)*. {Cross-Chapter Box COVID}

Targeted investments to strengthen health systems and enhance protection against specific climate-sensitive exposures are effective for adapting to key risks in the short- to medium-term (*high confidence).* Building climate resilient health systems will require concerted, collaborative, and cooperative efforts at all levels of governance *(very high confidence)*. Globally, health systems are poorly resourced to respond to climate change (*very high confidence*). Financial support for health adaptation to climate change is currently low, with only 0.5% of dispersed multilateral climate finance going to projects specifically addressing health. {7.4}

Collaboration between health and other sectors (e.g., water, food, energy, transport) will be needed to address long-term climate change impacts on health, wellbeing, and health systems *(high confidence).* Absolute and relative burdens of climate-sensitive health outcomes are often reflections of wider socio-economic inequities, with decisions made outside the health sector having impacts on underlying conditions that make people vulnerable (*high confidence*). Many cross-sectoral solutions for health and well-being have co-benefits and synergies, examples including improvements in air quality through transition to renewable energy sources *(very high confidence)*, active transport (e.g., walking and cycling) *(high confidence)*, shifts to more plant-based diets (*high confidence*), and nature-based solutions *(high confidence)*. Heat Action Plans have strong potential to prevent mortality from extreme heat events and elevated temperature (*high confidence*). Risk sharing and transfer mechanisms such as insurance markets and index-based weather insurance can increase resilience to extreme events (*high confidence*). {7.4; Cross-Chapter Box HEALTH}

Adaptation to climate risks for nutrition is complex, and requires collaboration across systems (e.g., food, social protection, health, water and sanitation) (*high confidence*). A wide range of proven adaptation response options exist, including early warning systems (*high confidence*), social protection services focused on nutrition (*very high confidence*), nutrition-sensitive sustainable food production (*high confidence*), and improving access to healthy, affordable diverse diets (*very high confidence*), to sanitation and safe water (*high confidence*), and to maternal and child health services (*high confidence*). Women who are empowered and valued can improve household food security, their own health and well-being, and that of their families and communities (*high confidence*). {7.4}

Limiting GHG-intensive animal foods, promoting plant protein sources, and reducing food waste, can have multiple co-benefits: healthy diets, reduced environmental footprints of food systems, and climate change mitigation (*high confidence*). Integrated agroecological food systems offer opportunities to improve dietary diversity at the household level while building climate-related local resilience to food insecurity (*high confidence*), especially when combined with gender equity and social justice. {7.4}

Reducing the health sector's carbon footprint provides an opportunity to support national mitigation efforts and reduce health burdens from air pollution and other adverse exposures (*high confidence*). Some systems have demonstrated the potential for rapid, substantial emissions reductions through broad and sustained efforts and supply chain management. Efforts are more often successful when championed by health practitioners. {7.4}

Weather events can act as direct drivers of climate-related migration (e.g., destruction of homes by tropical cyclones) and as indirect drivers (e.g., rural incomes affected by prolonged droughts) *(high confidence)*. Since 2008, an average of 12.8 million people annually have been displaced by natural disasters, largely weather-related, with storms and floods being the two largest drivers. Estimates of the global population at risk of displacement due to sea level rise vary from tens of millions to hundreds of millions of people depending on the sea level rise scenarios and elevation baselines used. Adaptive climate-related migration is often closely related to wage-seeking labour migration (*medium confidence*). {7.4, 7.2}

Future changes in climate-related migration are expected to vary by region and over time, according to region-specific changes in climatic drivers, changes in the future adaptive capacity of exposed populations, regional patterns of population growth, and mediating factors such as international development and migration policies (*high confidence*). {7.3}

Migration following climate hazards is often observed when institutional adaptation responses are weak (*high confidence*). Broad-based institutional investments in building adaptive capacity in risk-exposed areas coupled with wider, cross-sectoral efforts aimed at sustainable social and economic development are part of climate-resilient pathways that can reduce future risks of involuntary migration and displacement from climate hazards *(medium confidence)*. {7.4}

Policies aimed at facilitating safe and orderly migration increases the potential for migration to be a positive adaptation to climate change (*high confidence*). Climate migration outcomes display high variability in terms of migrant success, with outcomes reflecting pre-existing socio-economic conditions, household wealth, gender, social context, and power dynamics (*high confidence*). Involvement of populations exposed to climatic hazards in planning for relocation increases the success of outcomes, with immobile populations that are, for socio-economic and cultural reasons, unable or unwilling to move warranting additional policy consideration (*medium confidence*). {7.4}

Climate hazards can be a potential multiplier of conflict within states that are experiencing political and/or socio-economic fragility (*high agreement, medium evidence*). Climate hazards can influence the nature, duration and characteristics of violent conflict within states, but there is no evidence of their being a direct driver of intrastate conflict, and there is no evidence of climate hazards influencing interstate conflicts *(medium confidence)*. {7.2, 7.3}

Solutions within the peacebuilding space present the opportunity for synergies with adaptation in other sectors (*high confidence*). High environmental quality underpins peaceful societies, and peacebuilding efforts can leverage environmental action for social cohesion. Conflict-sensitive adaptation focuses on institutional frameworks, conflict management, and governance mechanisms and could be integrated into National Adaptation Plans (*high agreement, medium evidence*). Robust institutions to manage conflicts over natural resources have benefits in other, non-climate related sectors, including gender equality. Gender equality work supports more robust institutions in both peacebuilding and natural resource management. {7.4}

7.1 Introduction

This chapter provides a synthesis and assessment of the literature on the impacts and projected risks of climate change for health, wellbeing, migration and conflict, taking into consideration determinants of vulnerability and the dynamic structure of communities. Particular attention is given to potential adaptation challenges and actions, as well as the potential of co-benefits for health associated with complementarity of adaptation and mitigation actions. AR5 presented strong evidence-based statements regarding the likely impacts of climate change on health, migration and conflict in two separate chapters on Human Health (chapter 11) and Human Security (Chapter 12). The present chapter covers all topics found in AR5 chapter 11 and sections 12.4, Migration and Mobility Dimensions of Human Security, 12.5 Climate Change and Armed Conflict, and 12.6 State Integrity and Geopolitical Rivalry, while expanding the range of literature and increasing the emphasis on mental health impacts, gender, and solutions.

Since AR5 there has been growth in the literature regarding detection and attribution of climate change impacts on health, wellbeing, and other areas. In the context of this chapter, detection and attribution relates to establishing whether impacts on, or observed changes in health, wellbeing, migration and conflict are attributable, partly or fully, to climate change and its influence on the probability of extreme hydro-meteorological or climatic events. While there has been growth in this area since AR5, there remains a dearth of studies on this topic, stemming from limited long observational records of cause-specific health outcomes, well-being status, migration and conflict; a limited ability to quantify the protective effects of adaptation activities; and the failure of climate models to reproduce some extreme events well. Notwithstanding such challenges, both expert judgement and a limited number of quantitative climate change-health attribution studies indicate climate change related alterations of temperature and precipitation patterns are adversely affecting human health.

7.1.1 Major Health-related Statements in AR5

The Fifth Assessment Report (AR5) stated with very high confidence that the health of human populations is sensitive to shifts in weather patterns and other aspects of climate change (Smith et al., 2014a). Existing diseases (e.g., foodborne infections) are extending their ranges into areas that are presently unaffected *(high confidence)*, and local changes in temperature and rainfall have altered distribution of some water-borne illnesses and disease vectors *(medium confidence)*. Major changes in human health will occur through: greater risk of injury, disease and death due to more intense heat waves and fires *(very high confidence)*, increased risk of undernutrition in poor regions *(high confidence)*, and increased risks of food- and water-borne diseases *(very high confidence)* and vector-borne diseases *(medium confidence)*. The most effective measures to reduce vulnerability in the near term are programmes that implement and improve basic public health measures *(very high confidence)*. There are opportunities to achieve co-benefits from mitigation actions, particularly reducing local emission of short lived climate pollutants from energy systems *(very high confidence)* and designing transport systems that promote active transport *(high confidence)*.

7.1.2. Major Human Security-related Sstatements in AR5

The executive summary of Chapter 12 Human Security offered five key statements relevant to migration, mobility, conflict and geopolitics. With respect to migration and mobility, the report concluded that climate change will have significant impacts on forms of migration that compromise human security, and that mobility is a widely used strategy to maintain livelihoods in response to social and environmental changes. With respect to conflict, the report concluded that some of the factors that increase the risk of violent conflict within states are sensitive to climate change and that people living in places affected by violent conflict are particularly vulnerable to climate change. On the links between climate change and state integrity and geopolitics, the report argued that climate change will lead to new challenges to states and will increasingly shape both conditions of security and national security policies. Research since AR5 summarised in this chapter builds on these findings and adds further detail to their implications for successful adaptation to climate change.

7.1.3 Developments since AR5

7.1.3.1 International agreements

Since AR5, several new international agreements have come into effect that may have significant influences on policy and action with respect to climate impacts on health, wellbeing, migration, conflict and interactions across sectors. These include the Paris Agreement, the Sendai Framework on Disaster Risk Reduction, the UN Sustainable Development Goals (SDGs), the New Urban Agenda, and the Global Compact for Safe, Orderly and Regular Migration. The Paris Agreement, which mentions health in three separate sections, established a working group to study the effects of climate change on population displacements and provided the Conference of the Parties to the UNFCCC a detailed set of recommendations in December 2018. The seventeen SDGs for 2030, adopted in 2015, are all important for building adaptive capacity in general, with goals number 13 (“Climate Action”) and number 3 (“Good Health and Wellbeing”) being closely linked and highly relevant for this chapter. Target 10.7 of the SDGs calls for “well-managed migration policies" and Targets 8.3 (“Decent Work for All”) and 5.4 (“Promotion of Peaceful and Inclusive Societies”) are crucial for migration (Piper, 2017). The Sendai Framework for Disaster Risk Reduction also put an important emphasis on health and wellbeing (Aitsi-Selmi and Murray, 2016). The New Urban Agenda aims to present sustainable approaches to our rapidly increasing rate of urbanization, with a view to healthy and liveable cities. The Global Compact for Migration, which is a voluntary initiative, explicitly recognizes the need to plan for climate-related migration and displacement (Warner 2018). With respect to conflict, since AR5 the UN system is reforming its Peace and Security agenda, as part of a larger series of reforms launched by UN Secretary-General in 2017, and the UN also launched its Climate Security Mechanism in 2018.

7.1.3.2 IPCC special reports

Since AR5, the IPCC has produced three special reports, each of which considered some of the research that is synthesized here in greater detail. The 2018 report on 1.5° C (SR1.5) included a review of climate change and health literature published since AR5, and called for further efforts for protecting health and wellbeing of the more vulnerable people and regions (Ebi et al., 2018). The report highlighted links between climate change impacts, poverty and food security, migration and conflict. The 2019 Special Report on Climate Change and Land (SRCCL) emphasized the impacts of climate change on food security. The SRCCL highlighted links between reduced resilience of dryland populations, land degradation migration, and conflict, highlighting the role of climate extremes as a stress multiplier. The 2019 Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) detailed how changes in the cryosphere and ocean systems this century have impacted people and ecosystem services, particularly food security, water resources, water quality, livelihoods, health and well-being, infrastructure, transportation, tourism and recreation, as well as culture of human societies, particularly for Indigenous peoples. It also noted the risks of future displacements due to rising sea levels and associated coastal hazards. This chapter builds upon and provides a more detailed synthesis of such findings.

7.1.4 Connections Between Dealth, Wellbeing, Migration, Conflict, and Other Global Processes

7.1.4.1 Health-wellbeing linkages

Assessing the links between human health, wellbeing, and climate change is a new task for AR6. Recent years have brought important shifts in perspectives and framing of wellbeing and health. The WHO defines health not just as the absence of disease but as “a state of complete physical, mental and social well-being” (World Health Organization, 2013, p.19; see also Kirmayer, Fletcher, & Watt 2009). A number of countries and groups are moving towards a greater acknowledgement of the importance of wellbeing, to counter the more typical measurement of progress using GDP, such as Bhutan’s Gross National Happiness and the Canadian Index of Wellbeing (Elliot et al, 2017; OECD, 2020; Vik & Carlquist, 2018). These moves reflect both an increasingly widespread prioritization of wellbeing and a broader recognition of its interaction with population health. Although the present chapter assesses physical health, mental health, and general wellbeing separately, they are interconnected, and any type of health problem can reduce overall wellbeing.

While there is no consensus definition of wellbeing, there is general agreement that wellbeing includes “the presence of positive emotions and moods (e.g. happiness), the absence of negative emotions (e.g. anxiety), and satisfaction with life, fulfilment and positive functioning”, with positive functioning incorporating the capacity for unimpaired cognitive functioning and economic productivity (Piekałkiewicz, 2017). A capabilities approach (Sen, 2001) focuses on wellbeing as the opportunity for people to achieve their goals in life (Vik & Carlquist, 2018) or the ability to take part in society in a meaningful way: the result of personal freedoms, human agency, self-efficacy, an ability to self-actualize, dignity and relatedness to others (e.g. Markussen et al, 2017). An indigenous perspective on wellbeing typically incorporates a healthy relationship with the natural world (Sangha et al., 2018).

The terms happiness, life satisfaction, and subjective wellbeing (SWB) are often used interchangeably by social scientists to describe the affective component of wellbeing. Diener and Tay (2015) defined SWB as comprising life satisfaction and feelings (more positive, and fewer negative, feelings). Research has established that SWB can be reliably measured and that it is consistently associated with a variety of personal indicators such as income, economic productivity and physical health (Diener & Tay; Delhey & Dragolov, 2016; De Neve et al, 2013) – noting, however, that improvements in income do not necessarily lead to improvements in wellbeing. Although wellbeing is often linked to economic conditions, SWB is also tied to environmental health, and to societal indicators such as social cohesion and equality. In a global sample of over 1 million obtained between 2004-2008 via the Gallup World Poll, annual income and access to food were strong predictors of SWB, and a healthy environment, particularly access to clean water, was also a significant predictor even when controlling for household income (Diener & Tay, 2015). Access to green spaces is also associated with wellbeing (high confidence; Yuan 2018). Among a European sample of just under 35,000 surveyed mostly in 2011, social inequality was negatively related to SWB, but this was fully mediated by social cohesion, which was reduced by inequality (Delhey & Dragolov, 2016). Cohesion was a significant predictor of SWB in all countries, although it was a more strongly associated with SWB in richer compared to poorer countries.

Wellbeing and health overlap, but health is commonly expressed in reference to specific diseases and with a different set of metrics. Population health status varies across several spectra. Lower life expectancy and poorer health outcomes are associated with poverty, lower social status, and limited access to goods, services, power, and responsive governance (Marmot et al., 2008). These gradients are observed between countries, within countries, and in smaller population units. Health care access is also a determinant of health, but variation in health care access explains a relative small proportion of the variation in health status in a given population (Pincus et al., 1998). While primary responsibility for population health is typically assigned to the health sector, abundant research in the past two decades has identified the importance of improving daily living conditions and reducing inequities in the distribution of power, wealth, and resources in order to promote population health, necessitating that other sectors also prioritize health in decision making, for example, through a health-in-all policies stance (Donkin et al., 2018).

7.1.4.2 Links between migration and adaptation

This chapter provides a more detailed assessment than previous ARs of the role played by migration (and mobility more generally) within wider processes of adaptation to climate change. Key elements that are examined include the degree to which people are able to choose whether or not to move when confronted with climatic risks (a.k.a. migrant agency), key climate-related drivers of migration and displacement, the duration and destination of climate-related movement, and the thresholds of vulnerability and adaptation that, once reached, are reflected in changes in migration patterns. There is a significant human rights dimension with respect to climate-related migration, for such migrants are vulnerable to exploitation, especially in situations where they have involuntarily lost ties to their land and social networks (Bettini 2017, Bettini and Gioli 2016, Parsons, 2018). Despite this, popular reporting and grey literature may raise fears that climate change will generate large scale, refugee-like floods of migrants across international borders, fears for which there is no empirical evidence (Baldwin 2017, McLeman 2019).

7.1.4.3 Linkages between climate change, migration and health

Climate change, migration and health are interconnected in multiple ways that are not fully understood. The health outcomes of migrants generally, and of climate migrants in particular, vary according to geographical context, country, and the particular circumstances of migration or immobility. Research from multiple countries shows that healthy individuals are more likely to migrate internationally than people in poorer health, and that migrants often have better health outcomes than people born in destination areas (a.k.a. the 'healthy migrant effect') (Kennedy et al 2015). By contrast, people who move within their home countries may display a range of positive and negative health outcomes compared to non-migrants (e.g. Dodd et al. (2017) research in South India). Refugees and other involuntary migrants experience higher exposure to disease and malnutrition, adverse indirect health effects of changes in diet or activity, and increased rates of mental health concerns attributable to sense of loss or to fear (Schwerdtle et al 2018, Torres and Casey 2017). A study of Mexico-US migration suggests that the 'healthy migrant effect' holds during periods of favourable climatic conditions, but that during droughts, rural outmigration rates from dryland areas increase across all groups, regardless of individual health (Hunter and Simon 2017, Riosmena et al 2017). Linkages between climate migration and the spread of infectious disease are bidirectional; migrants may be exposed to diseases at the destination to which they have lower immunity than the host community; in other cases, migrants could introduce diseases to the receiving community (McMichael 2015).

7.1.5 Trends and Events Relevant for Assessment of Climate Change Impacts on Health

The literature cut-off date for AR5 WGII report was early 2013. Several important trends and events have emerged since, each of which has relevance for this chapter assessment of climate change and impacts on health and wellbeing. First, there has been a steady increase in standardized, globally scoped, data-driven health impact assessment, signified by the ongoing Global Burden of Disease (GBD) study (James et al., 2018) and its linkages with other global priorities, including the SDGs (Fullman et al., 2017). The GBD now includes scenario-based projections (Chang et al., 2019). Second, attention has turned from prioritization of specific diseases like HIV/AIDS, malaria, and tuberculosis, to health system strengthening and universal health coverage (Chang et al., 2019), accompanying an ongoing emphasis on the social determinants of health. Third, climate change has recently gained additional attention in global health assessments: several climate-sensitive health outcomes are now tracked in the annual Lancet Countdown reports (Watts et al., 2018; Watts et al., 2019a), and the GBD is beginning to examine climate sensitive disease burdens, incorporate temperature as a risk factor (Murray et al., 2020b), and project future cause-specific disease burdens in a warming world (Burkart et al., submitted).

While the knowledge base regarding global health has increased, linkages between indicators of health, wellbeing and environmental impacts from climate change remain patchy. Moreover, significant cracks in the foundation of global health governance that affect preparedness and adaptive capacity for climate change, among other threats, have been laid bare (Phelan et al., 2020). While attention to climate change and health has increased (Watts et al., 2019b) and there is evidence of increasing adaptation activity in the health sector (Watts et al., 2019a), there is also continued evidence of substantial adaptation gaps (UNEP, 2018) that appear to be widening as adverse climate change impacts on health and wellbeing accrue.

7.1.6 Continuing Evolution of Global Frameworks

In recent years, the field of public health has expanded from its early focus on monitoring and prevention of infectious disease to incorporate a wide range of other health issues and health determinants (Rosen 2015, Marmot 2005). Ongoing efforts have been made to expand and systematize social science contributions to the determinants of health, emphasizing the role of social structures, agency, equity and governance into the study of health (Haslam et al 2018). At the same time, global health has developed new methods for incorporating relevant exposure pathways and system dynamics into its study and practice.

As the field works to include considerations at a global scale and to incorporate dynamics associated with the long-time horizons associated with climatic and other global changes, more comprehensive frameworks for framing and studying global health issues, including planetary health, 'one health', and eco-health, have gained traction. These frameworks share an ecological perspective, emphasize the role of complex systems, and highlight the need for interdisciplinary related to human health research and practice. While they have much in common, each framework focuses on particular systems and dynamics. 'One health', for instance, focuses on the interactions between humans, animals and plants, as well as implications for individual, population, and ecosystem health, with a growing consideration of climate change (Lerner and Berg 2015, Zinsstag et al., 2018). Planetary health focuses on global systems fundamental to human health and highlights the importance of avoiding certain thresholds in those systems (e.g., stratospheric ozone depletion) that could have major adverse health impacts if crossed (Whitmee et al 2015, Steffen et al 2015).

Large global health assessments are beginning to integrate these frameworks and perspectives. *The Lancet Countdown: Tracking Progress on Climate and Health* (Watts et al. 2018, Watts et al., 2019) is one example. In addition, the GBD for 2019 was updated to include non-optimal temperature as a risk factor (Murray et al., 2020; Vos et al., 2020), and an initial effort at estimating climate-sensitive disease burden in the GBD (Ji et al., submitted) and projections of cause-specific disease burdens associated with future warming using GBD (Burkart et al., submitted) have been developed. At the same time, work by sociologists continues to highlight the challenges climate change is very likely to pose, in particular via indirect pathways affecting resource availability, productivity, migration, and conflict (Burke et al. 2015; Carleton and Hsiang 2016; Hsiang et al. 2017), bringing multiple lines of inquiry together to highlight the associations between global environmental changes, socio-economic dynamics, and impacts on health and wellbeing.

7.1.7 Visual Guide to this Chapter

The pathways through which climate change may affect health, wellbeing, and migration are complex. The magnitude and nature of climate-related risks depend on climate change influences on: (a) the hazards, (b) the exposure of people, communities, and natural systems to those hazards, (c) the vulnerability of these communities and systems, and (d) the responses of people, communities, and health systems in preparing for and managing the increasing risks (Haines and Ebi, 2019). A recurrent theme in this chapter is that health and well-being in a changing climate cannot be considered separately from societal structure and dynamics, and that changes in health, wellbeing, migration, and conflict are often the product of climate change impacts experiences in other sectors reported in this report.

Figure 7.1 provides a visual guide to how the assessment in this chapter has been structured. Section 7.2 identifies observed impacts on health and wellbeing, migration and conflicts that have emerged from interactions of climate and weather-related hazards, exposure to such hazards, and vulnerability of communities and systems. Section 7.3 reviews peer-reviewed literature on projected risks climate change poses for health, wellbeing, migration and conflict through direct pathways (e.g. increased exposure to high ambient temperatures), and indirect pathways (e.g., through changes in patterns of non-communicable diseases). Section 7.4 assesses the range of available adaptation responses to climate risks, opportunities for transformative change, co-benefits, and how solutions for reducing climate impacts on health, wellbeing, migration, and conflicts contribute to climate resilient development pathways.

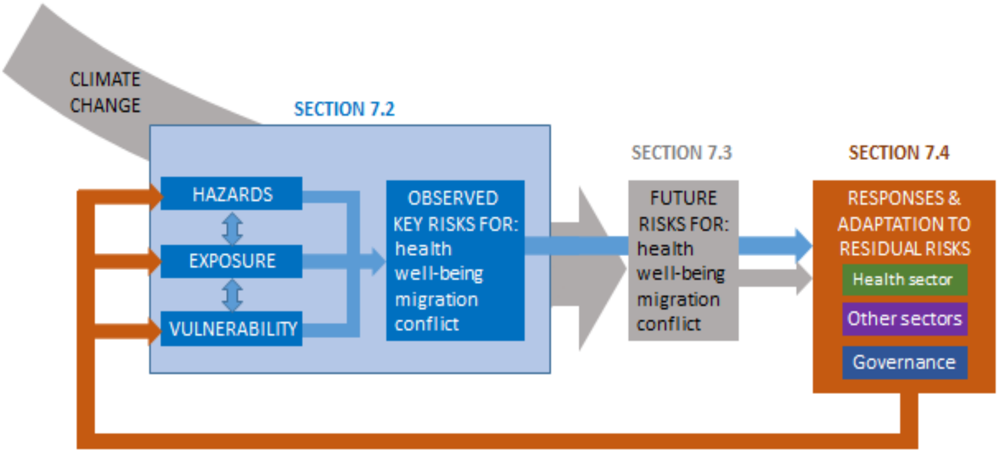


Figure 7.1: Framework used to guide the structure of this chapter. [PLACEHOLDER FOR FINAL DRAFT: artwork to be improved]

7.2. Observed Impacts of Climate Change on Health, Wellbeing, Migration and Conflict

7.2.1 Observed Impacts on Health and Wellbeing

Eleven categories of diseases and health outcomes have been identified as being climate-sensitive through direct pathways – such heat-related mortality and morbidity – and indirect pathways mediated through natural systems and economic and social disruption, such as disease vectors, allergens, air and water pollution, and food production and mental illness (Foreman et al. 2018) *(high confidence)*. A key challenge in quantifying the specific relationship between climate and health outcomes is distinguishing the extent to which observed changes in prevalence of a climate sensitive disease or condition are attributable directly or indirectly to climatic factors as opposed to other, non-climatic, causal factors. A subsequent challenge is then determining the extent to which those observed changes in health outcomes associated with climate are attributable to events or conditions associated with current climate variability versus persistent shifts in the mean and/or the variability characteristics of climate (i.e. climate change).

[START BOX 7.1 HERE]

Box 7.1: Quantifying Climate Impacts on Health Outcomes

Global statistics for death and loss of health are increasingly described in terms of burden, which describes gaps between a population's actual health status and what its status would be if its members lived free of disease and disability to their collective life expectancy. Burden is estimated by adding together the number of years of life a person loses as a consequence of early death (Years of Life Lost (YLL)) and the number of years a person lives with disability (Years of Life lived with Disability (YLD)). The resulting statistic, the Disability Adjusted Life Year (or DALY)) represents the loss of one year of life lived in full health. The total global burden of disease (GBD), expressed in DALYs, is what the world's health systems must manage, and is reported annually in Global Burden of Disease Study (GBD 2019). The estimated current global burden of climate sensitive diseases and conditions described in this chapter, and the geographical regions most affected, are summarized in Table Box 7.1.1.

The global magnitude of climate-sensitive diseases was estimated in 2019 to be 39,503,684 deaths (69.9 % of total annual deaths) and 1,530,630,442 Disability Adjusted Life Years (GBD 2019). Of these, cardiovascular diseases comprised the largest proportion of climate-sensitive diseases (32.8% of deaths, 15.5% DALYs). The next largest category consists of respiratory diseases – with chronic respiratory disease contributing to 7% of deaths and 4.1% of DALYs and respiratory infection and tuberculosis contributing to 6.5% of deaths and 6% of DALYs. The observed trend of climate-sensitive disease deaths since 1990 is marked by increasing cardiovascular mortality and decreasing mortality from respiratory infections, enteric diseases, and other infectious diseases (GBD 2019). Since AR5 there have been new estimates of the burden of causes of death attributable to the direct effects of exposure to heat and cold (Murray et al. 2020): Ischaemic heart disease, stroke, hypertensive heart disease, diabetes, chronic kidney disease, lower respiratory infection, chronic obstructive pulmonary disease (COPD), homicide, suicide, mechanical injuries, transport-related injuries, and drowning, displayed a monotonic increase. These estimated 2.0 million temperature attributable deaths (95% uncertainty interval [UI] 1.7–2.3) and 37.8 million (32.2-47.6) temperature attributable DALYs occurred in 2019, which accounted for 3.4% (3.06-3.93) and 1.5% (1.3-1.9) of global deaths and DALYs, respectively. A larger burden is attributable to cold deaths (1.7 million; 1.4-1.9) and DALYs (24.8 million; 20.4-29.4) than heat deaths (323,000; 229,000-476,000) and heat DALYs (13.0 million; 8.2-37.5), but trends since 1990 suggest a decreased burden for low temperatures and increasing burden for high temperatures.

Table Box 7.1.1: Global burden of climate-sensitive health risks assessed in this chapter (in order of assessment) (GBD 2019)

Disease/condition	Annual deaths	Regions most affected (deaths)	DALY*	Regions most affected (DALYs)
Malaria	643,381.00	Africa (92%)	46,437,811	Africa (93%)
Dengue	36,055	Asia (96%)	2,383,375	Asia (92%)

Diarrheal diseases	1,534,443	Asia (56%)	80,917,779	Africa (54%)
Salmonella	79,046	Africa (89%)	6,114,292	Africa (90%)
Respiratory tract infections	2,493,200	Asia (47%)	97,189,708	Africa (44%)
Non-communicable respiratory illness	3,741,705	Asia (74%)	95,983,342	Asia (69%)
Cardiovascular disease	18,562,510.00	Asia (58%)	393,107,482	Asia (62%)
Death from malignant melanoma	62,844	Europe (41%)	1,707,846	Europe (39%)
Diabetes	1,551,170	Asia (56%)	70,880,155	Asia (57%)
Environmental heat and cold exposure	47,461	Asia (46%)	2,551,878	Asia (44%)
Malnutrition	251,577	Africa (43%)	49,775,124	Asia (58%)

[END BOX 7.1 HERE]

7.2.2 Observed Impacts on Communicable Diseases

7.2.2.1 Observed impacts on vector-borne diseases

Climate-sensitive vector-borne diseases include mosquito-borne diseases, rodent-borne diseases and tick-borne diseases. Many infectious agents, vectors, non-human reservoir hosts, and pathogen replication rates can be sensitive to ambient climatic conditions. Elevated proliferation and reproduction rates at higher temperatures, longer transmission season, changes in ecology, and climate-related migration of vectors, reservoir hosts, or human populations contribute to this climate sensitivity. Age-standardized disability-adjusted life year (DALY) rates for many VBDs have decreased over the last decade due to factors unrelated to climate. Vulnerability to VBD is strongly determined by sociodemographic factors (e.g. children, the elderly and pregnant women are at greater risk) with exposure to vectors being strongly influenced by various factors including housing quality, occupational setting, recreational activity, conflicts and displacement. Figure 7.2 illustrates how climatic and non-climatic drivers and responses interact to determine VBD outcomes.

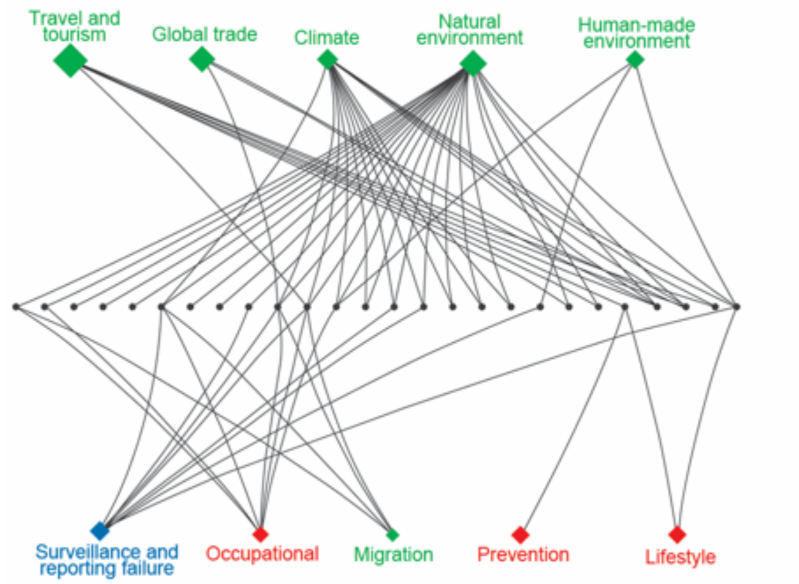


Figure 7.2: VBD threat events illustrated as horizontal dots in the middle with contributing drivers above and below, observed in Europe, 2008–2013. The 3 driver categories are represented by green (globalization and environment), red (sociodemographic), and blue (public health systems) symbols, the sizes of which are proportional to the overall frequency of the driver.

Evidence has increased since AR5 that the vectorial capacity has improved for dengue fever, malaria, and other mosquito borne diseases, and that higher global average temperatures are making wider geographic areas more suitable for transmission (*very high confidence*). Transmission rates of malaria are directly influenced by climatic and weather variables such as temperature, with non-climatic socio-economic factors and health system responses counteracting the climatic drivers *(very high confidence).* The burden of malaria is greatest in Africa, where more than 90% of all malaria-related deaths occur (M'Bra, 2018, Caminade, 2019). Between 2007 and 2017, DALY rates for malaria have decreased by 39% globally. Malaria is mainly caused by five distinct species of plasmodium parasite (*Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, *Plasmodium knowlesi*), transmitted by Anopheline mosquitoes between individuals. Evidence suggests that in highland areas of Colombia and Ethiopia, malaria has shifted in warmer years toward higher altitudes, indicating that, without intervention, malaria will increase at higher elevations as the climate warms. Each year, local outbreaks of malaria occur in areas from which it was once eradicated, such as Europe, but the risk of re-establishment is considered low.

The transmission of dengue fever is linked to climatic and weather variables such as temperature, relative humidity, and rainfall (*high confidence*). The dengue virus is carried and spread by *Aedes* mosquitoes, primarily *Aedes aegypti*. Dengue has the second highest burden of VBDs, with the majority of deaths occurring in Asia (Bhatt et al 2013). Since 1950, global dengue burden has grown, attributable to a combination of climate-associated expansion in the geographic range of the vector species and non-climatic factors such as globalized air traffic, urbanization, and ineffective vector abatement measures. Temperature, relative humidity, and rainfall variables are significantly and positively associated with increased dengue case incidence and/or transmission rates globally, including in Vietnam (Phung et al., 2015; Xuan le et al., 2014), Thailand (Xu et al., 2019a), India (Mutheneni et al., 2017; Rao et al., 2018; Mala & Jat, 2019), Indonesia (Kesetyaningsih et al.. 2018), the Philipines (Carvajal et al., 2018), the United States (Lopez et al., 2018; Pena-Garcia et al., 2017; Duarte et al., 2019; Rivas et al., 2018; Silva et al., 2016), Jordan (Obaidat and Roess, 2018), and Timor-Leste (Wangdi et al., 2018). Variation in winds, sea surface temperatures and rain over the tropical eastern Pacific Ocean (El Nino Southern Oscillation) have been linked to increased dengue incidence in Colombia (Quintero-Herrera et al., 2015, McGregor and Ebi 2018). The observed lag time between climate exposures and increased dengue incidence is approximately 1–2 months (Chuang et al., 2017; Lai, 2018; Chang et al., 2018).

Changing climatic patterns are facilitating the spread of chikungunya virus (CHIKV) in Asia, Latin America, North America and Europe (*high confidence*) (Chadsuthi et al., 2016; Mascarenhas et al., 2018; Morens and

Fauci, 2014). Climate change may have facilitated the emergence of CHIKV as a significant public health challenge in some Latin American and Caribbean countries (Yactayo et al., 2016, Pineda et al., 2016), and contributed to a chikungunya outbreak in Italy in 2017 (Rocklov, et al.,). The Zika virus outbreak in South America in 2016 followed a period of record high temperatures and severe drought conditions in 2015 (Paz and Semenza, 2016; Tesla et al., 2018). Increased use of household water storage containers during the drought is correlated with a range expansion of *Aedes aegypti* during this period, increasing household exposure to the vector (Paz and Semenza, 2016). Changing climate also appears to be a risk factor for the spread of Japanese encephalitis to higher altitudes in Nepal (Ghimire and Dhakal, 2015) and in southwest China (Zhao et al., 2014). In Eastern Africa, climate change may be a risk factor in the spread of Rift Valley Fever (Taylor et al., 2016).

Changes in temperature, precipitation, and relative humidity have been implicated as drivers of West Nile fever in southeastern Europe (Semenza et al., 2016). The average temperature and precipitation prior to the exceptional 2018 West Nile outbreak in Europe was above the 1981–2010 period average, which may have contributed to an early upsurge of the vector population (Haussig et al., 2018, Copernicus Climate Change Service 2018).

Climate change has contributed to the spread of the Lyme disease vector Ixodes scapularis*, and a corresponding increase in cases of Lyme disease in North America* (high confidence)*, and of the spread of the Lyme disease and Tick-Borne Encephalitis vector* Ixodes ricinus *in Europe* (*medium confidence*) .
In Canada, there has been a geographic range expansion of the black-legged tick *I. scapularis,* the main vector of *Borrelia burgdorferi*, and the agent of Lyme disease. Vector surveillance of *I. scapularis* has identified strong correlation between temperatures and the emergence of tick populations, their range and recent geographic spread, with recent climate warming coinciding with a rapid increase in human Lyme disease cases (Clow et al 2017, Cheng et al, 2017, Gasmi et al. 2017; Ebi et al, 2017). *Ixodes ricinus*, the primary vector in Europe for both Lyme borreliosis, and tick-borne encephalitis is sensitive to humidity and temperature (Daniel et al, 2018, Estrada-Peña et al, 2020) (*high confidence*). There has been an observed range expansion to higher latitudes in Sweden and to higher elevations in Austria and the Czech Republic.

Rodent-borne disease outbreaks have been linked to weather and climate conditions in a small number of studies published since AR5, but more research is needed in this area. In Kenya, a positive association exists between precipitation patterns and *Theileria*-infected rodents, but for *Anaplasma*, *Theileria* and *Hepatozoon*, the association between rainfall and pathogen varies according to rural land-use types (Young et al 2017). Weather variability plays a significant role in transmission rates of haemorrhagic fever with renal syndrome (HFRS) (Hansen et al., 2015, Xiang et al., 2018b, Liang e t al., 2018, Fei et al., 2015, Xiao et al., 2014, Vratnica et al., 2017). In Chingqing, HFRS incidence has been positively associated with rodent density and rainfall, Bai et al (2015).

7.2.2.2 Observed impacts on waterborne diseases

Important water-borne diseases (WBD) include diarrhoeal diseases (particularly cholera, shigella, and typhoid), hepatitis A and E and poliomyelitis (Cissé, 2019, WHO, 2017). The number of cases of water-borne diseases is considerable, and even in high-income countries water-borne illness continues to be a concern (Cissé et al., 2018; Kirtman et al., 2014; Levy et al., 2018; Murphy et al., 2014). Nevertheless, the global burden of WBD has decreased in line with poverty reduction and improved sanitation and hygiene. Drinking water containing pathogenic microorganisms is the main driver of the burden of WBD (David et al., 2014; Murphy et al., 2014). WBD outbreaks, particularly intestinal diseases, are attributable to a combination of the presence of particular pathogens (bacteria, protozoa, viruses or parasites) and the characteristics of drinking water systems in a given location (Bless et al., 2016; Ligon and Bartram, 2016).

[START BOX 7.2 HERE]

Box 7.2: Cascading Risk Pathways Linking Waterborne Disease to Climate Hazards

The causal linkages between climate variability and change and incidence of waterborne diseases follows multiple direct and indirect pathways, often as part of a cascading series of risks. For example, extreme precipitation can result in a cascading hazard or disease event with implications of greater magnitude than the initial hazard, especially if there are pre-existing vulnerabilities in critical infrastructure and human populations. Intense or prolonged precipitation can flush pathogens in the environment from pastures and fields to groundwater, rivers and lakes, consequently infiltrating water treatment and distribution systems (Howard et al., 2016; Khan et al., 2015; Sherpa et al., 2014, Cissé et al., 2016; Kostyla et al., 2015). Table Box 7.2.1 shows the variety and complexity of pathways between climate hazard and waterborne disease outcomes.

Table Box 7.2.1: Pathways between climate hazard and waterborne disease outcomes

Cascading risk pathways from heavy rain and flooding
Storm runoff yields water turbidity which compromises water treatment efficiency Storm runoff mobilizes and transports pathogens Overwhelmed or damaged infrastructure compromises water treatment efficiency Floods overwhelm containment system and discharge untreated waste water Floods damage critical water supply and sanitation infrastructure Floods displace populations towards inadequate sanitation infrastructure
Cascading risk pathways from drought
Low water availability augments travel distance to alternate (contaminated) sources Intensified demand and sharing (e.g. with livestock) of limited water resources decreases water availability and quality Intermittent drinking water supply results in cross-connections with sewer lines and water contamination Uncovered household water containers are a source of vector breeding Poor hygiene due to decreased volume of source water and increased concentration of pathogens Exposure to accumulated human excrements and animal manure
Cascading risk pathways from increasing temperature
Extended transmission season for opportunistic pathogens Permissive temperature for the replication of marine bacteria Enhanced pathogen load in animal reservoirs (e.g. chicken) Pathogen survival and proliferation outside of host Wildfires during heat waves degrade water quality Exposure to contaminated water due to higher water consumption Behaviour change (e.g. barbeque) and food spoilage
Cascading risk pathways from sea-level rise
Population displacement due to powerful storm surges Disruption of drinking water supply and sanitation infrastructure due to inundation Decline in soil and water quality due to saline intrusion into coastal aquifers Seawater infiltration into drinking water distribution and sewage lines

Notes:
Examples are purposely not exhaustive and should be considered illustrative.

[END BOX 7.2 HERE]

Since AR5 there is a growing body of evidence that increases in temperature (very high confidence), heavy rainfall (high confidence), flooding (medium confidence) and drought (low confidence) are associated with an increase of diarrheal diseases. In the majority of studies there is a significant positive association observed between waterborne diseases and elevated temperatures, especially in areas where water, sanitation and hygiene deficiencies are significant (Levy et al., 2018; Carlton et al., 2016a, Levy et al., 2018; Sherpa et al., 2014, Guzman Herrador et al., 2015; Levy et al., 2016; Lo Iacono et al., 2017). In Ethiopia, South Africa and Senegal, increases in temperatures are associated with increases in diarrhea caused by bacteria and protozoa (Carlton et al., 2016b), while in Ethiopia, Senegal and Mozambique, increases in monthly rainfall are associated with an increase in cases of childhood diarrhea (Azage et al., 2015, Thiam et al., 2017, Horn et al., 2018). Similar associations between weather and diarrhea have been observed in Cambodia, China, Bangladesh and the Philippines (McIver et al., 2016a; McIver et al., 2016b, Liu et al., 2018, Wu et al., 2014, Matsushita et al., 2018). Heavy precipitation events have been consistently associated with outbreaks of waterborne diseases in Europe, Scandinavia, USA, UK and Canada (Guzman Herrador et al., 2015; Levy et al., 2016; Lo Iacono et al., 2017; Curriero et al., 2001; Guzman Herrador et al., 2016, Levy et al., 2018). In Europe, impacts of floods can include outbreaks of waterborne diseases (Suk et al., 2019) with flood-affected populations showing higher rates of risk than periods before and after floods, as well as in direct comparison with populations unaffected by floods (Guzman Herrador et al., 2015; Levy et al., 2016; Lo Iacono et al., 2017). During extreme precipitation events, parasites such as Cryptosporidium can infiltrate and overload water treatment facilities and persist in water distribution systems. Such events disproportionally affect the young, elderly and immunocompromised (Zhang et al 2019).

Heavy rainfall and higher than normal temperatures are associated with increased cholera risk in affected regions (*very high confidence*) (see also SROCCC chap5 p510, Cross-Chapter Box ILLNESS in Chapter 2). Cholera is an acute diarrheal disease typically caused by the bacterium *Vibrio cholerae* that results in severe diarrheal disease and mortality. Linkages between climate and cholera have been observed in some recent studies in Africa (Mpandeli, 2018, Amegah, 2016, Escobar, 2015)

Heavy rainfall, warmer weather and drought are linked to increased risks for other gastro-intestinal (GI) infections (*high confidence*). As temperature increases bacterial causes of GI infection appear to increase and this association is variably influenced by humidity and rainfall (Ghazani et al., 2018; Levi et al. 2016). A study in New York found that every 1°C increase in temperature was correlated with a 0.70-0.96% increase in daily hospitalization for GI infections (Lin et al., 2016). In the Philippines, leptospirosis and typhoid fever showed an increase in incidence following heavy rainfall and flooding events (Matsushita et al., 2018)

7.2.2.3 Observed impacts on food-borne diseases

Food-borne diseases (FBDs) refer to any illness resulting from ingesting food that is spoiled or contaminated by pathogenic bacteria, viruses, parasites, toxins, pesticides and/or medicines (WHO, 2015). FBD risks are present throughout the food chain, from production to consumption, and most often arise due to contamination at source and from improper handling, preparation and/or food storage (Smith 2019). As with waterborne disease, FBD outbreaks can follow multiple causal pathways as climatic risk factors interact with food production and distribution systems, urbanization and population growth, resource and energy scarcity, decreasing agricultural productivity, price volatility, modification of diet trends, new technologies and the emergence of antimicrobial resistance (Lake, 2018, Park, 2018, Yeni, 2017).

A strong association exists between increases in foodborne diseases and high air and water temperatures and longer summer seasons (*very high confidence*). The risks occur through complex transmission pathways throughout the food chain and the wide range of foodborne pathogens (Cissé, 2019; Hellberg and Chu, 2016; Lake and Barker, 2018; Park et al., 2018a; Smith and Fazil, 2019). Food-borne pathogens of most concern are those having low infective doses, a significant persistence in the environment and high stress tolerance to temperature change (e.g. enteric viruses, *Campylobacter spp*., *E. coli* STEC strains, *Mycobacterium avium,* tuberculosis complexes, parasitic protozoa and *Salmonella*) (Lake, 2018; Lake, 2017; Lake and Barker, 2018; Smith and Fazil, 2019; EFSA, 2020). Priority risks include marine biotoxins, mycotoxins, salmonellosis, vibriosis, transfer of contaminants due to extreme precipitation, floods, increased use of chemicals (plant protection products, fertilizers, veterinary drugs) in the food chain, and potential residues in food (EFSA 2020; FAO 2019; WHO 2018).

There is a strong association observed between increase in Salmonella *infections and increase in average ambient temperature* (*high confidence*). Most types of *Salmonella* infections lead to salmonellosis, while some other types (*Salmonella* Typhi and *Salmonella* Paratyphi) can lead to typhoid fever or paratyphoid fever. The transmission to humans of the non-typhoidal *Salmonella* infection, one of the most widespread foodborne diseases, occurs usually through eating foods contaminated with animal feces. Studies conducted in Australia (Milazzo et al., 2016), New Zealand (Lal et al., 2016), the UK (Lake, 2017), South Korea (Park et al., 2018a; Park et al., 2018b, Park, Park and Bahk 2018), Singapore (Aik et al., 2018) and Hong Kong

(Wang et al., 2018a; Wang et al., 2018b) have shown that *Salmonella* outbreaks are strongly associated with temperature increases.

Significant associations exist between food-borne diseases due to Campylobacter*, precipitation and temperature* (*medium confidence*). The timing of heat-associated Campylobacteriosis events varies across countries, whilst infection rates in the UK appear to decline immediately after periods of high rainfall (Djennad et al., 2019, Lake et al., 2019, Rosenberg et al., 2018, Yun et al., 2016, Weisent et al., 2014). This suggest the association with climate may be indirect and due to weather conditions that encourage outdoor food preparation and recreational activities (Lake, 2017).

Outbreaks of human and animal Cryptococcus's have been reported as being associated with a combination of climatic factors, and shifts in host and vector populations (Chang and Chen, 2016; Rickerts, 2019) Childhood cryptosporidiosis rates in the tropics and sub-tropics show seasonal and short-term associations with rainfall (Lal, 2019). Studies from Ghana, Guinea Bissau, Tanzania, Kenya and Zambia show a higher prevalence of Cryptosporidium during high rainfall seasons, with some peaks observed before, at the onset or at the end of the rainy season (Squire, 2017).

7.2.2.4 Observed impacts on other risks in food chain

7.2.2.4.1 Intoxications through marine and fresh water biotoxins

Harmful Algal Blooms (HABs) are climate sensitive, and are projected to increase in the 21st century, thus increasing the risk of seafood contamination with marine toxins, and associated diseases (high confidence) (IPCC SROC, 2019). These diseases include amnesic shellfish poisoning, diarrheic shellfish poisoning, neurotoxic shellfish poisoning, azaspiracid shellfish poisoning, paralytic shellfish poisoning, ciguatera fish poisoning, and cyanobacteria poisoning. Marine toxins may cause respiratory and digestive problems, memory loss, seizures, skin irritation and some of them can be acutely lethal. Increased surface water warming is changing the occurrence, intensity, species composition and toxicity of potentially toxic marine and freshwater algae and bacteria, and some dinoflagellates are causing outbreaks in areas where they had not been reported before (Botana et al. 2016). For example Ciguatera fish poisoning which was usually reported in tropical areas in the Caribbean, has been reported in the Canary Islands and in Madeira (Botana et al. 2016), and appears to be expanding in the Southern Hemisphere (Kohli et al. 2016). In fresh water habitats, cyanobacteria blooms poses a health risk, primarily through the contamination of drinking water by cyan toxins. Human communities in poorly monitored areas are among the most vulnerable to these biological hazards (medium confidence) (IPCC SROCC, 2019).

7.2.2.4.2 Mycotoxins

Climatic factors affect the growth and geographical expansion of toxigenic fungi in crops and consequent contamination with mycotoxins (medium confidence). A number of studies report that mycotoxins cause adverse health outcomes such as cancer, immuno-suppression or acute toxicity and growth retardation in children (Battilani et al 2016, EFSA2020). Higher temperatures and droughts exacerbate aflatoxin contamination, which increase the risks of human exposure through contaminated food (Battilani et al 2016, EFSA2020, Stepman, 2018).

7.2.2.5 Respiratory Tract Infections

Climatic risk factors for respiratory tract infections (RTIs) due to multiple pathogens (bacteria, viruses, fungi) include heat waves, dust storms, extreme precipitation events, and increased climate variability.

Higher temperatures are associated with higher risks for developing pneumonia and pneumonia-related mortality (medium confidence). In Thailand, heat waves have been shown to positively and significantly increase the risk for pneumonia-related mortality (RR 1.052 - 1.267) and may worsen pneumonia-related mortality associated with air pollution (Huang et al. 2018). In Hong Kong, the effects of air pollution for pneumonia cases living in warmer areas were significantly higher than among cases living in cooler locations (Sun et al. 2019). Increased wintertime temperature variability may also increase the risk for pneumonia infection; a study in China found the hazard ratio (HR) for developing pneumonia was 1.15 (95% CI: 1.01–1.31) for every 1°C increase in wintertime temperature variability (Sun et al. 2018).

There is an inverse relationship between influenza incidence with certain weather variables (temperature, absolute humidity, precipitation) (*medium confidence*), but influenza may have increased mortality when associated with La Niña events (*medium confidence*) and extreme precipitation events (*medium confidence*). In mice models, exposure to high ambient temperature (i.e., ≥ 36°C) has been shown to impair immune responses to influenza (Moriyama and Ichinohe 2019). At the human population level, extreme precipitation events have been positively and significantly associated with influenza-related emergency department visits (Smith et al. 2017). Influenza pandemic dynamics have been associated with El Niño Southern Oscillation (ENSO) (Oluwole 2017), with seasonal influenza shown to be more severe and frequent when coinciding with La Niña events (Flahault et al. 2016). However, influenza incidence rates (Caini et al. 2018) and influenza mortality (Geier et al. 2018) are inversely correlated with climate variables such as temperature, absolute humidity, and precipitation. More research is needed on climate-influenza risk linkages.

[START CROSS-CHAPTER BOX COVID HERE]

Cross-Chapter Box COVID: COVID-19

Authors: Maarten van Aalst (Netherlands, Ch.16), Guéladio Cissé (Mauritania/France, Ch.7), Ayansina Ayanlade (Nigeria, Ch.9), Lea Berrang-Ford (UK/Canada, Ch.16), Rachel Bezner Kerr (Canada/USA, Ch.5), Robbert Biesbroek (Netherlands, Ch.13), Kathryn Bowen (Australia, Ch.7), Martina Angela Caretta (Sweden, Ch.4), So-Min Cheong (Republic of Korea, Ch.17), Winston Chow (Singapore, Ch.6), Mark Costello (New Zealand/Norway/Ireland, Ch.11, CCP1), Kristie Ebi (USA, Ch.1), Elisabeth Gilmore (USA, Ch.14), Bruce Glavovic (South Africa/New Zealand, Ch.18), Walter Leal (Germany, Ch.8), Stefanie Langsdorf (TSU), Elena Lopez-Gunn (Spain, Ch.4), Ruth Morgan (Australia, Ch.4), Aditi Mukherji (India, Ch.4), Camille Parmesan (France/UK/USA, Ch.2), Mark Pelling (UK, Ch.6), Elvira Poloczanska (TSU), Marie-Fanny Racault (UK/France, Ch.3), Diana Reckien (Germany/Netherlands, Ch.17), Jan Semenza (Sweden, Ch.7), Pramod Kumar Singh (India, Ch.18), Stavana Strutz (USA, Ch.2), Maria Cristina Tirado von der Pahlen (Spain/USA, Ch.7), Corinne Schuster-Wallace (Canada), Zinta Zommers (Latvia, Ch.17)

This Cross-Chapter Box outlines how the COVID-19 pandemic that emerged in 2019 affects climate change impacts, vulnerability and adaptation. It highlights the overlapping and compound risks from COVID-19, biodiversity loss and climate change impacts on the most vulnerable within countries, which require a coordinated response and holistic risk management strategies

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes Coronavirus Disease 2019 (COVID-19), emerged in late 2019 (Vanwambeke et al., 2020), halfway through the preparation of the IPCC WGII Sixth Assessment. Individuals, countries, and international organizations have generally responded in similar ways. Parallels have been drawn to the scale and urgency of response required to effectively address climate change (Polyakova et al., 2020, Shrestha et al., 2020). The disease and the response measures have enormous impacts on human health, but also on economic activity, food production and availability, health services, poverty and social inequalities, supply chains, the maintenance of infrastructure, and the environment interacting with many risks associated with global warming (IMF, 2020).

The role of climate in the origin and spread of COVID-19

There is insufficient time to know whether there is a direct link between climate change and the origin or spread of SARS-CoV-2 (Kroumpouzos et al., 2020, Monami et al., 2020) (Tosepu et al., 2020). However, there may be climate-related seasonal dynamics in the long term (Merow and Urban 2020). Infectious diseases may emerge through multiple climate-related avenues, including: direct effects of climatic conditions on disease reproduction and transmission; effects of anthropogenic greenhouse gases and particulate matter on human health and disease transmission; climate-related movements of both humans and wild animals into new areas, thereby altering human-animal interactions; and climate-related agricultural losses with subsequent food scarcity leading to an increase in the use of bush meat and wildlife trading, thereby also increasing human-animal interactions (see Figure CCB COVID.1, Sections 2.4.2.1, 2.4.2.5, 5.2.2.3 and 7.2, Chapter 3, Cross-Chapter Boxes ILLNESS in Chapter 2 and MOVING SPECIES in Chapter

5). The spread of some emerging infectious diseases, including SARS-CoV-2, from wildlife into humans is associated with live animal-human markets, and increased human intrusion into wild animal habitats. Climate change has increased the risk of emerging infectious diseases by driving the movements of new species, including vectors and reservoirs of diseases, into novel human populations and vice-versa (high confidence) (2.4.2.5; 5.2.2.3; Cross-Chapter Box ILLNESS in Chapter 2; SRCCL; IPBES 2020). However, the vector for the COVID-19 pandemic is human to human transmission rather than climatic, animal or parasite factors (Xiong et al. 2020, PNAS).

Studies of the extent to which weather and climate variability are associated with COVID-19 infection and transmission rates are inconsistent, often because few confounding factors were taken into account; there also are differences in epidemiological metrics and methodologies used *(moderate evidence, low agreement)* (Iqbal et al, 2020, Lin Changqing et al, 2020, Pan et al, 2020, Shakil MH et al, 2020). Some results suggest higher COVID-19 infections and transmission rates in the coldest locations (Sajadi et al., 2020; Ma et al., 2020; Shi et al., 2020, Bashir et al., 2020), but this effect is weak and not always significant (Poirier et al, 2020) (Chakraborti S et al, in press). It is unclear whether colder temperatures could drive behavioural changes towards indoor, poorly ventilated spaces or alter the biology of the virus. There is generally more evidence for lowered transmission in high humidity, but not all studies support this, and the effect is consistently small and interacts with temperature *(limited evidence, moderate agreement) (*Schuit et al., 2020, Morris et al., 2020, Smither et al. 2020, Zhang et al, 2020).

In contrast, pollutants, many of which also affect the climate system (for example, carbon particulate matter), have been consistently positively correlated with higher transmission of, and mortality from, COVID-19 (Hendryx & Luo, 2020, Magazzino et al, 2020, Zhu et al, 2020, Pozzer et al. 2020, NAS, 2020). High levels of pollution may increase COVID-19 incidence by as much as 5–7%, particularly at higher temperatures (Zhang et al 2020). Evidence from studies of other airborne viruses suggests this is due both to the detrimental effect of air pollution directly on health and to viral transport *via* particulate matter facilitating airborne transmission (Comunian, 2020). Breathing dry air promotes epithetical damage and inhibits mucociliary clearance, thereby increasing mortality (Ma et al., 2020; Poole, 2020).

Impacts of COVID-19 and their relation to climate risks

The severe economic impacts and reduction in travel due to COVID-19 have had a measurable impact on global greenhouse gas emissions (Quéré et al., 2020). However, CO_2 concentrations are still increasing and climate hazard scenarios for the coming years and decades are not affected substantially by a temporary reduction in emissions, unless the current crisis leads to a more consistent change in emissions pathways, either due to long-term economic contraction or a drastic policy choice towards green recovery.
The COVID-19 pandemic has already resulted in a cascade of negative and some positive impacts across sectors *(medium evidence, medium confidence)* (e.g. Pfister et al. 2020), with significant implications for the climate-related impacts and risks covered across the WGII Sixth Assessment Report. Beyond COVID-19-related mortality and morbidity, mortality from other diseases, as well as maternal and neonatal mortality, has increased as a result of disruption in health services (Bill and Melinda Gates Foundation 2020). Family violence has also increased (e.g., Usher et al., 2020). Over 100 countries have closed educational facilities at all levels, affecting over 900 million students (Nicola et al. 2020). It is estimated that close to 90 million additional people may fall into extreme poverty due to the COVID-19 crisis (IMF 2020). Every percentage point drop in global gross domestic product (GDP) means an additional 0.7 million stunted children (UNSG 2020). The effects of the pandemic will likely increase the number of people suffering from acute food insecurity from 135 million to 270 million people (WFP-FSIN, 2020) and exacerbate malnutrition and non-communicable diseases (NCDs) (FAO et al. 2020; Rippin et al. 2020). This overlaps with conflict conditions and displacement with vulnerable populations facing the triple risks of conflict, COVID-19 and climate impacts (WFP-FSIN, 2020).

At the same time, compound disasters have arisen because of extreme weather and climate events such as droughts, storms, floods, wildfires and heatwaves (*medium confidence*). Between March and September 2020, 92 extreme weather events coincided with the COVID-19 pandemic, affecting 51.6 million people (Walton and van Aalst 2020). The COVID-19 pandemic may hinder disaster response and safe evacuations, while physical distancing regulations may reduce the capacity of temporary shelters (UNDRR 2020). Additionally, 431.7 million people were exposed to extreme heat, and 2.3 million people were affected by wildfires (Walton and van Aalst 2020). Extreme heat can drive people indoors for air conditioning, which may influence the spread of COVID-19 *(limited evidence, moderate agreement)* (e.g. Correia et al. 2020; Chirico et al. 2020).

Improved contingency and recovery planning, including COVID-19 mitigation measures, are crucial for the aftermath of climate-related disasters (Guo et al. 2020; Ebrahim et al 2020; Baidya et al 2020; Shultz et al 2020; Mukherjee et al, 2020), as well as for preparedness measures (Alcayna et al. 2020; Tozier de la Poterie et al., 2020). For instance, public health responses to the COVID-19 pandemic, and the associated socioeconomic and environmental impacts of these measures, increased handwashing and crowd avoidance, requiring more water and sanitation, evacuation and shelter infrastructures (Armitage & Nellums 2020), wastewater management (Adelodun et al. 2020; Poch et al 2020), and water quality (Hallema et al 2020; Yunus, Masago & Hijoka, 2020; Patel et al, 2020; Espejo et al 2020). The lack of basic water access in select low- and middle-income countries (WHO, 2019) and among marginalised groups in high-income countries (see section 4.4.3 and Box 4.3) exacerbates these challenges and increases the risks of COVID-19 transmission (Brauer et al. 2020), particularly in mega-cities, slums, rural areas, refugee camps, and among minorities (Armitage and Nellum, 2020b) and in the Global South (Staddon et al 2020; Haddout et al 2020).

Societal responses to the COVID-19 pandemic and lessons for climate responses

The pandemic underscores the interconnected and compound nature of risks and responses - and the uneven distribution of impacts and responses - relating to public health, food and water security, non-communicable diseases, the economy, democracy and justice, climate risk and resilience, and sustainable development (Brosemer et al., 2020; Dodds et al., 2020; Gebreslassie, 2020; Hynes et al., 2020; Philips et al., 2020; Schipper et al., 2020). The COVID-19 pandemic is an opportunity to advance societal imperatives beyond the pandemic; these could be applied to promoting adaptation and mitigation to increase resilience (high confidence) (Sovacool et al 2020; Roosenbloom and Markard, 2020, Lambert et al 2020, Boyle et al 2020; Bouman et al. 2020, UN 2020, Brosemer et al., 2020; Dodds et al., 2020; Hynes et al., 2020; Markard & Rosenbloom 2020; Philips et al., 2020; Schipper et al., 2020; Willi et al., 2020).

Yet, windows of opportunity to enable transitions are only open for a limited period and need to be acted upon to effect change (*high confidence*) (Weible et al 2020). Responses to previous crises (e.g. 2008-2011 financial crisis) demonstrate that despite high ambitions during the response phase, opportunities for reform do not necessarily materialise (*high confidence*). Major crisis events act either as critical junctures to fundamentally reconsider the political arena or reinforce the political status-quo (Bol et al 2020, Boin et al 2005). Lessons from previous crises demonstrate the importance of policy design and feedback, institutionalized ambitions, and dedicated resources (*high agreement, medium evidence*) (Jordan and Matt, 2014), Klenert et al., 2020; Rickels & Peterson, 2020.

COVID-19 also highlights the role of scientific (including medical) expertise, and communication of that knowledge. Many warnings about the risks of zoonotic transmission (“delay is costly”, “adapt early” and “prevention pays”) did not result in sufficient attention, funding and preparation (*high confidence*). There now appears to be increased awareness of risks and real or perceived trade-offs (e.g. economy vs. health; impacts vs. adaptation). However, groups in society that are climate-sceptic also tend to be sceptical about COVID-19 management (Brzezinski et al 2020). Shifting trust-relations might offer the possibility to recalibrate the role of government in responding to crises, and society-government relations more generally (Amat et al., 2020; Deslatte, 2020).

Pathways and synergies and trade-offs between pandemic responses and climate change responses

COVID-19 recovery investments offer an opportunity to contribute to Climate-Resilient Development Pathways through a green, resilient, healthy and inclusive recovery (high confidence) (Hepburn et al., 2020; WHO, 2020; Bateman et al, 2020; Meige et al., 2020). Whilst the COVID-19 pandemic creates opportunities for climate-resilient development, heightened societal and political attention to one crisis issue area often comes at the cost of other policy priorities (*high confidence*) (Maor 2018; Tosun et al 2017). This has direct impacts on climate-resilient development as societal and political attention, and financial and staff resources, have been prioritized for COVID-19 responses. The economic consequences of the pandemic could also result in lowered ambition and budget cuts of businesses towards climate and sustainability (e.g. dismantling sustainability offices).

Table CCB COVID.1 identifies the pathways, synergies and trade-offs between pandemic responses (actions taken to manage emerging zoonotic disease including COVID-19) and climate responses. It illustrates that many responses to COVID-19 have implications for climate change risk management. For instance, strengthening health systems helps to deal with COVID-19, but also increases capacity to address future climate related health issues (Fuentes et al., 2020; Howarth et al., 2020; Newell & Dale, 2020). Similarly, social protection systems have supported pandemic responses, and can equally play a role in coping with rising climate risks.

Many of these examples demonstrate how COVID-19 highlights three drivers of risk to development that have long been recognised but not sufficiently prioritised in national and international policy (Manzanedo and Manning 2020; Markard and Rosenbloom 2020, Lindskog et al 2020, Barnett 2019). First, action to manage climate change risk has often focused on reducing hazards and exposure rather than vulnerability. Social vulnerability in particular, can be reduced in the short term by investments in a social safety net and universal access to health care, and over the medium-term by investment in housing, water and sanitation, health care, skills training, and education. Second, climate change risk management has tended to ignore root causes of risk that are often grounded in decision-making capacities, rule of law, accountability and transparency in decision-making. Third, climate change risk management has tended to focus on single drivers of risk, while action on a wider set of components of compound risk and strengthening institutions can help reduce climate risk more effectively. By adopting such holistic risk management strategies, countries have an opportunity to both address the current pandemic and tackle rising climate risks at the same time.

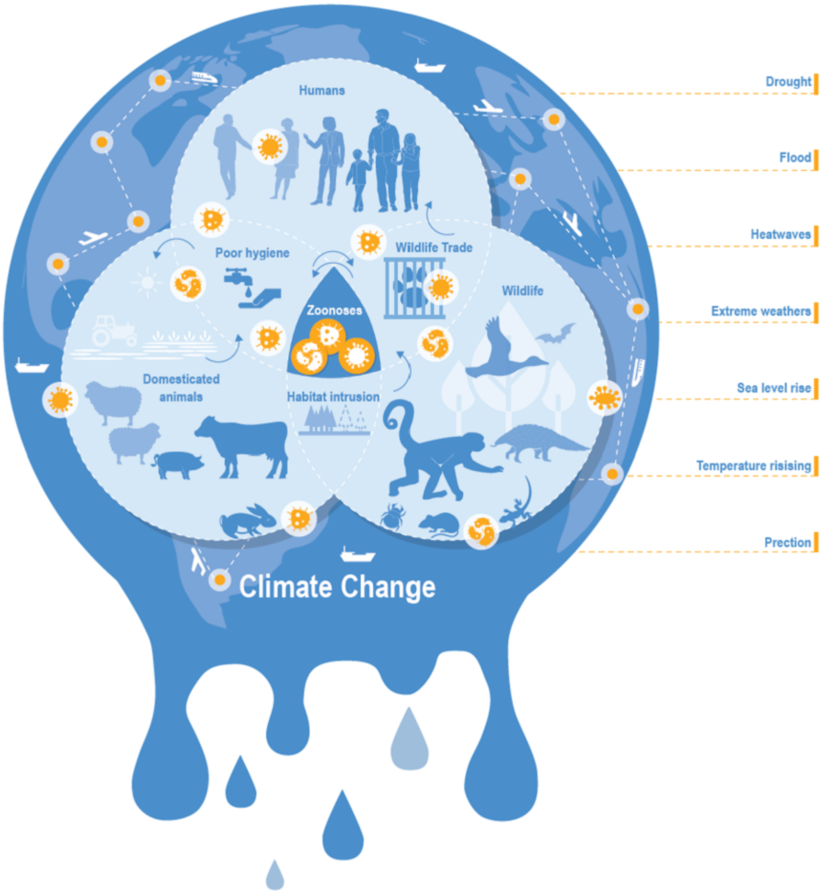


Figure CCB COVID.1: Climate change impact on humans, animals and ecosystems and how it affects the drivers of zoonosis

Table CCB COVID.1: Pathways, synergies and trade-offs between pandemic responses and climate responses

Interdependency	**Pandemic responses including COVID-19 action**	**Climate change responses** **(implications for inclusive adaptation & mitigation)**
Risk reduction		
Habitat fragmentation and increased interactions between humans and wildlife Volpato et al, 2020	Ban of some animal trades and consumption in markets and restaurants	Increase protected area networks, restore ecosystem functioning of degraded systems, decrease legal and illegal wildlife trade. These actions increase ecosystem services, including GHG mitigation, and reduce risk of emerging infectious diseases
Deforestation and forest incursion	Improved forest management	Reforestation and slower deforestation reduce flood and fire risk and contributes to climate mitigation.
Wildlife trade Zhu and Zhu, 2020	Better regulated trade in wildlife	Conservation of wildlife resources (via protection and restoration of natural habitats) supports sustainable rural economies and builds resilience amongst marginal populations.
Food systems Cohen et al, 2020 Ayanlade and Radeny, 2020 Oldekop et al, 2020	Preference for local food production to reduce food insecurity from interrupted supply chains	Local food production can increase local livelihoods and enhance the quality of food available for targeted vulnerable groups e.g., school children, hospital patients and so reduce vulnerability to health impacts of climate change risk, while also reducing the carbon footprint of food production.
Underlying individual human vulnerabilities Gupte and Mitlin, 2020 Wilkinson, 2020	Education and support for healthy living to reduce chronic poor health (e.g. diabetes, obesity) and social isolation.	Reduces individual vulnerability, especially amongst the elderly to heat and flood risk. Community cohesion enhances local adaptive capacity.
Underlying social vulnerabilities, including mental health Coker et al, 2020 Abrams and Szefler, 2020 Gupte and Mitlin, 2020	Resolving high-density subserviced living conditions including access for all to clean water; education and trusted information for risk avoidance; good quality public transport; support for mental health impacts of COVID-19	Better housing and access to clean and sufficient water to reduce exposure and vulnerability to flooding, drought and temperature shocks. Educated populations and trusted broadcasters are better able to communicate climate change associated risks and promote adaptive actions. Improved public transport contributes to climate mitigation. Improved mental health resilience in the face of changing livelihoods, impacts, and adaptation and mitigation transitions.
Risk Early Warning, Monitoring and Containment		

Disease emergence	Improved community health surveillance	Improved knowledge base for health systems policy, including work at the interface of local health, environmental change and social status. Expanded medical training to include potential novel diseases Periodic re-evaluation of reportable disease to detect new diseases entering a country due to climate change induced range shifts
Disease tracking Huang et al., 2020	Better data on interconnections between trade flows and population movement.	Better understanding of tele connected climate risks and climate risk cascades across policy domains.
Containing spread of infection Botzen et al, 2020	Public willingness to undertake lifestyle changes to reduce risk	Case studies in behaviour change. COVID-19 changes may enable flexibility or resistance to additional changes.
Impact control		
Addressing economic impacts Gossling et al 2020	Financial support for exposed sectors including aviation and construction and hospitality.	Scope for enhancing mitigation and climate resilient development, including stimulus for new sectors and support during decline of other sectors.
Addressing social impacts Ahmed et al, 2020 De Paz et al 2020	Extending social welfare	Scope for addressing both short-term and long-term gender, racial, economic, and other inequalities driving vulnerability to climate change associated hazards.
Addressing environmental impacts	Observing impacts from accelerated construction and increased use of medical supplies e.g. PPE	Enhance insight into the creation of flood hazard through development activity Ishiwatari et al, 2020
Addressing secondary health impacts	Safe areas in medical facilities for non-COVID-19 treatments	Scope for developing surge capacity of standard care during seasonal or exceptional weather events
Activating emergency management	Essential life support services, disaster risk management, and infrastructure for WaSH, nutrition, and trauma support	Scope for ability to manage climate change associated impacts during hazard events, including providing clean water and WaSH infrastructure, safely housing and feeding displaced populations, and support for mental trauma and injury.
Geopolitical relationships Van Barneveld et al, 2020	Bifurcation between collaboration and fragmentation of international relations	Hardens international contexts for collaborative action on climate change mitigation and adaptation.

Cheval et al, 2020 Dodds et al, 2020		
International financial flows and trade Oldekop et al, 2020 Sirkeci, I. (2020).	Addressing supply chain and remittance disruptions.	Renewed emphasis on local production chains can contribute to climate mitigation. Prioritisation of renewed and reliable remittances can promote resilience of impoverished and vulnerable families.
Economic Renewal Hepburn et al, 2020 Leal Filho et al 2020	Large scale and concentrated investment of public funds in labour intensive sectors e.g. construction and agriculture. Fiscal macroeconomic policy to address long-term public debt.	Scope for stimulating a global transformation for climate mitigation and resilience.

Notes:
* Chapter and Cross-Chapter Box lines of sight are indicated for each interdependency.
The above table is based on expert judgement with limited peer review literature available. It seeks to illustrate the depth of connection between the driving forces shaping risk, loss and recovery for COVID-19 and the drivers shaping risk and resilience to climate change. Any recovery from COVID-19 or movement towards an inclusive and sustainable climate adaptation will be interdependent.

[END CROSS-CHAPTER BOX COVID HERE]

7.2.3 Observed Impacts on Non-communicable Diseases

Non-communicable diseases (NCDs) impose the largest disease burden globally. NCDs constitute approximately 80% of the burden of disease in high-income countries; the NCD burden is lower in low- and middle-income countries but expected to rise (Bollyky et al., 2017). NCDs constitute a large group of diseases driven principally by environmental, lifestyle, and other factors; those identified as being climate sensitive include non-infectious respiratory disease, cardiovascular disease, cancer, and endocrine disease including diabetes.

7.2.3.1 Non-communicable respiratory diseases

Lung diseases, including asthma, chronic obstructive pulmonary disease, and lung cancer, comprise the largest subsets of non-communicable pulmonary disease (Ferkol and Schraufnagel, 2014). Overall, the global burden of non-communicable lung disease including all chronic lung disease and lung cancer is substantial, responsible for 10.6% of deaths and 5.9% of DALYs globally in 2019 (Vos et al., 2020).

Several non-communicable respiratory diseases are climate sensitive based on their exposure pathways (very high confidence). Multiple exposure pathways contribute to non-communicable respiratory disease (Deng et al 2020), some of which are climate-related, (Rice et al., 2014), including mobilization and transport of dust (Schweitzer et al., 2018); changes in concentrations of air pollutants such as small particulates (PM2.5) and ozone formed by photochemical reactions sensitive to temperature (Hansel et al., 2016), increased wildland fires and related smoke exposure (Johnston et al., 2002; Reid et al., 2016), increased exposure to ambient heat driving reduced lung function and exacerbations of chronic lung disease (Collaco et al., 2018) (Jehn et al., 2013; McCormack et al., 2016; Witt et al., 2015); and, modification of aeroallergen production and duration of exposure (Ziska et al., 2019).

Burdens of allergic disease, particularly allergic rhinitis and allergic asthma, may be changing in response to climate change (*medium confidence*) (D'Amato et al., 2020; Eguiluz-Gracia et al., 2020, Deng et al 2020). This is supported by evidence showing an increase in the length of the North American pollen season attributable to climate change (Ziska et al., 2019), an association between timing of spring onset and higher asthma hospitalizations presumed to be due to higher pollen exposure (Sapkota et al., 2020), and other evidence linking aeroallergen exposure with a worsening burden of allergic disease (Demain, 2018; Poole et al., 2019).

7.2.3.2 Cardiovascular diseases

Cardiovascular diseases (CVD) are a group of disorders of the heart and blood vessels that include coronary heart disease, cerebrovascular disease, peripheral arterial disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolism. CVDs are the leading cause of death globally and over three quarters of the world's CVD deaths now occur in low- and middle-income countries (WHO 2017). AR5 described the thermoregulatory mechanisms and responses, including acclimatization, linking climate and CVD, and these have been further confirmed by recent studies and reviews (e.g. Giorgini et al., 2017; Ikaheimo, 2018; McGregor and Vanos, 2018; Stewart et al., 2017; Schuster, 2017; Zhang et al., 2018a).

Excess deaths during extreme heat events occur predominantly in older individuals and are overwhelmingly cardiovascular in origin (very high confidence). A higher occurrence of CVD mortality in association with prolonged period of low temperatures has been well documented globally (Giorgini et al., 2017; Stewart et al., 2017); however, there is growing evidence that heat events are more directly linked to cardiovascular death than cold spells (Chen et al., 2019; Liu et al., 2015; Bunker et al., 2016). There is a clear impact of heat on mortality, although the evidence for morbidity remains mixed (Song et al., 2017), with some CVD morbidity sub-groups such as myocardial infarction and stroke hospitalization displaying temperature sensitivity, while others do not (Bao et al., 2019; Sun et al., 2018b; Wang et al., 2016). Whilst there is strong association between ambient temperature and cardiovascular events globally, there are complex interactions and modulators of individual response (Wang et al., 2017a; Wang et al., 2017b). Although older adults have inherent sensitivities to temperature-related health impacts (Bunker et al., 2016; Phung et al., 2016), cardiovascular capacity/health is a critical determinant of individual health outcomes (Schuster et al., 2017). Medications used to treat CVD diseases, such as diuretics and beta-blockers, may impair resilience to heat stress (Stewart et al., 2017); other mediating factors in the causal pathway range from alcohol consumption to pre-existing conditions such as diabetes and hyperlipidaemia, and urban characteristics (Chen et al. 2019, Sera et al., 2019).

In addition to changes in temperature, climate change has the potential to increase the risk of CVD through other mechanisms (medium confidence), though the degree to which risks may increase remains unclear. For example, exposure to air pollutants including particulate matter, ozone (via its precursors), black carbon, oxides of nitrogen, oxides of sulphur, hydrocarbons and metals can invoke pro-inflammatory and prothrombotic states, endothelial dysfunction and hypertensive responses (Giorgini et al., 2017; Stewart et al., 2017). Winter peaks in CVD events, associated with greater concentrations of air pollutants, have been reported in a range of countries and climates (Claeys et al., 2017; Stewart et al., 2017); however, the association between air pollution, weather and CVD events is complex and seems to differ in cold *versus* warm months, particularly for gaseous pollutants such as ozone (Shi et al., 2020).

Although climate change is projected to increase the number and severity of naturally occurring wildfires (Liu et al., 2015b; Youssouf et al., 2014) the evidence for wildfire smoke-related CVD morbidity remains inconclusive or negative (Reid et al., 2016), although significant increases in certain cardiovascular outcomes (e.g., cardiac arrests) may occur (Dennekamp et al., 2015). Other climate related mechanisms that may increase CVD risk (Frumkin and Haines, 2019) include hot weather related reduction in physical activity (Obradovich and Fowler, 2017, sleep disturbance (Obradovich et al., 2017) and sea level rise related saline intrusion of groundwater (Taylor et al., 2012) which may increase the salt intake of affected populations, a risk factor for hypertension, (Talukder et al., 2017).

7.2.3.3 Cancer

Climate change is likely to increase the risk of several malignancies (high confidence), though the degree to which risks may increase remains unclear. Cancers, also known as malignant neoplasms, include a heterogeneous collection of diseases with various causal pathways, many with environmental influences. Malignant neoplasms impose a substantial burden of disease globally, responsible for slightly over 10 million deaths and 251 million DALYs globally in 2019 (Vos et al., 2020). Climatic hazards affect exposure pathways for several different chemical hazards associated with carcinogenesis (Portier et al., 2010). Most relevant literature has focused on elaborating potential pathways and producing qualitative or quantitative estimates of effect, though there is limited literature on current and projected impacts.

The vast majority of elaborated pathways point to increased risk; for example, there is concern that climate change may alter fate and transport of carcinogenic polyaromatic hydrocarbons (Domínguez-Morueco et al. 2019) and increase mobilization of carcinogens such as bromide (Regli et al. 2015), persistent organic pollutants including polychlorinated-biphenyls (Miner et al. 2018), and radioactive material (Evangeliou et al. 2014). Other harmful pathways include migration of and increased exposure to liver flukes, which cause hepatobiliary cancer (Prueksapanich et al. 2018). Increased exposure to carcinogenic toxins via multiple pathways is also a concern. Aflatoxin exposure, for example, is expected to increase in Europe (Moretti et al. 2019), India (Shekhar et al. 2018), Africa (Gnonlonfin et al. 2013; Bandyopadhyay et al. 2016), and North America (Wu et al. 2011). Other carcinogenic toxins originate from cyanobacteria blooms (Lee et al. 2017), which are projected to increase in frequency and extent with climate change (Wells et al. 2015; Paerl et al. 2016; Chapra et al. 2017).

7.2.3.4 Diabetes

Individuals suffering from diabetes are at higher risk for heat-related illness and death (medium confidence). Evidence suggests that the local heat loss response of skin blood flow (SkBF) is affected by diabetes-related impairments, resulting in lower elevations in SkBF in response to a heat or pharmacological stimulus. Thermoregulatory sweating may also be diminished by type 2 diabetes, impairing the body’s ability to transfer heat from its core to the environment. A number of epidemiological studies have found that high temperatures are associated with increased mortality, whilst a few detected the effects of cold temperatures. Xu et al. (2017) also observed higher rates of doctor consultations by patients with type-2 diabetes and diabetics with cardiovascular comorbidities are at increased demands of medical consultation during hot days, but there was no heightened risk with renal failure or neuropathy comorbidities.

Chronically ill people are at particular risk during and after extreme weather events due to treatment interruptions and lack of access to medication (medium confidence). The impacts of extreme weather events on the health of chronically ill people are due to a range of factors including disruption of transport, weakened health systems including drug supply chains, loss of power, and evacuations of populations (Ryan et al., 2015). Evacuations also pose health risks to older adults (especially those who are frail, medically incapacitated, or residing in nursing or assisted living facilities) and may be complicated by the need for concurrent transfer of medical records, medications and medical equipment (Becquart et al., 2018; Quast and Feng, 2019; USGCRP, 2016). Emergency room visits after Hurricane Sandy rose among individuals with type-2 diabetes (Velez-Valle et al. 2016)

7.2.4 Observed Impacts on Other Climate-sensitive Health Outcomes

7.2.4.1 Injuries arising from heat, cold, and extreme weather events

Injuries comprise a substantial portion of the global burden of disease. In 2019, injuries comprised 9.82% of total global DALYs and 7.61% of deaths (Vos et al., 2020). The causal pathways for many injuries, particularly those from heat and extreme weather events, flooding, and fires, exhibit clear climate sensitivity (Roberts and Arnold, 2007; Roberts and Hillman, 2005), as do some injuries occurring in occupational settings (Marinaccio et al., 2019; Sheng et al., 2018), but a comprehensive assessment of climate sensitivity in injury causal pathways has not been done. Certain groups, including indigenous populations (Thomson) and children and elders (Ahmed et al., 2020) are at greater risk for a wide range of injuries. Extreme events impose substantial disease burden directly as a result of traumatic injuries, drowning, and burns and large mental health burdens associated with displacement (Fullilove, 1996), depression, and post-traumatic stress disorder, but the overall injury burden associated with extreme weather is not known. It is known that the

Asia-Pacific region experienced the highest relative burden of injuries from extreme weather in recent decades (Hashim and Hashim, 2016).

Extreme weather imposes a substantial morbidity and mortality burden that is quite variable by location and hazard. The proportion of this burden related to injuries specifically is not established. From 1998-2017 there were 526,000 deaths from 11,500 extreme weather events, and the average annual attributable all-cause mortality incidence in the ten most affected countries was 3.5 per 100,000 population (Eckstein et al., 2017). Rates can be much higher, however: mortality incidence in Puerto Rico and Dominica from extreme weather were 90.2 and 43.7 per 100,000 population in 2017, respectively (Eckstein et al., 2017). Not all of these deaths are from injuries, and the proportion of mortality and morbidity associated with injuries varies by location and hazard. One review found that one-year post-event prevalence rates for injuries associated with extreme events (floods, droughts, heatwaves, and storms) in developing countries ranged from 1.4% to 37.9% (Rataj et al., 2016). Other literature has documented an increase in risk of motor vehicle crashes in association with extreme precipitation (Liu et al., 2017; Stevens et al., 2019) and in association with sandstorms (Islam et al., 2019), and an increased risk of traumatic occupational injuries associated with temperature extremes, particularly extreme heat, likely from fatigue and decreased psychomotor performance (Varghese et al., 2019).

Extreme heat events and extreme temperature have well documented, observed impacts on health, mortality (*very high confidence*) and morbidity (*high confidence*). Large death tolls and hospitalizations were directly attributable to heat events in Europe (2003), Russia (2015), India (2015) and Japan (2018) (McGregor et al., 2017, Hayashida et al., 2019). There are multiple pathways through which ambient temperatures interact with heat-sensitive physiological mechanisms to affect health, which can in worst cases lead to organ failure and death (Mora et al., 2017). All-cause mortality attributable to heat and cold varies across a range of countries between 3.37 and 11.0 percent (Gasparrini et al., 2015) (Zhang et al., 2019), but heat as a health risk factor has largely been overlooked in low and middle income countries, (Campbell et al., 2018) (Green et al., 2019). For countries where data availability permits, there is evidence that extreme heat (and extreme cold) lead to higher rates of early deaths (Armstrong et al., 2017; Cheng et al., 2018; Costa et al., 2017). Rapid changes and variability in temperatures are observed to increase heat-related health and mortality risks, the outcomes varying across temperate and tropical regions (Guo et al., 2016; Cheng et al., 2019; Kim et al., 2019; Tian et al., 2019; Zhang et al., 2018; Zhao et al., 2019)

Under extreme heat conditions, there are observed increases in hospitalizations for fluid disorders, renal failure, urinary tract infections, septicemia, general heat stroke, as well as unintentional injuries (Borg et al., 2017; Phung et al., 2017; Goggins and Chan, 2017; Hayashida et al., 2019; Hopp et al., 2018; Ito et al., 2018; Kampe et al., 2016; McTavish et al., 2018; Ponjoan et al., 2017; van Loenhout et al., 2018). However, such outcomes vary by locale (Phung et al., 2016), suggesting outcomes are highly moderated by socio-economic and other non-climatic determinants of individual health and socio-economic vulnerability (McGregor et al., 2017; Schuster et al, 2017, Benmarhnia et al., 2015; Gifford et al., 2019). Access to air conditioning is an important determinant (Guirguis et al., 2018).

Significant effects of heat exposure on work-related injuries have been observed in Australia, China, Italy, Spain, and Canada. In a study in of work-related injury insurance claims in Guangzhou, China, Ma et al. (2019) found that 4.8% of work-related injuries and 4.1% of work-related injury insurance payouts were attributed to heat exposure, with male workers, those working in small enterprises and workers with low educational attainment being especially exposed.

There is a need for more research regarding the specific detection and attribution of heat and cold-related mortality/morbidity to observed climate change. Although there has been an observed increase in winter season temperatures for a number of regions, to date there is little evidence for a consequential reduction in winter mortality due to milder winters (e.g. Astrom et al., 2014; Diaz et al., 2019; Hajat, 2017; Lee et al., 2018)). The few quantitative attempts to attribute observed changes in heat-related mortality suggest a significant association with climate change. For example, for London and Paris, anthropogenic climate change increased the risk of heat-related mortality by approximately 70% and 20% respectively during the 2003 European heat wave (Mitchell et al., 2016). For the severe heat event across Egypt in 2015, the impact on human discomfort was 69% (±17%) more likely due to anthropogenic climate change (Mitchell, 2016).

There is clear evidence of climate sensitivity for multiple injuries from floods, fires, and storms, but limited evidence regarding current injury burden attributable to climate change. *It is as likely as not that climate change has increased the current burden of disease from injuries related to extreme weather, particularly in low income settings (low confidence).* Approximately 120 million people are exposed to coastal flooding annually (Nicholls et al., 2007), causing an estimated 12,000 deaths (Shultz et al., 2005), and there is significant concern for worsening associated with climate change (Shultz et al., 2018a; Shultz et al., 2018b; Woodward and Samet, 2018) but very limited quantification of attributable burden. As for projected exposures, there is sufficient evidence to assess risks related to flooding only, though there is very limited literature highlighting increased morbidity and mortality an increase in fires in sub-zero temperatures that are thought to be highly attributed to climate change (Metallinou and Log 2017).

7.2.4.2 Observed impacts on maternal, fetal, and neonatal health

Maternal and neonatal disorders accounted for 3.67% of total global deaths and 7.83% of global DALYs in 2019 (Vos et al., 2020). Children and pregnant females have potentially higher rates of vulnerability and/or exposure to climatic hazards, extreme weather events, and undernutrition (Garcia and Sheehan, 2016, Sorensen et al., 2018, Chersich et al., 2018). Available evidence suggests that heat is associated with higher rates of preterm birth (Wang et al., 2020), low birthweight, stillbirth, and neonatal stress (Cil and Cameron, 2017; Kuehn and McCormick, 2017) and with adverse child health (Kuehn and McCormick, 2017). Extreme weather events are associated with reduced access to prenatal care and unattended deliveries (Abdullah et al., 2019) and decreased paediatric health care access (Haque et al., 2019).

7.2.4.3 Observed impacts on malnutrition

Climatic variability and change, including changes in temperatures and precipitation patterns, and greater frequency of extreme events, increases food insecurity and poor access to healthy food in many regions (high confidence). All dimensions of food security, including food production and availability, stability of food supplies, access to food, and food utilization, are affected (Mbow et al., 2019). Food insecurity and poor access to healthy food contribute not only to undernutrition, but also to obesity, and susceptibility to non-communicable diseases in low- and middle-income countries (FAO, 2018; Swinburn et al., 2019). Between 2015 and 2019, an estimated 166 million people in 26 countries, primarily in East Africa, Southern Africa and Central America, required urgent humanitarian assistance due to climate-related food emergencies (Nkunzimana et al., 2016, FSIN 2017, 2018, 2019; FSIN & GNAFC, 2020; FAO et al., 2018). The pathways through which climate change affects malnutrition include impacts on household food security and access, dietary diversity and nutrient quality; impacts experienced through changes in water quality, food safety and consequent disease outbreaks; and impacts on access maternal, reproductive and child health and care (Tirado et al., 2017; FAO, 2018). Climatic influences on nutrition are strongly mediated by socio-economic factors that determine food security and nutrition, such as livelihoods, assets, income, access to health, to education, to food aid, institutions, inequities, human rights, infrastructure, resources and political structures (Hallegatte and Rozenberg, 2017; Tirado et al. 2017; FAO 2018). Climate and food system linkages and outcomes are further developed in Chapter 4 of this report. Extreme events may lead to exposed populations consuming inadequate or insufficient food, leading to malnutrition and increasing the risk of disease (Rodriguez-Llanes et al. 2016; Gari et al., 2017; Kumar et al., 2016; Lazzaroni and Wagner, 2016).

[START BOX 7.3 HERE]

Box 7.3: Malnutrition: Definitions and Current Global Baselines

Malnutrition is a broad term that refers to all forms of poor nutrition, and includes conditions that range from undernutrition to obesity. Malnutrition is caused by a complex array of factors, including dietary inadequacy (deficiencies, excesses, or imbalances in energy, protein, and micronutrients), infections, and sociocultural factors (GNR, 2018). Undernutrition exists when a combination of insufficient food intake, health, and care conditions results in one or more of the following: being underweight for age, short for age (stunted), thin for height (wasted), or functionally deficient in vitamins and/or minerals (micronutrient malnutrition). Since AR5, analyses of the links between climate change and food insecurity have expanded beyond undernutrition to include the impacts of climate change on a wider set of diet and weight-related risk factors and their impacts on NCDs, as well as the role of dietary choices for GHG emissions (SROC 2019).

Globally, more than 690 million people are undernourished, 144 million children are stunted, 47 million children are wasted, and more than 2 billion people are micronutrient deficient (FAO, 2020). More than 135 million people across 55 countries experienced acute hunger requiring urgent food, nutrition and livelihoods assistance in 2019 (FSIN and GNAFC, 2020). Nearly half of all deaths in children under 5 are attributable to undernutrition, which puts children at greater risk of dying from common infections (GRN, 2018; UNICEF, WHO, WB, 2019). Undernutrition in the first 1,000 days of a child's life can lead to stunted growth, which results in impaired cognitive ability and reduced school and work performance in the future (UNICEF, WHO, WB, 2019). The associated costs of stunting in terms of lost economic growth can be of the order of 10% of GDP per year in Africa (Wagstaff, 2016).

At the same time, diseases associated with high-calorie, unhealthy diets are increasing globally, with 38.3 million of under five children overweight (GNR, 2018), 2.1 billion adults overweight or obese and the global prevalence of diabetes almost doubling in the past 30 years (Swinburn et al., 2019). Imbalanced diets, such as diets low in fruits and vegetables and high in red and processed meat, are, and have been for years, the number one risk factor for mortality globally and in most regions (GBD 2017 Risk Factor Collaborators; GBD 2017 Diet Collaborators).

[END BOX 7.3 HERE]

7.2.4.4 Observed impacts on exposure to chemical contaminants

Changing climate in northern regions is causing permafrost to thaw, creating potential for mercury (Hg) to enter the food chain (medium agreement, low evidence). Methyl Hg is highly neurotoxic and nephrotoxic and bio accumulates and biomagnifies throughout the food chain via dietary uptake of fish, seafood, and mammals (Fort et al., 2015). Mercury methylation processes in aquatic environments are expected to be exacerbated by ocean warming, coupled with more acidic and anoxic sediments (FAO, 2020). Consumption of mercury-contaminated fish is linked to neurological disorders due to methyl mercury poisoning (i.e., Minamata disease). In addition, climate change-contaminant interactions may also alter the bioaccumulation and bio magnification of toxic and fat-soluble persistent organic pollutants, such as polychlorinated biphenyls (Alava et al., 2017) in seafood and marine mammals (medium confidence). Indigenous communities have a higher exposure to such risks because of the potential accumulation of such toxins in traditional foods (Tirado et al., 2015; Alava et al., 2017). Contamination of food with PCBs and dioxins that have a range of adverse health impacts are associated with increased frequency of inland floods (Lake et al. 2015).

7.2.5 Observed Impacts on Mental Health and Wellbeing

7.2.5.1 Observed impacts on mental health

A wide range of climatic events and conditions have observed, detrimental impacts on mental health (very high confidence). The pathways through which climatic events affect mental health are varied, complex and interconnected with other non-climatic influences that create vulnerability. The climatic exposure may be direct, such as experiencing an extreme weather event or prolonged high temperatures, or indirect, such as mental health consequences of undernutrition or even anxiety about climate change. Non-climatic moderating influences range from an individual's personality and pre-existing conditions, to social support, to structural inequities (Gariepy et al., 2016; Hrabak et al., 2020; Nagy et al., 2018; Silva, Loureiro, & Cardoso, 2016).. Similar climatic events may result in a range of potential mental health outcomes, including anxiety, depression, acute traumatic stress, post-traumatic stress disorder, substance abuse, and sleep problems, with conditions ranging from being mild in nature to those that require hospitalization (Berry et al 2010; Ciancono et al., 2020; Clayton et al., 2017; Ruszkiewicz et al. 2019, Bromet et al., 2017; Lowe et al 2019).

There is an observable association between high temperatures and mental health decrements (high confidence), with an additional possible influence of increased precipitation (Baylis et al., 2018; Obradovich, Migliorini, Paulus, et al., 2018) (medium agreement, medium evidence). Heat-associated mental health outcomes include suicide (Williams, Hill, and Spicer 2015; Carleton 2017; Burke et al. 2018; Kim et al., 2019; Parks et al. 2020, Thompson et al 2018), increased psychiatric hospital admissions (Hansen et al. 2008; Wang et al. 2014; Chan et al. 2018; Mullins and White 2019), greater experiences of anxiety, depression, and acute stress (Obradovich et al. 2018; Mullins and White 2019), and fluctuations in mood and sentiments (Noelke et al. 2016; Baylis et al. 2018; Moore et al. 2019; Wang, Obradovich, & Zheng, 2020). In Canada, Wang et al. (2014) found an association between greater hospital admissions for mood and behavioural disorders (including schizophrenia, mood and neurotic disorders) and mean heat exposure of 28°C within 0 to 4 days of exposure. A US study found mental health problems increased by 0.5% when average temperatures exceeded 30°C, compared to averages between 25–30°C; a 1°C warming over 5 years was associated with a 2% increase in mental health problems (Obradovich et al. 2018). Another study found a 1°C rise in monthly average temperatures over several decades was associated with a 2.1% rise in suicide rates in Mexico and a 0.7% rise in suicide rates in the US (Burke et al. 2018). In a systematic review of published research using a variety of methodologies from 19 countries, Thompson et al. (2018) found increased risk of suicide associated with 1°C rise.

Discrete climate hazards including storms (Kessler et al. 2008; Boscarino et al. 2013, 2017; Obradovich et al. 2018), floods (Baryshnikova and Pham 2019), heatwaves, wildfires, and drought (Hanigan et al. 2012; Carleton 2017; Zhong et al., 2018) have significant negative consequences for mental health (very high confidence). Much existing research has been done in the U.S. and the UK, although a growing number of studies also find evidence for similar impacts on mental health in other countries, including Spain (Foudi et al., 2016), Brazil (Alpino, Sena, & Freitas, 2016), Chile (Navarro et al. 2016), and Vietnam (Pollack et al. 2016). Approximately 20–30% of those who live through a hurricane develop depression and/or post-traumatic stress disorder (PTSD) within the first few months following the event (Obradovich et al. 2018, Schwartz et al. 2015, Whaley, 2009), with similar rates for people who have experienced flooding (Waite et al., 2017, Fernandez et al., 2015). Studies conducted in South America and Asia indicate an increase in post-traumatic stress disorders and depressive disorders after extreme weather events (Rataj et al., 2016). Evidence is lacking for African countries (Serdeczny et al., 2017). Children and adolescents are particularly vulnerable to post-traumatic stress after extreme weather events (Brown et al 2017), and increased susceptibility to mental health problems may linger into adulthood (Maclean et al. 2016). *Wildfires have observed negative impacts on mental health (high confidence)* (Dodd et al. 2018; Brown et al. 2019; Psarros et al., 2017), due to the trauma of the immediate experience and/or subsequent displacement and evacuation. Subclinical outcomes, such as increases in anxiety, sleeplessness, or substance abuse are reported in response to wildfires and extreme weather events, with impacts being pronounced among those who experience greater losses or are more directly exposed to the event; this may include first responders.

Mental health impacts can emerge as result of climate impacts on economic, social and food systems (high confidence) For example, malnutrition among children has been associated with a variety of mental health problems (Adhvaryu et al 2019; Hock et al., 2018; Yan et al., 2018), as has food insecurity among adults (Lund et al., 2018). The economic impacts of droughts have been associated with increases in suicide, particularly among farmers (Carleton, 2017; Edwards, et al 2015, Vins et al. 2015). Residents of low and middle-income countries may be more severely impacted due to lesser access to mental health services and lower financial resources to help cope with impacts (Abramson et al. 2015).

Anxiety about the potential risks of climate change (Steentjes et al. 2017), and awareness of climate change itself can affect mental health (low confidence). (Clayton & Karazsia, 2020; Cunsolo & Ellis 2018; Helm et al 2018). There is not yet solid evidence about the prevalence or severity of climate change-related anxiety, but national surveys in the U.S., Europe, and Australia show high levels of concern and perceived harm (Leiserowitz et al., 2017; Reser et al., 2012; Steentjes et al. 2017). Studies conducted in the Solomon Islands and in Tuvalu found qualitative and quantitative evidence of experiences of climate change and worry about the future, with negative impacts on respondents' wellbeing (Asugeni et al. 2015, Gibson, Barnett, Haslam, & Kaplan, 2020). In a U.S. sample, perceived ecological stress, defined as personal stress associated with environmental problems, predicted depressive symptoms (Helm et al 2018). However, other studies have found no correlation between climate change worry and mental health issues (Berry & Peel 2015). Because these perceived threats are based on subjective perceptions of risk and coping ability as well as experiences and knowledge (Bradley et al 2014), even people who have not been directly affected may be stressed by a perception of looming danger (Clayton & Karazsia, 2020). Not surprisingly, those who have directly experienced some of the effects of climate change may be more likely to show such responses. Indigenous communities, whose culture and wellbeing tend to be strongly linked to local environments, may be particularly likely to experience mental health effects associated with changes in environmental risks; studies suggest connections to an increase in depression, substance abuse, or suicide in some indigenous communities (Canu et al,, 2027; Cunsolo Willox et al., 2013; Middleton, et al 2020; Jaakkola, et al 2018).

7.2.5.2 Observed impacts on wellbeing

Overall, research suggests that climate change has already had a negative effect on subjective wellbeing (medium confidence). Impacts of climate change on wellbeing can result from a number of mechanisms, including loss of access to green and blue spaces, due to damage from such things as storms, coastal erosion, drought, or wildfires; heat; decreased air quality; and disruptions to one's normal pattern of behaviour, residence, or social interactions. For example, substantial evidence shows a negative correlation between air pollution and SWB or happiness (Apergis, 2018; Cunado & de Gracia, 2013; Luechinger, 2010; Menz & Welsch, 2010; Orru et al., 2016; Yuan etall, 2018; Zhang et al., 2017); in the reverse direction, there is evidence not only that time in nature but more specifically a feeling of connectedness to nature are both associated with wellbeing (Martin et al., 2020). Negative emotions are associated with the degradation of local or valued landscapes (Eisenmann et al., 2015; Ellis & Albrecth, 2017; Polain et al. 2011), which may threaten cultural rituals, especially among Indigenous communities (Cunsolo & Ellis, 2018; Cunsolo et al., 2020).

Heat is one of the best-studied factors associated with climate change that can affect wellbeing (Carleton & Hsiang, 2016; Miles-Novelo & Anderson, 2019). Higher summer temperatures have been associated with decreased happiness and ratings of wellbeing in the U.S. (Connolly, 2013). In a study of 1.9 million Americans, Noelke et al. (2016) found that exposure to one day averaging 21–27 °C was associated with reduced wellbeing by 1.6% of a standard deviation, and days above 32°C were associated with reduced wellbeing by 4.4% relative to a reference interval of 10–16 °C. A similar relationship between heat and mood has been observed in China (Wang et al 2020). The causal mechanism is unclear, but could be due to impacts on health, economic costs, social interactions (Belkin & Kouchaki 2017; Osberghaus & Kühling, 2016), or reduced quality or quantity of sleep (Fujii et al. 2015; Obradovich et al. 2017; Obradovich and Migliorini 2018). Heat has also been associated with interpersonal and intergroup aggression, and increases in violent crime (Mapou et al. 2017). For the most part, studies have measured daily response to average daily temperatures and are unable to predict whether the effect is cumulative in response to a sequence of unusually warm days. However, there is no evidence of adaptation, whereby people cease to be affected by the warm temperatures (Moore et al, 2019).

Climate change also threatens wellbeing defined in terms of capabilities, or the capacity to fulfil one's potential and fully participate in society. Heat can limit labour capacity, one study estimating that 45 billion hours of labour productivity were lost in 2018 due to high temperatures (Watts et al., 2018). Both heat and air pollution also impair human capabilities through a negative effect on cognitive performance, and even impair skills acquisition, affecting marginalized groups more strongly (Park et al 2020). Systematic reviews have found an association between higher ambient levels of fine airborne particles and cognitive impairment in the elderly, or behavioural problems (related to impulsivity and attention problems) in children (Power et al. 2016; Yorifuji et al. 2017; Younan et al. 2018; Zhao et al. 2018). Malnutrition has also been associated with long-term decrements in cognitive function (Kim et al. 2017; Talhaoui et al. 2019).

7.2.6 Observed Impacts on Migration

Weather events and climate conditions can act as a direct driver of migration and displacement (e.g. destruction of homes by tropical cyclones) and as an indirect driver (e.g. rural income losses and/or food insecurity due to heat- or drought-related crop failures) (high confidence). Extreme sudden-onset events such as storms and floods are strongly associated with high levels of short- and long-term displacement, while cumulative, slower-onset conditions such as droughts, extreme heat and precipitation anomalies are more likely to be associated with longer term changes in migration patterns (Kaczan & Orgill-Meyer 2019, Hoffmann et al 2020). Annual statistics since 2008 on global displacements due to weather-related hazards recorded by the Internal Displacement Monitoring Centre suggest an average of 12.8 million people are displaced each year, though there is considerable interannual variability (IDMC2020). Displacement is most often associated with extreme storms and floods, and is disproportionately concentrated in low- and middle-income countries of Asia and Africa where household and institutional adaptive capacity are economically constrained. However, climate-related population movements are experienced in all regions, and since AR5 there have been multiple examples of population displacements in the United States, Australia, and other high-income countries due to extreme sudden-onset events, such as cyclones, floods and wildfires (IDMC 2020).

Climate-related migration outcomes are diverse (high confidence), and may be manifest as decreases or increases in migration flows, changes in the timing or duration of migration, and changes in migration source locations and destinations (see Cross-Chapter Box MIGRATE). Multi-country studies of climatic impacts on migration in Africa have found that migration rates exhibit weak, inconsistent associations with variations in precipitation, and that migration respond quite differently between countries, and between rural and urban areas (Gray and Wise 2016, Mueller et al 2020). Multidirectional findings such as these are common in published studies from multiple regions (Call et al 2017, Nawrotzki et al 2017, Cattaneo et al 2019, Kaczan & Orgill-Meyer 2019).

[START CROSS-CHAPTER BOX MIGRATE HERE]

Cross-Chapter Box MIGRATE: Climate-related Migration

Authors: David Wrathall (Ch.8), Robert McLeman (Ch.07), Helen Adams (Ch.7), Elisabeth Gilmore (Ch.14), Ben Orlove (Ch.17), Nathalie Hilmi (Ch.18), Ritwika Basu (Ch.18), Halvard Buhaug (Ch.16), Edwin Castellanos (Ch.12), David Dodman (Ch.6), Francois Gemenne (Ch.8), Felix Kalaba (Ch.9), Rupa Mukerji (Ch.18), Norma Patricia Muñoz Sevilla, Vishnu Pandi, Karishma Patel (Ch.1), Chandni Singh (Ch.10), Philip Thornton, Christopher Trisos (Ch.9), Olivia Warrick (Ch.15), Sumaya Zakieldeen (Ch.9)

Migration is a universal strategy for pursuing wellbeing and livelihoods, as well as managing household risks to economic uncertainty, political instability and environmental change and can, in some instances, occur as a response to or in preparation for climate change impacts (*high agreement, robust evidence*). The IPCC glossary adopts the International Organization for Migration's (2018) definition of migration as being:

The movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification.

Climatic events and conditions interact with economic, social, political and demographic processes to shape migration flows within and between countries, with climate change always one of many influences although the strength of that influence varies (Black et al. 2011). Confidence statements about migration in the AR5 included observations that "mobility is a widely used strategy to maintain livelihoods in response to social and environmental changes (*high agreement, medium evidence*)." This conclusion supports the view of migration as an adaptive strategy that enhances people's capacity to adjust to increasing climate risk. At the same time, the AR5 recognized that "climate change will have impacts on forms of migration that compromise human wellbeing (*high agreement, medium evidence*)," suggesting there are limits to adaptation measures that can be taken in situ, and at such limits, climate hazards can force migration decisions that people may not otherwise take (WGII AR5 Chapter 12). Due to the combination of underlying drivers, climate-related migration outcomes are context specific: that is, in one situation, a given climate risk may lead to increased rates of migration, and in another, it may lower them (Cattaneo et al. 2019; Nawrotzki & DeWaard 2018). The long-term development context in which adaptation interventions occur – and the resulting adaptation options available to households and communities exposed to climatic risks – have determining effects on migration resulting from climate change impacts in both sending and receiving communities (Benveniste et al. 2020; Wrathall et al. 2019).

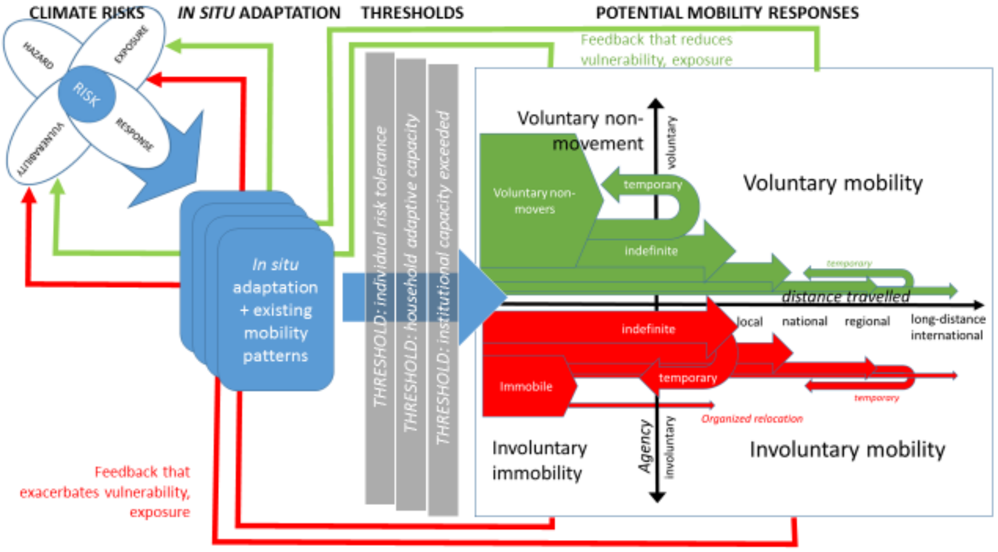


Figure CCB MIGRATE.1: Migration and (im)mobility responses to climatic risks. From McLeman et al 2020 submitted)

Figure CCB MIGRATE.1 depicts the range of migration and (im) mobility responses to climate risk (see supporting evidence in Table CCB MIGRATE.1). Migration and mobility-based adaptations begin to emerge once a context-specific threshold is reached where *in situ* adaptation is inadequate which might include such circumstances as the exhaustion of a household's assets or ability to access sufficient food, where assistance from governments or higher level actors is wanting, or where individuals perceive the risks as being no longer bearable (McLeman 2018). This is consistent with a large body of peer-reviewed scholarship that indicates that significant changes to migration participation and patterns typically emerge only after less disruptive forms of adaptation have proven inadequate (Adger et al. 2018). Migration outcomes may then be described in terms of two axes: 1) the agency or voluntarity of the act of migration, and 2) the distance of the destination and the duration.

The diversity of forms of migration is represented by the arrows that emerge in the mobility adaptation space on the right side of the diagram (see Table CCB MIGRATE.1), with red shadings suggesting involuntary or low-agency decisions (such as displacements due to housing damage caused by extreme storms) and green arrows reflecting decisions where the migrant has greater agency over the timing, duration and/or destination of migration. Where arrows bend back, this represents indefinite migration of a temporary nature that is followed by a return to the community of origin. It is also possible to suggest the relative volume of the likely migration from any given place of origin using the thickness of the arrows, reflecting evidence that most people experiencing climatic impacts are unable or prefer not to move, with the greatest number of movers being those that travel relatively short distances (usually within their local region, and home country) and with short durations in mind (Gentle & Thwaites 2016; Liechti & Biber 2016). Conversely, long-distance international migration for indefinite periods typically represents the smallest proportion of migration outcomes in most observed climate-related migration events (Nawrotzki et al 2015).

Migration decisions and outcomes have a feedback effect on the conditions of exposure and vulnerability in the sending communities, and may amplify or moderate the risks associated with specific hazards; these are represented by green and red arrows that run back to the risk propeller.

Table CCB MIGRATE.1 presents evidence supporting the typology of migration and mobility shown in Figure CCB MIGRATE.1. Most migration, including climate-related migration, is internal (i.e. occurs within countries) and is short-distance (*high agreement, robust evidence*). When international, it is greatest between contiguous states and between states that have labour-migration agreements and/or longstanding cultural ties (Abel and Sander 2014). The political, legal, cultural and socioeconomic conditions under which migration occurs are important determinants of success, as measured by the economic, social and cultural benefits gained by the migrant, the destination community and the sending community. The more agency migrants have that is, the degree of freedom an individual or household has when deciding whether to migrate (or not), where to migrate, and the timing and duration of migration the more likely the outcomes will be successful (*high agreement, robust evidence*). Generally, migrants acting with higher agency have greater potential to return benefits such as remittances and other social and economic assets to make the sending community more resilient (Karanja Ng'ang'a et al. 2016). Conversely, involuntary or low-agency migration such as that of refugees and displaced persons, is associated with poor outcomes in terms of health, wellbeing and socio-economic security for migrants, and returns fewer benefits to sending or receiving communities (*high agreement, robust evidence*) (Antwi-Agyei et al. 2018; Jacobson 2019). Involuntary immobility may amplify exposure to climatic risks, and such extremely vulnerable people want or need to move out of especially hazardous locales as they experience accumulating losses, but are increasingly unable to do so (Adams & Kay 2019). Migrant agency is limited by such factors as financial resources available to the migrant, individual characteristics, such as education and skills that may enable them to absorb costs and leverage benefits of migration, as well as social networks, labour markets, and government regulations on mobility and movement.

Together the diagram (Figure CCB MIGRATE.1) and its accompanying typology (Table CCB MIGRATE.1) provide a basis for unifying the terminology and models of the IPCC around risk with important concepts related to environmental migration. Additionally, this diagram is useful for examining scenarios for communities passing through many iterations of climate impact and migration. Regular patterns may emerge. For example, for high risk communities (in red), the proportion of the population that is involuntarily immobile may increase through several iterations. Policy measures, such as community relocation, may be necessary to arrest such feedbacks. Likewise, cycles of adaptive migration (green) may work to establish translocal social networks, and build community resilience (Sakdapolrak et al. 2016).

Table CCB MIGRATE.1: Typology of climate-related migration and examples in AR6

Type of climate-related mobility	Characteristics	Recent/current examples	Climate-related examples in literature	References in the AR6 (Chapter, Page, Line)
Temporary and/or seasonal migration	Frequently used as a risk-reduction strategy by rural households in less-developed regions with highly seasonal precipitation. Includes transhumance	Pastoralists in sub-Saharan Africa; seasonal farm workers in South Asia; rural-urban labour migration in Central America	Afifi et al 2016, Call et al 2017; Piguet et al 2018; Borderon et al 2019; Cattaneo et al 2019; Hoffmann et al 2020; de Leeuw et al. 2019; López-i-Gelats 2015	Chapter 5.5.1.1, Section 5.5.3.5 Chapter 8.2.1.3
Indefinite or permanent migration	Less common than temporary or seasonal migration, particularly when the whole household permanently relocates.	Examples in all regions	See reviews listed in cell above	Chapter 8.2.1.3
Internal migration (i.e. within state borders)	Most common form of climate-related migration, most often rural-urban in direction	Numerous examples in all regions	Kibet et al. 2016; Bruyere et al. 2018	Chapter 5.5.4, 5.10.1.1; Chapter 9, Section 9.7.2; 9.11-Box 9.9
International migration	Less common than internal migration; most often occurs between contiguous countries within the same region; often undertaken for purpose of earning wages to remit home	Pacific Island states to Australia, New Zealand or USA; Central America to the USA	Veronis et al 2018; McLeman 2019; Falco et al. 2019	Chapter 5.12.2
Rural-urban or rural-rural (typically internal, less	The most common directions of climate-related migration; may be	Drought migration in Mexico, East Africa;	Adger et al 2015; Gautier et al 2016; Nawrotzki	Chapter 5.13.3 Chapter 6 Chapter 8.2.1.3

frequently between contiguous states)	for temporary or indefinite periods; migrant may be an individual household members or the entire household; may be followed by remittances		et al 2017; Wiederkehr et al 2018; Robalino et al. 2015; Paprocki 2018	Chapter 14
Involuntary displacement	Households are forced to leave homes for temporary or indefinite period; typically occurs as a result of extreme events and starts with seemingly temporary evacuation	Hurricane Katrina, Louisiana, USA; Hurricane Maria, Puerto Rico; Cyclone Aila, Bay of Bengal; Yangtze River floods, China	Marino & Lazrus 2015; Islam and Shamsuddoha 2017; see IDMC (2020) for annual global statistics	Chapter 7; Chapter 9, Section 9.7.2; Section 10.3; Chapter 14
Planned/organized resettlement	Initiated in areas where settlements become permanently uninhabitable; requires assistance from governments/institutions. Government-sponsored sedentarisation of pastoral populations	Shishmarref, Kivalina, Alaska, USA; Carteret Islands, Papua New Guinea; coastal settlements, Fiji	Hino et al 2017; McNamara et al 2018; McMichael & Katonivualiku 2020; Vermeulen et al. 2018	Chapter 5.14; Chapter 14
Immobility	Adverse weather or climatic conditions warrant moving, but households are unable to relocate because of lack of resources, or choose to remain because of strong social, economic or cultural attachments to place		Adams 2016; Zickgraf 2018; Nawrotzki & DeWaard 2018; Farbotko et al 2020	Chapter 8. Box 8.1

Future climate risk and migration: Reasons for Concern and potential migration outcomes

Predicting future migration outcomes around climate hazards is vexed by the multiple contextual drivers of migration (Black et al. 2011), including the policies that influence outcomes (Wrathall et al. 2019). However the Reasons for Concern (RFC) are a useful organising framework for aggregating the key risks of climate change into five broad categories according to future rates of warming (O'Neil, 2017) (Figure CCB MIGRATE.2 below). Future flows of migration within and between countries are likely to respond strongly to particular combinations of climatic hazards, and may present challenges for future adaptation policies and programs at national and global scales. In fragile, unique and sensitive ecosystems (RFC 1) in many low- and middle income countries, migration is already a commonly observed form of livelihood adaptation, especially among rural, resource-dependent, and Indigenous populations (e.g. Robson et al 2018, Ahmed et al 2019). Future disruptions to such environments due to climate change, such as increased desertification, damage to coral reefs, coastal erosion, and biodiversity loss, can be expected to disrupt livelihood practices, stimulate higher rates of outmigration to urban centres, and in some instances necessitate planned or organized relocations of exposed settlements (McNamara et al. 2015; Arnall 2019). Likewise Indigenous communities in the Arctic who have persisted for generations on areas at risk due to permafrost melt and sea-level rise represent a uniquely threatened group (Marino & Lazrus 2015).

Extreme weather events (RFC2) are the most identifiable climatic drivers of migration; in 2019, an estimated 24.9 million people were displaced globally by weather related disasters. Responses to extreme weather events can range from short-term evacuation and displacement, to organized resettlement within the original community, to indefinite displacement and long-term migration. The outcomes in such cases depend on the severity and rate of onset of the weather event and the extent of damages caused to housing, livelihood assets, and built infrastructure. Future displacement due to extreme weather is expected to increase with changes in the frequency and severity of such events, and is amplified by growing population densities in highly exposed areas. The problem of displacement is treated in depth in Chapter 7 of this report.

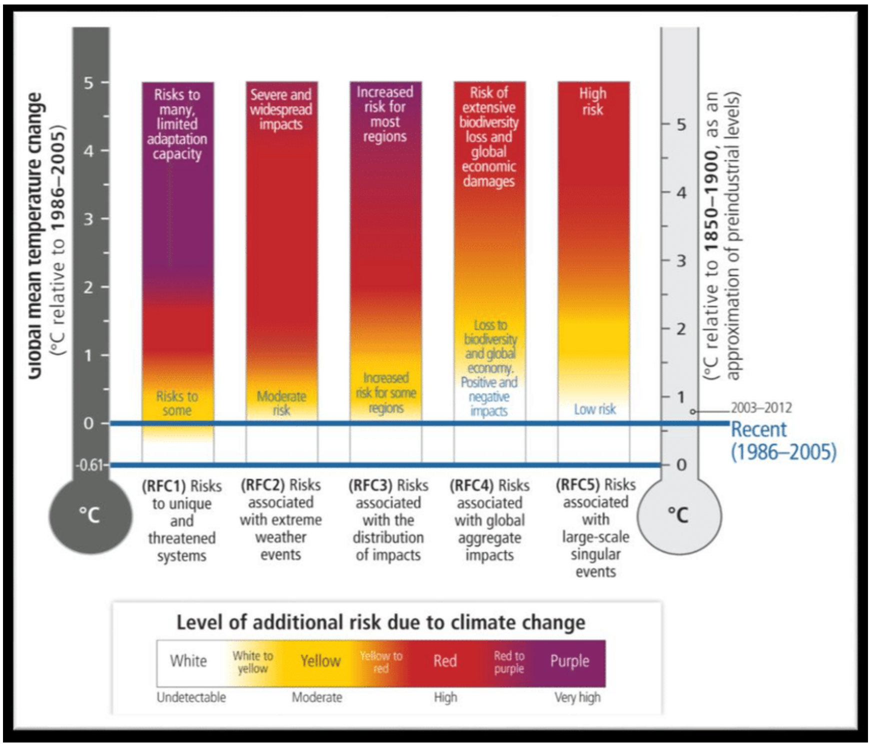


Figure CCB MIGRATE.2: Reasons for Concern

The distribution of the adverse impacts of climate change (RFC 3) is expected to be unequal within and between countries, with groups that have been historically socio-economically marginalized expected to have greater exposure and less capacity to adapt to climatic risks. The intersection of poverty, migration and climate risk is treated in depth in Chapter 8 of this report (Chapter 8.2.1.3). The relationship between climate change, livelihoods of the poor and migration is a key risk identified in the literature. In circumstances of prolonged drought, for example, acute pressure from temperature extremes and chronic pressure from increasingly variable rainfall can result in successive years of agricultural losses, requiring households to find alternative livelihood strategies, including migration (Chen & Mueller 2018; Bohra-Mishra et al. 2014). However, such groups often also have limited agency in terms of destination choices and mobility, or may be entirely immobile (Nawrotzki & DeWard 2018).

Global aggregate impacts (RFC 4), especially sea-level change and desertification, have the potential to magnify existing climatic and non-climatic migration drivers. Estimates of the number of people living in settlements exposed to sea-level rise range from 88 million to 1.4 billion depending on the elevation criteria and SLR scenario used (Hauer et al, 2019), whilst an estimated 1.3 billion people currently live in areas experiencing land degradation (IPCC SROCC Land 2019). Climate change-driven changes in SLR and desertification present direct threats to the viability of highly exposed settlements and, on an indirect basis, to household well-being through disruptions to food systems, and are likely to stimulate increased rates of low-agency migration and need for planned relocations under high RCP scenarios.

Large scale singular events (RFC 5), such as rapid loss of Antarctic and/or Greenland ice sheets that trigger a rapid increase in mean sea level, would have high probability of generating large scale low-agency migration and/or involuntary displacement at sub-national, national and regional scales. There are few recent analogous examples to draw upon; the closest example referred to in AR6 is the 1930s "Dust Bowl" on the North American Great Plains, when multi-year droughts coincided with the Great Depression and triggered the migration of hundreds of thousands of people in a short period (see North America chapter this report.). Examples of possible future risks of this type other than sea level rise could include rapid warming of the Arctic that would necessitate relocation of large numbers of settlements and infrastructure (Chapter link); and rises in average temperatures in tropical and sub-tropical regions that lead to widespread, repeated extreme heat events beyond humans' physical tolerance (Xu et al 2020).

Policy implications

There is widespread concern among policymakers and researchers that low-agency migration rates will rise in coming decades due to the impacts of climate change, particularly increases in the frequency and/or severity of floods, tropical cyclones, droughts and other extreme events, with sea level rise presenting additional risks for settlements in low-elevation coastal zones and on small islands. Global and regional projections of future climate-related migration rates and flows are currently limited in number and scope, and contain wide variations that reflect uncertainties regarding future trends in GHG emissions, underlying problems with availability of reliable migration data and definitional uncertainty in distinguishing climate-related migration from other forms of migration. An ancillary concern is the potential growth of *immobile* populations in locations highly exposed to climate hazards – people who are entirely unable to migrate or reluctant to do so for reasons of socio-economic ties or cultural attachment (Adams 2016, Nawrotzki & DeWaard 2018).

Research is increasingly focused on the determining role of governance and policy interventions in expanding agency of both migrants and their host communities now and in the future (Wrathall et al, 2019). When migration is managed to allow regularized and safe movement within and between countries, it contributes positively to the economic and social wellbeing of sending and receiving communities and of migrants' households. Since AR5, the basic framework and instruments have been established to guide future international policymaking for orderly and migration in a changing climate in a changing climate. Migration and mobility are strongly embedded in the Sustainable Development Goals, as is the ambition to build greater adaptive capacity to meet the risks associated with climate change. Under the Paris Agreement, a task force began work to find ways that signatories might "to avert, minimize and address displacement related to the adverse impacts of climate change". The UN Global Compact for Safe, Orderly and Regular Migration a voluntary agreement launched in 2018 contains among its objectives recommendations for managing migration and displacement caused by climate change. Progress remains to be made in terms of the successful implementation and achievement of the stated goals of these agreements.

As climate change hazards manifest with increasing severity and/or frequency, multiple, simultaneous forms of climate-related migration should be expected to occur with greater frequency. At incipient stages of RFCs shown above, early migration flows may include those most mobile and able to benefit from migration, such as young, skilled workers; as RFCs intensify, temporary migration may become increasingly permanent or migration of individual household members supplanted by relocations of entire households. Populations remaining in highly exposed locations would increasingly consist of immobile, vulnerable people that require institutional assistance to relocate. To accommodate immobile populations, governments may need to invest resources building protective infrastructure for densely populated coastal settlements and financing the relocation of others that must be abandoned. Such worst-case scenarios are likely to manifest in futures where the international community takes no action to control GHG emissions, fails to achieve the SDGs, and imposes further constraints on safe and orderly migration. However, with adequate policy support, migration in the context of climate change can result in synergies for both adaptation and development.

[END CROSS-CHAPTER BOX MIGRATE HERE]

The diversity of potential migration responses to climate risks reflects the varying impacts of particular climatic drivers and the wide range of social, economic, cultural and political contexts in which migration and adaptation decisions are made (high confidence). The diversity in drivers, contexts and outcomes make it difficult to offer simple generalizations about the relationship between climate change and migration. The characteristics of climatic drivers vary in terms of their rate of onset, intensity, duration, spatial extent, and severity of damage caused to due housing, infrastructure, and livelihoods, and potential migration responses to these are mediated by cultural, demographic, economic, political, social, and other non-climatic factors operating across multiple scales (Neumann et al 2015, McLeman 2017, Barnett and McMichael 2018, Cattaneo et al 2019).

Climate-related migration outcomes display high variability in terms of migrant success, often reflecting pre-existing socio-economic conditions and household wealth (high confidence). The decision to migrate or remain in place when confronted by climatic hazards is strongly influenced by range and accessibility of alternative, *in situ* (i.e. non-migration) adaptation options that may be less costly or disruptive (Cattaneo et al 2019). Migration decisions (whether climate-related or not) are typically made at the individual or household level, and are influenced by a household's perceptions of risk, social networks, wealth, age structure, health, and livelihood choices (Koubi et al 2016a, Gemenne and Blocher 2017). Households with greater financial resources and higher levels of educational attainment have greater capacity to adapt *in situ* (Cattaneo and Massetti 2019, Ocello et al 2015) but, if required or desirable, are also better able to migrate, and with greater agency (Kubik & Maurel 2016, Koubi et al 2016a, Riosmena et al 2018; Adams & Kay, 2019). By contrast, poor households with limited physical, social and financial resources have less capacity to adapt *in situ*, and are limited in their migration options by insufficient financial and social capital (Nawrotzki and DeWaard 2018, Suckall et al 2017, Zickgraf et al 2016). Thus, when poorer households do migrate, it is often in reaction to lost income or livelihood due to an extreme climate event (Mallick et al 2017), takes the form of distress migration (Bhatta et al, 2016) and perpetuates conditions of precarity (Natarajan et al 2019). For example, a study conducted in poorer neighbourhoods in Dhaka found that migrants who moved there following extreme events in their home community were poorer, and remained poorer and more vulnerable, than migrants who came for other reasons (Adri and Simon 2018). Perceptions of residents of recipient communities are important for determining the success of migrant integration, with research from Kenya and Vietnam suggesting urbanites generally perceive climate hazards as being legitimate reasons for migration (Spilker et al 2020).

Climate-related migration most often originates in rural areas in low- and middle-income countries, with migrant destinations most usually being other rural areas or to urban centres within their home countries (i.e. internal migration) (medium confidence). Rural livelihoods and incomes, because they tend to be based on farming, keeping of livestock and/or natural resource collection, are sensitive to climate variability and change, creating greater potential for migration as an adaptive response (Bohra-Mishra et al 2017, Viswanathan and Kumar 2015). In recent decades, droughts have generated higher rates of rural to urban migration within Mexico (Chort and de la Rupelle 2016, Leyk et al 2017, Nawrotzki et al 2017) and within Senegal (Nawrotzki and Bakhtsiyarava 2017). Extreme temperatures are associated with higher rates of temporary rural out-migration in South Africa and in Bangladesh (Mastrorillo et al 2016, Call et al 2017). In rural Tanzania, weather-related shocks to crop production increase the likelihood of migration, but typically only for households in the middle of the community wealth distribution (Kubik and Maurel 2016). Weather-related losses in rice production are associated with small-percentage increases in internal migration in India (Viswanathan and Kumar 2015) and the Philippines (Bohra-Mishra et al 2017). In East Africa, temporary rural-urban labour migration does not show a strong response to climatic drivers (Mueller et al 2020). There is a growing literature on mobility as adaptation to climate change in urban populations, with a focus on resettlement of flood-prone informal settlements within cities (Kita, 2017; Tadgell et al, 2017).

Most documented examples of international climate-related migration are intra-regional movements of people between countries that share a border (*high agreement, medium evidence*). Systematic reviews find few documented examples of long-distance, inter-regional migration driven by climate events (Veronis et al 2018, Kaczan and Orgill-Meyer 2019, Hoffmann et al 2020). One macro-economic analysis suggests a strong correlation between migrant flows from low- to high-income countries and adverse climatic events in the source country (Coniglio and Pesce 2015), but contrary evidence is found in India, where long-distance international migration increases during favourable weather conditions and declines in response to adverse weather conditions (Sedova and Kalkuhl 2020). Small-sample studies of migrants to Canada from Bangladesh, Haiti, and sub-Saharan Africa suggest environmental factors in the source country can be a primary or secondary motivation for some migrants within larger flows of economic and family-reunification migrants (Veronis and McLeman 2014, Mezdour et al 2015, McLeman et al 2017). A recent study suggesting that asylum applications in Europe increase during climate fluctuations, due to interactions with conflict (Missirian and Schlenker, 2017) is contested by multiple other authors. Despite media reports in recent years that climate change has driven large numbers of migrants to the US from Central America and to Europe from the Middle East and Africa, there is no evidence in the assessable literature to substantiate this.

7.2.6.1 Relative importance of specific climatic drivers of migration

Reliable global estimates of climate-related migration are unavailable due to the complexity of relationship between climate and migration, the multidimensional drivers of migration outcomes, and low capacity of many countries to measure internal population movements. Data collected annually since 2008 on internal displacements attributed to extreme weather events by the Internal Displacement Monitoring Centre (IDMC) provide a partial view of climate-related population movements and indicate that extreme storms and floods are the two most significant weather-related drivers of population displacements globally. On a year-to-year basis, weather-related displacements vary considerably. In 2019 (the most recent year at time of writing), the most significant global weather-related drivers of displacement were extreme storms (13 million people), floods (10 million people), wildfires (528,500 people), and droughts (276,700 people) (IDMC 2020). The data indicate weather-related displacement events occur primarily in East, Southeast, and South Asia; sub-Saharan Africa; the US; and the Caribbean region. These data are only loosely indicative of actual global flows of climate-related migration, given that they likely underestimate the actual number of people displaced by climate events more generally, do not take into account slower onset climate events, and do not measure migration between countries or non-displacement climate-related migration within countries.

Tropical cyclones and extreme storms are a particularly significant displacement risk in East and Southeast Asia, the Caribbean region, the Bay of Bengal region, and southeast Africa (IDMC 2020) (high confidence). The scale of displacement from any given storm and potential for subsequent migration depend heavily on the extent of damage to housing and livelihood assets, and the responsive capacity of governments and humanitarian relief agencies (Saha 2016, Islam et al 2018, Mahajan and Yang 2020, Spencer et al 2018). In Bangladesh, the rural poor are most often displaced, with initial increases in short-term, labour-seeking migration followed by more permanent migration by some groups (Saha 2016, Islam and Hasan 2016, Islam and Shamsuddoha 2017). Past hurricanes in the Caribbean basin have generated internal and interstate migration within the region, typically along pre-existing social networks, and to the US (Loebach 2016, Chort and de la Rupelle 2016). Hurricane Maria was followed by the migration of tens of thousands of Puerto Ricans to Florida and New York (Echenique and Melgar 2018). In the United States, coastal counties experience increased out-migration after hurricanes, flowing along social networks to predictable destinations (Hauer, 2017), with post-disaster reconstruction employment opportunities potentially attracting new labour migrants to disaster areas (Ouattara and Strobl 2014, Curtis et al 2015, DeWaard et al 2016, Fussell 2018).

Flood displacement can lead to increases or decreases in temporary or short-distance migration flows, depending on the local context (Robalino et al 2015, Ocello et al 2015, Afifi et al 2016, Koubi et al 2016a) (medium confidence). Floods are a particularly important driver of displacement in river valleys and deltas in Asia and sub-Saharan Africa, although large flood-related displacements have been recorded by IDMC in all regions. In areas where flooding is especially frequent, *in situ* adaptations may be more common, and out-migration may temporarily decline after a flood (Afifi et al 2016, Chen et al 2017, Call et al 2017). Rates of indefinite or permanent migration tend not to change following riverine floods unless damage to homes and livelihood assets is especially severe and widespread, with household perceptions of short- and longer term risks playing an important role (Koubi et al 2016b).

Migration and displacements due to droughts, extreme heat, and associated impacts on food and water security are most frequent in East Africa and, to a lesser extent, South Asia, and West and Southern Africa (IDMC 2020). Because droughts unfold progressively and typically do not cause permanent damage to housing or livelihood assets, there is greater opportunity for government and NGO interventions, and greater use of *in situ* adaptation options (Cattaneo et al 2019). Drought-related migration is most common in dryland rural areas of low-income countries, where changes in migration occur only after a threshold is crossed and *in situ* adaptation options are exhausted (Gautier et al 2016, Wiederkehr et al 2018, McLeman 2017). For example, multi-level modelling shows that in Mexico, above-average temperatures do not have an influence on migration until a threshold of ~34 heat months is surpassed, after which rural-urban migration ensues and accelerates with each passing month (Nawrotzki et al 2017). The most common migration response is an increase in short-distance, rural-urban migration, with examples being documented in Bangladesh, Pakistan, sub-Saharan Africa, Latin America and Brazil (Neumann et al 2015, Gautier et al 2016, Mastrorillo et al 2016, Baez et al 2017, Call et al 2017, Nawrotzki et al 2017, Jessoe et al 2018, Carrico and Donato 2019). During recent droughts in northern Ethiopia, an estimated 40% of rural households adapted through migration (Hermans and Garbe 2019).

7.2.6.2 Immobility and resettlement in the context of climatic risk

Immobility as an adaptive strategy under increasing climate risk, can reflect both vulnerability and lack of agency, and a deliberate choice made by place-attached people living in exposed locations (high agreement, *medium evidence)*. Research on immobility under climate change has expanded since AR5 and shows that immobility is not only associated with financial barriers to migration (Nawrotzki & DeWaard 2018), but can also reflect a voluntary decision to stay, when people exposed to climate hazard prioritize their attachments to place, culture and people (Adams, 2016, Farbotko & McMichael, 2019, Zickgraf 2019, Neef 2018). These choices are reflected on a continuum from those who are physically or financially unable to leave to those who elect to stay despite experiencing loss or harm (Suckall et al 2017, Ayeb-Karlsson et al, 2018, Zickgraf 2018; Mallick & Schanze 2020). Involuntary immobility is associated with individuals and households with low adaptive capacity and high exposure to hazard and can therefore exacerbate inequality and future vulnerability to climate change (Fussel, 2015; Sheller, 2018), including through impacts on health (Schwerdtle et al, 2018). Voluntary mobility represents an assertion of the importance of culture, livelihood and people to well-being, which can intersect with political marginalization in indigenous groups (Suliman et al 2019).

Planned relocation of communities exposed to climatic risks are contentious, expensive, and can undermine the well-being of those involved. Ajibade et al (2020) outline the ways in which managed retreat differs from climate-related migration, highlighting the more direct causal mechanism, different rights regimes and funding source and different consequences for land, among other discursive differences. Ajibade et al (2020) crucially highlight that managed retreat involves the movement of people, infrastructure, assets as well as ecosystems. There is (*high agreement, medium evidence)* that successful climate-related resettlement requires agency and engagement of the affected populations prior to movement and measures that improve livelihoods (Tadgell et al 2017; Piggott-McKellar et al 2019; Miller, 2020). The literature on resettlement and planned relocation since AR5 draws predominantly on examples of planned or implemented resettlement from coastal areas in the context of increased coastal hazards related to increased storminess and sea level rise, including in particular, island nations such as Fiji or the Maldives (e.g. Azfa et al 2020), and low lying coastal cities (e.g. such as See & Wilmsen 2020). A large evidence base coming from relocations of coastal villages in Fiji suggests that relocated people can experience significant financial and emotional distress as cultural and spiritual bonds to place and livelihoods are disrupted and that adaptation preferences have to embedded in local social institutions (Keef et al 2018; McMichael and Katonivualiku 2020, Farbotko et al 2018, Piggott-McKellar et al 2019, Bertana 2020). There is a growing body of evidence on the environmental justice concerns on relocation of populations within urban areas, from hazard-exposed informal settlements.

[START BOX 7.4 HERE]

Box 7.4: Gender Dimensions of Climate-related Migration

Migration decision-making and outcomes – in both general terms and in response to climatic risks – are strongly mediated by gender, social context, power dynamics, and human capital (Bhagat 2017, Singh & Basu 2019, Rao et al 2019b, Ravera et al 2016). Women suffer disproportionately from the negative impacts of climate events for reasons ranging from caregiving responsibilities to lack of control over household resources to cultural norms for attire (i.e. saris in South Asia) (Belay et al 2017, Jost et al 2016). In many cultures, migrants are most often able-bodied, young men, (Call et al 2017, Heaney and Winter 2016). Women wait longer to migrate because of higher social costs and risks (Evertsen & van der Geest 2019) and barriers such as social structures, cultural practices, lack of education, and reproductive roles (Belay et al 2017, Afriyie et al 2018, Evertsen & van der Geest 2019).

Various authors have critiqued the tendency to portray women as victims, rather than recognizing differences between women and the potential for women to use their agency and informal networks to negotiate their situations (Eriksen et al 2015, Guyo 2017, Ngigi et al 2017, Pollard et al 2015, Rao 2019, Ravera et al 2016). Migration changes household composition and structure, which in turn affect the adaptive capacity and choices of the households (Rao et al 2019a, Rao et al 2019b, Singh 2019a). Migration of male household members generates female headed households (Goodrich et al 2019a, Rao et al 2019b, Rigg and Salamanca 2015), leading to increased workload and greater vulnerability for those left behind (Arora et al 2017, Bhagat 2017, Flatø et al 2017, Lawson et al 2019, Singh 2019b). It can, however, also increase women's economic freedom anddecision capacity and enhance their agency (Djoudi et al 2016, Rao 2019) and alter the gendered division of paid work and care and intra-household relations (Rigg et al 2018, Singh and Basu 2019).

[END BOX 7.4 HERE]

7.2.7 Observed Impacts of Climate on Conflict

Conflict was addressed in AR5 in Chapter 12 on Human Security, which concluded that violent conflict increases the vulnerability of regions to climate change by undermining adaptive capacity and increasing vulnerability, and that climate change will worsen poverty and structural conditions that magnify the potential for violent conflict, as well as changing the geopolitical landscape. The chapter distinguished between armed conflict (Section 12.5) and state integrity and geopolitical rivalry (Section 12.6). Armed conflicts are defined as conflicts involving greater than 25 battle-related deaths in a year, which is consistent with the Uppsala Conflict Data Program's (UCDP) threshold for inclusion in their database, a core resource in this field. The chapter covered conflicts, intrastate conflicts that involve governments, non-state conflicts in which governments are not directly involved, and one-sided conflicts involving organized violence against civilians. Similar to AR5, this chapter separates violent conflict from non-violent conflict and geopolitical tension, but consider different forms of armed conflict together. Consistent with AR5 findings, there continues to be little observed evidence that climatic variability or change cause inter-state conflicts (Koubi et al, 2019). Most post-AR5 literature focuses on the role of climate change as a ‘risk multiplier’ in conflict settings – that is, one of many factors that interact to raise tensions – and on understanding the causal mechanisms (Mach et al 2019, Ide et al, 2020).

Climate variability is associated with changes in the nature, duration and characteristics of violent conflict, rather than with its onset (high confidence). Experts in the field conclude that climatic conditions have affected organized armed conflict within countries, but its influence is small compared to low socioeconomic development and low state capacity (Mach et al 2019). Causal mechanisms are generally based on the greed or grievance model of conflict, which argues that inter-group inequality, and consequent relative deprivation leads to conflict, and climate change leads to a falling opportunity cost of conflict. Ethnic diversity and income inequality have been used as proxies (e.g. ethnic fractualisation; Schleussner et al, 2016) with other work observing links between relative deprivation and conflict, political exclusion, ethnic grievances, and the means by which an individual’s reduction in quality of life translates to group mobilization (Theisen, 2017; Buhaug et al, 2020). A global study by Ide et al (2020) estimates that a third of conflict onsets were preceded by a disaster that provided opportunity for armed groups to mobilize and seize assets.

The relationship between climate variability and change and conflict varies due to diversity in the characteristics of the climate impact; the conflict and the actors within that conflict; as well as the socio-economic, political and cultural context (high agreement, medium evidence). Potential causal pathways can include climatic influences can include direct physiological impacts of heat/resource scarcity, and indirect links through impacts on economic output, agricultural incomes, raising food prices, increasing migration flows, and unintended effects of climate mitigation and adaptation policies (Koubi 2019, Busby 2018, Sawas et al (2018). Most research relies on relative deprivation theory and the falling opportunity cost of violence as being the underlying mechanism that pushes groups down such pathways (Buhaug et al 2020; Vestby 2019).

Increases in food price due to reduced agricultural production are associated with conflict risk and represent a key causal mechanism linking climate variability and conflict (medium agreement, limited evidence). Rises in food prices are associated with civil in urban areas among populations unable to afford or produce their own food, and in rural populations due to changes in availability of agricultural jobs related to shifting commodity prices (Martin-Shields & Stojetz 2019). Under such conditions, locally-specific grievances, hunger, and social inequalities can initiate or exacerbate conflicts. Food price volatility in general is not associated with violence, but sudden food price hikes have been linked to social unrest in some circumstances (Bellemare 2015, McGuirk & Burke, 2017; Winne and Peersman, 2019). In Indonesia, Caruso et al (2016) found an association between rises in minimum temperature, reduced rice yields and violence.

Temperature variability, particularly large deviations from expected norms, has been associated with collective violence in certain settings (medium agreement, low evidence). Existing evidence includes studies that consider how heat may be associated with a violent loss of individual self-control (Van Lange et al,

2017) and studies that examine the role of temperature versus political and social predictors of violence (e.g. Owain and Maslin, 2018). However, most of this research has been done in a small number of conflict-prone areas, and is thus sensitive to potential bias and streetlight effect (Adams et al 2018).

Variation in availability of water has also been associated with international non-violent conflict and intra-national collective violence (low agreement, medium evidence). Reductions in precipitation causing drought conditions have been associated with violence due to impacts on income and food security, with studies focusing predominantly on sub-Saharan Africa and the Middle East (Ide & Frohlich, 2015; De Juan 2015; von Uexkull et al, 2016; Waha et al 2017, Abbott et al, 2017; D'Odorico et al 2018) [See also Chapter 5 this report]. A small set of published studies has argued inconclusively over the role of drought in causing the Syrian civil war (Gleick, 2014; Kelley et al., 2015; Selby et al., 2017) (see box 16.x). However, research stresses the underlying economic, social and political drivers of conflict. For example, research on conflict in the Lake Chad region has demonstrated that the factors leading to conflict are multiple and the lake drying was only one of many issues (Okpara et al 2016; Nagarajan et al, 2018; Tayimlong, 2020). Rather, research shows that insecure land tenure and conflicting land uses interacting with market-driven pressures and existing ethnic divisions produce conflict over land resources, rather than scarcity of natural resources caused by drought (high agreement, medium evidence) (Theisen 2017; Selby & Hoffman 2014, Balestri and Maggioni 2017, Kuusaanaa & Bukari 2015).

Climate-related migration is associated with experience of violence by migrants and the prolongation of conflicts in host areas (medium agreement, low evidence). Research points to the potential for conflict to serve as an intervening factor between climate and migration. Displaced people and migrants may be associated with heightened social tensions through mechanisms such as ecological degradation, reduced access to services, and a disturbed demographic balance in the host area (Rüegger & Bohnet 2020). Ghimire et al (2015) argue that an influx of flood-displaced people prolonged conflict by causing a lack of access to services by some of the host population and feelings of grievance. Climate-related migrants have reported higher levels of perception, and experience, of violence in their destination (Linke et al 2018; Koubi et al 2018) and higher levels of internal migration have been associated with higher levels of riots depending on the political alignment of the host state with the capital (Bhavnani & Lacina 2015). Migration from drought-stricken areas has been used to suggest a climate trigger for the Syrian conflict, however, this link has been strongly contested by research that contextualizes the drought in wider in political economic approaches and existing migration patterns (DeChatel 2014; Frölich 2016; Selby 2019).[See Box, Chapter 16 on climate change and the Syrian conflict]. However, evidence of international migration creating a national security threat is limited, and associations between migration and security threats are often predicated on unjust racial logics (Frölich 2016; Telford, 2018).

7.2.7.1 Observed impacts on non-violent conflict and geopolitics

Climate adaptation projects implemented without accounting for competing interests and power struggles have the potential to cause conflict (high agreement, medium evidence). Reforestation or forest management programs driven by REDD+, land zoning and managed retreat due to sea level rise have been identified as having the potential to cause friction and conflict within and between groups and communities (de la Vega-Leinert et al, 2017; Froese & Schilling, 2019). Land-based solutions to climate change associated with biofuels and protecting forests for the carbon stored within them tend to be imposed by higher levels of government upon communities, with land acquisitions involuntarily displacing people and/or undermining local livelihoods of people living in those areas, without taking procedural and distributional justice into account (Hunsberger et al 2017). Conflict may arise when there is resistance to a proposed project or where interventions favour one group over another (e.g. Taenzler et al, 2010; Nightingale, 2017; Sovacool, 2015 2018).

There is high agreement, medium evidence that economic and social changes in the Arctic will be managed as part of existing governance structures The opening-up of the Arctic and associated geopolitical maneuvering for access to shipping routes and sub-sea hydrocarbons is often highlighted as a potential source of climate conflict (e.g. Koivurova, 2009; Åtland 2013; Tamnes & Offerdal, 2014). Research leading up to AR5 focused the potential for resource wars, Arctic land grabs. Research since AR5 has moved to a less sensationalist approach to Arctic security, focusing instead on the to the practicalities of polycentric Arctic governance under climate change, the economic impacts and protecting the human security of Arctic populations whose autonomy is at risk (Heininen, & Exner-Pirot, 2020), how different regions (e.g. EU) are positioning themselves more prominently in the Arctic space (Raspotnik & Østhagen, 2009), and Arctic indigenous groups understanding of security (Hossain, 2016) [see also the North America regional chapter, this report].

Structural inequalities play out at an individual level to create gendered experiences of violence (high confidence, medium evidence). Violent conflict is experienced differently by men and women because of gender norms that already exist in society and shape vulnerabilities. For example, conflict deepens gendered vulnerabilities to climate change related to unequal access to land and livelihood opportunities (Chandra et al 2017). Research has found a positive correlation between crop failures and suicides by male farmers who could not adapt their livelihoods to rising temperatures (Bryant & Garnham 2015; Kennedy & King 2014; Carleton 2017). There is (*high agreement and medium evidence)* that adverse climatic conditions are associated with increases in violence against girls and women. During drought and flood, studies have found an increase in domestic violence, as a result of men's use of negative coping mechanisms, such as alcoholism, when unable to meet norms of providing for the household (Anwar et al, 2019; Stork et al, 2015). Further, scarcity of water in the Sahel forces women and girls to walk longer distances to fetch water and fuel, increasing their exposure and risk of harassment and sexual assault (Le Masson, 2019). Changing gender norms as men migrate to find work in post-disaster settings can lead to violent backlash or heightened tensions (Stork et al, 2015). Some researchers have found increased risk of harassment, sexual violence and trafficking risk to women, girls and the LGBTQI (Le Masson et al 2019, Myrttinen et al 2015, Chindarkar 2012). Motivations for intergroup violence may be influenced by constructions of masculinity, for example the responsibility to secure their family's survival, or pay dowries (Myrttinen et al, 2017), and gendered roles may incentivize young men to protest or to join non-state armed groups during periods of adverse climate (Myrttinen et al 2015, 2017, Anwar et al 2019, Hendrix & Haggard 2015, Koren and Baggozi 2017).

7.3 Projected Future Risks Under Climate Change

7.3.1 Projected Future Risks for Health and Wellbeing

7.3.1.1 Global impacts

Climate change is expected to increase significantly the health risks resulting from a range of climate-sensitive diseases and conditions, with the scale of impacts depending on emissions and adaptation pathways pursued in coming decades (very high confidence). Adaptation pathways and options for managing risks are detailed in section 7.4. Sub-sections 7.3.1.2 to 7.3.1.11 assesses available studies on future projections for risks associated with specific climate sensitive diseases and conditions previously described in Section 7.2.1. In the case of diabetes, cancer, injuries, mosquito-borne diseases other than dengue and malaria, and rodent borne diseases, insufficient literature was found to allow for assessment.

Even in the absence of further warming beyond current levels, the proportion of the overall global deaths caused by climate sensitive diseases and conditions would increase marginally by mid-century (high confidence). Global Burden of Disease statistics for climate-sensitive diseases presented in Box 1 have been projected forward to the year 2050 accounting for changes in demographics, fertility, educational attainment, and economics development using standardized methods, but not accounting for any changes in climate forcing (Ji et al. submitted). These projections show that the proportion of climate-sensitive deaths in 2050 increases marginally, with higher rates of cardiovascular and respiratory diseases driving much of the increased burden.

Studies that incorporate climate forcing project an additional 250,000 deaths per year by mid-century due to climate-sensitive diseases and conditions and, under high-emissions scenarios over 9 million additional deaths per year by 2100 (high confidence). Two global projections of climate change health impacts have been conducted since AR5. The first focused on cause-specific mortality for eight different exposures for 2030 and 2050 for a mid-range emissions scenario (A1b) and three different scenarios of economic growth (World Health Organization 2014). The study estimated that by 2050 there would be an excess of approximately 250,000 deaths per year attributable to climate change, dominated by increases in deaths due to heat (94,000), undernutrition (85,000), malaria (33,000), and diarrheal disease (33,000). The second study, which focused on all-cause mortality associated with warming under a high emissions scenario (RCP 8.5) and accounted for population growth, economic development, and adaptation, projected an increase of approximately 85 excess deaths per 100,000 population per year by the end of the century (Carleton et al. 2020), for a total annual excess of 9,250,000 per year based on United Nations population projections (United Nations and Social Affairs 2019). The authors estimate that removing adaptation and projected economic growth increased the estimate by a factor of 2.6.

Temperatures above pre-industrial levels at which risks levels increase for six key climate-sensitive health outcomes highlight the criticality of building adaptive capacity in health systems and in other sectors that influence health and well-being (high confidence). Recently reported research illustrates the temperature thresholds at which the following health risks change under three SSP-based adaptation scenarios: heat-related morbidity and mortality; ozone-related mortality; malaria incidence rates; incidence rates of Dengue and other diseases spread by Aedes sp. mosquitos; Lyme disease; and West Nile fever (Ebi et al submitted). As shown in Figure 7.3, adaptation under all SSPs significantly alters the warming thresholds at which risks accelerate, with an SSP1 adaptation scenario – which emphasizes international cooperation toward achieving sustainable development having the greatest potential to avoid significant increases in risks under all but the highest warming scenarios.

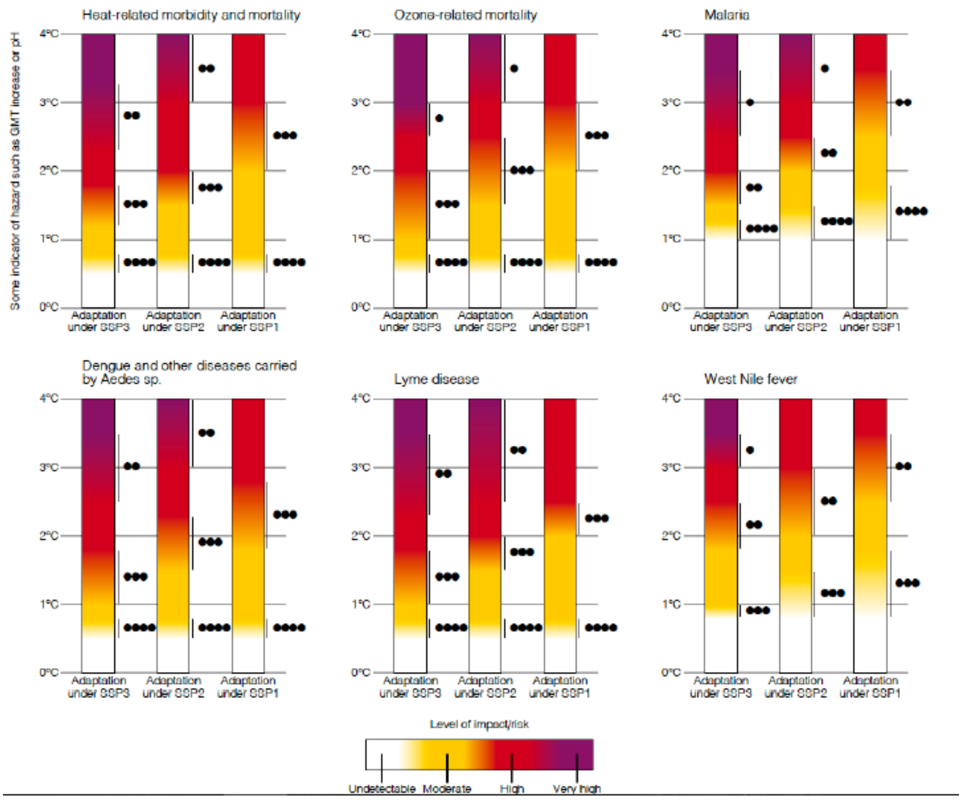


Figure 7.3: Change in risks for six climate-sensitive health outcomes by increases in temperature above pre-industrial levels, under adaptation scenarios

7.3.1.2 *Changes in mortality due to heat and cold*

Higher average temperatures and extreme heat events associated with climate change are expected to lead to increased rates of mortality from a variety of temperature-sensitive diseases and injuries (high confidence). global and regional levels of heat-related mortality will increase under climate change (Ahmadalipour and Moradkhani, 2018, Kendrovski et al., 2017, Limaye et al., 2018, Morefield et al., 2018) even with adaptation (Anderson et al., 2018, Gosling et al., 2017, Guo et al., 2018, Wang et al., 2018). The number of heat-attributable deaths by end of century as compared with 2020 baselines have been projected to increase by 400% under RCP4.5 and by 800% under RCP 8.5, totaling 1.1 million and 2.3 million deaths respectively (Burkart et al. submitted). Many of the most common heat-related causes of death captured in these studies are assessed individually in later sections of this chapter. It is almost certain the impacts for a 2°C increase in global temperatures will be significantly greater than those for the 1.5°C target of the Paris Agreement (Dosio et al., 2018, Ebi et al., 2018, King and Karoly, 2017, Vicedo-Cabrera et al., 2018a), with most increases in heat-related excess mortality expected in tropical and subtropical countries/regions (Guo et al., 2018, Burkart et al submitted).Heat risks are expected to be greater in urban areas due to 'heat island' effects (Heaviside et al., 2016) with local scale variations attributable to land cover contrasts (Macintyre et al., 2018, Schinasi et al., 2018).

The extent to which projected increases in average winter temperatures will reduce cold/winter related health impacts is uncertain. Most studies project that future increases in heat-related deaths will outweigh those related to cold (Aboukari et al., 2020; Huber et al., 2020; Martinez et al., 2018; Mills et al., 2015; Rodrigues et al., 2020; Vardoulakis et al., 2014; Weinberger et al., 2017; 2018; Weitensfelder and Moshammer, 2020) with recent research by Burkart et al (submitted) finding no change in cold-related deaths under RCPs 4.5 or 8.5. Assumptions and methodologies used in model projections of temperature-related excess mortality could conceivably underestimate future levels of cold/winter-related mortality under climate change (Arbuthnott et al., 2018; Ebi, 2015; Kinney, 2018; Liddell et al., 2016; Huber et al., 2017). If winter mortality rates do not decline appreciably under climate change, then the total temperature-related health burden could be higher than expected. More research on this specific topic is warranted.

7.3.1.3 Projected impacts on vector-borne diseases

There is a high likelihood that climate change will contribute to increased distributional range and vectorial capacity of malaria vectors in parts of Sub-Saharan Africa, Asia, and South America (high confidence)(See Figure 7.3.) In Nigeria, the range and abundance of *Anopheles* mosquitoes are projected to increase under higher emissions scenarios (RCP 8.5) due to longer tropical rainfall seasons and rapid land use changes (Akpan et al., 2019). Similarly, vegetation acclimation due to elevated atmospheric CO_2 under climate change will likely increase the abundance of *Anopheles* vectors in Kenya (Le et al 2019). In other areas of East Africa and the highlands, the distribution and intensity of transmission is expected to decrease in areas where temperatures are predicted to exceed the optimal thermal range of the vector (Nkumama et al., 2017; Ryan et al., 2015; Zaitchik, 2019), (Leedale et al., 2016; Murdock, Sternberg, & Thomas, 2016; Yamana, Bomblies, & Eltahir, 2016). Distribution of *Anopheles* may decrease in parts of India and Southeast Asia, but there is an expected increase in vectorial capacity in China and Taiwan (Khormi & Kumar, 2016). In South America, climate change is projected to expand the distributions of malaria vectors to 35-46% of the continent by 2070, particularly component species of the *Albitarsis* Complex (Laporta et al 2015).

Malaria infections of the types Plasmodium vivax and Plasmodium falciparum have significant potential to increase in parts of Sub-Saharan Africa and Asia, with risk varying according to the warming scenario (medium confidence). In Africa, due to the likely expansion of vector distribution and increase in biting rates, climate change is likely to increase the overall transmission of malaria (Bouma et al, 2016; M'Bra et al., 2018; Nkumama, O'Meara, & Osier, 2017; Ryan et al., 2015; Tompkins & Caporaso, 2016). In Sub-Saharan Africa, malaria case incidence associated with dams in malaria-endemic regions will likely be exacerbated by climate change, with significantly higher rates predicted under RCP 8.5 in comparison to lower-emission scenarios (Kibret et al 2016). Incidence of malaria in Madagascar is projected to increase under RCPs 4.5 through 8.5 (Rakotoarison et al., 2018). Distribution of *P. vivax* and *P. falciparum* malaria in China is likely to increase under RCPs higher than 2.6, especially RCP8.5 (Hundessa et al 2018). In India, projected scenarios for the 2030s under RCP 4.5 indicate changes in the spatial distribution of malaria, with new foci and potential outbreaks in the Himalayan region, southern and eastern states, and an overall increase in months suitable for transmission overall, with some other areas experiencing a reduction in transmission months (Sarkar et al 2019).

Rising temperatures are likely to cause polewards shifts and overall expansion in the distribution of mosquitos Aedes aegypti *and* Ae. albopictus*, the principal vectors of dengue (Figure 7.3), yellow fever, chikungunya and zika (high confidence)*. Globally, the population exposed to disease transmission by one or other of these vectors is expected to increase significantly due to the combination of climate change and non-climatic processes including urbanization and socio-economic interconnectivity, with exposure rates rising under higher warming scenarios (Kamal et al, 2018, Kraemer et al, 2019). For examples, approximately 50% of the global population is projected to be exposed to these vectors by 2050 under RCP6.0 (Kraemer et al, 2019). The effect of climate change alone is projected to increase the population exposed to *Ae. aegypti* by 8-

12% by 2061–2080 (Monaghan et al, 2018), and its abundance is projected to increase by 20% under RCP2.6 and 30% under RCP8.5 by the end of the century (Liu-Helmersson et al, 2019). Exposure to transmission by *Ae. albopictus* specifically would be highest at intermediate climate change scenarios and would decrease in the warmest scenarios (Ryan et al 2019). Under scenarios other than RCP2.6, most of Europe would experience significant increases in exposure to viruses transmitted by both vectors (Liu-Helmersson et al., 2019).

Climate change is expected to increase dengue risk and facilitate its global spread, with the risk being greatest under high emissions scenarios (high Confidence). Future exposure to risk will be influenced by the combined effects of climate change and non-climatic factors such as population density and economic development (Akter et al, 2017). Overall risk levels expected to rise on all continents (Akter et al., 2015; Messina et al., 2015; Rogers, 2015), with projections varying for Europe (Liu-Helmersson et al., 2016; Messina et al., 2019). Compared to 2015, an additional 1 billion people are projected to be at risk of Dengue exposure by 2080 under an RCP4.5/SSP1 scenario, 2.25 billion under RCP6.0/SSP2, and 5 billion under RCP8.5/SSP3 (Messina et al., 2019). In North America, risk is projected to expand in north-central Mexico and to US southern states to mid-western regions, with annual dengue incidence in Mexico increasing by up to 40% by 2080 (Proestos et al, 2015; Colon-Gonzalez et al, 2013).In China, an RCP 8.5 scenario would increase dengue exposure from 168 million people in 142 counties to 490 million people in 456 counties by the late 2100s under RCP8.5 (Fan et al 2018). In Nepal, dengue fever is expected to expand throughout the 2050s and 2070s under all RCPs (Acharya et al., 2018). In Tanzania, there is a projected shift in distribution towards central and north-eastern areas and risk intensification in nearly all parts of the country by 2050 (Mweya et al, 2016). Dengue vectorial capacity is projected to increase in Korea under higher RCP scenarios (Lee et al. 2018).

There are insufficient studies for assessment of projected effects of climate change on other arboviral diseases, such as chikungunya and zika. Zika virus transmits under different temperature optimums than does Dengue, suggesting environmental suitability for zika transmission could expand with future warming (Tesla et al., 2018) (*low confidence*).

Climate change has already contributed to the geographical spread of the Lyme disease vector Ixodes scapularis *(high confidence) and the spread of tick-borne encephalitis and Lyne disease vector* Ixodes ricinus *in Europe (medium confidence), trends that can be expected to continue under future warming.* In Canada, vector surveillance of the black-legged tick *I. scapularis* has identified strong temperature effects on the limits of their occurrence, on recent geographic spread, temporal coincidence in emergence of tick populations, and acceleration of the speed of spread (Clow et al 2017, Cheng et al, 2017)). In Europe, increasing temperatures over the period 1950-2018 have significantly accelerated the life cycle of *Ixodes Ricinus* and contributed to its spread (Estrada-Peña et al, 2020). Under RCP4.5 and RCP8.5 scenarios, a northward and eastward shift of the distribution of *I. persulcatus and I. ricinus,* vector of Lyme disease and tick-borne encephalitis in Northern Europe and Russia, with an overall large increase in distribution in the second half of the current Century (Popov and Yasjukevich 2014; Yasjukevich et al 2018), and increases in intensity of tick-borne encephalitis transmission in central Europe (Nah et al, 2020).

Climate change is expected to increase the incidence rate of Lyme disease and tick-borne encephalitis in the Northern Hemisphere (high Confidence) (see also Figure 7.3). The climate-related geographic spread of vectors in North America and Europe has already been reflected in an increase in human Lyme disease cases and tick-borne encephalitis (Gasmi et al. 2017; Ebi et al, 2017, Daniel et al, 2018). The basic reproduction number (R0) of *I. scapularis* in at least some regions of Canada is projected to increase under all RCP scenarios (McPherson et al., 2017). In the United States, a 2°C warming could increase the number of Lyme disease cases by over 20% over the coming decades, and lead to an earlier onset and longer length of the annual Lyme disease season (Dumic & Severnini, 2018, Monaghan et al., 2015).

Climate change is expected to change the distribution of schistosomiasis in Africa and Asia (high confidence), with a possible increase in global land area suitable for transmission (medium confidence). A global increase in land area suitable for transmission by the three main species of *Schistosoma* is possible in the periods an RCP4.5 scenario (Yang and Bergquist, 2018) but regional outcomes are expected to vary. In Africa, shifting temperature regimes associated with climate change are expected to lead to reduced snail populations in areas with already high temperatures, and higher populations in areas with currently low winter temperatures (Kalinda et al, 2017; McCreesh et al, 2014). Infection risk with *Schistosoma mansoni* may increase by up to 20% over most of eastern Africa over the next 20-50 years, but decrease by more than 50% in parts of north and east Kenya, southern South Sudan and eastern PDRC (McCreesh, Nikulin, & Booth, 2015), with a possible overall net contraction (Stensgaard et al, 2013). In China, currently endemic areas in Sichuan Province may become unsuitable for snail habitats, but currently non-endemic areas in Sichuan and Hunan/Hubei provinces may see new emergence (Yang and Bergquist, 2018).

7.3.1.4 Projected impacts on water-borne diseases

Climate change will contribute to additional deaths and mortality due to diarrheal diseases in the absence of adaptation (medium confidence) (see Figure 7.3). Risk factors for future excess deaths due to diarrheal diseases are highly mediated by future levels of socio-economic development and adaptation. An additional 1°C increase in mean average temperature is expected to result in a 7% (95% CI, 3%-10%) increase in all-cause diarrhea (Carlton et al., 2016), an 8% (95% CI, 5%-11%) increase in the incidence of diarrheic *E. coli* (Philipsborn et al 2016)*,* and a 3% to 11% increase in deaths attributable to diarrhea (WHO 2014). WHO Quantitative Risk Assessments for the effects of climate change on selected causes of death for the 2030s and 2050s (World Health Organization, 2014) projects that overall deaths from diarrhea should fall due to socioeconomic development, but that the effect of climate change under higher emission scenarios would be cause an additional 48,000 deaths in children aged under 15 years in 2030 and 33,000 deaths for 2050, particularly in Africa and parts of Asia. In Ecuador, projected increases in rainfall variability and heavy rainfall events may increase diarrhea burden in urban regions (Deshpande, 2020). A limit in the assessable literature is a lack of studies in highest risk areas (Liang & Gong, 2017; UNEP, 2018).

Climate change is expected to increase future health risks associated with a range of other waterborne diseases and parasites, with effects varying by region (medium confidence). Waterborne diseases attributable to protozoan parasites including *Cryptosporidium* spp and *Giardia duodenalis (intestinalis)* are expected to increase in Africa due to increasing temperatures and drought (Ahmed et al 2018; Efstratiou et al 2017). Recent data suggest a poleward expansion of *Vibrios* to areas with no previous incidence, particularly in mid- to high- latitude regions in areas where rapid warming is taking place (Baker-Austin et al 2017). The number of *Vibrio*-induced diarrhea cases per year has increased in past decades in the Baltic Sea region, and the projected risk of vibriosis will increase in northern areas, where waters are expected to become warmer and more saline due to reduced precipitation and have higher chlorophyll concentrations (Escobar et al., 2015; Semenza et al., 2017).

The risk of Campylobacteriosis and other enteric pathogens could rise in regions where heavy precipitation events or flooding are projected to increase (medium confidence). In Europe, the risk of Campylobacteriosis and other enteric pathogens could also rise in regions where precipitation or extreme flooding are projected to increase (European Environment Agency, 2017), although incidence rates may be further mediated by seasonal social activities (Rushton et al., 2019; Williams et al., 2015). Accelerated releases of dissolved organic matter to inland and coastal waters through increases in precipitation are expected to reduce the potential for solar UV inactivation of pathogens and increase risks for associated waterborne diseases (Williamson et al., 2017). A study in British Columbia, estimated that the combined relative risk for waterborne campylobacteriosis, Verotoxin-producing Escherichia coli and salmonellosis was 1.1 for every 1°C in mean annual temperature (Brubacher, 2020). Another study from British Columbia found that under RCP8.5 annual rates of cryptosporidiosis and giardiasis could rise by approximately 16% by the 2080s due to more severe precipitation events (Chhetri, 2019).

7.3.1.5 Projected impacts on food-borne diseases

The prevalence of Salmonella is expected to rise as higher temperatures enable more rapid replication (medium confidence). Research from Canada finds a very strong association of salmonellosis and other food-borne diseases with higher temperatures, suggesting that climate change will increase food safety risks ranging from increased public health burden to emergent risks not currently seen in the food chain (Smith & Fazil, 2019). In Europe, the average annual number of temperature-related cases of salmonellosis under high emissions scenarios by 2100 could increase by up to 50% more than would be expected on the basis of on population change alone (Lake 2017) (European Environment Agency, 2017). Warming trends in the southern US may lead to increased rates of Salmonella infections (Akil, Ahmad, & Reddy, 2014).

7.3.1.6 Respiratory diseases

Climate change will substantially increase the burden of non-communicable respiratory disease related to PM2.5 (*high confidence*) and moderately increase the burden related to ozone (*high confidence*) (See figure 7.3). A systematic review of studies published between 2012 and 2017, along with additional studies since completed, indicate that climate change will increase non-communicable respiratory disease risks, principally through increased PM2.5 exposure (Orru et al., 2017). Subsequent studies have estimated that an additional 215,000 (95% CI-76,100–595,000) deaths from PM2.5 and 43,600 (95% CI -195,000–237,000) additional deaths from ozone could be expected globally by 2100 (Silva et al. 2017), and that in India, premature mortality due to PM2.5 would increase by 2.4–4% in 2031-2040 and 28.5–38.8% for 2091–2100 under RCP8.5 relative to additional burden that would be expected under RCP4.5 (Chowdhury et al. 2018). Hong et al. (2020) estimate that under RCP 4.5 China could expect by 2050 an additional 12,100 annual deaths from PM2.5 and 8,900 deaths from ozone. A study by Silva et al. (2016) considered the mediating effects of demographic change later this century, and projected substantial increases in deaths due to ozone exposure globally, but net decreases in deaths attributable to PM2.5 late in the present century (Hong et al., 2019; Silva et al., 2016). PM2.5 exposure is also a well-established risk factor for lung cancer, and Park et al. (2020) project increased lung cancer burden in all regions of the world except sub-Saharan Africa for the end of the century under RCP 8.5 (Park et al., 2020).

The burden of disease associated with aeroallergens is expected to grow due to climate change (*high confidence*). The incidence of pollen allergy and associated allergic disease increases with pollen exposure, and pollen concentrations are rising, and expected to continue to rise as a result of climate change (Ziska et al., 2019, Ziska 2020, De Sario et al., 2019). The overall length of pollen season and total seasonal pollen counts/concentrations for allergenic species such as birch (Betula) and ragweed (Ambrosia) are expected to grow as a result of CO_2 fertilization and warming, leading to greater sensitization (Hamaoui-Laguel et al., 2015, Lake et al., 2017, Zhang et al., 2013). Changes in pollen levels for several species of trees and grasses are expected to increase emergency department visits in the US by 2090 by between 8% for RCP4.5 and 14% for RCP8.5 (Neumann et al., 2019).

7.3.1.7 Cardio-vascular diseases

Climate change is expected to increase heat-related cardio-vascular disease (CVD) mortality by the end of the 21st century, particularly under higher emission scenarios (high confidence). Most modelling studies conducted since AR5 project higher rates of heat-related CVD mortality throughout the remainder of this century (Chen et al., 2019; Huang et al., 2018; Li et al., 2015; Li et al., 2018; Limaye et al., 2018; Zhang et al., 2018). CVD mortality could increase by an average percentage of 18.4%, 47.8%, and 69.0% in the 2020s, 2050s, and 2080s under RCP 4.5, respectively, and by 16.6%, 73.8% and 134% in different decades respectively, under RCP 8.5 compared to the 1980s (Li et al., 2015). Projections carried out for Beijing in the 2080s predict increased levels of temperature-related mortality from CVD, with figures varying with RCP and population assumptions (Zhang et al 2018). In particular, deaths from ischemic strokes would increase significantly as a result of warming, but mortality associated with acute ischemic heart disease and hemorrhagic stroke would remain stable over time. Li et al., 2018). Projections for Ningo, China, suggest heat-related years of lost life will increase significantly in the month of August, by between 3 and 11.5 times greater over current baselines by the 2070s, even with adaptation (Huang et al 2018). The future burden of temperature-related myocardial infarctions (MI) in Germany is expected to rise under high emissions scenarios (Chen et al., 2019), while in the eastern United States Limaye et al. (2018) project by mid-century and additional 11,562 annual deaths (95% CI: 2,641–20,095) due to cardiovascular stress in the population aged 65 years and above.

It is important to note that the assessed studies typically take an observed epidemiological relationship, and apply future temperature projections (often derived from regional climate projections), to this relationship. Because the relationship between CVD death is influenced by both climatic and non-climatic factors (such as population size and aging), future projections are highly sensitive to assumptions about interactions between climate, population characteristics and adaptation pathways. Changes in air quality are an additional important factor. For example, an assessment of future annual and seasonal excess mortality from short-term exposure to higher levels of ambient ozone in Chinese cities under RCP 8.5 projected approximately 1,500 excess annual CVD deaths in 2050 (Chen et al., 2018).

7.3.1.8 Maternal, fetal, and neonatal health

Additional research is needed on future impacts of climate change on maternal, fetal and neonatal health. Maternal heat exposure is a risk factor for several adverse maternal, fetal, and neonatal outcomes (Kuehn and McCormick, 2017), including fetal growth (Sun et al., 2019) and congenital heart disease (CHD) (Auger et al., 2017). There is a lack of assessable studies directly or indirectly related to this subject, an exception being a study by Zhang et al. (2020) that projected an up to 34% increase in CHD risk in the United States for the period between 2025 and 2035 based on increased maternal extreme heat exposure.

7.3.1.9 Malnutrition

Climate change will adversely affect food security and nutrition, leading to higher levels of childhood undernutrition and stunting, related mortality, and disability-adjusted life years lost in Africa and Asia (*high confidence*). The number of children affected by undernutrition, stunting and related mortality is expected to rise in Asia and Africa, with rates of childhood stunting projected at up to 7.5 million by 2030 and 10.1 million by 2050 respectively (WHO, 2014). Lloyd et al (2018) projected moderate and severe stunting in children aged under five to be between 570,000 and one million children by 2030 across 44 countries, with the greatest rates in rural areas.

Climate change will make it increasingly difficult to ensure all people have access to healthy diets (high confidence). Climate change impacts on agricultural production and regional food availability will affect the composition of diets, which can have major consequences for health. Springmann et al (2016a) project that by 2050, climate change will lead to per-person reductions of 3.2% in global food availability, 4.0% in fruit and vegetable consumption, and 0.7% in red meat consumption. Such changes could be associated with 529 000 climate-related deaths worldwide, most projected to occur in South and East Asia. Adaptation and cross-sectoral cooperation in food systems strongly mediate future projections, however, and could reduce the number of future climate-related deaths by 29–71%, depending on their stringency (Springmann et al. 2016a). Future dietary composition will also reflect availability, affordability and diversity of nutrient-dense foods including fruits and vegetables (Nelson et al 2018). Using SSPs 1, 2, and 3, global crop and economic models by Hasegawa et al (2018) project higher cereal prices of up to 29% by 2050 under RCP 6.0, with up to 183 million additional people in low-income households at risk of hunger as a result (Hasegawa et al. 2018).

The nutritional content of important food crops, including protein content and micronutrients, is affected negatively by higher CO2 concentrations, creating potential risks for future food utilization (*high confidence*). (SRCCL 2019; Smith and Myers, 2018; see AR6 Chapter 5). Under elevated levels of CO_2, the protein content of rice, wheat and barley are expected to decrease by 7.6%, 7.8%, 14.1%, and 6.4%, respectively by 2050, creating a risk of protein deficiency for up to 148.4 million people (Medek et al. 2017). Increased CO_2 levels corresponding to RCP6 in the 2080s are projected to reduce the protein, micronutrient and B vitamin content of widely grown rice cultivars in Southeast Asia, creating nutrition-related health risks for 600 million people (Zhu et al., 2018). An additional 175 million people could become zinc deficient and an additional 122 million protein deficient globally as a consequence (Smith and Myers, 2018). Approximately 1.4 billion women of reproductive age and children under 5 live in countries with greater than 20% anemia prevalence, and could lose more than 4% of their dietary iron, with the highest risk occurring in South and Southeast Asia, Africa, and the Middle East (Smith and Myers, 2018). The combined effects of increases in atmospheric CO_2 in terms of plant nutrients, CO_2 fertilization, and production losses due to climate change will offset gains in food production that might otherwise be realized through technological innovations and economic growth; one study estimates these lost production gains by 2050 in nutrient terms as being 19·5% for protein, 14·4% for iron, and 14·6% for zinc (Beach et al. 2019).

7.3.1.10 Projected impacts on harmful algal blooms, mycotoxins, aflatoxins and chemical contaminants

Harmful algal blooms are projected to increase globally, thus increasing the risk of seafood contamination with marine toxins (*high confidence*) (EFSA, 2017; Gobler et al., 2017; Barange and Cochrane, 2018;

Bindoff et al., 2019; Wells et al., 2020). *Climate change impacts on oceans could generate increased risks of ciguatera poisoning in some regions (high confidence).* Studies have suggested that rising sea surface temperatures could lead to increased rates of ciguatera poisoning in Spain (Botana 2016), other parts of Europe (EFSA 2020) and in the Caribbean, with Gingold et al (2014) projections a 200-400% increased incidence rate in the latter region under 2.5–3.5°C increases in sea surface temperatures.

Mycotoxins and aflatoxins may also become more prevalent due to climate change (medium confidence). Models of aflatoxin occurrence in maize under climate change scenarios of +2 °C and +5 °C in Europe over the next 100 years project that aflatoxin B1 may become a major food safety issue in maize, especially in Eastern Europe, the Balkan Peninsula and the Mediterranean regions (Battilani et al., 2016).
The occurrence of toxin-producing fungal phytopathogens has the potential to increase and expand from tropical and subtropical into regions where such contamination does not currently occur (Battilani et al., 2016).

Climate change may alter regional and local exposures to anthropogenic chemical contaminants (medium agreement, low evidence). Changes in future occurrences of wildfires could lead to a 14 percent increase in global emissions of mercury by 2050, depending on scenarios used (Kumar et al 2018). Mercury exposure via consumption of fish may be affected by warming waters, as suggested by a study by Schartup et al. (2019) that suggests warming trends in the Gulf of Maine could increase the MeHg levels in resident tuna by 30 percent between 2015 and 2030. In that study, an observed annual 3.5 percent increase in mercury levels was attributed to fish having higher metabolisms in warmer waters, leading them to consume more prey. The combined impacts of climate change and the presence of arsenic in paddy fields are projected to potentially double the toxic heavy metal content of rice in some regions, potentially leading to a 39 percent reduction in overall production by 2100 under some models (Muehe et al., 2019, Neumann et al., 2017).

7.3.1.11 Mental health and wellbeing

Climate change is expected to have adverse impacts on wellbeing, some of which will become serious enough to threaten mental health (very high confidence). Changes in extreme events due to climate change, including floods (Baryshnikova and Pham 2019), droughts (Carleton 2017) and hurricanes (Kessler et al. 2008; Boscarino et al. 2013, 2017; Obradovich et al. 2018) directly worsen mental health and wellbeing, and increase anxiety (high confidence). Projections suggest that sub-Saharan African children and adolescents, particularly girls, are extremely vulnerable to negative direct and indirect impacts on their mental health and well-being (Atkinson and Bruce, 2015; Owen et al., 2016). The direct risks are greatest for people with existing mental disorders, physical injuries, impacts on respiratory, cardiovascular and reproductive systems, with indirect impacts potentially arising from displacement, migration, famine and malnutrition, degradation or destruction of health and social care systems, conflict, and climate-related economic and social losses (high to very high confidence) (Burke et al., 2018; Curtis et al., 2017; Hayes et al., 2018; Serdeczny et al., 2017; Watts et al., 2018). Based on evidence assessed in Section 7.2 of this chapter, future direct impacts of increased heat risks and associated illnesses can be expected to have implications for mental health and wellbeing, with outcomes being highly mediated by adaptation, but there are no assessable studies that quantify such risks.

Human behaviors and systems will be disrupted by climate change in a myriad of ways (Duffy et al. 2019), and the potential consequences for mental health and wellbeing are correspondingly large in number and complex in mechanism (high confidence). For example, climate change may alter human physical activity and mobility patterns, in turn producing alterations in the mental health statuses promoted by regular physical activity (Obradovich and Fowler 2017; Obradovich and Rahwan 2019). Climate change may affect labour capacity, because heat can compromise the ability to engage in manual labor as well as cognitive functioning, with impacts on the economic status of individual households as well as societies (Kjellstrom et al., 2016; Liu, 2020). Migrations and displacement caused by climate change may worsen the wellbeing of those affected (Vins et al. 2015; Missirian and Schlenker 2017). Broad societal outcomes such as economic unrest, political conflict, or governmental dysfunction assessed in sections 7.3.5 may undermine mental health of populations in the future (*medium confidence*). Food insecurity presents its own risks for mental health (Jones, 2017).

7.3.2 Migration in a Changing Climate

Future changes in climate-related migration and displacement are expected to vary by region and over time, according to: (1) region-specific changes in climatic drivers, (2) changes in the future adaptive capacity of exposed populations, (3) population growth in regions most exposed to climatic risks, and (4) future developments in mediating factors such as international development and migration policies (Gemenne and Blocher 2017, Cattaneo et al 2019, McLeman 2019)(High agreement, medium evidence). Climatic drivers in this context include future changes in the frequency and/or severity of storms, floods, droughts, extreme heat, wildfires and other events already observed in section 7.2 as affecting migration and displacement patterns, and the future impacts on coastal settlements of climate change-related sea level rise and associated hazards.

7.3.2.1 Region-specific changes in climatic risks

As outlined in 7.2, the most common drivers of observed climate-related migration and displacement are extreme storms, floods, extreme heat, droughts, and wildfires (high confidence). The future frequency and/or severity of such events due to anthropogenic climate change are expected to vary by region according to future GHG emission pathways, with there being an increased potential for compound effects of successive or multiple hazards (e.g. tropical storms accompanied by extreme heat events, Matthews et al 2019). Table 7.1 summarizes anticipated changes in future climate-related migration and displacement risks by region (and by sub-regions for Africa and Asia, where climatic risks vary considerably within the region).

Table 7.1: Projected impacts of climate change on future migration and displacement, by region

1. Region	**2. Main directions of current migration flows (from Abel & Sander 2014)**	**3. Current climatic drivers of migration & displacement (based on IDMC statistics, except where noted)**	**4. Expected changes in drivers**	**5. References for column 4 in addition to IPCC 2018, 2019; Pörtner et al. 2019 (add WGI report when ready)**	**6. Notes (additional call outs to other WGII Chapters will be made in 3rd order draft)**
East and Southeast Asia	Within countries and between countries within same region	Floods, extreme storms	Return rate and severity of floods, intensity of extreme storm events are projected to increase under all RCPs except RCP 2.6	Wang et al. 2017; Bacmeister et al. 2018; Gettelman et al. 2018; Wang and Wu 2018; Mure-Ravaud et al. 2019	Changes in geographical distribution of typhoon tracks would affect number/ location of people at risk; see also Chapter 10, box 10.3
South and Central Asia	Within countries and between countries within same region; from South Asia to Middle East, North America, Europe	Floods, extreme storms; extreme heat (see note)	Return rate and severity of floods in South Asia projected to increase under all RCPs except RCP2.6; frequency & severity of extreme storms not expected to change greatly in RCPs other than RCP 8.5; significant increases in extreme heat events under 1.5°C and 2°C warming	Bacmeister et al., 2018; Kettner et al., 2018; Alfieri et al., 2017; Maharjan et al. 2020; Pradhan et al. 2020; Sedova et al. 2020; Singh & Basu 2020; Kaczan & Orgill-Meyer 2020	Extreme heat is associated with increased migration (not involuntary) displacement in Bangladesh, India, Pakistan (see also Chapter 10, box 10.3

West Asia, North Africa	Within countries and between countries within the same region; to Europe	Floods	Precipitation expected to become scarcer under most RCPs, shortfalls being greatest under RCPs 6 and 8.5; SLR and coastal flooding expected to increase in the Nile Delta, effects being greatest under RCP 8.5	Alfieri et al., 2017; Greve et al, 2018; Lehner et al., 2017; Naumann et al., 2018; Wartenburger et al., 2017; Abadie et al., 2020; Kulp and Strauss 2019	Droughts and extreme heat are not currently major drivers of displacement/ migration in region, but attention should be paid to these given projections of future extreme heat, drought risks for region. See also Chapter 9
Eastern sub-Saharan Africa	Within countries and between countries within the same region; to Europe and Middle East	Floods, droughts/ extreme heat	Precipitation is expected to increase in most areas under most RCPs; significant increases in extreme heat events under 1.5ºC and 2ºC warming	Dosio et al 2018; Greve et al., 2018; Lehner et al., 2017; Naumann et al., 2018; Wartenburger et al., 2017; Kumari Rigaud et al., 2018	Effects of greater precipitation and increasing extreme heat events may reduce drought-displacement risks but increase flood-displacement risks; more data is needed. See also chapter 9
Western & southern sub-Saharan Africa	Within countries and between countries in same region; to Europe	Floods, droughts/ extreme heat	Precipitation is expected to become scarcer under most RCPs, shortfalls being greatest under RCPs 6 and 8.5; significant increases in extreme heat events in West Africa, especially under 2°C warming	Dosio et al 2018; Alfieri et al., 2017; Greve et al, 2018; Lehner et al., 2017; Naumann et al., 2018; Wartenburger et al., 2017	Effects of reduced precipitation may lead to drought & extreme heat outpacing floods as main migration & displacement risk. See also chapter 9
Europe	Within countries and between countries in same region	Floods	Increased risk of river & coastal flooding in northern coastal areas under most scenarios	Bevacqua et al 2019, Blöschl et al 2019; Forzieri et al 2016	Risk of compound flooding expected to increase in coastal areas of northern Europe; multiple hazards of drought, heat and wildfires to increase in southern Europe

North America	Within countries and between countries in same region	Floods; extreme storms (US Atlantic & Caribbean coast); tornadoes; wildfires	Increased flood risk in most watersheds under RCPs 4.5-8.6; frequency & severity of extreme storms projected to grow significantly in RCP 8.5	Wobus et al 2017; Hauer et al 2016, 2019	
Central and South America;	Within countries and between countries in same region; to North America, Europe	Floods (CA & SA), extreme storms (CA)	Variations in rainfall patterns within region, with decreased precipitation in NE Brazil, increases precipitation in SE South America; frequency & severity of Caribbean storms projected to grow significantly in RCP 8.5	Bacmeister et al., 2018; Burgess et al., 2018;	
Australasia	Displacement within countries	Wildfires (Australia)	Greater heat events, fire risks in eastern Australia	Di Virgilio et al 2019, Dowdy et al 2019	
Small island states	Within and between countries in same region (e.g. Pacific Islands to Australia & New Zealand; Caribbean islands to USA)	Extreme storms	Increased frequency, severity of storms, especially in RCPs 6, 8,5	Thomas et al 2020; Burgess et al, 2018;	Planned relocations already underway in Fiji, Carterets

In low-lying coastal areas of most regions, future increases in mean sea levels will amplify the effects of coastal hazards, including erosion, inland penetration of storm surges and groundwater contamination by salt water, and eventually lead to inundation of very low-lying coastal settlements (Diaz 2016, Hauer et al 2016, B. Neumann et al 2015, Rahman et al 2019, SROCC 2019) (high confidence). Projections of the number of people at risk of future displacement by sea level rise range from millions to hundreds of millions by the end of this century, depending on (1) the RCP selected, (2) projections of future population growth in exposed areas and (3) the criteria used for identifying exposure. These latter measures can include the existence of settlements situated within 10m of mean sea level, settlements in 1-in-100 year floodplains, or settlements in areas likely to be entirely inundated under specific RCPs (B. Neumann et al 2015, Hauer et al 2016, Merkens et al 2018).

Sea level rise is not presently a significant driver of migration in most coastal areas, but has been attributed as being one of several factors necessitating the near-term resettlement of small coastal settlements in Alaska, Louisiana, Fiji, Tuvalu, and the Carteret Islands of Papua New Guinea (Marino and Lazrus 2015, Connell 2016, Nichols 2019). In coastal Louisiana, communities tend to resist leaving exposed settlements until approximately 50% of available land has been lost (Hauer et al 2019). Movements away from highly exposed areas may have longer-term demographic implications for inland settlements (Hauer, 2017), but this requires further study. At present, there is minimal evidence regarding the risks of sea level rise as being a motivation for international migration originating in small island states in the Indian and Pacific Oceans, with economic considerations and family reunification currently being the main migration drivers (McCubbin et al 2015, Stojanov et al 2016, Heslin 2019, Kelman et al 2019). However, climatic drivers are expected to take on greater significance in coming decades (Thomas et al 2020), and may discourage return migration to small island states (van der Geest et al 2020).

Country-level studies assessed in section 7.2 suggest an association between extreme heat and changes rural-to-urban migration flows in parts of South Asia and sub-Saharan Africa (medium confidence). A small number of recent studies have suggested that future increases in average temperatures could have adverse impacts on the habitability of settlements in the tropics and sub-tropics and stimulate out-migration to cooler locations (Zander et al 2019, Xu et al 2020), and potentially lead to decreased fertility rates among rural populations (Casey et al 2019). Dosio et al (2018) project that at 1.5°C warming, between 9% and 18% of the global population will be regularly exposed to extreme heat events at least once in 5 years, with the exposure rate nearly tripling with 2°C warming. The small number of available studies does not allow for confidence statements regarding extreme heat and future migration/population patterns at large spatial scales, and is consequently noted as a subject requiring further research.

7.3.2.2 Interactions with non-climatic determinants and projections of future migration flows

Only a very small number of studies have attempted making systematic projections of future regional or global migration numbers under climate change. A World Bank report by Rigaud et al (2018) offered wide-ranging projections of potential internal population displacements in South Asia, sub-Saharan Africa and Latin America by 2050 using multiple climate and development scenarios. Key methodological limitations for making such projections include the availability of reliable data on migration within and between countries and definitional ambiguity in distinguishing climate-related migration from migration undertaken for other reasons. Rigaud et al (2018) show that the potential for future migration and displacement will be strongly mediated by socio-economic development pathways in low- and middle-income countries. Hoffmann et al (2020) used meta-regression based analyses to suggest that future environmental influences on migration are likely to be greatest in low- and middle income countries in Latin America and the Caribbean, Sub-Saharan Africa, the Middle East and most of continental Asia.

Research reviewed in AR4, AR5 and section 7.2 observed that at higher rates of socio-economic development, the in situ *adaptive capacity of households and institutions is greater, and climatic influences on migration correspondingly decline, with recent evidence adding further support for such conclusions (Jha et al 2018, Mallick 2019, Gray et al 2020)(high confidence).* Future demographic trends will also influence climate-related migration at regional scales. Population growth rates are currently highest in low-income countries (UN DESA 2019) that have high rates of exposure to climatic hazards described in the preceding section, further emphasizing the importance of socio-economic development and adaptive capacity building. Although country-specific scenarios for socio-economic development and population are embedded in SSPs, existing projections of future migration flows under climate change have not made great use of these. One of the few studies to do so found that safe and orderly international migration tends to increase wealth at regional and global scales in all SSP narratives and reduces income inequality between countries (Benveniste et al 2020a). International barriers to safe and orderly migration have considerable potential to reduce international development objectives and increase exposure to climatic hazards in low- and middle income countries (McLeman 2019, Benveniste et al 2020b).

7.3.3 Climate Change and Future Risks of Conflict

Higher temperatures and extreme events associated with climate change have the potential to become 'threat multipliers' for future conflicts (high agreement, medium evidence), but their effects will be highly mediated by non-climatic factors. Projections of future effects of climate change in conflict genesis are typically based on statistical models of associations drawn from limited datasets and make coarse assumptions about future socio-economic and demographic pathways. This has generated an ongoing debate among researchers about their reliability and replicability of results, with researchers suggesting they are reliable only for specific local or regional contexts and limited time periods (Buhaug et al, 2014; van Weezel, 2019, Abel et al 2019). The most commonly held climate-conflict association concerns the effect of heat (see section 7.2). In a meta-analysis of existing studies, Hsiang et al (2015) concluded that with each one standard deviation increase in temperature, interpersonal conflict increases by 2.4% and intergroup conflict by 11.3%. Witmer et al (2017) forecast sub-national violent conflict for the period 2015-2065 using temperature and precipitation anomalies, finding significant relationships between levels of violent conflict and political rights, population size, and rising temperatures, but no association between conflict and precipitation.

Although regularly used in the study of future impacts of climate change, the SSPs are less well suited for climate-conflict projections given that they do not take into account disruptions to economic growth, which are often crucial in onset of conflicts (Buhaug and Vestby, 2019). Further, definitions of climate anomalies will also shift over time as societies adapt (Roche et al, 2020). Thus, projections are more likely to be able to predict the countries in which conflict is likely to emerge over the long term, based on known causal factors that increase susceptibility to conflict, rather than be able to project when a conflict will emerge and where, or to predict the changes in conflict-related deaths to be expected with a particular change in climate parameters (Mach et al, 2020).

Key research needs include investigating linkages between specific climatic drivers and outcomes (Seter, 2016; Ide, 2017), especially beyond current conflict zones in Africa and the Middle East (Hendrix 2017, Adams et al 2018, Busby 2018) and on the effectiveness of interventions (Mach et al 2020). There is a significant gap in research on climate-conflict linkages in Asia, where there are large numbers of people living in locations highly exposed to hazards expected to increase in frequency and severity under climate change (Busby et al, 2018, Vinke et al, 2017). Climate impacts in politically unstable and/or conflict-affected areas of Central Asia warrant additional research (Reyer et al, 2017, Nordqvist and Kampe, 2018), including on the resilience of transboundary water agreements (Atef et al, 2019) and potential for water use conflicts between hydropower and irrigation (Shokhrukh-Mirzo et al, 2019, see Box 7.5).

Conflict is multi-causal, therefore the identification of potential future climate-related tipping points, thresholds and triggers is difficult. Tipping points commonly associated with civil unrest are weather and market-related economic shocks that lead to increases in domestic food prices (Weinberg et al, 2014; Raleigh et al, 2015), but such linkages are less clear for armed conflicts (Koren, 2019). A potential tipping point due to future climate impacts may concern water sharing agreements, as changing geopolitical dynamics and the impacts of climate change could stretch the ability of such agreements to maintain cooperation (de Stefano, 2017; Williams, 2018). Other tipping points exist within social processes, reflecting the point at which individual losses (which could in turn be climate-related) become group grievances (Buhaug et al, 2020) or the point at which social conflict becomes armed conflict. There is also a need for research that identifies positive tipping points that lead to rapid changes in the wider social system that decrease the likelihood of conflict (e.g. Tàbara et al, 2018), and to prevent conflict itself from becoming a tipping point in the wider social-ecological system (Kopp et al, 2015). Further, there is a need to avoid conflict itself representing a social tipping point in the wider social-ecological system (e.g. Kopp et al, 2015) since there is no evidence that climate change will lead to mass conflict or that conflict will in turn lead to mass migration.

[START BOX 7.5 HERE]

Box 7.5: Potential for Climate Change to Cause Conflict in Asia

Research on conflict-climate linkages in Asia is needed given the high population density in areas of south, southeast and east Asia exposed to extreme heat, monsoon variability, flooding, tropical cyclones and sea-level rise (Busby et al 2018, Vinke et al, 2017). Central Asia is projected to experience altered precipitation regimes, more frequent heat extremes, increasing aridity, greater seasonality of river runoff, and consequent water and food security challenges (Reyer et al, 2017). Climate stressors have potentially contributed, at least in part, to local level conflicts in Bangladesh and Nepal (Sultana et al 2018) but there is no evidence to suggest that larger-scale political instability and conflicts in Asia in recent decades have been directly caused by climatic drivers (Roth et al 2018). Research is lacking on the question of whether climate risks have played a role in prolonging larger civil conflicts, unlike sub-Saharan Africa which has been subject to much greater study (Nordqvist and Kampe, 2018).

In terms of future potential for conflict in south and southeast Asia, non-peer-reviewed security studies envisage greater military involvement in humanitarian response to cyclones, flooding, and to other impacts of climate change that might contribute to increased instability (Pai 2013; Busby and Krishnan, 2015). A small number of peer-reviewed studies have considered future potential impacts of climate change on food security (Caruso et al, 2016; Raghavan et al, 2019) while others have analyzed how climate change might test the effectiveness of transboundary water agreements by raising regional geopolitical tensions (Atef et al, 2019, Scott et al, 2019) or create water use conflicts between hydropower and irrigation within countries

(Shokhrukh-Mirzo et al, 2019). Current research suggests existing transboundary water governance institutions will be able to address future changes in water availability (Bernauer & Siegfried, 2012; Siegfriend et al 2012).

[END BOX 7.5 HERE]

7.4 Responses, Adaptation to Risks, and Climate Resilient Development Pathways

A point of emphasis in the AR6 WGII report is the “solutions space”, in which chapter author teams have been encouraged to identify and assess adaptation opportunities, challenges, and pathways to climate resilient development. Climate change risks described in other chapters of this report are often ultimately manifested as impacts on the health and wellbeing of communities, households and individuals that have been described in sections 7.2 and 7.3 of this chapter. These include exacerbations of pre-existing risks, such as malaria, diabetes, and civil unrest, and the emergence of new risks, such as release of toxins and displacements caused by rising sea levels. With effective adaptation, many observed and projected risks for human health and wellbeing, health systems, migration, and conflict can be reduced or potentially avoided.

Achieving effective adaptation requires cooperation across regions, sections, and scales of governance. It also requires financial resources and commitments to public health and to adaptation needs specific to health systems that are currently inadequate in most jurisdictions, including many high-income settings. Investing in adaptation for health and community wellbeing has the potential to generate considerable co-benefits in terms of reducing impacts of non-climate health challenges, making additional progress toward the Sustainable Development Goals. Similarly, investments in mitigating greenhouse gas emissions will not only reduce risks associated with dangerous climate change, but will increase population health and wellbeing through a number of salutary pathways. Migration can contribute to or work against adaptation goals and progress, depending on the circumstances under which it occurs. Policies that support safe and orderly movements of people, protect migrant rights, and facilitate flows of financial and other resources between sending and receiving communities are consistent with adaptive capacity building and building sustainability, and are part of climate resilient development pathways. These pathways are in turn a potential way to reduce the risks that climate change will interact with the drivers of conflict. The remainder of this chapter identifies and assesses specific elements in adapting to risks identified in 7.2 and 7.3 and opportunities for fostering sustainability and pursuing climate resilient development pathways:

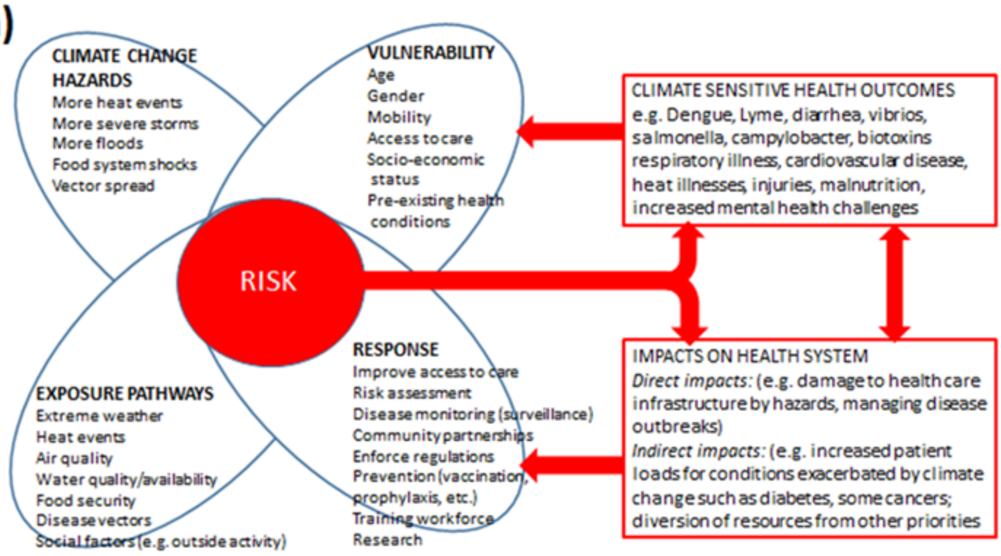
7.4.1 Adaptation for Hhealth and Wellbeing: Systems Approaches and Transformational Change

The solutions space for health and wellbeing, and the necessity of engaging a broad range of underlying support systems to advance sustainable development, has expanded since AR5. There is increased understanding of exposure and vulnerabilities to climate variability and change, of the effectiveness of adaptation (including a growing number of lessons learned and best practices), and of the co-benefits of mitigation policies and technologies (high confidence). To date, focus in the health sector has been on filling the adaptation gap by implementing incremental changes to policies and measures that strengthen health systems, some of which have led to sustained public health gains over the past three decades, and scattered protective interventions more specific to climate variability and change like early warning systems (Ebi et al 2017). In many cases, steady improvements in public health systems have obscured the influence of climate change on climate-sensitive disease burdens, but the influence of climate change is becoming more apparent in many cases, for example, with infectious disease (Hess et al. 2020). As climate change progresses and the likelihood of dangerous risks to human health continue to increase (Ebi et al., submitted), there may emerge greater pressure for more transformational changes to health systems. Such considerations emerged as a result of the COVID-19 pandemic, which has revealed many capacity and governance constraints in health systems and in other sectors that strongly influence population health (Murray et al. 2020). Ultimately, insights from a wide range of ongoing global health assessments have highlighted the need for explicitly and urgently addressing the interactions between environmental change, socioeconomic development, and human wellbeing (WHO, 2019).

Effectively preparing for and managing the health risks of climate change requires a systems based approach (high confidence) to incorporate the magnitude and pattern of future climate impacts as well as *potential changes in factors that determine vulnerability and exposure to climate hazards, such as determinants of health care access, demographic shifts, urbanization patterns, and changes in ecosystems (high confidence).* Given the wide range of causal pathways through which climate change affects environmental and social systems to result in health impacts, a systems-based approach to identifying, implementing, and evaluating solutions provides an opportunity to inform policies and programs in health-determining sectors (e.g. water and food safety and security), support population health and health systems in the short and longer-term, and inform health system policies to reduce adverse and unexpected consequences in other systems (WHO, 2015; (Ebi and Otmani Del Barrio, 2017)) *(high agreement, medium evidence).* This involves devising operational frameworks that build climate resilience into the health sector by anticipating impacts, identifying vulnerable populations, and assessing public health intervention options, and as part of this identify needs in terms of health workforce, information systems, facilities and delivery mechanisms (Marinucci et al, 2014; WHO, 2015; US CDC, 2019, WHO, 2015). The potential gains to be made by such an approach would be mediated by the extent of coordination with adaptation processes in other sectors that influence health and wellbeing.

Multisectoral collaborations aimed at strengthening the health sector can also generate multiple co-benefits across other sectors (high agreement, medium evidence) (WHO, 2015; Bowen, 2014a; Machalaba, 2015; Confalonieri, 2015; Bowen, 2014b). Solutions for health and wellbeing risks described in 7.2 and 7.3 often have their origins in sectors that include water, sanitation, food systems, social protection systems, and key components of urban systems such as housing and employment. Climate resilient development pursued in these other sectors, and in cooperation with the health sector, simultaneously increases the potential for adaptation and climate resilience in terms of health and wellbeing *(high confidence)* (Ahmad, 2017,Watts, 2018, Levy, 2015, World Health Organization, 2018, Chiabai, 2018, Dudley, 2015, Zinsstag, 2018, Sherpa, 2014). Figure 7.4 illustrates the context within which risks to health and health systems emerge as a result of climate change. Part (a) of the figure presents the emergence of risk from interactions between specific types of climatic hazards, exposure and vulnerability to those hazards, and the responses taken within the health sector; examples given are drawn from those discussed in this chapter. Part (b) of the figure illustrates how health risks are situated within larger interactions between the health system and other sectors and systems, with underlying enabling conditions making adaptation and transformation possible. Within this context, response options can decrease the impacts of climate change impacts on human health, wellbeing and health systems by 1) reducing exposure to climate-related hazards; 2) reducing vulnerability to such hazards; and 3) strengthening health system responses to future risks. In the health sector, such approaches are described as "Lateral Public Health" and emphasize the importance of involving community members and stakeholders in the planning and coordination of activities.

(a)



(b) Risks to health and health systems

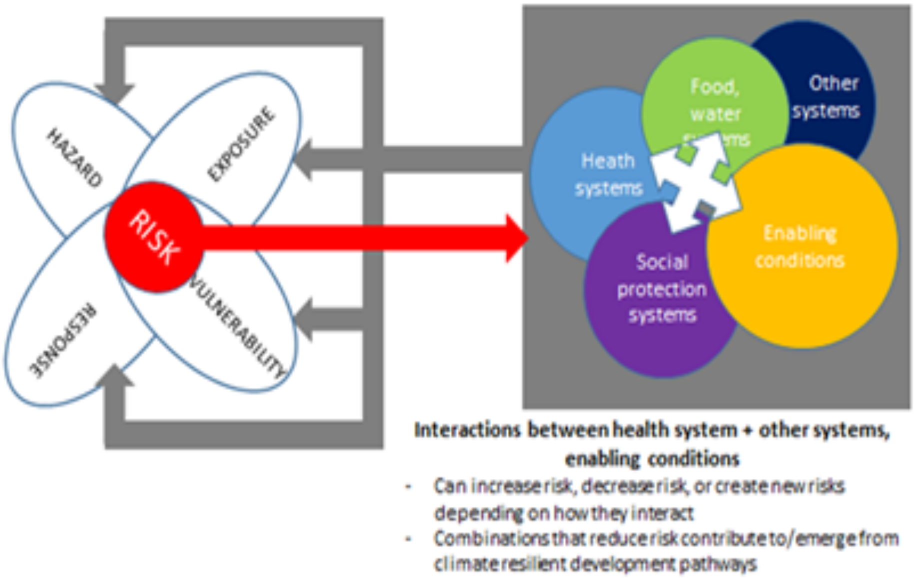


Figure 7.4: Context within which climatic risks to health emerge and responses are formed. Figure (a) is nested within Figure (b).

7.4.2 Adaptation to Climate Change Risks in the Health Sector

Health policies have historically not been designed or implemented with the risks of climate change taken into consideration, and as currently structured may not be capable of managing changing health burdens in coming decades (high confidence). The magnitude and pattern of future health burdens attributable to climate change, at least until mid-century, will be determined primarily by adaptation. Continued investment in strengthening general health systems, along with targeted investment in systems to enhance protection against specific climate-sensitive exposures (e.g. malaria net initiatives, hazard early warning systems), is an effective strategy for adapting to key risks (*high confidence*). Investments in proven strategies to reduce inequalities through investments in social determinants of health (Thornton et al., 2016), many of which are driven by decisions outside the health sector, will also have significant impacts on underlying vulnerability (Wallace et al., 2015) (*high confidence*). Adaptation options with high potential for reducing risk for several key health risks identified in section 7.3 are summarized in Table 7.2, with additional details on adaptation options for a selected sample of these provided below.

Table 7.2: Key health risks, hazards, exposures, vulnerabilities and adaptation options with highest potential for reducing risks. See more detailed version in Chapter 16.

Key risk	**Geographic region**	**Consequence that would be considered severe, and to whom**	**Hazard conditions that would contribute to this risk being severe**	**Exposure conditions that would contribute to this risk being severe**	**Vulnerability conditions that would contribute to this risk being severe**	**Adaptation options with high potential for reducing risk**
Heat-related mortality and morbidity	Global but mainly low to mid-latitude regions	Substantial increase in heat-related mortality and morbidity rates, especially in urban centers and for outside workers, and people suffering from obesity, weak cardiovascular capactiy /physical fitness. Increased risk of Respiratory Diseases and cardiovascular disease (CVD) mortality.	Substantial increase in frequency and duration of extreme heat events, especially in cities where heat will be exacerbated by urban heat island effects	Poor access to health facilities. Large increases in exposure, particularly in urban areas, driven by population growth and urbanization. Exposure will increase in agricultural areas where there are large numbers of people working outside	Increases in the number of very young and elderly, and of those with other health conditions such as diabetes and associated comorbidities, lack of capacity to implement adaptation measures,	Improved building and urban design, passive cooling systems acknowledging that not all will have access to air conditioning. Broader understanding of heat hazard and better access to public health systems for the most vulnerable. Application where possible of renewable energy sources. Communication around drinking, availability of clean water, simple water purification systems in low income settings, and water spray cooling.

Vector-borne disease incidence	Africa, Asia and Latin America	Increase in the incidence of some vector-borne diseases such as malaria, dengue, and other mosquito-borne diseases, in endemic areas and in new risk areas (e.g. cities, mountains, northern hemisphere)	Substantial increase in average temperature, precipitation, and/or humidity	Large increases in human exposure to mosquito vectors driven by growth in human and mosquito populations, globalization, population mobility and urbanization	Lack of effective vaccine, ineffective personal and household protection, poverty, poor hygiene conditions, insecticide resistance, behavioural factors.	Improved housing, better sanitation conditions and self-protection awareness. Insecticide treated bednets and indoor spraying of insecticide. Broader access to public health system for the most vulnerable. The establishment of early-warning system of vector-borne diseases. Cross-border joint control of outbreaks. Sound usage of insecticides. Targeted efforts to develop vaccines.
Occurrence and intensity of some waterborne diseases	Mostly developing countries (Africa and Asia); global for Vibrios	Increase in the occurrence and intensity of waterborne diseases such as vibrios (particularly *V.cholerae*), diarrheal diseases, other water-borne gastro-intestinal illnesses	Substantial changes in temperature and precipitation patterns, increased frequency and intensity of extreme weather events (e.g. droughts, storms, floods), ocean warming and acidification among others.	Large increases in exposure, particularly in areas with poor sanitation, flood-prone areas and favorable ecological environment for waterborne disease pathogens	Poor hygiene conditions, lack of clean drinking water and safe food, flood and drought prone areas, vulnerabilities of water and sanitation systems	Improved water, sanitation and hygiene conditions and better surveillance system. Improved personal drinking and eating habits, behavior change.

Occurrence and intensity of some foodborne diseases	Global	Increase in the occurrence and intensity of some foodborne diseases such as *Salmonella* and *Campylobacter,* including in high-income countries,	Substantial changes in temperature and precipitation patterns, increased frequency and intensity of extreme weather events (e.g. droughts, storms, floods), ocean warming and acidification among others.	Large increases in exposure, particularly in areas with poor sanitation, flood-prone areas and favourable ecological environment for foodborne disease pathogens.	Poor hygiene conditions, lack of clean drinking water and safe food, flood and drought prone areas,Vulnerabilities of water and sanitation systems, food storage systems, food processes, food preservation and cold chain/storage.	Improved water, sanitation and hygiene conditions and better surveillance system. Improved personal drinking and eating habits, behavior change.Improved food storage, food processing, food preservation, cold chain/storage.
Heat-related mental illness	Global, but more likely in areas experiencing high temperatures	Substantial increase in mental illness compared to base rate	Increased number of days with high temperatures	Large increase in exposure	Lack of air conditioning. The elderly may be more susceptible	Emergency shelters for people to escape the heat; enhanced building design to protect inhabitants; mental health support.

Mental health impacts in response to floods, storms and fires	Global; some areas at greater risk for storms, flooding, or wildfires	Substantial increase in mental illness compared to base rate	Increased frequency of major storms, weather-related flooding, or wildfires	Low-lying areas, dry areas, urban areas	Physical infrastructure that is vulnerable to extreme weather, inadequate emergency response and mental health services, social inequality	Improved urban infrastructure, warning systems, and post-disaster social support, improving funding and access to mental health care; improved surveillance and monitoring of mental health impacts of extreme weather events; climate change resilience planning in the mental health system (including at a community level); and mental health first aid training for care providers and first responders

Malnutrition due to decline in food availability and increased cost of healthy food	Global, with greater risks in Africa, South Asia, Southeast Asia, Latin America, Caribbean, Oceania	Substantial number of additional people at risk of hunger, stunting and diet-related morbidity and mortality. Micro- and macronutrient deficiencies. Severe impacts on low-income populations from Low Income and Medium Income countries (LIMICs). Risks especially high to groups that suffer greater inequality & marginalization (see vulnerability column),	Climate changes leading to reductions in crop, livestock, or fisheries yield, including temperature and precipitation changes and extremes, drought, and ocean warming and acidification.	Large numbers of people in areas and markets particularly affected by climate impacts on food security and nutrition	High levels of inequality (including gender inequality), substantial numbers of people subject to poverty or violent conflict, in marginalized groups, or with low education levels. Slow economic development; ineffective social protection systems, nutrition services and health services.	Multi-sectoral approach to nutrition-sensitive adaptation and disaster risk reduction / management, including food, health and social protection systems. Inclusive governance involving marginalized groups. Improved education for girls & women, maternal and child health, water and sanitation, gender equality, climate services, social protection mechanisms.

7.4.2.1 Example adaptation strategies and actions for key health risks

Successful adaptation strategies typically involve implicit or explicit vulnerability and capacity assessments (VCAs) that include identification of past, current and projected climate change risks (McIver et al., 2016) and aim to design both short- and long-term responses. Adaptation responses for climate change in the health sector need to be included (or "mainstreamed") in larger health policies, programs, strategies, measures and actions to be successfully implemented (Ebi, 2018). A review of public health systems in 34 countries found that only slightly more than half considered climate change impacts and adaptation needs (Berry et al., 2018), suggesting an ongoing need for such processes at a large scale. The following subsections identify adaptation options that have been assessed for multiple key risks and found promising.

7.4.2.1.1 Adaptation options for vector-borne, food-borne and water-borne diseases

Climate change will create conditions that facilitate the geographic spread and suitability of conditions for transmission of many vector-borne diseases (VBD) described in 7.2 and 7.3 (high confidence). The future effects of climate change on VBD can be offset through enhanced commitment to integrated vector control management approaches that are already in existence (Cissé et al., 2018; Confalonieri et al., 2017). Important components of these are disease surveillance and early warning systems that can identify potential outbreaks at time scales from sub-seasonal to decadal and vaccine development and implementation of systems to ensure availability (Rocklöv and Dubrow, 2020; Semenza and Zeller, 2014). In many cases, the exposure dynamics of VBD are strongly influenced by socio-economic dynamics, and these require consideration as part of the adaptation process (UNEP, 2018). This is especially the case for VBDs in low-income countries. For example, access to sanitation and presence of standing water are important determinants of A. aegypti populations in urban and peri-urban areas, and also affect the presence of viscera leishmaniasis. As a result, strategies that address underlying conditions of uneven development and lack of adequate housing and access to water and sanitation systems in areas endemic to mosquito-borne diseases can be expected to have health cobenefits.

Adaptation options for future climate risks associated with water-borne and food-borne diseases are strongly tied to wider, multi-sectoral initiatives to improve sustainable development and improve the well-being of low-income communities (high confidence). Important measures include improving access to potable water and reducing exposure of water and sanitation systems to flooding and extreme weather events (Brubacher et al., 2020; Cissé, 2019). This also requires a focus on farm-level interventions that limit the spread of pathogens into adjacent waterways, preventing the ongoing contamination of water and sanitation systems and the promotion of food-safe human behaviors (Levy, Smith, & Carlton, 2018; Nichols, Lake, & Heaviside, 2018). It is also important to implement well-targeted and integrated WASH interventions, including at school levels and ensuring proper disposal of excreta and wastewater. Cities can integrate regional climate projections into their engineering models, to produce lower-risk source waters, to increase the resilience of water and sanitation technologies and management systems under a number of climate scenarios. Technologies can help to abstract source water from cooler depths, introduce or increase secondary booster disinfection, design or modify system to reduce residence times within pipes, and/or coat exposed pipes (Levy et al., 2018). Examples of efficient interventions include source water protection, promoting water filtration and improvement of hygiene at all levels. Needed actions also include early warning systems, strengthening the resilience of communities and health systems, and promoting water safety plans and sanitation safety plans (Brubacher et al., 2020; Cissé, 2019; Ford & Hamner, 2018; Lake & Barker, 2018; Levy et al., 2018; Nichols et al., 2018; World Health Organization, 2009; 2016; 2018).

7.4.2.1.2 Adaptation options for heat

Heat action plans (HAP) link weather forecasts with alert systems and response activities, such as public cooling centres, enhanced heat-related disease surveillance and a range of individual actions designed to mitigate the health effects of extreme heat such as seeking shade and altering the pattern of work (McGregor et al. 2015; WHO, 2011). Evaluations of established HAPs provide strong evidence that HAPs prevent mortality from extreme heat events and elevated temperature (high confidence) (McGregor et al., 2015, Benmarhnia et al., 2016; Heo et al., 2019b; Martinez-Solanas and Basagana, 2019; Martinez-Solanas et al., 2019; De'Donato et al., 2018; Hess et al., 2018). Evaluations of specific of HAP components for their respective contributions to health benefits are lacking, meaning that further research is needed to increase their effectiveness (Boeckmann and Rohn, 2014; Chiabai et al., 2018) (Boeckmann et al., 2014; Chiabai et al., 2018; Diaz et al., 2019). For example, evaluations of heatwave early warning systems as a component within HAP show inconsistent results in term of their impact on mortality rates (Nitschke et al., 2016; (Benmarhnia et al., 2016; Heo et al., 2019a, b); Ragettli and Roosli, 2019; Martinez-Solanas et al., 2019; de Donato et al 2018; Hess et al., 2018; Weinberger et al., 2018). To support HAP, identification and mapping of heat vulnerability 'hot spots' within urban areas has been proposed by researchers, which would allow for more effective targeting of resources to higher risk populations (Janicke et al., 2019; Krstic et al., 2017; Nayak et al., 2018; Wolf et al., 2014). However, the uptake by policy makers has been lacking (Chen et al., 2019; Hatvani-Kovacs et al., 2018; Keramitsoglou et al., 2017; Wolf et al., 2015).

A multi-sectoral approach is beneficial to responding to extreme heat risks, through measures such as urban design that mitigates urban heat island effects (high confidence) (Alexander et al., 2016; Fritz, 2017; Levy, 2016; Masson et al., 2018; McEvoy, 2019; Pisello et al., 2018) and localized solutions such as awnings, louvers, directional reflective materials, mist sprays, evaporative materials and green roofs (Takebayashi, 2018). Nature-based initiatives to reduce heat that offer co-benefits for ecological systems include green and blue infrastructure (e.g. urban greening/forestry and the creation of water bodies) (Koc et al., 2018; Lai et al., 2019; Shooshtarian et al., 2018; Ulpiani, 2019; Zuvela-Aloise et al., 2016, Hobbie and Grimm, 2020) (see section 7.6.6). The implementation of climate sensitive design and planning can be constrained by governance issues (Alexandra, 2017; Jim et al., 2018) and the benefits are not always evenly distributed among residents. Implementation of these does, however, need to be carried out within the context of wider public health planning, as water bodies and moist vegetated surfaces provide suitable habitats for a range of disease vectors (Hansford et al., 2017; Heylen et al., 2019; Nasir et al., 2017; Tian et al., 2016; Trewin et al., 2020).

The aforementioned adaptation options have been developed largely in high- and middle income countries, and typically require significant financial resources for their planning and implementation. The assessment for this section did not encounter assessable studies of the benefits of Indigenous or non-Western approaches to managing and adapting to extreme heat risk. Further documentation of these is encouraged.

7.4.2.1.3 Adaptation for nutrition

The protection and promotion of nutrition in a changing climate requires a multi-sectoral, integrated adaptation approach that involves food systems, social protection and health systems, and water and sanitation services, among others (High agreement, medium evidence) (SRCCL 2019; Swinburn 2019; UNICEF, 2020). Adaptation responses include a combination of healthy food systems and diets, social protection schemes and safety nets, access to health services, nutrition-sensitive risk reduction, community-based development, women empowerment, nutrition-smart investments, increased policy coherence, and institutional and cross-sectoral collaboration (High agreement, medium evidence) (FAO, 2018; SRCCL 2019, Mbow et al., 2019). Food systems resilience can be fostered through governance, policies, markets and institutions at all scales scale throughout food systems (Braimoh 2020; Paloviita and Järvelä 2019; Nagoda and Nightingale 2017)(see also chapter on Food Systems, this report).

Integrated agroecological systems where food is considered to be a public good and human right (Vivero-Pol et al., 2019) offer opportunities to increase dietary diversity at household levels while building local resilience to climate-related food insecurity (high confidence) (FAO 2018; HLPE 2019) especially when gender equity and social justice are integrated (Bezner Kerr et al. 2019a; Debray et al. 2019; HLPE 2019; Pandey et al., 2017; Rogé et al. 2014; Schipanski et al., 2016). A beneficial component of such systems is participatory community-based adaptation planning (Nalau et al. 2018, Tschakert et al. 2014). Complementing these are adaptive social protection programs and mechanisms that support food insecure households and individuals through cash transfers or public work programs, land reforms and extension of credit and insurance services which have been shown in studies to reduce food insecurity and malnutrition during times of environmental stress (Carter and Janzen, 2018, Johnson et al., 2013, World Bank 2018, 2019; Alderman, 2016). For example, children from families participating in Ethiopia's Productive Safety Net Program have shown improved nutritional outcomes, partly due to better household food consumption patterns and reduced child labor (Porter and Goyal, 2016). School feeding programs have shown to improve nutritional outcomes, especially among girls, by promoting education, reducing child pregnancy and fertility rates (Drake et al., 2017). Adaptive social protection is most effective when it combines climate risk assessment with disaster risk reduction and wider socioeconomic development objectives (Davies et al., 2013; Steinbach et al., 2016).

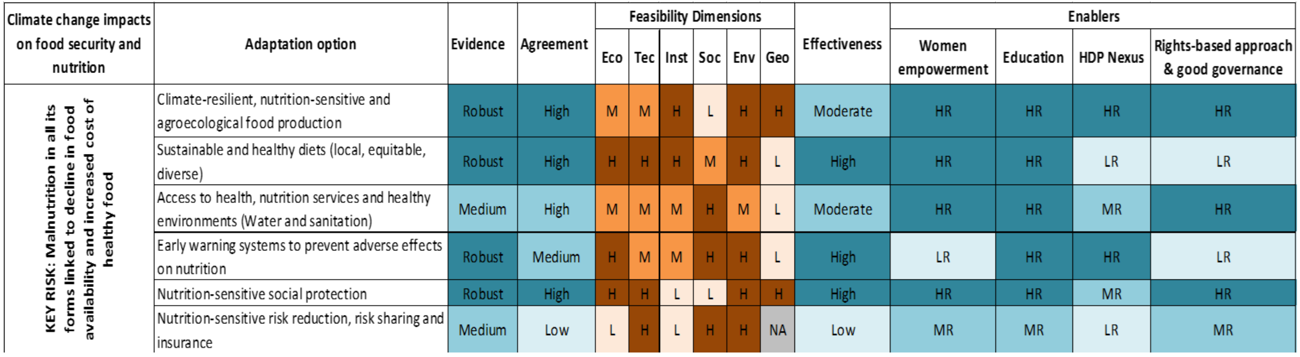
Transformative approaches towards more healthy, sustainable, plant-based dietary patterns require integrated strategies, policies and measures including economic incentives for the production and consumption of more fruits, vegetables and pulses, inclusion of sustainability criteria in dietary guidelines, labelling, public education programs and promoting collaboration, good governance and policy coherence (Glover and Poole, 2019). Food systems resilience can be fostered through governance, policies, markets and institutions at all scales scale throughout food systems (Braimoh 2020; Paloviita and Järvelä 2019; Nagoda and Nightingale 2017, see also chapter on Food Systems, this report). The protection and promotion of nutrition under climate change requires a multi-sectoral combination of adaptation practices including healthy and sustainable diets, nutrition sensitive and agroecological food production, climate-adapted social protection schemes and safety nets, universal access to healthy and healthy environments (including safe water) and nutrition-sensitive risk reduction (including weather-related insurance). Additionally, women and girls' empowerment, enhanced education (either formal education for all and targeted extension services), policy coherence between humanitarian, developmental and peace domains and rights-based approaches and cross-sectoral collaboration are also relevant enablers for nutrition-sensitive adaptation measures (as well as other adaptive measures, since co-benefits of food-security related enablers are paramount).

[START BOX 7.6 HERE]

Box 7.6: Feasibility and Effectiveness Assessment of Multisectoral Adaptation for Food Security and Nutrition

A feasibility and effectiveness assessment was conducted of six adaptation strategies often used and recommended by the UN to respond to malnutrition risks (UNSCN 2010; Tirado et al 2013). Methods adapted from de Coninck et al. (2018) and Singh et al (2020) were used, and combined literature assessment and expert judgment. Six dimensions of feasibility (economic, technical, social, institutional, environmental and geophysical) were considered using nineteen indicators, and the expected longevity of each option and the lead time to initiate it were also examined. Feasibility was defined as how significant the barriers reported in the literature are to implementing a particular adaptation option. Highly feasible options are those where no or very few barriers are reported (and had an average score >2.5 on the scoring criteria. Moderately feasible are those where barriers exist but do not have a strong negative effect on the adaptation option (or evidence is mixed). Low feasibility options have multiple barriers reported that can block the adaptation option, and score below 1.5 on the criteria used. Effectiveness ratings were based on expert consultation and reflect the potential capability of the adaptation option to reduce risk. The final effectiveness and feasibility scores are categorized as high, medium or low, and reflect the combined results of all studies for a given adaptation option (Table Box 7.6.1). The list of studies assessed and their categorizations are shown in Table Box 7.6.2.

Table Box 7.6.1: Preliminary feasibility and effectiveness assessments of multisectoral adaptation for food security and nutrition. From Tirado et al. (in press).



Climate change impacts on food security and nutrition	Adaptation option	Evidence	Agreement	Feasibility Dimensions						Effectiveness	Enablers			
				Eco	Tec	Inst	Soc	Env	Geo		Women empowerment	Education	HDP Nexus	Rights-based approach & good governance
KEY RISK: Malnutrition in all its forms linked to decline in food availability and increased cost of healthy food	Climate-resilient, nutrition-sensitive and agroecological food production	Robust	High	M	M	H	L	H	H	Moderate	HR	HR	HR	HR
	Sustainable and healthy diets (local, equitable, diverse)	Robust	High	H	H	H	M	H	L	High	HR	HR	LR	LR
	Access to health, nutrition services and healthy environments (Water and sanitation)	Medium	High	M	M	M	H	M	L	Moderate	HR	HR	MR	HR
	Early warning systems to prevent adverse effects on nutrition	Robust	Medium	H	M	M	H	H	L	High	LR	HR	HR	LR
	Nutrition-sensitive social protection	Robust	High	H	H	L	L	H	H	High	HR	HR	MR	HR
	Nutrition-sensitive risk reduction, risk sharing and insurance	Medium	Low	L	H	L	H	H	NA	Low	MR	MR	LR	MR

Notes:
Abbreviations used: Ec: Economic; Tec: Technical; Inst: Institutional; Soc: Socio-cultural; Env: Environmental; Geo: Geophysical. HR: high relevance, MR: medium relevance, LR: low relevance. NA = Non-applicable/insufficient evidence to make assessment

Table Box 7.6.2: Studies assessed.

ADAPTATION MEASURES	REFERENCES
Climate-resilient, nutrition-sensitive and agroecological food production	(Calderón et al. 2018; Boedecker et al. 2019; D'Annolfo et al. 2017; HPLE 2019; Heckelman et al. 2018; Bezner Kerr et al. 2019a; Makate et al. 2016; Rogé et al. 2014).
Sustainable and healthy diets	(Tilman and Clark 2014; Springmann 2018b; Willett et al. 2019).
Access to Health, Nutrition Services and Healthy Environments (water and sanitation)	(Tirado et al. 2013; FAO, 2018; Mbow et al., 2019; Hamm et al. 2019; Sanson et al., 2019)
Nutrition-sensitive social protection	(Johnson et al., 2013; Alderman, 2016 ; del Ninno et al., 2016; Asfaw et al., 2017; Asfaw and Davis, 2018; Gilligan, 2019; Ulrichs et al. 2019).
Early warning- Early Action systems to prevent adverse effects on nutrition	(Choularton and Krishnamurthy, 2019; Cools et al., 2016; Funk et al., 2019; Funk et al., 2018; Ewbank et al., 2019; Ruth et al. 2017)
Nutrition-sensitive risk reduction, risk sharing and insurance	(Wilkinson et al., 2018; Atela et al., 2018 ; Peterson and Osgood, 2016; 2018; Aryal et al., 2019 ; Jensen and Barrett, 2017; Greatrex et al., 2015; Fisher et al., 2019)
Women and girls' empowerment	(Bezner Kerr et al. 2016; Alston 2014; Ruel et al. 2018; Nyantakyi-Frimpong, 2017 ; Cáceres-Arteaga et al. 2020).
Education	(Tambo, 2016; Alam et al., 2017; Fadina and Barjolle, 2018; Ali and Erenstein, 2017; Mulwa and Visser, 2020).
Rights-based approach and good governance	(Tirado et al. 2013; FAO 2018; Bizikova et al., 2016; Bailey and Buck 2016; Jacobi et al. 2018; Raheem, 2018; Ensor et al. 2015; Duyck et al., 2018).
Humanitarian Development Peace Nexus	(FSIN-GNAFC, 2020; Weishaupt, 2020; Vivekananda et al., 2014; WFP, 2018; OECD, 2019; Fanning and Fullwood-Thomas, 2019; Howe, 2019; Horne and Boland, 2020; Agensky, 2019)

[END BOX 7.6 HERE]

7.4.2.1.4 Adaptation for mental health

There is a range of adaptation options for reducing mental health risks associated with extreme weather that includes both preventative and post-event responses (high confidence)(Brown et al., 2017; Cohen et al., 2019, James et al. 2020). Responses include improving funding and access to mental health care, surveillance and monitoring of psychosocial impacts of extreme weather events, community-level planning for mental health as part of climate resilience planning (Clayton et al., 2017); and mental health first aid training for care providers and first responders (Hayes et al., 2018). Advance planning for disasters has been shown to reduce post-event mental health challenges, one example coming from China, where pre-planning of temporary shelters found that displaced people who accessed them had significantly lower rates of anxiety, depression, and PTSD in the aftermath of flooding (Zhong et al. 2020). Key elements of successful initiatives include coordinated planning and action between key regional agencies and governments, with a focus on improving accountability and removing barriers to implementation and subsequent access to programs, is important (Ali et al. 2020). As an example, following the 2019 Australian bushfires, the federal government allocated funds to support mental health through free counselling for those affected, increased access to tele-health, extended hours for mental health services and programs designed specifically for youth (Newnham, Titov, & McEvoy, 2020).

Given that mental health is fundamentally intertwined with social and economic wellbeing, adaptation for climate-related mental health risks benefits from wider multi-sectoral initiatives to enhance wellbeing, with there being potential for cobenefits to emerge (high confidence). Improvements in education, quality of housing, safety, and social protections support and connections enhance general wellbeing and make individuals more resilient to climate risks (Lund et al., 2018, Hayes et al 2019). As an example, a study of domestic rainwater harvesting initiatives to promote household water security were also found to improve mental health in participating households (Mercer & Hanrahan, 2017). Adaptive urban design that provides access to healthy natural spaces – described earlier in this section as an option for reducing risks associated with heat stress – has also shown to promote social cohesion and mitigate mental health challenges *(high confidence)* (Buckley et al., 2019; Clayton et al., 2017; Mygind et al., 2019).

7.4.2.1.5 Non-heat early warning systems

Early warning systems are skilled at forecasting risk and are a potentially valuable tool in adapting to climate-related risks associated with infectious diseases (high confidence). Through advanced seasonal weather forecasting that draws upon established associations between climate and infection/transmission conditions, conditions conducive to disease outbreaks can be identified to months in advance, providing time to implement effective population health responses (Morin et al. 2018). Most existing examples are focused on malaria and dengue, but there are examples for other diseases, such as an early warning system also developed for *Vibrios* monitoring in the Baltic Sea (Semenza et al. 2017). An early warning system for dengue outbreaks in Colombia based on temperature, precipitation, and humidity successfully detected 75% of all outbreaks between one and five months in advance, detected 12.5% in the same month, and missed only 12.5% (Lee et al. 2017). Dengue warning systems in Brazil, Malaysia, and Mexico have also generated satisfactory results (Hussain-Alkhateeb et al. 2018). An early warning system for malaria implemented in recent years for the Amhara region of Ethiopia has also proven adept (Merkord et al. 2017).

Early warning systems are effective at detecting and potentially reducing food security and nutrition risks (high confidence). Examples of proven systems include the USAID Famine Early Warning System, FAO's Global Information and Early Warning System, and WFP's Corporate Alert System. Such systems are fundamental for anticipating when a crisis might occur and setting priorities for interventions (Funk et al., 2019). Financial investments are needed to develop early warning systems (Choularton and Krishnamurthy, 2019), but experience has proven they are both cost-effective and reduce human suffering (*high confidence*). For instance, during the 2017 drought-induced food crisis in Kenya, 500,000 fewer people required humanitarian assistance than would have been expected based on past experiences, and this was largely due to timely and effective interventions triggered by early warning (Funk et al., 2018).

7.4.2.2 Challenges and complexities in adaptation in the health sector

7.4.2.2.1 Costs and benefits

There are substantial health costs associated with health impacts of climate change (Ebi, 2008; Hutton, 2011), which increase with the severity of climate change (Martinez et al., 2015) (high confidence). The financial costs associated with extreme weather and climate events have been heavily studies and provide useful insights into the additional costs to be expected as a result of health risks associated with climate change. For example, a study of ten climate-sensitive events in the US in 2012 calculated the health-related costs as amounting to $10 billion, and estimated that the economic burden of extreme weather events is 26% higher than given national estimates when health-related costs are taken into consideration (Limaye et al., 2019). In Sri Lanka, current direct health care costs associated with floods and drought are estimated at $19 million per year (De Alwis and Noy, 2019). Dramatic increases in health and economic burdens of weather-related extreme events are expected as global temperatures rise (Schmitt et al., 2016). There are fewer assessable studies relating to the economic cost of climate-related diseases. In one of the few examples, Stephen (2017, Stephen and Barnett, 2017) estimated that under climate change the costs of salmonellosis in 2036 would increase to AUD$319 million (95% CI: AUD308 million, AUD330 million) compared to 2016.

Extreme heat events generate significant economic costs to the health system and to the wider economy (high confidence). Human health and well-being is one of five pathways through which extreme heat generates negative economic impacts, particularly in countries with hot climates (Acevedo et al., 2020). Under climate change, heat extremes will have the greatest economic impact in terms of GDP exposure on Asia, followed by North America, Europe, Africa, South America and Oceania, with GDP exposure in Africa predicted to rapidly increase in the future (Chen et al., 2020, San et al., 2017). The morbidity and mortality costs associated with extreme temperature and air pollution under climate scenarios RCP 4.5 and RCP 8.5 were estimated by San José et al (2017) for locales within three cities in Europe on an average dollar cost per spatial unit basis; under RCP 8.5, significant costs were identified in Madrid (5.35K$/m2), Milan (1.65K$/m2) and London (0.99K$/m2). Extreme heat increases costs associated with emergency department visits (Toloo et al., 2015), hospitalization, and ambulance services (Wondmagegn et al., 2019). Analysis of the economic costs of heatwaves in Europe in 2003, 2010, and 2015 estimated losses to agriculture of USD$59–90 per worker, and losses in the construction sector of USD$41–$72 per per worker (Orlov et al., 2019).

Controlling air pollution as part of climate mitigation efforts generates significant cobenefits (high confidence). The net benefits of such initiatives could potentially reach trillions of dollars annually depending on the air quality policies adopted globally (Markandya et al., 2018; Scovronick et al., 2019). Air pollution reductions that would result from meeting Paris Agreement targets are estimated as providing a health cobenefits-to-mitigation ratio of between 1.4 and 2.45, with additional economic benefits likely to be realized in India and China for pursuing mitigation goals associated with 1.5°C warming (Markandya et al., 2018). In Asia, the benefit of air pollution reduction through climate mitigation measures was found to be three times their cost, with life value savings estimated at USD 2.8 trillion versus mitigation costs of USD 840 billion, equating to 6% and 1.8% of GDP respectively (Xie et al., 2018). Similarly, achieving ambitious mitigation targets in South Korea (i.e. limiting radiative forcing to 3.4 W/m^2) would lead to a USD 23.52 billion cost reduction from the combined benefits of avoided premature mortality, health expenditures and lost work hours (Kim et al., 2020). In the US, reductions in O_3 and PM2.5 result in significant savings associated with reduced all cause deaths, cardiovascular and respiratory hospital admissions, and lost work days from 2046 to 2055 (Yang et al., 2019). Similarly, the health co-benefits related to physical exercise and reduced air pollution largely offset the costs of implementing low CO_2 emitting urban mobility strategies in three Austrian cities (Wolkinger et al., 2018). However, cost-benefit analyses for climate mitigation in urban settings do not account for health, and may thereby underestimate the potential cost savings and benefits (Markanday et al., 2019).

Mitigation responses initiated in other sectors, including energy generation, transportation, food and agriculture, household, and industry, are often health-promoting and lead to beneficial, cost-effective, outcomes in the health sector (high confidence)(Gao et al., 2018). As one example, a study in New Zealand of dietary change from animal-based foods to plant-based foods could result in up to 44% reduction of diet-related GHG emissions in New Zealand while generating NZ$13.9 to 20.2 billion in health system savings and health gains of between 1.02 and 1.46 million quality-adjusted life years (Drew et al., 2020).

There is a need for greater research focusing on cost-effectiveness and cost-benefits of adaptation and mitigation, as well as costs of delayed action and inaction (high confidence). There are numerous challenges associated with developing cost-benefit analyses to support climate adaptation decision-making within and for the health sector. Examples include insufficient evidence, lack of comparability of results across studies, partial scope and short-term focus of the analyses, technical challenge with quantifying economic costs and benefits of health outcomes, and inherent uncertainty regarding climate risks and underlying processes (Limaye et al., 2019; Martinez et al., 2015; Remais et al., 2014; Workman et al., 2018). As a result, (Hutton, 2011; Limaye et al., 2019; Menne et al., 2015; Schmitt et al., 2016; Wondmagegn et al., 2019).

Comprehensive cost-benefit assessment of health co-benefits requires an interdisciplinary process and is best carried out with in collaboration with policy makers (Remais et al., 2014; Wolkinger et al., 2018, Hess et al 2020). This is particularly important to support decision-making processes as co-benefits and related cost reductions are often not taken into consideration (Wolkinger et al., 2018; Workman et al., 2018). For example, public health, climate change and economic costs/benefits are three important axes for decision-making for urban sanitation, but incomplete public health evidence and cost-benefit analyses, combined with the lack of perceived immediacy of climate change risks pose significant barriers to their consideration (Mills et al., 2020). Asia and Africa are priority regions for further research given their high levels of population and GDP exposure to climate risks (Chen et al., 2020).

7.4.2.2.2 Financial constraints

Financial constraints are the most commonly referenced barrier to adaptation (Wheeler and Watts, 2018) and so scaling up financial investments remains a key international priority (high confidence) (UNFCCC, 2017a). AR5 estimated the costs of adaptation in developing countries at between US$70 billion and US$100 billion annually in the year 2050, but these are likely to be a significant underestimate, particularly in the years 2030 and beyond (UNEP, 2014). National surveys from the World Health Organization make it clear that a major barrier to the implementation of health adaptation priorities is finance (Watts et al., 2020). Novel research drawing on global financial transaction data suggests an evolving picture. In 2019, global spending within the healthcare sector on climate adaptation reached US$18.4 billion, representing some 5.3% of total global spending on adaptation (Watts et al 2020). While this represents a small proportion of the overall total, positive health outcomes can be achieved through investment outside of the formal healthcare sector, so the net benefits are greater. Growth in health adaptation spending from 2018 to 2019 outpaced growth in overall spending; however, most of this has been driven by spending in by high- and upper-middle income countries, with investment in Africa, South-East Asia, and the Eastern Mediterranean being more or less stagnant in recent years (Watts et al., 2020).

There has been limited participation of the health sector in international climate financing mechanisms (Martinez and Berry, 2018). Of 149 projects listed in the Adaptation Fund (adaptation-fund.org) database in October 2020, a large number are broad based initiatives that may have considerable indirect benefits for health systems, such as enhanced disaster preparedness and food security, but none were explicitly aimed at strengthening health systems or channeled funds through state ministries of health. A recent survey of national public health organization representatives from a mix of low-, middle- and high-income countries found that a lack of political commitment, insufficient coordination across sectors, and inadequate funding for public health-specific adaptation initiatives as being common barriers to building climate resilience (Marcus and Hanna 2020). Under-investment in climate-specific initiatives in health systems coincides with persistent under-investment in health care more generally relative to other government spending, especially in low and middle income countries (Schäferhoff et al 2019).

Adaptation financing often does not reach places where the climate-sensitivity of the health sector is greatest (Weiler, 2019). Financial constraints are reported in African contexts as one of the key reasons for slow implementation of adaptation measures for health (Nhamo & Muchuru, 2019). Strengthening health systems in vulnerable countries has the potential to reduce current and future economic costs related to environmental health risks, thus enabling reinvestment in the health system and sustainable development (WHO, 2020). Robust and comprehensive climate and health financing builds first on core health sector investments (World Health Organization, 2015). Other potential opportunities for resource mobilization include health-specific funding mechanisms, climate change funding streams, and investments from multi-sectoral action and action in health-determining sectors (World Health Organization, 2015). Incorporating climate change and health considerations into disaster reduction and management strategies could potentially improve funding opportunities and increase potential funding streams (Aitsi-Selmi et al., 2015). Reinforcing cross-sectoral governance mechanisms maximizes health co-benefits and economic savings, by allowing for multisectoral costs and benefits to be comprehensively considered in decision-making (Belesova et al., 2016; WHO, 2020). An additional financial need concerns health research, the existing funding for which does not match what is needed to support the implementation of the combined objectives of the UN 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction; and the Paris Agreement (Ebi et al., 2016).

7.4.2.2.3 Governance, collaboration and coordination

Effective governance institutions, arrangements, funding and mandates is a key element in adaptation for climate-related health risks (high confidence). Without integration and collaboration across sectors, health adaptation has the potential to become siloed, leading to less effective adaptation or even maladaptation (Magnan et al, 2016, Fox et al., 2019). Integration and collaboration includes working laterally across national government departments and agencies, as well as vertically, from national agencies to local governments, and with the private sector, academia, NGOs and civil society. In this context, top-down policy design and implementation is complemented by bottom-up approaches that engage community actors in program design, and draw upon their local practices, perspectives, opinions and experiences. Opportunities exist to better integrate public health into climate change discourse and policymaking processes and strengthen public health partnerships and collaborative opportunities (Awuor et al., 2020). Creating networks, integration across organizations and jointly developed policies are some ways cross-sectoral collaboration can be carried out (Bowen & Ebi, 2017).

7.4.2.3 Incorporating Disaster Risk Reduction into adaptation responses

Integrating health into national disaster risk management plans has wider benefits for resilience and adaptation to climate change risks (high confidence). (UNFCCC, 2017a, Watts et al., 2019). Disaster risk reduction (DRR), including disaster preparedness and response, is widely recognized as important for reducing health consequences of climate-related hazards and extreme weather events (Few, 2007; Keim, 2008; Keim, 2011; Paterson et al., 2014; Phalkey and Louis, 2016). Global events, including climate-related extreme events and public health emergencies of international concern (for example, Ebola, MERS and COVID-19) have influenced the development of national public health preparedness and response systems and attracted significant investment over the last two decades (Khan et al., 2015; Murthy et al., 2017; Watson et al., 2017). The Sendai Framework for Disaster Risk Reduction and the International Health Regulations establish important global and regional goals for increasing health system resilience, and reducing health impacts from biological hazards and extreme climate events (Aitsi-Selmi et al., 2015; Maini et al., 2017; UNFCCC, 2017b; UNISDR, 2015; Wright et al., 2020). There are explicit links between the health aspect of the Sendai Framework and UN Sustainable Development Goals 1, 2, 3, 4, 6, 9, 11, 13, 14, 15 and 17 (Wright et al., 2020). More specifically, reducing the number of disaster-related deaths, illnesses and injuries, as well as damage to health facilities are key indicators for achieving the goals set out in the Sendai Framework (UNFCCC, 2017b).

The intersection of health and multisectoral DRM, recognized as Health Emergency and Disaster Risk Management (Health-EDRM), encompasses approaches from multisectoral DRM, epidemic preparedness and response including the capacities for implementing the International Health Regulations (IHR, 2005), health systems strengthening and health systems resilience (Lo et al., 2017; World Health Organization, 2019; Wright et al., 2020). Health-EDRM costs are affordable for most governments and are notably lower than the cost of inaction (Peters et al., 2019). Additional per capita costs in low-income countries range from 4.33 USD (capital) and 4.16 USD (annual recurrent costs), to additional 1.35 USD (capital) and 1.41 USD (annual recurrent costs) in upper middle-income countries (Peters et al., 2019). Adopting a Health-EDRM approach supports the systematic integration of health and multisectoral DRM to ensure a holistic approach to health risks and assists alignment of action in health security, climate change and sustainable development (Chan and Shi, 2017; Dar et al., 2014; World Health Organization, 2019; Wright et al., 2020).

Climate-informed Health-EDRM is crucial for the climate resilience of health systems (World Health Organization, 2015), particularly to account for additional risks and uncertainties associated with climate change and allow for well-planned, effective and appropriate DRM and adaptation (Watts et al., 2018a; World Health Organization, 2013; World Health Organization, 2015). Potential coherent approaches to addressing climate change and disaster risks to health include: strengthening health systems, vulnerability and risk assessment which incorporate disaster and climate change risk, building resilience of health systems and health infrastructure, and climate-informed EWSs (Banwell et al., 2016; Phalkey and Louis, 2016). However, a review of DRR projects including climate change in South Asia found that the health sector was the least represented with only 2% of 371 projects relating to health (Mall et al., 2019) indicating a need to strengthen the incorporation of climate change in Health-EDRM. Current tracking under the Sendai Framework of Disaster Risk Reduction 2015-2030 shows that most countries (particularly low-income countries and lower-middle income countries) still lack robust systems of integrated risk monitoring and early warning (UNEP 2018).

7.4.2.4 Monitoring, Evaluation and Learning

Monitoring, evaluation and learning (MEL) is a process that is important for ensuring the long term success of climate adaptation planning in the health sector. MEL describes a process that includes baseline assessment, selection of priority actions and activities, identification of important indicators to track, ongoing collection of data on these indicators, and periodic consideration of new information, as well as ongoing progress relative to stipulated goals (Kruk et al 2015). One of the challenges for MEL in the context of adaptation is that climate risks vary as a function of time, location, socioeconomic development, demographics, and activities in other sectors (Ebi et al., 2018). MEL indicators in the health sector need to account for factors related to governance, implementation, and learning as well as for important exposures, impacts, and programmatic activities, all of which are context dependent and are often outside the health sector (Ebi et al., 2018; Fox et al., 2019). A survey of national ministries of health from 101 countries over 2017/2018 found approximately 50% had developed national health and climate strategies, over 2/3 of these within the preceding 5 years, and 48/101 had conducted a vulnerability and adaptation assessment for health (Watts et al 2019). However, the majority of countries reported only moderate or low levels of implementation with financing being cited as the most common barrier (24 out of 43 respondents), specifically due to a lack of information on opportunities, a lack of connection by health actors to climate change processes and a lack of capacity to prepare country proposals.

There is as yet no universal standardized approach to monitoring or evaluating adaptation activities in the health sector (high confidence). Considerable work has been done to identify candidate indicators of climate change health impacts and adaptation activity, typically at the national level (Bowen and Ebi, 2017; Cheng and Berry, 2013; English et al., 2009; Environmental Protection, 2010; Kenney et al., 2016; Navi et al., 2017; World Health, 2015). Recent work suggests that indicators are best grouped by category of activity, i.e. indicators of vulnerability, risk, and exposure; indicators of impacts; and indicators of adaptation and resilience (Ebi et al., 2018). As health adaptation expands, enhanced monitoring will be needed to ensure that scientific advances are translated into policy and practice. An initiative that has emerged since AR5 that shows considerable value is the *Lancet Countdown*, which represents a global effort at tracking various indicators of exposures, impacts, adaptation activities, finance, and media activity related to climate change and health (Watts et al., 2018b).

Community-based monitoring of adaptation responses to health impacts, especially in Indigenous communities, has not been widely undertaken, despite it being a promising strategy to improve monitoring of, and local adaptation to, environmental change (Kipp et al., 2018). The health sector has been particularly weak at recognizing climate impacts on and adaptation needs of Indigenous communities and in engaging Indigenous communities in monitoring progress (Ford et al., 2018, David-Chavez et al., 2018; Galloway-McLean, 2017). Successful adaptation to the health impacts of climate change in Indigenous communities requires recognition of their rights to self-determination, focusing on Indigenous conceptualizations of wellbeing, prioritize Indigenous knowledge, and be grounded in a broader agenda of decolonization, health and human rights (*high confidence)* (Ford et al., 2015; Green and Minchin, 2014; Hoy et al., 2014; Jones, 2019; Jones et al., 2014; Mugambiwa, 2018; Nursey-Bray and Palmer, 2018).

Attribution to climate change as a risk factor, which can be difficult to parse (Ebi et al., 2017) is rarely addressed for most adaptation outcomes (Ebi et al., 2018). Indicators should capture measures of process that drive adaptation readiness, including measures that facilitate progress such as leadership, institutional learning, and intersectoral collaboration (Ford and King, 2015), as well as outcome measures such as presence of programming known to reduce risk (Ebi et al., 2018). Additionally, indicators related to scaling up of interventions known to be effective, relying on implementation science frameworks (Damschroder et al., 2009; Theobald et al., 2018), would be a helpful addition in this category but have not yet been fully elaborated (Ebi et al., 2018; Fox et al., 2019). The issue of specificity, and the extent to which monitoring, evaluation and learning of adaptation in the health sector should focus on programming related to and impacts attributable to climate change remains unresolved. This can most likely can be addressed with a combination of indicators related to overall health system performance and population vulnerability, with indicators more specifically related to climate change and related vulnerability, risks, impacts, and adaptation activities (Ebi et al., 2018).

7.4.2.5 Perceptions of climate change risks and links to adaptation

Adaptation decisions and responses to climate change can be influenced by perceptions of risks, which are a function of individuals' characteristics, knowledge and experience (medium agreement, medium evidence). Institutional and governmental responses are critical for adapting to climate-related risks in health and other sectors, but individual responses are also relevant. Individual responses are in turn strongly affected by perceptions that climate change is real and requires a response (Ogunbude et al., 2019). Perceptions of climate risks are formed by such things as including experiencing changes in local weather and observing environmental changes (Hornsey et al., 2016), experiences of extreme weather events (van der Linden, 2015), knowledge about climate change impacts (van der Linden, 2015), and individual characteristics such as values and worldviews (Poortinga et al. 2019) (*high agreement, medium evidence*). In addition to perceptions of risk, the likelihood that an individual will implement behavioural adaptations, or support relevant public policy, is a function of subjective assessments of the response options. Research examining individual variation in adaptation responses includes studies of disaster preparation (Bamberg et al. 2017; van Valkengoed & Steg, 2019) and examining measures taken to protect oneself from high temperatures (Akompab et al. 2013). Personal experiences with climate hazards tend to have only a small impact on disaster preparations (Bamberg et al., 2017, Valkengoed & Steg, 2019). There is mixed evidence from research regarding the extent to which beliefs in the reality of climate change, perceived risks of climate change, and accepting personal responsibility predict probability of implementing response options in the form of personal disaster preparations (Hornsey et al., 2016; van Valkengoed & Steg, 2019, Brenkert-Smith et al 2015). Risk perceptions include both logical assessments about the likelihood and severity of climate change impacts, and affective feelings about those impacts. On average, affective measures of risk perception are more strongly associated with disaster preparation than cognitive measures (Bamberg et al., 2017; van Valkengoed & Steg, 2019). Place attachment, having a strong emotional connection to a particular location, is weakly associated with disaster preparation (Brügger et al 2015). In some cases place attachment may inhibit adaptive responses, either by reducing perceptions of risk, or by making people reluctant to leave an area that is threatened (de Dominicis et al., 2015; van Valkengoed & Steg, 2019).

Efficacy beliefs, social norms, and subjective resilience, have implications for communication about the need for climate adaptation. Efficacy beliefs represent the belief in one's ability to carry out particular action and the belief that the action will have the desired outcome. Belief that one is personally able to complete a behavior is moderately associated with engaging disaster preparations (van Valkengoed & Steg, 2019) and with adaptation intentions in a study of Chinese farmers (Burnham & Ma, 2017). *Collective efficacy*, the belief that a group of people working together are able to achieve a desired outcome, is important for participating in community adaptation behaviors (Bandura, 1982; Chen, 2015; Thaker et al 2015). Related to this is *response efficacy*, a belief that a behavior will achieve its desired outcome, which is also moderately associated with engaging in disaster preparations (van Valkengoed & Steg, 2019). Collective efficacy can potentially be developed by strengthening communication networks and social ties within a community. Examples in which groups of similar others have engaged in a desired response can increase motivation to comply with the norm illustrated and convey collective efficacy, which can also translate into stronger perceptions of personal efficacy (Jugert et al., 2016).

Distinct from efficacy beliefs, subjective resilience is a more general optimism or belief about one's ability (Jones, 2019; Khanian et al 2019). Subjective resilience (Clare et al 2017), can influence preferred responses to climate change via assessment of one's ability to engage in specific response options. Identities can influence assessment of subjective resilience. For example, one study found that those with greater attachment to a region were more likely to perceive that they had the capacity to adapt to drought conditions, which led them to decide to stay and cope with these conditions rather than migrate (Khanian et al., 2019; see also Jones, 2019).

7.4.2.6 Transformative actions in the health sector

Chapter 1 of this report places emphasis on the need for transformative change across sectors to respond to the risks of climate change. Context determines when adaptation limits have been reached, and how profound a transformational change is needed; context specificity is thus one of the most complex challenges in making generalized prescriptions for transformational change (IPCC, 2017), and complicates decisions of how to prioritize strategies and actions to implement them once these are identified. A simple example from the field of climate and health human heat tolerance illustrates. Core body temperatures can reach lethal levels under sustained periods of ambient temperatures of 35°C or more (or at lower temperatures if there is significant exertion (Wheeler, 2018)), such as will become more common in many regions (IPCC, 2018). The adaptation response to this challenge depends heavily on the socio-economic context. For example, in high-income countries, common adaptation measures include the use of air conditioning, visits to swimming pools and so forth (Willett and Sherwood, 2012). Such options are often not readily available to many people in low-income countries, and so transformational development trajectories are needed to expand access to these and other options.

In literature pertinent to climate risk responses in the health sector and multispectral responses for health, three types of transformational change that are encountered are:

- Universal Health Coverage, which leads to a substantial reduction in vulnerability by increasing health care access; informative examples come from a range of countries including Iran (Ahmadnezhad et al, 2019) and Turkey (Caner et al 2018; Stokes et al, 2015; Tigril et al 2018)

- coordinated adaptation strategies across health, food, energy and transport sectors that reduce vulnerability (see section 7.4.2.1.3; also Ranabhat et al. 2018; Charlesworth & Jamieson, 2018), and

- cobenefits in reducing emissions and thereby reducing exposure to future a range of heat and respiratory risks.

With regard to emissions reductions, the health sector has considerable opportunity to reduce its own carbon footprint, and by doing so would contribute to mitigation efforts, and help reduce health burdens associated with air quality (Vidal et al, 2014; Duane et al, 2019; Charlesworth & Jamieson, 2019; Charlesworth et al 2018; Guetter et al, 2018; Bharara et al, 2018; Frumkin, 2018). Health systems are large carbon polluters have the potential to look beyond traditional 'green' initiatives towards more fundamental, longer-term redesign of current service models, with health practitioners participating actively in this process (Charlesworth & Jamieson, 2018). As one small the type of food served in hospitals influence its carbon footprint of a hospital, which can in turn be lowered depending on the type of food being served (Vidal et al, 2014). Other options include investing in energy efficient lighting (which is also a cost-saving measure), rainwater harvesting systems, solar water heating systems, and replacing fossil fuel use in the power used for heating and laundry systems (Bharara et al, 2018). Examples of recent and ongoing initiatives include those undertaken by the Kaiser Permanente and the Gundersen Clinics in the US; the UK National Health Service; Canada's Health Care without Harm Programme in Canada; and the Green Hospital Initiative in New Delhi (Frumkin, 2018; Bharara et al, 2018).

7.4.2.7 Reproductive health care access as transformative change

Sustainable Development Goal (SDG) 3.7 commits the international community to ensuring universal access to reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programs (UNGA, 2015). Its achievement would represent a transformative change that greatly enhances families' resilience and reduces vulnerability to a range of climate-related and non-climatic risks. Female education is an essential component of adaptive capacity to climate change (Lutz et al. 2014; Sorensen et al. 2018). Adolescent pregnancy has negative effects on education outcomes at both secondary and tertiary level, with especially negative effects at earlier ages (Berthelon et al. 2017; Timaeus and Moultrie, 2015). Emergencies resulting from climate-related extreme events have a range of impacts on physical, mental and reproductive health, including increased risk of maternal and infant mortality and morbidity, increased risk of sexual and other forms of gender-based violence, disruption in access to family planning, and disruption of prevention of mother to child transmission regimens for HIV positive pregnant women (Global Facility for Disaster Reduction and Recovery 2014; Dar 2014). Post-disaster needs assessments for varying climate-related hazards, including cyclones in the Pacific and extended drought in Angola, have identified significant sexual and reproductive health and gender-based violence needs as part of response and recovery (Government of Vanuatu 2015; Government of Angola, 2017). Integrating the planning and delivery of Reproductive Health (RH), for instance through strengthening the linkages between HIV and other services, optimizes resources and opportunities for improving universal access to SRH in communities, including during disaster response.

Increased access to reproductive health services and family planning can result in multiple health and well-being benefits for women and their children, including increased education, empowerment and economic status. Collectively, these benefits help reduce human vulnerability to climate change impacts (Onarheim et al. 2016; Starbird et al. 2016). Meeting the unmet need for reproductive health services in areas that have high fertility and high vulnerability to climate change can improve human health and build climate resilience in low- and middle-income settings (Hardee et al. 2018; Lopez-Carr and Ervin 2017; Bongaarts and O'Neill 2018; Sinaga et al. 2015; Robson 2017)(*high confidence*).

7.4.3 Migration and Adaptation in the Context of Climate Change

7.4.3.1 Linkages between migration, adaptation, household resilience

AR5 Chapter 17 (Human Security) concluded that migration is often, though not in all situations, a potential form of adaptation initiated by households, and subsequent peer reviewed research provides further support for that conclusion. *The "solutions space" for climate-related migration is shaped by the circumstances under which migration occurs, and the degree of agency under which household migration decisions are made; these determine if the outcomes are successful in terms of advancing the wellbeing of the household and providing benefits to sending and receiving communities (high confidence)* (Adger et al 2015, Cattaneo et al 2019; Cross-Chapter Box MIGRATE). Evidence from refugee studies and general migration research indicate that higher agency migration, in which migrants have mobility options, are allowed opportunities for integrating into labour markets at the destination, and are able to easily remit money home, has the greatest potential for generating benefits for migrant households and for sending and receiving communities (International Organization for Migration 2019). Bilateral agreements that facilitate this have been identified as being especially urgently needed for Pacific small island states (Weber 2017).

Adaptive migration and the implied assumption that people can or should simply move out of harm's way is not a substitute for underinvestment in adaptive capacity building (high confidence) (Bettini and Gioli 2016). Climate-related migration most often occurs only after *in situ* adaptation options have been exhausted and where government actions are inadequate (Adger et al 2015, Ocello 2015). The threshold at which household adaptation transitions from *in situ* measures to migration is highly context specific and reflects the degree of exposure to specific climate risks, mobility options and the socio-economic circumstances of the household and the local community (McLeman 2017, Adams and Kay 2019). A consistent theme in the research literature is that proactive investments in health, social, and physical infrastructure including those not aimed specifically at climate risks build societal adaptive capacity and household resilience, thereby expanding the range of adaptation options available to households and increasing the likelihood that, when migration does occur, it does so under conditions of high agency that lead to greater chances of success. Identifying appropriate solutions that create climate-resilient communities benefits from understanding exposed populations' social and economic needs (Adams & Kay, 2019).

7.4.3.2 Climate, migration and linkages to labour markets and social networks

Adaptive climate-related migration is often closely related to wage-seeking labour migration (medium confidence). Because of the circumstances under which they move, climate-related migrants' destination and labour market choices, and the returns from migration, may be more heavily constrained than are those of other labour migrants (Jessoe et al 2018, Wrathall and Suckall 2016).Within low- and middle-income countries, rural-urban migrant networks (often referred to as 'trans-local' networks) are important channels for remittances that help build socio-economic resilience to climate hazards (Porst and Sakdapolrak 2020), with higher levels of wage-seeking labour participation having been observed in climate-sensitive locales in South Asia (Maharjan et al 2020). Social networks are a key asset in helping climate migrants overcome financial and structural impediments to their mobility, but these have their limits, particularly with respect to international migration. Since AR5, greater restrictions have emerged on movement between low- and high-income countries, suggesting future climate migrants may be constrained in their destination options (McLeman 2019). Transnational diasporic connections are a potential asset for building resilience in sending communities highly exposed to climatic risks, with migrants' remittances potentially providing resources for long term resilience building, recovery from extreme events, and reducing income inequality (Bragg et al, 2018, Mosuela and Matias 2015, Obokata and Veronis 2018, Shayegh 2017). Safe and orderly labour migration is consequently a potentially beneficial component of wider cross sectoral approaches to building adaptive capacity and supporting sustainable development in regions highly exposed to climate risks (McLeman 2019)

7.4.3.3 Attitudes toward climate migration

An important determinant of the success of climate-related migration as an adaptive response relates to how migrants are perceived and how policy discussions are framed. The possibility that climate change may enlarge international migrant flows has in some policy discussions been interpreted as a potential threat to the security of destination countries (Sow et al, 2016, Telford 2018), but there is little evidence of such in the literature assessed for this chapter. There is also an inconsistency between framing in some policy discussions of undocumented migration (climate-related and other forms) as being "illegal'' and the objectives of the Global Compact on Safe, Orderly and Regular Migration adopted by UN member states in 2018 (McLeman 2019). Although AR4 and AR5 explicitly rejected the framing of climate-related migrants as being 'environmental refugees', the term continues to persist in popular media and policy discussions (Høeg and Tulloch 2018, Wiegel et al 2019). The framing of migration policy discussions is relevant, for example, in discussing climate adaptation options for Pacific small island states, where there is considerable disagreement over policy discussions that range from a 'migration-with dignity' approach that would liberalize labour migration in the Pacific region, to those that see migration as a last resort option to be avoided as much as possible (McNamara 2015, Farbotko and McMichael 2019, Oakes 2019, Remling 2020). A more beneficial policy framing in terms of ensuring that future migration contributes to climate resilience and sustainable development has been established since AR5 within the framework of the Global Compact for Safe, Orderly and Regular Migration (see 7.4.3.5).

Attitudes with respect to climate-related migration that occurs within countries are relevant to adaptation policymaking. Research from Kenya and Vietnam shows that residents of receiving communities view environmental drivers as being legitimate reasons for people to move and are unlikely to stigmatize such migrants (Spilker et al 2020). Case studies from India suggesting that a lack of recognition by local authorities of climatic factors as being legitimate drivers of rural-urban migration may lead to discrimination against migrants in terms of access to housing and other social protections, thereby undermining household resilience (Chu and Michael 2018).

7.4.3.4 Planned relocation and managed retreats

There is high agreement among existing studies that immobile populations often have greater vulnerability and/or higher long term exposure to climate hazards than other populations, and that non-climatic political and social factors within countries may strongly constrain mobility (Zickgraf 2019, Ayeb-Karlsson et al 2020). Section 7.2 of this chapter highlighted the particular vulnerability of immobile populations that are unable or unwilling to relocate in the face of growing risks. However, research suggests governments should be slow to label such populations as being 'trapped' or to actively promote relocations in the absence of local agreement that *in situ* adaptation options have been exhausted (Adams 2016, Farbotko and McMichael 2019). Considerable health implications can potentially emerge within populations that are relocated as part of planned retreat, and represent an important consideration for planners (Dannenberg et al 2019).

Where in situ *adaptation options are exhausted, disruptive and expensive abandonments and organized relocations of coastal settlements may become increasingly necessary in coming decades, especially in coastal locations exposed to extreme storms, floods and sea level rise (high confidence)* (Hauer 2017, Hino et al 2017). The financial costs of managed retreat are high, ranging from US$10,000 per person in examples from Fiji, to US$100,000 per person in Louisiana, USA (Hino et al 2017). Managed retreat is politically and emotionally charged, will not necessarily be undertaken autonomously by exposed populations, and is most successful when approached proactive and strategically requires a strategic approach to avoid increasing the socio-economic vulnerability of those who are relocated (Bronen & Chapin 2013, Kousky 2014, Wilmsen and Webber 2015, Chapin et al, 2016, Hauer et al 2019). Key considerations for protecting the rights and wellbeing of people who might need to be resettled include proactive communication with and participation of the affected communities, availability of compensation, livelihood protection, and ensuring there is permanence and security of tenure at the relocation destination (Tadgell et al 2018). Availability of funds for resettlement, how to manage relocation from communally owned lands, how to value privately owned land to be abandoned, and the potential for loss and damage claims are just some of the many additional complications involved (Marino, 2018; McNamara et al 2018).

7.4.3.5 International policy frameworks for migration that lead to climate-resilient development

Changes in the geographical characteristics of the human niche in coming decades due to anthropogenic warming (Xu et al 2020) will coincide with a growing demographic gap between agings, slow-growing populations in high-income countries and rapidly growing, youthful populations in low-income countries (UN DESA 2019). Given this confluence, coordinated national and international strategies that integrate migration considerations with wider adaptation and sustainable development policies may present the most climate-resilient development pathways. Since AR5, the international community has established policymaking frameworks consistent with scholarly literature on how to make climate-related migration a positive contribution toward adaptive capacity building and sustainable development more broadly (Warner 2018).

An important policy framework for responding to climate-related migration has emerged since AR5, the 2018 Global Compact on Safe, Orderly and Regular Migration. Among its 23 objectives, the Compact explicitly encourages the international community to implement migration policies to facilitate voluntary migration and manage more frequent involuntary displacements due to climate change, especially in low- and middle-income countries. The Compact's objectives include reducing barriers to legal and safe migration, facilitating the freer flow of remittances between sending and receiving communities, and in doing so increase the potential for migration to make positive contributions to sustainable development and to adaptive capacity-building. There are particular provisions from climate- and disaster-related migration and displacement. Objective 2 of the Compact aims at reducing drivers of involuntary or low-agency migration, and recommends that states establish systems for sharing information on environmental migration, develop climate adaptation and resilience strategies harmonized at subregional and regional levels; and cooperate on disaster risk prevention and response. Other objectives in the Compact relevant to climate-related migration include Objective 5 (increasing pathways for regular migration) and Objective 19 (facilitating migrants' ability to contribute to sustainable development). Objective 18, which links migration and skills development, is consistent with the 'migration with dignity' proposal advanced by the government of Kiribati described above.

Pursuant to the Paris Agreement, a task force was struck by the Warsaw International Mechanism to make recommendations to the Conference of the Parties to the UNFCCC on how to reduce the risks of climate-related displacement. Its 2018 report recommended that parties work toward development of national legislation, cooperate on research, strengthen preparedness, integrate mobility into wider adaptation plans, work toward safe and orderly migration, and provide assistance to people internally displaced for climate-related reasons. Such recommendations dovetail strongly with the objectives of the Compact on Migration and with the Sendai Framework for Disaster Risk Reduction and the 2030 Sustainable Development Goals. The SDGs, which include multiple goals and targets in which migration plays an explicit role in fostering development (Nurse 2019), may be seen as completing the international policy arrangements necessary for addressing future climate-related migration and displacement.

7.4.4 Adaptation Solutions for Reducing Conflict Risks

Policy responses and strategies that localize development and expand the adaptation and mobility options of populations exposed to climatic risks are also likely to generate co-benefits in terms of reducing risks of *climate-related conflict and political instability* (*high agreement, medium evidence*). AR5 concluded that climate change affects underlying drivers of conflict such as poverty and inequality, and that the impacts of conflict, and being conflict-affected reduces adaptive capacity. *Recent research is consistent with AR5 conclusions that conflict will have a negative impact on adaptive capacity* (*high agreement, medium evidence*) (Crawford et al, 2015). Sections 7.2 and 7.3 highlighted how climate variability is associated with changes in the nature of violent conflict, rather than its onset, and that the presence of contradictory findings on climate-conflict linkages reflect high levels of context specificity and methodological issues. Solutions for climate and conflict are emerging from research on the potential implication for peacebuilding, and reflect differing approaches taken by researchers and by practitioners within the security and military communities (Jayaram, 2020; Diez et al, 2016). While the practitioner community requires information on monitoring, evaluation and how to assess the efficacy of interventions to prevent climate conflict (Gilmore, 2018), the academic community has focused instead on understanding causal pathways between conflict and environmental variables (Barnett, 2018). There has been increased activity within the international community on climate-conflict linkages since AR5, with high level actions including the UN Climate Security Mechanism, launched in 2018, tasked with providing integrated climate risk assessments to the UN Security Council and other UN bodies, in partnership with UN and external actors (UNDPPA, 2019). G7 governments have initiated an integrated agenda for resilience (Ruttinger et al. 2015) and the Berlin Call for Action in 2019 sought foreign policy as a platform to address climate security concerns. Non-peer-reviewed 'grey literature' regarding policy and research about climate-related conflict is disproportionately generated by a small number of consultancies working for particular governments, and needs to be interpreted accordingly

The environment can form the basis for active peace building and a sustainable natural environment is important for ongoing peace (high agreement, medium evidence). Environmental peacebuilding (EP) involves preserving the natural environment such that changes do not contribute to violence; protecting natural resources during conflict and using natural resources as core factor in post-conflict economic recovery (Kron, 2019). Ide (2020) maps out five sets of key EP practices three of which directly relate to climate change: i) 'climate-security' activities, including efforts to reduce grievances and incentives for violence by adapting to climate change and building resilient livelihoods; ii) Disaster risk reduction (DRR) and post disaster reconstruction, that aim to address existing conflict dynamics or to promote social cohesion through environmental work; and, iii) shared environmental challenges as incentives for joint problem-solving, which can facilitate better intergroup relations. There is emergent evidence for the success of these pathways, for example a resource sharing agreement on the Kenya-Uganda border brokered by Mercycorps (see Abrahams, 2020); but their long-term impacts on sustaining peace are yet to be monitored and evaluated (Ide and Tubi, 2019).

The United Nations Environment Programme, the European Union and Adelphi have developed a toolkit for addressing climate fragility risks in peacebuilding, adaptation and livelihoods support (UNEP, EU, Adelphi, 2019). Crawford et al (2015) provide concrete suggestions in line with the UN Secretary-General's five peacebuilding dimensions, including integrating ex-combatants through the construction of climate resilient infrastructure, using climate impacts as a platform to engage previously conflicting groups, developing national disaster risk reduction and management strategies, in addition to climate-proofing economic development activities. The United States Agency for International Development, in a report prepared for the Adaptation Thought Leadership and Assessments (ATLAS) program (Adelphi & Chemonics 2020) builds on the work of the community of practice as well as lessons learned from resilience and peacebuilding programs in the Horn of Africa, recommend two critical conditions to ensure work addresses compound climate fragility risks. Firstly, conducting local analyses of the links between climate, conflict, and fragility to identify specific risks to target; and secondly, ensuring long term commitment with a focus on participation and flexibility.

There is high agreement within and between the grey and academic literature on a need for conflict-sensitive adaptation that focuses on institutional frameworks, conflict management, and governance mechanisms (Scheffen et al, 2012, Matthew, 2018, Marana et al, 2018). Moreover, such adaptation should be actively utilized for a long-term approach to complex interacting risks and emergencies (Okpara et al. 2018). However, most adaptation activities continue to be planned and implemented under development or climate finance funds without systematic integration of conflict sensitivity. National Adaptation Strategies tend to address conflict and fragility risks implicitly, if they do at all (Tänzler et al, 2019) and there exists no specific guidance for adaptation programming in fragile and conflict-affected contexts. Practitioners and policy researchers have attempted to address this gap by developing guidance and delivering training (e.g. Tänzler et al, 2019; Bob and Bronkhurst, 2014). Crawford and Church (2020) highlight the synergies between adaptation planning under the UNFCCC's National Adaptation Plan process and conflict reduction. Discussing development more broadly, Abrahams (2020) suggests three barriers to development that incorporate conflict-climate risks: geographically disconnected impacts and outcomes, the threat multiplier discourse, and teleconnected risks across occurring at different scales.

Disasters and disaster recovery have the potential to act as windows of opportunity to bring about peace (medium evidence, medium agreement). There is the potential for extreme weather events and disasters to cause political instability (Donovan, 2016) and governments to use the window of opportunity post-disaster to intensify state repression (Wood and Wright, 2016), to alter insurgent groups' behaviour (Walch, 2018) and to illuminate the priorities and weaknesses of state actors. Research highlights how different stakeholders use disasters to establish new narratives and alter public opinion (Venugopal and Yasir, 2017). However, some research has demonstrated how the disaster space has had positive impacts in terms of the state-social contract, and strengthening citizenship of marginalized communities, through state action on social protection mechanisms (Siddiqi, 2018; 2019). Thus, there is more scope to investigate the potential for the post-disaster space to offer windows of opportunity for transformative political change (e.g. Pelling and Dill, 2010). A body of literature interrogates the potential for disaster diplomacy; the ability of disaster-risk related activities to reduce conflict and promote cooperation with findings showing that the potential for disasters to bring about peace is limited (e.g. Kelman et al, 2018). Others speak to the risks and opportunities associated with 'securitizing' disasters through state and multi-lateral actors, such as the UNSC (Peters, 2018).

Formal institutional arrangements for natural resource management can contribute to wider cooperation and peacebuilding (high agreement, high evidence) (See also chapter on Water, this report). Evidence from the field of from transboundary water agreements shows that tools employed to adapt to climate change require robust institutions, which are built through agreements and river basin organizations (De Stefano et al. 2012; Milman et al. 2013, Dinar et al. 2015). States are motivated to become involved in environmental cooperation even where there is tension, creating a vehicle for peace (Barquest et al. 2014). Securing cooperation over shared waters often involves negotiations over other associated topics, including foreign policy, and such approaches have long been practiced, as in the case of the Colorado-Rio Grande (Dombrowsky 2010). As such, cooperation over natural resources can be leveraged for wider gains, such as economic development and security, as in the case between China and Kazakhstan (Ho 2017). Conflicts arising from water-related hazards have the potential to devise new measures to address vulnerability (Kallis and Zografos 2014). However, the links between water and its impacts from climate change, conflict and security are highly complex.

7.4.5 Climate Resilient Development Pathways

Climate-resilient development pathways (CRDP) are development trajectories that combine adaptation and mitigation to realize the goal of sustainable development, with health, well-being, and equity being core elements (see Chapter 18). The integration of adaptation and mitigation in sustainable development can bring co-benefits for health, wellbeing, and equity, and this recognition is starting to inform adaptation and risk management decision-making (Chapter 17). The remainder of the present chapter considers the roles played by health, health systems and wider community well-being in creating CRDP.

7.4.5.1 Health and wellbeing co-benefits of climate resilient development pathways

Substantial health benefits associated with climate adaptation and mitigation derive from changes in air quality from policies that span several economic sectors (Chang et al. 2017). In economic terms, the incremental health co-benefits of tackling many of the most common air pollutants outweigh the incremental mitigation cost of a 2°C target (Peng, et al 2017; Woodward et al., 2019; Xie et al., 2018). In Europe, Scasny et al (2015) estimated that a mitigation scenario compatible with RCP 2.6 would reduce total pollution costs, mostly from PM2.5, by 84%, with human health benefits equal to more than 1 € trillion over five years. In the EU, ambitious climate mitigation policies could reduce years of lost life due to fine particulate matter from over 4.6 million in 2005 to 1 million in 2050, reduce ozone-related premature deaths from 48,000 to 7000, and generate health benefits of 62 billion €/year in 2050 (Schucht et al., 2015)

Given the overlap in sources of GHGs and co-pollutants in energy systems, energy strategies that pursue GHG emission reductions and improvements in energy efficiency hold significant potential health co-benefits through air pollution emission reductions (high confidence)(Gao et al., 2018). Within these broad categories, however, and under a life cycle assessment lens, there may be significant trade-offs with other environmental impacts (Dong et al., 2019; Gao et al., 2018). Further, in some scenarios, mitigation policies consistent with the NDCs may slow down poverty reduction efforts (Campagnolo & Davide, 2019) with implications for health. A framework of "co-impacts" that assumes neither a general beneficial nature of all implications from mitigation policy nor a hierarchy between climate and other types benefits, may be more adequate (Ürge-Vorsatz et al 2014, Cohen et al 2017). Transitioning to renewable energy sources also presents opportunities for substantial health co-benefits (Gibon et al. 2017; Lacey et al. 2017; Peng et al. 2018; Vandyck et al. 2018; Williams et al. 2018). Adherence to planned emission reductions from the Paris Agreement related to renewables would subsequently improve air quality could and prevent 71,000-99,000 premature deaths annually by 2030 (Vandyck et al. 2018). This effect increases with a 2° mitigation pathway, with 0.7–1.5 million premature deaths avoided annually by 2050 (Vandyck et al. 2018). Co-benefits are also observed at national and regional levels. For instance, China would expect 55,000–69,000 averted deaths in 2030 if it transitioned to a half-decarbonized power supply for its residential and vehicle sectors (Peng et al. 2018).

Assessment of the whole range of available opportunities for cross-sectoral cooperation and investment that would generate mitigation and adaptation benefits for health and wellbeing is beyond the capacity of this chapter. A closer assessment of several proven areas of opportunity is given in the Cross-Chapter Box HEALTH, with beneficial outcomes for health summarized in the table therein.

7.4.5.2 Creating climate-resilient food systems and diets

The current food system accounts for up to 30% of total GHG emissions (IPCC ROCC, 2019). Transforming the food system by limiting the demand for GHG-intensive animal foods, and limiting food waste at the consumption level can have significant co-benefits to health and need to be a critical component in climate policies (Hedenus et al. 2014: Ripple et al. 2014; Tirado et al 2017; Springmann et al. 2018; IPCC RS1.5, 2018). (High Confidence). Reducing food over-consumption, changing dietary preferences towards less meat, more plant-based protein, and avoiding food waste can contribute significantly to provide healthy diets for all, reduce the food system's environmental footprint and mitigate climate change (SROC 2019). Healthy diets high in vegetables, fruits, whole grains, pulses, nuts, and seeds, with modest amounts of meat and dairy, promote health and well-being (Nelson et al. 2016; Willet et al. 2019) while also helping to reduce GHG emissions (*high confidence*) (Tilman and Clark 2014; Green et al. 2015; Springmann et al. 2016b; Milner et al. 2017; Springmann 2018b; Willett et al. 2019). A number of studies have shown that reduction of red meat helps reduce the risk of cardiovascular disease and the risk colorectal cancer; and the consumption of more fruits and vegetables can reduce the risk of cardiovascular disease, type II diabetes, cancer, and all causes of mortality (WHO, 2015; Tilman and Clarke 2014; Sabate et. al 2014; Willett et al. 2019).

Since AR5, a number of studies at national level have estimated health and environmental benefits from dietary shifts to reduce GHG emissions and diet-related non-communicable diseases, while still conforming to WHO dietary recommendations (Green et al. 2015, Milner et al. 2015, Milner et al. 2017, Farchi et al. 2017, Song et al. 2017). In China, changing diets in could also mitigate health issues caused by PM2.5 air pollution (Zhao et al. 2017). Studies in the US suggest adoption of healthier diets reduces relative risk of coronary heart disease, colorectal cancer, and type 2 diabetes by 20–45%, reduces health care costs by USD 77–93 billion per year (Hallström et al. 2017). Globally, it is estimated that transitioning to more plant-based diets, in line with WHO recommendations on healthy eating could reduce global mortality by 6–10% and food-related greenhouse gas emissions by 29–70% by 2050 (Springmann et al. 2016b). A transformation to healthy diets by 2050 will require substantial dietary shifts (which differ regionally), including a greater than 50% reduction in global consumption of foods, such as red meat and sugar, and a greater than 100% increase in consumption of healthy foods, such as nuts, fruits, vegetables, and legumes (Willett et al. 2019). This could prevent up to 11.1 million deaths per year in 2030, a 19.9% reduction of all premature mortality due to prevention of cardiovascular disease, diabetes, and cancer, among others (Willett et al. 2019).

The Eat Lancet Commission outlines five implementable strategies for achieving a Food System Transformation towards healthy diets: i) international and national commitment to shift towards healthy diets ii) re-orienting agricultural priorities from producing high quantities of food to producing healthy food; iii) sustainably intensify food production to increase high-quality output; iv) strong and coordinated governance of land and oceans; and v) halve food losses and waste, in line with global sustainable development goals, across the food supply chain, from production to consumption (Willet et al. 2019). Options for achieving these include economic incentives for the production and consumption of more fruits, vegetables and pulses; taxing and eliminating subsidies of unhealthy foods; inclusion of sustainability criteria in dietary guidelines; conducting public education campaigns; promoting traditional food cultural heritage and gastronomy; labelling; establishing healthy and sustainable institutional food procurement; and promoting collaboration and shared agreements among others (Garnett, 2015; FAO/FCRN 2016; Springmann et al. 2017; 2018b, Tirado 2017; 2019; Nordic Council Food Policy Lab, 2018; Willet et al. 2019; Swinburn 2019). Ensuring access to healthy, sustainable food for all requires reducing the volatility of food prices, such as by removing market barriers across local regions or markets, ensuring access to price information and early warning systems, implementing strict regulations against speculation, international management of food stocks, revisions of biofuel subsidies and tariffs to avoid diversion of food to energy use (Chapter 5), and establishing social protection schemes, insurance programs, and other safety nets (Torero et al 2016).

[START CROSS-CHAPTER BOX HEALTH HERE]

Cross-Chapter Box HEALTH: Co-benefits of Climate Solutions for Human Health and Wellbeing

Authors: Cristina Tirado (Ch 7 WGII); Jeremy Hess (Ch 7 WGII); Robbert Biesbroek (Ch 13, WGII); Ara Begum (Ch 1, WGII); Mercedes Bustamante (Ch 7; WGIII); Felix Creutzig (Ch 5, WGIII); Luisa Cabeza (Ch 9 WGIII); Diarmid Campbell-Lendrum (Ch 7 WGII); Nathalie Hilmi (Ch 18 WGII); Rachel Bezier Kerr (Ch 5, WGII); Fatima Denton (Ch 17, WGIII); Siri Eriksen (Ch 18, WGII) Maria Figueroa (Ch 2, WGIII); Elisabeth Gilmore (Ch 14, WGII); Peter Newman (Ch 10 WGIII); Sebastian Mirasgedis (Ch 9, WGIII); Mark Pelling (Ch6 WGII) Yamina Sahed (Ch 9, WGIII); Gerardo Sanchez (Ch 7, WGII); Pete Smith & Adrian Leip (Ch 12, WGIII), Dhar Subash (Ch 10, WGIII); Chris Tristos (Ch9 WGII); Diana Urge-Vorsatz, (Ch 8, WGIII), Mohamed Y. Sokona (Ch 15, WGIII).

Measuring co-benefits of climate action

Achieving the Paris Agreement and SDGs requires urgent actions into low-carbon, healthy, resilient and equitable societies with high-wellbeing for all (Alfredsson et al. 2018, O'Neill et al. 2018, Sections 1.5 and 7.4, WGIII AR6 Chapter 5). Climate change adaptation and mitigation can have net-positive impacts on health, wellbeing and equity (Westet al. 2013; Chang et al. 2017; Markandya et al. 2018). Measures to adapt to adverse health impacts of climate change can substantially offset mitigation costs at the societal level (Chang et al. 2017; Scasny et al., 2015; Schucht et al., 2015). Estimates of health co-benefits show that pursuit of a 1.5°C of warming would result in 152 ± 43 million fewer premature deaths worldwide between in 2100 (compared to a business-as-usual scenario), particularly due to reductions in exposure to PM2.5 (Shindell et al. 2018). Some of the most substantial health, wellbeing and equity benefits associated with climate action derive from investing in basic infrastructure for all: sanitation, clean drinking water, clean energy, affordable healthy diets, clean public transport and improved air quality from transformative solutions across economic sectors including agriculture, energy, transport and buildings (Chang et al. 2017). Many of such measures have strong adaptation potential to reduce the impacts and increase adaptive capacity. This Cross-Chapter Box provides a comprehensive assessment of the co-benefits of climate solutions to health and wellbeing as well as their synergies and trade-offs (Examples of HL Key Messages below and in the Table).

Key messages:

Access to affordable renewable energy for all.

Transitioning to affordable renewable energy sources for all, presents opportunities for substantial wellbeing, health and equity co-benefits *(High Confidence)* (Gibon et al. 2017; Lacey et al. 2017; Peng et al. 2018; Vandyck et al. 2018; Williams et al. 2018, Section 7.4, Chapter 18). The largest share (85%) of human-made air pollution derives from fuel combustion related to energy production and use (IEA, 2016). Adherence to planned emission reductions from the Paris Agreement related to renewables would subsequently improve air quality and prevent 71,000-99,000 premature deaths annually by 2030 (Vandyck et al. 2018). (Section 7.4). This effect increases with a 2°C-mitigation pathway, with 0.7-1.5 M premature deaths avoided annually by 2050 (Vandyck et al. 2018). Due to the overlap in sources of GHGs and co-pollutants in energy systems, strategies to reduce GHG emission and improvement in energy efficiency hold significant potential health co-benefits through air pollution emission reductions (Gao et al., 2018, Chapter 18). In some scenarios, mitigation policies consistent with the National Determined Contributions could slow down poverty reduction efforts (Campagnolo & Davide, 2019, Section 7.4, WGIII AR6 Section 6.3). Residential solid fuel use affects health and degraded indoor air quality for up to 3.1 billion people in low and middle-income countries (WHO, 2016, Wang et al., 2017).

Urban transformation: healthy, green and inclusive cities

Investing in basic infrastructure for all - sanitation, clean drinking water, drainage, electricity and land-rights, can transform development opportunities, increase adaptive capacity and reduce climate risk *(high agreement, high evidence)* (Sections 6.1 and 6.3). Transformative approaches that deliver enhanced social inclusion and development opportunity for the urban poor as well as reducing climate risk are most likely where local government act in partnership with local communities and other civil society actors (high confindence) (Sections 6.1, 6.3 and 6.4).

Stimulate active transport (walking and bicycling) can bring physical and mental health benefits *(high confidence)* (7.4) (6.) (8.2 WG III) (Rojas et al. 2016; Avila-Palencia et al. 2018; Gascon et. al 2019). Urban planning that provides high accessibility for active modes, thus shifting car users to cycling and shared pooled mobility, are strategies that combine low-carbon solutions with equitable and healthy societies and high-wellbeing for all (6.4, 13.7.3, 5.3 WGIII). Health benefits from use of public transportation and lower-emission vehicles accrue through improvements in air quality and decreased traffic-related injuries (Gao et al. 2018, Kwan et al. 2017; Sarigiannis et al. 2017; Tainio et al. 2017). The health gains from active transport outweigh traffic-related injuries, due to a decreased incidence of chronic diseases (Ahmad et al. 2017; Maizlish et al. 2017; Tainio et al. 2017; Woodcock et al. 2018).

Urban green spaces contribute to climate change adaptation, mitigation and bringing benefits to physical and mental health and wellbeing *(high confidence)* *(Hansen 2017; EC, 2018; WHO, 2018; Rojas-Rueda et al. 2019).* (7.4, 13.7.3, 6.) (8.4 WGIII). Urban green infrastructure can bring benefits to mental health and wellbeing and reduce the health impacts of heatwaves by decreasing temperatures (Murague et al. 2020), thus reducing inequities in exposure to heat stress for low income, marginalized groups (Hoffman et al. 2020) (14.4.10.3, 7.4) (6.) (13.7).

Green buildings

Climate solutions in the building sector offer multiple wellbeing and health co-benefits *(High Confidence)* *Diaz* Mendez et al. 2018; MacNaughton et al. 2018) (7.4, 13.6.2,) 9.8 WGIII). These measure can increasehealth benefits through better indoor air quality, energy/fuel poverty alleviation, better ambient air quality, and elimination of the heat island effect (MacNaughton et al. 2018; Levy et al. 2016; Balaban and Puppim de Oliveira 2017; Tonn et al. 2018; Thema et al. 2017; Payne et al. 2015; Liddell and Guiney 2015) (7.4, 9.8 WGIII). Moreover, such actions are shown to help improve social well-being through energy poverty alleviation, increased productive time, creation of new jobs, increased income, more thermal comfort and lighting indoors, reduced noise impact, etc. (Smith et al. 2016; Payne et al. 2015; Tonn et al. 2018; Berrueta et al. 2017; Galán-Marín et al. 2015; Mehetre et al. 2017; Rosenthal et al. 2018; Burney et al. 2017; McCollum et al. 2018; Thema et al. 2017; Mirasgedis et al. 2014; Alawneh et al. 2019) (7.4, 9.8 WGIII). The value of these multiple co-benefits associated with climate actions in buildings is equal or greater than the costs of energy savings (Ürge-Vorsatz et al. 2016; Payne et al. 2015) (9.8 WGIII). (14.4.5.3, 7.4).

Plant-rich diets and land use reduction

Limiting the demand for GHG-intensive animal protein and shifting into healthier plant-rich diets can significantly reduce of GHG emissions, and reduce land-use bringing adaptation and health co-benefits especially in regions where ill health related to over-consumption of animal-based products is prevalent *(High Confidence)*(5.WGII) (7.4, 13.5,) (5.WGIII) (7.3 WGIII) (Hedenus et al. 2014: Ripple et al. 2014; Springmann et al. 2018; SRCCL 2019; Clark and Tilman 2017; Poore and Nemecek 2018) Hayek et al. (2020). Transitioning to plant-rich diets, in line with WHO recommendations on healthy eating could reduce global mortality by 6–10% and food-related GHG emissions by 29–70% by 2050 (Springmann et al. 2016b; Tilman and Clarke 2014; Sabate et. al 2014; Green et al. 2015, Milner et al. 2015; 2017; Farchi et al. 2017, Song et al. 2017). (7.4) (5.4) (6.3 WGIII). Agroecological approaches, including agroforestry, can provide substantial mitigation and adaptation and bring benefits to health and equity (Rosenstock et al. 2019) (5.) (13.5, 14.4.4). Ensuring access to and affordability of healthy diets from sustainable food systems for all requires reducing volatility of food prices, at the regional or local level. (7.4) (14.4.4.3)

Transformation toward healthier, equitable, high wellbeing and low-carbon demand societies:

High wellbeing requires decent standards of living for all (5.2. WGIII) (18.). These require 20-50GJ/cap energy supply for everyone, requiring additional energy for the lower income quintiles in poorer countries (Rao et al 2019). (5.1 WGIII). Avoiding and shifting energy of high-emitters includes strategies that combine the low-carbon solutions, highlighted above, with equitable and healthy societies and high-wellbeing for all, and this replaces a material consumption-based economy with a low-carbon, energy-services, and wellbeing and equity-oriented economy (O'Neill et al. 2018; Alfredsson et al. 2018) (14.4.7.3) (7.4) (5. WGIII). Civil society, shaping new social norms, social identity and ensuing collective action, such as forwarded by the youth Fridays For the Future, are important initiators of a corresponding transition (Bamberg et al. 2015; Nyborg et al. 2016, 18 WGIII) These need to translate into policy action that reshape infrastructures and incentives to enable broad buy-in by all societal actors (Creutzig et al. 2016) (14.7).

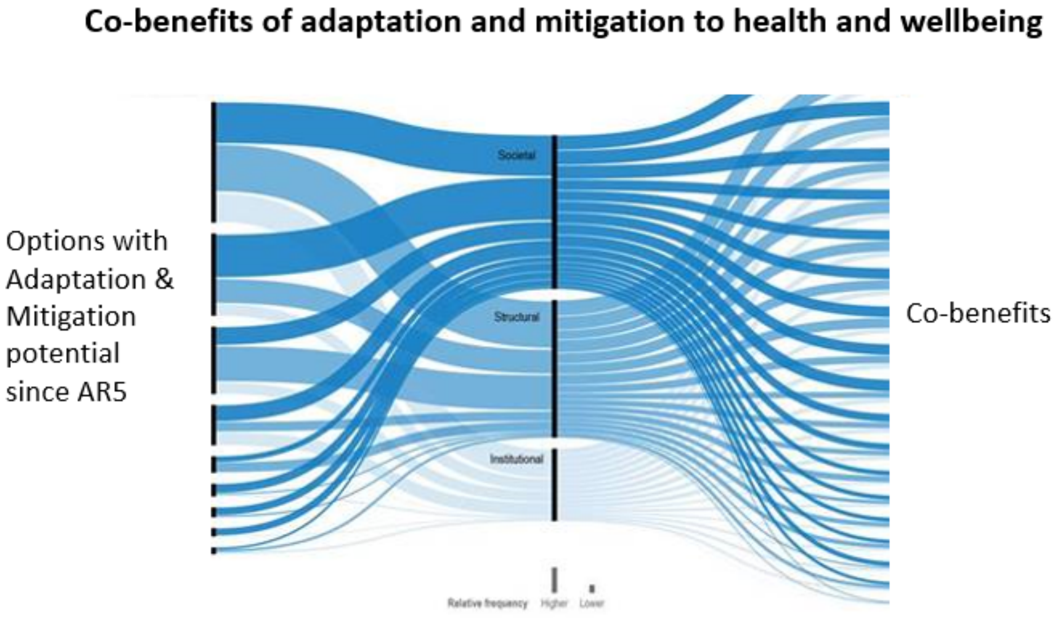
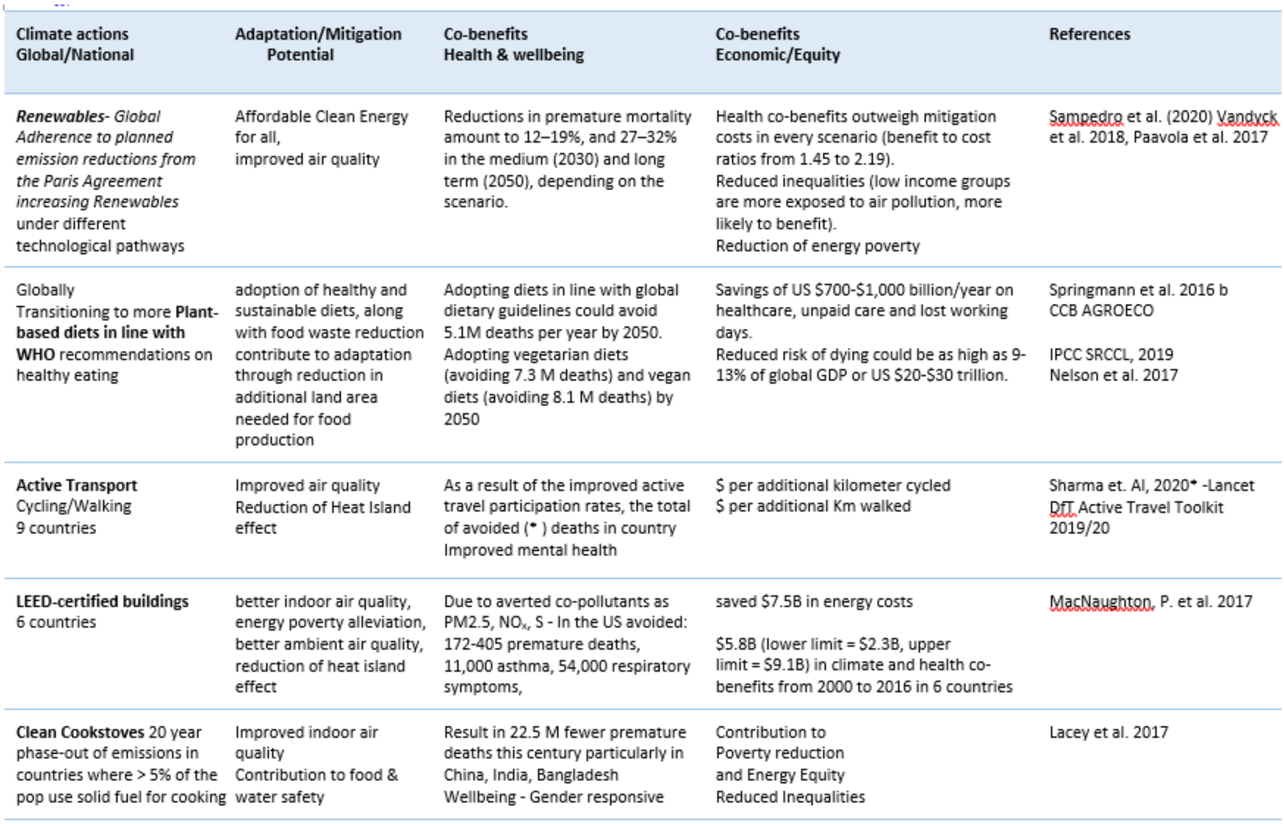


Figure CCB HEALTH.1: [PLACEHOLDER FOR FINAL DRAFT: Figure 13.11 (shown) will be updated to show a range of adaptation and mitigation options to reduce climate risks and the health co-benefits this creates. The figure will collect input from the the various sections of the WGII report].

Table CCB HEALTH.1: Co-benefits of climate adaptation and mitigation for health and wellbeing



Climate actions Global/National	Adaptation/Mitigation Potential	Co-benefits Health & wellbeing	Co-benefits Economic/Equity	References
***Renewables**- Global Adherence to planned emission reductions from the Paris Agreement increasing Renewables* under different technological pathways	Affordable Clean Energy for all, improved air quality	Reductions in premature mortality amount to 12–19%, and 27–32% in the medium (2030) and long term (2050), depending on the scenario.	Health co-benefits outweigh mitigation costs in every scenario (benefit to cost ratios from 1.45 to 2.19). Reduced inequalities (low income groups are more exposed to air pollution, more likely to benefit). Reduction of energy poverty	Sampedro et al. (2020) Vandyck et al. 2018, Paavola et al. 2017
Globally Transitioning to more **Plant-based diets in line with WHO** recommendations on healthy eating	adoption of healthy and sustainable diets, along with food waste reduction contribute to adaptation through reduction in additional land area needed for food production	Adopting diets in line with global dietary guidelines could avoid 5.1M deaths per year by 2050. Adopting vegetarian diets (avoiding 7.3 M deaths) and vegan diets (avoiding 8.1 M deaths) by 2050	Savings of US $700-$1,000 billion/year on healthcare, unpaid care and lost working days. Reduced risk of dying could be as high as 9-13% of global GDP or US $20-$30 trillion.	Springmann et al. 2016 b CCB AGROECO IPCC SRCCL, 2019 Nelson et al. 2017
Active Transport Cycling/Walking 9 countries	Improved air quality Reduction of Heat Island effect	As a result of the improved active travel participation rates, the total of avoided (*) deaths in country Improved mental health	$ per additional kilometer cycled $ per additional Km walked	Sharma et. Al, 2020* -Lancet DfT Active Travel Toolkit 2019/20
LEED-certified buildings 6 countries	better indoor air quality, energy poverty alleviation, better ambient air quality, reduction of heat island effect	Due to averted co-pollutants as PM2.5, NO$_x$, S - In the US avoided: 172-405 premature deaths, 11,000 asthma, 54,000 respiratory symptoms,	saved $7.5B in energy costs $5.8B (lower limit = $2.3B, upper limit = $9.1B) in climate and health co-benefits from 2000 to 2016 in 6 countries	MacNaughton, P. et al. 2017
Clean Cookstoves 20 year phase-out of emissions in countries where > 5% of the pop use solid fuel for cooking	Improved indoor air quality Contribution to food & water safety	Result in 22.5 M fewer premature deaths this century particularly in China, India, Bangladesh Wellbeing - Gender responsive	Contribution to Poverty reduction and Energy Equity Reduced Inequalities	Lacey et al. 2017

References

Alfredsson, E., Bengtsson, M., Brown, H. S., Isenhour, C., Lorek, S., Stevis, D., & Vergragt, P. (2018). Why achieving the Paris Agreement requires reduced overall consumption and production. *Sustainability: Science, Practice and Policy*, *14*(1), 1-5.

Alawneh, R., F. Ghazali, H. Ali, and M. Asif, 2019: A new index for assessing the contribution of energy efficiency in LEED 2009 certified green buildings to achieving UN sustainable development goals in Jordan. Int. J. Green Energy, 16, 490–499, https://doi.org/10.1080/15435075.2019.1584104.

Bamberg, S., Rees, J., & Seebauer, S. (2015). Collective climate action: Determinants of participation intention in community-based pro-environmental initiatives. Journal of Environmental Psychology, 43, 155-165.

Bozzola, M., & Smale, M. (2020). The welfare effects of crop biodiversity as an adaptation to climate shocks in Kenya. World Development, 135, 105065. https://doi.org/https://doi.org/10.1016/j.worlddev.2020.105065

Balaban, O., and J. A. Puppim de Oliveira, 2017: Sustainable buildings for healthier cities: assessing the co-benefits of green buildings in Japan. J. Clean. Prod., 163, S68–S78, https://doi.org/10.1016/j.jclepro.2016.01.086.

Berrueta, V. M., M. Serrano-Medrano, C. García-Bustamante, M. Astier, and O. R. Masera, 2017: Promoting sustainable local development of rural communities and mitigating climate change: the case of Mexico's Patsari improved cookstove project. Clim. Change, 140, 63–77, https://doi.org/10.1007/s10584-015-1523-y.

Burney, J., H. Alaofè, R. Naylor, and D. Taren, 2017: Impact of a rural solar electrification project on the level and structure of women's empowerment. Environ. Res. Lett., 12, https://doi.org/10.1088/1748-9326/aa7f38.

Campagnolo, L., & Davide, M. (2019). Can the Paris deal boost SDGs achievement? An assessment of climate mitigation co-benefits or side-effects on poverty and inequality. *World Development*, *122*, 96–109. https://doi.org/https://doi.org/10.1016/j.worlddev.2019.05.015

Casey, G., & Galor, O. (2017). Is faster economic growth compatible with reductions in carbon emissions? The role of diminished population growth. *Environmental Research Letters*, *12*(1), 014003. https://doi.org/10.1088/1748-9326/12/1/014003

Chang, K. M., Hess, J. J., Balbus, J. M., Buonocore, J. J., Cleveland, D. A., Grabow, M. L., … Ebi, K. L. (2017, November 1). Ancillary health effects of climate mitigation scenarios as drivers of policy uptake: A review of air quality, transportation and diet co-benefits modeling studies. *Environmental Research Letters*. IOP Publishing Ltd. https://doi.org/10.1088/1748-9326/aa8f7b

Cohen, B., Tyler, E., & Gunfaus, M. T. (2017). Lessons from co-impacts assessment under the Mitigation Action Plans and Scenarios (MAPS) Programme. *CLIMATE POLICY*, *17*(8), 1065–1075. https://doi.org/10.1080/14693062.2016.1222258

Creutzig, F., Fernandez, B., Haberl, H., Khosla, R., Mulugetta, Y., & Seto, K. C. (2016). Beyond technology: demand-side solutions for climate change mitigation. Annual Review of Environment and Resources, 41, 173-198.

Dong, C., Huang, G., Cheng, G., An, C., Yao, Y., Chen, X., & Chen, J. (2019). Wastewater treatment in amine-based carbon capture. *Chemosphere*, *222*, 742–756. https://doi.org/10.1016/j.chemosphere.2019.01.038

Galán-Marín, C., C. Rivera-Gómez, and A. García-Martínez, 2015: Embodied energy of conventional load-bearing walls versus natural stabilized earth blocks. Energy Build. 97, 146–154, https://doi.org/10.1016/j.enbuild.2015.03.054.

Haines, A., Amann, M., Borgford-Parnell, N., Leonard, S., Kuylenstierna, J., & Shindell, D. (2017). Short-lived climate pollutant mitigation and the Sustainable Development Goals. *Nature Climate Change*, *7*(12), 863–869. https://doi.org/10.1038/s41558-017-0012-x

Hansen 2017. Shinrin-Yoku (Forest Bathing) and Nature Therapy: A State-of-the-Art Reviewhttps://www.ncbi.nlm.nih.gov/pmc/articles/PMC5580555/

Hoffman, J. S., Shandas, V., & Pendleton, N. (2020). The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas. *Climate*, *8*(1), 12. https://doi.org/10.3390/cli8010012

IEA. (2016). *Energy and Air Pollution: A Special Edition of World Energy Outlook Report*. Vienna, Austria. Retrieved from https://www.iea.org/publications/freepublications/publication/WorldEnergyOutlookSpecialReport2016EnergyandAirPollution.pdf

Kerr, D. (2016). Population growth, energy use, and environmental impact: Comparing the Canadian and Swedish records on CO2 emissions. https://doi.org/10.1.1.977.3807

Kwan, S. C., & Hashim, J. H. (2016). A review on co-benefits of mass public transportation in climate change mitigation. *Sustainable Cities and Society*, *22*, 11–18. https://doi.org/10.1016/j.scs.2016.01.004

Lacey, F. G., Henze, D. K., Lee, C. J., van Donkelaar, A., & Martin, R. V. (2017). Transient climate and ambient health impacts due to national solid fuel cookstove emissions. *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*, *114*(6), 1269–1274. https://doi.org/10.1073/pnas.1612430114

Liu, C., Chen, R., Sera, F., Vicedo-Cabrera, A. M., Guo, Y., Tong, S., … Kan, H. (2019). Ambient Particulate Air Pollution and Daily Mortality in 652 Cities. *New England Journal of Medicine*, *381*(8), 705–715. https://doi.org/10.1056/NEJMoa1817364

Markandya, A., Sampedro, J., Smith, S. J., Van Dingenen, R., Pizarro-Irizar, C., Arto, I., & González-Eguino, M. (2018). Health co-benefits from air pollution and mitigation costs of the Paris Agreement: a modelling study. *The Lancet. Planetary Health*, *2*(3), e126–e133. https://doi.org/10.1016/S2542-5196(18)30029-9

Nyborg, K., Anderies, J. M., Dannenberg, A., Lindahl, T., Schill, C., Schlüter, M., ... & Chapin, F. S. (2016). Social norms as solutions. Science, 354(6308), 42-43.

O'Neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018). A good life for all within planetary boundaries. Nature sustainability, 1(2), 88-95.

Paavola, J. (2017). Health impacts of climate change and health and social inequalities in the UK. Environmental Health, 16(S1), 113. https://doi.org/10.1186/s12940-017-0328-z

Peng, W., Yang, J., Wagner, F., & Mauzerall, D. L. (2017). Substantial air quality and climate co-benefits achievable now with sectoral mitigation strategies in China. *SCIENCE OF THE TOTAL ENVIRONMENT*, *598*, 1076–1084. https://doi.org/10.1016/j.scitotenv.2017.03.287

Quam, V. G. M., Rocklov, J., Quam, M. B. M., & Lucas, R. A. I. (2017). Assessing Greenhouse Gas Emissions and Health Co-Benefits: A Structured Review of Lifestyle-Related Climate Change Mitigation Strategies. *INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH*, *14*(5). https://doi.org/10.3390/ijerph14050468

Ramaswami, A., Tong, K., Fang, A., Lal, R. M., Nagpure, A. S., Li, Y., Wang, S. (2017). Urban cross-sector actions for carbon mitigation with local health co-benefits in China. *Nature Climate Change*, *7*(10), 736–742. https://doi.org/10.1038/nclimate3373.

Rao, N. D., Min, J., & Mastrucci, A. (2019). Energy requirements for decent living in India, Brazil and South Africa. *Nature Energy*, *4*(12), 1025-1032.

Roe, S., Streck, C., Obersteiner, M., Frank, S., Griscom, B., Drouet, L., Fricko, O., Gusti, M., Harris, N., Hasegawa, T., Hausfather, Z., Havlík, P., House, J., Nabuurs, G.J., Popp, A., Sanz Sánchez, M.J., Sanderman, J., Smith, P., Stehfest, E. & Lawrence, D. 2019. Contribution of the land sector to a 1.5°C World. Nature Climate Change, 9, 817–828. doi: 10.1038/s41558-019-0591-9

Rojas-Rueda et al. 2019. Green spaces and mortality: a systematic reivew and meta-analysis of cohort studies. Lancet Planetary Health 10.1016/S2542-5196(19)30215-3.

Rosenstock, T. S., Dawson, I. K., Aynekulu, E., Chomba, S., Degrande, A., Fornace, K., Steward, P. (2019). A Planetary Health Perspective on Agroforestry in Sub-Saharan Africa. *One Earth*, *1*(3), 330–344. https://doi.org/10.1016/j.oneear.2019.10.017.

Sabel, C. E., Hiscock, R., Asikainen, A., Bi, J., Depledge, M., van den Elshout, S., … Willers, S. (2016). Public health impacts of city policies to reduce climate change: findings from the URGENCHE EU-China project. *Environmental Health*, *15*(S1), S25. https://doi.org/10.1186/s12940-016-0097-0

Sampedro, J., Smith, S. J., Arto, I., González-Eguino, M., Markandya, A., Mulvaney, K. M., Van Dingenen, R. (2020). Health co-benefits and mitigation costs as per the Paris Agreement under different technological pathways for energy supply. *Environment International*, *136*(January), 105513. https://doi.org/10.1016/j.envint.2020.105513

Sarofim, M. C., Waldhoff, S. T., & Anenberg, S. C. (2017). Valuing the Ozone-Related Health Benefits of Methane Emission Controls. *Environmental and Resource Economics*, *66*(1), 45–63. https://doi.org/10.1007/s10640-015-9937-6

Scasny, M., Massetti, E., Melichar, J., & Carrara, S. (2015). Quantifying the Ancillary Benefits of the Representative Concentration Pathways on Air Quality in Europe. *ENVIRONMENTAL & RESOURCE ECONOMICS*, *62*(2), 383–415. https://doi.org/10.1007/s10640-015-9969-y

Schucht, S., Colette, A., Rao, S., Holland, M., Schoepp, W., Kolp, P., Rouil, L. (2015). Moving towards ambitious climate policies: Monetised health benefits from improved air quality could offset mitigation costs in Europe. *ENVIRONMENTAL SCIENCE & POLICY*, *50*, 252–269. https://doi.org/10.1016/j.envsci.2015.03.001

Schummers, L., Hutcheon, J. A., Hernandez-Diaz, S., Williams, P. L., Hacker, M. R., VanderWeele, T. J., & Norman, W. V. (2018). Association of Short Interpregnancy Interval with Pregnancy Outcomes According to Maternal Age. *JAMA Internal Medicine*, *178*(12), 1661. https://doi.org/10.1001/jamainternmed.2018.4696

Scovronick, N., Budolfson, M., Dennig, F., Errickson, F., Fleurbaey, M., Peng, W., Wagner, F. (2019). The impact of human health co-benefits on evaluations of global climate policy. *NATURE COMMUNICATIONS*, *10*. https://doi.org/10.1038/s41467-019-09499-x

Scovronick, N., Dora, C., Fletcher, E., Haines, A., & Shindell, D. (2015, November 7). Reduce short-lived climate pollutants for multiple benefits. *The Lancet*. Lancet Publishing Group. https://doi.org/10.1016/S0140-6736(15)61043-1

Shachar, B., Mayo, J., Lyell, D., Baer, R., Jeliffe-Pawlowski, L., Stevenson, D., & Shaw, G. (2016). Interpregnancy interval after live birth or pregnancy termination and estimated risk of preterm birth: a retrospective cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology*, *123*(12), 2009–2017. https://doi.org/10.1111/1471-0528.14165

Shindell, D., Faluvegi, G., Seltzer, K., & Shindell, C. (2018). Quantified, localized health benefits of accelerated carbon dioxide emissions reductions. *Nature Climate Change*, *8*(4), 291–295. https://doi.org/10.1038/s41558-018-0108-y

Syed, A. A. (2018). Impact of economic growth and population dynamics on CO2 emissions: Study of developing nations. *Indian Journal of Environmental Protection*, *38*(6). Retrieved from https://findit.dtu.dk/en/catalog/2449072330

Ürge-Vorsatz, D., Herrero, S. T., Dubash, N. K., & Lecocq, F. (2014). Measuring the Co-Benefits of Climate Change Mitigation. *Annual Review of Environment and Resources*, *39*(1), 549–582. https://doi.org/10.1146/annurev-environ-031312-125456

Vicedo-Cabrera, A. M., Sera, F., Liu, C., Armstrong, B., Milojevic, A., Guo, Y., Gasparrini, A. (2020). Short term association between ozone and mortality: global two stage time series study in 406 locations in 20 countries. *The BMJ*, *368*, 1–10. https://doi.org/10.1136/bmj.m108

Wang, H., Abajobir, A. A., Abate, K. H., Abbafati, C., Abbas, K. M., Abd-Allah, F., … Murray, C. J. L. (2017). Global, regional, and national under-5 mortality, adult mortality, age-specific mortality, and life expectancy, 1970–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, *390*(10100), 1084–1150. https://doi.org/10.1016/S0140-6736 (17)31833-0

WHO. (2015). Reducing Global Health Risks. *Through Mitigation of Short-Lived Climate Pollutants*, 1–121. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/189524/9789241565080?sequence=1----------

WHO. (2016). *WHO household energy database*. Retrieved from https://www.who.int/airpollution/data/household-energy-database/en/

Wolkinger, B., Haas, W., Bachner, G., Weisz, U., Steininger, K., Hutter, H.-P., … Reifeltshammer, R. (2018). Evaluating Health Co-Benefits of Climate Change Mitigation in Urban Mobility. *International Journal of Environmental Research and Public Health*, *15*(5). https://doi.org/10.3390/ijerph15050880

Woodward, A., Baumgartner, J., Ebi, K. L., Gao, J., Kinney, P. L., & Liu, Q. (2019). Population health impacts of China's climate change policies. *ENVIRONMENTAL RESEARCH*, *175*, 178–185. https://doi.org/10.1016/j.envres.2019.05.020

Xie, Y., Dai, H., Xu, X., Fujimori, S., Hasegawa, T., Yi, K., Kurata, G. (2018). Co-benefits of climate mitigation on air quality and human health in Asian countries. *ENVIRONMENT INTERNATIONAL*, *119*, 309–318. https://doi.org/10.1016/j.envint.2018.07.008

Yang, Y., Ruan, Z., Wang, X., Yang, Y., Mason, T. G., Lin, H., & Tian, L. (2019). Short-term and long-term exposures to fine particulate matter constituents and health: A systematic review and meta-analysis. *Environmental Pollution*, *247*, 8

Zhang, Y., Bowden, J. H., Adelman, Z., Naik, V., Horowitz, L. W., Smith, S. J., & West, J. J. (2016). Co-benefits of global and regional greenhouse gas mitigation for US air quality in 2050. *ATMOSPHERIC CHEMISTRY AND PHYSICS*, *16*(15), 9533–9548. https://doi.org/10.5194/acp-16-9533-2016

Zhang, Y., Smith, S. J., Bowden, J. H., Adelman, Z., & West, J. J. (2017). Co-benefits of global, domestic, and sectoral greenhouse gas mitigation for US air quality and human health in 2050. *ENVIRONMENTAL RESEARCH LETTERS*, *12*(11). https://doi.org/10.1088/1748-9326/aa8f76

Levy, J. I., M. K. Woo, S. L. Penn, M. Omary, Y. Tambouret, C. S. Kim, and S. Arunachalam, 2016: Carbon reductions and health co-benefits from US residential energy efficiency measures. Environ. Res. Lett., 11, 34017, https://doi.org/10.1088/1748-9326/11/3/034017.

Liddell, C., and C. Guiney, 2015: Living in a cold and damp home: Frameworks for understanding impacts on mental well-being. Public Health, 129, 191–199, https://doi.org/10.1016/j.puhe.2014.11.007.

MacNaughton, P., X. Cao, J. Buonocore, J. Cedeno-Laurent, J. Spengler, A. Bernstein, and J. Allen, 2018: Energy savings, emission reductions, and health co-benefits of the green building movement review-article. J. Expo. Sci. Environ. Epidemiol. 28, 307–318, https://doi.org/10.1038/s41370-017-0014-9.

Mehetre, S. A., N. L. Panwar, D. Sharma, and H. Kumar, 2017: Improved biomass cookstoves for sustainable development: A review. Renew. Sustain. Energy Rev., 73, 672–687, https://doi.org/10.1016/j.rser.2017.01.150.

Mirasgedis, S., C. Tourkolias, E. Pavlakis, and D. Diakoulaki, 2014: A methodological framework for assessing the employment effects associated with energy efficiency interventions in buildings. Energy Build. 82, 275–286, https://doi.org/10.1016/j.enbuild.2014.07.027.

Payne, J., D. Weatherall, and F. Downy, 2015: Capturing the multiple benefits of energy efficiency in practice: the UK example. ECEE Summer Study Proc., 229–238.

Rosenthal, J., A. Quinn, A. P. Grieshop, A. Pillarisetti, and R. I. Glass, 2018: Clean cooking and the SDGs: Integrated analytical approaches to guide energy interventions for health and environment goals. Energy Sustain. Dev., 42, 152–159, https://doi.org/10.1016/j.esd.2017.11.003.

Smith, A. C., and Coauthors, 2016: Health and environmental co-benefits and conflicts of actions to meet UK carbon targets. Clim. Policy, 16, 253–283, https://doi.org/10.1080/14693062.2014.980212.

Thema, J., and Coauthors, 2017: More than energy savings: quantifying the multiple impacts of energy efficiency in Europe. 1727–1736.

Tonn, B., E. Rose, and B. Hawkins, 2018: Evaluation of the U.S. department of energy's weatherization assistance program: Impact results. Energy Policy, 118, 279–290, https://doi.org/10.1016/j.enpol.2018.03.051.

Ürge-Vorsatz, D., and Coauthors, 2016: Measuring multiple impacts of low-carbon energy options in a green economy context. Appl. Energy, 179, 1409–1426, https://doi.org/10.1016/j.apenergy.2016.07.027

[END CROSS-CHAPTER BOX HEALTH HERE]

Frequently Asked Questions

FAQ 7.1: How will climate change affect physical and mental health and wellbeing?

Climate change will affect human health and wellbeing in a variety of direct and indirect ways. Changes in the magnitude, frequency and intensity of extreme climate events (e.g. storms, floods, wildfires, heatwaves and dust storms) will expose people to increased risks of climate-sensitive illnesses and injuries, and, in worst cases, higher mortality rates. Higher temperatures and changing geographical and seasonal precipitation patterns will facilitate the spread of mosquito- and tick-borne diseases, such as Lyme disease and dengue fever, and water- and food-borne diseases. An increase in the frequency of extreme heat events will exacerbate health risks associated with cardiovascular disease. Access to fresh water will be affected in multiple regions, impairing agricultural productivity, increasing food insecurity, undernutrition, and poverty in low-income areas. Increased risks for mental health and wellbeing are associated with changes caused by direct and indirect impacts of climate change on climate-sensitive health outcomes. Vulnerability to climate change-related health risks is heterogeneous and varies within societies, influenced by social, economic, and geographic factors, as well as by individual differences in pre-existing conditions and developmental stage. Children, pregnant people, elderly people and people with pre-existing health conditions will be particularly vulnerable.

FAQ 7.2: What solutions can effectively protect and improve health and well-being in a changing climate?

There are many options for reducing health risks associated with climate change. A key starting point is strengthening public health systems so that they become more climate resilient, which also requires cooperation with other sectors (water, food, sanitation, transportation, etc) to ensure appropriate funding and progress on sustainable development goals. Building climate resilience into the health sector requires anticipating potential impacts, identifying vulnerable populations, and assessing public health intervention options and needs in terms of health workforce, information systems, and facilities. Interventions to enhance protection against specific climate-sensitive health could reduce morbidity and mortality and prevent many losses and damages. These range from malaria net initiatives, vector control programs, health hazard (syndromic) surveillance and early warning systems, improving access to water, sanitation and hygiene, heat action plans, behavioral changes and integration with disaster risk reduction and response strategies. Reducing socio-economic inequalities and managing the social, environmental and economic determinants of climate-related health risks, will reduce underlying general population and specific community or group vulnerability.

FAQ7.3: Will climate change lead to wide-scale forced migration and involuntary displacement?

Climate change will have impacts on future migration patterns that will vary by region and over time, depending on the types of climate risks people are exposed to, their vulnerability to those risks, and their capacity – and the capacity of their governments – to adapt and respond. Depending on the range of adaptation options available, households may use migration as a strategy to adapt to climate risks, often through labour migration. The most common drivers of involuntary climate-related displacement are extreme weather events, floods, and droughts, especially when these events cause severe damage to homes, livelihoods and food systems. The specific outcomes differ from one event to another, but most climate related migration takes place within countries, or between immediate neighbouring ones; long-distance international migration occurs, but is less common. Rising sea levels will present a new risk for communities situated in low-lying coastal areas and small island states. Planned relocations of highly exposed communities will increasingly become necessary; these are financially very expensive, and require careful planning and engagement with affected residents to ensure their rights and future wellbeing is not undermined. The greater the scale of future warming and extreme events, the greater the likely scale of future, involuntary climate-related migration; progress toward the sustainable development goals has the opposite effect. Migrant agency (i.e. the degree of freedom people have in deciding whether to migrate and where to go) is an important consideration for making policies for climate migration, with the Global Compact for Safe, Orderly and Regular Migration providing a useful roadmap.

FAQ7.4: Will climate change increase the potential for violent conflict?

Adverse impacts of climate change threaten to increase poverty and inequality, undermine progress in meetings sustainable development goals, and place strain on civil institutions – all of which are factors that contribute to the emergence or worsening of civil unrest and conflict. Climate change impacts on crop productivity and water availability can function as a 'risk multiplier' for conflict in areas that are already politically and/or socially fragile and depending on circumstances, could increase the length or the nature of an existing conflict. There is no evidence to suggest that climate change in itself directly triggers violent conflict. Institutional initiatives within or between states to protect the environment and manage natural resources can serve simultaneously as mechanisms for engaging rival groups and adversaries to cooperate in policymaking and peacebuilding.

FAQ7.5: What role can climate-resilient development pathways (CRDP) play in reducing climate change risks to health, well-being, forced migration and conflict?

CRDP can lead to improvement in overall health and well-being and reduce underlying causes of vulnerability, and provides a framework for prioritizing mitigation and adaptation options that support sustainable development. Transformative changes in key sectors including water, food, energy, transportation and built environments offer significant co-benefits for health. Ensuring health and well-being are considered in policymaking across sectors, and at all levels from national to local levels, is important for creating CRDP and for understanding, managing and reducing potential trade-offs. There are often close interconnections between health, migration and conflict, and interventions that address climate risks in one area often have synergistic benefits in others. For example, conflicts often result in large numbers of people being involuntarily displaced and facilitate the spread of climate-sensitive diseases; tackling the underlying causes of vulnerability and exposure that generate conflict reduces risks across all areas.

FAQ 7.6: What are some specific examples of actions taken in other sectors that reduce climate change risks in the health sector?

Many of the greatest risks of climate change in other sectors lead to adverse impacts on health and wellbeing. Adaptive urban design that provides greater access to green and natural spaces simultaneously enhances biodiversity, improves air quality, and moderates the hydrological cycle; it also helps reduce health risks associated with heat stress and respiratory illnesses, and mitigates mental health challenges associated with congested urban living. Transitioning away from internal-combustion vehicles and fossil fuel-powered generating stations to renewable energy mitigates GHG emissions, improves air quality and lowers risks of respiratory illnesses. Policies and designs that facilitate active urban transport (walking and bicycling) increase efficiency in that sector, reduce emissions, improve air quality, and generate physical and mental health benefits for residents. Improved building and urban design that foster energy efficiency improve indoor air quality reduce risks of heat stress and respiratory illness. Food systems that emphasize healthy, plant-centered diets reduce emissions in the agricultural sector while helping in the fight against malnutrition. The financial benefits of these and other mitigation actions become especially compelling when health system cost savings and avoided years of life lost are included in cost-benefit analyses.

References

Abadie, L., Jackson, L., de Murieta, E., Jevrejeva, S. and Galarraga, I., 2020. Comparing urban coastal flood risk in 136 cities under two alternative sea-level projections: RCP 8.5 and an expert opinion-based high-end scenario. Ocean & Coastal Management, 193.

Abbott, M., Bazilian, M., Egel, D. and Willis, H.H., 2017. Examining the food–energy–water and conflict nexus. Current Opinion in Chemical Engineering, 18: 55-60.

Abdel-Tawwab, M. and Wafeek, M., 2014. Influence of water temperature and waterborne cadmium toxicity on growth performance and metallothionein-cadmium distribution in different organs of Nile tilapia, Oreochromis niloticus (L.). J Therm Biol, 45: 157-62.

Abel, G. and Sander, N., 2014. Quantifying Global International Migration Flows. Science, 343(6178): 1520-1522.

Abel, G.J., Barakat, B., Samir, K.C. and Lutz, W., 2016. Meeting the Sustainable Development Goals leads to lower world population growth. Proceedings of the National Academy of Science, 113(50): 14294-14299.

Abel, G.J., Brottrager, M., Cuaresma, J.C. and Muttarak, R., 2019. Climate, conflict and forced migration. Global Environmental Change, 54: 239-249.

Abeysiriwardena, N.M., Gascoigne, S.J.L. and Anandappa, A., 2018. Algal Bloom Expansion Increases Cyanotoxin Risk in Food. Yale J Biol Med, 91(2): 129-142.

Aboubakri, O., Khanjani, N., Jahani, Y., Bakhtiari, B. and Mesgari, E., 2020. Projection of mortality attributed to heat and cold; the impact of climate change in a dry region of Iran, Kerman. Science of the Total Environment, 728: 138700.

Abrahams, D., 2020. Conflict in abundance and peacebuilding in scarcity: Challenges and opportunities in addressing climate change and conflict. World Development, 132: 104998.

Abramson, M., Grattan, M., Mayer, B., Colten, E., Arosemena, A., Bedimo-Rung, A. and Lichtveld, M., 2015. The resilience activation framework: a conceptual model of how access to social resources promotes adaptation and rapid recovery in post-disaster settings. The Journal of Behavioral Health Services and Research, 42(1): 42-57.

Achakulwisut, P., Mickley, L.J. and Anenberg, S.C., 2018. Drought-sensitivity of fine dust in the US Southwest: Implications for air quality and public health under future climate change. Environ. Res. Lett., 13(5): 054025.

Acharya, B.K., Cao, C., Xu, M., Khanal, L., Naeem, S. and Pandit, S., 2018. Present and Future of Dengue Fever in Nepal: Mapping Climatic Suitability by Ecological Niche Model. Int J Environ Res Public Health, 15(2).

Achyut, P., Mishra, A., Montana, L., Sengupta, R., Calhoun, L. and Nanda, P., 2016. Integration of family planning with maternal health services: an opportunity to increase postpartum modern contraceptive use in urban Uttar Pradesh. India Journal of Family Planning and Reproductive Health Care, 42: 107-115.

Adams, C., Ide, T., Barnett, J. and Detges, A., 2018a. Sampling bias in climate-conflict research. Nature Climate Change, 8(3): 200-+.

Adams, C., Ide, T., Barnett, J. and Detges, A., 2018b. Sampling bias in climate–conflict research. Nature Climate Change, 8(3): 200-203.

Adams, H., 2016. Why populations persist: mobility, place attachment and climate change. Population and Environment, 37(4): 429-448.

Adams, H. and Kay, S., 2019. Migration as a human affair: Integrating individual stress thresholds into quantitative models of climate migration. Environmental Science & Policy, 93: 129-138.

Adeeb Alam, S. and Pörtner, C.C., 2018. Income shocks, contraceptive use, and timing of fertility. Journal of Development Economics, 131: 96-103.

Adelphi and Inc, C.I., 2020. Pathways to peace: addressing conflict and strengthening stability in a changing climate. Lessons learned from resilience and peacebuilding programs in the horn of Africa, United States Agency for International Developement.

Adeola, A.M., Botai, J.O., Rautenbach, H., Adisa, O.M., Ncongwane, K.P., Botai, C.M. and Adebayo-Ojo, T.C., 2017. Climatic Variables and Malaria Morbidity in Mutale Local Municipality, South Africa: A 19-Year Data Analysis. Int J Environ Res Public Health, 14(11).

Adger, W., Arnell, N., Black, R., Dercon, S., Geddes, A. and Thomas, D., 2015. Focus on environmental risks and migration: Causes and consequence. Environmental Research Letters, 10: 60201.

Adhvaryu, A., Fenske, J. and Nyshadham, A., 2019. Early life circumstance and adult mental health. Journal of Political Economy, 127(4).

Adri, N. and Simon, D., 2018. A tale of two groups: focusing on the differential vulnerability of "climate-induced" and "non-climate-induced" migrants in Dhaka City. Climate and Development, 10(4): 321-336.

AfDB, 2018. African Development Bank, 2018. African Economic Outlook 2018. Abidjan.

Affairs, U.N.D.o.P.a.P., Programme, U.N.D. and Programme, U.N.E., 2020. United Nations Climate Security Mechanism Toolbox Briefing Note.

Afifi, T., Milan, A., Etzold, B., Schraven, B., Rademacher-Schulz, C., Sakdapolrak, P. and Warner, K., 2016. Human mobility in response to rainfall variability: Opportunities for migration as a successful adaptation strategy in eight case studies. . Migration and Development, 5: 254-274.

Afriyie, K., Ganle, J. and Santos, E., 2018. 'The floods came and we lost everything': Weather extremes and households' asset vulnerability and adaptation in rural Ghana. Climate and Development, 10(3): 259-274.

Agency, E.E., 2017. Climate change, impacts and vulnerability in Europe 2016: An indicator-based report.

Ahlstrom, C.A., Manuel, C.S., Den Bakker, H.C., Wiedmann, M. and Nightingale, K.K., 2018. Molecular ecology of Listeria spp., Salmonella, Escherichia coli O157:H7 and non-O157 Shiga toxin-producing E. coli in pristine natural environments in Northern Colorado. J Appl Microbiol, 124(2): 511-521.

Ahmad, S., Pachauri, S. and Creutzig, F., 2017. Synergies and trade-offs between energy-efficient urbanization and health. 12(11)).

Ahmadalipour, A. and Moradkhani, H., 2018. Escalating heat-stress mortality risk due to global warming in the Middle East and North Africa (MENA). Environment International, 117: 215-225.

Ahmadnezhad, E., Murphy, A., Alvandi, R. and Abdi, Z., The impact of health reform in Iran on catastrophic health expenditures: Equity and policy implications. International Journal of Health Planning and Management.

Ahmed, S., Hasan, M.Z., Pongsiri, M.J., Ahmed, M.W. and Szabo, S., 2020. - Effect of extreme weather events on injury, disability, and death in Bangladesh.

Ahmed, S.A., Guerrero Flórez, M. and Karanis, P., 2018. The impact of water crises and climate changes on the transmission of protozoan parasites in Africa. Pathog Glob Health, 112(6): 281-293.

Ahmed, T., Scholz, M., Al-Faraj, F. and Niaz, W., 2016. Water-Related Impacts of Climate Change on Agriculture and Subsequently on Public Health: A Review for Generalists with Particular Reference to Pakistan. Int J Environ Res Public Health, 13(11).

Aik, J., Heywood, A.E., Newall, A.T., Ng, L.C., Kirk, M.D. and Turner, R., 2018. Climate variability and salmonellosis in Singapore - A time series analysis. Sci Total Environ, 639: 1261-1267.

Aitsi-Selmi, A. and Murray, V., 2016. Protecting the Health and Well-being of Populations from Disasters: Health and Health Care in The Sendai Framework for Disaster Risk Reduction 2015-2030. Prehosp Disaster Med, 31(1): 74-8.

Ajibade, I., Sullivan, M. and Haeffner, M., 2020a. Why climate migration is not managed retreat: Six justifications. Global Environmental Change, 65: 102187.

Ajibade, I., Sullivan, M. and Haeffner, M., 2020b. Why climate migration is not managed retreat: Six justifications. Global Environmental Change, 65: 102187.

Akdag, R., 2015. Lessons from Health Transformation in Turkey: Leadership and Challenges. Health Systems & Reform, 1(1): 3-8.

Akdağ, R., 2015. Lessons from Health Transformation in Turkey: Leadership and Challenges. Health Systems & Reform, 1: 3-8.

Akhter, M., 2015. Dams as a Climate Change Adaptation Strategy: Geopolitical Implications for Pakistan. Strategic Analysis, 39(6): 744-748.

Akil, L., Ahmad, H.A. and Reddy, R.S., 2014. Effects of climate change on Salmonella infections. Foodborne Pathog Dis, 11(12): 974-80.

Akinyemi, T.E. and Olaniyan, A., 2017. Nigeria: Climate War. Migratory Adaptation and Farmer-Herder Conflicts. Conflict Studies Quarterly (21): 3-21.

Akompab, D., Bi, P., Williams, S., Grant, J., Walker, I. and Augoustinos, M., 2013a. Heat Waves and Climate Change: Applying the Health Belief Model to Identify Predictors of Risk Perception and Adaptive Behaviours in Adelaide, Australia. International Journal of Environmental Research and Public Health, 10(6): 2164-2184.

Akompab, D.A., Bi, P., Williams, S., Grant, J., Walker, I.A. and Augoustinos, M., 2013b. Heat Waves and Climate Change: Applying the Health Belief Model to Identify Predictors of Risk Perception and Adaptive Behaviours in Adelaide, Australia. International Journal of Environmental Research and Public Health, 10(6): 2164-2184.

Akresh, R., 2016. Climate Change, Conflict, and Children. Future of Children, 26(1): 51-71.

Alam, G., Alam, K. and Mushtaq, S., 2017. Climate change perceptions and local adaptation strategies of hazard-prone rural households in Bangladesh. Climate Risk Management, 17: 52-63.

Alava, J.J., Cisneros-Montemayor, A., Sumaila, R. and Cheung, W., 2018. Projected amplification of food web bioaccumulation of MeHg and PCBs under climate change in the Northeastern Pacific. Scientific Reports, 8: 1-12.

Albert, M. and Vasilache, A., 2018. Governmentality of the Arctic as an international region. Cooperation and Conflict, 53(1): 3-22.

Albrecht, T.R., Varady, R.G., Zuniga-Teran, A.A., Gerlak, A.K., De Grenade, R.R., Lutz-Ley, A., Martin, F., Megdal, S.B., Meza, F., Melgar, D.O., Pineda, N., Rojas, F., Taboada, R. and Willems, B., 2018. Unraveling transboundary water security in the arid Americas. Water International, 43(8): 1075-1113.

Alexander, K.A., Heaney, A.K. and Shaman, J., 2018. Hydrometeorology and flood pulse dynamics drive diarrheal disease outbreaks and increase vulnerability to climate change in surface-water-dependent populations: A retrospective analysis. PLoS Med, 15(11): e1002688.

Alexander, P.J., Fealy, R. and Mills, G.M., 2016. Simulating the impact of urban development pathways on the local climate: A scenario-based analysis in the greater Dublin region, Ireland. Landscape and Urban Planning, 152: 72-89.

Alfieri, L., Bisselink, B., Dottori, F., Naumann, G., de Roo, A., Salamon, P., Wyser, K. and Feyen, L., 2017. Global projections of river flood risk in a warmer world. Earths Future, 5(2): 171-182.

Alfieri, L., Bisselink, B., Dottori, F., Naumann, G., Roo, A., Salamon, P., Wyser, K. and Feyen, L., 2016. Global projections of river flood risk in a warmer world: River flood risk in a warmer world. Earth's Future, 5.

Alfieri, L., Cohen, S., Galantowicz, J., Schumann, G., Trigg, M., Zsoter, E., Prudhomme, C., Kruczkiewicz, A., de Perez, E., Flamig, Z., Rudari, R., Wu, H., Adler, R., Brakenridge, R., Kettner, A., Weerts, A., Matgen, P., Islam, S., de Groeve, T. and Salamon, P., 2018. A global network for operational flood risk reduction. Environmental Science & Policy, 84: 149-158.

Ali, A. and Erenstein, O., 2017. Assessing farmer use of climate change adaptation practices and impacts on food security and poverty in Pakistan. Climate Risk Management, 16: 183-194.

Ali, N., 2019. Aflatoxins in rice: Worldwide occurrence and public health perspectives. Toxicology Reports, 6: 1188-1197.

Ali, S., Williams, O., Chang, O., Shidhaye, R., Hunter, E. and Charlson, F., 2020. Mental health in the Pacific: Urgency and opportunity. Asia Pacific Viewpoint, n/a (n/a).

Allam, M.M. and Eltahir, E.A.B., 2019. Water-Energy-Food Nexus Sustainability in the Upper Blue Nile (UBN) Basin. Frontiers in Environmental Science, 7.

Almer, C., Laurent-Lucchetti, J. and Oechslin, M., 2017. Water scarcity and rioting: Disaggregated evidence from Sub-Saharan Africa. Journal of Environmental Economics and Management, 86: 193-209.

Alston, M., 2014. Gender mainstreaming and climate change. Womens Studies International Forum, 47: 287-294.

Alston, M. and Akhter, B., 2016. Gender and food security in Bangladesh: the impact of climate change. Gender Place and Culture, 23(10): 1450-1464.

Alternatives, M.R.W. and undefined, 'Mafias' in the waterscape: Urban informality and everyday public authority in Bangalore. Water-alternatives.org.

Alvarez, A., 2016. Borderlands, Climate Change, and the Genocidal Impulse. Genocide Studies International, 10(1): 27-36.

Alvidrez, J., Napoles, A.M., Bernal, G., Lloyd, J., Cargill, V., Godette, D., Cooper, L., Horse Brave Heart, M.Y., Das, R. and Farhat, T., 2019. Building the Evidence Base to Inform Planned Intervention Adaptations by Practitioners Serving Health Disparity Populations. American journal of public health, 109(S1): S94-S101.

Amegah, A.K., Rezza, G. and Jaakkola, J.J., 2016. Temperature-related morbidity and mortality in Sub-Saharan Africa: A systematic review of the empirical evidence. Environ Int, 91: 133-49.

Amundsen, H., 2015. Place attachment as a driver of adaptation in coastal communities in Northern Norway. Local Environment, 20(3): 257-276.

Andersen, L.K. and Davis, M.D., 2015. The effects of the El Niño Southern Oscillation on skin and skin-related diseases: a message from the International Society of Dermatology Climate Change Task Force. Int J Dermatol, 54(12): 1343-51.

Anderson, G.B., Oleson, K.W., Jones, B. and Peng, R.D., 2018. Projected trends in high-mortality heatwaves under different scenarios of climate, population, and adaptation in 82 US communities. Climatic Change, 146(3-4): 455-470.

Ang, J.B. and Gupta, S.K., 2018. Agricultural yield and conflict. Journal of Environmental Economics and Management, 92: 397-417.

Anwar, N., Sawas, A. and Mustafa, D., 2019. 'Without water, there is no life': Negotiating everyday risks and gendered insecurities in Karachi's informal settlements. Urban Studies.

Apergis, N., 2018. The Impact of Greenhouse Gas Emissions on Personal Well-Being: Evidence from a Panel of 58 Countries and Aggregate and Regional Country Samples. Journal of Happiness Studies, 19(1): 69-80.

Arbuthnott, K., Hajat, S., Heaviside, C. and Vardoulakis, S., 2016. Changes in population susceptibility to heat and cold over time: assessing adaptation to climate change. Environmental Health, 15.

Arbuthnott, K., Hajat, S., Heaviside, C. and Vardoulakis, S., 2018. What is cold-related mortality? A multi-disciplinary perspective to inform climate change impact assessments. Environment International, 121: 119-129.

Arbuthnott, K., Hajat, S., Heaviside, C. and Vardoulakis, S., 2020. Years of life lost and mortality due to heat and cold in the three largest English cities. Environment International, 144: 105966.

Arbuthnott, K.G. and Hajat, S., 2017. The health effects of hotter summers and heat waves in the population of the United Kingdom: a review of the evidence. Environmental Health, 16: 1-13.

Armstrong, B., Bell, M., Coelho, M., Guo, Y.-L., Guo, Y., Goodman, P., Hashizume, M., Honda, Y., Kim, H., Lavigne, E., Michelozzi, P., Saldiva, P., Schwartz, J., Scortichini, M., Sera, F., Tobias, A., Tong, S., Wu, C.-f., Zanobetti, A. and Gasparrini, A., 2017a. Longer-Term Impact of High and Low Temperature on Mortality: An International Study to Clarify Length of Mortality Displacement. Environmental Health Perspectives, 508: 1-8.

Armstrong, B., Bell, M.L., Coelho, M., Guo, Y.L.L., Guo, Y.M., Goodman, P., Hashizume, M., Honda, Y., Kim, H., Lavigne, E., Michelozzi, P., Saldiva, P.H.N., Schwartz, J., Scortichini, M., Sera, F., Tobias, A., Tong, S., Wu, C.F., Zanobetti, A., Zeka, A. and Gasparrini, A., 2017b. Longer-Term Impact of High and Low Temperature on Mortality: An International Study to Clarify Length of Mortality Displacement. Environmental Health Perspectives, 125(10).

Arnall, A., 2014. A climate of control: flooding, displacement and planned resettlement in the Lower Zambezi River valley, Mozambique. Geographical Journal, 180(2): 141-150.

Arnell, N.W. and Lloyd-Hughes, B., 2014. The global-scale impacts of climate change on water resources and flooding under new climate and socio-economic scenarios. Climatic Change, 122(1-2): 127-140.

Arora, D., Arongo, J., Burkart, S., Chirinda, N. and Twyman, J., 2017. Gender (Im) balance in Productive and Reproductive Labor among Livestock Producers in Colombia: Implications for Climate Change Responses. CGIAR Research Program on Climate Change, Agriculture and Food Security.

Arroyo, V., Diaz, J., Carmona, R., Ortiz, C. and Linares, C., 2016. Impact of air pollution and temperature on adverse birth outcomes: Madrid, 2001-2009. Environ Pollut, 218: 1154-1161.

Asadullah, M.N. and Chaudhury, N., 2012. Subjective well-being and relative poverty in rural Bangladesh. Journal of Economic Psychology, 33(5): 940-950.

Asah, S.T., 2015. Transboundary hydro-politics and climate change rhetoric: an emerging hydro-security complex in the Lake Chad basin. Wiley Interdisciplinary Reviews-Water, 2(1): 37-45.

Ashofteh, P.S., Bozorg-Haddad, O. and Loaiciga, H.A., 2017. Impacts of Climate Change on the Conflict between Water Resources and Agricultural Water Use. Journal of Irrigation and Drainage Engineering, 143(4).

Åström, C., Åström, D.O., Andersson, C., Ebi, K.L. and Forsberg, B., 2017. Vulnerability Reduction Needed to Maintain Current Burdens of Heat-Related Mortality in a Changing Climate—Magnitude and Determinants. International Journal of Environmental Research and Public Health, 14(7): 741-741.

Astrom, D.O., Ebi, K.L., Vicedo-Cabrera, A.M. and Gasparrini, A., 2018. Investigating changes in mortality attributable to heat and cold in Stockholm, Sweden. International Journal of Biometeorology, 62(9): 1777-1780.

Åström, D.O., Forsberg, B., Ebi, K.L. and Rocklöv, J., 2014. Reply to 'Adaptation to extreme heat in Stockholm County, Sweden'. Nature Climate Change, 4(5): 303-303.

Asugeni, J., MacLaren, D., Massey, P.D. and Speare, R., 2015. Mental health issues from rising sea level in a remote coastal region of the Solomon Islands: current and future. Australasian Psychiatry, 23(6): 22-25.

Åtland, K., 2013. The security implications of climate change in the Arctic Ocean, Environmental Security in the Arctic Ocean. Springer, pp. 205-216.

Atteridge, A. and Remling, E., 2018. Is adaptation reducing vulnerability or redistributing it? Wiley Interdisciplinary Reviews-Climate Change, 9(1).

Auger, N., Fraser, W.D., Smargiassi, A., Bilodeau-Bertrand, M. and Kosatsky, T., 2017. Elevated outdoor temperatures and risk of stillbirth. International Journal of Epidemiology, 46(1): 200-208.

Austin, S.E., Biesbroek, R., Berrang-Ford, L., Ford, J.D., Parker, S. and Fleury, M.D., 2016. Public Health Adaptation to Climate Change in OECD Countries. Int J Environ Res Public Health, 13(9).

Austin, S.E., Ford, J.D., Berrang-Ford, L., Biesbroek, R. and Ross, N.A., 2019. Enabling local public health adaptation to climate change. Soc Sci Med, 220: 236-244.

Australian and Association, P., 2018. Psychological preparation for natural disasters.

Authority), E.E.F.S., Maggiore, A., Afonso, A., Barrucci, F. and De Sanctis, G., 2020. Climate change as a driver of emerging risks for food and feed safety, plant, animal health and nutritional quality. EFSA (European Food Safety Authority): 1-146.

Avery, S.V., Singleton, I., Magan, N. and Goldman, G.H., 2019. The fungal threat to global food security. Fungal Biology, 123(8): 555-557.

Awuor, L., Meldrum, R. and Liberda, E., 2020. Institutional Engagement Practices as Barriers to Public Health Capacity in Climate Change Policy Discourse: Lessons from the Canadian Province of Ontario. International Journal of Environmental Research and Public Health, 17(17).

Ayana, E.K., Ceccato, P., Fisher, J.R.B. and DeFries, R., 2016. Examining the relationship between environmental factors and conflict in pastoralist areas of East Africa. Science of the Total Environment, 557: 601-611.

Ayeb-Karlsson, S., Kniveton, D. and Cannon, T., 2020. Trapped in the prison of the mind: Notions of climate-induced (im)mobility decision-making and wellbeing from an urban informal settlement in Bangladesh. Palgrave Communications, 6(1): 62.

Ayeb-Karlsson, S., Smith, C.D. and Kniveton, D., 2018. A discursive review of the textual use of 'trapped' in environmental migration studies: The conceptual birth and troubled teenage years of trapped populations. Ambio, 47(5): 557-573.

Azage, M., Kumie, A., Worku, A., C Bagtzoglou, A. and Anagnostou, E., 2017. Effect of climatic variability on childhood diarrhea and its high risk periods in northwestern parts of Ethiopia. PLoS One, 12(10): e0186933.

Azfa, A., Jackson, G., Westoby, R., McNamara, K.E., McMichael, C. and Farbotko, C., 2020. 'We didn't want to leave our island': stories of involuntary resettlement from Gaadhoo Island, Maldives. Territory, Politics, Governance: 1-21.

Azuma, K., Kagi, N., Yanagi, U. and Osawa, H., 2018. Effects of low-level inhalation exposure to carbon dioxide in indoor environments: A short review on human health and psychomotor performance. Environment International, 121: 51-56.

Babaie, J., Barati, M., Azizi, M., Ephtekhari, A. and Sadat, S.J., 2018. A systematic evidence review of the effect of climate change on malaria in Iran. J Parasit Dis, 42(3): 331-340.

Bacmeister, J., Reed, K., Hannay, C., Lawrence, P., Bates, S., Truesdale, J., Rosenbloom, N. and Levy, M., 2018a. Projected changes in tropical cyclone activity under future warming scenarios using a high-resolution climate model. Climatic Change, 146(3-4): 547-560.

Bacmeister, J., Reed, K., Hannay, C., Lawrence, P., Bates, S., Truesdale, J., Rosenbloom, N. and Levy, M., 2018b. Projected changes in tropical cyclone activity under future warming scenarios using a high-resolution climate model. Climatic Change, 146.

Badland, H., C. Whitzman, M. Lowe, M. Davern, L. Aye, I. Butterworth, D. Hes and B. Giles-Corti, 2014. Urban liveability: emerging lessons from Australia for exploring the potential for indicators to measure the social determinants of health. Social Science and Medicine, 111: 64-73.

Baez, J., Caruso, G., Mueller, V. and Niu, C., 2017. Droughts augment youth migration in Northern Latin America and the Caribbean. Climatic Change, 140(3-4): 423-435.

Bagozzi, B.E., Koren, O. and Mukherjee, B., 2017. Droughts, Land Appropriation, and Rebel Violence in the Developing World. Journal of Politics, 79(3): 1057-1072.

Bai, Y.T., Xu, Z.G., Lu, B., Sun, Q.H., Tang, W.G., Liu, X.B., Yang, W.Z., Xu, X.Y. and Liu, Q.Y., 2015. Effects of Climate and Rodent Factors on Hemorrhagic Fever with Renal Syndrome in Chongqing, China, 1997-2008. Plos One, 10(7).

Bailey, I. and Buck, L., 2016. Managing for resilience: a landscape framework for food and livelihood security and ecosystem services. Food Security, 8(3): 477-490.

Baker-Austin, C., Trinanes, J., Gonzalez-Escalona, N. and Martinez-Urtaza, J., 2017. Non-Cholera Vibrios: The Microbial Barometer of Climate Change. Trends Microbiol, 25(1): 76-84.

Bakkensen, L.A. and Mendelsohn, R.O., 2019. Global Tropical Cyclone Damages and Fatalities under Climate Change: An Updated Assessment. In: J.M. Collins and K. Walsh (Editors), Hurricane Risk. Springer International Publishing, Cham, pp. 179-197.

Baldwin, A., 2013. Racialisation and the figure of the climate-change migrant. Environment and Planning A, 45(6): 1474-1490.

Baldwin, A., 2017. Climate change, migration, and the crisis of humanism. Wiley Interdisciplinary Reviews-Climate Change, 8(3).

Balestri, S. and Maggioni, M.A., 2017. Land-Use Change and Communal Confllicts in Sub-Saharan Africa. Peace Economics Peace Science and Public Policy, 23(4).

Bamberg, S., Masson, T., Brewitt, K. and Nemetschek, N., 2017. Threat, coping and flood prevention - A meta-analysis. Journal of Environmental Psychology, 54: 116-126.

Bandino, J.P., Hang, A. and Norton, S.A., 2015. The Infectious and Noninfectious Dermatological Consequences of Flooding: A Field Manual for the Responding Provider. Am J Clin Dermatol, 16(5): 399-424

Bandura, A., 1982. SELF-EFFICACY MECHANISM IN HUMAN AGENCY. American Psychologist, 37(2): 122-147.

Bandyopadhyay, R., Ortega-Beltran, A., Akande, A., Mutegi, C., Atehnkeng, J., Kaptoge, L., Senghor, A.L., Adhikari, B.N. and Cotty, P.J., 2016. Biological control of aflatoxins in Africa: current status and potential challenges in the face of climate change. World Mycotoxin J., 9(5): 771-789.

Banwell, N., Rutherford, S., Mackey, B., Street, R. and Chu, C., 2018. Commonalities between disaster and climate change risks for health: A theoretical framework. International Journal of Environmental Research and Public Health, 15(3): 538.

Bao, J., Guo, Y., Wang, Q., He, Y., Ma, R., Hua, J., Jiang, C., Morabito, M., Lei, L., Peng, J. and Huang, C., 2019. Effects of heat on first-ever strokes and the effect modification of atmospheric pressure: A time-series study in Shenzhen, China. Science of the Total Environment, 654: 1372-1378.

Bao, J., Li, X. and Yu, C., 2015. The Construction and Validation of the Heat Vulnerability Index, a Review. International Journal of Environmental Research and Public Health, 12: 7220-7234.

Barange, M., Bahri, T., Beveridge, M., Cochrane, K., Funge-Smith, S. and Poulain, F., 2018. Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper.

Bardosh, K., Ryan, S., Ebi, K., Welburn, S. and Singer, B., 2017. Addressing vulnerability, building resilience: community-based adaptation to vector-borne diseases in the context of global change. Infectious Diseases of Poverty, 6.

Barkdull, J. and Harris, P.G., 2015. Climate-induced conflict or Hospice Earth: the increasing importance of eco-socialism. Global Change Peace & Security, 27(2): 237-243.

Barnes, J., 2017. The future of the Nile: climate change, land use, infrastructure management, and treaty negotiations in a transboundary river basin. Wiley Interdisciplinary Reviews-Climate Change, 8(2).

Barnett, J. and McMichael, C., 2018. The effects of climate change on the geography and timing of human mobility. Population and Environment, 39(4): 339-356.

Barquet, K., Lujala, P. and Rod, J., 2014a. Transboundary conservation and militarized interstate disputes. Political Geography, 42: 1-11.

Barquet, K., Lujala, P. and Rød, J.K., 2014b. Transboundary conservation and militarized interstate disputes. Political Geography, 42: 1-11.

Barriopedro, D., Fischer, E.M., Luterbacher, J., Trigo, R.M. and Garcia-Herrera, R., 2011. The hot summer of 2010: redrawing the temperature record map of Europe. Science, 332(6026): 220-4.

Barth, M., Masson, T., Fritsche, I. and Ziemer, C.T., 2018. Closing ranks: Ingroup norm conformity as a subtle response to threatening climate change. Group Processes & Intergroup Relations, 21(3): 497-512.

Baryshnikova, N. and Pham, N., 2019. Natural disasters and mental health: A quantile approach. Economics Letters, 180: 62-66.

Basagaña, X., Esnaola, M., Rivas, I., Amato, F., Alvarez-Pedrerol, M., Forns, J., López-Vicente, M., Pujol, J., Nieuwenhuijsen, M., Querol, X. and Sunyer, J., 2016. Neurodevelopmental Deceleration by Urban Fine Particles from Different Emission Sources: A Longitudinal Observational Study. Environmental Health Perspectives, 124(5).

Battilani, P., Palumbo, R., Giorni, P., Dall'Asta, C., Dellafiora, L., Gkrillas, A., Toscano, P., Crisci, A., Brera, C., De Santis, B., Cammarano, R., Seta, M., Campbell, K., Elliot, C., Venâncio, A., Gonçalves, A., Terciolo, c. and Oswald, I., 2020. Mycotoxin mixtures in food and feed: holistic, innovative, flexible risk assessment modelling approach:: MYCHIF. EFSA Supporting Publications, 17.

Bauer, A. and Steurer, R., 2014. Multi-level governance of climate change adaptation through regional partnerships in Canada and England. Geoforum, 51: 121-129.

Baysal, B. and Karakas, U., 2017. Climate Change and Security: Different Perceptions, Different Approaches. Uluslararasi Iliskiler-International Relations, 14(54): 21-44.

Becquart, N.A., Naumova, E.N., Singh, G. and Chui, K.K.H., 2018. Cardiovascular Disease Hospitalizations in Louisiana Parishes' Elderly before, during and after Hurricane Katrina. Int J Environ Res Public Health, 16(1).

Beer, K.D., Gargano, J.W., Roberts, V.A., Reses, H.E., Hill, V.R., Garrison, L.E., Kutty, P.R., Hilborn, E.D., Wade, T.J., Fullerton, K.E. and Yoder, J.S., 2015. Outbreaks Associated With Environmental and Undetermined Water Exposures, United States, 2011–2012, Centers for Disease Control and Prevention (CDC).

Beggs, P., Zhang, Y., Bambrick, H., Berry, H., Linnenluecke, M., Trueck, S., Bi, P., Boylan, S., Green, D., Guo, Y., Hanigan, I., Johnston, F., Madden, D., Malik, A., Morgan, G., Perkins-Kirkpatrick, S., Rychetnik, L., Stevenson, M., Watts, N. and Capon, A., 2019. The 2019 report of the MJA-Lancet Countdown on health and climate change: a turbulent year with mixed progress. Medical Journal of Australia, 211(11).

Belay, A., Recha, J., Woldeamanuel, T. and Morton, J., 2017. Smallholder farmers' adaptation to climate change and determinants of their adaptation decisions in the Central Rift Valley of Ethiopia. Agriculture and Food Security, 6: 1-13.

Belesova, K., Kelman, I. and Boyd, R., 2016. Governance through Economic Paradigms: Addressing Climate Change by Accounting for Health. Politics and Governance, 4(4): 87-96.

Belkin, L. and Kouchaki, M., 2017. Too hot to help! Exploring the impact of ambient temperature on helping. European Journal of Social Psychology, 47(5): 525-538.

Bell, C. and Keys, P.W., 2018. Conditional Relationships between Drought and Civil Conflict in Sub-Saharan Africa. Foreign Policy Analysis, 14(1): 1-23.

Bell, E.J., Turner, P., Meinke, H. and Holbrook, N.J., 2015. Developing rural community health risk assessments for climate change: a Tasmanian pilot study. Rural Remote Health, 15(3): 3174.

Bell, S.L., Tabe, T. and Bell, S., 2020. Seeking a disability lens within climate change migration discourses, policies and practices. Disability & Society, 35(4): 682-687.

Bellemare, M.F., 2015. Rising food prices, food price volatility, and social unrest. American Journal of agricultural economics, 97(1): 1-21.

Benedict, K.M., Reses, H., Vigar, M., Roth, D.M., Roberts, V.A., Mattioli, M., Cooley, L.A., Hilborn, E.D., Wade, T.J., Fullerton, K.E., Yoder, J.S. and Hill, V.R., 2015. Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water, United States, 2013–2014, US Department of Health and Human Services, and Centres for Disease Control and Prevention.

Benjamin, L., Thomas, A. and Haynes, R., 2018. An 'Islands' COP'? Loss and damage at COP23. Review of European Comparative & International Environmental Law, 27(3): 332-340.

Benmarhnia, T., Bailey, Z., Kaiser, D., Auger, N., King, N. and Kaufman, J.S., 2016. A Difference-in-Differences Approach to Assess the Effect of a Heat Action Plan on Heat-Related Mortality, and Differences in Effectiveness According to Sex, Age, and Socioeconomic Status (Montreal, Quebec). Environ Health Perspect, 124(11): 1694-1699.

Benmarhnia, T., Deguen, s., Kaufman, J. and Smargiassi, A., 2015a. Vulnerability to Heat-related Mortality: A Systematic Review, Meta-analysis, and Meta-regression Analysis. Epidemiology (Cambridge, Mass.), 26.

Benmarhnia, T., Deguen, S., Kaufman, J.S. and Smargiassi, A., 2015b. Vulnerability to Heat-related Mortality A Systematic Review, Meta-analysis, and Meta-regression Analysis. Epidemiology, 26(6): 781-793.

Benveniste, H., Cuaresma, J., Gidden, M. and Muttarak, R., 2020b submitted. Tracing international migration in projections of income and inequality across the Shared Socioeconomic Pathways. Climatic Change.

Benveniste, H., Oppenheimer, M. and Fleurbaey, M., 2020. Effect of border policy on exposure and vulnerability to climate change. Proceedings of the National Academy of Sciences, 117(43): 26692-26702.

Bereketeab, R., 2014. Environmental Change, Conflicts and Problems of Sustainable Development in the Horn of Africa. African and Asian Studies, 13(3): 291-314.

Bernzen, A., Jenkins, J.C. and Braun, B., 2019. Climate change-induced migration in coastal Bangladesh? A critical assessment of migration drivers in rural households under economic and environmental stress. 9(1): 51.

Berrang-Ford, L., Pearce, T. and Ford, J.D., 2015. Systematic review approaches for climate change adaptation research. Regional Environmental Change, 15(5): 755-769.

Berry, H., Waite, T., Dear, K., Capon, A. and Murray, V., 2018a. The case for systems thinking about climate change and mental health. Nature Climate Change, 8(4): 282-290.

Berry, H.L., Bowen, K. and Kjellstrom, T., 2010. Climate change and mental health: a causal pathways framework. International Journal of Public Health, 55(2): 123-132.

Berry, K.A., Kalluri, B. and La Vina, A., 2018b. South-to-south exchanges in understanding and addressing natural resource conflicts. Ecology and Society, 23(3).

Berry, L. and Peel, D., 2015. Worrying about climate change: is it responsible to promote public debate? BJPsych International, 12(2): 31-32.

Berry, P., Enright, P.M., Shumake-Guillemot, J., Villalobos Prats, E. and Campbell-Lendrum, D., 2018c. Assessing Health Vulnerabilities and Adaptation to Climate Change: A Review of International Progress. Int J Environ Res Public Health, 15(12).

Bertana, A., 2020. The role of power in community participation: Relocation as climate change adaptation in Fiji. Environment and Planning C: Politics and Space, 38: 239965442090939.

Berthelon, M. and Kruger, D., 2017. Does adolescent motherhood affect education and labor market outcomes of mothers? A study on young adult women in Chile during 1990–2013. International Journal of Public Health, 62(2): 293-303.

Bettini, G., 2014. Climate migration as an adaption strategy: de-securitizing climate-induced migration or making the unruly governable? Critical Studies on Security, 2(2): 180-195.

Bettini, G. and Gioli, G., 2016. Waltz with development: insights on the developmentalization of climate-induced migration. Migration and Development, 5(2): 171-189.

Bettini, G., Nash, S.L. and Gioli, G., 2017. One step forward, two steps back? The fading contours of (in) justice in competing discourses on climate migration. Geographical Journal, 183(4): 348-358.

Bevacqua, E., Maraun, D., Vousdoukas, M., Voukouvalas, E., Vrac, M., Mentaschi, L. and Widmann, M., 2019. Higher probability of compound flooding from precipitation and storm surge in Europe under anthropogenic climate change. Science Advances, 5(9).

Bhagat, R., 2017. Migration, gender and right to the city. Economic and Political Weekly: 35-40.

Bharara, T., Gur, R., Duggal, S., Jena, P., Khatri, S. and Sharma, P., 2018. Green Hospital Initiative by a North Delhi Tertiary Care Hospital: Current Scenario and Future Prospects. Journal of Clinical and Diagnostic Research, 12: DC10-DC14.

Bhatt, S., Gething, P.W., Brady, O.J., Messina, J.P., Farlow, A.W., Moyes, C.L., Drake, J.M., Brownstein, J.S., Hoen, A.G., Sankoh, O., Myers, M.F., George, D.B., Jaenisch, T., Wint, G.R.W., Simmons, C.P., Scott, T.W., Farrar, J.J. and Hay, S.I., 2013. The global distribution and burden of dengue. Nature, 496(7446): 504-507.

Bhatta, G. and Aggarwal, P., 2016. Coping with weather adversity and adaptation to climatic variability: A cross-country study of smallholder farmers in South Asia. Climate and Development, 8: 145-157.

Bhatta, G., Aggarwal, P., Poudel, S. and Belgrave, D., 2015. Climate-induced migration in South Asia: Migration decisions and the gender dimensions of adverse climatic events. Journal of Rural and Community Development, 10: 1-23.

Bhattarai, B., Beilin, R. and Ford, R., 2015. Gender, agrobiodiversity, and climate change: A study of adaptation practices in the Nepal Himalayas. World Development, 70: 122-132.

Bhavnani, R.R. and Lacina, B., 2015. The effects of weather-induced migration on sons of the soil riots in India. World Pol., 67: 760.

Biesbroek, G.R., Termeer, C.J.A.M., Klostermann, J.E.M. and Kabat, P., 2014. Rethinking barriers to adaptation: Mechanism-based explanation of impasses in the governance of an innovative adaptation measure. Global Environmental Change-Human and Policy Dimensions, 26: 108-118.

Biesbroek, R., Peters, B.G. and Tosun, J., 2018. Public Bureaucracy and Climate Change Adaptation. Review of Policy Research, 35(6): 776-791.

Bizikova, L., Tyler, S., Moench, M., Keller, M. and Echeverria, D., 2016. Climate resilience and food security in Central America: a practical framework. Climate and Development, 8(5): 397-412.

Black, P.F. and Butler, C.D., 2014. One Health in a world with climate change. Rev Sci Tech, 33(2): 465-73.

Black, R., Adger, W.N., Arnell, N.W., Dercon, S., Geddes, A. and Thomas, D., 2011a. The effect of environmental change on human migration. Global Environmental Change, 21(SI): S3-S11.

Black, R., Bennett, S.R.G., Thomas, S.M. and Beddington, J.R., 2011b. Migration as adaptation. Nature, 478(7370): 447-449.

Blackstone, N.W. and Golladay, J.M., 2018. Why Do Corals Bleach? Conflict and Conflict Mediation in a Host/Symbiont Community. Bioessays, 40(8).

Blasiak, R., Spijkers, J., Tokunaga, K., Pittman, J., Yagi, N. and Osterblom, H., 2017. Climate change and marine fisheries: Least developed countries top global index of vulnerability. Plos One, 12(6).

Bless, P.J., Muela Ribera, J., Schmutz, C., Zeller, A. and Mausezahl, D., 2016. Acute Gastroenteritis and Campylobacteriosis in Swiss Primary Care: The Viewpoint of General Practitioners. PLoS One, 11(9): e0161650.

Bloodhart, B., Swim, J.K. and Zawadzki, M.J., 2013. Spreading the Eco-Message: Using Proactive Coping to Aid Eco-Rep Behavior Change Programming. Sustainability, 5(4): 1661-1679.

Blöschl, G., Hall, J., Viglione, A., Perdigão, R.A.P., Parajka, J., Merz, B., Lun, D., Arheimer, B., Aronica, G.T., Bilibashi, A., Boháč, M., Bonacci, O., Borga, M., Čanjevac, I., Castellarin, A., Chirico, G.B., Claps, P., Frolova, N., Ganora, D., Gorbachova, L., Gül, A., Hannaford, J., Harrigan, S., Kireeva, M., Kiss, A., Kjeldsen, T.R., Kohnová, S., Koskela, J.J., Ledvinka, O., Macdonald, N., Mavrova-Guirguinova, M., Mediero, L., Merz, R., Molnar, P., Montanari, A., Murphy, C., Osuch, M., Ovcharuk, V., Radevski, I., Salinas, J.L., Sauquet, E., Šraj, M., Szolgay, J., Volpi, E., Wilson, D., Zaimi, K. and Živković, N., 2019. Changing climate both increases and decreases European river floods. Nature, 573(7772): 108-111.

Boas, I., 2014. Where is the South in security discourse on climate change? An analysis of India. Critical Studies on Security, 2(2): 148-161.

Bob, U. and Bronkhorst, S., 2014. Conflict-sensitive adaptation to climate change in Africa, Berliner Wissenschafts-Verlag.

Bobb, J.F., Obermeyer, Z., Wang, Y. and Dominici, F., 2014. Cause-specific risk of hospital admission related to extreme heat in older adults. JAMA, 312(24): 2659-2667.

Boeckmann, M. and Rohn, I., 2014. Is planned adaptation to heat reducing heat-related mortality and illness? A systematic review. BMC public health, 14: 1112.

Bohmelt, T., Bernauer, T., Buhaug, H., Gleditsch, N.P., Tribaldos, T. and Wischnath, G., 2014. Demand, supply, and restraint: Determinants of domestic water conflict and cooperation. Global Environmental Change-Human and Policy Dimensions, 29: 337-348.

Bohra-Mishra, P., Oppenheimer, M., Cai, R., Feng, S. and Licker, R., 2016. Climate variability and migration in the Philippines. Population and Environment, 38(3): 286-308.

Bohra-Mishra, P., Oppenheimer, M., Cai, R., Feng, S. and Licker, R., 2017. Climate variability and migration in the Philippines. Population and Environment, 38(3): 286-308.

Bollfrass, A. and Shaver, A., 2015. The Effects of Temperature on Political Violence: Global Evidence at the Subnational Level. Plos One, 10(5).

Bond, J. and Mkutu, K., 2018. A "patchwork" for peace: institutions and activities in Kenya's northern drylands. Local Environment, 23(3): 293-315.

Borg, M., Bi, P., Nitschke, M., Williams, S. and McDonald, S., 2017a. The impact of daily temperature on renal disease incidence: an ecological study. Environmental Health, 16.

Borg, M., Bi, P., Nitschke, M., Williams, S. and McDonald, S., 2017b. The impact of daily temperature on renal disease incidence: An ecological study. Environmental Health, 16.

Borras, S.M. and Franco, J.C., 2018. The challenge of locating land-based climate change mitigation and adaptation politics within a social justice perspective: towards an idea of agrarian climate justice. Third World Quarterly, 39(7): 1308-1325.

Botana, L.M., 2016a. Toxicological Perspective on Climate Change: Aquatic Toxins. Chemical Research in Toxicology, 29(4): 619-625.

Botana, L.M., 2016b. Toxicological Perspective on Climate Change: Aquatic Toxins. Chemical Research in Toxicology, 29(4): 619-625.

Bowen, K., Ebi, K. and Friel, S., 2014a. Climate change adaptation and mitigation: next steps for cross-sectoral action to protect global health. Mitigation and Adaptation Strategies For Global Change, 19(7): 1033-1040.

Bowen, K.J., Alexander, D., Miller, F. and Dany, V., 2014b. Using social network analysis to evaluate health-related adaptation decision-making in Cambodia. Int J Environ Res Public Health, 11(2): 1605-25.

Bowen, K.J. and Ebi, K.L., 2017. Health risks of climate change in the World Health Organization South-East Asia Region. WHO South East Asia J Public Health, 6(2): 3-8.

Bowles, D.C., 2015. Climate Change and Health Adaptation: Consequences for Indigenous Physical and Mental Health. Annals of Global Health, 81(3): 427-431.

Bragg, C., Gibson, G., King, H., Lefler, A.A. and Ntoubandi, F., 2018. Remittances as aid following major sudden-onset natural disasters. Disasters, 42(1): 3-18.

Branch, A., 2018. From disaster to devastation: drought as war in northern Uganda. Disasters, 42: S306-S327.

Branson, N. and Byker, T., 2018. Causes and consequences of teen childbearing: Evidence from a reproductive health intervention in South Africa. Journal of Health Economics, 57: 221-235.

Bregazzi, H. and Jackson, M., 2018. Agonism, critical political geography, and the new geographies of peace. Progress in Human Geography, 42(1): 72-91.

Brenkert-Smith, H., Meldrum, R. and Champ, A., 2015. Climate change beliefs and hazard mitigation behaviors: homeowners and wildfire risk. Environmental Hazards, 14(4): 341-360.

Bromet, E., Atwoli, L., Kawakami, N., Navarro-Mateu, F., Piotrowski, P., King, A., Aguilar-Gaxiola, S., Alonso, J., Bunting, B., Demyttenaere, K., Florescu, S., de Girolamo, G., Gluzman, S., Haro, J., de Jonge, P., Karam, E., Lee, S., Kovess-Masfety, V., Medina-Mora, M., Mneimneh, Z., Pennell, B., Posada-Villa, J., Salmeron, D., Takeshima, T. and Kessler, R., 2017. Post-traumatic stress disorder associated with natural and human-made disasters in the World Mental Health Surveys. Psychological Medicine, 47(2): 227-241.

Bronen, R. and Chapin, F.S., III, 2013. Adaptive governance and institutional strategies for climate-induced community relocations in Alaska. Proceedings of the National Academy of Sciences of the United States of America, 110(23): 9320-9325.

Brooks, D.B. and Trottier, J., 2014. De-nationalization and de-securitization of transboundary water resources: the Israeli-Palestinian case. International Journal of Water Resources Development, 30(2): 211-223.

Brottem, L.V., 2016. Environmental Change and Farmer-Herder Conflict in Agro-Pastoral West Africa. Human Ecology, 44(5): 547-563.

Brown, H.C.P., 2017. Implementing REDD+ in a Conflict-Affected Country: A Case Study of the Democratic Republic of Congo. Environments, 4(3).

Brown, M.R.G., Agyapong, V., Greenshaw, A.J., Cribben, I., Brett-MacLean, P., Drolet, J., McDonald-Harker, C., Omeje, J., Mankowsi, M., Noble, S., Kitching, D. and Silverstone, P.H., 2019. After the Fort McMurray wildfire there are significant increases in mental health symptoms in grade 7-12 students compared to controls (vol 19, 18, 2019). Bmc Psychiatry, 19.

Brown, O., Hammill, A. and McLeman, R., 2007. Climate change as the new security threat: implications for Africa. Climate change as the ënewísecurity threat: implications for Africa. 83(6): 1141-1154.

Brown, R., Witt, A., Fegert, J., Keller, F., Rassenhofer, M. and Plener, P., 2017a. Psychosocial interventions for children and adolescents after man-made and natural disasters: a meta-analysis and systematic review. Psychological medicine, 47: 1-13.

Brown, R.C., Witt, A., Fegert, J.M., Keller, F., Rassenhofer, M. and Plener, P.L., 2017b. Psychosocial interventions for children and adolescents after man-made and natural disasters: a meta-analysis and systematic review. Psychological Medicine, 47(11): 1893-1905.

Brown, S. and Bean, F., 2005. International migration. In: D.L. Poston and M. Micklin (Editors), Handbook of Population. Kluwer, Dordrecht, pp. 347-382.

Brubacher, J., Allen, D.M., Déry, S.J., Parkes, M.W., Chhetri, B., Mak, S., Sobie, S. and Takaro, T.K., 2020. Associations of five food- and water-borne diseases with ecological zone, land use and aquifer type in a changing climate. Sci Total Environ, 728: 138808.

Brugger, A., Dessai, S., Devine-Wright, P., Morton, T.A. and Pidgeon, N.F., 2015. Psychological responses to the proximity of climate change. Nature Climate Change, 5(12): 1031-1037.

Brunn, A., Fisman, D.N., Sargeant, J.M. and Greer, A.L., 2018. The Influence of Climate and Livestock Reservoirs on Human Cases of Giardiasis. Ecohealth.

Buckley, R., Brough, P., Hague, L., Chauvenet, A., Fleming, C., Roche, E., Sofija, E. and Harris, N., 2019. Economic value of protected areas via visitor mental health. Nature Communications, 10(1): 5005.

Buhaug, H., 2015. Climate-conflict research: some reflections on the way forward. Wiley Interdisciplinary Reviews-Climate Change, 6(3): 269-275.

Buhaug, H., 2016. Climate Change and Conflict: Taking Stock. Peace Economics Peace Science and Public Policy, 22(4): 331-338.

Buhaug, H., Benjaminsen, T.A., Sjaastad, E. and Theisen, O.M., 2015. Climate variability, food production shocks, and violent conflict in Sub-Saharan Africa. Environmental Research Letters, 10(12).

Buhaug, H., Cederman, L.-E. And Gleditsch, K.S., 2014a. Square pegs in round holes: Inequalities, grievances, and civil war. International Studies Quarterly, 58(2): 418-431.

Buhaug, H., Croicu, M., Fjelde, H. and Uexkull, N.v., 2020. A conditional model of local income shock and civil conflict.

Buhaug, H., Nordkvelle, J., Bernauer, T., Böhmelt, T., Brzoska, M., Busby, J.W., Ciccone, A., Fjelde, H., Gartzke, E. and Gleditsch, N.P., 2014b. One effect to rule them all? A comment on climate and conflict. Climatic Change, 127(3-4): 391-397.

Buhaug, H. and Vestby, J., 2019. On growth projections in the Shared Socioeconomic Pathways. Global Environmental Politics, 19(4): 118-132.

Bunce, A. and Ford, J., 2015. How is adaptation, resilience, and vulnerability research engaging with gender? Environmental Research Letters, 10: 1-11.

Bunker, A., Wildenhain, J., Vandenbergh, A., Henschke, N., Rocklov, J., Hajat, S. and Sauerborn, R., 2016. Effects of Air Temperature on Climate-Sensitive Mortality and Morbidity Outcomes in the Elderly; a Systematic Review and Meta-analysis of Epidemiological Evidence. EBioMedicine, 6: 258-268.

Bureau, P.R., 2014. Making the Connection: Population Dynamics and Climate Compatible Development Recommendations from an Expert Working Group.

Burge, C.A., Mark Eakin, C., Friedman, C.S., Froelich, B., Hershberger, P.K., Hofmann, E.E., Petes, L.E., Prager, K.C., Weil, E., Willis, B.L., Ford, S.E. and Harvell, C.D., 2014. Climate change influences on marine infectious diseases: implications for management and society. Ann Rev Mar Sci, 6: 249-77.

Burgess, C.P., Taylor, M.A., Spencer, N., Jones, J. and Stephenson, T.S., 2018. Estimating damages from climate-related natural disasters for the Caribbean at 1.5 °C and 2 °C global warming above preindustrial levels. Regional Environmental Change, 18(8): 2297-2312.

Burke, M., Gonzalez, F., Bayliss, P., Heft-Neal, S., Baysan, C., Basu, S. and Hsiang, S., 2018. Higher temperatures increase suicide rates in the United States and Mexico. Nature Climate Change, 8(8): 723-+.

Burke, M., Hsiang, S.M. and Miguel, E., 2015. Global non-linear effect of temperature on economic production. Nature, 527(7577): 235-239.

Burnham, M. and Ma, Z., 2017. Climate change adaptation: factors influencing Chinese smallholder farmers' perceived self-efficacy and adaptation intent. Regional Environmental Change, 17(1): 171-186.

Busby, J., 2018. Taking stock: the field of climate and security. Current Climate Change Reports, 4(4): 338-346.

Busby, J., Smith, T.G., Krishnan, N., Wight, C. and Vallejo-Gutierrez, S., 2018. In harm's way: Climate security vulnerability in Asia. World Development, 112: 88-118.

Busby, J.W., Smith, T.G. and Krishnan, N., 2014. Climate security vulnerability in Africa mapping 3.0. Political Geography, 43: 51-67.

Bush, K. and Duggan, C., 2014. How can research contribute to peacebuilding? PeaceBuilding, 2(3): 303-321.

Butler, J.R.A., Busilacchi, S. and Skewes, T., 2019. How resilient is the Torres Strait Treaty (Australia and Papua New Guinea) to global change? A fisheries governance perspective. Environmental Science & Policy, 91: 17-26.

Błażejczyk, K., Baranowski, J. and Błażejczyk, A., 2018. Climate related diseases. Current regional variability and projections to the year 2100. Quaestiones Geographicae, 37(1): 23-36.

Caceres-Arteaga, N. and Lane, K., 2020. Agroecological Practices as a Climate Change Adaptation Mechanism in Four Highland Communities in Ecuador. Journal of Latin American Geography, 19(3): 47-73.

Cai, R., Feng, S., Oppenheimer, M. and Pytlikova, M., 2016. Climate variability and international migration: The importance of the agricultural linkage. Journal of Environmental Economics and Management, 79: 135-151.

Call, M., Gray, C., Emch, M. and Yunus, M., 2017a. Disruption, not displacement: environmental variability and temporary migration in Bangladesh. Global Environmental Change, 46.

Call, M., Gray, C., Yunus, M. and Emch, M., 2017b. Disruption, not displacement: Environmental variability and temporary migration in Bangladesh. Global Environmental Change, 46: 157-165.

Camfield, L. and Esposito, L., 2014. A Cross-Country Analysis of Perceived Economic Status and Life Satisfaction in High- and Low-Income Countries. World Development, 59: 212-223.

Caminade, C., McIntyre, K.M. and Jones, A., 2018. Impact of recent and future climate change on vector-borne diseases. Annals of the New York Academy of Sciences, 1436.

Caminade, C., McIntyre, K.M. and Jones, A.E., 2019. Impact of recent and future climate change on vector-borne diseases. Ann N Y Acad Sci, 1436(1): 157-173.

Campagnolo, L. and Davide, M., 2019. Can the Paris deal boost SDGs achievement? An assessment of climate mitigation co-benefits or side-effects on poverty and inequality. World Development, 122: 96-109.

Campbell, S., Remenyi, T.A., White, C.J. and Johnston, F.H., 2018a. Heatwave and health impact research: A global review. Health & Place, 53: 210-218.

Campbell, S., Remenyi, T.A., White, C.J. and Johnston, F.H., 2018b. Heatwave and health impact research: A global review. Health & Place, 53: 210-218.

Campbell-Lendrum, D., Pruss-Ustan, A. and Corvalan, C., 2003. How much disease could climate change cause? In: A. McMichael, D. Campbell-Lendrum, C. Corvalan, K. Ebi, A. Githeko, J. Scheraga and A. Woodward (Editors), Climate Change and Human Health: Risks and Responses. World Health Organization/World Meteorological Organization/United Nations Environmental Programme, Geneva, pp. 133-159.

Campbell-Lendrum, D. and Woodruff, R., 2006. Comparative risk assessment of the burden of disease from climate change. Environ Health Perspect, 114(12): 1935-41.

Caner, A., Karaoglan, D. and Yasar, G., 2018a. Utilization of health-care services by young children: The aftermath of the Turkish Health Transformation Program. International Journal of Health Planning and Management, 33(3): 596-613.

Caner, A., Karaoğlan, D. and Yaşar, G., 2018b. Utilization of health-care services by young children: The aftermath of the Turkish Health Transformation Program. The International Journal of Health Planning and Management, 33(3): 596-613.

Canu, W.H., Jameson, J.P., Steele, E.H. and Denslow, M., 2017. Mountaintop Removal Coal Mining and Emergent Cases of Psychological Disorder in Kentucky. Community Mental Health Journal, 53(7): 802-810.

Canzonieri, C., 2007. M.E. Benedict and E.T. McMahon, Green Infrastructure: Linking Landscapes and Communities, Landscape Ecology, pp. 797-798.

Capaldi CA, Dopko RL and JM., Z., 2014. The relationship between nature connectedness and happiness: a meta-analysis. Front Psychol. 5:976.

Carbonell, J.R., 2016. Military spending, liberal institutions and state compliance with international environmental agreements. International Environmental Agreements-Politics Law and Economics, 16(5): 691-719.

Caretta, M. and Börjeson, L., 2015. Local gender contract and adaptive capacity in smallholder irrigation farming: a case study from the Kenyan drylands. Gender, Place and Culture, 22(5): 644-661.

Carleton, T.A., 2017. Crop-damaging temperatures increase suicide rates in India. Proceedings of the National Academy of Sciences of the United States of America, 114(33): 8746-8751.

Carleton, T.A. and Hsiang, S.M., 2016. Social and economic impacts of climate. Science, 353(6304).

Carleton, T.A., Jina, A., Delgado, M.T., Greenstone, M., Houser, T., Hsiang, S.M., Hultgren, A., Kopp, R.E., McCusker, K.E. and Nath, I.B., 2020. - Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits.

Carlton, E.J., Eisenberg, J.N., Goldstick, J., Cevallos, W., Trostle, J. and Levy, K., 2014. Heavy rainfall events and diarrhea incidence: the role of social and environmental factors. Am J Epidemiol, 179(3): 344-52.

Carlton, E.J., Woster, A.P., DeWitt, P., Goldstein, R.S. and Levy, K., 2016. A systematic review and meta-analysis of ambient temperature and diarrhoeal diseases. Int J Epidemiol, 45(1): 117-30.

Carrico, A.R. and Donato, K., 2019. Extreme weather and migration: evidence from Bangladesh. Population and Environment, 41(1): 1-31.

Carrico, A.R., Donato, K.M., Best, K.B. and Gilligan, J., 2020. Extreme weather and marriage among girls and women in Bangladesh. Global Environmental Change, 65.

Carter, M. and Janzen, S., 2018. Social protection in the face of climate change: targeting principles and financing mechanisms. Environment and Development Economics, 23(3): 369-389.

Carter, T.A. and Veale, D.J., 2015. The timing of conflict violence: Hydraulic behavior in the Ugandan civil war. Conflict Management and Peace Science, 32(4): 370-394.

Caruso, R., Petrarca, I. and Ricciuti, R., 2016a. Climate change, rice crops, and violence: Evidence from Indonesia. Journal of Peace Research, 53(1): 66-83.

Caruso, R., Petrarca, I. and Ricciuti, R., 2016b. Climate change, rice crops, and violence: Evidence from Indonesia. Journal of Peace Research, 53(1): 66-83.

Carvajal, T.M., Viacrusis, K.M., Hernandez, L.F.T., Ho, H.T., Amalin, D.M. and Watanabe, K., 2018. Machine learning methods reveal the temporal pattern of dengue incidence using meteorological factors in metropolitan Manila, Philippines. BMC Infect Dis, 18(1): 183.

Casas-Cortes, M., Cobarrubias, S., De Genova, N., Garelli, G., Grappi, G., Heller, C., ... and & Peano, I., 2015. New Keywords: Migration and Borders. Cultural Studies, 29(1): 55-87.

Casey, G. and Galor, O., 2017. Is faster economic growth compatible with reductions in carbon emissions? The role of diminished population growth. Environmental Research Letters, 12(1).

Casey, G., Shayegh, S., Moreno-Cruz, J., Bunzl, M., Galor, O. and Caldeira, K., 2019. The impact of climate change on fertility. Environmental Research Letters, 14(5).

Cash, B.A., Rodó, X., Emch, M., Yunus, M., Faruque, A.S. and Pascual, M., 2014. Cholera and shigellosis: different epidemiology but similar responses to climate variability. PLoS One, 9(9): e107223.

Castellani, J.W. and Young, A.J., 2016. Human physiological responses to cold exposure: Acute responses and acclimatization to prolonged exposure. Autonomic Neuroscience, 196: 63-74.

Castro-Nunez, A., 2018. Responding to Climate Change in Tropical Countries Emerging from Armed Conflicts: Harnessing Climate Finance, Peacebuilding, and Sustainable Food. Forests, 9(10).

Castro-Nunez, A., Mertz, O. and Quintero, M., 2016. Propensity of farmers to conserve forest within REDD plus projects in areas affected by armed-conflict. Forest Policy and Economics, 66: 22-30.

Cattaneo, C., Beine, M., Frohlich, C.J., Kniveton, D., Martinez-Zarzoso, I., Mastrorillo, M., Millock, K., Piguet, E. and Schraven, B., 2019. Human Migration in the Era of Climate Change. Review of Environmental Economics and Policy, 13(2): 189-206.

Cattaneo, C. and Bosetti, V., 2017. Climate-induced International Migration and Conflicts. Cesifo Economic Studies, 63(4): 500-528.

Cattaneo, C. and Massetti, E., 2015. Migration and climate change in rural Africa. Munich: Center for Economic Studies and Ifo Institute.

Centre, I.D.M., 2020. Global report on internal displacement, Geneva.

Chadsuthi, S., Iamsirithaworn, S., Triampo, W. and Cummings, D.A., 2016. The impact of rainfall and temperature on the spatial progression of cases during the chikungunya re-emergence in Thailand in 2008-2009. Trans R Soc Trop Med Hyg, 110(2): 125-33.

Chan, E., Lam, H., So, S., Goggins, W., Ho, J., Liu, S. and Chung, P., 2018. Association between ambient temperatures and mental disorder hospitalizations in a subtropical city: A time-series study of Hong Kong special administrative region. International Journal of Environmental Research and Public Health, 15(4): 754.

Chan, M., 2015. Achieving a cleaner, more sustainable, and healthier future. Lancet (London, England), 386.

Chandra, A., McNamara, K.E., Dargusch, P., Caspe, A.M. and Dalabajan, D., 2017a. Gendered vulnerabilities of smallholder farmers to climate change in conflict-prone areas: A case study from Mindanao, Philippines. Journal of Rural Studies, 50: 45-59.

Chandra, A., McNamara, K.E., Dargusch, P., Caspe, A.M. and Dalabajan, D., 2017b. Gendered vulnerabilities of smallholder farmers to climate change in conflict-prone areas: A case study from Mindanao, Philippines. Journal of Rural Studies, 50: 45-59.

Chandran M.A, S., Subbarao, A., Vm, S., Parameswaran, P., Pani, P., Rao, V., Venugopalan, V. and Ch, S., 2016. Indian summer heat wave of 2015: a biometeorological analysis using half hourly automatic weather station data with special reference to Andhra Pradesh. International Journal of Biometeorology, 61: 1063-1072.

Chandrasekhar, S. and Mitra, A., 2018. Migration, caste and livelihood: Evidence from Indian city-slums. Urban Research and Practice: 1-17.

Chang, C.C. and Chen, S.C., 2015. Colliding Epidemics and the Rise of Cryptococcosis. J Fungi (Basel), 2(1).

Chang, C.J., Chen, C.S., Tien, C.J. and Lu, M.R., 2018. Epidemiological, clinical and climatic characteristics of dengue fever in Kaohsiung City, Taiwan with implication for prevention and control. PLoS One, 13(1): e0190637.

Chang, I.P.o.C., 2014. Climate change 2014: Synthesis Report.

Chang, K., Hess, J., Balbus, M., Buonocore, J., Cleveland, A., Grabow, L. and Ebi, K., 2017a. Ancillary health effects of climate mitigation scenarios as drivers of policy uptake: A review of air quality, transportation and diet co-benefits modeling studies. Environmental Research Letters.

Chang, K.M., Hess, J.J., Balbus, J.M., Buonocore, J.J., Cleveland, D.A., Grabow, M.L., Neff, R., Saari, R.K., Tessum, C.W., Wilkinson, P., Woodward, A. and Ebi, K.L., 2017b. Ancillary health effects of climate mitigation scenarios as drivers of policy uptake: a review of air quality, transportation and diet co-benefits modeling studies. Environ. Res. Lett., 12(11): 113001.

Chapin, F.S., III, Knapp, C.N., Brinkman, T.J., Bronen, R. and Cochran, P., 2016. Community-empowered adaptation for self-reliance. Current Opinion in Environmental Sustainability, 19: 67-75.

Chapra, S.C., Boehlert, B., Fant, C., Bierman, V.J., Jr., Henderson, J., Mills, D., Mas, D.M.L., Rennels, L., Jantarasami, L., Martinich, J. and Others, 2017. Climate change impacts on harmful algal blooms in US freshwaters: a screening-level assessment. Environ. Sci. Technol., 51(16): 8933-8943.

Charlesworth, K. and Jamieson, M., 2018a. Healthcare in a carbon-constrained world. Australian Health Review, 43.

Charlesworth, K., Stewart, G. and Sainsbury, P., 2018a. Addressing the carbon footprint of health organisations: eight lessons for implementation. Public Health Research & Practice, 28.

Charlesworth, K.E. and Jamieson, M., 2018b. Healthcare in a carbon-constrained world. Aust Health Rev.

Charlesworth, K.E. and Jamieson, M., 2019. Healthcare in a carbon-constrained world. Australian Health Review, 43(3): 241-245.

Charlesworth, K.E., Stewart, G.J. and Sainsbury, P., 2018b. Addressing the carbon footprint of health organisations: eight lessons for implementation. Public Health Research & Practice, 28(4).

Chen, G., Zhang, W., Li, S., Zhang, Y., Williams, G., Huxley, R., Ren, H., Cao, W. and Guo, Y., 2017a. The impact of ambient fine particles on influenza transmission and the modification effects of temperature in China: A multi-city study. Environ Int, 98: 82-88.

Chen, J.J., Mueller, V., Jia, Y. and Tseng, S., 2017b. Validating Migration Responses to Flooding Using Satellite and Vital Registration Data. American Economic Review, 107(5): 441-445.

Chen, K., Breitner, S., Wolf, K., Hampel, R., Meisinger, C., Heier, M., von Scheidt, W., Kuch, B., Peters, A., Schneider, A. and Group, K.S., 2019. Temporal variations in the triggering of myocardial infarction by air temperature in Augsburg, Germany, 1987-2014. Eur Heart J.

Chen, M., 2015. Self-efficacy or collective efficacy within the cognitive theory of stress model: Which more effectively explains people's self-reported proenvironmental behavior? Journal of Environmental Psychology, 42: 66-75.

Cheng, A., Chen, D.M., Woodstock, K., Ogden, N.H., Wu, X.T. and Wu, J.H., 2017. Analyzing the Potential Risk of Climate Change on Lyme Disease in Eastern Ontario, Canada Using Time Series Remotely Sensed Temperature Data and Tick Population Modelling. Remote Sensing, 9(6).

Cheng, J., Xu, Z.W., Bambrick, H., Su, H., Tong, S.L. and Hu, W.B., 2018a. Heatwave and elderly mortality: An evaluation of death burden and health costs considering short-term mortality displacement. Environment International, 115: 334-342.

Cheng, J., Xu, Z.W., Bambrick, H., Su, H., Tong, S.L. and Hu, W.B., 2019. Impacts of heat, cold, and temperature variability on mortality in Australia, 2000-2009. Science of the Total Environment, 651: 2558-2565.

Cheng, Q., Bai, L., Zhang, Y., Zhang, H., Wang, S., Xie, M., Zhao, D. and Su, H., 2018b. Ambient temperature, humidity and hand, foot, and mouth disease: A systematic review and meta-analysis. Sci Total Environ, 625: 828-836.

Chersich, M. and Wright, C., 2019. Climate change adaption in South Africa: a case study on the role of the health sector. Globalization and Health, 15(22).

Chersich, M.F., Scorgie, F., Rees, H. and Wright, C.Y., 2018. How climate change can fuel listeriosis outbreaks in South Africa. S Afr Med J, 108(6): 453-454.

Chhetri, B.K., Galanis, E., Sobie, S., Brubacher, J., Balshaw, R., Otterstatter, M., Mak, S., Lem, M., Lysyshyn, M., Murdock, T., Fleury, M., Zickfeld, K., Zubel, M., Clarkson, L. and Takaro, T.K., 2019. Projected local rain events due to climate change and the impacts on waterborne diseases in Vancouver, British Columbia, Canada. Environ Health, 18(1): 116.

Chiabai, A., Quiroga, S., Martinez-Juarez, P., Higgins, S. and Taylor, T., 2018. The nexus between climate change, ecosystem services and human health: Towards a conceptual framework. Science of the Total Environment, 635: 1191-1204.

Chindarkar, N., 2012. Gender and climate change-induced migration: proposing a framework for analysis. Environmental Research Letters, 7(2): 025601-025601.

Chirico, F., 2018. Comments on "Climate Change and Public Health: A Small Frame Obscures the Picture". New Solut: 1048291117752463.

Chort, I. and de la Rupelle, M., 2016. Determinants of Mexico-U.S. Outward and Return Migration Flows: A State-Level Panel Data Analysis. Demography, 53(5): 1453-1476.

Choularton, R. and Krishnamurthy, P., 2019. How accurate is food security early warning? Evaluation of FEWS NET accuracy in Ethiopia. Food Security, 11(2): 333-344.

Chowdhury, F.R., Ibrahim, Q.S.U., Bari, M.S., Alam, M.M.J., Dunachie, S.J., Rodriguez-Morales, A.J. and Patwary, M.I., 2018a. The association between temperature, rainfall and humidity with common climate-sensitive infectious diseases in Bangladesh. PLoS One, 13(6): e0199579.

Chowdhury, S., Dey, S. and Smith, K.R., 2018b. Ambient PM2.5 exposure and expected premature mortality to 2100 in India under climate change scenarios. Nat. Commun., 9(1): 318.

Chu, E. and Michael, K., 2018. Recognition in urban climate justice: marginality and exclusion of migrants in Indian cities. Environment and Ubanization, 31(1): 139-156.

Chuang, T.W., Chaves, L.F. and Chen, P.J., 2017. Effects of local and regional climatic fluctuations on dengue outbreaks in southern Taiwan. PLoS One, 12(6): e0178698.

Chung, Y., Yang, D., Gasparrini, A., Vicedo-Cabrera, A.M., Fook Sheng Ng, C., Kim, Y., Honda, Y. and Hashizume, M., 2018. Changing Susceptibility to Non-Optimum Temperatures in Japan, 1972-2012: The Role of Climate, Demographic, and Socioeconomic Factors. Environmental health perspectives, 126(5): 057002-057002.

Cianconi, P., Betro, S. and Janiri, L., 2020. The Impact of Climate Change on Mental Health: A Systematic Descriptive Review. Frontiers in Psychiatry, 11.

Cil, G. and Cameron, T.A., 2017. Potential Climate Change Health Risks from Increases in Heat Waves: Abnormal Birth Outcomes and Adverse Maternal Health Conditions. Risk Anal., 37(11): 2066-2079.

Cissé, G., Traoré, D., Touray, S., Bâ, H., Keïta, M., Sy, I., Koné, B., Utzinger, J. and Tanner, M., 2016. Vulnerabilities of water and sanitation at households and community levels in face of climate variability and change: trends from historical climate time series in a West African medium-sized town. Int. J. Global Environmental Issues Vol. 15, Nos. 1/2: 81–99.

Cissé, G., 2019. Food-borne and water-borne diseases under climate change in low- and middle-income countries: Further efforts needed for reducing environmental health exposure risks. Acta Trop, 194: 181-188.

Cissé, G., Menezes, J.A. and Confalonieri, U., 2018. Climate-sensitive infectious diseases. In: Unep (Editor), the Adaptation Gap Report 2018. United Nations Environment Programme (UNEP), Nairobi, Kenya, pp. 49-59.

Clare, A., Graber, R., Jones, L. and Conway, D., 2017. Subjective measures of climate resilience: What is the added value for policy and programming? Global Environmental Change-Human and Policy Dimensions, 46: 17-22.

Clayton, S. and Karazsia, B., 2020. Development and validation of a measure of climate change anxiety. Journal of Environmental Psychology, 69.

Clayton, S., Manning, C.M., Krygsman, K. and Speiser, M., 2017. Mental Health and Our Changing Climate: Impacts, Implications, and Guidance. American Psychological Association, and ecoAmerica. , Washington, DC.

Clow, K.M., Leighton, P.A., Ogden, N.H., Lindsay, L.R., Michel, P., Pearl, D.L. and Jardine, C.M., 2017. Northward range expansion of Ixodes scapularis evident over a short timescale in Ontario, Canada. Plos One, 12(12).

Cohen, A.J., Brauer, M., Burnett, R., Anderson, H.R., Frostad, J., Estep, K., Balakrishnan, K., Brunekreef, B., Dandona, L., Dandona, R., Feigin, V., Freedman, G., Hubbell, B., Jobling, A., Kan, H., Knibbs, L., Liu, Y., Martin, R., Morawska, L., Pope, C.A., 3rd, Shin, H., Straif, K., Shaddick, G., Thomas, M., van Dingenen, R., van Donkelaar, A., Vos, T., Murray, C.J.L. and Forouzanfar, M.H., 2017a. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. Lancet, 389(10082): 1907-1918.

Cohen, B., Tyler, E. and Gunfas, T., 2017b. Lessons from co-impacts assessment under the Mitigation Action Plans and Scenarios (MAPS) Programme. Climate Policy, 17(8): 1065-1075.

Cohen, G.H., Tamrakar, S., Lowe, S., Sampson, L., Ettman, C., Kilpatrick, D., Linas, B.P., Ruggiero, K. and Galea, S., 2019. Improved social services and the burden of post-traumatic stress disorder among economically vulnerable people after a natural disaster: a modelling study. Lancet Planetary Health, 3(2): E93-E101.

Colgan, J.D., 2018. Climate Change and the Politics of Military Bases. Global Environmental Politics, 18(1): 33-51.

Collaco, J.M., Appel, L.J., McGready, J. and Cutting, G.R., 2018. The relationship of lung function with ambient temperature. PLoS One, 13(1): e0191409.

Conca, K., 2019. Is There a Role for the UN Security Council on Climate Change? Environment, 61(1): 4-15.

Conca, K., Thwaites, J. and Lee, G., 2017. Climate Change and the UN Security Council: Bully Pulpit or Bull in a China Shop? Global Environmental Politics, 17(2): 1-20.

Coniglio, N.D. and Pesce, G., 2015. Climate variability and international migration: an empirical analysis. Environment and Development Economics, 20(4): 438-468.

Connell, J., 2016. Last days in the Carteret Islands? Climate change, livelihoods and migration on coral atolls. Asia Pacific Viewpoint, 57(1): 3-15.

Connolly, M., 2013. Some like It Mild and Not Too Wet: The Influence of Weather on Subjective Well-Being. Journal of Happiness Studies, 14(2): 457-473.

Cooper, R. and Price, R., 2019. Unmet needs and opportunities for climate change adaptation and mitigation in the G5 Sahel region Institute of Development Studies, Brighton, UK.

Costa, A., Hoek, G., Brunekreef, B. and De Leon, A., 2016. Air Pollution and Deaths among Elderly Residents of São Paulo, Brazil: An Analysis of Mortality Displacement. Environmental health perspectives, 125.

Costa, A.F., Hoek, G., Brunekreef, B. and de Leon, A., 2017. Air Pollution and Deaths among Elderly Residents of Sao Paulo, Brazil: An Analysis of Mortality Displacement. Environmental Health Perspectives, 125(3): 349-354.

Crawford, A., Dazé, A., Hammill, A., Parry, J.-E. And Zamudio, A.N., 2015. Promoting climate-resilient peacebuilding in fragile states, International Institute for Sustainable Development (IISD), Geneva.

Crost, B., Duquennois, C., Felter, H. and Rees, I., 2018a. Climate change, agricultural production and civil conflict: Evidence from the Philippine. Journal of Environmental Economics and Management, 88: 379-395.

Crost, B., Duquennois, C., Felter, J.H. and Rees, D.I., 2018b. Climate change, agricultural production and civil conflict: Evidence from the Philippines. Journal of Environmental Economics and Management, 88: 379-395.

Cseh, A., 2019. Aligning climate action with the self-interest and short-term dominated priorities of decision-makers. Climate Policy, 19(2): 139-146.

Cui, J. and Sinoway, L.I., 2014. Cardiovascular responses to heat stress in chronic heart failure. Curr Heart Fail Rep, 11(2): 139-45.

Cunado, J. and de Gracia, F.P., 2013. Environment and Happiness: New Evidence for Spain. Social Indicators Research, 112(3): 549-567.

Cunsolo, A. and Ellis, N.R., 2018. Ecological grief as a mental health response to climate change-related loss. Nature Climate Change, 8(4): 275-281.

Curriero, F.C., Patz, J.A., Rose, J.B. and Lele, S., 2001. The association between extreme precipitation and waterborne disease outbreaks in the United States, 1948-1994. American Journal of Public Health, 91(8): 1194-1199.

Curtis, K., Fussell, E. and DeWaard, J., 2015. Recovery Migration after Hurricanes Katrina and Rita: Spatial Concentration and Intensification in the Migration System. Demography, 52(4): 1269-1293.

Cushing, L., Morello-Frosch, R., Wander, M. and Pastor, M., 2015. The haves, the have-nots, and the health of everyone: the relationship between social inequality and environmental quality. Annu Rev Public Health, 36: 193-209.

Czerwińska, A.E. and Krzyścin, J.W., 2020. - Climatological aspects of the increase of the skin cancer (melanoma) incidence rate in Europe. - 40(- 6).

D'Odorico, P., Davis, K.F., Rosa, L., Carr, J.A., Chiarelli, D., Dell'Angelo, J., Gephart, J., MacDonald, G.K., Seekell, D.A. and Suweis, S., 2018. The global food-energy-water nexus. Reviews of Geophysics, 56(3): 456-531.

da Silva, J., Kernaghan, S. and Luque, A., 2012. A systems approach to meeting the challenges of urban climate change. International Journal of Urban Sustainable Development, 4(2): 125-145.

Daanen, H.A.M. and Van Marken Lichtenbelt, W.D., 2016. Human whole body cold adaptation. Temperature, 3(1): 104-118.

Dalby, S., 2017. Anthropocene Formations: Environmental Security, Geopolitics and Disaster. Theory Culture & Society, 34(2-3): 233-252.

Dally, M., Butler-Dawson, J., Kopp Krisher, L., Monaghan, A., Weitzenkamp, D., Sorensen, C., Johnson, R., Carlton, E., Asensio, C., Tenney, L. and Newman, L., 2018. The impact of heat and impaired kidney function on productivity of Guatemalan sugarcane workers. PLOS ONE, 13: e0205181.

Daniel, M., Danielova, V., Fialova, A., Maly, M., Kriz, B. and Nuttall, P.A., 2018. Increased Relative Risk of Tick-Borne Encephalitis in Warmer Weather. Frontiers in Cellular and Infection Microbiology, 8.

Dannenberg, A., Frumkin, H., Hess, J. and Ebi, K., 2019. Managed retreat as a strategy for climate change adaptation in small communities: public health implications. Climatic Change, 153(1-2): 1-14.

Das, S.K., Chisti, M.J., Sarker, M.H.R., Das, J., Ahmed, S., Shahunja, K.M., Nahar, S., Gibbons, N., Ahmed, T., Faruque, A.S.G., Rahman, M., J Fuchs, G., Al Mamun, A. and John Baker, P., 2017. Long-term impact of changing childhood malnutrition on rotavirus diarrhoea: Two decades of adjusted association with climate and socio-demographic factors from urban Bangladesh. PLoS One, 12(9): e0179418.

Dasgupta, P., Ebi, K. and Sachdeva, I., 2016. Health sector preparedness for adaptation planning in India. Climatic Change, 138(3-4): 551-566.

Dasgupta, S., 2018. Burden of climate change on malaria mortality. Int J Hyg Environ Health, 221(5): 782-791.

Davenport, F., Grace, K., Funk, C. and Shukla, S., 2017. Child health outcomes in sub-Saharan Africa: A comparison of changes in climate and socio-economic factors. Glob. Environ. Change, 46: 72-87.

David, J.M., Ravel, A., Nesbitt, A., Pintar, K. and Pollari, F., 2014. Assessing multiple foodborne, waterborne and environmental exposures of healthy people to potential enteric pathogen sources: effect of age, gender, season, and recall period. Epidemiology and Infection, 142(1): 28-39.

David-Chavez, D. and Gavin, M., 2018. A global assessment of Indigenous community engagement in climate research. Environmental Research Letters, 13(12).

Davies, G.I., McIver, L., Kim, Y., Hashizume, M., Iddings, S. and Chan, V., 2014. Water-borne diseases and extreme weather events in Cambodia: review of impacts and implications of climate change. Int J Environ Res Public Health, 12(1): 191-213.

Davis, J., 2017. Fertility after natural disaster: Hurricane Mitch in Nicaragua. Population and Environment, 38(4): 448-464.

Davis, R.E., Knappenberger, P.C., Michaels, P.J. and Novicoff, W.M., 2003. Changing heat-related mortality in the United States. Environmental Health Perspectives, 111(14): 1712-1718.

Davis, R.E., McGregor, G.R. and Enfield, K.B., 2016. Humidity: A review and primer on atmospheric moisture and human health. Environmental Research, 144: 106-116.

Davis Robert, E., Hondula David, M. and Patel Anjali, P., 2016. Temperature Observation Time and Type Influence Estimates of Heat-Related Mortality in Seven U.S. Cities. Environmental Health Perspectives, 124(6): 795-804.

Davoudi, S., 2014. Climate change, securitisation of nature, and resilient urbanism. Environment and Planning C-Government and Policy, 32(2): 360-375.

Day, A.M., 2017. Companion animals and natural disasters: A systematic review of literature. International Journal of Disaster Risk Reduction, 24: 81-90.

De Alwis, D. and Noy, I., 2019. Sri Lankan households a decade after the Indian Ocean tsunami. Review of Development Economics, 23(2): 1000-1026.

de Amorim, W.S., Valduga, I.B., Ribeiro, J.M.P., Williamson, V.G., Krauser, G.E., Magtoto, M.K. and Guerra, J., 2018. The nexus between water, energy, and food in the context of the global risks: An analysis of the interactions between food, water, and energy security. Environmental Impact Assessment Review, 72: 1-11.

De Châtel, F., 2014. The role of drought and climate change in the Syrian uprising: Untangling the triggers of the revolution. Middle Eastern Studies, 50(4): 521-535.

De Dominicis, S., Fornara, F., Ganucci Cancellieri, U., Twigger-Ross, C. and Bonaiuto, M., 2015. We are at risk, and so what? Place attachment, environmental risk perceptions and preventive coping behaviours. Journal of Environmental Psychology, 43: 66-78.

de Jong, F.C., GeurtsvanKessel, C.H., Molenkamp, R., Bangma, C.H. and Zuiverloon, T.C.M., 2020. Sewage surveillance system using urological wastewater: Key to COVID-19 monitoring? Urol Oncol.

De Juan, A., 2015. Long-term environmental change and geographical patterns of violence in Darfur, 2003–2005. Political Geography, 45: 22-33.

de la Vega-Leinert, A.C., Stoll-Kleemann, S. and Wegener, E., 2018. Managed Realignment (MR) along the Eastern German Baltic Sea: A Catalyst for Conflict or for a Coastal Zone Management Consensus. Journal of Coastal Research, 34(3): 586-601.

DE Man, H., Mughini Gras, L., Schimmer, B., Friesema, I.H., DE Roda Husman, A.M. and VAN Pelt, W., 2016. Gastrointestinal, influenza-like illness and dermatological complaints following exposure to floodwater: a cross-sectional survey in The Netherlands. Epidemiol Infect, 144(7): 1445-54.

de Man, H., van den Berg, H.H., Leenen, E.J., Schijven, J.F., Schets, F.M., van der Vliet, J.C., van Knapen, F. and de Roda Husman, A.M., 2014. Quantitative assessment of infection risk from exposure to waterborne pathogens in urban floodwater. Water Res, 48: 90-9.

De Stefano, L., Duncan, J., Dinar, S., Stahl, K., Strzepek, K.M. and Wolf, A.T., 2012. Climate change and the institutional resilience of international river basins. Journal of Peace Research, 49(1): 193-209.

De Stefano, L., Petersen-Perlman, J.D., Sproles, E.A., Eynard, J. and Wolf, A.T., 2017. Assessment of transboundary river basins for potential hydro-political tensions. Global Environmental Change, 45: 35-46.

De'Donato, F., Scortichini, M., De Sario, M., de Martino, A. and Michelozzi, P., 2018. Temporal variation in the effect of heat and the role of the Italian heat prevention plan. Public Health, 161: 154-162.

Dear, K., 2018. Modelling Productivity Loss from Heat Stress. Atmosphere, 9: 286.

Delhey, J. and Dragolov, G., 2016. Happier together. Social cohesion and subjective well-being in Europe. International Journal of Psychology, 51(3): 163-176.

Dell'Angelo, J., D'Odorico, P., Rulli, M.C. and Marchand, P., 2017. The Tragedy of the Grabbed Commons: Coercion and Dispossession in the Global Land Rush. World Development, 92: 1-12.

Demuth, L., Morss, E., Lazo, K. and Trumbo, C., 2016. The effects of past hurricane experiences on evacuation intentions through risk perception and efficacy beliefs: A mediation analysis Weather, Climate and Society, 8: 327-344.

Deng, S.Z., Jalaludin, B.B., Antó, J.M., Hess, J.J. and Huang, C.R., 2020. Climate change, air pollution, and allergic respiratory diseases: a call to action for health professionals. Chin Med J (Engl), 133(13): 1552-1560.

Deshpande, A., Chang, H.H. and Levy, K., 2020. Heavy Rainfall Events and Diarrheal Diseases: The Role of Urban-Rural Geography. Am J Trop Med Hyg, 103(3): 1043-1049.

Detges, A., 2014. Close-up on renewable resources and armed conflict the spatial logic of pastoralist violence in northern Kenya. Political Geography, 42: 57-65.

Detges, A., 2017. Droughts, state-citizen relations and support for political violence in Sub-Saharan Africa: A micro-level analysis. Political Geography, 61: 88-98.

Devisscher, T., Malhi, Y. and Boyd, E., 2019. Deliberation for wildfire risk management: Addressing conflicting views in the Chiquitania, Bolivia. Geographical Journal, 185(1): 38-54.

Devlin, C. and Hendrix, C.S., 2014. Trends and triggers redux: Climate change, rainfall, and interstate conflict. Political Geography, 43: 27-39.

DeWaard, J., Curtis, K.J. and Fussell, E., 2016. Population recovery in New Orleans after Hurricane Katrina: exploring the potential role of stage migration in migration systems. Population and Environment, 37(4): 449-463.

Dhimal, M., Dhimal, M.L., Pote-Shrestha, R.R., Groneberg, D.A. and Kuch, U., 2017. Health-sector responses to address the impacts of climate change in Nepal. WHO South East Asia J Public Health, 6(2): 9-14.

Di Virgilio, G., Evans, J., Blake, S., Armstrong, M., Dowd, A., Sharples, J. and McRae, R., 2019. Climate Change Increases the Potential for Extreme Wildfires. Geophysical Research Letters, 46(14): 8517-8526.

Diaz, D.B., 2016. Estimating global damages from sea level rise with the Coastal Impact and Adaptation Model (CIAM). Climatic Change, 137(1-2): 143-156.

Diaz, J., Carmona, R., Miron, I.J., Luna, M.Y. and Linares, C., 2019. Time trends in the impact attributable to cold days in Spain: Incidence of local factors. Science of the Total Environment, 655: 305-312.

Diaz, J., Carmona, R., Miron, I.J., Ortiz, C. and Linares, C., 2015. Comparison of the effects of extreme temperatures on daily mortality in Madrid (Spain), by age group: The need for a cold wave prevention plan. Environ Res, 143(Pt A): 186-91.

Diaz-Mendez, S.E., Torres-Rodríguez, A.A., Abatal, M., Soberanis, M.A.E., Bassam, A. and Pedraza-Basulto, G.K., 2018. Economic, environmental and health co-benefits of the use of advanced control strategies for lighting in buildings of Mexico. Energy Policy, 113: 401-409.

Dieleman, J.L., Sadat, N., Chang, A.Y., Fullman, N., Abbafati, C., Acharya, P., Adou, A.K., Ahmad Kiadaliri, A., Alam, K., Alizadeh-Navaei, R., Alkerwi, A.a., Ammar, W., Antonio, C.A.T., Aremu, O., Asgedom, S.W., Atey, T.M., Avila-Burgos, L., Ayer, R., Badali, H., Banach, M., Banstola, A., Barac, A., Belachew, A.B., Birungi, C., Bragazzi, N.L., Breitborde, N.J.K., Cahuana-Hurtado, L., Car, J., Catalá-López, F., Chapin, A., Chen, C.S., Dandona, L., Dandona, R., Daryani, A., Dharmaratne, S.D., Dubey, M., Edessa, D., Eldrenkamp, E., Eshrati, B., Faro, A., Feigl, A.B., Fenny, A.P., Fischer, F., Foigt, N., Foreman, K.J., Ghimire, M., Goli, S., Hailu, A.D., Hamidi, S., Harb, H.L., Hay, S.I., Hendrie, D., Ikilezi, G., Javanbakht, M., John, D., Jonas, J.B., Kaldjian, A., Kasaeian, A., Kasahun, Y.C., Khalil, I.A., Khang, Y.-H., Khubchandani, J., Kim, Y.J., Kinge, J.M., Kosen, S., Krohn, K.J., Kumar, G.A., Lafranconi, A., Lam, H., Listl, S., Magdy Abd El Razek, H., Magdy Abd El Razek, M., Majeed, A., Malekzadeh, R., Malta, D.C., Martinez, G., Mensah, G.A., Meretoja, A., Micah, A., Miller, T.R., Mirrakhimov, E.M., Mlashu, F.W., Mohammed, E., Mohammed, S., Moses, M., Mousavi, S.M., Naghavi, M., Nangia, V., Ngalesoni, F.N., Nguyen, C.T., Nguyen, T.H., Niriayo, Y., Noroozi, M., Owolabi, M.O., Patel, T., Pereira, D.M., Polinder, S., Qorbani, M., Rafay, A., Rafiei, A., Rahimi-Movaghar, V., Rai, R.K., Ram, U., Ranabhat, C.L., Ray, S.E., Reiner, R.C., Sajadi, H.S., Santoro, R., Santos, J.V., Sarker, A.R., Sartorius, B., Satpathy, M., Sepanlou, S.G., Shaikh, M.A., Sharif, M., She, J., Sheikh, A., Shrime, M.G., Sisay, M., Soneji, S., Soofi, M., Sorensen, R.J.D., Tadesse, H., Tao, T., Templin, T., Tesema, A.G., Thapa, S., Tobe-Gai, R., Topor-Madry, R., Tran, B.X., Tran, K.B., Tran, T.T., Undurraga, E.A., Vasankari, T., Violante, F.S., Werdecker, A., Wijeratne, T., Xu, G., Yonemoto, N., Younis, M.Z., Yu, C., Zaki, M.E.S., Zlavog, B. and Murray, C.J.L., 2018. Trends in future health financing and coverage: future health spending and universal health coverage in 188 countries, 2016–40. The Lancet, 391(10132): 1783-1798.

Diener, E., Heintzelman, S.J., Kushlev, K., Tay, L., Wirtz, D., Lutes, L.D. and Oishi, S., 2017. Findings All Psychologists Should Know From the New Science on Subjective Well-Being. Canadian Psychology-Psychologie Canadienne, 58(2): 87-104.

Diener, E. and Tay, L., 2015. Subjective well-being and human welfare around the world as reflected in the Gallup World Poll. International Journal of Psychology, 50(2): 135-149.

Diez, T., Von Lucke, F. and Wellmann, Z., 2016. The securitisation of climate change: Actors, processes and consequences. Routledge.

Dilling, L., Pizzi, E., Berggren, J., Ravikumar, A. and Andersson, K., 2017. Drivers of adaptation: Responses to weather- and climate-related hazards in 60 local governments in the Intermountain Western U.S. Environment and Planning A: Economy and Space, 49(11): 2628-2648.

Dinar, S., Katz, D., De Stefano, L. and Blankespoor, B., 2015. Climate change, conflict, and cooperation: global analysis of the effectiveness of international river treaties in addressing water variability. Political Geography, 45: 55-66.

Dinar, S., Katz, D., De Stefano, L. and Blankespoor, B., 2019. Do treaties matter? Climate change, water variability, and cooperation along transboundary river basins. Political Geography, 69: 162-172.

Ding, N., Berry, H.L. and Bennett, C.M., 2016. The Importance of Humidity in the Relationship between Heat and Population Mental Health: Evidence from Australia. Plos One, 11(10).

Djekic, I., Kuzmanović, J., Anđelković, A., Saračević, M., Stojanović, M.M. and Tomašević, I., 2016. Relationships among hygiene indicators in take-away foodservice establishments and the impact of climatic conditions. J Appl Microbiol, 121(3): 863-72.

Djennad, A., Lo Iacono, G., Sarran, C., Lane, C., Elson, R., Hoser, C., Lake, I.R., Colon-Gonzalez, F.J., Kovats, S., Semenza, J.C., Bailey, T.C., Kessel, A., Fleming, L.E. and Nichols, G.L., 2019. Seasonality and the effects of weather on Campylobacter infections. Bmc Infectious Diseases, 19.

Djoudi, H., Locatelli, B., Vaast, C., Asher, K., Brockhaus, M. and Sijapati, B., 2016. Beyond dichotomies: gender and intersecting inequalities in climate change studies. Ambio, 45(3): S248-S262.

Dodd, W., Howard, C., Rose, C., Scott, C., Scott, P., Cunsolo, A. and Orbinski, J., 2018. The summer of smoke: ecosocial and health impacts of a record wildfire season in the Northwest Territories, Canada. Lancet Global Health, 6: S30-S30.

Dodd, W., Humphries, S., Patel, K., Majowicz, S., Little, M. and Dewey, C., 2017. Determinants of internal migrant health and the healthy migrant effect in South India: a mixed methods study. Bmc International Health and Human Rights, 17.

Dombrowsky, I., 2010. The role of intra-water sector issue linkage in the resolution of transboundary water conflicts. Water International, 35(2): 132-149.

Dominguez, D. and Yeh, C., 2018. Social justice disaster relief, counseling, and advocacy: the case of the Northern California wildfires. Counselling Psychology Quarterly.

Domínguez-Morueco, N., Ratola, N., Sierra, J., Nadal, M. and Jiménez-Guerrero, P., 2019. Combining monitoring and modelling approaches for BaP characterization over a petrochemical area. Sci. Total Environ. 658: 424-438.

Dong, B., Sutton, R., Shaffrey, L. and Wilcox, L., 2016. The 2015 European Heat Wave. Bulletin of the American Meteorological Society, 97: S57-S62.

Dong, C., Huang, G., Cheng, G., An, C., Yao, Y., Chen, X. and Chen, J., 2019. Wastewater treatment in amine-based carbon capture. Chemosphere, 222: 742-756.

Donovan, A., 2017. Geopower: Reflections on the critical geography of disasters. Progress in Human Geography, 41(1): 44-67.

Dosio, A. and Fischer, E., 2018. Will Half a Degree Make a Difference? Robust Projections of Indices of Mean and Extreme Climate in Europe Under 1.5 degrees C, 2 degrees C, and 3 degrees C Global Warming. Geophysical Research Letters, 45(2): 935-944.

Dosio, A., Mentaschi, L., Fischer, E. and Wyser, K., 2018. Extreme heat waves under 1.5 °C and 2 °C global warming. Environmental Research Letters, 13.

Dovie, D.B.K., Dzodzomenyo, M. and Ogunseitan, O.A., 2017. Sensitivity of health sector indicators' response to climate change in Ghana. Sci Total Environ, 574: 837-846.

Dowdy, A.J., Ye, H., Pepler, A., Thatcher, M., Osbrough, S.L., Evans, J.P., Di Virgilio, G. and McCarthy, N., 2019. Future changes in extreme weather and pyroconvection risk factors for Australian wildfires. Scientific Reports, 9(1): 10073.

Doyle, M.P., Erickson, M.C., Alali, W., Cannon, J., Deng, X., Ortega, Y., Smith, M.A. and Zhao, T., 2015. The food industry's current and future role in preventing microbial foodborne illness within the United States. Clin Infect Dis, 61(2): 252-9.

Drew, J., Cleghorn, C., Macmillan, A. and Mizdrak, A., 2020. Healthy and Climate-Friendly Eating Patterns in the New Zealand Context. Environmental Health Perspectives, 128(1).

Drouillard, J.S., 2018. Current situation and future trends for beef production in the United States of America - A review. Asian-Australas J Anim Sci, 31(7): 1007-1016.

Duane, B., Harford, S., Ramasubbu, D., Stancliffe, R., Pasdeki-Clewer, E., Lomax, R. and Steinbach, I., 2019. Environmentally sustainable dentistry: a brief introduction to sustainable concepts within the dental practice. British Dental Journal, 226: 292-295.

Duarte, J.L., Diaz-Quijano, F.A., Batista, A.C. and Giatti, L.L., 2019. Climatic variables associated with dengue incidence in a city of the Western Brazilian Amazon region. Rev Soc Bras Med Trop, 52: e20180429.

Dube, E., Mtapuri, O. and Matunhu, J., 2018. Managing flood disasters on the built environment in the rural communities of Zimbabwe: Lessons learnt. Jamba-Journal of Disaster Risk Studies, 10: 11.

Dudley, J., Hoberg, E., Jenkins, E. and Parkinson, A., 2015a. Climate Change in the North American Arctic: A One Health Perspective. Ecohealth, 12(4): 713-725.

Dudley, J.P., Hoberg, E.P., Jenkins, E.J. and Parkinson, A.J., 2015b. Climate Change in the North American Arctic: A One Health Perspective. Ecohealth, 12(4): 713-25.

Duffy, R., 2016. War, by Conservation. Geoforum, 69: 238-248.

Dulli, L., Eichleay, M., Rademacher, K., Sortijas, S. and Nsengiyumva, T., 2016. Meeting Postpartum Women’s Family Planning Needs through Integrated Family Planning and Immunization Services: Results of a Cluster-Randomized Controlled Trial in Rwanda. Global Health: Science and Practice, 4(1): 73-86.

Dumic, I. and Severnini, E., 2018. "Ticking Bomb": The Impact of Climate Change on the Incidence of Lyme disease. Can J Infect Dis Med Microbiol, 2018: 5719081.

Dunlap, A. and Fairhead, J., 2014. The Militarisation and Marketisation of Nature: An Alternative Lens to 'Climate-Conflict'. Geopolitics, 19(4): 937-961.

Dunn, G. and Johnson, G.D., 2018. The geo-spatial distribution of childhood diarrheal disease in West Africa, 2008-2013: A covariate-adjusted cluster analysis. Spat Spatiotemporal Epidemiol, 26: 127-141.

Durkalec, A., Furgal, C., Skinner, M.W. and Sheldon, T., 2015. Climate change influences on environment as a determinant of Indigenous health: Relationships to place, sea ice, and health in an Inuit community. Social Science & Medicine, 136: 17-26.

Döll, P., Trautmann, T., Gerten, D., Schmied, H.M., Ostberg, S., Saaed, F. and Schleussner, C.-F., 2018. Risks for the global freshwater system at 1.5 °C and 2 °C global warming. Environmental Research Letters, 13(4): 44038-44038.

D’Amato, G., Chong-Neto, H.J., Monge Ortega, O.P., Vitale, C., Ansotegui, I., Rosario, N., Haahtela, T., Galan, C., Pawankar, R. and Murrieta-Aguttes, M., 2020. - The effects of climate change on respiratory allergy and asthma induced by pollen and mold allergens. - 75(- 9).

Eastin, J., 2016. Fuel to the Fire: Natural Disasters and the Duration of Civil Conflict. International Interactions, 42(2): 322-349.

Eastin, J., 2018. Hell and high water: Precipitation shocks and conflict violence in the Philippines. Political Geography, 63: 116-134.

Ebi, K., 2015a. Greater understanding is need of whether warmer and shorter winters associated with climate change could reduce winter mortality. Environmental Research Letters, 10: 111002.

Ebi, K., 2016. Adaptation and resilience. Public Health Reviews, 37.

Ebi, K. and Barrio, M., 2017. Lessons Learned on Health Adaptation to Climate Variability and Change: Experiences Across Low- and Middle-Income Countries. Environmental Health Perspectives, 125.

Ebi, K., Berry, P., Hayes, K., Boyer, C., Sellers, S., Enright, P. and Hess, J., 2018a. Stress Testing the Capacity of Health Systems to Manage Climate Change-Related Shocks and Stresses. International Journal of Environmental Research and Public Health, 15(11).

Ebi, K., Hasegawa, T., Hayes, K., Monaghan, A., Paz, S. and Berry, P., 2018b. Health risks of warming of 1.5 degrees C, 2 degrees C, and higher, above pre-industrial temperatures. Environmental Research Letters, 13(6).

Ebi, K. and Prats, E., 2015. Health in National Climate Change Adaptation Planning. Annals of Global Health, 81(3): 418-426.

Ebi, K., Ziska, L. and Yohe, G., 2016. The shape of impacts to come: lessons and opportunities for adaptation from uneven increases in global and regional temperatures. Climatic Change, 139(3-4): 341-349.

Ebi, K.L., 2015b. Greater understanding is needed of whether warmer and shorter winters associated with climate change could reduce winter mortality. Environmental Research Letters, 10(11).

Ebi, K.L., Boyer, C., Bowen, K.J., Frumkin, H. and Hess, J., 2018c. Monitoring and Evaluation Indicators for Climate Change-Related Health Impacts, Risks, Adaptation, and Resilience. Int J Environ Res Public Health, 15(9).

Ebi, K.L., Hasegawa, T., Hayes, K., Monaghan, A., Paz, S. and Berry, P., 2018d. Health risks of warming of 1.5 degrees C, 2 degrees C, and higher, above pre-industrial temperatures. Environmental Research Letters, 13(6).

Ebi, K.L., Ogden, N.H., Semenza, J.C. and Woodward, A., 2017. Detecting and Attributing Health Burdens to Climate Change. Environmental Health Perspectives, 125(8): 085004.

Ebi, K.L. and Otmani Del Barrio, M., 2017. Lessons Learned on Health Adaptation to Climate Variability and Change: Experiences Across Low- and Middle-Income Countries. Environ Health Perspect, 125(6): 065001.

Ebi, K.L., Semenza, J.C. and Rocklöv, J., 2016. Current medical research funding and frameworks are insufficient to address the health risks of global environmental change. Environmental Health: A Global Access Science Source, 15: 1-8.

Echenique, M. and Melgar, L., 2018. Mapping Puerto Rico's Hurricane Migration with Mobile Phone Data, Citylab.

Eckenwiler, L., 2018. Displacement and solidarity: An ethic of place-making. Bioethics, 32(9): 562-568.

Eckstein, D., Künzel, V. and Schäfer, L., 2017. Global climate risk index 2018. Germanwatch eV: Bonn, Germany.

Edwards, B., Gray, M. and Hunter, B., 2015. The Impact of Drought on Mental Health in Rural and Regional Australia. Social Indicators Research, 121(1): 177-194.

Efstratiou, A., Ongerth, J. and Karanis, P., 2017. Waterborne transmission of protozoan parasites: Review of worldwide outbreaks - An update 2011-2016. Water Research, 114: 14-22.

Eguiluz-Gracia, I., Mathioudakis, A.G., Bartel, S., Vijverberg, S.J.H., Fuertes, E., Comberiati, P., Cai, Y.S., Tomazic, P.V., Diamant, Z. and Vestbo, J., 2020. - The need for clean air: The way air pollution and climate change affect allergic rhinitis and asthma.

Eisenack, K., Moser, S., Hoffmann, E., Klein, R., Oberlack, C., Pechan, A., Rotter, M. and Termeer, C., 2014. Explaining and overcoming barriers to climate change adaptation. Nature Climate Change, 4(10): 867-872.

Eklund, L., Degerald, M., Brandt, M., Prishchepov, A.V. and Pilesjo, P., 2017. How conflict affects land use: agricultural activity in areas seized by the Islamic State. Environmental Research Letters, 12(5).

Eklund, L. and Thompson, D., 2017. Differences in resource management affects drought vulnerability across the borders between Iraq, Syria, and Turkey. Ecology and Society, 22(4).

Ekmekcioglu, C., Wallner, P., Kundi, M., Weisz, U., Haas, W. and Hutter, H.-P., 2018. Red meat, diseases, and healthy alternatives: A critical review. Crit. Rev. Food Sci. Nutr., 58(2): 247-261.

El-Zein, A. and Tonmoy, F.N., 2017. Nonlinearity, fuzziness and incommensurability in indicator-based assessments of vulnerability to climate change: A new mathematical framework. Ecological Indicators, 82: 82-93.

Elliott, J., Dixon, J., Bisung, E. and Kangmennaang, J., 2017. A GLOWING footprint: Developing an index of wellbeing for low to middle income countries. International Journal of Wellbeing, 7(2).

Elliott, J.R. and Pais, J., 2006. Race, class, and Hurricane Katrina: Social differences in human responses to disaster. Social Science Research, 35(2): 295-321.

Ellis, N.R. and Albrecht, G.A., 2017. Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt. Social Science & Medicine, 175: 161-168.

Engelstaedter, S., Washington, R. and Mahowald, N., 2009. Impact of changes in atmospheric conditions in modulating summer dust concentration at Barbados: A back-trajectory analysis. Journal of Geophysical Research-Atmospheres, 114.

English, P.B. and Richardson, M.J., 2016. Components of Population Vulnerability and Their Relationship with Climate-Sensitive Health Threats. Curr Environ Health Rep, 3(1): 91-8.

Ensor, J., Park, S., Hoddy, E. and Ratner, B., 2015. A rights-based perspective on adaptive capacity. Global Environmental Change-Human and Policy Dimensions, 31: 38-49.

Entwisle, B., Williams, N.E., Verdery, A.M., Rindfuss, R.R., Walsh, S.J., Malanson, G.P., Mucha, P.J., Frizzelle, B.G., McDaniel, P.M., Yao, X., Heumann, B.W., Prasartkul, P., Sawangdee, Y. and Jampaklay, A., 2016. Climate shocks and migration: an agent-based modeling approach. Population and Environment, 38(1): 47-71.

Eriksen, S., Nightingale, A. and Eakin, H., 2015. Reframing adaptation: the political nature of climate change adaptation. Global Environmental Change, 35: 523-533.

Escobar, L.E., Ryan, S.J., Stewart-Ibarra, A.M., Finkelstein, J.L., King, C.A., Qiao, H. and Polhemus, M.E., 2015. A global map of suitability for coastal Vibrio cholerae under current and future climate conditions. Acta Trop, 149: 202-11.

Estevez, P., Sibat, M., Leão-Martins, J., Tudó, À., Rambla-Alegre, M., Aligizaki, K., Diogène, J., Gago-Martinez, A. and Hess, P., 2020. Use of Mass Spectrometry to Determine the Diversity of Toxins Produced by Gambierdiscus and Fukuyoa Species from Balearic Islands and Crete (Mediterranean Sea) and the Canary Islands (Northeast Atlantic). Toxins, 12: 305.

Estrada-Pena, A. and Fernandez-Ruiz, N., 2020. A Retrospective Assessment of Temperature Trends in Northern Europe Reveals a Deep Impact on the Life Cycle of Ixodes ricinus (Acari: Ixodidae). Pathogens, 9(5).

Etzold, B. and Sakdapolrak, P., 2016. Socio-spatialities of vulnerability: Towards a polymorphic perspective in vulnerability research. Journal of the Geographical Society of Berlin, 147: 234-251.

Evangeliou, N., Balkanski, Y., Cozic, A., Hao, W.M. and Møller, A.P., 2014. Wildfires in Chernobyl-contaminated forests and risks to the population and the environment: a new nuclear disaster about to happen? Environ. Int., 73: 346-358.

Evertsen, K. and Van Der Geest, K., 2019. Gender, environment and migration in Bangladesh. Climate and Development.

Eze, J.I., Scott, E.M., Pollock, K.G., Stidson, R., Miller, C.A. and Lee, D., 2014. The association of weather and bathing water quality on the incidence of gastrointestinal illness in the west of Scotland. Epidemiol Infect, 142(6): 1289-99.

Fadina, A. and Barjolle, D., 2018. Farmers' Adaptation Strategies to Climate Change and Their Implications in the Zou Department of South Benin. Environments, 5(1).

Fagan, M., 2017. Security in the anthropocene: Environment, ecology, escape. European Journal of International Relations, 23(2): 292-314.

Fair, C.C., Kuhn, P.M., Malhotra, N. and Shapiro, J.N., 2017. Natural Disasters and Political Engagement: Evidence from the 2010-11 Pakistani Floods. Quarterly Journal of Political Science, 12(1): 99-141.

Fang, J., El-Tawil, S. and Aguirre, B., 2016. New

Agent-Based Egress Model Allowing for Social Relationships. Journal of Computing in Civil Engineering, 30(4): 04015066.

Fang, Y., Mauzerall, D., Liu, J., Fiore, A. and Horowitz, L., 2013a. Impacts of 21st century climate change on global air pollution-related premature mortality. Clim. Change, 121(2): 239-253.

Fang, Y., Naik, V., Horowitz, L.W. and Mauzerall, D.L., 2013b. Air pollution and associated human mortality: the role of air pollutant emissions, climate change and methane concentration increases from the preindustrial period to present. Atmos. Chem. Phys., 13(3): 1377-1394.

Fanzo, J., Davis, C., McLaren, R. and Choufani, J., 2018. The effect of climate change across food systems: Implications for nutrition outcomes. Global Food Security-Agriculture Policy Economics and Environment, 18: 12-19.

FAO, 2016. FAO. 2016 The State of Food and Agriculture. Climate Change, Agriculture and Food Security. Rome.

FAO, 2017. FAO. 2017. Crops Prospects and Food Situation. No. 1, March 2017. Rome.

FAO, 2018a. FAO. 2018a. GIEWS (Global Information Early Warning System). Food Price Monitoring and Analysis Tool. Rome.

FAO, 2018b. FAO. 2018b. Crop prospects and food situation. Quarterly Global Report #2, June 2018. Rome.

FAO, 2018c. Northeastern Nigeria – Adamawa, Borno and Yobe. Situation Report. June 2018. Rome.

FAO and WHO, 2018. Evaluation of Certain Veterinary Drug Residues in Food: Eighty-Fifth Report of the Joint FAO/WHO Expert Committee on Food Additives. Evaluation of Certain Veterinary Drug Residues in Food: Eighty-Fifth Report of the Joint Fao/who Expert Committee on Food Additives, 1008: 1-150.

FAO/ECA, 2018. Regional Overview of Food Security and Nutrition. Addressing the threat from climate variability and extremes for food security and nutrition. Accra. 116 pp.

FAO/FCRN, 2016. Plates, pyramids and planets Developments in national healthy and sustainable dietary guidelines: a state of play assessment. Published by the Food and Agriculture Organization of the United Nations and The Food Climate Research Network at The University of Oxford.

FAO/IFAD/UNICEF/WFP/WHO, 2018. The State of Food Security and Nutrition in the World 2018.

Building climate resilience for food security and nutrition. Rome, Italy.

Faour-Klingbeil, D. and Todd, E.C.D., 2018. The Impact of Climate Change on Raw and Untreated Wastewater Use for Agriculture, Especially in Arid Regions: A Review. Foodborne Pathog Dis, 15(2): 61-72.

Farbotko, C., 2018. Climate change and national security: an agenda for geography. Australian Geographer, 49(2): 247-253.

Farbotko, C., Dun, O., Thornton, F., McNamara, K.E. and McMichael, C., 2020. Relocation planning must address voluntary immobility. Nature Climate Change, 10(8): 702-704.

Farbotko, C. and McMichael, C., 2019. Voluntary immobility and existential security in a changing climate in the Pacific. Asia Pacific Viewpoint, 60: 148-162.

Farchi, S., De Sario, M., Lapucci, E., Davoli, M. and Michelozzi, P., 2017. Meat consumption reduction in Italian regions: Health co-benefits and decreases in GHG emissions. Plos One, 12(8).

Fawcett, D., Pearce, T., Ford, J.D. and Archer, L., 2017. Operationalizing longitudinal approaches to climate change vulnerability assessment. Global Environmental Change, 45: 79-88.

Fazey, I., Wise, R.M., Lyon, C., Campeanu, C., Moug, P. and Davies, T.E., 2016. Past and future adaptation pathways. Climate and Development, 8(1): 26-44.

Fei, L., Wang, Z.G., Yao, Y., Xu, X.M. and Gu, P.Q., 2015. [Population change of farmland rodent and the influences of climate and cultivation factors in Fengxian District of Shanghai, China]. Ying Yong Sheng Tai Xue Bao, 26(2): 579-87.

Feitelson, E. and Tubi, A., 2017. A main driver or an intermediate variable? Climate change, water and security in the Middle East. Global Environmental Change-Human and Policy Dimensions, 44: 39-48.

Felli, R., 2013a. Managing Climate Insecurity by Ensuring Continuous Capital Accumulation: "Climate Refugees' and "Climate Migrants'. New Political Economy, 18(3): 337-363.

Felli, R., 2013b. Managing Climate Insecurity by Ensuring Continuous Capital Accumulation: "Climate Refugees' and "Climate Migrants'. New Political Economy, 18(3): 337-363.

Felli, R. and Castree, N., 2012. Neoliberalising adaptation to environmental change: foresight or foreclosure? Environment and Planning A, 44(1): 1-4.

Ferkol, T. and Schraufnagel, D., 2014. The global burden of respiratory disease. Ann. Am. Thorac. Soc., 11(3): 404-406.

Fernandez, A., Black, J., Jones, M., Wilson, L., Salvador-Carulla, L., Astell-Burt, T. and Black, D., 2015. Flooding and Mental Health: A Systematic Mapping Review. Plos One, 10(4).

Ferrao, J.L., Mendes, J.M. and Painho, M., 2017. Modelling the influence of climate on malaria occurrence in Chimoio Municipality, Mozambique. Parasit Vectors, 10(1): 260.

Fielde, H., 2015. Farming or fighting? Agricultural price shocks and civil war in Afric. World Development, 67: 525-534.

Filho, W.L., Balogun, A.B., Ayal, D.Y., Bethurem, E.M., Murambadoro, M., Mambo, J., Taddese, H., Tefera, G.W., Nagy, G.J., Fudjumdjum, H. and Mugabe, P., 2018. Strengthening climate change adaptation capacity in Africa-case studies from six major African cities and policy implications. Environmental Science and Policy, 86: 29–37.

Fiore, A.M., Naik, V. and Leibensperger, E.M., 2015. Air quality and climate connections. J. Air Waste Manag. Assoc., 65(6): 645-685.

Fisher, E., Hellin, J., Greatrex, H. and Jensen, N., 2019. Index insurance and climate risk management: Addressing social equity. Development Policy Review, 37(5): 581-602.

Flahaux, M.-L. And De Haas, H., 2016. African migration: trends, patterns, drivers. Comparative Migration Studies, 4(1).

Flat ø, M., Muttarak, R. and Pelser, A., 2017. Women, weather, and woes: The triangular dynamics of female-headed households, economic vulnerability, and climate variability in South Africa. World Development, 90: 41-62.

Ford, J. and King, D., 2015. A framework for examining adaptation readiness, 20.

Ford, T.E. and Hamner, S., 2018. A Perspective on the Global Pandemic of Waterborne Disease. Microb Ecol, 76(1): 2-8.

Foreman, K.J., Marquez, N., Dolgert, A., Fukutaki, K., Fullman, N., McGaughey, M., Pletcher, M.A., Smith, A.E., Tang, K., Yuan, C.W., Brown, J.C., Friedman, J., He, J.W., Heuton, K.P., Holmberg, M., Patel, D.J., Reidy, P., Carter, A., Cercy, K., Capin, A., Douwes-Schultz, D., Frank, T., Goettsch, F., Liu, P.Y., Nandakumar, V., Reitsma, M.B., Reuter, V., Sadat, N., Sorensen, R.J.D., Srinivasan, V., Updike, R.L., York, H., Lopez, A.D., Lozano, R., Lim, S.S., Mokdad, A.H., Vollset, S.E. and Murray, C.J.L., 2018. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016-40 for 195 countries and territories. Lancet, 392(10159): 2052-2090.

Forzieri, G., Feyen, L., Russo, S., Vousdoukas, M., Alfieri, L., Outten, S., Migliavacca, M., Bianchi, A., Rojas, R. and Cid, A., 2016. Multi-hazard assessment in Europe under climate change. Climatic Change, 137.

Foudi, S., Osés-Eraso, N. and Galarraga, I., 2017. The effect of flooding on mental health: lessons learned for building resilience. Water Resource Research, 53(7): 5831-5844.

Frankenberg, E., Sikoki, B., Sumantri, C., Suriastini, W. and Thomas, D., 2013. Education, Vulnerability, and Resilience after a Natural Disaster. Ecol Soc, 18(2): 16.

Fredriksson-Ahomaa, M., 2019. Wild Boar: A Reservoir of Foodborne Zoonoses. Foodborne Pathog Dis, 16(3): 153-165.

Freeman, L., 2017. Environmental Change, Migration, and Conflict in Africa: A Critical Examination of the Interconnections. Journal of Environment & Development, 26(4): 351-374.

Frumkin, H., 2017. The US Health Care Sector's Carbon Footprint: Stomping or Treading Lightly? American Journal of Public Health, 108: e1-e2.

Frumkin, H. and Haines, A., 2019. Global Environmental Change and Noncommunicable Disease Risks. Annual Review of Public Health, 40(1): 261-282.

Fröhlich, C.J., 2016. Climate migrants as protestors? Dispelling misconceptions about global environmental change in pre-revolutionary Syria. Contemporary levant, 1(1): 38-50.

FSIN, 2018. Food Security Information Network). 2018. Global Report on Food
Crises. Rome, World Food Programme.

Fujii, H., Fukuda, S., Narumi, D., Ihara, T. and Watanabe, Y., 2015. Fatigue and sleep under large summer temperature differences. Environmental Research, 138: 17-21.

Fullman, N., et al., 2017. Measuring progress and projecting attainment on the basis of past trends of the health-related Sustainable Development Goals in 188 countries: an analysis from the Global Burden of Disease Study 2016. Lancet, 390(10100): 1423-1459.

Fussell, E., 2015. The Long-Term Recovery of New Orleans' Population after Hurricane Katrina. American Behavioral Scientist, 59(10): 1231-1245.

Fussell, E., McLeman, R. and Gemenne, F., 2018. Population displacements and migration patterns in response to Hurricane Katrina. Routledge Handbook of Environmental Displacement and Migration: 277-288.

Gabaccia, D., 2016. Feminization of Migration, the Wiley Blackwell Encyclopedia of Gender and Sexuality Studies. John Wiley & Sons.

Galasso, E., Wagstaff A., 2018. The aggregate income losses from childhood stunting and the returns to a nutrition intervention aimed at reducing stunting. Policy Research working paper; no. WPS 8536. Washington, D.C. : World Bank Group.

Gao, J., Hou, H., Zhai, Y., Woodward, A., Vardoulakis, S., Kovats, S. and Liu, Q., 2018a. Greenhouse gas emissions reduction in different economic sectors: Mitigation measures, health co-benefits, knowledge gaps, and policy implications. Environmental Pollution, 240: 683-698.

Gao, J., Kovats, S., Vardoulakis, S., Wilkinson, P., Woodward, A., Li, J., Gu, S., Liu, X., Wu, H., Wang, J., Song, X., Zhai, Y., Zhao, J. and Liu, Q., 2018b. Public health co-benefits of greenhouse gas emissions reduction: A systematic review. Sci. Total Environ. 627: 388-402.

Gao, J., Sun, Y., Lu, Y. and Li, L., 2014. Impact of ambient humidity on child health: a systematic review. PLoS One, 9(12): e112508.

Garcia, A.K., 2018. Territorial Conflicts, Agency and the Strategic Appropriation of Interventions in Kenya's Southern Drylands. Sustainability, 10(11).

Garcia, D.M. and Sheehan, M.C., 2016. Extreme Weather-driven Disasters and Children's Health. Int. J. Health Serv., 46(1): 79-105.

Garcia-Menendez, F., Saari, R.K., Monier, E. and Selin, N.E., 2015. U.S. Air Quality and Health Benefits from Avoided Climate Change under Greenhouse Gas Mitigation. Environ. Sci. Technol., 49(13): 7580-7588.

Gariepy, G., Honkaniemi, H. and Quesnel-Vallée, A., 2016. Social support and protection from depression: systematic review of current findings in Western countries. The British Journal of Psychiatry, 209.

Garnett, T., 2016. Plating up solutions. Science, 353(6305): 1202-1204.

Garnett T, M.S., Angelidis P, Borthwick F 2015. Garnett T, Mathewson S, Angelidis P, Borthwick F (2015) Policies and Actions to Shift Eating Patterns: What Works? A Review of the Evidence of the Effectiveness of Interventions Aimed at Shifting Diets in More Sustainable and Healthy Directions (Food Climate Research Network, Oxford).

Gasparrini, A., Guo, Y. and Sera, F., 2017. Projections of temperature-related excess mortality under climate change scenarios. The Lancet Planetary Health, 1(9): e360-e367.

Gasparrini, A., Guo, Y.M., Hashizume, M., Lavigne, E., Tobias, A., Zanobetti, A., Schwartz, J.D., Leone, M., Michelozzi, P., Kan, H.D., Tong, S.L., Honda, Y., Kim, H. and Armstrong, B.G., 2016. Changes in Susceptibility to Heat during the Summer: A Multicountry Analysis. American Journal of Epidemiology, 183(11): 1027-1036.

Gasparrini, A., Guo, Y.M., Hashizume, M., Lavigne, E., Zanobetti, A., Schwartz, J., Tobias, A., Tong, S.L., Rocklov, J., Forsberg, B., Leone, M., De Sario, M., Bell, M.L., Guo, Y.L.L., Wu, C.F., Kan, H., Yi, S.M., Coelho, M., Saldiva, P.H.N., Honda, Y., Kim, H. and Armstrong, B., 2015. Mortality risk attributable to high and low ambient temperature: a multicountry observational study. Lancet, 386(9991): 369-375.

Gautam, Y., 2017. Seasonal Migration and Livelihood Resilience in the Face of Climate Change in Nepal. Mountain Research and Development, 37(4): 436-445.

Gautier, D., Denis, D. and Locatelli, B., 2016. Impacts of drought and responses of rural populations in West Africa: a systematic review. WIREs Climate Change, 7(5): 666-681.

Gawande, K., Kapur, D. and Satyanath, S., 2017. Renewable natural resource shocks and conflict intensity: Findings from Indiaís ongoing Maoist insurgency. Journal of Conflict Resolution, 61: 140-172.

Gebhart, K.A., Malm, W.C., Rodriguez, M.A., Barna, M.G., Schichtel, B.A., Benedict, K.B., Collett, J.L., Jr. and Carrico, C.M., 2014. Meteorological and Back Trajectory Modeling for the Rocky Mountain Atmospheric Nitrogen and Sulfur Study II. Advances in Meteorology.

Gemenne, F., 2011. Why the numbers don't add up: A review of estimates and predictions of people displaced by environmental changes. Global Environmental Change, 21(S1): S41-S49.

Gemenne, F. and Blocher, J., 2017. How can migration serve adaptation to climate change? Challenges to fleshing out a policy ideal. The Geographical Journal.

Germond, B. and Mazaris, A.D., 2019. Climate change and maritime security. Marine Policy, 99: 262-266.

Gettelman, A., Bresch, D.N., Chen, C.C., Truesdale, J.E. and Bacmeister, J.T., 2018. Projections of future tropical cyclone damage with a high-resolution global climate model. Climatic Change, 146(3-4): 575-585.

Ghazani, M., FitzGerald, G., Hu, W., Toloo, G.S. and Xu, Z., 2018. Temperature Variability and Gastrointestinal Infections: A Review of Impacts and Future Perspectives. Int J Environ Res Public Health, 15(4).

Ghimire, R. and Ferreira, S., 2016. Floods and armed conflict. Environment and Development Economics, 21(1): 23-52.

Ghimire, R., Ferreira, S. and Dorfman, J.H., 2015. Flood-Induced Displacement and Civil Conflict. World Development, 66: 614-628.

Ghimire, S. and Dhakal, S., 2015. Japanese encephalitis: Challenges and intervention opportunities in Nepal. Vet World, 8(1): 61-5.

Giannadaki, D., Giannakis, E., Pozzer, A. and Lelieveld, J., 2018. Estimating health and economic benefits of reductions in air pollution from agriculture. Sci. Total Environ. 622-623: 1304-1316.

Gibler, D.M., 2017. Combining Behavioral and Structural Predictors of Violent Civil Conflict: Getting Scholars and Policymakers to Talk to Each Other. International Studies Quarterly, 61(1): 28-37.

Gibney, K.B., O'Toole, J., Sinclair, M. and Leder, K., 2017. Burden of Disease Attributed to Waterborne Transmission of Selected Enteric Pathogens, Australia, 2010. Am J Trop Med Hyg, 96(6): 1400-1403.

Gibon, T., Hertwich, E.G., Arvesen, A., Singh, B. and Verones, F., 2017. Health benefits, ecological threats of low-carbon electricity. Environ. Res. Lett., 12(3): 034023.

Gibson, K., Barnett, J., Haslam, N. and Kaplan, I., 2020. The mental health impacts of climate change: Findings from a Pacific Island atoll nation. Journal of Anxiety Disorders, 73.

Gifford, R.M., Todisco, T., Stacey, M., Fujisawa, T., Allerhand, M., Woods, D. and Reynolds, R.M., 2018. Risk of heat illness in men and women: A systematic review and meta-analysis. Environmental Research, 171.

Gilmore, E.A., Risi, L.H., Tennant, E. and Buhaug, H., 2018. Bridging research and policy on climate change and conflict. Current climate change reports, 4(4): 313-319.

Gioli, G., Hugo, G., Costa, M. and Scheffran, J., 2016. Human mobility, climate adaptation, and development. Migration and Development, 5: 165-170.

Giorgini, P., Di Giosia, P., Petrarca, M., Lattanzio, F., Stamerra, C.A. and Ferri, C., 2017. Climate Changes and Human Health: A Review of the Effect of Environmental Stressors on Cardiovascular Diseases across Epidemiology and Biological Mechanisms. Curr Pharm Des, 23(22): 3247-3261.

Gleditsch, N.P. and Nordas, R., 2014. Conflicting messages? The IPCC on conflict and human security. Political Geography, 43: 82-90.

Gleditsch, N.P., Wallensteen, P., Eriksson, M., Sollenberg, M. and Strand, H., 2002. Armed conflict 1946-2001: A new dataset. Journal of Peace Research, 39(5): 615-637.

Gleick, P.H., 2014. Water, Drought, Climate Change, and Conflict in Syria. Weather Climate and Society, 6(3): 331-340.

Global Burden of Disease, C., 2018. GHDx - Global Burden of Disease Results Tool.

Glover, D. and Poole, N., 2019. Principles of innovation to build nutrition-sensitive food systems in South Asia. Food Policy, 82: 63-73.

Gnonlonfin, G.J.B., Hell, K., Adjovi, Y., Fandohan, P., Koudande, D.O., Mensah, G.A., Sanni, A. and Brimer, L., 2013. A review on aflatoxin contamination and its implications in the developing world: a sub-Saharan African perspective. Crit. Rev. Food Sci. Nutr., 53(4): 349-365.

GNR, 2018. Global Nutrition Report: Shining a light to spur action on nutrition. Bristol, UK: Development Initiatives.

Gobler, C.J., Doherty, O.M., Hattenrath-Lehmann, T.K., Griffith, A.W., Kang, Y. and Litaker, R.W., 2017. Ocean warming since 1982 has expanded the niche of toxic algal blooms in the North Atlantic and North Pacific oceans. Proceedings of the National Academy of Sciences, 114(19): 4975.

Godsmark, C.N., Irlam, J., van der Merwe, F., New, M. and Rother, H.A., 2019. Priority focus areas for a sub-national response to climate change and health: A South African provincial case study. Environ Int, 122: 31-51.

Goggins, W.B. and Chan, E.Y.Y., 2017. A study of the short-term associations between hospital admissions and mortality from heart failure and meteorological variables in Hong Kong: Weather and heart failure in Hong Kong. International Journal of Cardiology, 228: 537-542.

Goodrich, C., Prakash, A. and Udas, P., 2019a. Gendered vulnerability and adaptation in Hindu-Kush Himalayas: Research insights. Environmental Development, 31: 1-8.

Goodrich, C., Udas, P. and Larrington-Spencer, H., 2019b. Conceptualizing gendered vulnerability to climate change in the Hindu Kush Himalaya: Contextual conditions and drivers of change. Environmental Development, 31: 9-18.

Gosling, S.N., Hondula, D.M., Bunker, A., Ibarreta, D., Liu, J.G., Zhang, X.X. and Sauerborn, R., 2017. Adaptation to Climate Change: A Comparative Analysis of Modeling Methods for Heat-Related Mortality. Environmental Health Perspectives, 125(8).

Gough, I., 2015a. Climate Change and Sustainable Welfare: the Centrality of Human Needs. Cambridge Journal of Economics, 39.

Gough, I., 2015b. Climate change and sustainable welfare: the centrality of human needs. Cambridge Journal of Economics, 39(5): 1191-1214.

Grainger, S. and Conway, D., 2014. Climate change and International River Boundaries: fixed points in shifting sands. Wiley Interdisciplinary Reviews-Climate Change, 5(6): 835-848.

Grantham, T.E. and Viers, J.H., 2014. 100 years of California's water rights system: patterns, trends and uncertainty. Environmental Research Letters, 9(8).

Gray, C., Hopping, D. and Mueller, V., 2020a. The changing climate-migration relationship in China, 1989-2011. Climatic Change, 160(1): 103-122.

Gray, C., Hopping, D. and Mueller, V., 2020b. The changing climate-migration relationship in China, 1989–2011. Climatic Change, 160(1): 103-122.

Gray, C. and Wise, E., 2016a. Country-specific effects of climate variability on human migration. Climatic Change, 135(3-4): 555-568.

Gray, C. and Wise, E., 2016b. Country-specific effects of climate variability on human migration. Climatic Change, 135(3-4): 555-568.

Gray, C.L. and Mueller, V., 2012. Natural disasters and population mobility in Bangladesh. Proceedings of the National Academy of Science, 109(16): 6000-6005.

Gray, J.S., Dautel, H., Estrada-Peña, A., Kahl, O. and Lindgren, E., 2009. Effects of Climate Change on Ticks and Tick-Borne Diseases in Europe. Interdisciplinary perspectives on infectious diseases, 2009: 593232.

Greaves, W., 2016. Securing sustainability: the case for critical environmental security in the Arctic. Polar Record, 52(6): 660-671.

Grech-Madin, C., Doring, S., Kim, K. and Swain, A., 2018. Negotiating water across levels: A peace and conflict "Toolbox" for water diplomacy. Journal of Hydrology, 559: 100-109.

Green, D. and Minchin, L., 2014. Living on Climate-Changed Country: Indigenous Health, Well-Being and Climate Change in Remote Australian Communities. Ecohealth, 11(2): 263-272.

Green, H., Bailey, J., Schwarz, L., Vanos, J., Ebi, K. and Benmarhnia, T., 2019. Impact of heat on mortality and morbidity in low and middle income countries: A review of the epidemiological evidence and considerations for future research. Environmental Research, 171: 80-91.

Green, R., Milner, J., Dangour, A.D., Haines, A., Chalabi, Z., Markandya, A., Spadaro, J. and Wilkinson, P.J.C.C., 2015. The potential to reduce greenhouse gas emissions in the UK through healthy and realistic dietary change. 129(1): 253-265.

Greve, P., Gudmundsson, L. and Seneviratne, S.I., 2018. Regional scaling of annual mean precipitation and water availability with global temperature change. Earth System Dynamics, 9: 227-240.

Guentchev, G.S., Rood, R.B., Ammann, C.M., Barsugli, J.J., Ebi, K., Berrocal, V., O'Neill, M.S., Gronlund, C.J., Vigh, J.L., Koziol, B. and Cinquini, L., 2016. Evaluating the Appropriateness of Downscaled Climate Information for Projecting Risks of Salmonella. Int J Environ Res Public Health, 13(3).

Guetter, C.R., Williams, B.J., Slama, E., Arrington, A., Henry, M.C., Möller, M.G., Tuttle-Newhall, J.E., Stein, S. and Crandall, M., 2018. Greening the operating room. The American Journal of Surgery, 216(4): 683-688.

Guilbeault, D., Becker, J. and Centola, D., 2018. Social learning and partisan bias in the interpretation of climate trends. Proceedings of the National Academy of Sciences of the United States of America, 115(39): 9714-9719.

Guirguis, K., Basu, R., Al-Delaimy, W.K., Benmarhnia, T., Clemesha, R.E.S., Corcos, I., Guzman-Morales, J., Hailey, B., Small, I., Tardy, A., Vashishtha, D., Zivin, J.G. and Gershunov, A., 2018. Heat, Disparities, and Health Outcomes in San Diego County's Diverse Climate Zones. GeoHealth, 2(7): 212-223.

Gunasekara, N., Kazama, S., Yamazaki, D. and Oki, T., 2014. Water Conflict Risk due to Water Resource Availability and Unequal Distribution. Water Resources Management, 28(1): 169-184.

Guo, Y., Gasparrini, A., Armstrong Ben, G., Tawatsupa, B., Tobias, A., Lavigne, E., Coelho Micheline de Sousa Zanotti, S., Pan, X., Kim, H., Hashizume, M., Honda, Y., Guo Yue, L., Wu, C.-F., Zanobetti, A., Schwartz Joel, D., Bell Michelle, L., Overcenco, A., Punnasiri, K., Li, S., Tian, L., Saldiva, P., Williams, G. and Tong, S., 2016. Temperature Variability and Mortality: A Multi-Country Study. Environmental Health Perspectives, 124(10): 1554-1559.

Guo, Y., Gasparrini, A., Li, S., Sera, F., Vicedo-Cabrera, A.M., de Sousa Zanotti Stagliorio Coelho, M., Saldiva, P.H.N., Lavigne, E., Tawatsupa, B., Punnasiri, K., Overcenco, A., Correa, P.M., Ortega, N.V., Kan, H., Osorio, S., Jaakkola, J.J.K., Ryti, N.R.I., Goodman, P.G., Zeka, A., Michelozzi, P., Scortichini, M., Hashizume, M., Honda, Y., Seposo, X., Kim, H., Tobias, A., Íñiguez, C., Forsberg, B., Åström, D.O., Guo, Y.L., Chen, B.-Y., Zanobetti, A., Schwartz, J., Dang, T.N., Van, D.D., Bell, M.L., Armstrong, B., Ebi, K.L. and Tong, S., 2018. Quantifying excess deaths related to heatwaves under climate change scenarios: A multicountry time series modelling study. PLOS Medicine, 15(7): e1002629.

Guo, Y.M., Gasparrini, A., Armstrong, B.G., Tawatsupa, B., Tobias, A., Lavigne, E., Coelho, M., Pan, X.C., Kim, H., Hashizume, M., Honda, Y., Guo, Y.L.L., Wu, C.F., Zanobetti, A., Schwartz, J.D., Bell, M.L., Scortichini, M., Michelozzi, P., Punnasiri, K., Li, S.S., Tian, L.W., Garcia, S.D.O., Seposo, X., Overcenco, A., Zeka, A., Goodman, P., Dang, T.N., Dung, D.V., Mayvaneh, F., Saldiva, P.H.N., Williams, G. and Tong, S.L., 2017. Heat Wave and Mortality: A Multicountry, Multicommunity Study. Environmental Health Perspectives, 125(8).

Guzman Herrador, B.R., de Blasio, B.F., MacDonald, E., Nichols, G., Sudre, B., Vold, L., Semenza, J.C. and Nygård, K., 2015. Analytical studies assessing the association between extreme precipitation or temperature and drinking water-related waterborne infections: a review. Environ Health, 14: 29.

Hailes, O., Jones, R., Menkes, D., Freeman, J. and Monasterio, E., 2018. Climate change, human health and the CPTPP. N Z Med J, 131(1471): 7-12.

Haines, A. and Ebi, K., 2019. The Imperative for Climate Action to Protect Health. New England Journal of Medicine, 380(3): 263-273.

Hajat, S., 2017. Health effects of milder winters: A review of evidence from the United Kingdom. Environmental Health, 16: 109.

Hajat, S., Haines, A., Sarran, C., Sharma, A., Bates, C. and Fleming, L.E., 2017. The effect of ambient temperature on type-2-diabetes: case-crossover analysis of 4+ million GP consultations across England. Environ Health, 16(1): 73.

Hald, T., Aspinall, W., Devleesschauwer, B., Cooke, R., Corrigan, T., Havelaar, A.H., Gibb, H.J., Torgerson, P.R., Kirk, M.D., Angulo, F.J., Lake, R.J., Speybroeck, N. and Hoffmann, S., 2016. World Health Organization Estimates of the Relative Contributions of Food to the Burden of Disease Due to Selected Foodborne Hazards: A Structured Expert Elicitation. PLoS One, 11(1): e0145839.

Hales, S., Kovats, S., Lloyd, S. and Campbell-Lendrum, D., 2014. Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization: 1-128.

Hallegatte, S.B.M.B.L., Fay M., Kane T., Narloch, U. Rozenberg, J. Treguer, D. Vogt-Schilb, A., 2016. Shock Waves: Managing the Impacts of Climate Change on Poverty. Shock Waves: Managing the Impacts of Climate Change on Poverty.

Hamaoui-Laguel, L., Vautard, R., Liu, L., Solmon, F., Viovy, N., Khvorostyanov, D., Essl, F., Chuine, I., Colette, A., Semenov, M.A., Schaffhauser, A., Storkey, J., Thibaudon, M. and Epstein, M.M., 2015. Effects of climate change and seed dispersal on airborne ragweed pollen loads in Europe. Nat. Clim. Chang. 5: 766.

Hamilton, L.C., Saito, K. and Loring, P.A., 2016. Climigration? Population and climate change in Arctic Alaska, Population and Environment, pp. 115-133.

Hanigan, I., Butler, C., Kokic, P. and Hutchinson, M., 2012. Suicide and drought in New South Wales, Australia, 1970-2007. Proceedings of the National Academy of Sciences of the United States of America, 109(35): 13950-13955.

Hannaford, M.J., 2018. Long-term drivers of vulnerability and resilience to drought in the Zambezi-Save area of southern Africa, 1505-1830. Global and Planetary Change, 166: 94-106.

Hansel, N.N., McCormack, M.C. and Kim, V., 2016. The Effects of Air Pollution and Temperature on COPD. COPD, 13(3): 372-379.

Hansen, A., Cameron, S., Liu, Q., Sun, Y., Weinstein, P., Williams, C., Han, G.S. and Bi, P., 2015. Transmission of haemorrhagic fever with renal syndrome in china and the role of climate factors: a review. Int J Infect Dis, 33: 212-8.

Hansen, A.-M., 2016. Women's ecological oral histories of recycling and development in coastal Yucatán. Gender, Place and Culture, 23: 467-483.

Haq, G. and Gutman, G., 2014. Climate gerontology Meeting the challenge of population ageing and climate change. Zeitschrift Fur Gerontologie Und Geriatrie, 47(6): 462-+.

Haque, M.R., Parr, N. and Muhidin, S., 2019. Parents' healthcare-seeking behavior for their children among the climate-related displaced population of rural Bangladesh. Soc. Sci. Med., 226: 9-20.

Harari, M. and Ferrara, E., 2018. Conflict, climate and cells: A disaggregated analysis. Review of Economics and Statistics.

Harlan, S.L., Brazel, A.J., Lela, P., Stefanov, W.L. and Larissa, L., 2006. Neighborhood microclimates and vulnerability to heat stress. Social Science & Medicine, 63(11): 2847-2863.

Harrington, L. and Otto, F., 2018. Changing population dynamics and uneven temperature emergence combine to exacerbate regional exposure to heat extremes under 1.5°C and 2°C of warming. Environmental Research Letters, 13.

Harrington, L.J., Frame, D.J., Hawkins, E. and Joshi, M., 2017. Seasonal cycles enhance disparities between low- and high-income countries in exposure to monthly temperature emergence with future warming. Environmental Research Letters, 12(11).

Harrison, A.G., Lin, T. and Wang, P., 2020. Mechanisms of SARS-CoV-2 Transmission and Pathogenesis. Trends Immunol.

Harrowell, E. and Ozerdem, A., 2018. The politics of the post-conflict and post-disaster nexus in Nepal. Conflict Security & Development, 18(3): 181-205.

Hartmann, B., 2014. Converging on Disaster: Climate Security and the Malthusian Anticipatory Regime for Africa. Geopolitics, 19(4): 757-783.

Hasegawa, T., Fujimori, S., Shin, Y., Takahashi, K., Masui, T. and Tanaka, A., 2014. Climate Change Impact and Adaptation Assessment on Food Consumption Utilizing a New Scenario Framework. Environmental Science & Technology, 48(1): 438-445.

Hasegawa, T., Fujimori, S., Shin, Y., Tanaka, A., Takahashi, K. and Masui, T., 2015. Consequence of Climate Mitigation on the Risk of Hunger. Environmental Science & Technology, 49(12): 7245-7253.

Hashim, J.H. and Hashim, Z., 2016. Climate Change, Extreme Weather Events, and Human Health Implications in the Asia Pacific Region. Asia. Pac. J. Public Health, 28(2 Suppl): 8S-14S.

Hashimoto, T., Karasawa, K., Hirayama, K., Wada, M. and Hosaka, H., 2018. Community Proactivity in Disaster Preparation: Research Based on Two Communities in Japan. Journal of Disaster Research, 13(4): 755-766.

Haslam, S.A., McMahon, C., Cruwys, T., Haslam, C., Jetten, J. and Steffens, N.K., 2018. Social cure, what social cure? The propensity to underestimate the importance of social factors for health. Social Science & Medicine, 198: 14-21.

Hathaway, J. and Maibach, E.W., 2018. Health Implications of Climate Change: a Review of the Literature About the Perception of the Public and Health Professionals. Curr Environ Health Rep, 5(1): 197-204.

Hatvani-Kovacs, G., Bush, J., Sharifi, E. and Boland, J., 2018a. Policy recommendations to increase urban heat stress resilience. Urban Climate, 25: 51-63.

Hatvani-Kovacs, G., Bush, J., Sharifi, E. and Boland, J., 2018b. Policy recommendations to increase urban heat stress resilience. Urban Climate, 25: 51-63.

Hauer, M., 2017a. Migration induced by sea-level rise could reshape the US population landscape. Nature Climate Change, 7: 321-325.

Hauer, M., Evans, J. and Alexander, C., 2015. Sea-level rise and sub-county population projections in coastal Georgia. Population and Environment, 37(1): 44-62.

Hauer, M.E., 2017b. Migration induced by sea-level rise could reshape the US population landscape. Nature Climate Change, 7(5): 321-+.

Hauer, M.E., Evans, J.M. and Mishra, D.R., 2016. Millions projected to be at risk from sea-level rise in the continental United States. Nature Climate Change, 6: 691-695.

Hauer, M.E., Hardy, R.D., Mishra, D.R. and Pippin, J.S., 2019. No landward movement: examining 80 years of population migration and shoreline change in Louisiana. Population and Environment.

Haussig, J.M., Young, J.J., Gossner, C.M., Mezei, E., Bella, A., Sirbu, A., Pervanidou, D., Drakulovic, M.B. and Sudre, B., 2018. Early start of the West Nile fever transmission season 2018 in Europe. Eurosurveillance, 23(32): 7-12.

Hayashida, K., Shimizu, K. and Yokota, H., 2019. Severe heatwave in Japan. Acute Medicine & Surgery, 6(2): 206-207.

Hayes, K., Berry, P. and Ebi, K., 2019. Factors Influencing the Mental Health Consequences of Climate Change in Canada. International Journal of Environmental Research and Public Health, 16: 1583.

Heaney, A. and Winter, S., 2016. Climate-driven migration: An exploratory case study of Maasai health perceptions and help-seeking behaviors. International Journal of Public Health, 61(6): 641-649.

Heaviside, C., Vardoulakis, S. and Cai, X.M., 2016. Attribution of mortality to the urban heat island during heatwaves in the West Midlands, UK. Environmental Health, 15.

Hedenus, F., Wirsenius, S. and Johansson, D.J.A.J.C.C., 2014. The importance of reduced meat and dairy consumption for meeting stringent climate change targets. 124(1): 79-91.

Hedlund, C., Blomstedt, Y. and Schumann, B., 2014. Association of climatic factors with infectious diseases in the Arctic and subarctic region--a systematic review. Glob Health Action, 7: 24161.

Hein, J.E. and Chaudhri, V., 2019. Delegitimizing the enemy: framing, tactical innovation, and blunders in the battle for the Arctic. Social Movement Studies, 18(2): 171-192.

Helgeson, J.F., Dietz, S. and Hochrainer-Stigler, S., 2013. Vulnerability to Weather Disasters: the Choice of Coping Strategies in Rural Uganda. Ecology and Society, 18(2).

Hellberg, R. and Chu, E., 2015. Effects of climate change on the persistence and dispersal of foodborne bacterial pathogens in the outdoor environment: A review. Critical Reviews in Microbiology, 42.

Hellin, J., Ratner, B.D., Meinzen-Dick, R. and Lopez-Ridaura, S., 2018. Increasing social-ecological resilience within small-scale agriculture in conflict-affected Guatemala. Ecology and Society, 23(3).

Helm, S., Pollitt, A., Barnett, M., Curran, M. and Craig, Z., 2018. Differentiating environmental concern in the context of psychological adaption to climate change. Global Environmental Change-Human and Policy Dimensions, 48: 158-167.

Henderson, J.V., Storeygard, A. and Deichmann, U., 2014. 50 years of urbanization in Africa: Examining the role of climate change, World Bank Group.

Hendrix, C. and Haggard, S., 2015. Global food prices, regime type, and urban unrest in the developing world. Journal of Peace Research, 52(2): 143-157.

Hendrix, C.S., 2017. The streetlight effect in climate change research on Africa. Global Environmental Change, 43: 137-147.

Heo, S., Bell, M.L. and Lee, J.T., 2019. Comparison of health risks by heat wave definition: Applicability of wet-bulb globe temperature for heat wave criteria. Environmental Research, 168: 158-170.

Hermans, K. and Garbe, L., 2019. Droughts, livelihoods, and human migration in northern Ethiopia. Regional Environmental Change.

Hernández-Delgado, E.A., 2015. The emerging threats of climate change on tropical coastal ecosystem services, public health, local economies and livelihood sustainability of small islands: Cumulative impacts and synergies. Mar Pollut Bull, 101(1): 5-28.

Herrador, B.G., de Blasio, B.F., Carlander, A., Ethelberg, S., Hygen, H.O., Kuusi, M., Lund, V., Lofdahl, M., MacDonald, E., Martinez-Urtaza, J., Nichols, G., Schonning, C., Sudre, B., Tronnberg, L., Vold, L., Semenza, J.C. and Nygard, K., 2016. Association between heavy precipitation events and waterborne outbreaks in four Nordic countries, 1992-2012. Journal of Water and Health, 14(6): 1019-1027.

Heslin, A., 2019. Climate Migration and Cultural Preservation: The Case of the Marshallese Diaspora. In Loss and Damage from Climate Change: Concepts, Methods and Policy Options. Loss and Damage from Climate Change: Concepts, Methods and Policy Options. Springer, Cham.

Hess, J., Boodram, L., Paz, S., Ibarra, A., Wasserheit, J. and Lowe, R., 2020. Strengthening the global response to climate change and infectious disease threats. Bmj-British Medical Journal, 371.

Hess, J., Marinucci, G., Schramm, P., Manangan, A., Luber, G., Pinkerton, K. and Rom, W., 2014. Management of Climate Change Adaptation at the United States Centers for Disease Control and Prevention. Global Climate Change and Public Health, 7: 341-360.

Hidalgo, D., Witten, I., Nunn, P., Burkhart, S., Bogard, J., Beazley, H. and Herrero, M., 2020. Sustaining healthy diets in times of change: linking climate hazards, food systems and nutrition security in rural communities of the Fiji Islands. Regional Environmental Change, 20(3).

Hillmann, F. and Ziegelmayer, U., 2016. Environmental change and migration in coastal regions: examples from Ghana and Indonesia. Erde, 147(2): 119-138.

Hine, W., Phillips, J., Cooksey, R., Reser, P., Nunn, P., Marks, D. and Watt, E., 2016. Preaching to different choirs: How to motivate dismissive, uncommitted, and alarmed audiences to adapt to climate change? Global Environmental Change, 36: 1-11.

Hino, M., Field, C.B. and Mach, K.J., 2017. Managed retreat as a response to natural hazard risk. Nature Climate Change, 7: 364-370.

Hintz, M.J., Luederitz, C., Lang, D.J. and von Wehrden, H., 2018. Facing the heat: A systematic literature review exploring the transferability of solutions to cope with urban heat waves. Urban Climate, 24: 714-727.

Hock, S., Bryce, P., Fischer, L., First, B., Fitzmaurice, M., Costa, T. and Galler, R., 2018. Childhood malnutrition and maltreatment are linked with personality disorder symptoms in adulthood: Results from a Barbados lifespan cohort. Psychiatry Research (269): 301-308.

Hodges, M., Belle, J.H., Carlton, E.J., Liang, S., Li, H., Luo, W., Freeman, M.C., Liu, Y., Gao, Y., Hess, J.J. and Remais, J.V., 2014. Delays reducing waterborne and water-related infectious diseases in China under climate change. Nat Clim Chang, 4: 1109-1115.

Hoegh-Guldberg, O., Jacob, D., Taylor, M., Guillen Bolanos, T., Bindi, M., Brown, S. and Englebrecht, F., 2019. The human imperative of stabilizing global climate change at 1.5° C. Science, 365(6459).

Hofacre, C.L., Smith, J.A. and Mathis, G.F., 2018. An optimist's view on limiting necrotic enteritis and maintaining broiler gut health and performance in today's marketing, food safety, and regulatory climate. Poult Sci, 97(6): 1929-1933.

Hoffmann, C., 2018. Environmental determinism as Orientalism: The geo-political ecology of crisis in the Middle East. Journal of Historical Sociology, 31(1): 94-104.

Hoffmann, R., Dimitrova, A., Muttarak, R., Crespo Cuaresma, J. and Peisker, J., 2020. A meta-analysis of country-level studies on environmental change and migration. Nature Climate Change, 10(10): 904-912.

Hofstra, N. and Vermeulen, L.C., 2016. Impacts of population growth, urbanisation and sanitation changes on global human Cryptosporidium emissions to surface water. Int J Hyg Environ Health, 219(7 Pt A): 599-605.

Hojman, D.A. and Miranda, A., 2018. Agency, Human Dignity, and Subjective Well-being. World Development, 101: 1-15.

Holmes, I., Potvin, C. and Coomes, O.T., 2017. Early REDD plus Implementation: The Journey of an Indigenous Community in Eastern Panama. Forests, 8(3).

Hondula, D.M., Balling, R.C., Vanos, J.K. and Georgescu, M., 2015. Rising Temperatures, Human Health, and the Role of Adaptation. Current Climate Change Reports, 1(3): 144-154.

Hondula, D.M., Georgescu, M. and Balling, R.C., 2014. Challenges associated with projecting urbanization-induced heat-related mortality. Science of the Total Environment, 490: 538-544.

Hone, T., Gurol-Urganci, I., Millett, C., Başara, B., Akdağ, R. and Atun, R., 2017. Effect of primary health care reforms in Turkey on health service utilization and user satisfaction. Health Policy Plan, 32(1): 57-67.

Hope, M., 2019. Cyclones in Mozambique may reveal humanitarian challenges of responding to a new climate reality. The Lancet Planetary Health, 3(8): e338-e339.

Hopp, S., Dominici, F. and Bobb, J., 2018a. Medical diagnoses of heat wave-related hospital admissions in older adults. Preventive Medicine, 110.

Hopp, S., Dominici, F. and Bobb, J.F., 2018b. Medical diagnoses of heat wave-related hospital admissions in older adults. Preventive Medicine, 110: 81-85.

Horn, L.M., Hajat, A., Sheppard, L., Quinn, C., Colborn, J., Zermoglio, M.F., Gudo, E.S., Marrufo, T. and Ebi, K.L., 2018. Association between Precipitation and Diarrheal Disease in Mozambique. Int J Environ Res Public Health, 15(4).

Hornsey, M., Harris, E., Bain, P. and Fielding, K., 2016a. Meta-analyses of the determinants and outcomes of belief in climate change. Nature Climate Change, 6(6): 622-+.

Hornsey, M.J., Harris, E.A., Bain, P.G. and Fielding, K.S., 2016b. Meta-analyses of the determinants and outcomes of belief in climate change. Nature Climate Change, 6(6): 622-+.

Hossain, K., 2016. Securitizing the Arctic indigenous peoples: A community security perspective with special reference to the Sámi of the European high north. Polar Science, 10(3): 415-424.

Hotez, P.J., 2018. Human Parasitology and Parasitic Diseases: Heading Towards 2050. Adv Parasitol, 100: 29-38.

Howard, G., Calow, R., Macdonald, A. and Bartram, J., 2016. Climate Change and Water and Sanitation: Likely Impacts and Emerging Trends for Action. Annu. Rev. Environ. Resour. 2016.41: 253-276.

Howe, P., 2019. The triple nexus: A potential approach to supporting the achievement of the Sustainable Development Goals? World Development, 124.

Hsiang, S., Kopp, R., Jina, A., Rising, J., Delgado, M., Mohan, S., Rasmussen, D.J., Muir-Wood, R., Wilson, P., Oppenheimer, M., Larsen, K. and Houser, T., 2017. Estimating economic damage from climate change in the United States. Science, 356(6345): 1362-1369.

Hsiang, S.M. and Burke, M., 2013. Climate, conflict, and social stability: what does the evidence say? Climatic Change, 123(1): 39-55.

Hsiang, S.M. and Meng, K.C., 2014. Reconciling disagreement over climate-conflict results in Africa. Proceedings of the National Academy of Sciences of the United States of America, 111(6): 2100-2103.

Hsiao, H.I., Jan, M.S. and Chi, H.J., 2016. Impacts of Climatic Variability on Vibrio parahaemolyticus Outbreaks in Taiwan. Int J Environ Res Public Health, 13(2): 188.

Hu, X.F., Chen, P., Huang, H., Sun, T. and Li, D., 2017. Contrasting impacts of heat stress on violent and nonviolent robbery in Beijing, China. Natural Hazards, 87(2): 961-972.

Huang, C., Cheng, J., Phung, D., Tawatsupa, B., Hu, W. and Xu, Z., 2018. Mortality burden attributable to heatwaves in Thailand: A systematic assessment incorporating evidence-based lag structure. Environment International, 121: 41-50.

Huber, V., Ibarreta, D. and Frieler, K., 2017. Cold- and heat-related mortality: a cautionary note on current damage functions with net benefits from climate change. Climatic Change, 142(3-4): 407-418.

Huber, V., Krummenauer, L., Peña-Ortiz, C., Lange, S., Gasparrini, A., Vicedo-Cabrera, A., García-Herrera, R. and Frieler, K., 2020. Temperature-related excess mortality in German cities at 2 °C and higher degrees of global warming. Environmental Research, 186: 109447.

Hummel, S., 2017. Relative Water Scarcity and Country Relations along Cross-Boundary Rivers: Evidence from the Aral Sea Basin. International Studies Quarterly, 61(4): 795-808.

Hundessa, S., Williams, G., Li, S., Liu, L., Cao, W., Ren, H., Guo, J., Gasparrini, A., Ebi, K., Zhang, W. and Guo, Y., 2018. Projecting potential spatial and temporal changes in the distribution of Plasmodium vivax and Plasmodium falciparum malaria in China with climate change. Sci Total Environ, 627: 1285-1293.

Hunsberger, C., Work, C. and Herre, R., 2018. Linking climate change strategies and land conflicts in Cambodia: Evidence from the Greater Aural region. World Development, 108: 309-320.

Hunter, L., Luna, J. and RM, N., 2015. Environmental Dimensions of Migration. Annual Review of Sociology, 41(1): 377-397.

Hunter, L.M., Murray, S. and Riosmena, F., 2013. Rainfall Variation and U.S. Migration from Rural Mexico. International Migration Review, 47(3): 874-909.

Hunter, L.M. and Simon, D.H., 2017. Might climate change the “healthy migrant” effect? Global Environmental Change, 47: 133-142.

Hurtado, L.A., Calzada, J.E., Rigg, C.A., Castillo, M. and Chaves, L.F., 2018. Climatic fluctuations and malaria transmission dynamics, prior to elimination, in Guna Yala, Republica de Panama. Malar J, 17(1): 85.

Hussain, M. and Mumtaz, S., 2014. Climate change and managing water crisis: Pakistan's perspective. Rev Environ Health, 29(1-2): 71-7.

Hussain-Alkhateeb, L., Kroeger, A., Olliaro, P., Rocklov, J., Sewe, M., Tejeda, G., Benitez, D., Gill, B., Hakim, S., Carvalho, R., Bowman, L. and Petzold, M., 2018. Early warning and response system (EWARS) for dengue outbreaks: Recent advancements towards widespread applications in critical settings. Plos One, 13(5).

Høeg, E. and Tulloch, C., 2018. Sinking Strangers: Media Representations of Climate Refugees on the BBC and Al Jazeera. Journal of Communication Inquiry, 43: 019685991880948.

Høeg, E.T., Christopher D, 2018a. Sinking Strangers: Media Representations of Climate Refugees on the BBC and Al Jazeera. Journal of Communication Inquiry, 43(3): 225-248.

Høeg, E.T., Christopher D, 2018b. Sinking Strangers: Media Representations of Climate Refugees on the BBC and Al Jazeera. Journal of Communication Inquiry, 43(3): 225-248.

Ide, T., 2016. Toward a constructivist understanding of socio-environmental conflicts. Civil Wars, 18(1): 69-90.

Ide, T., 2017. Research methods for exploring the links between climate change and conflic. Climate Change, 8: 1-14.

Ide, T., 2018. Does environmental peacemaking between states work? Insights on cooperative environmental agreements and reconciliation in international rivalries. Journal of Peace Research, 55(3): 351-365.

Ide, T., Brzoska, M., Donges, J. and Schleussner, C., 2020a. Multi-method evidence for when and how climate-related disasters contribute to armed conflict risk. Global Environmental Change-Human and Policy Dimensions, 62.

Ide, T., Brzoska, M., Donges, J.F. and Schleussner, C.-F., 2020b. Multi-method evidence for when and how climate-related disasters contribute to armed conflict risk. Global Environmental Change, 62: 102063.

Ide, T. and Detges, A., 2018. International Water Cooperation and Environmental Peacemaking. Global Environmental Politics, 18(4): 63-84.

Ide, T. and Frohlich, C., 2015. Socio-environmental cooperation and conflict? A discursive understanding and its application to the case of Israel and Palestine. Earth System Dynamics, 6(2): 659-671.

Ide, T., Schilling, J., Link, J.S.A., Scheffran, J., Ngaruiya, G. and Weinzierl, T., 2014. On exposure, vulnerability and violence: Spatial distribution of risk factors for climate change and violent conflict across Kenya and Uganda. Political Geography, 43: 68-81.

Ide, T. and Tubi, A., 2020. Education and environmental peacebuilding: insights from three projects in Israel and Palestine. Annals of the American Association of Geographers, 110(1): 1-17.

IEA, 2016. Energy and Air Pollution: A Special Edition of World Energy Outlook Report, Vienna, Austria.

IFPRI, 2016. 2016 Global Nutrition Report. From Promise to Impact: Ending Malnutrition by 2030. International Food Policy Research Institute (IFPRI), Washington.

Ikaheimo, T.M., 2018. Cardiovascular diseases, cold exposure and exercise. Temperature (Austin), 5(2): 123-146.

Ikeda, T., Behera, S.K., Morioka, Y., Minakawa, N., Hashizume, M., Tsuzuki, A., Maharaj, R. and Kruger, P., 2017. Seasonally lagged effects of climatic factors on malaria incidence in South Africa. Sci Rep, 7(1): 2458.

IPCC, 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. In: R.K.P.a.L.A. Meyer (Editor). IPCC, Geneva, Switzerland.

IPCC, 2017. Background report for the scoping meeting: Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (SR2). In: M.H. Pete Smith (Chair), Thelma Krug, Valérie, C.M. Masson-Delmotte, Hans-Otto Pörtner, Andy Reisinger, Josep Canadell and P. O'Brien (Editors).

IPCC, 2018. Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

Iqbal, M.W., Donjadee, S., Kwanyuen, B. and Liu, S.Y., 2018. Farmers' perceptions of and adaptations to drought in Herat Province, Afghanistan. Journal of Mountain Science, 15(8): 1741-1756.

Islam, M.R. and Hasan, M., 2016. Climate-induced human displacement: a case study of Cyclone Aila in the south-west coastal region of Bangladesh. Natural Hazards, 81(2): 1051-1071.

Islam, M.R. and Shamsuddoha, M., 2017. Socioeconomic consequences of climate induced human displacement and migration in Bangladesh. International Sociology, 32(3).

Ito, Y., Akahane, M. and Imamura, T., 2018. Impact of Temperature in summer on Emergency Transportation for Heat-Related Diseases in Japan. Chinese medical journal, 131: 574-582.

Jaafar, H.H. and Woertz, E., 2016. Agriculture as a funding source of ISIS: A GIS and remote sensing analysis. Food Policy, 64: 14-25.

Jaakkola, J.J.K., Juntunen, S. and Nakkalajarvi, K., 2018. The Holistic Effects of Climate Change on the Culture, Well-Being, and Health of the Saami, the Only Indigenous People in the European Union. Curr Environ Health Rep, 5(4): 401-417.

Jacobi, J., Mukhovi, S., Llanque, A., Augstburger, H., Kaser, F., Pozo, C., Peter, M., Delgado, J., Kiteme, B., Rist, S. and Speranza, C., 2018. Operationalizing food system resilience: An indicator-based assessment in agroindustrial, smallholder farming, and agroecological contexts in Bolivia and Kenya. Land Use Policy, 79: 433-446.

Jacobson, T., Kler, J., Hernke, M., Braun, R., Meyer, K. and Funk, W., 2019. Direct human health risks of increased atmospheric carbon dioxide.

Jambroes, M., Nederland, T., Kaljouw, M., van Vliet, K., Essink-Bot, M.L. and Ruwaard, D., 2016. Implications of health as 'the ability to adapt and self-manage' for public health policy: a qualitative study. Eur J Public Health, 26(3): 412-6.

James, L., Welton-Mitchell, C., Noel, J. and James, A., 2020a. Integrating mental health and disaster preparedness in intervention: a randomized controlled trial with earthquake and flood-affected communities in Haiti. Psychological Medicine, 50(2): 342-352.

James, L.E., Welton-Mitchell, C., Noel, J.R. and James, A.S., 2020b. Integrating mental health and disaster preparedness in intervention: a randomized controlled trial with earthquake and flood-affected communities in Haiti. Psychological Medicine, 50(2): 342-352.

Jamir, O., 2016. Understanding India-Pakistan water politics since the signing of the Indus Water Treaty. Water Policy, 18(5): 1070-1087.

Jankowska, M.M., Lopez-Carr, D., Funk, C., Husak, G.J. and Chafe, Z.A., 2012. Climate change and human health: Spatial modeling of water availability, malnutrition, and livelihoods in Mali, Africa. Appl. Geogr., 33(1): 4-15.

Jayaram, D., 2020. ‘Climatizing’military strategy? A case study of the Indian armed forces. International Politics: 1-21.

Jehn, M., Donaldson, G., Kiran, B., Liebers, U., Mueller, K., Scherer, D., Endlicher, W. and Witt, C., 2013. Tele-monitoring reduces exacerbation of COPD in the context of climate change--a randomized controlled trial. Environ. Health, 12: 99.

Jensen, N. and Barrett, C., 2017. Agricultural Index Insurance for Development. Applied Economic Perspectives and Policy, 39(2): 199-219.

Jerneck, A., 2017. Taking gender seriously in climate change adaptation and sustainability science research: Views from feminist debates and sub-Saharan small-scale agriculture. Sustainability.

Jessoe, K., Manning, D.T. and Taylor, J.E., 2018. Climate Change and Labour Allocation in Rural Mexico: Evidence from Annual Fluctuations in Weather. Economic Journal, 128(608): 230-261.

Jiang, C., Shaw, K.S., Upperman, C.R., Blythe, D., Mitchell, C., Murtugudde, R., Sapkota, A.R. and Sapkota, A., 2015. Climate change, extreme events and increased risk of salmonellosis in Maryland, USA: Evidence for coastal vulnerability. Environ Int, 83: 58-62.

Johnston, F.H., Kavanagh, A.M., Bowman, D.M. and Scott, R.K., 2002. Exposure to bushfire smoke and asthma: an ecological study. Med. J. Aust., 176(535-8).

Jones, B.T., Mattiacci, E. and Braumoeller, B.F., 2017. Food scarcity and state vulnerability: Unpacking the link between climate variability and violent unrest. Journal of Peace Research, 54(3): 335-350.

Jones, F.K., Ko, A.I., Becha, C., Joshua, C., Musto, J., Thomas, S., Ronsse, A., Kirkwood, C.D., Sio, A., Aumua, A. and Nilles, E.J., 2016. Increased Rotavirus Prevalence in Diarrheal Outbreak Precipitated by Localized Flooding, Solomon Islands, 2014. Emerg Infect Dis, 22(5): 875-9.

Jones, L., 2019. Resilience isn't the same for all: Comparing subjective and objective approaches to resilience measurement. Wiley Interdisciplinary Reviews-Climate Change, 10(1).

Jore, S., Vanwambeke, S.O., Viljugrein, H., Isaksen, K., Kristoffersen, A.B., Woldehiwet, Z., Johansen, B., Brun, E., Brun-Hansen, H., Westermann, S., Larsen, I.L., Ytrehus, B. and Hofshagen, M., 2014. Climate and environmental change drives Ixodes ricinus geographical expansion at the northern range margin. Parasit Vectors, 7: 11.

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., Aggarwal, P., Bhatta, G., Chaudhury, M., Tapio-Bistrom, M., Nelson, S. and Kristjanson, P., 2016. Understanding gender dimensions of agriculture and climate change in smallholder farming communities. Climate and Development, 8(2): 133-144.

Jugert, P., Greenaway, K.H., Barth, M., Buchner, R., Eisentraut, S. and Fritsche, I., 2016. Collective efficacy increases pro-environmental intentions through increasing self-efficacy. Journal of Environmental Psychology, 48: 12-23.

Jun, T., 2017. Temperature, maize yield, and civil conflicts in sub-Saharan Africa. Climatic Change, 142(1-2): 183-197.

Jutla, A., Aldaach, H., Billian, H., Akanda, A., Huq, A. and Colwell, R., 2015. Satellite Based Assessment of Hydroclimatic Conditions Related to Cholera in Zimbabwe. PLoS One, 10(9): e0137828.

Jutla, A., Khan, R. and Colwell, R., 2017. Natural Disasters and Cholera Outbreaks: Current Understanding and Future Outlook. Curr Environ Health Rep, 4(1): 99-107.

Jägerskog, A. and Swain, A., 2016. Water, migration and how they are interlinked. SIWI, Stockholm.

Jänicke, B., Holtmann, A., Kim, K., Kang, M., Fehrenbach, U. and Scherer, D., 2018. Quantification and evaluation of intra-urban heat-stress variability in Seoul, Korea. International Journal of Biometeorology.

Kabir, M.I., Rahman, M.B., Smith, W., Lusha, M.A. and Milton, A.H., 2016. Climate change and health in Bangladesh: a baseline cross-sectional survey. Glob Health Action, 9: 29609.

Kaczan, D.J. and Orgill-Meyer, J., 2020. The impact of climate change on migration: a synthesis of recent empirical insights. Climatic Change, 158(3): 281-300.

Kaldor, M., 2013. In defence of new wars. Stability: International Journal of Security and Development, 2(1).

Kallis, G. and Zografos, C., 2014a. Hydro-climatic change, conflict and security. Climatic Change, 123(1): 69-82.

Kallis, G. and Zografos, C., 2014b. Hydro-climatic change, conflict and security. Climatic change, 123(1): 69-82.

Kampe, E.O.I., Kovats, S. and Hajat, S., 2016. Impact of high ambient temperature on unintentional injuries in high-income countries: a narrative systematic literature review. Bmj Open, 6(2).

Kampfer, S. and Mutz, M., 2013. On the Sunny Side of Life: Sunshine Effects on Life Satisfaction. Social Indicators Research, 110(2): 579-595.

Kane, S., Dhiaulhaq, A., Sapkota, L.M. and Gritten, D., 2018. Transforming forest landscape conflicts: the promises and perils of global forest management initiatives such as REDD+. Fs-Forest and Society, 2(1): 1-17.

Karlsson, M., van Oort, B. and Romstad, B., 2015. What we have lost and cannot become: societal outcomes of coastal erosion in southern Belize. Ecology and Society, 20(1): 14.

Kasselman, L.J., Veves, A., Gibbons, C.H. and Rutkove, S.B., 2009. Cold exposure exacerbates the development of diabetic polyneuropathy in the rat. Exp. Diabetes Res.

Keels, E., 2019. Praying for Rain? Water Scarcity and the Duration and Outcomes of Civil Wars. Defence and Peace Economics, 30(1): 27-45.

Kelley, C.P., Mohtadi, S., Cane, M.A., Seager, R. and Kushnir, Y., 2015. Climate change in the Fertile Crescent and implications of the recent Syrian drought. Proceedings of the National Academy of Sciences of the United States of America, 112(11): 3241-3246.

Kelman, I., Field, J., Suri, K. and Bhat, G.M., 2018. Disaster diplomacy in Jammu and Kashmir. International journal of disaster risk reduction, 31: 1132-1140.

Kelman, I., Orlowska, J., Upadhyay, H., Stojanov, R., Webersik, C., Simonelli, A., Prochazka, D. and Nemec, D., 2019. Does climate change influence people's migration decisions in Maldives? Climatic Change, 153(1-2): 285-299.

Kendrovski, V., Baccini, M., Martinez, G.S., Wolf, T., Paunovic, E. and Menne, B., 2017. Quantifying Projected Heat Mortality Impacts under 21st-Century Warming Conditions for Selected European Countries. International Journal of Environmental Research and Public Health, 14(7).

Kennedy, J. and King, L., 2014. The political economy of farmers' suicides in India: indebted cash-crop farmers with marginal landholdings explain state-level variation in suicide rates. Globalization and Health, 10(1): 16-16.

Kennedy, S., Kidd, M.P., McDonald, J.T. and Biddle, N., 2015. The Healthy Immigrant Effect: Patterns and Evidence from Four Countries. Journal of International Migration and Integration, 16(2): 317-332.

Kenney, W.L., Craighead, D.H. and Alexander, L.M., 2014. Heat waves, aging, and human cardiovascular health. Med Sci Sports Exerc, 46(10): 1891-9.

Keramitsoglou, I., Sismanidis, P., Analitis, A., Butler, T., Founda, D., Giannakopoulos, C., Giannatou, E., Karali, A., Katsouyanni, K., Kendrovski, V., Lemesios, G., Myrivili, E., Ordoñez, D., Varotsos, K.V., Vlastou, G. and Kiranoudis, C.T., 2017. Urban thermal risk reduction: Developing and implementing spatially explicit services for resilient cities. Sustainable Cities and Society, 34: 56-68.

Kerr, D., Population growth, energy use, and environmental impact: Comparing the Canadian and Swedish records on CO2 emissions. Canadian Studies on Population, 41(1-2): 120-143.

Kerr, R., Chilanga, E., Nyantakyi-Frimpong, H., Luginaah, I. and Lupafya, E., 2016. Integrated agriculture programs to address malnutrition in northern Malawi. Bmc Public Health, 16.

Kesetyaningsih, T.W., Andarini, S., Sudarto and Pramoedyo, H., 2018. Determination of Environmental Factors Affecting Dengue Incidence in Sleman District, Yogyakarta, Indonesia. Afr J Infect Dis, 12(1 Suppl): 13-25.

Kessler, R., Galea, S., Gruber, M., Sampson, N., Ursano, R. and Wessely, S., 2008. Trends in mental illness and suicidality after Hurricane Katrina. Molecular Psychiatry, 13(4): 374-384.

Kettner, A., Cohen, S., Overeem, I., Fekete, B., Brakenridge, G., Syvitski, J., Schumann, G., Bates, P., Apel, H. and Aronica, G., 2018a. Estimating Change in Flooding for the 21st Century under a Conservative RCP Forcing: A Global Hydrological Modeling Assessment. Global Flood Hazard: Applications in Modeling, Mapping, and Forecasting, 233: 157-167.

Kettner, A.J., Cohen, S., Overeem, I., Fekete, B.M., Brakenridge, G.R. and Syvitski, J.P.M., 2018b. Estimating Change in Flooding for the 21st Century under a Conservative RCP Forcing. Wiley.

Khan, S.J., Deere, D., Leusch, F.D., Humpage, A., Jenkins, M. and Cunliffe, D., 2015. Extreme weather events: Should drinking water quality management systems adapt to changing risk profiles? Water Res, 85: 124-36.

Khanian, M., Serpoush, B. and Gheitarani, N., 2019a. Balance between place attachment and migration based on subjective adaptive capacity in response to climate change: the case of Famenin County in Western Iran. Climate and Development, 11(1): 69-82.

Khanian, M., Serpoush, B. and Gheitarani, N., 2019b. Balance between place attachment and migration based on subjective adaptive capacity in response to climate change: the case of Famenin County in Western Iran. Climate and Development, 11(1): 69-82.

Kikuta, K., 2019. Postdisaster Reconstruction as a Cause of Intrastate Violence: An Instrumental Variable Analysis with Application to the 2004 Tsunami in Sri Lanka. Journal of Conflict Resolution, 63(3): 760-785.

Kim, B., Santo, R., Scatterday, A., Fry, J., Synk, C., Cebron, S., Mekonnen, M., Hoekstra, A., de Pee, S., Bloem, M., Neff, R. and Nachman, K., 2020. Country-specific dietary shifts to mitigate climate and water crises. Global Environmental Change-Human and Policy Dimensions, 62.

Kim, H., Kim, H., Byun, G., Choi, Y., Song, H. and Lee, J.-T., 2019a. Difference in temporal variation of temperature-related mortality risk in seven major South Korean cities spanning 1998–2013. Science of the Total Environment, 656: 986-996.

Kim, K.H., Kabir, E. and Ara Jahan, S., 2014. A review of the consequences of global climate change on human health. J Environ Sci Health C Environ Carcinog Ecotoxicol Rev, 32(3): 299-318.

Kim, S., Fleisher, B. and Sun, Y., 2017. The Long-term Health Effects of Fetal Malnutrition: Evidence from the 1959–1961 China Great Leap Forward Famine. Health Economics, 26(10): 1264-1277.

Kim, Y., Kim, H., Gasparrini, A., Armstrong, B., Honda, Y., Chung, Y., Ng, C., Tobias, A., Iniguez, C., Lavigne, E., Sera, F., Vicedo-Cabrera, A., Ragettli, M., Scovronick, N., Acquaotta, F., Chen, B., Guo, Y., Seposo, X., Dang, T., Coelho, M., Saldiva, P., Kosheleva, A., Zanobetti, A., Schwartz, J., Bell, M. and Hashizume, M., 2019b. Suicide and Ambient Temperature: A Multi-Country Multi-City Study. Environmental Health Perspectives, 127(11).

King, A.D., Donat, M.G., Lewis, S.C., Henley, B.J., Mitchell, D.M., Stott, P.A., Fischer, E.M. and Karoly, D.J., 2018. Reduced heat exposure by limiting global warming to 1.5 degrees C. Nature Climate Change, 8(7): 549-551.

King, A.D. and Karoly, D.J., 2017. Climate extremes in Europe at 1.5 and 2 degrees of global warming. Environmental Research Letters, 12(11).

King, E. and Mutter, J.C., 2014. Violent conflicts and natural disasters: the growing case for cross-disciplinary dialogue. Third World Quarterly, 35(7): 1239-1255.

Kingsborough, A., Jenkins, K. and Hall, J.W., 2017. Development and appraisal of long-term adaptation pathways for managing heat-risk in London. Climate Risk Management, 16: 73-92.

Kinney, P., 2018. Temporal Trends in Heat-Related Mortality: Implications for Future Projections. Atmosphere, 9: 409.

Kinney, P.L., Matte, T., Knowlton, K., Madrigano, J., Petkova, E., Weinberger, K., Quinn, A., Arend, M. and Pullen, J., 2015. New York City Panel on Climate Change 2015 Report. Chapter 5: Public health impacts and resiliency. Ann N Y Acad Sci, 1336: 67-88.

Kirk, M.D., Pires, S.M., Black, R.E., Caipo, M., Crump, J.A., Devleesschauwer, B., Dopfer, D., Fazil, A., Fischer-Walker, C.L., Hald, T., Hall, A.J., Keddy, K.H., Lake, R.J., Lanata, C.F., Torgerson, P.R., Havelaar, A.H. and Angulo, F.J., 2015. World Health Organization Estimates of the Global and Regional Disease Burden of 22 Foodborne Bacterial, Protozoal, and Viral Diseases, 2010: A Data Synthesis. PLoS Med, 12(12): e1001921.

Kita, S.M., 2017. Urban vulnerability, disaster risk reduction and resettlement in Mzuzu city, Malawi. International journal of disaster risk reduction, 22: 158-166.

Kjellstrom, T., Briggs, D., Freyberg, C., Lemke, B., Otto, M. and Hyatt, O., 2016. Heat, Human Performance, and Occupational Health: A Key Issue for the Assessment of Global Climate Change Impacts. Annual Review of Public Health, 37(1): 97-112.

Klabunde, A. and Willekens, F., 2016. Decision-Making in Agent-Based Models of Migration: State of the Art and Challenges. European Journal of Population, 32(1): 73-97.

Klein, R., Midgley, G., Preston, B., Alam, M., Berkhout, F., Dow, K., Shaw, M., Botzen, W., Buhaug, H., Butzer, K., Keskitalo, E., Li, Y., Mateescu, E., Muir-Wood, R., Mustelin, J., Reid, H., Rickards, L., Scorgie, S., Smith, T., Thomas, A., Watkiss, P., Wolf, J., Field, C., Barros, V., Dokken, D., Mach, K., Mastrandrea, M., Bilir, T., Chatterjee, M., Ebi, K., Estrada, Y., Genova, R., Girma, B., Kissel, E., Levy, A., MacCracken, S., Mastrandrea, P. and White, L., 2014. Adaptation Opportunities, Constraints, and Limits. Climate Change 2014: Impacts, Adaptation, and Vulnerability, Pt a: Global and Sectoral Aspects: 899-943.

Kniel, K.E. and Spanninger, P., 2017. Preharvest Food Safety under the Influence of a Changing Climate. Microbiol Spectr, 5(2).

Kohli, G.S., Haslauer, K., Sarowar, C., Kretzschmar, A.L., Boulter, M., Harwood, D.T., Laczka, O. and Murray, S.A., 2017. Qualitative and quantitative assessment of the presence of ciguatoxin, P-CTX-1B, in Spanish Mackerel (Scomberomorus commerson) from waters in New South Wales (Australia). Toxicology Reports, 4: 328-334.

Kopp, R.E., Shwom, R.L., Wagner, G. and Yuan, J., 2016. Tipping elements and climate–economic shocks: Pathways toward integrated assessment. Earth's Future, 4(8): 346-372.

Koren, O., 2018. FOOD ABUNDANCE AND VIOLENT CONFLICT IN AFRICA. American Journal of Agricultural Economics, 100(4): 981-1006.

Koren, O. and Bagozzi, B.E., 2017. Living off the land: The connection between cropland, food security, and violence against civilians. Journal of Peace Research, 54(3): 351-364.

Korhonen, M., Kangasraasio, S. and Svento, R., 2019. Do people adapt to climate change? Evidence from the industrialized countries. International Journal of Climate Change Strategies and Management, 11(1): 54-71.

Kostyla, C., Bain, R., Cronk, R. and Bartram, J., 2015. Seasonal variation of fecal contamination in drinking water sources in developing countries: A systematic review. Science of the Total Environment, 514: 333-343.

Kothari, U., 2014. Political discourses of climate change and migration: resettlement policies in the Maldives. Geographical Journal, 180(2): 130-140.

Koubi, V., 2018. Exploring the relationship between climate change and violent conflict. Chinese Journal of Population Resources and Environment, 16(3): 197-202.

Koubi, V., 2019. Climate Change and Conflict. In: M. Levi and N.L. Rosenblum (Editors), Annual Review of Political Science, Vol 22. Annual Review of Political Science. Annual Reviews, Palo Alto, pp. 343-360.

Koubi, V., Bˆhmelt, T., Spilker, G. and Schaffer, L., 2018. The determinants of environmental migrantsí conflict perception. Internation Organisation, 72(4): 905-936.

Koubi, V., Levi, M. and Rosenblum, N., 2019. Climate Change and Conflict. Annual Review of Political Science, Vol 22, 22: 343-360.

Koubi, V., Spilker, G., Schaffer, L. and Bernauer, T., 2016a. Environmental stressors and migration: Evidence from Vietnam. World Development, 79: 197-210.

Koubi, V., Spilker, G., Schaffer, L. and Böhmelt, T., 2016b. The role of environmental perceptions in migration decision-making: evidence from both migrants and non-migrants in five developing countries. Population and Environment, 38(2): 134-163.

Koubi, V., Spilker, G., Schaffer, L. and Böhmelt, T., 2016c. The role of environmental perceptions in migration decision-making: Evidence from both migrants and non-migrants in five developing countries. Population and Environment, 38(2): 134-163.

Koubi, V., Stoll, S. and Spilker, G., 2016d. Perceptions of environmental change and migration decisions. Climatic Change, 138(3): 439-451.

Kousky, C., 2014. Managing shoreline retreat: a US perspective. Climatic Change, 124(1-2): 9-20.

Kovats, R.S. and Hajat, S., 2008. Heat stress and public health: a critical review. Annu Rev Public Health, 29: 41-55.

Kranz, O., Sachs, A. and Lang, S., 2015. Assessment of environmental changes induced by internally displaced person (IDP) camps in the Darfur region, Sudan, based on multitemporal MODIS data. International Journal of Remote Sensing, 36(1): 190-210.

Kron, A., 2019. Environmental Peacebuilding and the UN Security Council. In: N.J. Schrijver and N.M. Blokker (Editors), Elected Members of the Security Council: Lame Ducks or Key Players? Nijhoff Law Specials. Brill, pp. 248-266.

Kroumpouzos, G., Gupta, M., Jafferany, M., Lotti, T., Sadoughifar, R., Sitkowska, Z. and Goldust, M., 2020. COVID-19: A relationship to climate and environmental conditions? Dermatol Ther: e13399.

Krstic, N., Yuchi, W., Ho, H.C., Walker, B.B., Knudby, A.J. and Henderson, S.B., 2017. The Heat Exposure Integrated Deprivation Index (HEIDI): A data-driven approach to quantifying neighborhood risk during extreme hot weather. Environment International, 109: 42-52.

Kubik, Z. and Maurel, M., 2016. Weather shocks, agricultural production and migration: Evidence from Tanzania. The Journal of Development Studies, 52(5): 665-680.

Kuehn, L. and McCormick, S., 2017. Heat Exposure and Maternal Health in the Face of Climate Change. Int. J. Environ. Res. Public Health, 14(8).

Kuhn, K.G., Nielsen, E.M., Mølbak, K. and Ethelberg, S., 2018. Epidemiology of campylobacteriosis in Denmark 2000-2015. Zoonoses Public Health, 65(1): 59-66.

Kulp, S.A. and Strauss, B.H., 2019. New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding. Nature Communications, 10(1): 4844.

Kumar Jha, C., Gupta, V., Chattopadhyay, U. and Amarayil Sreeraman, B., 2017. Migration as adaptation strategy to cope with climate change: A study of farmers’ migration in rural India. International Journal of Climate Change Strategies and Management, 10.

Kuruvilla, S., Sadana, R., Montesinos, E.V., Beard, J., Vasdeki, J.F., Araujo de Carvalho, I., Thomas, R.B., Drisse, M.B., Daelmans, B., Goodman, T., Koller, T., Officer, A., Vogel, J., Valentine, N., Wootton, E., Banerjee, A., Magar, V., Neira, M., Bele, J.M.O., Worning, A.M. and Bustreo, F., 2018a. A life-course approach to health: synergy with sustainable development goals. Bull World Health Organ, 96(1): 42-50.

Kuruvilla, S., Sadana, R., Montesinos, E.V., Beard, J., Vasdeki, J.F., de Carvalho, I.A., Thomas, R.B., Drisse, M.N.B., Daelmans, B., Goodman, T., Koller, T., Officer, A., Vogel, J., Valentine, N., Wootton, E., Banerjee, A., Magar, V., Neira, M., Bele, J.M.O., Worning, A.M. and Bustreo, F., 2018b. A life-course approach to health: synergy with sustainable development goals. Bulletin of the World Health Organization, 96(1): 42-50.

Kuusaana, E.D. and Bukari, K.N., 2015. Land conflicts between smallholders and Fulani pastoralists in Ghana: Evidence from the Asante Akim North District (AAND). Journal of Rural Studies, 42: 52-62.

Kuzdas, C. and Wiek, A., 2014. Governance scenarios for addressing water conflicts and climate change impacts. Environmental Science & Policy, 42: 181-196.

Kwan, C. and Hashim, H., 2016. A review on co-benefits of mass public transportation in climate change mitigation. Sustainable Cities and Society, 22: 11-18.

Kwan, S.C., Tainio, M., Woodcock, J., Sutan, R. and Hashim, J.H., 2017. The carbon savings and health co-benefits from the introduction of mass rapid transit system in Greater Kuala Lumpur, Malaysia. Journal of Transport & Health, 6: 187-200.

Lacey, F.G., Marais, E.A., Henze, D.K., Lee, C.J., van Donkelaar, A., Martin, R.V., Hannigan, M.P. and Wiedinmyer, C., 2017a. Improving present day and future estimates of anthropogenic sectoral emissions and the resulting air quality impacts in Africa. Faraday Discuss. 200: 397-412.

Lacey, G., Henze, K., Lee, J., van Donkelaar, A. and Martin, V., 2017b. Transient climate and ambient health impacts due to national solid fuel cookstove emissions. Proceedings of the national Academy of Sciences of the United States of America, 114(6): 1269-1274.

Lai, Y.H., 2018. The climatic factors affecting dengue fever outbreaks in southern Taiwan: an application of symbolic data analysis. Biomed Eng Online, 17(Suppl 2): 148.

Lake, A.A., 2018. Neighbourhood food environments: food choice, foodscapes and planning for health. Proceedings of the Nutrition Society, 77(3): 239-246.

Lake, I.R., 2017. Food-borne disease and climate change in the United Kingdom. Environ Health, 16(Suppl 1): 117.

Lake, I.R. and Barker, G.C., 2018. Climate Change, Foodborne Pathogens and Illness in Higher-Income Countries. Curr Environ Health Rep, 5(1): 187-196.

Lake, I.R., Jones, N.R., Agnew, M., Goodess, C.M., Giorgi, F., Hamaoui-Laguel, L., Semenov, M.A., Solmon, F., Storkey, J., Vautard, R. and Epstein, M.M., 2017. Climate Change and Future Pollen Allergy in Europe. Environ. Health Perspect. 125(3): 385-391.

Lake, I.R., Colon-Gonzalez, F.J., Takkinen, J., Rossi, M., Sudre, B., Dias, J.G., Tavoschi, L., Joshi, A., Semenza, J.C. and Nichols, G., 2019. Exploring Campylobacter seasonality across Europe using The European Surveillance System (TESSy), 2008 to 2016. Euro Surveill, 24(13).

Lal, A., Fearnley, E. and Wilford, E., 2019. Local weather, flooding history and childhood diarrhoea caused by the parasite Cryptosporidium spp.: A systematic review and meta-analysis. Sci Total Environ, 674: 300-306.

Lal, A., Hales, S., Kirk, M., Baker, M.G. and French, N.P., 2016. Spatial and temporal variation in the association between temperature and salmonellosis in NZ. Aust N Z J Public Health, 40(2): 165-9.

Lamond, E., Joseph, D. and Proverbs, G., 2015. An exploration of factors affecting the long term psychological impact and deterioration of mental health in flooded households. Environmental Research (140): 325-334.

Lancet, T., 2020. - Global health: time for radical change? , - 396(- 10258).

Landis, S.T., 2014. Temperature seasonality and violent conflict: The inconsistencies of a warming planet. Journal of Peace Research, 51(5): 603-618.

Landis, S.T., Rezaeedaryakenari, B., Zhang, Y.F., Thies, C.G. and Maciejewski, R., 2017. Fording differences? Conditions mitigating water insecurity in the Niger River Basin. Political Geography, 56: 77-90.

Lau, S.Y., Wang, X., Wang, M., Liu, S., Zee, B.C., Han, X., Yu, Z., Sun, R., Chong, K.C. and Chen, E., 2018. Identification of meteorological factors associated with human infection with avian influenza A H7N9 virus in Zhejiang Province, China. Sci Total Environ, 644: 696-709.

Lawson, E., Alare, R., Salifu, A. and Thompson-Hall, M., 2019. Dealing with climate change in semi-arid Ghana: Understanding intersectional perceptions and adaptation strategies of women farmers. GeoJournal.

Le Billon, P. and Duffy, R., 2018. Conflict ecologies: connecting political ecology and peace and conflict studies. Journal of Political Ecology, 25: 239-260.

Le Masson, V., Benoudji, C. and Reyes, S., 2019. Everyday violence and its impact on insecurity and resilience in Chad, UNEP, Nairobi.

Leckebusch, G.C. and Abdussalam, A.F., 2015. Climate and socioeconomic influences on interannual variability of cholera in Nigeria. Health Place, 34: 107-17.

Lee, D.C., Gupta, V.K., Carr, B.G., Malik, S., Ferguson, B., Wall, S.P., Smith, S.W. and Goldfrank, L.R., 2016. Acute post-disaster medical needs of patients with diabetes: emergency department use in New York City by diabetic adults after Hurricane Sandy. BMJ Open Diabetes Res Care, 4(1): e000248.

Lee, H.S., Ha Hoang, T.T., Pham-Duc, P., Lee, M., Grace, D., Phung, D.C., Thuc, V.M. and Nguyen-Viet, H., 2017a. Seasonal and geographical distribution of bacillary dysentery (shigellosis) and associated climate risk factors in Kon Tam Province in Vietnam from 1999 to 2013. Infect Dis Poverty, 6(1): 113.

Lee, J., Lee, S. and Jiang, X., 2017b. Cyanobacterial Toxins in Freshwater and Food: Important Sources of Exposure to Humans. Annu. Rev. Food Sci. Technol., 8: 281-304.

Lee, J.Y. and Kim, H., 2016. Projection of future temperature-related mortality due to climate and demographic changes. Environment International, 94: 489-494.

Lee, S., Lee, H., Myung, W., Kim, J. and Kim, H., 2018a. Mental disease-related emergency admissions attributable to hot temperatures. Science of the Total Environment (616): 688-694.

Lee, W., Choi, H.M., Kim, D., Honda, Y., Guo, Y.-L.L. and Kim, H., 2018b. Temporal changes in mortality attributed to heat extremes for 57 cities in Northeast Asia. Science of the Total Environment, 616-617: 703-709.

Lee, W.-H., Lim, Y.-H., Tran, N.D., Seposo, X., Honda, Y., Guo, Y.-L., Jang, H.-M. and Kim, H., 2017c. An Investigation on Attributes of Ambient Temperature and Diurnal Temperature Range on Mortality in Five East-Asian Countries. Scientific Reports, 7.

Lehner, F., Coats, S., Stocker, T., Pendergrass, A., Sanderson, B., Raible, C. and Smerdon, J., 2017. Projected drought risk in 1.5°C and 2°C warmer climates: Drought in 1.5(degree sign) C and 2(degree sign)C warmer climates. Geophysical Research Letters, 44.

Lehrer, S. and Rosenzweig, K.E., 2014. Cold Climate Is a Risk Factor for Thyroid Cancer. Clin Thyroidol, 26(10): 273-276.

Leichenko, R. and Silva, J.A., 2014. Climate change and poverty: vulnerability, impacts, and alleviation strategies. Wiley Interdisciplinary Reviews-Climate Change, 5(4): 539-556.

Lerner, H. and Berg, C., 2015. The concept of health in One Health and some practical implications for research and education: what is One Health? Infect. Ecol. Epidemiol., 5: 25300.

Lerner, H. and Berg, C., 2017. A Comparison of Three Holistic Approaches to Health: One Health, EcoHealth, and Planetary Health. Frontiers in Veterinary Science, 4.

Lesnikowski, A., Ford, J., Biesbroek, R., Berrang-Ford, L., Maillet, M., Araos, M. and Austin, S.E., 2017. What does the Paris Agreement mean for adaptation? Climate Policy, 17(7): 825-831.

Levi, M., Kjellstrom, T. and Baldasseroni, A., 2018. Impact of climate change on occupational health and productivity: a systematic literature review focusing on workplace heat. La Medicina del lavoro, 109.

Levy, B.S. and Patz, J.A., 2015. Climate Change, Human Rights, and Social Justice. Ann Glob Health, 81(3): 310-22.

Levy, B.S. and Sidel, V.W., 2014. Collective violence caused by climate change and how it threatens health and human rights. Health Hum Rights, 16(1): 32-40.

Levy, K., 2017. Reducing Health Regrets in a Changing Climate. J Infect Dis, 215(1): 14-16.

Levy, K., Smith, S.M. and Carlton, E.J., 2018. Climate Change Impacts on Waterborne Diseases: Moving Toward Designing Interventions. Curr Environ Health Rep, 5(2): 272-282.

Levy, K., Woster, A.P., Goldstein, R.S. and Carlton, E.J., 2016. Untangling the Impacts of Climate Change on Waterborne Diseases: a Systematic Review of Relationships between Diarrheal Diseases and Temperature, Rainfall, Flooding, and Drought. Environ Sci Technol, 50(10): 4905-22.

Lewis, S.C., King, A.D. and Mitchell, D.M., 2017. Australia's Unprecedented Future Temperature Extremes under Paris Limits to Warming. Geophysical Research Letters, 44(19): 9947-9956.

Leyk, S., Runfola, D., Nawrotzki, R.J., Hunter, L.M. and Riosmena, F., 2017. Internal and International Mobility as Adaptation to Climatic Variability in Contemporary Mexico: Evidence from the Integration of Census and Satellite Data. Population, Space and Place.

Li, T., Ban, J., Horton, R.M., Bader, D.A., Huang, G., Sun, Q. and Kinney, P.L., 2015. Heat-related mortality projections for cardiovascular and respiratory disease under the changing climate in Beijing, China. Scientific Reports, 5: 11441.

Li, T.T., Horton, R.M., Bader, D.A., Zhou, M.G., Liang, X.D., Ban, J., Sun, Q.H. and Kinney, P.L., 2016. Aging Will Amplify the Heat-related Mortality Risk under a Changing Climate: Projection for the Elderly in Beijing, China. Scientific Reports, 6.

Li, Y., Lan, L., Wang, Y., Yang, C., Tang, W., Cui, G., Luo, S., Cheng, Y., Liu, Y., Liu, J. and Jin, Y., 2014. Extremely cold and hot temperatures increase the risk of diabetes mortality in metropolitan areas of two Chinese cities. Environ Res, 134: 91-7.

Li, Y., Ren, T., Kinney, P.L., Joyner, A. and Zhang, W., 2018. Projecting future climate change impacts on heat-related mortality in large urban areas in China. Environmental Research, 163: 171-185.

Liang L and Gong P, 2017. Climate change and human infectious diseases: A synthesis of research findings from global and spatio-temporal perspectives. Environmenta International (103): 99–108.

Liang, L. and Gong, P., 2017. Climate change and human infectious diseases: A synthesis of research findings from global and spatio-temporal perspectives. Environment International, 103: 99-108.

Liang, W., Gu, X., Li, X., Zhang, K., Wu, K., Pang, M., Dong, J., Merrill, H.R., Hu, T., Liu, K., Shao, Z. and Yan, H., 2018. Mapping the epidemic changes and risks of hemorrhagic fever with renal syndrome in Shaanxi Province, China, 2005-2016. Sci Rep, 8(1): 749.

Liddell, C., Morris, C., Thomson, H. and Guiney, C., 2016. Excess winter deaths in 30 European countries 1980–2013: a critical review of methods. Journal of Public Health, 38(4): 806-814.

Ligon, G. and Bartram, J., 2016a. Literature Review of Associations among Attributes of Reported Drinking Water Disease Outbreaks. Int J Environ Res Public Health, 13(6).

Ligon, G. and Bartram, J., 2016b. Literature Review of Associations among Attributes of Reported Drinking Water Disease Outbreaks. Int J Environ Res Public Health, 13(6).

Limaye, V.S., Vargo, J., Harkey, M., Holloway, T. and Patz, J.A., 2018. Climate Change and Heat-Related Excess Mortality in the Eastern USA. Ecohealth, 15(3): 485-496.

Lin, S., Sun, M., Fitzgerald, E. and Hwang, S.A., 2016. Did summer weather factors affect gastrointestinal infection hospitalizations in New York State? Sci Total Environ, 550: 38-44.

Lindgren, E., Andersson, Y., Suk, J.E., Sudre, B. and Semenza, J.C., 2012. Public health. Monitoring EU emerging infectious disease risk due to climate change. Science, 336(6080): 418-9.

Link, P.M., Brucher, T., Claussen, M., Link, J.S.A. and Scheffran, J., 2015. THE NEXUS OF CLIMATE CHANGE, LAND USE, AND CONFLICT Complex Human-Environment Interactions in Northern Africa. Bulletin of the American Meteorological Society, 96(9).

Link, P.M., Scheffran, J. and Ide, T., 2016. Conflict and cooperation in the water-security nexus: a global comparative analysis of river basins under climate change. Wiley Interdisciplinary Reviews-Water, 3(4): 495-515.

Linke, A.M., O'Loughlin, J., McCabe, J.T., Tir, J. and Witmer, F.D.W., 2015. Rainfall variability and violence in rural Kenya: Investigating the effects of drought and the role of local institutions with survey data. Global Environmental Change-Human and Policy Dimensions, 34: 35-47.

Linke, A.M., Witmer, F., O'Loughlin, J., McCabe, J.T. and Tir, J., 2018a. The consequences of relocating in response to drought: human mobility and conflict in contemporary Kenya. Environmental Research Letters, 13(9): 094014.

Linke, A.M., Witmer, F.D.W., O'Loughlin, J., McCabe, J.T. and Tir, J., 2018b. Drought, Local Institutional Contexts, and Support for Violence in Kenya. Journal of Conflict Resolution, 62(7): 1544-1578.

Liu, C., Chen, R., Sera, F., Vicedo-Cabrera, M., Guo, Y., Tong, S. and Kan, H., 2019a. Ambient Particulate Air Pollution and Daily Mortality in 652 Cities. New England Journal of Medicine, 381(8): 705-715.

Liu, C., Hofstra, N. and Franz, E., 2016a. Impacts of Climate and Management Variables on the Contamination of Preharvest Leafy Greens with Escherichia coli. J Food Prot, 79(1): 17-29.

Liu, C., Yavar, Z. and Sun, Q., 2015a. Cardiovascular response to thermoregulatory challenges. American Journal of Physiology-Heart and Circulatory Physiology, 309(11): H1793-H1812.

Liu, J.C., Mickley, L.J., Sulprizio, M.P., Yue, X., Peng, R.D., Dominici, F. and Bell, M.L., 2016b. Future respiratory hospital admissions from wildfire smoke under climate change in the Western US. Environ. Res. Lett., 11(12): 124018.

Liu, J.C., Pereira, G., Uhl, S.A., Bravo, M.A. and Bell, M.L., 2015b. A systematic review of the physical health impacts from non-occupational exposure to wildfire smoke. Environ Res, 136: 120-32.

Liu, K., Zhou, H., Sun, R.X., Yao, H.W., Li, Y., Wang, L.P., Mu, D., Li, X.L., Yang, Y., Gray, G.C., Cui, N., Yin, W.W., Fang, L.Q., Yu, H.J. and Cao, W.C., 2015c. A national assessment of the epidemiology of severe fever with thrombocytopenia syndrome, China. Sci Rep, 5: 9679.

Liu, X., Liu, H., Fan, H., Liu, Y. and Ding, G., 2019b. Influence of heat waves on daily hospital visits for mental illness in Jinan, China—a case-crossover study. International Journal of Environmental Research and Public Health, 16(1): 87.

Liu, Y.J., Zhou, C.Q., Li, L., Su, L. and Zhang, Y.B., 2018a. Fragile States Metric System: An Assessment Model Considering Climate Change. Sustainability, 10(6).

Liu, Z., Zhang, F., Zhang, Y., Li, J., Liu, X., Ding, G., Zhang, C., Liu, Q. and Jiang, B., 2018b. Association between floods and infectious diarrhea and their effect modifiers in Hunan province, China: A two-stage model. Sci Total Environ, 626: 630-637.

Lloyd, 2018. A Global-Level Model of the Potential Impacts of Climate Change on Child Stunting via Income and Food Price in 2030. Environmental Health Perspectives, 126(9): 097007.

Lo Iacono, G., Armstrong, B., Fleming, L.E., Elson, R., Kovats, S., Vardoulakis, S. and Nichols, G.L., 2017. Challenges in developing methods for quantifying the effects of weather and climate on water-associated diseases: A systematic review. Plos Neglected Tropical Diseases, 11(6).

Loebach, P., 2016. Household migration as a livelihood adaptation in response to a natural disaster: Nicaragua and Hurricane Mitch. Population and Environment.

Longden, T., 2018. Measuring temperature-related mortality using endogenously determined thresholds. Climatic Change, 150(3-4): 343-375.

Lopez, M.S., Muller, G.V. and Sione, W.F., 2018. Analysis of the spatial distribution of scientific publications regarding vector-borne diseases related to climate variability in South America. Spat Spatiotemporal Epidemiol, 26: 35-93.

Lovell, C.R., 2017. Ecological fitness and virulence features of Vibrio parahaemolyticus in estuarine environments. Appl Microbiol Biotechnol, 101(5): 1781-1794.

Low, A., Frederix, K., McCracken, S., Manyau, S., Gummerson, E. and Radin, E., 2019. Association between severe drought and HIV prevention and care behaviors in Lesotho: A population-based survey 2016–2017. PLoS Med, 16(1).

Lu, X., Wrathall, D., Sundsoy, P., Nadiruzzaman, M., Wetter, E., Iqbal, A., Qureshi, T., Tatem, A., Canright, G., Engo-Monsen, K. and Bengtsson, L., 2016. Detecting climate adaptation with mobile network data in Bangladesh: Anomalies in communication, mobility and consumption patterns during Cyclone Mahasen. Climate Change, 138(3-4): 505-19.

Lucas, C. and Warman, R., 2018. Disrupting polarized discourses: Can we get out of the ruts of environmental conflicts? Environment and Planning C-Politics and Space, 36(6): 987-1005.

Luechinger, S., 2010. Life satisfaction and transboundary air pollution. Economics Letters, 107(1): 4-6.

Lujala, P., Bezu, S., Kolstad, I., Mahmud, M. and Wiig, A., 2020. How do host–migrant proximities shape attitudes toward internal climate migrants? Global Environmental Change, 65: 102156.

Luke, D.A. and Stamatakis, K.A., 2012. Systems science methods in public health: dynamics, networks, and agents. Annu. Rev. Public Health, 33: 357-376.

Lund, C., Baron, E. and Breuer, E., 2018. Social determinants of mental disorders and the Sustainable Development Goals: a systematic review of reviews. The Lancet Psychiatry, 5.

Lutz, W., Muttarak, R. and Striessnig, E., 2014. Universal education is key to enhanced climate adaptation. Science, 346(6213): 1061-1062.

Lutz, W. and Striessnig, E., 2015. Demographic aspects of climate change mitigation and adaptation. Popul Stud (Camb), 69 Suppl 1: S69-76.

Lyon, B., Dinku, T., Raman, A. and Thomson, M.C., 2017. Temperature suitability for malaria climbing the Ethiopian Highlands. Environmental Research Letters, 12(6).

M'Bra, R.K., Kone, B., Soro, D.P., N'Krumah R, T.A.S., Soro, N., Ndione, J.A., Sy, I., Ceccato, P., Ebi, K.L., Utzinger, J., Schindler, C. and Cisse, G., 2018. Impact of climate variability on the transmission risk of malaria in northern Cote d'Ivoire. PLoS One, 13(6): e0182304.

M.Z, I., Kolade, O. and Kibreab, G., 2018. Post-disaster Housing Reconstruction: The Impact of Resourcing in Post-cyclones Sidr and Aila in Bangladesh. Journal of International Development, 30(6): 934-960.

Ma, R., Zhong, S., Morabito, M., Hajat, S., Xu, Z., He, Y., Bao, J., Sheng, R., Li, C., Fu, C. and Huang, C., 2019. Estimation of work-related injury and economic burden attributable to heat stress in Guangzhou, China. Sci Total Environ, 666: 147-154.

Mach, K., Kraan, C., Adger, W., Buhaug, H., Burke, M., Fearon, J., Field, C., Hendrix, C., Maystadt, J., O'Loughlin, J., Roessler, P., Scheffran, J., Schultz, K. and von Uexkull, N., 2019. Climate as a risk factor for armed conflict. Naure, 571(7764): 193-+.

Mach, K.J., Adger, W.N., Buhaug, H., Burke, M., Fearon, J.D., Field, C.B., Hendrix, C.S., Kraan, C.M., Maystadt, J.-F. and O'Loughlin, J., 2020. Directions for Research on Climate and Conflict. Earth's Future.

Macintyre, H.L., Heaviside, C., Taylor, J., Picetti, R., Symonds, P., Cai, X.M. and Vardoulakis, S., 2018. Assessing urban population vulnerability and environmental risks across an urban area during heatwaves - Implications for health protection. Science of the Total Environment, 610: 678-690.

Maclean, C., Popovici, I. and French, T., 2016. Are natural disasters in early childhood associated with mental health and substance use disorders as an adult? Social Science and Medicine (151): 78-91.

Macnaughton, P., Cao, X., Buonocore, J., Cedeno-Laurent, J., Spengler, J., Bernstein, A. and Allen, J., 2018. Energy savings, emission reductions, and health co-benefits of the green building movement. J. Expo. Sci. Environ. Epidemiol. 28(4): 307-318.

Madhuri, Tewari, H.R. and Bhowmick, P.K., 2015. Ingenuity of skating on marshy land by tying a pot to the belly: Living with flood is a way of life. Environment Development and Sustainability, 17(6): 1287-1311.

Madianou, M. and Miller, D., 2011. Mobile phone parenting: Reconfiguring relationships between Filipina migrant mothers and their left-behind children. New Media & Society, 13(3): 457-470.

Madrigano, J., Ito, K., Johnson, S., Kinney, P.L. and Matte, T., 2015a. A Case-Only Study of Vulnerability to Heat Wave-Related Mortality in New York City (2000-2011). Environmental health perspectives, 123(7): 672-678.

Madrigano, J., Ito, K., Johnson, S., Kinney, P.L. and Matte, T., 2015b. A Case-Only Study of Vulnerability to Heat Wave-Related Mortality in New York City (2000-2011). Environmental Health Perspectives, 123(7): 672-678.

Magnan, A., Schipper, L., Burkett, M., Bharwani, S., Burton, I., Eriksen, S., Gemenne, F., Schaar, J. and Ziervogel, G., 2016. Addressing the risk of maladaptation to climate change. Wiley interdisciplinary reviews: Climate Change, 7: 646-665.

Mahajan, P.Y., Dean. 2020. Taken by storm: Hurricanes, migrant networks and US immigration. American Economic Journal: Applied Economics, 12(2): 250-277.

Maharjan, A., Safra de Campos, R., Singh, C., Das, S., Srinivas, A., Rashed, M., Bhuiyan, M., Muhammad, Umar, A., Dilshad, T., Shrestha, K., Bhadwal, S., Ghosh, T., Suckall, N., Vincent, K. and Umar, M., 2020. Migration and Household Adaptation in Climate-Sensitive Hotspots in South Asia. Current Climate Change Reports.

Maizlish, N., Linesch, N.J. and Woodcock, J., 2017. Health and greenhouse gas mitigation benefits of ambitious expansion of cycling, walking, and transit in California. J Transp Health, 6: 490-500.

Makkar, H., 2017. Review: Feed demand landscape and implications of food-not feed strategy for food security and climate change. Animal, 12: 1-11.

Makondo, C.C. and Thomas, D.S.G., 2018. Climate change adaptation: Linking indigenous knowledge with western science for effective adaptation. Environmental Science & Policy, 88: 83-91.

Mala, S. and Jat, M.K., 2019. Implications of meteorological and physiographical parameters on dengue fever occurrences in Delhi. Sci Total Environ, 650(Pt 2): 2267-2283.

Malamud, M., 2018. The Environment as a Factor in Small Wars. Small Wars and Insurgencies, 29(2): 245-268.

Mallick, B., 2019. The Nexus between Socio-Ecological System, Livelihood Resilience, and Migration Decisions: Empirical Evidence from Bangladesh. Sustainability, 11(12).

Mallick, B., Ahmed, B. and Vogt, J., 2017. Living with the risks of cyclone disasters in the South-Western coastal region of Bangladesh. Environments, 4(1): 13.

Mallick, B. and Schanze, J., 2020. Trapped or Voluntary? Non-Migration despite Climate Risks. Sustainability, 12(11).

Mangaliso, M. and Thembumenzi, D., 2018. Predictors of food insecurity in Eswatini: lessons from the 2015/16 El Niño induced drought. African Review of Economics and Finance, 10(2): 69-96.

Manning, C. and Clayton, S., 2018. Threats to mental health and wellbeing associated with climate change, pp. 217-244.

Manrique, D.R., Corral, S. and Pereira, A.G., 2018. Climate-related displacements of coastal communities in the Arctic: Engaging traditional knowledge in adaptation strategies and policies. Environmental Science & Policy, 85: 90-100.

Mapou, A.E.M., Shendell, D., Ohman-Strickland, P., Madrigano, J., Meng, Q.Y., Whytlaw, J. and Miller, J., 2017. Environmental Factors and Fluctuations in Daily Crime Rates. Journal of Environmental Health, 80(5): 8-22.

Marcantonio, R.A., Attari, S.Z. and Evans, T.P., 2018. Farmer Perceptions of Conflict Related to Water in Zambia. Sustainability, 10(2).

Marcus, H. and Hanna, L., 2020. Understanding national barriers to climate change adaptation for public health: a mixed-methods survey of national public health representatives. International Journal of Health Governance.

Mari-Dell'Olmo, M., Tobias, A., Gomez-Gutierrez, A., Rodriguez-Sanz, M., de Olalla, P.G., Camprubi, E., Gasparrini, A. and Borrell, C., 2019. Social inequalities in the association between temperature and mortality in a South European context. International Journal of Public Health, 64(1): 27-37.

Marino, E., 2018. Adaptation privilege and Voluntary Buyouts: Perspectives on ethnocentrism in sea level rise relocation and retreat policies in the US. Global Environmental Change-Human and Policy Dimensions, 49: 10-13.

Marino, E. and Lazrus, H., 2015. Migration or Forced Displacement?: The Complex Choices of Climate Change and Disaster Migrants in Shishmaref, Alaska and Nanumea, Tuvalu. Human Organization, 74(4): 341-350.

Markanday, A., Galarraga, I. and Markandya, A., 2019. A CRITICAL REVIEW OF COST-BENEFIT ANALYSIS FOR CLIMATE CHANGE ADAPTATION IN CITIES. Climate Change Economics, 10(4).

Markandya, A., Sampedro, J., Smith, S.J., Van Dingenen, R., Pizarro-Irizar, C., Arto, I. and González-Eguino, M., 2018. Health co-benefits from air pollution and mitigation costs of the Paris Agreement: a modelling study. Lancet Planet Health, 2(3): e126-e133.

Markland, S.M., Ingram, D., Kniel, K.E. and Sharma, M., 2017. Water for Agriculture: the Convergence of Sustainability and Safety. Microbiol Spectr, 5(3).

Markou, M.T. and Kassomenos, P., 2010. Cluster analysis of five years of back trajectories arriving in Athens, Greece. Atmospheric Research, 98(2-4): 438-457.

Markussen, T., Fibaek, M., Tarp, F. and Tuan, N.D.A., 2018. The Happy Farmer: Self-Employment and Subjective Well-Being in Rural Vietnam. Journal of Happiness Studies, 19(6): 1613-1636.

Marmot, M., 2005. Social determinants of health inequalities. Lancet, 365(9464): 1099-1104.

Marmot, M., Friel, S., Bell, R., Houweling, T.A.J., Taylor, S. and Commission Social Determinants, H., 2008. Closing the gap in a generation: health equity through action on the social determinants of health. Lancet, 372(9650): 1661-1669.

Marshall, N.A. and Stokes, C.J., 2014. Influencing adaptation processes on the Australian rangelands for social and ecological resilience. Ecology and Society, 19(2): 12.

Martens, W.J.M., 1998. Climate change, thermal stress and mortality changes. Social Science & Medicine, 46(3): 331-344.

Martin, L., White, M., Hunt, A., Richardson, M., Pahl, S. and Burt, J., 2020. Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. Journal of Environmental Psychology, 68.

Martin-Shields, C.P. and Stojetz, W., 2019. Food security and conflict: Empirical challenges and future opportunities for research and policy making on food security and conflict. World Development, 119: 150-164.

Martinez, G.S., Diaz, J., Hooyberghs, H., Lauwaet, D., De Ridder, K., Linares, C., Carmona, R., Ortiz, C., Kendrovski, V. and Adamonyte, D., 2018. Cold-related mortality vs heat-related mortality in a changing climate: A case study in Vilnius (Lithuania). Environmental Research, 166: 384-393.

Martinez-Solanas, E. and Basagana, X., 2019. Temporal changes in temperature-related mortality in Spain and effect of the implementation of a Heat Health Prevention Plan. Environmental Research, 169: 102-113.

Martinez-Urtaza, J., Trinanes, J., Abanto, M., Lozano-Leon, A., Llovo-Taboada, J., Garcia-Campello, M., Pousa, A., Powell, A., Baker-Austin, C. and Gonzalez-Escalona, N., 2018. Epidemic Dynamics of Vibrio parahaemolyticus Illness in a Hotspot of Disease Emergence, Galicia, Spain. Emerg Infect Dis, 24(5): 852-859.

Marx, C., Johnson, C. and Lwasa, S., 2020. Multiple interests in urban land: disaster-induced land resettlement politics in Kampala. International Planning Studies: 1-13.

Mascarenhas, M., Garasia, S., Berthiaume, P., Corrin, T., Greig, J., Ng, V., Young, I. and Waddell, L., 2018. A scoping review of published literature on chikungunya virus. PLoS One, 13(11): e0207554.

Mastrorillo, M., Licker, R., Bohra-Mishra, P., Fagiolo, G., Estes, L.D. and Oppenheimer, M., 2016. The influence of climate variability on internal migration flows in South Africa. Global Environmental Change, 39: 155-169.

Mathbout, S., Lopez-Bustins, J.A., Martin-Vide, J., Bech, J. and Rodrigo, F.S., 2018. Spatial and temporal analysis of drought variability at several time scales in Syria during 1961-2012. Atmospheric Research, 200: 153-168.

Mathers, C.D. and Loncar, D., 2006. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med, 3(11):e442.

Matsushita, N., Ng, C.F.S., Kim, Y., Suzuki, M., Saito, N., Ariyoshi, K., Salva, E.P., Dimaano, E.M., Villarama, J.B., Go, W.S. and Hashizume, M., 2018. The non-linear and lagged short-term relationship between rainfall and leptospirosis and the intermediate role of floods in the Philippines. Plos Neglected Tropical Diseases, 12(4).

Matthew, R., 2014. Integrating climate change into peacebuilding. Climatic Change, 123(1): 83-93.

Matthews, T., Wilby, R. and Murphy, C., 2019. An emerging tropical cyclone-deadly heat compound hazard. Nature Climate Change, 9(8): 602-+.

Mawson, A.R., 2005. Understanding mass panic and other collective responses to threat and disaster. Psychiatry-Interpersonal and Biological Processes, 68(2): 95-113.

Mayer, B., 2016. The Arbitrary Project of Protecting Environmental Migrants. Environmental Migration and Social Inequality, 61: 189-200.

Mayrhuber, E.A., Duckers, M.L.A., Wallner, P., Arnberger, A., Allex, B., Wiesbock, L., Wanka, A., Kolland, F., Eder, R., Hutter, H.P. and Kutalek, R., 2018. Vulnerability to heatwaves and implications for public health interventions - A scoping review. Environ Res, 166: 42-54.
Maystadt, J.F., Calderone, M. and You, L.Z., 2015. Local warming and violent conflict in North and South Sudan. Journal of Economic Geography, 15(3): 649-671.
Mazaris, A.D. and Germond, B., 2018. Bridging the gap between climate change and maritime security: Towards a comprehensive framework for planning. Science of the Total Environment, 635: 1076-1080.
Mbaye, L.M., 2017. Climate change, natural disasters, and migration. IZA World of Labor.
McCabe, J., Smith, N., Leslie, P. and Telligman, A., 2014. Livelihood Diversification through Migration among a Pastoral People: Contrasting Case Studies of Maasai in Northern Tanzania. Human Organization, 73(4): 389-400.
McCormack, M.C., Belli, A.J., Waugh, D., Matsui, E.C., Peng, R.D., Williams, D.a.L., Paulin, L., Saha, A., Aloe, C.M., Diette, G.B., Breysse, P.N. and Hansel, N.N., 2016. Respiratory Effects of Indoor Heat and the Interaction with Air Pollution in Chronic Obstructive Pulmonary Disease. Ann. Am. Thorac. Soc., 13(12): 2125-2131.
McCubbin, S., Smit, B. and Pearce, T., 2015a. Where does climate fit? Vulnerability to climate change in the context of multiple stressors in Funafuti, Tuvalu. Global Environmental Change-Human and Policy Dimensions, 30: 43-55.
McCubbin, S., Smit, B. and Pearce, T., 2015b. Where does climate fit? Vulnerability to climate change in the context of multiple stressors in Funafuti, Tuvalu. Global Environmental Change, 30: 43-55.
McDonald, M., 2013. Discourses of climate security. Political Geography, 33: 42-51.
McDonald, M., 2018. Climate change and security: towards ecological security? International Theory, 10(2): 153-180.
McDougal, T., Hagerty, T., Inks, L. and Conroy, S., 2018. The Effect of Farmer-Pastoralist Violence on State-Level Internal Revenue Generation in Nigeria: A Modified Synthetic Control Analysis Approach. Peace Economics Peace Science and Public Policy, 24(1).
McGregor, G., 2015. Climatology in support of climate risk management: A progress report. Progress in Physical Geography, 39(4): 536-553.
McGregor, G., 2017. Hydroclimatology, modes of climatic variability and stream flow, lake and groundwater level variability: A progress report. Progress in Physical Geography, 41(4): 496-512.
McGregor, G.R., Bessemoulin, P., Ebi, K. and Menne, B., 2015. Heatwaves and Health: Guidance on Warning-System Development.
McGregor, G.R., Bone, A. and Pappenberger, F., 2017. Meteorological risk: extreme temperatures. In: K. Poljanšek (Editor), Science for disaster risk management 2017: knowing better and losing less. European Union, Luxembourg, pp. 257-270.
McGregor, G.R. and Ebi, K., 2018. El Nino Southern Oscillation (ENSO) and Health: An Overview for Climate and Health Researchers. Atmosphere, 9(7): 32.
McGregor, G.R. and Vanos, J.K., 2018. Heat: a primer for public health researchers. Public Health, 161: 138-146.
McIntyre, K.M., Setzkorn, C., Hepworth, P.J., Morand, S., Morse, A.P. and Baylis, M., 2017. Systematic Assessment of the Climate Sensitivity of Important Human and Domestic Animals Pathogens in Europe. Sci Rep, 7(1): 7134.
McIver, L., Hashizume, M., Kim, H., Honda, Y., Pretrick, M., Iddings, S. and Pavlin, B., 2015. Assessment of Climate-sensitive Infectious Diseases in the Federated States of Micronesia. Trop Med Health, 43(1): 29-40.
McIver, L., Kim, R., Woodward, A., Hales, S., Spickett, J., Katscherian, D., Hashizume, M., Honda, Y., Kim, H., Iddings, S., Naicker, J., Bambrick, H., McMichael, A. and Ebi, K., 2016a. Health Impacts of Climate Change in Pacific Island Countries: A Regional Assessment of Vulnerabilities and Adaptation Priorities. Environmental Health Perspectives, 124(11): 1707-1714.
McIver, L.J., Chan, V.S., Bowen, K.J., Iddings, S.N., Hero, K. and Raingsey, P.P., 2016b. Review of Climate Change and Water-Related Diseases in Cambodia and Findings from Stakeholder Knowledge Assessments. Asia Pac J Public Health, 28(2 Suppl): 49S-58S.
McIver, L.J., Imai, C., Buettner, P.G., Gager, P., Chan, V.S., Hashizume, M., Iddings, S.N., Kol, H., Raingsey, P.P. and Lyne, K., 2016c. Diarrheal Diseases and Climate Change in Cambodia. Asia Pac J Public Health, 28(7): 576-585.
Mckinney M, S.P., Rune Dietz, Christian Sonne, Aaron T. Fisk, Denis Roy, Bjørn M. Jenssen, Robert J. Letcher, 2015. A review of ecological impacts of global climate change on persistent organic pollutant and mercury pathways and exposures in arctic marine ecosystems, Current Zoology, Volume 61, Issue 4, 1 August 2015, Pages 617–628, https://doi.org/10.1093/czoolo/61.4.617.
McLeman, R., 2017. Thresholds in climate migration. Population and Environment.
McLeman, R., 2018. Migration and displacement risks due to mean sea-level rise. Bulletin of the Atomic Scientists, 74(3): 148-154.
McLeman, R., 2019. International migration and climate adaptation in an era of hardening borders. Nature Climate Change, 9(12): 911-918.
McLeman, R., Moniruzzaman, M. and Akter, N., 2018. Environmental influences on skilled worker migration from Bangladesh to Canada. Canadian Geographer-Geographe Canadien, 62(3): 352-371.
McLeman, R., Wrathall, D., Gilmore, E., Thornton, P., Adams, H. and Gemenne, F., 2020 submitted. Human migration thresholds and responses in the IPCC risk framework. Climatic Change Letters.
McMichael, A.J., 2014. Climate Change and Children: Health Risks of Abatement Inaction, Health Gains from Action. Children (Basel), 1(2): 99-106.

McMichael, C., 2015. Climate change-related migration and infectious disease. Virulence, 6(6): 548-553.

McMichael, C., Barnett, J. and McMichael, A.J., 2012. An ill wind? Climate change, migration, and health. Environ Health Perspect, 120(5): 646-54.

McMichael, C. and Katonivualiku, M., 2020. Thick temporalities of planned relocation in Fiji. Geoforum, 108: 286-294.

McNamara, K., Bronen, R., Fernando, N. and Klepp, S., 2018. The complex decision-making of climate-induced relocation: adaptation and loss and damage. Climate Policy, 18(1): 111-117.

McNamara, K.E., 2015. Cross-border migration with dignity in Kiribati. Forced Migration Review, 49: 62-62.

McTavish, R.K., Richard, L., McArthur, E., Shariff, S.Z., Acedillo, R., Parikh, C.R., Wald, R., Wilk, P. and Garg, A.X., 2018. Association between High Environmental Heat and Risk of Acute Kidney Injury among Older Adults in a Northern Climate: A Matched Case-Control Study. American Journal of Kidney Diseases, 71(2): 200-208.

Medek, S., Danielle, E., Schwartz, J. and S, M., 2017. Estimated Effects of Future Atmospheric CO2 Concentrations on Protein Intake and the Risk of Protein Deficiency by Country and Region. Environmental Health Perspectives, 125(8): 087002.

Medlock, J.M., Hansford, K.M., Bormane, A., Derdakova, M., Estrada-Pena, A., George, J.C., Golovljova, I., Jaenson, T.G., Jensen, J.K., Jensen, P.M., Kazimirova, M., Oteo, J.A., Papa, A., Pfister, K., Plantard, O., Randolph, S.E., Rizzoli, A., Santos-Silva, M.M., Sprong, H., Vial, L., Hendrickx, G., Zeller, H. and Van Bortel, W., 2013. Driving forces for changes in geographical distribution of Ixodes ricinus ticks in Europe. Parasit Vectors, 6: 1.

Medlock, J.M. and Vaux, A.G.C., 2015. Impacts of the creation, expansion and management of English wetlands on mosquito presence and abundance developing strategies for future disease mitigation. Parasites & Vectors, 8(1): 142.

Melde, S., Laczko, F. and Gemenne, F., 2017. Making mobility work for adaptation to environmental changes: Results from the MECLEP global research, International Organization for Migration, Geneva.

Mellor, J., Kumpel, E., Ercumen, A. and Zimmerman, J., 2016a. Systems Approach to Climate, Water, and Diarrhea in Hubli-Dharwad, India. Environ Sci Technol, 50(23): 13042-13051.

Mellor, J.E., Levy, K., Zimmerman, J., Elliott, M., Bartram, J., Carlton, E., Clasen, T., Dillingham, R., Eisenberg, J., Guerrant, R., Lantagne, D., Mihelcic, J. and Nelson, K., 2016b. Planning for climate change: The need for mechanistic systems-based approaches to study climate change impacts on diarrheal diseases. Sci Total Environ, 548-549: 82-90.

Menz, T. and Welsch, H., 2010. Population aging and environmental preferences in OECD countries: The case of air pollution. Ecological Economics, 69(12): 2582-2589.

Meo, S.A., Abukhalaf, A.A., Alomar, A.A., Al-Beeshi, I.Z., Alhowikan, A., Shafi, K.M., Meo, A.S., Usmani, A.M. and Akram, J., 2020. Climate and COVID-19 pandemic: effect of heat and humidity on the incidence and mortality in world's top ten hottest and top ten coldest countries. Eur Rev Med Pharmacol Sci, 24(15): 8232-8238.

Mercer, J., Kelman, I., do Rosario, F., Lima, A.D.D., da Silva, A., Beloff, A.M. and McClean, A., 2014. Nation-building policies in Timor-Leste: disaster risk reduction, including climate change adaptation. Disasters, 38(4): 690-718.

Mercer, N. and Hanrahan, M., 2017. “Straight from the heavens into your bucket”: domestic rainwater harvesting as a measure to improve water security in a subarctic indigenous community. International Journal of Circumpolar Health, 76(1).

Merkens, J., Lincke, D., Hinkel, J., Brown, S. and Vafeidis, A., 2018a. Regionalisation of population growth projections in coastal exposure analysis. Climatic Change, 151(3-4): 413-426.

Merkens, J.-L., LenaReimann, JochenHinkel and T.Vafeidis, A., 2016. Gridded population projections for the coastal zone under the Shared Socioeconomic Pathways. Global and Planetary Change, 145: 57-66.

Merkens, J.-L., Lincke, D., Hinkel, J., Brown, S. and Vafeidis, A.T., 2018b. Regionalisation of population growth projections in coastal exposure analysis. Climatic Change, 151(3-4): 413-426.

Metallinou, M.-M. and Log, T., 2017. Health Impacts of Climate Change-Induced Subzero Temperature Fires. Int. J. Environ. Res. Public Health, 14(7).

Mezdour, A., Veronis, L. and McLeman, R., 2015. Environmental Influences on Haitian Migration to Canada and Connections to Social Inequality: Evidence from Ottawa-Gatineau and Montreal. In: R. McLeman, J. Schade and T. Faist (Editors). Springer, Dordrecht, pp. 103-116.

Mezdour, A., Veronis, L., McLeman, R., Schade, J. and Faist, T., 2016. Environmental Influences on Haitian Migration to Canada and Connections to Social Inequality: Evidence from Ottawa-Gatineau and Montreal. Environmental Migration and Social Inequality, 61: 103-115.

Michaels, L. and Tal, A., 2015. Convergence and conflict with the 'National Interest': Why Israel abandoned its climate policy. Energy Policy, 87: 480-485.

Michelozzi, P. and de' Donato, F., 2014. [Climate changes, floods, and health consequences]. Recenti Prog Med, 105(2): 48-50.

Middleton, J., Cunsolo, A., Jones-Bitton, A., Wright, C. and Harper, S., 2020. Indigenous mental health in a changing climate: a systematic scoping review of the global literature. Environmental Research Letters, 15(5).

Migration, I.O.f., 2019. World Migration Report.

Milan, B.F. and Creutzig, F., 2015. Reducing urban heat wave risk in the 21st century. Current Opinion in Environmental Sustainability, 14: 221-231.

Milazzo, A., Giles, L.C., Zhang, Y., Koehler, A.P., Hiller, J.E. and Bi, P., 2016a. Heatwaves differentially affect risk of Salmonella serotypes. J Infect, 73(3): 231-40.

Milazzo, A., Giles, L.C., Zhang, Y., Koehler, A.P., Hiller, J.E. and Bi, P., 2016b. The effect of temperature on different Salmonella serotypes during warm seasons in a Mediterranean climate city, Adelaide, Australia. Epidemiol Infect, 144(6): 1231-40.

Milazzo, A., Giles, L.C., Zhang, Y., Koehler, A.P., Hiller, J.E. and Bi, P., 2017. The effects of ambient temperature and heatwaves on daily Campylobacter cases in Adelaide, Australia, 1990-2012. Epidemiol Infect, 145(12): 2603-2610.

Milburn, R., 2014. The roots to peace in the Democratic Republic of Congo: conservation as a platform for green development. International Affairs, 90(4): 871-+.

Miles-Novelo, A. and Anderson, C., 2019. Climate Change and Psychology: Effects of Rapid Global Warming on Violence and Aggression. Current Climate Change Reports, 5(1): 36-46.

Miletto, M., Caretta, M., Burchi, F. and Zanlucchi, G., 2017. Migration and its interdependencies with water scarcity, gender and youth employment. WWAP, Paris.

Milićević, D., Nastasijevic, I. and Petrovic, Z., 2016. Mycotoxin in the food supply chain-implications for public health program. J Environ Sci Health C Environ Carcinog Ecotoxicol Rev, 34(4): 293-319.

Miller, F., 2020. Exploring the consequences of climate-related displacement for just resilience in Vietnam. Urban Studies, 57(7): 1570-1587.

Mills, E.N., 2018. Implicating "fisheries justice' movements in food and climate politics. Third World Quarterly, 39(7): 1270-1289.

Milman, A. and Arsano, Y., 2014. Climate adaptation and development: Contradictions for human security in Gambella, Ethiopia. Global Environmental Change-Human and Policy Dimensions, 29: 349-359.

Milman, A., Bunclark, L., Conway, D. and Adger, W.N., 2013. Assessment of institutional capacity to adapt to climate change in transboundary river basins. Climatic change, 121(4): 755-770.

Milne, S., Mahanty, S., To, P., Dressler, W., Kanowski, P. and Thavat, M., 2019. Learning From 'Actually Existing' REDD plus : A Synthesis of Ethnographic Findings. Conservation & Society, 17(1): 84-95.

Milner, J., Joy, E.J.M., Green, R., Harris, F., Aleksandrowicz, L., Agrawal, S., Smith, P., Haines, A. and Dangour, A.D., 2017. Projected health effects of realistic dietary changes to address freshwater constraints in India: a modelling study. The Lancet Planetary Health, 1(1): e26-e32.

Miner, K.R., Bogdal, C., Pavlova, P., Steinlin, C. and Kreutz, K.J., 2018. Quantitative screening level assessment of human risk from PCBs released in glacial meltwater: Silvretta Glacier, Swiss Alps. Ecotoxicol. Environ. Saf. 166: 251-258.

Miraglia, M., Marvin, H.J.P., Kleter, G.A., Battilani, P., Brera, C., Coni, E., Cubadda, F., Croci, L., De Santis, B., Dekkers, S., Filippi, L., Hutjes, R.W.A., Noordam, M.Y., Pisante, M., Piva, G., Prandini, A., Toti, L., van den Born, G.J. and Vespermann, A., 2009. Climate change and food safety: An emerging issue with special focus on Europe. Food and Chemical Toxicology, 47(5): 1009-1021.

Miranda, M.A., Stegeman, J., Bicout, D., Botner, A., Butterworth, A., Calistri, P., Depner, K., Edwards, S., Garin-Bastuji, B., Margaret, Good, C., Schmidt, V., Michel, S., More, M., Raj, Nielsen, S., Nielsen, L., Sihvonen, H., Spoolder, H. and Dhollander, S., 2017. Bluetongue: control, surveillance and safe movement of animals EFSA Panel on Animal Health and Welfare. EFSA Journal, 15.

Mirumachi, N., Sawas, A. and Workman, M., 2019. Unveiling the security concerns of low carbon development: climate security analysis of the undesirable and unintended effects of mitigation and adaptation. Climate and Development: 1-13.

Missirian, A. and Schlenker, W., 2017. Asylum applications respond to temperature fluctuations. Science, 358(6370): 1610-1614.

Mitchell, D., 2016. Human Influences on Heat-Related Health Indicators during the 2015 Egyptian Heat Wave. Bulletin of the American Meteorological Society, 97: S70-S74.

Mitchell, D., Heaviside, C., Schaller, N., Allen, M., Ebi, K.L., Fischer, E.M., Gasparrini, A., Harrington, L., Kharin, V., Shiogama, H., Sillmann, J., Sippel, S. and Vardoulakis, S., 2018. Extreme heat-related mortality avoided under Paris Agreement goals. Nature Climate Change, 8(7): 551-553.

Mitchell, D., Heaviside, C., Vardoulakis, S., Huntingford, C., Masato, G., Guillod, B., Frumhoff, P., Bowery, A., Wallom, D. and Allen, M., 2016. Attributing human mortality during extreme heat waves to anthropogenic climate change. Environmental Research Letters, 11.

Mitchell, M.I., 2018. Migration, sons of the soil conflict, and international relations. International Area Studies Review, 21(1): 51-67.

Molden, D., Harma, E., Shrestha, A.B., Chettri, N., Pradhan, N.S. and Kotru, R., 2017. Advancing Regional and Transboundary Cooperation in the Conflict-Prone Hindu Kush-Himalaya. Mountain Research and Development, 37(4): 502-508.

Molina, O. and Saldarriaga, V., 2017. The perils of climate change: In utero exposure to temperature variability and birth outcomes in the Andean region. Economics & Human Biology, 24: 111-124.

Molitoris, J., Barclay, K. and Kolk, M., 2018. When Birth Spacing does and Does Not Matter for Child Survival: An International Comparison using the DHS. Research Reports in Demography, 56(4): 1349-1370.

Monaghan, A.J., Moore, S.M., Sampson, K.M., Beard, C.B. and Eisen, R.J., 2015. Climate change influences on the annual onset of Lyme disease in the United States. Ticks Tick Borne Dis, 6(5): 615-22.

Monami, M., Silverii, A. and Mannucci, E., 2020. Potential Impact of Climate on Novel Corona Virus (COVID-19) Epidemic. J Occup Environ Med, 62(7): e371-e372.

Monforti-Ferrario, F., Kona, A., Peduzzi, E., Pernigotti, D. and Pisoni, E., 2018. The impact on air quality of energy saving measures in the major cities signatories of the Covenant of Mayors initiative. Environ. Int., 118: 222-234.

Moore, F., Obradovich, N., Lehner, F. and Baylis, P., 2019. Rapidly declining remarkability of temperature anomalies may obscure public perception of climate change. Proceedings of the National Academy of Sciences of the United States of America, 116(11): 4905-4910.

Mora, C., Counsell Chelsie, W.W., Bielecki Coral, R. and Louis Leo, V., 2017a. Twenty-Seven Ways a Heat Wave Can Kill You. Circulation: Cardiovascular Quality and Outcomes, 10(11): e004233.

Mora, C., Dousset, B., Caldwell, I.R., Powell, F.E., Geronimo, R.C., Bielecki, C.R., Counsell, C.W., Dietrich, B.S., Johnston, E.T., Louis, L.V., Lucas, M.P., McKenzie, M.M., Shea, A.G., Tseng, H., Giambelluca, T., Leon, L.R., Hawkins, E. and Trauernicht, C., 2017b. Global risk of deadly heat. Nature Climate Change, 7(7): 501-+.

Morabito, S., Silvestro, S. and Faggio, C., 2018. How the marine biotoxins affect human health. Nat Prod Res, 32(6): 621-631.

Morales, I., Salje, H., Saha, S. and Gurley, E.S., 2016. Seasonal Distribution and Climatic Correlates of Dengue Disease in Dhaka, Bangladesh. Am J Trop Med Hyg, 94(6): 1359-61.

Morchain, D., Prati, G., Kelsy, F. and Ravon, L., 2015. What if gender became an essential, standard element of vulnerability assessments? Gender and Development, 23(3): 481-496.

Morefield, P.E., Fann, N., Grambsch, A., Raich, W. and Weaver, C.P., 2018. Heat-Related Health Impacts under Scenarios of Climate and Population Change. International Journal of Environmental Research and Public Health, 15(11).

Moreno-Serra, R. and Smith, P., 2012. Does Progress Towards Universal Health Coverage Improve Population Health. Lancet, 380: 917-23.

Morens, D.M. and Fauci, A.S., 2014. Chikungunya at the door--deja vu all over again? N Engl J Med, 371(10): 885-7.

Moretti, A., Pascale, M. and Logrieco, A.F., 2019. Mycotoxin risks under a climate change scenario in Europe. Trends Food Sci. Technol., 84: 38-40.

Morgese, M. and Trabace, L., 2016. Maternal malnutrition in the etiopathogenesis of psychiatric diseases: role of polyunsaturated fatty acids. Brain Sciences, 6(3): 24.

Morral-Puigmal, C., Martínez-Solanas, È., Villanueva, C.M. and Basagaña, X., 2018. Weather and gastrointestinal disease in Spain: A retrospective time series regression study. Environ Int, 121(Pt 1): 649-657.

Morris, A., Gozlan, R.E., Hassani, H., Andreou, D., Couppié, P. and Guégan, J.F., 2014. Complex temporal climate signals drive the emergence of human water-borne disease. Emerg Microbes Infect, 3(8): e56.

Morrow, G. and Bowen, K., 2014. Accounting for health in climate change policies: a case study of Fiji. Glob Health Action, 7: 23550.

Mortreux, C. and Barnett, J., 2017. Adaptive capacity: exploring the research frontier. Wiley Interdisciplinary Reviews-Climate Change, 8(4): 12.

Mosuela, C., Matias, D., Hillmann, F., Pahl, M., Rafflenbeul, B. and Sterly, H., 2015. The Role of a Priori Cross-Border Migration after Extreme Climate Events: The Case of the Philippines after Typhoon Haiyan. Environmental Change, Adaptation and Migration: Bringing in the Region: 98-116.

Mourad, K.A. and Alshihabi, O., 2016. Assessment of future Syrian water resources supply and demand by the WEAP model. Hydrological Sciences Journal-Journal Des Sciences Hydrologiques, 61(2): 393-401.

Mpandeli, S., Naidoo, D., Mabhaudhi, T., Nhemachena, C., Nhamo, L., Liphadzi, S., Hlahla, S. and Modi, A.T., 2018. Climate Change Adaptation through the Water-Energy-Food Nexus in Southern Africa. Int J Environ Res Public Health, 15(10).

Mudd, L., Rosowsky, D., Letchford, C. and Lombardo, F., 2017. Joint Probabilistic Wind–Rainfall Model for Tropical Cyclone Hazard Characterization. Journal of Structural Engineering, 143(3).

Mueller, V., Gray, C. and Kosec, K., 2014. Heat stress increases long-term human migration in rural Pakistan. Nature Climate Change, 4: 182-185.

Mueller, V., Sheriff, G., Dou, X. and Gray, C., 2020. Temporary migration and climate variation in eastern Africa. World Development, 126.

Mugambiwa, S., 2018. Adaptation measures to sustain indigenous practices and the use of indigenous knowledge systems to adapt to climate change in Mutoko rural district of Zimbabwe. Jamba-Journal of Disaster Risk Studies, 10.

Mukabutera, A., Thomson, D., Murray, M., Basinga, P., Nyirazinyoye, L., Atwood, S., Savage, K.P., Ngirimana, A. and Hedt-Gauthier, B.L., 2016. Rainfall variation and child health: effect of rainfall on diarrhea among under 5 children in Rwanda, 2010. BMC Public Health, 16: 731.

Muller, M.F., Yoon, J., Gorelick, S.M., Avisse, N. and Tilmant, A., 2016. Impact of the Syrian refugee crisis on land use and transboundary freshwater resources. Proceedings of the National Academy of Sciences of the United States of America, 113(52): 14932-14937.

Mullins, J. and White, C., 2019. Temperature and mental health: Evidence from the spectrum of mental health outcomes. Journal of Health Economics, 68.

Mulwa, C. and Visser, M., 2020. Farm diversification as an adaptation strategy to climatic shocks and implications for food security in northern Namibia. World Development, 129.

Mure-Ravaud, M., Kavvas, M. and Dib, A., 2019a. Investigation of Intense Precipitation from Tropical Cyclones during the 21st Century by Dynamical Downscaling of CCSM4 RCP 4.5. International Journal of Environmental Research and Public Health, 16: 687.

Mure-Ravaud, M., Kavvas, M. and Dib, A., 2019b. Investigation of Intense Precipitation from Tropical Cyclones during the 21st Century by Dynamical Downscaling of CCSM4 RCP 4.5. International Journal of Environmental Research and Public Health, 16(5).

Mure-Ravaud, M., Levent Kavvas, M. and Dib, A., 2019c. Investigation of Intense Precipitation from Tropical Cyclones during the 21st Century by Dynamical Downscaling of CCSM4 RCP 4.5. International Journal of Environmental Research and Public Health, 16(5): 687-687.

Murphy, H.M., Pintar, K.D., McBean, E.A. and Thomas, M.K., 2014. A systematic review of waterborne disease burden methodologies from developed countries. J Water Health, 12(4): 634-55.

Murray, C.J.e.a., 2020. Five insights from the global burden of disease study 2019. The Lancet, 396(10258): 1135-1139.

Murray, C.J.L., Abbafati, C., Abbas, K.M., Abbasi, M., Abbasi-Kangevari, M., Abd-Allah, F., Abdollahi, M., Abedi, P., Abedi, A. and Abolhassani, H., 2020a. - Five insights from the Global Burden of Disease Study 2019. - 396(-10258).

Murray, C.J.L., Aravkin, A.Y., Zheng, P., Abbafati, C., Abbas, K.M., Abbasi-Kangevari, M., Abd-Allah, F., Abdelalim, A., Abdollahi, M. and Abdollahpour, I., 2020b. - Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. - 396(- 10258).

Murray, C.J.L. and Lopez, A.D., 2017. Measuring global health: motivation and evolution of the Global Burden of Disease Study. Lancet, 390(10100): 1460-1464.

Musengimana, G., Mukinda, F.K., Machekano, R. and Mahomed, H., 2016. Temperature Variability and Occurrence of Diarrhoea in Children under Five-Years-Old in Cape Town Metropolitan Sub-Districts. Int J Environ Res Public Health, 13(9).

Mustafa, D., Anwar, N., Geography, A.S.P. and undefined, Gender, global terror, and everyday violence in urban Pakistan. Elsevier.

Mutheneni, S.R., Morse, A.P., Caminade, C. and Upadhyayula, S.M., 2017. Dengue burden in India: recent trends and importance of climatic parameters. Emerg Microbes Infect, 6(8): e70.

Muthers, S., Laschewski, G. and Matzarakis, A., 2017. The Summers 2003 and 2015 in South-West Germany: Heat Waves and Heat-Related Mortality in the Context of Climate Change. Atmosphere, 8 (11).

Myers, S.S., Zanobetti, A., Kloog, I., Huybers, P., Leakey, A.D.B., Bloom, A.J., Carlisle, E., Dietterich, L.H., Fitzgerald, G., Hasegawa, T., Holbrook, N.M., Nelson, R.L., Ottman, M.J., Raboy, V., Sakai, H., Sartor, K.A., Schwartz, J., Seneweera, S., Tausz, M. and Usui, Y., 2014. Increasing CO2 threatens human nutrition. Nature, 510: 139.

Mygind, L., Kjeldsted, E., Hartmeyer, R.D., Mygind, E., Bølling, M. and Bentsen, P., 2019. Immersive Nature-Experiences as Health Promotion Interventions for Healthy, Vulnerable, and Sick Populations? A Systematic Review and Appraisal of Controlled Studies. Frontiers in psychology, 10: 943-943.

Myrttinen, H., Khattab, L. and Maydaa, C., 2017. ‘Trust no one, beware of everyone’. Routledge, Abingdon, Oxon; New York, NY: Routledge, 2017. pp. 61-76.

Myrttinen, H., Naujoks, J. and Schilling, J., 2015. Gender, Natural Resources, and Peacebuilding in Kenya and Nepal. Peace Review, 27(2): 181-187.

Na, W., Lee, K.E., Myung, H.N., Jo, S.N. and Jang, J.Y., 2016. Incidences of Waterborne and Foodborne Diseases after Meteorologic Disasters in South Korea. Ann Glob Health, 82(5): 848-857.

Nagarajan, C., Pohl, B., Rittinger, L., Sylvestre, F., Vivekananda, J., Wall, M. and Wolfmaier, S., 2018. Climate fragility profile: lake Chad Basilisks.

Nagel, J., 2015. Gender, Conflict, and the Militarization of Climate Change Policy. Peace Review-a Journal of Social Justice, 27(2): 202-208.

Nagoda, S. and Nightingale, A., 2017. Participation and Power in Climate Change Adaptation Policies: Vulnerability in Food Security Programs in Nepal. World Development, 100: 85-93.

Nalau, J., Preston, B. and C. Maloney, M., 2015. Is adaptation a local responsibility?, 48.

Nanvyat, N., Mulambalah, C.S., Barshep, Y., Ajiji, J.A., Dakul, D.A. and Tsingalia, H.M., 2018. Malaria transmission trends and its lagged association with climatic factors in the highlands of Plateau State, Nigeria. Trop Parasitol, 8(1): 18-23.

Narain, V. and Singh, A.K., 2017. Flowing against the current: The socio-technical mediation of water (in) security in periurban Gurgaon, India. Geoforum, 81: 66-75.

Nardulli, P.F., Peyton, B. and Bajjalieh, J., 2015. Climate Change and Civil Unrest: The Impact of Rapid-onset Disasters. Journal of Conflict Resolution, 59(2): 310-335.

Natarajan, N., Brickell, K. and Parsons, L., 2019a. Climate change adaptation and precarity across the rural–urban divide in Cambodia: Towards a ‘climate precarity’approach. Environment and Planning E: Nature and Space, 2(4): 899-921.

Natarajan, N., Parsons, L. and Brickell, K., 2019b. Debt-Bonded Brick Kiln Workers and Their Intent to Return: Towards a Labour Geography of Smallholder Farming Persistence in Cambodia. Antipode, 51(5): 1581-1599.

Nathan, D. and Fischhendler, I., 2016. Triggers for securitization: a discursive examination of Israeli-Palestinian water negotiations. Water Policy, 18(1): 19-38.

Naumann, G., Alfieri, L., Wyser, K., Mentaschi, L., Betts, R., Carrao, H., Spinoni, J., Vogt, J. and Feyen, L., 2018. Global Changes in Drought Conditions under Different Levels of Warming. Geophysical Research Letters, 45.

Navarro, J., Pulido, R., Berger, C., Arteaga, M., Osofsky, J., Martinez, M. and Hansel, C., 2016. Children's disaster experiences and psychological symptoms: An international comparison between the Chilean earthquake and tsunami and Hurricane Katrina. International Social Work, 59(4): 545-558.

Nawrotzki, R. and DeWaard, J., 2016. Climate shocks and the timing of migration from Mexico. Population and Environment, 38(1): 72-100.

Nawrotzki, R. and DeWaard, J., 2018a. Putting trapped populations into place: Climate change and inter-district migration flows in Zambia. Regional Environmental Change, 18(2): 533-546.

Nawrotzki, R.J. and Bakhtsiyarava, M., 2017. International Climate Migration: Evidence for the Climate Inhibitor Mechanism and the Agricultural Pathway. Population, Space and Place, 23(4): e2033-e2033.

Nawrotzki, R.J. and DeWaard, J., 2018b. Putting trapped populations into place: climate change and inter-district migration flows in Zambia. Regional Environmental Change, 18(2): 533-546.

Nawrotzki, R.J., DeWaard, J., Bakhtsiyarava, M. and Ha, J.T., 2017. Climate shocks and rural-urban migration in Mexico: exploring nonlinearities and thresholds. Climatic Change, 140(2): 243-258.

Nawrotzki, R.J., Hunter, L.M., Runfola, D.M. and Riosmena, F., 2015. Climate change as a migration driver from rural and urban Mexico. Environmental Research Letters, 10: 114023-114023.

Nawrotzki, R.J., Riosmena, F. and Hunter, L.M., 2013. Do Rainfall Deficits Predict U.S.-Bound Migration from Rural Mexico? Evidence from the Mexican Census. Population Research and Policy Review, 32(1): 129-158.

Nayak, S.G., Shrestha, S., Kinney, P.L., Ross, Z., Sheridan, S.C., Pantea, C.I., Hsu, W.H., Muscatiello, N. and Hwang, S.A., 2018. Development of a heat vulnerability index for New York State. Public Health, 161: 127-137.

Ndhlovu, N., Saito, O., Djalante, R. and Yagi, N., 2017. Assessing the Sensitivity of Small-Scale Fishery Groups to Climate Change in Lake Kariba, Zimbabwe. Sustainability, 9(12).

Neef, A., Benge, L., Boruff, B., Pauli, N., Weber, E. and Varea, R., 2018. Climate adaptation strategies in Fiji: The role of social norms and cultural values. World Development, 107: 125-137.

Network, G.B.o.D.H.F.C., 2018. Trends in future health financing and coverage: future health spending and universal health coverage in 188 countries, 2016-40. Lancet, 391(10132): 1783-1798.

Neumann, B., Vafeidis, A.T., Zimmermann, J. and Nicholls, R.J., 2015a. Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment. PLoS ONE, 10(6): e0131375-e0131375.

Neumann, J.E., Anenberg, S.C., Weinberger, K.R., Amend, M., Gulati, S., Crimmins, A., Roman, H., Fann, N. and Kinney, P.L., 2019. Estimates of Present and Future Asthma Emergency Department Visits Associated With Exposure to Oak, Birch, and Grass Pollen in the United States. GeoHealth, 3(1): 11-27.

Neumann, K. and Hermans, F., 2015. What Drives Human Migration in Sahelian Countries? A Meta-analysis. Population, Space and Place.

Neumann, K., Sietz, D., Hilderink, H., Janssen, P., Kok, M. and van Dijka, H., 2015b. Environmental drivers of human migration in drylands – A spatial picture. Applied Geography, 56: 116-126.

Newman, E., 2004. The 'New wars' debate: A historical perspective is needed. Security Dialogue, 35(2): 173-189.

Newnham, E., Titov, N. and McEvoy, P., 2020. Preparing mental health systems for climate crisis. Lancet Planetary Health, 4(3): E89-E90.

NFPC, 2018. Guidelines for sustainable food policies. Nordic Food Policy Lab. Nordic Council.

Ngaruiya, G.W. and Scheffran, J., 2016. Actors and networks in resource conflict resolution under climate change in rural Kenya. Earth System Dynamics, 7(2): 441-452.

Ngigi, M., Mueller, U. and Birner, R., 2017. Gender differences in climate change adaptation strategies and participation in group-based approaches: An intra-household analysis from rural Kenya. Ecological Economics, 138: 99-108.

Ngo, N.S. and Horton, R.M., 2016. Climate change and fetal health: The impacts of exposure to extreme temperatures in New York City. Environ Res, 144(Pt A): 158-164.

Nguyen, V.K., Parra-Rojas, C. and Hernandez-Vargas, E.A., 2018. The 2017 plague outbreak in Madagascar: Data descriptions and epidemic modelling. Epidemics, 25: 20-25.

Ngwa, M.C., Liang, S., Kracalik, I.T., Morris, L., Blackburn, J.K., Mbam, L.M., Ba Pouth, S.F., Teboh, A., Yang, Y., Arabi, M., Sugimoto, J.D. and Morris, J.G., Jr., 2016. Cholera in Cameroon, 2000-2012: Spatial and Temporal Analysis at the Operational (Health District) and Sub Climate Levels. PLoS Negl Trop Dis, 10(11): e0005105.

Nhapi, T.G., 2019. Socioeconomic Barriers to Universal Health Coverage in Zimbabwe: Present Issues and Pathways toward Progress. Journal of Developing Societies, 35(1): 153-174.

Nicholls, R.J., Hanson, S., Herweijer, C., Patmore, N., Hallegatte, S., Corfee-Morlot, J., Chateau, J. and Muir-Wood, R., 2007. Ranking of the world's cities most exposed to coastal flooding today and in the future. Organisation for Economic Co-operation and Development (OECD), Paris.

Nichols, A., 2019a. Climate change, natural hazards, and relocation: insights from Nabukadra and Navuniivi villages in Fiji. Climatic Change, 156(1-2): 255-271.

Nichols, A., 2019b. Climate change, natural hazards, and relocation: insights from Nabukadra and Navuniivi villages in Fiji. Climatic Change, 156(1): 255-271.

Nightingale, A., 2017. Power and politics in climate change adaptation efforts: struggles over authority and recognition in the context of political instability. Geoforum, 84: 11-20.

Nisbet, E.K., Zelenski, J.M. and Murphy, S.A., 2011. Happiness is in our Nature: Exploring Nature Relatedness as a Contributor to Subjective Well-Being. Journal of Happiness Studies, 12(2): 303-322.

Nkanga, M.S.N., Longo-Mbenza, B., Adeniyi, O.V., Ngwidiwo, J.B., Katawandja, A.L., Kazadi, P.R.B. and Nzonzila, A.N., 2017. Ageing, exposure to pollution, and interactions between climate change and local seasons as oxidant conditions predicting incident hematologic malignancy at KINSHASA University clinics, Democratic Republic of CONGO (DRC). BMC Cancer, 17(1): 559.

Noelke, C., McGovern, M., Corsi, D.J., Jimenez, M.P., Stern, A., Wing, I.S. and Berkman, L., 2016. Increasing ambient temperature reduces emotional well-being. Environmental Research, 151: 124-129.

Noonan, O. and Kevlihan, R., 2018. Managing conflict in north-west Kenya: the siege of Loregon and its aftermath. Conflict Security & Development, 18(2): 137-157.

Noradilah, S.A., Moktar, N., Anuar, T.S., Lee, I.L., Salleh, F.M., Manap, S.N.A.A., Mohtar, N.S.H.M., Azrul, S.M., Abdullah, W.O., Nordin, A. and Abdullah, S.R., 2017. Molecular epidemiology of blastocystosis in Malaysia: does seasonal variation play an important role in determining the distribution and risk factors of Blastocystis subtype infections in the Aboriginal community? Parasit Vectors, 10(1): 360.

Novak Babič, M., Zupančič, J., Brandão, J. and Gunde-Cimerman, N., 2018. Opportunistic Water-Borne Human Pathogenic Filamentous Fungi Unreported from Food. Microorganisms, 6(3).

Novarro, A.J., Gabor, C.R., Goff, C.B., Mezebish, T.D., Thompson, L.M. and Grayson, K.L., 2018. Physiological responses to elevated temperature across the geographic range of a terrestrial salamander. J Exp Biol, 221(Pt 18).

Nunes, A.R., 2016. Assets for health: linking vulnerability, resilience and adaptation to climate change. 1-41.

Nunes, A.R., 2018. The contribution of assets to adaptation to extreme temperatures among older adults. PLoS One, 13(11).

Nunes, A.R., 2019. General and specified vulnerability to extreme temperatures among older adults. International Journal of Environmental Health Research: 1-18.

Nunfam, V.F., Adusei-Asante, K., Van Etten, E.J., Oosthuizen, J. and Frimpong, K., 2018. Social impacts of occupational heat stress and adaptation strategies of workers: A narrative synthesis of the literature. Science of the Total Environment, 643: 1542-1552.

Nurse, K., 2019. Migration, Diasporas, Remittances and the Sustainable Development Goals in Least Developed Countries. Journal of Globalization and Development, 9(2): 20190006.

Nursey-Bray, M., 2017. Towards socially just adaptive climate governance: the transformative potential of conflict. Local Environment, 22(2): 156-171.

Nursey-Bray, M. and Palmer, R., 2018. Country, climate change adaptation and colonisation: insights from an Indigenous adaptation planning process, Australia. Heliyon, 4(3).

Nursey-Bray, M., Palmer, R., Stuart, A., Arbon, V. and Rigney, L.-I., 2020. Scale, colonisation and adapting to climate change: Insights from the Arabana people, South Australia. Geoforum, 114: 138-150.

Nutsford, D., A. L. Pearson, and, S.K. and Reitsma, F., 2016. Residential exposure to visible blue space (but not green space) associated with lower psychological distress in a capital city. Health Place, 39: 70-78.

Nyantakyi-Frimpong, H., 2017. Agricultural diversification and dietary diversity: A feminist political ecology of the everyday experiences of landless and smallholder households in northern Ghana. Geoforum, 86: 63-75.

Nyberg, G., Knutsson, P., Ostwald, M., Öborn, I., Wredle, E., Otieno, D.J., Mureithi, S., Mwangi, P., Said, M.Y., Jirström, M., Grönvall, A., Wernersson, J., Svanlund, S., Saxer, L., Geutjes, L., Karmebäck, V., Wairore, J.N., Wambui, R., Malmer, van De Leeuw, J. and Malmer, A., 2015. Enclosures in West Pokot, Kenya: Transforming land, livestock and livelihoods in drylands. Pastoralism, 5.

O'Loughlin, J., Linke, A.M. and Witmer, F.D.W., 2014. Effects of temperature and precipitation variability on the risk of violence in sub-Saharan Africa, 1980-2012. Proceedings of the National Academy of Sciences of the United States of America, 111(47): 16712-16717.

Oakes, R., 2019. Culture, climate change and mobility decisions in Pacific Small Island Developing States. Population and Environment, 40(4): 480-503.

Obaidat, M.M. and Roess, A.A., 2018. First report on seroprevalence and risk factors of dengue virus in Jordan. Trans R Soc Trop Med Hyg, 112(6): 279-284.

Obokata, R. and Veronis, L., 2018. Transnational approaches to remittances, risk reduction, and disaster relief: Evidence from post-Typhoon Haiyan experiences of Filipino immigrants in Canada. In: R. McLeman and F. Gemenne (Editors). Routledge, London.

Obokata, R., Veronis, L. and McLeman, R., 2014. Empirical research on international environmental migration: a systematic review. Population and Environment, 36(1): 111-135.

Obradovich, N. and Fowler, J.H., 2017. Climate change may alter human physical activity patterns. Nature Human Behaviour, 1: 0097.

Obradovich, N., Migliorini, R., Mednick, S.C. and Fowler, J.H., 2017. Nighttime temperature and human sleep loss in a changing climate. Science advances, 3(5): e1601555-e1601555.

Obradovich, N., Migliorini, R., Paulus, M.P. and Rahwan, I., 2018. Empirical evidence of mental health risks posed by climate change. Proceedings of the National Academy of Sciences of the United States of America, 115(43): 10953-10958.

Ocello, C., Petrucci, A., Testa, M. and Vignoli, D., 2015. Environmental aspects of internal migration in Tanzania. Population and Environment, 37(1): 99-108.

Odame, E.A., Li, Y., Zheng, S., Vaidyanathan, A. and Silver, K., 2018. Assessing Heat-Related Mortality Risks among Rural Populations: A Systematic Review and Meta-Analysis of Epidemiological Evidence. International journal of environmental research and public health, 15(8): 1597.

Ogunbode, A., Demski, C., Capstick, B. and Sposato, G., 2019. Attribution Matters: Revisiting the link between extreme weather experience and climate change mitigation responses. Global Environmental Change, 54: 31-39.

Okoli, A. and Lenshie, N.E., 2018. Nigeria: Nomadic Migrancy and Rural Violence. Conflict Studies Quarterly (25): 68-85.

Okpara, U.T., Stringer, L.C. and Dougill, A.J., 2016. Perspectives on contextual vulnerability in discourses of climate conflict. Earth System Dynamics, 7(1): 89-102.

Okpara, U.T., Stringer, L.C. and Dougill, A.J., 2018. Integrating climate adaptation, water governance and conflict management policies in lake riparian zones: Insights from African drylands. Environmental Science & Policy, 79: 36-44.

Olaniyan, A. and Okeke-Uzodike, U., 2015. DESPERATE GUESTS, UNWILLING HOSTS: CLIMATE CHANGE-INDUCED MIGRATION AND FARMER-HERDER CONFLICTS IN SOUTHWESTERN NIGERIA. Conflict Studies Quarterly (10): 23-40.

Oloukoi, G., Bob, U. and Jaggernath, J., 2014. Perception and trends of associated health risks with seasonal climate variation in Oke-Ogun region, Nigeria. Health Place, 25: 47-55.

Organization, W.H., 2014. Gender, climate change and health. Current Allergy & Asthma Reports, 12(6): 485-94.

Organization, W.H., 2016. Global report on diabetes, Geneva.

Organization, W.H., 2018. COP24 Special Report on Health and Climate Change.

Orloy, M., 2019. INVESTIGATION OF THE PROCESS OF EXPLOSIVE LOADING OF FRESHWATER ICE. Thermal Science, 23: S561-S567.

Orru, H., Ebi, K.L. and Forsberg, B., 2017. The Interplay of Climate Change and Air Pollution on Health. Curr Environ Health Rep, 4(4): 504-513.

Orru, K., Orru, H., Maasikmets, M., Hendrikson, R. and Ainsaar, M., 2016. Well-being and environmental quality: Does pollution affect life satisfaction? Quality of Life Research, 25(3): 699-705.

Osberghaus, D. and Kühling, J., 2016. Direct and indirect effects of weather experiences on life satisfaction–which role for climate change expectations? Journal of Environmental Planning and Management, 59(12): 2198-2230.

Ostby, G., 2016. Rural-urban migration, inequality and urban social disorder: Evidence from African and Asian cities. Conflict Management and Peace Science, 33(5): 491-515.

Otte im Kampe, E., Kovats, S. and Hajat, S., 2016. Impact of high ambient temperature on unintentional injuries in high-income countries: A narrative systematic literature review. BMJ Open, 6: e010399.

Otto, I.M., Reckien, D., Reyer, C.P.O., Marcus, R., Masson, V.L., Jones, L., Norton, A. and Serdeczny, O., 2017. Social vulnerability to climate change: a review of concepts and evidence. Regional Environmental Change, 17(6): 1651-1662.

Ouattara, B. and Strobl, E., 2014. Hurricane strikes and local migration in US coastal counties. Economics Letters, 124(1): 17-20.

Ouedraogo, N., Ngangas, S.M., Bonkoungou, I.J., Tiendrebeogo, A.B., Traore, K.A., Sanou, I., Traore, A.S. and Barro, N., 2017. Temporal distribution of gastroenteritis viruses in Ouagadougou, Burkina Faso: seasonality of rotavirus. BMC Public Health, 17(1): 274.

Owain, E.L. and Maslin, M.A., 2018a. Assessing the relative contribution of economic, political and environmental factors on past conflict and the displacement of people in East Africa. Palgrave Communications, 4(1): 1-9.

Owain, E.L. and Maslin, M.A., 2018b. Assessing the relative contribution of economic, political and environmental factors on past conflict and the displacement of people in East Africa. Palgrave Communications, 4.

Oyebanjo, E. and Bushell, F., 2014. A critical evaluation of the UK SunSmart campaign and its relevance to Black and minority ethnic communities. Perspect. Public Health, 134(3): 144-149.

Paavola, J., 2017. Health impacts of climate change and health and social inequalities in the UK. Environ Health, 16(Suppl 1): 113.

Padikkal, S., Sumam, K.S. and Sajikumar, N., 2018. Sustainability indicators of water sharing compacts. Environment Development and Sustainability, 20(5): 2027-2042.

Paerl, H.W., Gardner, W.S., Havens, K.E., Joyner, A.R., McCarthy, M.J., Newell, S.E., Qin, B. and Scott, J.T., 2016. Mitigating cyanobacterial harmful algal blooms in aquatic ecosystems impacted by climate change and anthropogenic nutrients. Harmful Algae, 54: 213-222.

Palomino-Schalscha, M., Leaman-Constanzo, C. and Bond, S., 2016. Contested water, contested development: unpacking the hydro-social cycle of the Nuble River, Chile. Third World Quarterly, 37(5): 883-901.

Panel, E., 2015. Urgent advice on lumpy skin disease EFSA Panel on Animal Health and Welfare. EFSA Journal, 13(1): 73.

Park, C., Vogel, E., Larson, L., Myers, S., Daniel, M. and Biggs, B.-A., 2019. The global effect of extreme weather events on nutrient supply: a superposed epoch analysis. The Lancet Planetary Health, 3: e429-e438.

Park, M.S., Park, K.H. and Bahk, G.J., 2018a. Combined influence of multiple climatic factors on the incidence of bacterial foodborne diseases. Sci Total Environ, 610-611: 10-16.

Park, M.S., Park, K.H. and Bahk, G.J., 2018b. Interrelationships between Multiple Climatic Factors and Incidence of Foodborne Diseases. Int J Environ Res Public Health, 15(11).

Park, R.J., Goodman, J. and Behrer, A.P., 2020a. Learning is inhibited by heat exposure, both internationally and within the United States. Nature Human Behaviour.

Park, S., Allen, R.J. and Lim, C.H., 2020b. - A likely increase in fine particulate matter and premature mortality under future climate change. - 13(- 2).

Parker, E.R., 2020. - The influence of climate change on skin cancer incidence–A review of the evidence.

Parolari, A.J., Li, D., Bou-Zeid, E., Katul, G.G. and Assouline, S., 2016. Climate, not conflict, explains extreme Middle East dust storm. Environmental Research Letters, 11(11). Parsons, L., 2018. Structuring the emotional landscape of climate change migration: Towards climate mobilities in geography. Progress in Human Geography,

Parvez, M.K. and Parveen, S., 2017. Evolution and Emergence of Pathogenic Viruses: Past, Present, and Future. Intervirology, 60(1-2): 1-7.

Paton, D., Buergelt, P.T., Tedim, F. and McCaffrey, S., 2015. Wildfires: International Perspectives on Their Social—Ecological Implications. In: J.F. Shroder and D. Paton (Editors). Elsevier, New York, pp. 1-14.

Patz, J.A., Frumkin, H., Holloway, T., Vimont, D.J. and Haines, A., 2014a. Climate change: challenges and opportunities for global health. JAMA, 312(15): 1565-80.

Patz, J.A., Grabow, M.L. and Limaye, V.S., 2014b. When it rains, it pours: future climate extremes and health. Ann Glob Health, 80(4): 332-44.

Paul, K.I. and Moser, K., 2009. Unemployment impairs mental health: Meta-analyses. Journal of Vocational Behavior, 74(3): 264-282.

Paz, S. and Semenza, J.C., 2016. El Nino and climate change--contributing factors in the dispersal of Zika virus in the Americas? Lancet, 387(10020): 745.

Paz, S., Negev, M., Clermont, A. and Green, M.S., 2016. Health Aspects of Climate Change in Cities with Mediterranean Climate, and Local Adaptation Plans. International journal of environmental research and public health, 13(4): 438-438.

Paz, S., Malkinson, D., Green, M.S., Tsioni, G., Papa, A., Danis, K., Sirbu, A., Ceianu, C., Katalin, K., Ferenczi, E., Zeller, H. and Semenza, J.C., 2013. Permissive summer temperatures of the 2010 European West Nile fever upsurge. PLoS One, 8(2): e56398.

Pelling, M. and Dill, K., 2010. Disaster politics: tipping points for change in the adaptation of sociopolitical regimes. Progress in human geography, 34(1): 21-37.

Pena-Garcia, V.H., Triana-Chavez, O. and Arboleda-Sanchez, S., 2017. Estimating Effects of Temperature on Dengue Transmission in Colombian Cities. Ann Glob Health, 83(3-4): 509-518.

Peng, W., Yang, J., Lu, X. and Mauzerall, D.L., 2018. Potential co-benefits of electrification for air quality, health, and CO2 mitigation in 2030 China. Appl. Energy, 218: 511-519.

Peng, W., Yang, J., Wagner, F. and Mauzerall, L., 2017. Substantial air quality and climate co-benefits achievable now with sectoral mitigation strategies in China. Science of the Total Environment, 598: 1076-1084.

Peregrine, P.N., 2019. Reducing post-disaster conflict: a cross-cultural test of four hypotheses using archaeological data. Environmental Hazards-Human and Policy Dimensions, 18(2): 93-110.

Perez, C., Jones, E., Kristjanson, P., Cramer, L., Thornton, P., F ö rch, W. and Barahona, C., 2015. How resilient are farming households and communities to a changing climate in Africa? A gender-based perspective. Global Environmental Change, 34: 95-107.

Perkins, S.E. and Alexander, L.V., 2013. On the Measurement of Heat Waves. Journal of Climate, 26(13): 4500-4517.

Peters, K., 2018. Disasters, climate change, and securitisation: the United Nations Security Council and the United Kingdom's security policy. Disasters, 42: S196-S214.

Petersen-Perlman, J.D. and Fischhendler, I., 2018. The weakness of the strong: re-examining power in transboundary water dynamics. International Environmental Agreements-Politics Law and Economics, 18(2): 275-294.

Petitti, D.B., Hondula, D.M., Yang, S., Harlan, S.L. and Chowell, G., 2016. Multiple Trigger Points for Quantifying Heat-Health Impacts: New Evidence from a Hot Climate. Environmental health perspectives, 124(2): 176-183.

Petkova, E., Ebi, K., Culp, D. and Redlener, I., 2015. Climate Change and Health on the US Gulf Coast: Public Health Adaptation is needed to Address Future Risks. International Journal of Environmental Research and Public Health, 12(8): 9342-9356.

Phalkey, R. and Louis, V., 2016. Two hot to handle: How do we manage the simultaneous impacts of climate change and natural disasters on human health? European Physical Journal-Special Topics, 225(3): 443-457.

Phalkey, R.K., Aranda-Jan, C., Marx, S., Höfle, B. and Sauerborn, R., 2015. Systematic review of current efforts to quantify the impacts of climate change on undernutrition. Proc. Natl. Acad. Sci. U. S. A., 112(33): E4522-9.

Phelan, A.L., Katz, R. and Gostin, L.O., 2020. The Novel Coronavirus Originating in Wuhan, China Challenges for Global Health Governance. Jama-Journal of the American Medical Association, 323(8): 709-710.

Philipsborn, R., Ahmed, S.M., Brosi, B.J. and Levy, K., 2016. Climatic Drivers of Diarrheagenic Escherichia coli Incidence: A Systematic Review and Meta-analysis. J Infect Dis, 214(1): 6-15.

Phillis, Y.A., Chairetis, N., Grigoroudis, E., Kanellos, F.D. and Kouikoglou, V.S., 2018. Climate security assessment of countries. Climatic Change, 148(1-2): 25-43.

Phung, D., Chu, C., Rutherford, S., Nguyen, H.L.T., Do, C.M. and Huang, C.R., 2017. Heatwave and risk of hospitalization: A multi-province study in Vietnam. Environmental Pollution, 220: 597-607.

Phung, D., Huang, C., Rutherford, S., Chu, C., Wang, X. and Nguyen, M., 2015a. Climate change, water quality, and water-related diseases in the Mekong Delta Basin: a systematic review. Asia Pac J Public Health, 27(3): 265-76.

Phung, D., Huang, C., Rutherford, S., Chu, C., Wang, X., Nguyen, M., Nguyen, N.H. and Manh, C.D., 2015b. Identification of the prediction model for dengue incidence in Can Tho city, a Mekong Delta area in Vietnam. Acta Trop, 141(Pt A): 88-96.

Phung, D., Huang, C., Rutherford, S., Chu, C., Wang, X., Nguyen, M., Nguyen, N.H., Manh, C.D. and Nguyen, T.H., 2015c. Association between climate factors and diarrhoea in a Mekong Delta area. Int J Biometeorol, 59(9): 1321-31.

Phung, D., Thai, P.K., Guo, Y., Morawska, L., Rutherford, S. and Chu, C., 2016. Ambient temperature and risk of cardiovascular hospitalization: An updated systematic review and meta-analysis. Sci Total Environ, 550: 1084-1102.

Piekałkiewicz, M., 2017. Why do economists study happiness? The Economics and Labour Relations Review, 28: 361-377.

Piggott-McKellar, A., McNamara, K., Nunn, P. and Sekinini, S., 2019. Moving People in a Changing Climate: Lessons from Two Case Studies in Fiji. Social Sciences, 8: 133.

Piguet, E., 2013. From “Primitive Migration” to “Climate Refugees”: The Curious Fate of the Natural Environment in Migration Studies. Annals of the Association of American Geographers, 103(1): 148-162.

Pincus, T., Esther, R., DeWalt, D.A. and Callahan, L.F., 1998. Social conditions and self-management are more powerful determinants of health than access to care. Annals of Internal Medicine, 129(5): 406-411.

Pineda, C., Munoz-Louis, R., Caballero-Uribe, C.V. and Viasus, D., 2016. Chikungunya in the region of the Americas. A challenge for rheumatologists and health care systems. Clin Rheumatol, 35(10): 2381-5.

Piper, N., 2017. Migration and the SDGs. Global Social Policy, 17(2): 231-238.

Polain, J.D., Berry, H.L. and Hoskin, J.O., 2011. Rapid change, climate adversity and the next 'big dry': Older farmers' mental health. Australian Journal of Rural Health, 19(5): 239-243.

Pollack, A., Weiss, B. and Trung, T., 2016. Mental health, life functioning and risk factors among people exposed to frequent natural disasters and chronic poverty in Vietnam. BJPsych Open, 2(3): 221-232.

Pollard, G., Davies, M. and Moore, H., 2015. Women, marketplaces and exchange partners amongst the Marakwet of northwest Kenya. Journal of Eastern African Studies, 9(3): 412-439.

Polyakova, M., Kocks, G., Udalova, V. and Finkelstein, A., 2020. Initial economic damage from the COVID-19 pandemic in the United States is more widespread across ages and geographies than initial mortality impacts. Proc Natl Acad Sci U S A.

Ponjoan, A., Blanch, J., Alves, L., Martí Lluch, R., Comas-Cufí, M., Parramon, D., Garcia-Gil, M., Ramos Blanes, R. and Petersen, I., 2017a. Effects of extreme temperatures on cardiovascular emergency hospitalizations in a Mediterranean region: a self-controlled case series study. Environmental Health, 16.

Ponjoan, A., Blanch, J., Alves-Cabratosa, L., Marti-Lluch, R., Comas-Cufi, M., Parramon, D., Garcia-Gil, M.D., Ramos, R. and Petersen, I., 2017b. Effects of extreme temperatures on cardiovascular emergency hospitalizations in a Mediterranean region: a self-controlled case series study. Environmental Health, 16.

Poole, J.A., Barnes, C.S., Demain, J.G., Bernstein, J.A., Padukudru, M.A., Sheehan, W.J., Fogelbach, G.G., Wedner, J., Codina, R. and Levetin, E., 2019. - Impact of weather and climate change with indoor and outdoor air quality in asthmatic patients.

Poortinga, W., Whitmarsh, L., Steg, L., Böhm, G. and Fisher, S., 2019. Climate change perceptions and their individual-level determinants: A cross-European analysis. Global Environmental Change, 55: 25-35.

Popovic, D.J., Ostojic, G., Milincic, M., Dordevic, T., Sabic, D. and Tatalovic, A., 2015. CLIMATE CHANGE AND REGIONAL CONFLICTS IN THE SOUTHERN EUROPE WITH AN EMPHASIS ON THE BALKAN PENINSULA OVER THE PAST TWO MILLENNIA. Journal of Environmental Protection and Ecology, 16(2): 539-549.

Porst, L. and Sakdapolrak, P., 2018. Advancing adaptation or producing precarity? The role of rural-urban migration and translocal embeddedness in navigating household resilience in Thailand. Geoforum, 97: 35-45.

Porst, L. and Sakdapolrak, P., 2020. Gendered translocal connectedness: Rural–urban migration, remittances, and social resilience in Thailand. Population, Space and Place, 26(4): e2314.

Porter, C. and Goyal, R., 2016. Social protection for all ages? Impacts of Ethiopia's Productive Safety Net Program on child nutrition. Social Science & Medicine, 159: 92-99.

Powell, N., Larsen, R.K., de Bruin, A., Powell, S. and Elrick-Barr, C., 2017. Water Security in Times of Climate Change and Intractability: Reconciling Conflict by Transforming Security Concerns into Equity Concerns. Water, 9(12).

Power, M., Adar, S., Yanosky, J. and Weuve, J., 2016. Exposure to air pollution as a potential contributor to cognitive function, cognitive decline, brain imaging, and dementia: A systematic review of epidemiologic research. Neurotoxicology, 56: 235-253.

Prachantasena, S., Charununtakorn, P., Muangnoicharoen, S., Hankla, L., Techawal, N., Chaveerach, P., Tuitemwong, P., Chokesajjawatee, N., Williams, N., Humphrey, T. and Luangtongkum, T., 2017. Climatic factors and prevalence of Campylobacter in commercial broiler flocks in Thailand. Poult Sci, 96(4): 980-985.

Pradhan, K. and Narayanan, K., 2020. Does climatic risk induce labour migration? Evidence from Semi-Arid Tropics region of India. Journal of Public Affairs.

Price, G.N. and Elu, J.U., 2017. Climate Change and Cross-State Islamist Terrorism in Nigeria. Peace Economics Peace Science and Public Policy, 23(3).

Program, C.C.S., 2016. The impacts of climate change on human health in the United States: a scientific assessment.

Programme, U.N.E., 2017. Adaptation Gap Report 2017.

Programme, U.N.E., 2018. Adaptation Gap Report 2018, Nairobi, Kenya.

Programme, U.N.E., Union, E. and Adelphi, 2019. Guidance Note and Tools to Address Climate-Fragility Risks.

Prueksapanich, P., Piyachaturawat, P., Aumpansub, P., Ridtitid, W., Chaiteerakij, R. and Rerknimitr, R., 2018. Liver Fluke-Associated Biliary Tract Cancer. Gut Liver, 12(3): 236-245.

Psarros, C., Theleritis, C., Economou, M., Tzavara, C., Kioulos, K.T., Mantonakis, L., Soldatos, C.R. and Bergiannaki, J.D., 2017. Insomnia and PTSD one month after wildfires: evidence for an independent role of the "fear of imminent death". International Journal of Psychiatry in Clinical Practice, 21(2): 137-141.

Quam, M., Rocklov, J., Quam, M. and Lucas, I., 2017. Assessing Greenhouse Gas Emissions and Health Co-Benefits: A Structured Review of Lifestyle-Related Climate Change Mitigation Strategies. International Journal of Environmental Research and Public Health, 14(5).

Quast, T. and Feng, L., 2019. Long-term Effects of Disasters on Health Care Utilization: Hurricane Katrina and Older Individuals with Diabetes. Disaster Med Public Health Prep: 1-8.

Quintero-Herrera, L.L., Ramirez-Jaramillo, V., Bernal-Gutierrez, S., Cardenas-Giraldo, E.V., Guerrero-Matituy, E.A., Molina-Delgado, A.H., Montoya-Arias, C.P., Rico-Gallego, J.A., Herrera-Giraldo, A.C., Botero-Franco, S. and Rodriguez-Morales, A.J., 2015. Potential impact of climatic variability on the epidemiology of dengue in Risaralda, Colombia, 2010-2011. J Infect Public Health, 8(3): 291-7.

Radeny, M., Desalegn, A., Mubiru, D., Kyazze, F., Mahoo, H., Recha, J., Kimeli, P. and Solomon, D., 2019. Indigenous knowledge for seasonal weather and climate forecasting across East Africa. Climatic Change, 156(4): 509-526.

Rahman, M.S., Carraro, R., Cardazzo, B., Carraro, L., Meneguolo, D.B., Martino, M.E., Andreani, N.A., Bordin, P., Mioni, R., Barco, L., Novelli, E., Balzan, S. and Fasolato, L., 2017. Molecular Typing of Vibrio parahaemolyticus Strains Isolated from Mollusks in the North Adriatic Sea. Foodborne Pathog Dis, 14(8): 454-464.

Rahman, S., Islam, A.K.M.S., Saha, P., Rahman Tazkia, A., Krien, Y., Durand, F., Testut, L., Islam, G.M.T. and Bala, S.K., 2019. Projected changes of inundation of cyclonic storms in the Ganges–Brahmaputra–Meghna delta of Bangladesh due to SLR by 2100. Journal of Earth System Science.

Rai, S.P., Young, W. and Sharma, N., 2017. Risk and Opportunity Assessment for Water Cooperation in Transboundary River Basins in South Asia. Water Resources Management, 31(7): 2187-2205.

Rajsekhar, D. and Gorelick, S.M., 2017. Increasing drought in Jordan: Climate change and cascading Syrian land-use impacts on reducing transboundary flow. Science Advances, 3(8).

Rakotoarison, N., Raholijao, N., Razafindramavo, L.M., Rakotomavo, Z.A.P.H., Rakotoarisoa, A., Guillemot, J.S., Randriamialisoa, Z.J., Mafilaza, V., Ramiandrisoa, V.A.M.P., Rajaonarivony, R., Andrianjafinirina, S., Tata, V., Vololoniaina, M.C., Rakotomanana, F. and Raminosoa, V.M., 2018. Assessment of Risk, Vulnerability and Adaptation to Climate Change by the Health Sector in Madagascar. Int J Environ Res Public Health, 15(12).

Raleigh, C., Choi, H.J. and Kniveton, D., 2015. The devil is in the details: An investigation of the relationships between conflict, food price and climate across Africa. Global Environmental Change, 32: 187-199.

Ramaswami, A., Tong, K., Fang, A., Lal, R.M., Nagpure, A.S., Li, Y., Yu, H., Jiang, D., Russell, A.G., Shi, L., Chertow, M., Wang, Y. and Wang, S., 2017. Urban cross-sector actions for carbon mitigation with local health co-benefits in China. Nat. Clim. Chang. 7: 736.

Ramírez, I.J., Lee, J. and Grady, S.C., 2018. Mapping Multi-Disease Risk during El Niño: An Ecosyndemic Approach. Int J Environ Res Public Health, 15(12).

Ranabhat, C.L., Atkinson, J., Park, M.B., Kim, C.B. and Jakovljevic, M., 2018a. The Influence of Universal Health Coverage on Life Expectancy at Birth (LEAB) and Healthy Life Expectancy (HALE): A Multi-Country Cross-Sectional Study. Front Pharmacol, 9: 960.

Ranabhat, S., Ghate, R., Bhatta, L.D., Agrawal, N.K. and Tankha, S., 2018b. Policy Coherence and Interplay between Climate Change Adaptation Policies and the Forestry Sector in Nepal. Environmental Management, 61(6): 968-980.

Ransan-Cooper, H., Farbotko, C., McNamara, K., Thornton, F. and Chevalier, E., 2015. Being(s) framed: The means and ends of framing environmental migrants. Global Environmental Change, 35: 106-115.

Rao, M.R.K., Padhy, R.N. and Das, M.K., 2018. Episodes of the epidemiological factors correlated with prevailing viral infections with dengue virus and molecular characterization of serotype-specific dengue virus circulation in eastern India. Infect Genet Evol, 58: 40-49.

Rao, N., 2017. Assets, Agency and Legitimacy: Towards a Relational Understanding of Gender Equality Policy and Practice. World Development, 95: 43-54.
Rao, N., 2019. From abandonment to autonomy: Gendered strategies for coping with climate change, Isiolo County, Kenya. Geoforum, 102: 27-37.
Rao, N., Lawson, E., Raditloaneng, W., Solomon, D. and Angula, M., 2019a. Gendered vulnerabilities to climate change: insights from the semi-aird regions of Africa and Asia. Climate and Development, 11(1): 14-26.
Rao, N., Singh, C., Solomon, D., Camfield, L., Sidiki, R., Angula, M., Poonacha, P., Sidibe, A. and Lawson, E., 2019b. Managing risk, changing aspirations and household dynamics: Implications from wellbeing and adaptation in semi-arid Africa and India. World Development.
Rao, N.D. and Min, J., 2018. Less global inequality can improve climate outcomes. Wiley Interdisciplinary Reviews-Climate Change, 9(2).
Raspotnik, A. and Østhagen, A., 2019. What about the Arctic? The European Union's Geopolitical Quest for Northern Space. Geopolitics: 1-25.
Rataj, E., Kunzweiler, K. and Garthus-Niegel, S., 2016. Extreme weather events in developing countries and related injuries and mental health disorders - a systematic review. BMC Public Health, 16(1): 1020.
Ratner, B.D., Meinzen-Dick, R., Hellin, J., Mapedza, E., Unruh, J., Veening, W., Haglund, E., May, C. and Bruch, C., 2017. Addressing conflict through collective action in natural resource management. International Journal of the Commons, 11(2): 877-906.
Ravera, F., Martin-Lopez, B., Pascual, U. and Drucker, A., 2016. The diversity of gendered adaptation strategies to climate change of Indian farmers: a feminist intersectional approach. Ambio, 45: 335-351.
Regli, S., Chen, J., Messner, M., Elovitz, M.S., Letkiewicz, F.J., Pegram, R.A., Pepping, T.J., Richardson, S.D. and Wright, J.M., 2015. Estimating Potential Increased Bladder Cancer Risk Due to Increased Bromide Concentrations in Sources of Disinfected Drinking Waters. Environ. Sci. Technol., 49(22): 13094-13102.
Reid, C.E., Brauer, M., Johnston, F.H., Jerrett, M., Balmes, J.R. and Elliott, C.T., 2016. Critical Review of Health Impacts of Wildfire Smoke Exposure. Environ. Health Perspect. 124(9): 1334-1343.
Rejeki, D.S.S., Nurhayati, N., Aji, B., Murhandarwati, E.E.H. and Kusnanto, H., 2018. A Time Series Analysis: Weather Factors, Human Migration and Malaria Cases in Endemic Area of Purworejo, Indonesia, 2005-2014. Iran J Public Health, 47(4): 499-509.
Remais, J., Hess, J., Ebi, K., Markandya, A., Balbus, J., Wilkinson, P., Haines, A. and Chalabi, Z., 2014. Estimating the Health Effects of Greenhouse Gas Mitigation Strategies: Addressing Parametric, Model, and Valuation Challenges. Environmental Health Perspectives, 122(5): 447-455.
Remling, E., 2020. Migration as climate adaptation? Exploring discourses amongst development actors in the Pacific Island region. Regional Environmental Change, 20(1): 3.
Republic of Kiribati Office of the, P., Kiribati climate change: Relocation.
Rey-Valette, H., Robert, S. and Rulleau, B., 2019. Resistance to relocation in flood-vulnerable coastal areas: a proposed composite index. Climate Policy, 19(2): 206-218.
Reyer, C.P., Otto, I.M., Adams, S., Albrecht, T., Baarsch, F., Cartsburg, M., Coumou, D., Eden, A., Ludi, E. and Marcus, R., 2017. Climate change impacts in Central Asia and their implications for development. Regional Environmental Change, 17(6): 1639-1650.
Riahia, K. and et al., 2017. The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview. Global Environmental Change, 42: 153-168.
Ribot, J., 2014. Cause and response: vulnerability and climate in the Anthropocene. Journal of Peasant Studies, 41(5): 667-705.
Rice, M.B., Thurston, G.D., Balmes, J.R. and Pinkerton, K.E., 2014. Climate change. A global threat to cardiopulmonary health. Am. J. Respir. Crit. Care Med., 189(5): 512-519.
Richard, W., Hirschi, M., Donat, M.G., Greve, P., Pitman, A.J. and Seneviratne, S.I., 2017. Changes in regional climate extremes as a function of global mean temperature: an interactive plotting framework. Geoscientific Model Development, 10(9): 3609-3634.
Rickerts, V., 2019. [Climate change and systemic fungal infections]. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz, 62(5): 646-651.
Rigaud, K.K., de Sherbinin, A., Jones, B., Bergmann, J., Clement, V., Ober, K., Schewe, J., Adamo, S., McCusker, B., Heuser, S. and Midgley, A., 2018. Groundswell: Preparing for Internal Climate Migration, Washington DC.
Rigg, J., Nguyen, T., Thu, T. and Luong, H., 2018. The texture of livelihoods: Migration and making a living in Hanoi. The Journal of Development Studies, 50: 368-382.
Rigg, J. and Salamanca, A., 2015. The Devil in the Details: Interpreting livelihood turbulence from a 25-year panel study from Thailand. Area 47(3): 296-304.
Riosmena, F., Kuhn, R. and Jochem, W.C., 2017. Explaining the Immigrant Health Advantage: Self-selection and Protection in Health-Related Factors among Five Major National-Origin Immigrant Groups in the United States. Demography, 54(1): 175-200.
Riosmena, F., Nawrotzki, R. and Hunter, L., 2018. Climate migration at the height and end of the Great Mexican Emigration Era. Population and Development Review, 44(3): 455-488.
Ripple, W.J., Smith, P., Haberl, H., Montzka, S.A., McAlpine, C. and Boucher, D.H., 2013. Ruminants, climate change and climate policy. Nature Climate Change, 4: 2.

Rivas, A.V., Defante, R., Delai, R.M., Rios, J.A., Britto, A.D.S., Leandro, A.S. and Goncalves, D.D., 2018. Building Infestation Index for Aedes aegypti and occurrence of dengue fever in the municipality of Foz do Iguacu, Parana, Brazil, from 2001 to 2016. Rev Soc Bras Med Trop, 51(1): 71-76.

Robalino, J., Jiminez, J. and Chacón, A., 2015. The Effect of Hydro-Meteorological Emergencies on Internal Migration. World Development, 67: 438-448.

Robine, J.M., Cheung, S.L., Le Roy, S., Van Oyen, H., Griffiths, C., Michel, J.P. and Herrmann, F.R., 2008. Death toll exceeded 70,000 in Europe during the summer of 2003. C R Biol, 331(2): 171-8.

Roche, K.R., Müller-Itten, M., Dralle, D.N., Bolster, D. and Müller, M.F., 2020. Climate change and the opportunity cost of conflict. Proceedings of the National Academy of Sciences, 117(4): 1935-1940.

Rochelle-Newall, E., Nguyen, T.M., Le, T.P., Sengtaheuanghoung, O. and Ribolzi, O., 2015. A short review of fecal indicator bacteria in tropical aquatic ecosystems: knowledge gaps and future directions. Front Microbiol, 6: 308.

Rockenbauch, T. and Sakdapolrak, P., 2017. Social networks and the resilience of rural communities in the Global South: a critical review and conceptual reflections. Ecology and Society, 22(1): 10.

Rocklov, J. and Dubrow, R., 2020. Climate change: an enduring challenge for vector-borne disease prevention and control. Nature Immunology, 21(5): 479-483.

Rocklov, J., Tozan, Y., Ramadona, A., Sewe, M.O., Sudre, B., Garrido, J., de Saint Lary, C.B., Lohr, W. and Semenza, J.C., 2019. Using Big Data to Monitor the Introduction and Spread of Chikungunya, Europe, 2017. Emerging Infectious Diseases, 25(6): 1041-1049.

Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F.S., 3rd, Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J., Nykvist, B., de Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P.K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R.W., Fabry, V.J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. and Foley, J.A., 2009. A safe operating space for humanity. Nature, 461(7263): 472-475.

Rodrigues, M. and Santana, P., 2020. Statistical Modelling of Temperature-Attributable Deaths in Portuguese Metropolitan Areas under Climate Change: Who Is at Risk? Atmosphere, 11: 159.

Rosado-García, F.M., Guerrero-Flórez, M., Karanis, G., Hinojosa, M.D.C. and Karanis, P., 2017. Water-borne protozoa parasites: The Latin American perspective. Int J Hyg Environ Health, 220(5): 783-798.

Rosen, G., 2015. A History of Public Health. JHU Press, 370 pp.

Rosenberg, A., Weinberger, M., Paz, S., Valinsky, L., Agmon, V. and Peretz, C., 2018. Ambient temperature and age-related notified Campylobacter infection in Israel: A 12-year time series study. Environ Res, 164: 539-545.

Rossati, A., 2017. Global Warming and Its Health Impact. Int J Occup Environ Med, 8(1): 7-20.

Rossi, V. and Efsa, P., 2013. Scientific Opinion on the risks to plant health posed by Bemisia tabaci species complex and viruses it transmits for the EU territory. EFSA Journal, 11.

Rother, H.-A., Sabel, C.E. and Vardoulakis, S., In press. A Collaborative Framework Highlighting Climate Sensitive Non-Communicable Diseases in Urban Sub-Saharan Africa. In: M. Ramutsindela and D. Mickler (Editors), Africa and the Sustainable Development Goals. Springer.

Rouge, C., Tilmant, A., Zaitchik, B., Dezfuli, A. and Salman, M., 2018. Identifying Key Water Resource Vulnerabilities in Data-Scarce Transboundary River Basins. Water Resources Research, 54(8): 5264-5281.

Rozenberg, H.a., 2017. Climate change through a poverty lens. Nature Climate Change 7(4):250–256.

Ruane, A., Teichmann, C., Arnell, N., Carter, T., Ebi, K., Frieler, K., Goodess, C., Hewitson, B., Horton, R., Kovats, R., Lotze, H., Mearns, L., Navarra, A., Ojima, D., Riahi, K., Rosenzweig, C., Themessl, M. and Vincent, K., 2016. The Vulnerability, Impacts, Adaptation and Climate Services Advisory Board (VIACS AB v1.0) contribution to CMIP6. Geoscientific Model Development, 9(9): 3493-3515.

Rudincova, K., 2017. Desiccation of Lake Chad as a cause of security instability in the Sahel region. Geoscape, 11(2): 112-120.

Ruel, M., Quisumbing, A. and Balagamwala, M., 2018. Nutrition-sensitive agriculture: What have we learned so far? Global Food Security-Agriculture Policy Economics and Environment, 17: 128-153.

Rufino, R., Gracie, R., Sena, A., de Freitas, C.M. and Barcellos, C., 2016. Diarrhea outbreaks in northeastern Brazil in 2013, according to media and health information systems - Surveillance of climate risk and health emergencies. Cien Saude Colet, 21(3): 777-88.

Rushton, S.P., Sanderson, R.A., Diggle, P.J., Shirley, M.D.F., Blain, A.P., Lake, I., Maas, J.A., Reid, W.D.K., Hardstaff, J., Williams, N., Jones, N.R., Rigby, D., Strachan, N.J.C., Forbes, K.J., Hunter, P.R., Humphrey, T.J. and O'Brien, S.J., 2019. Climate, human behaviour or environment: individual-based modelling of Campylobacter seasonality and strategies to reduce disease burden. J Transl Med, 17(1): 34.

Ruszkiewicz, J., Tinkov, A., Skalny, A., Siokas, V., Dardiotis, E., Tsatsakis, A., Bowman, A., da Rocha, J. and Aschner, M., 2019. Brain diseases in changing climate. Environmental Research, 177.

Rutt, R.L. and Lund, J.F., 2014. WHAT ROLE FOR GOVERNMENT? THE PROMOTION OF CIVIL SOCIETY THROUGH FORESTRY-RELATED CLIMATE CHANGE INTERVENTIONS IN POST-CONFLICT NEPAL. Public Administration and Development, 34(5): 406-421.

Ryan, B., Franklin, R.C., Burkle, F.M., Jr., Aitken, P., Smith, E., Watt, K. and Leggat, P., 2015. Identifying and Describing the Impact of Cyclone, Storm and Flood Related Disasters on Treatment Management, Care and Exacerbations of Non-communicable Diseases and the Implications for Public Health. PLoS currents, 7: ecurrents.dis.62e9286d152de04799644dcca47d9288.

Rylander, C., Øyvind Odland, J. and Manning Sandanger, T., 2013. Climate change and the potential effects on maternal and pregnancy outcomes: an assessment of the most vulnerable--the mother, fetus, and newborn child. Glob. Health Action, 6(1): 19538.

Rüegger, S. and Bohnet, H., 2020. The Link between Forced Migration and Conflict. Environmental Conflicts, Migration and Governance: 177.

Rüttinger, L., Smith, D., Stang, G., Tänzler, D., Vivekananda, J., Brown, O., Carius, A., Dabelko, G., De Souza, R.-M. and Mitra, S., 2015. A new climate for peace: taking action on climate and fragility risks. Berlin/London/Washington/Paris: Adelphi.

Sabel, E., Hiscock, R., Asikainen, A., Bi, J., Depledge, M., van den Elshout, S. and Willers, S., 2016. Public health impacts of city policies to reduce climate change: findings from the URGENCHE EU-China project. Environmental Health, 15: 25.

Saeed, A.R., McDermott, C. and Boyd, E., 2017. Are REDD plus community forest projects following the principles for collective action, as proposed by Ostrom? International Journal of the Commons, 11(1): 572-596.

Safarzynska, K., 2018. The Impact of Resource Uncertainty and Intergroup Conflict on Harvesting in the Common-Pool Resource Experiment. Environmental & Resource Economics, 71(4): 1001-1025.

Saha, S.K., 2016. Cyclone Aila, livelihood stress, and migration: empirical evidence from coastal Bangladesh. Disasters.

Saifuddin, A., Salahuddin, A., McKaig, C., Begum, N., Mungia, J., Norton, M. and Baqui, A., 2015. The Effect of Integrating Family Planning with a Maternal and Newborn Health Program on Postpartum Contraceptive Use and Optimal Birth Spacing in Rural Bangladesh. Studies in Family Planning, 46(3).

Sajadi, M.M., Habibzadeh, P., Vintzileos, A., Shokouhi, S., Miralles-Wilhelm, F. and Amoroso, A., 2020. Temperature, Humidity and Latitude Analysis to Predict Potential Spread and Seasonality for COVID-19. SSRN: 3550308.

Sakdapolrak, P., Naruchaikusol, S., Ober, K., Peth, S., Porst, L., Rockenbauch, T. and Tolo, V., 2016. Migration in a changing climate. Towards a translocal social resilience approach. Erde, 147(2): 81-94.

Sakdapolrak, P., Promburom, P. and Reif, A., 2014. Why successful in situ adaptation with environmental stress does not prevent people from migrating? Empirical evidence from Northern Thailand. Climate and Development, 6(1): 38-45.

Salazar, M.A., Law, R., Pesigan, A. and Winkler, V., 2017. Health Consequences of Typhoon Haiyan in the Eastern Visayas Region Using a Syndromic Surveillance Database. PLoS Curr, 9.

Salehyan, I. and Hendrix, C.S., 2014. Climate shocks and political violence. Global Environmental Change-Human and Policy Dimensions, 28: 239-250.

Sanderson, M., Arbuthnott, K., Kovats, S., Hajat, S. and Falloon, P., 2017. The use of climate information to estimate future mortality from high ambient temperature: A systematic literature review. Plos One, 12(7).

Sang, S., Gu, S., Bi, P., Yang, W., Yang, Z., Xu, L., Yang, J., Liu, X., Jiang, T., Wu, H., Chu, C. and Liu, Q., 2015. Predicting unprecedented dengue outbreak using imported cases and climatic factors in Guangzhou, 2014. PLoS Negl Trop Dis, 9(5): e0003808.

Sapkota, A., Dong, Y., Li, L., Asrar, G., Zhou, Y., Li, X., Coates, F., Spanier, A.J., Matz, J. and Bielory, L., 2020. - Association Between Changes in Timing of Spring Onset and Asthma Hospitalization in Maryland. - 3(- 7).

Sarigiannis, D.A., Kontoroupis, P., Nikolaki, S., Gotti, A., Chapizanis, D. and Karakitsios, S., 2017. Benefits on public health from transport-related greenhouse gas mitigation policies in Southeastern European cities. Sci. Total Environ. 579: 1427-1438.

Sarnquist, C., Sinclair, J.a., Omondi Mboya, B., Langat, N., Paiva, L., Halpern-Felsher, B., Golden, N., Maldonado, Y. and Baiocchi, M., 2017. Evidence That Classroom-Based Behavioral Interventions Reduce Pregnancy-Related School Dropout Among Nairobi Adolescents. Health, Education and Behavior, 44(2): 297-303.

Sarofim, C., Waldhoff, T. and Anenberg, C., 2017. Valuing the Ozone-Related Health Benefits of Methane Emission Controls. Environmental and Resource Economics, 66(1): 45-63.

Sarsons, H., 2015. Rainfall and conflict: A cautionary tale. Journal of Development Economics, 115: 62-72.

Sass, V., Kravitz-Wirtz, N., Karceski, S.M., Hajat, A., Crowder, K. and Takeuchi, D., 2017. The effects of air pollution on individual psychological distress. Health & Place, 48: 72-79.

Sato, M.O., Sato, M., Chaisiri, K., Maipanich, W., Yoonuan, T., Sanguankiat, S., Pongvongsa, T., Boupha, B., Moji, K. and Waikagul, J., 2014. Nematode infection among ruminants in monsoon climate (Ban-Lahanam, Lao PDR) and its role as food-borne zoonosis. Rev Bras Parasitol Vet, 23(1): 80-4.

Sawas, A., Workman, M. and Mirumachi, N., 2018. Climate change, low-carbon transitions and security. Grantham Institute Briefing paper No. 25, Imperial College, London.

Scannell, L. and Gifford, R., 2013. Personally Relevant Climate Change: The Role of Place Attachment and Local versus Global Message Framing in Engagement. Environment and Behavor, 45(1): 60-85.

Scannell, L. and Gifford, R., 2017. The experienced psychological benefits of place attachment. Journal of Environmental Psychology, 51: 256-269.

Scasny, M., Massetti, E., Melichar, J. and Carrara, S., 2015. Quantifying the Ancillary Benefits of the Representative Concentration Pathways on Air Quality in Europe. Environmental and Resource Economics, 62(2): 383-415.

Schaefer, M.S., Scheffran, J. and Penniket, L., 2016. Securitization of media reporting on climate change? A cross-national analysis in nine countries. Security Dialogue, 47(1): 76-96.

Schewe, J., Gosling, S.N., Reyer, C., Zhao, F., Ciais, P., Elliott, J., Francois, L., Huber, V., Lotze, H.K., Seneviratne, S.I., van Vliet, M.T.H., Vautard, R., Wada, Y., Breuer, L., Buchner, M., Carozza, D.A., Chang, J.F., Coll, M., Deryng, D., de Wit, A., Eddy, T.D., Folberth, C., Frieler, K., Friend, A.D., Gerten, D., Gudmundsson, L., Hanasaki, N., Ito, A., Khabarov, N., Kim, H., Lawrence, P., Morfopoulos, C., Muller, C., Schmied, H.M., Orth, R., Ostberg, S., Pokhrel, Y., Pugh, T.A.M., Sakurai, G., Satoh, Y., Schmid, E., Stacke, T., Steenbeek, J., Steinkamp, J., Tang, Q.H., Tian, H.Q., Tittensor, D.P., Volkholz, J., Wang, X.H. and Warszawski, L., 2019. State-of-the-art global models underestimate impacts from climate extremes. Nature Communications, 10: 14.

Schilling, J., Akuno, M., J.S.s.a.t. and undefined, On raids and relations: climate change, pastoral conflict and adaptation in Northwestern Kenya. books.google.com.

Schilling, J., Locham, R., Weinzierl, T., Vivekananda, J. and Scheffran, J., 2015. The nexus of oil, conflict, and climate change vulnerability of pastoral communities in northwest Kenya. Earth System Dynamics, 6(2): 703-717.

Schilling, J., Nash, S.L., Ide, T., Scheffran, J., Froese, R. and von Prondzinski, P., 2017. Resilience and environmental security: towards joint application in peacebuilding. Global Change Peace & Security, 29(2): 107-127.

Schinasi, L.H., Benmarhnia, T. and De Roos, A.J., 2018. Modification of the association between high ambient temperature and health by urban microclimate indicators: A systematic review and meta-analysis. Environmental Research, 161: 168-180.

Schipanski, M., MacDonald, G., Rosenzweig, S., Chappell, M., Bennett, E., Kerr, R., Blesh, J., Crews, T., Drinkwater, L., Lundgren, J. and Schnarr, C., 2016. Realizing Resilient Food Systems. Bioscience, 66(7): 600-610.

Schijven, J., Bouwknegt, M., de Roda Husman, A.M., Rutjes, S., Sudre, B., Suk, J.E. and Semenza, J.C., 2013. A decision support tool to compare waterborne and foodborne infection and/or illness risks associated with climate change. Risk Anal, 33(12): 2154-67.

Schleussner, C.-F., Donges, J.F., Donner, R.V. and Schellnhuber, H.J., 2016a. Armed-conflict risks enhanced by climate-related disasters in ethnically fractionalized countries. Proceedings of the National Academy of Sciences, 113(33): 9216-9221.

Schleussner, F., Donges, F., Donner, V. and Schellnhuber, J., 2016b. Armed-conflict risks enhanced by climate-related disasters in ethnically fractionalized countries. Proceedings of the National Academy of Sciences USA, 113: 9216-9221.

Schmeltz, M. and Gamble, J., 2017. Risk characterization of hospitalizations for mental illness and/or behavioral disorders with concurrent heat-related illness. PLOS ONE, 12: e0186509.

Schraven, B. and Rademacher-Schultz, C., 2015. Beyond adaptation? The changing nature of seasonal migration in northern Ghana in the context of climate change, agricultural decline and food insecurity, beyond adaptation? The changing nature of seasonal migration in northern Ghana in the context of climate change, agricultural decline and food insecurity. Palgrave Macmillan, London, pp. 267-280.

Schreckenberg, K., Mace, G. and Poudyal, M., 2018. Ecosystem Services and Poverty Alleviation:
Trade-offs and Governance. Routledge, Oxford.

Schucht, S., Colette, A., Rao, S., Holland, M., Schoepp, W., Kolp, P. and Rouil, L., 2015. Moving towards ambitious climate policies: Monetised health benefits from improved air quality could offset mitigation costs in Europe. Environmental Science and Policy, 50: 252-269.

Schummers, L., Hutcheon, A., Hernandez-Diaz, S., Williams, L., Hacker, R., VanderWeele, J. and Norman, V., 2018. Association of Short Interpregnancy Interval with Pregnancy Outcomes According to Maternal Age. JAMA Internal Medicine, 178(12): 1661.

Schuster, C., Honold, J., Lauf, S. and Lakes, T., 2017. Urban heat stress: Novel survey suggests health and fitness as Future Avenue for research and adaptation strategies. Environmental Research Letters, 12.

Schwartz, R., Sison, C., Kerath, S., Murphy, L., Breil, T., Sikavi, D. and Taioli, E., 2015. The impact of Hurricane Sandy on the mental health of New York area residents. American journal of disaster medicine, 10(4): 339-346.

Schweitzer, M.D., Calzadilla, A.S., Salamo, O., Sharifi, A., Kumar, N., Holt, G., Campos, M. and Mirsaeidi, M., 2018. Lung health in era of climate change and dust storms. Environ. Res., 163: 36-42.

Schwerdtle, P., Bowen, K. and McMichael, C., 2018. The health impacts of climate-related migration. BMC medicine, 16(1): 1-7.

Schütte, S., Gemenne, F., Zaman, M., Flahault, A. and Depoux, A., 2018. Connecting planetary health, climate change, and migration. The Lancet: Planetary Health, 2(2): PE58-E59.

Scortichini, M., de'Donato, F., De Sario, M., Leone, M., Åström, C., Ballester, F., Basagaña, X., Bobvos, J., Gasparrini, A., Katsouyanni, K., Lanki, T., Menne, B., Pascal, M. and Michelozzi, P., 2018. The inter-annual variability of heat-related mortality in nine European cities (1990–2010). Environmental Health, 17(1): 66.

Scoullos, I.M., Lopez Vazquez, C.M., van de Vossenberg, J., Hammond, M. and Brdjanovic, D., 2019. Effect of Artificial Solar Radiation on the Die-Off of Pathogen Indicator Organisms in Urban Floods. Int J Environ Res, 13(1): 107-116.

Scovronick, N., Budolfson, M., Dennig, F., Errickson, F., Fleurbaey, M., Peng, W. and Wagner, F., 2019. The impact of human health co-benefits on evaluations of global climate policy. Nature Communications, 10.

Scovronick, N., Dora, C., Fletcher, E., Haines, A. and Shindell, D., 2015. Reduce short-lived climate pollutants for multiple benefits. The Lancet.

Sedova, B. and Kalkuhl, M., 2020. Who are the climate migrants and where do they go? Evidence from rural India. World Development, 129: 104848.

See, J. and Wilmsen, B., 2020. Just adaptation? Generating new vulnerabilities and shaping adaptive capacities through the politics of climate-related resettlement in a Philippine coastal city. Global Environmental Change, 65: 102188.
Selby, J., 2014. Positivist Climate Conflict Research: A Critique. Geopolitics, 19(4): 829-856.
Selby, J., 2019. Climate change and the Syrian civil war, Part II: The Jazira's agrarian crisis. Geoforum, 101: 260-274.
Selby, J., Dahi, O.S., Frohlich, C. and Hulme, M., 2017. Climate change and the Syrian civil war revisited. Political Geography, 60: 232-244.
Selby, J. and Hoffmann, C., 2014a. Beyond scarcity: Rethinking water, climate change and conflict in the Sudans. Global Environmental Change-Human and Policy Dimensions, 29: 360-370.
Selby, J. and Hoffmann, C., 2014b. Rethinking climate change, conflict and security. Taylor & Francis.
Sellers, S. and Ebi, K.L., 2017. Climate Change and Health under the Shared Socioeconomic Pathway Framework. Int J Environ Res Public Health, 15(1).
Sellers, S. and Gray, C., 2019. Climate shocks constrain human fertility in Indonesia. World Development, 117: 357-369.
Seltzer, N. and Nobles, J., 2017. Large-scale climate events can have enduring effects on population size and composition. Natural disasters affect population fertility through multiple mechanisms, including displacement, demand for children, and reproductive care access. Fertility effect. Population and Environment, 38(4): 465-490.
Semenza, J., Trinanes, J., Lohr, W., Sudre, B., Lofdahl, M., Martinez-Urtaza, J., Nichols, G. and Rocklov, J., 2017. Environmental Suitability of Vibrio Infections in a Warming Climate: An Early Warning System. Environmental Health Perspectives, 125(10).
Semenza, J. and Zeller, H., 2014. Integrated surveillance for prevention and control of emerging vector-borne diseases in Europe. Eurosurveillance, 19(13): 2-5.
Semenza, J.C. and Suk, J.E., 2018. Vector-borne diseases and climate change: a European perspective. FEMS Microbiol Lett, 365(2).
Semenza, J.C., Tran, A., Espinosa, L., Sudre, B., Domanovic, D. and Paz, S., 2016. Climate change projections of West Nile virus infections in Europe: implications for blood safety practices. Environmental Health, 15.
Semenza, J.C., Herbst, S., Rechenburg, A., Suk, J.E., Hoser, C., Schreiber, C. and Kistemann, T., 2012. Climate Change Impact Assessment of Food- and Waterborne Diseases. Crit Rev Environ Sci Technol, 42(8): 857-890.
Semenza, J.C., Tran, A., Espinosa, L., Sudre, B., Domanovic, D. and Paz, S., 2016. Climate change projections of West Nile virus infections in Europe: implications for blood safety practices. Environ Health, 15 Suppl 1: 28.
Semenza, J.C., Trinanes, J., Lohr, W., Sudre, B., Löfdahl, M., Martinez-Urtaza, J., Nichols, G.L. and Rocklöv, J., 2017. Environmental Suitability of Vibrio Infections in a Warming Climate: An Early Warning System. Environ Health Perspect, 125(10): 107004.
Sen, A., 2001. Development as Freedom. Oxford University Press, Oxford.
Seneviratne, S.I., Rogelj, J., Seferian, R., Wartenburger, R., Allen, M.R., Cain, M., Millar, R.J., Ebi, K.L., Ellis, N., Hoegh-Guldberg, O., Payne, A.J., Schleussner, C.F., Tschakert, P. and Warren, R.F., 2018. The many possible climates from the Paris Agreement's aim of 1.5 degrees C warming. Nature, 558(7708): 41-49.
Serdeczny, O., Adams, S., Baarsch, F., Coumou, D., Robinson, A., Hare, W., Schaeffer, M., Perrette, M. and Reinhardt, J., 2017. Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions. Regional Environmental Change, 17(6): 1585-1600.
Seter, H., 2016. Connecting climate variability and conflict: implications for empirical testing. Political Geography, 53: 1-9.
Setty, K.E., Enault, J., Loret, J.F., Puigdomenech Serra, C., Martin-Alonso, J. and Bartram, J., 2018. Time series study of weather, water quality, and acute gastroenteritis at Water Safety Plan implementation sites in France and Spain. Int J Hyg Environ Health, 221(4): 714-726.
Shachar, B., Mayo, J., Lyell, D., Baer, R., Jeliffe-Pawlowski, L., Stevenson, D. and Shaw, G., 2016. Interpregnancy interval after live birth or pregnancy termination and estimated risk of preterm birth: a retrospective cohort study. BJOG: International Journal of Obstetrics and Gynaecology, 123(12): 2009-2017.
Shackleton, S., Ziervogel, G., Sallu, S., Gill.T. and Tschakert, P., 2015. Why is socially-just climate change adaptation in sub-Saharan Africa so challenging? A review of barriers identified from empirical cases. WIRES Climate Change, 6(3): 321-344.
Shadmi, E., Chen, Y., Dourado, I., Faran-Perach, I., Furler, J., Hangoma, P., Hanvoravongchai, P., Obando, C., Petrosyan, V. and Rao, K.D., 2020. - Health equity and COVID-19: global perspectives. - 19(- 1).
Sharmin, S., Glass, K., Viennet, E. and Harley, D., 2015. Interaction of Mean Temperature and Daily Fluctuation Influences Dengue Incidence in Dhaka, Bangladesh. PLoS Negl Trop Dis, 9(7): e0003901.
Shayegh, S., 2017. Outward migration may alter population dynamics and income inequality. Nature Climate Change, 7: 828-828.
Sheffield, P.E. and Landrigan, P.J., 2011. Global Climate Change and Children's Health: Threats and Strategies for Prevention. Environ. Health Perspect. 119(3): 291-298.
Shekhar, M., Singh, N., Bisht, S., Singh, V. and Kumar, A., 2018. Effects of Climate Change on Occurrence of Aflatoxin and its Impacts on Maize in India. Int. J. Curr. Microbiol. App. Sci, 7(6): 109-116.
Sheller, M., 2018. Theorising mobility justice. Tempo Social, 30(2): 17-34.
Shen, S. and Gemenne, F., 2011. Contrasted Views on Environmental Change and Migration: the Case of Tuvaluan Migration to New Zealand. International Migration, 49(S!): e224-e242.

Sheng, R., Li, C., Wang, Q., Yang, L., Bao, J., Wang, K., Ma, R., Gao, C., Lin, S., Zhang, Y., Bi, P., Fu, C. and Huang, C., 2018. Does hot weather affect work-related injury? A case-crossover study in Guangzhou, China. Int J Hyg Environ Health, 221(3): 423-428.

Sheridan, S. and Allen, M., 2018. Temporal trends in human vulnerability to excessive heat. Environmental Research Letters, 13.

Sherpa, A., Koottatep, T., Zurbrugg, C. and Cisse, G., 2014. Vulnerability and adaptability of sanitation systems to climate change. Journal of Water and Climate Change, 5(4): 487-495.

Shimaponda-Mataa, N.M., Tembo-Mwase, E., Gebreslasie, M. and Mukaratirwa, S., 2017. Knowledge, attitudes and practices in the control and prevention of malaria in four endemic provinces of Zambia. Southern African Journal of Infectious Diseases, 32(1): 29-39.

Shindell, D., Faluvegi, G., Seltzer, K. and Shindell, C., 2018a. Quantified, Localized Health Benefits of Accelerated Carbon Dioxide Emissions Reductions. Nat Clim Chang, 8(4): 291-295.

Shindell, D., Faluvegi, G., Seltzer, K. and Shindell, C., 2018b. Quantified, Localized Health Benefits of Accelerated Carbon Dioxide Emissions Reductions. Nat. Clim. Chang. 8(4): 291-295.

Shindell, D., Kuylenstierna , J.C.I., Vignati, E., van Dingenen, R., Amann, M., Klimont, Z., Anenberg, S.C., Muller, N., Janssens-Maenhout, G., Raes, F., Schwartz, J., Faluvegi, G., Pozzoli , L., Kupiainen, K., Höglund-Isaksson, L., Emberson, L., Streets, D., Ramanathan , V., Hicks , K., Kim Oanh, N.T., Milly, G., Williams , M., Demkine , V. and Fowler, D., 2012. Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security. SCIENCE, 335: 183-189.

Shindell, D. and Smith, C.J., 2019. Climate and air-quality benefits of a realistic phase-out of fossil fuels. NATURE, 573: 408-411.

Shonkoff, S.B., Morello-Frosch, R., Pastor, M. and Sadd, J., 2011. The climate gap: environmental health and equity implications of climate change and mitigation policies in California—a review of the literature. Climatic Change, 109(1): 485-503.

Short, E.E., Caminade, C. and Thomas, B.N., 2017. Climate Change Contribution to the Emergence or Re-Emergence of Parasitic Diseases. Infect Dis (Auckl), 10: 1178633617732296.

Shrestha, N., Shad, M.Y., Ulvi, O., Khan, M.H., Karamehic-Muratovic, A., Nguyen, U.D.T., Baghbanzadeh, M., Wardrup, R., Aghamohammadi, N., Cervantes, D., Nahiduzzaman, K.M., Zaki, R.A. and Haque, U., 2020. The impact of COVID-19 on globalization. One Health: 100180.

Shultz, J.M., Kossin, J.P., Shepherd, J.M., Ransdell, J.M., Walshe, R., Kelman, I. and Galea, S., 2018a. Risks, Health Consequences, and Response Challenges for Small-Island-Based Populations: Observations from the 2017 Atlantic Hurricane Season. Disaster Med. Public Health Prep.: 1-13.

Shultz, J.M., Russell, J. and Espinel, Z., 2005. Epidemiology of tropical cyclones: the dynamics of disaster, disease, and development. Epidemiol. Rev., 27: 21-35.

Shultz, J.M., Shepherd, J.M., Kelman, I., Rechkemmer, A. and Galea, S., 2018b. Mitigating tropical cyclone risks and health consequences: urgencies and innovations. Lancet Planet Health, 2(3): e103-e104.

Shumake-Guillemot, J., Ebi, K., Kabir, I., Nguyen, T., Malkawi, M., Schipper, E., Ayers, J., Reid, H., Huq, S. and Rahman, A., 2014. Scaling up community-based adaptation to protect health from climate change. Community-Based Adaptation To Climate Change: Scaling It Up: 155-171.

Sibhatu, K.T. and Qaim, M., 2017. Rural food security, subsistence agriculture, and seasonality. Plos One, 12(10).

Siddiqi, A., 2018a. 'Disaster citizenship': an emerging framework for understanding the depth of digital citizenship in Pakistan. Contemporary South Asia, 26(2): 157-174.

Siddiqi, A., 2018b. Disasters in conflict areas: finding the politics. Disasters, 42: S161-S172.

Siddiqi, A., 2019. In the Wake of Disaster: Islamists, the State and a Social Contract in Pakistan. Cambridge University Press.

Siddiqi, A. and Canuday, J.J.P., 2018. Stories from the frontlines: decolonising social contracts for disasters. Disasters, 42: S215-S238.

Silva, F.D., dos Santos, A.M., Correa Rda, G. and Caldas Ade, J., 2016a. Temporal relationship between rainfall, temperature and occurrence of dengue cases in Sao Luis, Maranhao, Brazil. Cien Saude Colet, 21(2): 641-6.

Silva, R.A., Jason West, J., Zhang, Y., Anenberg, S.C., Lamarque, J.-F., Shindell, D.T., Collins, W.J., Dalsoren, S., Faluvegi, G., Folberth, G., Horowitz, L.W., Nagashima, T., Naik, V., Rumbold, S., Skeie, R., Sudo, K., Takemura, T., Bergmann, D., Cameron-Smith, P., Cionni, I., Doherty, R.M., Eyring, V., Josse, B., MacKenzie, I.A., Plummer, D., Righi, M., Stevenson, D.S., Strode, S., Szopa, S. and Zeng, G., 2013. Global premature mortality due to anthropogenic outdoor air pollution and the contribution of past climate change. Environ. Res. Lett., 8(3): 034005.

Silva, R.A., West, J.J., Lamarque, J.-F., Shindell, D.T., Collins, W.J., Dalsoren, S., Faluvegi, G., Folberth, G., Horowitz, L.W., Nagashima, T., Naik, V., Rumbold, S.T., Sudo, K., Takemura, T., Bergmann, D., Cameron-Smith, P., Cionni, I., Doherty, R.M., Eyring, V., Josse, B., MacKenzie, I.A., Plummer, D., Righi, M., Stevenson, D.S., Strode, S., Szopa, S. and Zeng, G., 2016b. The effect of future ambient air pollution on human premature mortality to 2100 using output from the ACCMIP model ensemble. Atmos. Chem. Phys., 16(15): 9847-9862.

Silva, R.A., West, J.J., Lamarque, J.-F., Shindell, D.T., Collins, W.J., Faluvegi, G., Folberth, G.A., Horowitz, L.W., Nagashima, T., Naik, V., Rumbold, S.T., Sudo, K., Takemura, T., Bergmann, D., Cameron-Smith, P., Doherty, R.M., Josse, B., MacKenzie, I.A., Stevenson, D.S. and Zeng, G., 2017. FUTURE GLOBAL MORTALITY

FROM CHANGES IN AIR POLLUTION ATTRIBUTABLE TO CLIMATE CHANGE. Nat. Clim. Chang. 7(9): 647-651.

Simane, B., Beyene, H., Deressa, W., Kumie, A., Berhane, K. and Samet, J., 2016. Review of Climate Change and Health in Ethiopia: Status and Gap Analysis. Ethiop J Health Dev, 30(1 Spec Iss): 28-41.

Simpson Np, M.K.J.C.A.H.J.H.R.H.M.L.J.L.R.J.M.V.M.B.N.M.G., 2020. - Assessing and responding to complex climate change risks. - Submitted.

Singh, C., 2019a. Migration as a driver of changing household structures: implications for local livelihoods and adaptation. Migration and Development, 8(3): 301-319.

Singh, C., 2019b. Of borewells and bicycles: The gendered nature of water access and its implications on local adaptive capacity. Handbook of Gender and Climate Change in South Asia. Routledge.

Singh, C. and Basu, R., 2020. Moving in and out of vulnerability: Interrogating migration as an adaptation strategy along a rural-urban continuum in India. Geographical Journal, 186(1).

Singh, C., Osbahr, H. and Dorward, P., 2018. The implications of rural perceptions of water scarcity on differential adaptation behaviour in Rajasthan, India. Regional Environmental Change, 18(8): 2417-2432.

Singh, R.K., Zander, K.K., Kumar, S., Singh, A., Sheoran, P., Kumar, A., Hussain, S.M., Riba, T., Rallen, O., Lego, Y.J., Padung, E. and Garnett, S.T., 2017. Perceptions of climate variability and livelihood adaptations relating to gender and wealth among the Adi community of the Eastern Indian Himalayas. Applied Geography, 86: 41-52.

Sippel, S., Otto, F.E.L., Flach, M. and van Oldenborgh, G.J., 2017. The Role of Anthropogenic Warming in 2015 Central European Heat Waves. Bulletin of the American Meteorological Society, 97(12): S51-S56.

Smith, B.A. and Fazil, A., 2019. How will climate change impact microbial foodborne disease in Canada? Can Commun Dis Rep, 45(4): 108-113.

Smith, C.D., 2014. Modelling migration futures: development and testing of the Rainfalls Agent-Based Migration Model – Tanzania. Climate and Development, 6(1): 77-91.

Smith, J., Tahani, L., Bobogare, A., Bugoro, H., Otto, F., Fafale, G., Hiriasa, D., Kazazic, A., Beard, G., Amjadali, A. and Jeanne, I., 2017. Malaria early warning tool: linking inter-annual climate and malaria variability in northern Guadalcanal, Solomon Islands. Malar J, 16(1): 472.

Smith, K., Woodward, A., Campbell-Lendrum, D., Chadee, D., Honda, Y., Liu, Q., Olwoch, J., Revich, B., Sauerborn, R., Aranda, C., Berry, H., Butler, C., Chafe, Z., Cushing, L., Ebi, K., Kjellstrom, T., Kovats, S., Lindsay, G., Lipp, E., McMichael, T., Murray, V., Sankoh, O., O'Neill, M., Shonkoff, S., Sutherland, J., Yamamoto, S., Field, C., Barros, V., Dokken, D., Mach, K., Mastrandrea, M., Bilir, T., Chatterjee, M., Estrada, Y., Genova, R., Girma, B., Kissel, E., Levy, A., MacCracken, S., Mastrandrea, P. and White, L., 2014a. Human Health: Impacts, Adaptation, and Co-Benefits. Climate Change 2014: Impacts, Adaptation, and Vulnerability, Pt a: Global and Sectoral Aspects: 709-754.

Smith, K.R., Woodward, A., Campbell-Lendrum, D., Chadee, D.D., Honda, Y., Liu, Q.Y., Olwoch, J.M., Revich, B., Sauerborn, R., Aranda, C., Berry, H., Butler, C., Chafe, Z., Cushing, L., Ebi, K.L., Kjellstrom, T., Kovats, S., Lindsay, G., Lipp, E., McMichael, T., Murray, V., Sankoh, O., O'Neill, M., Shonkoff, S.B., Sutherland, J. and Yamamoto, S., 2014b. Human Health: Impacts, Adaptation, and Co-Benefits. Climate Change 2014: Impacts, Adaptation, and Vulnerability, Pt A: Global and Sectoral Aspects: 709-754.

Smith, M., Skjoth, C., Myszkowska, D., Stach, A. and Kasprzyk, I., 2009. Investigating ragweed pollen episodes in Poland using back-trajectory analysis. Allergy, 64: 300-300.

Smith, M.R. and Myers, S.S., 2018. Impact of anthropogenic CO2 emissions on global human nutrition. Nature Climate Change, 8(9): 834-839.

Snorek, J., Moser, L. and Renaud, F.G., 2017. The production of contested landscapes: Enclosing the pastoral commons in Niger. Journal of Rural Studies, 51: 125-140.

Soneja, S., Jiang, C., Romeo Upperman, C., Murtugudde, R., S Mitchell, C., Blythe, D., Sapkota, A.R. and Sapkota, A., 2016. Extreme precipitation events and increased risk of campylobacteriosis in Maryland, U.S.A. Environ Res, 149: 216-221.

Song, G., Li, M., Fullana-i-Palmer, P., Williamson, D. and Wang, Y., 2017. Dietary changes to mitigate climate change and benefit public health in China. Science of the Total Environment, 577: 289-298.

Song, M., Fung, T.T., Hu, F.B., Willett, W.C., Longo, V.D., Chan, A.T. and Giovannucci, E.L., 2016. Association of Animal and Plant Protein Intake with All-Cause and Cause-Specific MortalityAssociation of Protein Intake With MortalityAssociation of Protein Intake With Mortality. JAMA Internal Medicine, 176(10): 1453-1463.

Song, Y.J., Cheong, H.K., Ki, M., Shin, J.Y., Hwang, S.S., Park, M. and Lim, J., 2018. The Epidemiological Influence of Climatic Factors on Shigellosis Incidence Rates in Korea. Int J Environ Res Public Health, 15(10).

Sorensen, C., Saunik, S., Sehgal, M., Tewary, A., Govindan, M., Lemery, J. and Balbus, J., 2018. Climate Change and Women's Health: Impacts and Opportunities in India. GeoHealth, 2(10).

Sovacool, B.K., 2018. Bamboo Beating Bandits: Conflict, Inequality, and Vulnerability in the Political Ecology of Climate Change Adaptation in Bangladesh. World Development, 102: 183-194.

Sovacool, K., LinnÈr, B. and Goodsite, M., 2015. The political economy of climate adaptation. Nature Climate Change, 5: 616-618.

Sow, P., Marmer, E. and Scheffran, J., 2016. Between the heat and the hardships. Climate change and mixed migration flows in Morocco. Migration and Development, 5(2): 293-313.

Spencer, N. and Urquhart, M.A., 2018. Hurricane Strikes and Migration: Evidence from Storms in Central America and the Caribbean. Weather Climate and Society, 10(3): 569-577.

Spijkers, J. and Boonstra, W.J., 2017. Environmental change and social conflict: the northeast Atlantic mackerel dispute. Regional Environmental Change, 17(6): 1835-1851.

Spilker, G., Nguyen, Q., Koubi, V. and Böhmelt, T., 2020. Attitudes of urban residents towards environmental migration in Kenya and Vietnam. Nature Climate Change, 10(7): 622-627.

Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B.L., Lassaletta, L., de Vries, W., Vermeulen, S.J., Herrero, M., Carlson, K.M., Jonell, M., Troell, M., DeClerck, F., Gordon, L.J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., Godfray, H.C.J., Tilman, D., Rockström, J. and Willett, W., 2018b. Options for keeping the food system within environmental limits. Nature, 562(7728): 519-525.

Springmann, M., Godfray, H.C.J., Rayner, M. and Scarborough, P., 2016a. Analysis and valuation of the health and climate change cobenefits of dietary change. 113(15): 4146-4151.

Springmann, M., Mason-D'Coz, D., Robinson, S., Wiebe, K., Godfrey, H., Rayner, M. and Scarborough, P., 2018a. Health-motivated taxes on red and processed meat: A modelling study on optimal tax levels and associated health impacts. Plos One, 13(11).

Springmann, M., Mason-D'Croz, D., Robinson, S., Garnett, T., Godfray, H.C., Gollin, D., Rayner, M., Ballon, P. and Scarborough, P., 2016. Global and regional health effects of future food production under climate change: a modelling study. Lancet, 387(10031): 1937-46.

Springmann, M., Mason-D'Croz, D., Robinson, S., Wiebe, K., Godfray, H.C.J., Rayner, M. and Scarborough, P., 2017. Mitigation potential and global health impacts from emissions pricing of food commodities. Nature Climate Change, 7: 69.

Springmann, M., Spajic, L., Clark, M., Poore, J., Herforth, A., Webb, P., Rayner, M. and Scarborough, P., 2020. The healthiness and sustainability of national and global food based dietary guidelines: modelling study. Bmj-British Medical Journal, 370.

Springmann, M., Wiebe, K., Mason-D'Croz, D., Sulser, T.B., Rayner, M. and Scarborough, P., 2018b. Health and nutritional aspects of sustainable diet strategies and their association with environmental impacts: a global modelling analysis with country-level detail. The Lancet Planetary Health, 2(10): e451-e461.

Squire, S.A. and Ryan, U., 2017. Cryptosporidium and Giardia in Africa: current and future challenges. Parasit Vectors, 10(1): 195.

SRCCL, I., 2019. Special Report on Climate Change and Land (SRCCL). Chapter 5 Food Security. Draft version.

Ssempiira, J., Kissa, J., Nambuusi, B., Mukooyo, E., Opigo, J., Makumbi, F., Kasasa, S. and Vounatsou, P., 2018. Interactions between climatic changes and intervention effects on malaria spatio-temporal dynamics in Uganda. Parasite Epidemiol Control, 3(3): e00070.

St Laurent, J. and Mazumder, A., 2014. Influence of seasonal and inter-annual hydro-meteorological variability on surface water fecal coliform concentration under varying land-use composition. Water Res, 48: 170-8.

Steentjes, K., Pidgeon, N., Poortinga, W., Corner, A., Arnold, A., Böhm, G., Mays, C., Poumadère, M., Ruddat, M., Scheer, D., Sonnberger, M. and Tvinnereim, E., 2017. European Perceptions of Climate Change: Topline findings of a survey conducted in four European countries in 2016, Cardiff University, Cardiff.

Steffen, W., Richardson, K., Rockstrom, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., de Vries, W., de Wit, C.A., Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B. and Sorlin, S., 2015. Planetary boundaries: Guiding human development on a changing planet. Science, 347(6223).

Stephen, D.M. and Barnett, A.G., 2017. Using Microsimulation to Estimate the Future Health and Economic Costs of Salmonellosis under Climate Change in Central Queensland, Australia. Environ Health Perspect, 125(12): 127001.

Sterzel, T., Ludeke, M., Kok, M., Walther, C., Sietz, D., de Soysa, I., Lucas, P. and Janssen, P., 2014. Armed conflict distribution in global drylands through the lens of a typology of socio-ecological vulnerability. Regional Environmental Change, 14(4): 1419-1435.

Stevens, S.E., Schreck Iii, C.J., Saha, S., Bell, J.E. and Kunkel, K.E., 2019. - Precipitation and fatal motor vehicle crashes: continental analysis with high-resolution radar data. (- 2019).

Stewart, S., Keates, A.K., Redfern, A. and McMurray, J.J.V., 2017. Seasonal variations in cardiovascular disease. Nat Rev Cardiol, 14(11): 654-664.

Stojanov, R., Boas, I., Kelman, I. and Duzi, B., 2017a. Local expert experiences and perceptions of environmentally induced migration from Bangladesh to India. Asia Pacific Viewpoint, 58(3): 347-361.

Stojanov, R., Duzi, B., Kelman, I., Nemec, D. and Prochazka, D., 2017b. Local perceptions of climate change impacts and migration patterns in Male, Maldives. Geographical Journal, 183(4): 370-385.

Stokes, J., Gurol-Urganci, I., Hone, T. and Atun, R., 2015a. Effect of health system reforms in Turkey on user satisfaction. Journal of Global Health, 5(2): 67-76.

Stokes, J., Gurol-Urganci, I., Hone, T. and Atun, R., 2015b. Effect of health system reforms in Turkey on user satisfaction. Journal of Global Health, 5: 020403.

Stone, B., Jr., Vargo, J., Liu, P., Habeeb, D., DeLucia, A., Trail, M., Hu, Y. and Russell, A., 2014. Avoided heat-related mortality through climate adaptation strategies in three US cities. PloS one, 9(6): e100852-e100852.

Stork, A., Travis, C. and Halle, S., 2015. Gender-Sensitivity in Natural Resource Management in Côte d'Ivoire and Sudan. Peace Review, 27(2): 147-155.

Stowell, J.D., Kim, Y.-M., Gao, Y., Fu, J.S., Chang, H.H. and Liu, Y., 2017. The impact of climate change and emissions control on future ozone levels: Implications for human health. Environ. Int., 108: 41-50.

Strand, L.B., Barnett, A.G. and Tong, S., 2012. Maternal exposure to ambient temperature and the risks of preterm birth and stillbirth in Brisbane, Australia. Am J Epidemiol, 175(2): 99-107.

Su, Y., Liu, L., Fang, X.Q. and Ma, Y.N., 2016. The relationship between climate change and wars waged between nomadic and farming groups from the Western Han Dynasty to the Tang Dynasty period. Climate of the Past, 12(1): 137-150.

Suckall, N., Fraser, E. and Forster, P., 2017. Reduced migration under climate change: evidence from Malawi using an aspirations and capabilities framework. Climate and Development, 9(4): 298-312.

Suk, J.E., Vaughan, E.C., Cook, R.G. and Semenza, J.C., 2020. Natural disasters and infectious disease in Europe: a literature review to identify cascading risk pathways. Eur J Public Health, 30(5): 928-935.

Suliman, S., Farbotko, C., Ransan-Cooper, H., Elizabeth McNamara, K., Thornton, F., McMichael, C. and Kitara, T., 2019. Indigenous (im) mobilities in the Anthropocene. Mobilities, 14(3): 298-318.

Sultana, P. and Thompson, P.M., 2017. Adaptation or conflict? Responses to climate change in water management in Bangladesh. Environmental Science & Policy, 78: 149-156.

Sun, J.M., Lu, L., Liu, K.K., Yang, J., Wu, H.X. and Liu, Q.Y., 2018a. Forecast of severe fever with thrombocytopenia syndrome incidence with meteorological factors. Sci Total Environ, 626: 1188-1192.

Sun, S., Spangler, K.R., Weinberger, K.R., Yanosky, J.D., Braun, J.M. and Wellenius, G.A., 2019. - Ambient temperature and markers of fetal growth: a retrospective observational study of 29 million US singleton births. - 127(- 6).

Sun, Z., Chen, C., Xu, D. and Li, T., 2018b. Effects of ambient temperature on myocardial infarction: A systematic review and meta-analysis. Environ Pollut, 241: 1106-1114.

Sundberg, R. and Melander, E., 2013. Introducing the UCDP Georeferenced Event Dataset. Journal of Peace Research, 50(4): 523-532.

Sunnu, A., Resch, F. and Afeti, G., 2013. Back-trajectory model of the Saharan dust flux and particle mass distribution in West Africa. Aeolian Research, 9: 125-132.

Swain, A. and Öjendal, J., 2018. Environmental conflict and peacebuilding: An introduction. In: A. Swain and J. Öjendal (Editors), Routledge Handbook of Environmental Conflict and Peacebuilding. Routledge, London, pp. 1.

Swinburn, B.A., Kraak, V.I., Allender, S., Atkins, V.J., Baker, P.I., Bogard, J.R., Brinsden, H., Calvillo, A., De Schutter, O., Devarajan, R., Ezzati, M., Friel, S., Goenka, S., Hammond, R.A., Hastings, G., Hawkes, C., Herrero, M., Hovmand, P.S., Howden, M., Jaacks, L.M., Kapetanaki, A.B., Kasman, M., Kuhnlein, H.V., Kumanyika, S.K., Larijani, B., Lobstein, T., Long, M.W., Matsudo, V.K.R., Mills, S.D.H., Morgan, G., Morshed, A., Nece, P.M., Pan, A., Patterson, D.W., Sacks, G., Shekar, M., Simmons, G.L., Smit, W., Tootee, A., Vandevijvere, S., Waterlander, W.E., Wolfenden, L. and Dietz, W.H., 2019. The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report. The Lancet, 393(10173): 791-846.

Syed, A., 2018. Impact of economic growth and population dyanamics on CO2 emissions: Study of developing nations. Indian Journal of Environmental Protection, 38(6).

Symons, K., 2014. Anti-politics, Apocalypse and Adaptation in Kenya's National Climate Change Response Strategy. Scottish Geographical Journal, 130(4): 266-278.

Sánchez, C.C., 2018. [Infectious diseases related to water in Peru]. Rev Peru Med Exp Salud Publica, 35(2): 309-316.

Tadgell, A., Doberstein, B. and Mortsch, L., 2018a. Principles for climate-related resettlement of informal settlements in less developed nations: a review of resettlement literature and institutional guidelines. Climate and Development, 10(2): 102-115.

Tadgell, A., Doberstein, B. and Mortsch, L., 2018b. Principles for climate-related resettlement of informal settlements in less developed nations: A review of resettlement literature and institutional guidelines. Climate and Development, 10(2): 102-115.

Tafere, M., 2018. Forced displacements and the environment: Its place in national and international climate agenda. Journal of Environmental Management, 224: 191-201.

Tainio, M., Monsivais, P., Jones, N.R., Brand, C. and Woodcock, J., 2017. Mortality, greenhouse gas emissions and consumer cost impacts of combined diet and physical activity scenarios: a health impact assessment study. BMJ Open, 7(2): e014199.

Takahashi, C., Watanabe, M., Shiogama, H., Imada, Y. and Mori, M., 2017. A Persistent Japanese Heat Wave in Early August 2015: Roles of Natural Variability and Human-Induced Warming. Bulletin of the American Meteorological Society, 97(12): S107-S112.

Takian, A. and Akbari-Sari, A., 2016. Sustainable Health Development Becoming Agenda for Public Health Academia. Iranian Journal of Public Health, 45(11): 1502-1506.

Talukder, M.R.R., Rutherford, S., Huang, C., Phung, D., Islam, M.Z. and Chu, C., 2017. Drinking water salinity and risk of hypertension: A systematic review and meta-analysis. Archives of Environmental & Occupational Health, 72(3): 126-138.

Tambo, J., 2016. Adaptation and resilience to climate change and variability in north-east Ghana. International Journal of Disaster Risk Reduction, 17: 85-94.

Tamnes, R. and Offerdal, K., 2014. Geopolitics and Security in the Arctic: Regional dynamics in a global world. Routledge.

Taub, D., Miller, B. and Allen, H., 2008. Effects of elevated CO2 on the protein concentration of food crops: a meta-analysis. Global Change Biology, 14: 565-575.

Tayimlong, R.A., 2020. Fragility and Insurgency as Outcomes of Underdevelopment of Public Infrastructure and Socio-Economic Deprivation: The Case of Boko Haram in the Lake Chad Basin. Journal of Peacebuilding & Development: 1542316620950188.

Taylor, D., Hagenlocher, M., Jones, A.E., Kienberger, S., Leedale, J. and Morse, A.P., 2016. Environmental change and Rift Valley fever in eastern Africa: projecting beyond HEALTHY FUTURES. Geospatial Health, 11: 115-128.

Taylor, R.G., Scanlon, B., Döll, P., Rodell, M., van Beek, R., Wada, Y., Longuevergne, L., Leblanc, M., Famiglietti, J.S., Edmunds, M., Konikow, L., Green, T.R., Chen, J., Taniguchi, M., Bierkens, M.F.P., MacDonald, A., Fan, Y., Maxwell, R.M., Yechieli, Y., Gurdak, J.J., Allen, D.M., Shamsudduha, M., Hiscock, K., Yeh, P.J.F., Holman, I. and Treidel, H., 2012. Ground water and climate change. Nature Climate Change, 3: 322.

Telford, A., 2018. A threat to climate-secure European futures? Exploring racial logics and climate-induced migration in US and EU climate security discourses. Geoforum, 96: 268-277.

Tesla, B., Demakovsky, L.R., Mordecai, E.A., Ryan, S.J., Bonds, M.H., Ngonghala, C.N., Brindley, M.A. and Murdock, C.C., 2018. Temperature drives Zika virus transmission: evidence from empirical and mathematical models. Proceedings of the Royal Society B-Biological Sciences, 285(1884).

Thaker, J., Maibach, E., Leiserowitz, A., Zhao, X.Q. and Howe, P., 2016. The Role of Collective Efficacy in Climate Change Adaptation in India. Weather Climate and Society, 8(1).

The Lancet Diabetes, E., 2017. South Asian floods and Hurricane Harvey: diabetes in crisis. Lancet Diabetes Endocrinol, 5(10): 757.

Theisen, O.M., 2017. Climate change and violence: insights from political science. Current Climate Change Reports, 3(4): 210-221.

Thiam, S., Diène, A.N., Sy, I., Winkler, M.S., Schindler, C., Ndione, J.A., Faye, O., Vounatsou, P., Utzinger, J. and Cissé, G., 2017. Association between Childhood Diarrhoeal Incidence and Climatic Factors in Urban and Rural Settings in the Health District of Mbour, Senegal. Int J Environ Res Public Health, 14(9).

Thiede, B.C. and Gray, C., 2017. Heterogeneous climate effects on human migration in Indonesia. Population and Environment, 39(2): 147-172.

Thober, J., Schwarz, N. and Hermans, K., 2018. Agent-based modeling of environment-migration linkages: a review. Ecology and Society, 23(2): 41-41.

Thomas, A., Baptiste, A., Martyr-Koller, R., Pringle, P. and Rhiney, K., 2020. Climate Change and Small Island Developing States. Annual Review of Environment and Resources, 45.

Thomas, K.A., 2017. The Ganges water treaty: 20 years of cooperation, on India's terms. Water Policy, 19(4): 724-740.

Thompson, C.N., Zelner, J.L., Nhu, T.o.H., Phan, M.V., Hoang Le, P., Nguyen Thanh, H., Vu Thuy, D., Minh Nguyen, N., Ha Manh, T., Van Hoang Minh, T., Lu Lan, V., Nguyen Van Vinh, C., Tran Tinh, H., von Clemm, E., Storch, H., Thwaites, G., Grenfell, B.T. and Baker, S., 2015. The impact of environmental and climatic variation on the spatiotemporal trends of hospitalized pediatric diarrhea in Ho Chi Minh City, Vietnam. Health Place, 35: 147-54.

Thompson, R., Hornigold, R., Page, L. and Waite, T., 2018. Associations between high ambient temperatures and heat waves with mental health outcomes: a systematic review. Public Health, 161: 171-191.

Tian, Y., Liu, H., Si, Y., Cao, Y., Song, J., Li, M., Wu, Y., Wang, X., Xiang, X., Juan, J., Chen, L., Wei, C., Gao, P. and Hu, Y., 2019. Association between temperature variability and daily hospital admissions for cause-specific cardiovascular disease in urban China: A national time-series study. PLOS Medicine, 16: e1002738.

Tilman, D. and Clark, M., 2014. Global diets link environmental sustainability and human health. Nature, 515(7528): 518-522.

Timaeus, M. and Moultrie, A., 2015. Teenage Childbearing and Educational Attainment in South Africa. Studies in Family Planning, 46(2): 143-160.

Tirado, 2017. Sustainable Diets for Healthy People and a Healthy Planet. United Nations System Standing Committee on Nutrition. Discussion paper. Italy, Rome.

Tirado, forthcoming. Integration of health and nutrition in the National Adpatation Plans and in the National Determined Contributions.

Tirado, M., Crahay, P., Mahy, L., Zanev, C., Neira, M., Msangi, S., Brown, R., Scaramella, C., Coitinho, D. and Muller, A., 2013. Climate change and nutrition: Creating a climate for nutrition security. Food and Nutrition Bulletin, 34(4): 533-547.

Tirgil, A., Gurol-Urganci, I. and Atun, R., 2018. Early experience of universal health coverage in Turkey on access to health services for the poor: regression kink design analysis. Journal of global health, 8(2): 020412-020412.

Tong, S., Berry, H.L., Ebi, K., Bambrick, H., Hu, W., Green, D., Hanna, E., Wang, Z. and Butler, C.D., 2016. Climate change, food, water and population health in China. Bull World Health Organ, 94(10): 759-765.

Torero, M. and Viceisza, A., 2015. To remit, or not to remit: that is the question. A remittance field experiment. Journal of Economic Behavior & Organization, 112: 221-236.

Tornevi, A., Simonsson, M., Forsberg, B., Säve-Söderbergh, M. and Toljander, J., 2016. Efficacy of water treatment processes and endemic gastrointestinal illness - A multi-city study in Sweden. Water Res, 102: 263-270.

Torres, J.M. and Casey, J.A., 2017. The centrality of social ties to climate migration and mental health. BMC Public Health, 17: 600-600.

Tourre, Y.M., Vignolles, C., Viel, C. and Mounier, F., 2017. Climate impact on malaria in northern Burkina Faso. Geospat Health, 12(2): 600.

Trang, P.M., Rocklov, J., Giang, K.B., Kullgren, G. and Nilsson, M., 2016. Heatwaves and Hospital Admissions for Mental Disorders in Northern Vietnam. Plos One, 11(5).

Trombetta, M.J., 2014. Linking climate-induced migration and security within the EU: insights from the securitization debate. Critical Studies on Security, 2(2): 131-147.

Truchado, P., Hernandez, N., Gil, M.I., Ivanek, R. and Allende, A., 2018. Correlation between E. coli levels and the presence of foodborne pathogens in surface irrigation water: Establishment of a sampling program. Water Res, 128: 226-233.

Tschakert, P., Barnett, J., Ellis, N., Lawrence, C., Tuana, N., New, M., Elrick-Barr, C., Pandit, R. and Pannell, D., 2017. Climate change and loss, as if people mattered: values, places, and experiences. WIREs Climate Change, 8(5): e476-e476.

Tschakert, P., Ellis, N.R., Anderson, C., Kelly, A. and Obeng, J., 2019. One thousand ways to experience loss: A systematic analysis of climate-related intangible harm from around the world. Global Environmental Change-Human and Policy Dimensions, 55: 58-72.

Tubi, A. and Feitelson, E., 2016. Drought and cooperation in a conflict prone area: Bedouin herders and Jewish farmers in Israel's northern Negev, 1957–1963. Political Geography, 51: 30-42.

Turhan, E., Zografos, C. and Kallis, G., 2015. Adaptation as biopolitics: Why state policies in Turkey do not reduce the vulnerability of seasonal agricultural workers to climate change. Global Environmental Change-Human and Policy Dimensions, 31: 296-306.

Turner, B.L., Kasperson, R.E., Matson, P.A., Mccarthy, J.J., Corell, R.W., Lindsey, C., Noelle, E., Kasperson, J.X., Amy, L. and Martello, M.L., 2003. A framework for vulnerability analysis in sustainability science. Proc Natl Acad Sci U S A, 100(14): 8074-8079.

Turner, M., 2016. Climate vulnerability as a relational concept. Geoforum, 68: 29-38.

Tàbara, J.D., Frantzeskaki, N., Hölscher, K., Pedde, S., Kok, K., Lamperti, F., Christensen, J.H., Jäger, J. and Berry, P., 2018. Positive tipping points in a rapidly warming world. Current Opinion in Environmental Sustainability, 31: 120-129.

Tänzler, D., Scherer, N. and Adelphi, 2019. Guidelines for conflict-sensitive adaptation to climate change, Dessau-Roßla.

Udas, B., Tamang, D., Unni, A., Hamal, M., Shrestha, K. and Pandit, A., 2019. Basin level gendered vulnerabilities and adaptation: A case of Gandaki River Basin. Environmental Development, 31: 43-54.

Ujunwa, A., Okoyeuzu, C. and Kalu, E.U., 2019. Armed Conflict and Food Security in West Africa: Socioeconomic Perspective. International Journal of Social Economics, 46(2): 182-198.

UNEP, 2014. The Adaptation Gap Report 2014, United Nations Environment Programme (UNEP).

UNEP, 2018. The Adaptation Gap Report 2018. United Nations Environment Programme (UNEP), Nairobi, Kenya.

UNICEF/WHO/WBG, 2019. United Nations Children's Fund (UNICEF), World Health Organization, International Bank for Reconstruction and Development/The World Bank. Levels and trends in child malnutrition: key findings of the 2019 Edition Joint Child Malnutrition Estimates. Geneva: World Health Organization, Geneva.

United Nations, D.o.E.a.S.A.P.D., 2017. International Migration Report 2017: Highlights. Report no. (ST/ESA/SER.A/404), New York.

Ürge-Vorsatz, D., Cabeza, L.F., Serrano, S., Barreneche, C. and Petrichenko, K., 2015. Heating and cooling energy trends and drivers in buildings. Renewable Sustainable Energy Rev., 41: 85-98.

Ürge-Vorsatz, D., Herrero, T., Dubash, K. and Lecocq, F., 2014. Measuring the Co-Benefits of Climate Change Mitigation. Annual Review of Environment and Resources, 39(6): 549-582.

Urquhart, E.A., Zaitchik, B.F., Waugh, D.W., Guikema, S.D. and Del Castillo, C.E., 2014. Uncertainty in model predictions of Vibrio vulnificus response to climate variability and change: a Chesapeake Bay case study. PLoS One, 9(5): e98256.

USGCRP, 2016. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, U.S. Global Change Research Program, Washington, DC.

Uson, M.A.M., 2017. Natural disasters and land grabs: the politics of their intersection in the Philippines following super typhoon Haiyan. Canadian Journal of Development Studies-Revue Canadienne D Etudes Du Developpement, 38(3): 414-430.

Valois, P., Blouin, P., Ouellet, C., Renaud, J.S., Bélanger, D. and Gosselin, P., 2016. The Health Impacts of Climate Change: A Continuing Medical Education Needs Assessment Framework. J Contin Educ Health Prof, 36(3): 218-25.

Van Baalen, S. and Mobjˆrk, M., 2017. Climate change and violent conflict in East Africa: integrating qualitative and quantitative research to probe the mechanisms. International Studies Review, 20(4): 547-575.

van den Berg, M., Wendel-Vos, W., van Poppel, M., Kemper, H., van Mechelen, W. and Maas, J., 2015. Health benefits of green spaces in the living environment: A systematic review of epidemiological studies. Urban Forestry & Urban Greening, 14(4): 806-816.

Van der Fels-Klerx, H.J., Olesen, J., Naustvoll, L., Friocourt, Y., Mengelers, M.J.B. and Christensen, J., 2012. Climate change impacts on natural toxins in food production systems, exemplified by deoxynivalenol in wheat and diarrhetic shellfish toxins. Food Additives & Contaminants: Part A, 29: 1647-59.

van der Geest, K., Burkett, M., Fitzpatrick, J., Stege, M. and Wheeler, B., 2020. Climate change, ecosystem services and migration in the Marshall Islands: are they related? Climatic Change, 161(1): 109-127.

van der Linden, S., 2015. The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. Journal of Environmental Psychology, 41: 112-124.

Van Kerkhove, M.D., Vandemaele, K.A., Shinde, V., Jaramillo-Gutierrez, G., Koukounari, A., Donnelly, C.A., Carlino, L.O., Owen, R., Paterson, B., Pelletier, L., Vachon, J., Gonzalez, C., Hongjie, Y., Zijian, F., Chuang, S.K., Au, A., Buda, S., Krause, G., Haas, W., Bonmarin, I., Taniguichi, K., Nakajima, K., Shobayashi, T., Takayama, Y., Sunagawa, T., Heraud, J.M., Orelle, A., Palacios, E., van der Sande, M.A., Wielders, C.C., Hunt, D., Cutter, J., Lee, V.J., Thomas, J., Santa-Olalla, P., Sierra-Moros, M.J., Hanshaoworakul, W., Ungchusak, K., Pebody, R., Jain, S., Mounts, A.W. and Infection, W.H.O.W.G.f.R.F.f.S.H.N.p., 2011. Risk factors for severe outcomes following 2009 influenza A (H1N1) infection: a global pooled analysis. PLoS Med, 8(7): e1001053.

Van Lange, P.A., Rinderu, M.I. and Bushman, B.J., 2017. Aggression and violence around the world: A model of CLimate, Aggression, and Self-control in Humans (CLASH). Behavioral and brain sciences, 40.

van Lange, P.A.M., Rinderu, M.I. and Bushman, B.J., 2018. CLASH: Climate (change) and cultural evolution of intergroup conflict. Group Processes & Intergroup Relations, 21(3): 457-471.

van Loenhout, J.A.F., Delbiso, T.D., Kiriliouk, A., Rodriguez-Llanes, J.M., Segers, J. and Guha-Sapir, D., 2018. Heat and emergency room admissions in the Netherlands. BMC Public Health, 18(1): 108.

van Ruijven, B., Levy, M., Agrawal, A., Biermann, F., Birkmann, J., Carter, T., Ebi, K., Garschagen, M., Jones, B., Jones, R., Kemp-Benedict, E., Kok, M., Kok, K., Lemos, M., Lucas, P., Orlove, B., Pachauri, S., Parris, T., Patwardhan, A., Petersen, A., Preston, B., Ribot, J., Rothman, D. and Schweizer, V., 2014. Enhancing the relevance of Shared Socioeconomic Pathways for climate change impacts, adaptation and vulnerability research. Climatic Change, 122(3): 481-494.

van Valkengoed, A. and Steg, L., 2019. Meta-analyses of factors motivating climate change adaptation behaviour. Nature Climate Change, 9(2): 158-+.

van Vuuren, D.P., Stehfest, E., Gernaat, D.E.H.J., van den Berg, M., Bijl, D.L., de Boer, H.S., Daioglou, V., Doelman, J.C., Edelenbosch, O.Y., Harmsen, M., Hof, A.F. and van Sluisveld, M.A.E., 2018. Alternative pathways to the 1.5 °C target reduce the need for negative emission technologies. Nature Climate Change, 8(5): 391-397.

van Weezel, S., 2019. On climate and conflict: Precipitation decline and communal conflict in Ethiopia and Kenya. Journal of Peace Research, 56(4): 514-528.

Vandyck, T., Keramidas, K., Kitous, A., Spadaro, J.V., Van Dingenen, R., Holland, M. and Saveyn, B., 2018. Air quality co-benefits for human health and agriculture counterbalance costs to meet Paris Agreement pledges. Nat. Commun., 9(1): 4939.

Vanwambeke, S.O., Linard, C., Gilbert, M. and Dellicour, S., 2020. SARS-CoV-2 emergence and diffusion: a new disease manifesting human-environment interactions and a global geography of health. Curr Opin Environ Sustain.

Vardoulakis, S., Dear, K., Hajat, S., Heaviside, C., Eggen, B. and McMichael, A.J., 2014. Comparative assessment of the effects of climate change on heat- and cold-related mortality in the United Kingdom and Australia. Environmental health perspectives, 122(12): 1285-1292.

Varghese, B.M., Barnett, A.G., Hansen, A.L., Bi, P., Hanson-Easey, S., Heyworth, J.S., Sim, M.R. and Pisaniello, D.L., 2019. - The effects of ambient temperatures on the risk of work-related injuries and illnesses: Evidence from Adelaide, Australia 2003–2013. - 170.

Vasil'eva, I.S., Ganushkina, L.A., Gutova, V.P. and Litvinov, S.K., 2013. [The impact of climatic changes on Ixodes (Ixodidae) ticks and their related natural and focal infections]. Med Parazitol (Mosk)(3): 55-63.

Velez-Valle, E.M., Echeverria, S. and Santorelli, M., 2016. Type II Diabetes Emergency Room Visits Associated With Hurricane Sandy in New Jersey: Implications for Preparedness. J Environ Health, 79(2): 30-7.

Velásquez, A.C., Castroverde, C.D.M. and He, S.Y., 2018. Plant–Pathogen Warfare under Changing Climate Conditions. Current Biology, 28(10): R619-R634.

Venugopal, R. and Yasir, S., 2017. The politics of natural disasters in protracted conflict: the 2014 flood in Kashmir. Oxford Development Studies, 45(4): 424-442.

Verhoeven, H., 2014. Gardens of Eden or Hearts of Darkness? The Genealogy of Discourses on Environmental Insecurity and Climate Wars in Africa. Geopolitics, 19(4): 784-805.

Vermeulen, S.J., Campbell, B.M. and Ingram, J.S.I., 2012. Climate Change and Food Systems. Annu. Rev. Environ. Resour. 37(1): 195-222.

Verner, G., Schutte, S., Knop, J., Sankoh, O. and Sauerborn, R., 2016. Health in climate change research from 1990 to 2014: positive trend, but still underperforming. Global Health Action, 9.

Veronis, L., Boyd, B., Obokata, R. and Main, B., 2017. Environmental change and international migration: a review.

Veronis, L., Boyd, B., Obokata, R. and Main, B., 2018. Environmental change and international migration: A review.

Veronis, L. and McLeman, R., 2014. Environmental influences on African migration to Canada: focus group findings from Ottawa-Gatineau. Population and Environment, 36(2): 234-251.

Vestby, J., 2019. Climate variability and individual motivations for participating in political violence. Global Environmental Change, 56: 114-123.

Vicedo-Cabrera, A.M., Gasparrini, A., Armstrong, B., Sera, F., Guo, Y., Hashizume, M., Honda, Y., Iñiguez, C., Jaakkola, J.J.K., Ryti, N.R.I., Kan, H., Tobias, A., Kim, H., Lavigne, E., Scortichini, M., Michelozzi, P., Osorio, S., Pascal, M., Ragettli, M.S., Zanobetti, A., Schwartz, J., Seposo, X., Forsberg, B., Åström, C., Tong, S., Bell, M.L., Chen, B.-Y., Guo, Y.L., de Sousa Zanotti Stagliorio Coelho, M., Saldiva, P.H.N., Ortega, N.V., Matus Correa, P., Cruz, J.C., Hurtado-Diaz, M., Do Van, D. and Dang, T.N., 2019. How urban characteristics affect vulnerability to heat and cold: a multi-country analysis.

Vicedo-Cabrera, A.M., Guo, Y.M., Sera, F., Huber, V., Schleussner, C.F., Mitchell, D., Tong, S.L., Coelho, M., Saldiva, P.H.N., Lavigne, E., Correa, P.M., Ortega, N.V., Kan, H.D., Osorio, S., Kysely, J., Urban, A., Jaakkola, J.J.K., Ryti, N.R.I., Pascal, M., Goodman, P.G., Zeka, A., Michelozzi, P., Scortichini, M., Hashizume, M., Honda, Y., Hurtado-Diaz, M., Cruz, J., Seposo, X., Kim, H., Tobias, A., Iniguez, C., Forsberg, B., Astrom, D.O., Ragettli, M.S., Roosli, M., Guo, Y.L., Wu, C.F., Zanobetti, A., Schwartz, J., Bell, M.L., Dang, T.N., Van, D.D., Heaviside, C., Vardoulakis, S., Hajat, S., Haines, A., Armstrong, B., Ebi, K.L. and Gasparrini, A., 2018a. Temperature-related mortality impacts under and beyond Paris Agreement climate change scenarios. Climatic Change, 150(3-4): 391-402.

Vicedo-Cabrera, A.M., Sera, F., Guo, Y., Chung, Y., Arbuthnott, K., Tong, S., Tobias, A., Lavigne, E., de Sousa Zanotti Stagliorio Coelho, M., Hilario Nascimento Saldiva, P., Goodman, P.G., Zeka, A., Hashizume, M., Honda, Y., Kim, H., Ragettli, M.S., Röösli, M., Zanobetti, A., Schwartz, J., Armstrong, B. and Gasparrini, A., 2018b. A multi-country analysis on potential adaptive mechanisms to cold and heat in a changing climate. Environment International, 111: 239-246.

Vidal, J., 2015. Health effects of climate change highlighted in Paris Agreement. Bmj-British Medical Journal, 351.

Vidal, R., Moliner, E., Pikula, A., Mena-Nieto, A. and Ortega, A., 2014. Comparison of the carbon footprint of different patient diets in a Spanish hospital. Journal of health services research & policy, 20.

Vidal, R., Moliner, E., Pikula, A., Mena-Nieto, A. and Ortega, A., 2015. Comparison of the carbon footprint of different patient diets in a Spanish hospital. Journal of Health Services Research & Policy, 20(1): 39-44.

Vij, S., Narain, V., Karpouzoglou, T. and Mishra, P., 2018. From the core to the periphery: Conflicts and cooperation over land and water in periurban Gurgaon, India. Land Use Policy, 76: 382-390.

Vik, M.H. and Carlquist, E., 2018. Measuring subjective well-being for policy purposes: The example of well-being indicators in the WHO "Health 2020" framework. Scandinavian Journal of Public Health, 46(2): 279-286.

Vinke, K., Martin, M.A., Adams, S., Baarsch, F., Bondeau, A., Coumou, D., Donner, R.V., Menon, A., Perrette, M. and Rehfeld, K., 2017. Climatic risks and impacts in South Asia: extremes of water scarcity and excess. Regional Environmental Change, 17(6): 1569-1583.

Vins, H., Bell, J., Saha, S. and Hess, J.J., 2015. The Mental Health Outcomes of Drought: A Systematic Review and Causal Process Diagram. International Journal of Environmental Research and Public Health, 12(10): 13251-13275.

Virgilio, G., Evans, J., Blake, S., Armstrong, M., Dowdy, A., Sharples, J. and McRae, R., 2019. Climate Change Increases the Potential for Extreme Wildfires. Geophysical Research Letters, 46.

Visser, H., Petersen, A.C. and Ligtvoet, W., 2014. On the relation between weather-related disaster impacts, vulnerability and climate change. Climatic Change, 125(3-4): 461-477.

Viswanathan, B. and Kumar, K., 2015. Weather, agriculture and rural migration: evidence from state and district level migration in India. Environment and Development Economics, 20(4): 469-492.

Vivekananda, J., Schilling, J. and Smith, D., 2014a. Climate resilience in fragile and conflict-affected societies: concepts and approaches. Development in Practice, 24(4): 487-501.

Vivekananda, J., Schilling, J. and Smith, D., 2014b. Understanding Resilience in Climate Change and Conflict Affected Regions of Nepal. Geopolitics, 19(4): 911-936.

Vivero-Pol, J., ViveroPol, J., Ferrando, T., DeSchutter, O. and Mattei, U., 2019. THE IDEA OF FOOD AS A COMMONS Multiple understandings for multiple dimensions of food. Routledge Handbook of Food as a Commons: 25-41.

Vollset, S.E., Goren, E., Yuan, C.-W., Cao, J., Smith, A.E., Hsiao, T., Bisignano, C., Azhar, G.S., Castro, E. and Chalek, J., 2020. - Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study.

von Lucke, F., 2018. Linking climate change and security in Mexico: explorations into an attempted securitisation in the Global South. Journal of International Relations and Development, 21(2): 415-441.

von Lucke, F., Wellmann, Z. and Diez, T., 2014. What's at Stake in Securitising Climate Change? Towards a Differentiated Approach. Geopolitics, 19(4): 857-884.

von Uexkull, N., 2014. Sustained drought, vulnerability and civil conflict in Sub-Saharan Africa. Political Geography, 43: 16-26.

Von Uexkull, N., Croicu, M., Fjelde, H. and Buhaug, H., 2016. Civil conflict sensitivity to growing-season drought. Proceedings of the National Academy of Sciences, 113(44): 12391-12396.

Vos, T., Abajobir, A.A., Abate, K.H., Abbafati, C., Abbas, K.M., Abd-Allah, F., Abdulkader, R.S., Abdulle, A.M., Abebo, T.A., Abera, S.F. and Others, 2017. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990--2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet, 390(10100): 1211-1259.

Vos, T., Lim, S.S., Abbafati, C., Abbas, K.M., Abbasi, M., Abbasifard, M., Abbasi-Kangevari, M., Abbastabar, H., Abd-Allah, F. and Abdelalim, A., 2020. - Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. - 396(- 10258).

Vratnica, Z., Busani, L., Zekovic, Z., Rakocevic, B., Medenica, S., Urciuoli, R., Rezza, G. and Mugosa, B., 2017. Haemorrhagic fever with renal syndrome in Montenegro, 2004-14. Eur J Public Health, 27(6): 1108-1110.

Wagstaff, G.a., 2016. The Economic Costs of Stunting and How to Reduce Them. Development Economics. The World Bank Group.

Waha, K., Krummenauer, L., Adams, S., Aich, V., Baarsch, F., Coumou, D., Fader, M., Hoff, H., Jobbins, G. and Marcus, R., 2017. Climate change impacts in the Middle East and Northern Africa (MENA) region and their implications for vulnerable population groups. Regional Environmental Change, 17(6): 1623-1638.

Waite, T.D., Chaintarli, K., Beck, C.R., Bone, A., Amlot, R., Kovats, S., Reacher, M., Armstrong, B., Leonardi, G., Rubin, G.J. and Oliver, I., 2017. The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one. Bmc Public Health, 17.

Walch, C., 2014. Collaboration or obstruction? Rebel group behavior during natural disaster relief in the Philippines. Political Geography, 43: 40-50.

Walch, C., 2018. Disaster risk reduction amidst armed conflict: informal institutions, rebel groups, and wartime political orders. Disasters, 42: S239-S264.

Walker, J.T., 2018. The influence of climate change on waterborne disease and Legionella: a review. Perspectives in Public Health, 138(5): 282-286.

Walpole, S., Vyas, A., Maxwell, J., Canny, B., Woollard, R., Wellbery, C., Leedham-Green, K., Musaeus, P., Tufail-Hanif, U., Patricio, K. and Rother, H., 2017. Building an environmentally accountable medical curriculum through international collaboration. Medical Teacher, 39(10): 1040-1050.

Wang, C., Jiang, B., Fan, J., Wang, F. and Liu, Q., 2014a. A study of the dengue epidemic and meteorological factors in Guangzhou, China, by using a zero-inflated Poisson regression model. Asia Pac J Public Health, 26(1): 48-57.

Wang, C., Liang, J. and Hodges, K., 2017a. Projections of tropical cyclones affecting Vietnam under climate change: Downscaled HadGEM2-ES using PRECIS 2.1. Quarterly Journal of the Royal Meteorological Society.

Wang, C., Liang, J. and Hodges, K.I., 2017b. Projections of tropical cyclones affecting Vietnam under climate change: downscaled HadGEM2-ES using PRECIS 2.1. Quarterly Journal of the Royal Meteorological Society, 143(705): 1844-1859.

Wang, C. and Wu, L., 2018. Future Changes of the Monsoon Trough: Sensitivity to Sea Surface Temperature Gradient and Implications for Tropical Cyclone Activity. Earths Future, 6(6): 919-936.

Wang, H., Abajobir, A., Abate, H., Abbafati, C., Abbas, M., Abd-Allah, F. and Murray, L., 2017c. Global, regional, and national under-5 mortality, adult mortality, age-specific mortality, and life expectancy, 1970–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet, 390(10100): 1084-1150.

Wang, H., Abbas, K.M., Abbasifard, M., Abbasi-Kangevari, M., Abbastabar, H., Abd-Allah, F., Abdelalim, A., Abolhassani, H., Abreu, L.G. and Abrigo, M.R.M., 2020a. - Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates in 204 countries and territories, 1950–2019: a comprehensive demographic analysis for the Global Burden of Disease Study 2019. - 396(- 10258).

Wang, P., Goggins, W.B. and Chan, E.Y.Y., 2018a. Associations of Salmonella hospitalizations with ambient temperature, humidity and rainfall in Hong Kong. Environ Int, 120: 223-230.

Wang, Q., Gao, C., Liu, H., Li, W., Zhao, Y., Xu, G., Yan, C., Lin, H. and Lang, L., 2017d. Hypertension modifies the short-term effects of temperature on morbidity of hemorrhagic stroke. Sci Total Environ, 598: 198-203.

Wang, Q., Li, B., Benmarhnia, T., Hajat, S., Ren, M., Liu, T., Knibbs, L.D., Zhang, H., Bao, J., Zhang, Y., Zhao, Q. and Huang, C., 2020b. Independent and Combined Effects of Heatwaves and. Environ Health Perspect, 128(1): 17006.

Wang, Q., Li, C., Guo, Y., Barnett, A.G., Tong, S., Phung, D., Chu, C., Dear, K., Wang, X. and Huang, C., 2017e. Environmental ambient temperature and blood pressure in adults: A systematic review and meta-analysis. Science of the Total Environment, 575: 276-286.

Wang, T., Li, X.L., Liu, M., Song, X.J., Zhang, H., Wang, Y.B., Tian, B.P., Xing, X.S. and Li, S.Y., 2017f. Epidemiological Characteristics and Environmental Risk Factors of Severe Fever with Thrombocytopenia Syndrome in Hubei Province, China, from 2011 to 2016. Front Microbiol, 8: 387.

Wang, X., Cao, Y., Hong, D., Zheng, D., Richtering, S., Sandset, E.C., Leong, T.H., Arima, H., Islam, S., Salam, A., Anderson, C., Robinson, T. and Hackett, M.L., 2016. Ambient Temperature and Stroke Occurrence: A Systematic Review and Meta-Analysis. Int J Environ Res Public Health, 13(7).

Wang, X., Lavigne, E., Ouellette-kuntz, H. and Chen, B.E., 2014b. Acute impacts of extreme temperature exposure on emergency room admissions related to mental and behavior disorders in Toronto, Canada. Journal of Affective Disorders, 155: 154-161.

Wang, X., Tang, S., Wu, J., Xiao, Y. and Cheke, R.A., 2019. A combination of climatic conditions determines major within-season dengue outbreaks in Guangdong Province, China. Parasit Vectors, 12(1): 45.

Wang, Y., Nordio, F., Nairn, J., Zanobetti, A. and Schwartz, J.D., 2018b. Accounting for adaptation and intensity in projecting heat wave-related mortality. Environmental Research, 161: 464-471.

Wangdi, K. and Clements, A.C., 2017. Spatial and temporal patterns of diarrhoea in Bhutan 2003-2013. BMC Infect Dis, 17(1): 507.

Wangdi, K., Clements, A.C.A., Du, T. and Nery, S.V., 2018. Spatial and temporal patterns of dengue infections in Timor-Leste, 2005-2013. Parasit Vectors, 11(1): 9.

Ward, A., Clark, J., McLeod, J., Woodul, R., Moser, H. and Konrad, C., 2019. - The impact of heat exposure on reduced gestational age in pregnant women in North Carolina, 2011–2015.

Wario, H.T., Roba, H.G. and Kaufmann, B., 2016. Responding to mobility constraints: Recent shifts in resource use practices and herding strategies in the Borana pastoral system, southern Ethiopia. Journal of Arid Environments, 127: 222-234.

Warner, K., 2018. Coordinated approaches to large-scale movements of people: contributions of the Paris Agreement and the Global Compacts for migration and on refugees. Population and Environment, 39(4): 384-401.

Warner, K. and Afifi, T., 2014. Where the rain falls: Evidence from 8 countries on how vulnerable households use migration to manage the risk of rainfall variability and food insecurity. Climate and Development, 6(1): 1-17.

Wartenburger, R., Hirschi, M., Donat, M., Greve, P., Pitman, A. and Seneviratne, S., 2017. Changes in regional climate extremes as a function of global mean temperature: an interactive plotting framework. Geoscientific Model Development, 10(9): 3609-3634.

Watson, I., 2014. Middle Power Alliances and the Arctic: Assessing Korea-UK Pragmatic Idealism. Korea Observer, 45(2): 275-320.

Watts, N., Adger, W., Ayeb-Karlsson, S., Bai, Y., Byass, P., Campbell-Lendrum, D., Colbourn, T., Cox, P., Davies, M., Depledge, M., Depoux, A., Dominguez-Salas, P., Drummond, P., Ekins, P., Flahault, A., Grace, D., Graham, H., Haines, A., Hamilton, I., Johnson, A., Kelman, I., Kovats, S., Liang, L., Lott, M., Lowe, R., Luo, Y., Mace, G., Maslin, M., Morrissey, K., Murray, K., Neville, T., Nilsson, M., Oreszczyn, T., Parthemore, C., Pencheon, D., Robinson, E., Schutte, S., Shumake-Guillemot, J., Vineis, P., Wilkinson, P., Wheeler, N., Xu, B., Yang, J., Yin, Y., Yu, C., Gong, P., Montgomery, H. and Costello, A., 2017a. The Lancet Countdown: tracking progress on health and climate change. Lancet, 389(10074): 1151-1164.

Watts, N., Adger, W.N., Agnolucci, P., Blackstock, J., Byass, P., Cai, W., Chaytor, S., Colbourn, T., Collins, M. and Cooper, A., 2015a. Health and climate change: policy responses to protect public health. The Lancet, 386(10006): 1861-1914.

Watts, N., Adger, W.N., Agnolucci, P., Blackstock, J., Byass, P., Cai, W., Chaytor, S., Colbourn, T., Collins, M., Cooper, A., Cox, P.M., Depledge, J., Drummond, P., Ekins, P., Galaz, V., Grace, D., Graham, H., Grubb, M., Haines, A., Hamilton, I., Hunter, A., Jiang, X., Li, M., Kelman, I., Liang, L., Lott, M., Lowe, R., Luo, Y., Mace, G., Maslin, M., Nilsson, M., Oreszczyn, T., Pye, S., Quinn, T., Svensdotter, M., Venevsky, S., Warner, K., Xu, B., Yang, J., Yin, Y., Yu, C., Zhang, Q., Gong, P., Montgomery, H. and Costello, A., 2015b. Health and climate change: policy responses to protect public health. Lancet, 386(10006): 1861-914.

Watts, N., Adger, W.N., Ayeb-Karlsson, S., Bai, Y., Byass, P., Campbell-Lendrum, D., Colbourn, T., Cox, P., Davies, M., Depledge, M., Depoux, A., Dominguez-Salas, P., Drummond, P., Ekins, P., Flahault, A., Grace, D., Graham, H., Haines, A., Hamilton, I., Johnson, A., Kelman, I., Kovats, S., Liang, L., Lott, M., Lowe, R., Luo, Y., Mace, G., Maslin, M., Morrissey, K., Murray, K., Neville, T., Nilsson, M., Oreszczyn, T., Parthemore, C., Pencheon, D., Robinson, E., Schütte, S., Shumake-Guillemot, J., Vineis, P., Wilkinson, P., Wheeler, N., Xu, B., Yang, J., Yin, Y., Yu, C., Gong, P., Montgomery, H. and Costello, A., 2017b. The Lancet Countdown: tracking progress on health and climate change. Lancet, 389(10074): 1151-1164.

Watts, N., Amann, M. and Arnell, N., 2020a. The 2018 report of The Lancet Countdown on health and climate change: shaping the health of nations for centuries to come (vol 392, pg 2479, 2018). Lancet, 395(10239): 1762-1762.

Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Berry, H., Bouley, T., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Chambers, J., Daly, M., Dasandi, N., Davies, M., Depoux, A., Dominguez-Salas, P., Drummond, P., Ebi, K., Ekins, P., Montoya, L., Fischer, H., Georgeson, L., Grace, D., Graham, H., Hamilton, I., Hartinger, S., Hess, J., Kelman, I., Kiesewetter, G., Kjellstrom, T., Kniveton, D., Lemke, B., Liang, L., Lott, M., Lowe, R., Sewe, M., Martinez-Urtaza, J., Maslin, M., McAllister, L., Mikhaylov, S., Milner, J., Moradi-Lakeh, M., Morrissey, K., Murray, K., Nilsson, M., Neville, T., Oreszczyn, T., Owfi, F., Pearman, O., Pencheon, D., Pye, S., Rabbaniha, M., Robinson, E., Rocklov, J., Saxer, O., Schutte, S., Semenza, J., Shumake-Guillemot, J., Steinbach, R., Tabatabaei, M., Tomei, J., Trinanes, J., Wheeler, N., Wilkinson, P., Gong, P., Montgomery, H. and Costello, A., 2018a. The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come. Lancet, 392(10163): 2479-2514.

Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Berry, H., Bouley, T., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Chambers, J., Daly, M., Dasandi, N., Davies, M., Depoux, A., Dominguez-Salas, P., Drummond, P., Ebi, K., Ekins, P., Montoya, L., Fischer, H., Georgeson, L., Grace, D., Graham, H., Hamilton, I., Hartinger, S., Hess, J., Kelman, I., Kiesewetter, G., Kjellstrom, T., Kniveton, D., Lemke, B., Liang, L., Lott, M., Lowe, R., Sewe, M., Martinez-Urtaza, J., Maslin, M., McAllister, L., Mikhaylov, S., Milner, J., Moradi-Lakeh, M., Morrissey, K., Murray, K., Nilsson, M., Neville, T., Oreszczyn, T., Owfi, F., Pearman, O., Pencheon, D., Pye, S., Rabbaniha, M., Robinson, E., Rocklov, J., Saxer, O., Schutte, S., Semenza, J., Shumake-Guillemot, J., Steinbach, R., Tabatabaei, M., Tomei, J., Trinanes, J., Wheeler, N., Wilkinson, P., Gong, P., Montgomery, H. and Costello, A., 2018b. The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come. Lancet, 392(10163): 2479-2514.

Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Berry, H., Bouley, T., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Chambers, J., Daly, M., Dasandi, N., Davies, M., Depoux, A., Dominguez-Salas, P., Drummond, P., Ebi, K., Ekins, P., Montoya, L., Fischer, H., Georgeson, L., Grace, D., Graham, H., Hamilton, I., Hartinger, S., Hess, J., Kelman, I., Kiesewetter, G., Kjellstrom, T., Kniveton, D., Lemke, B., Liang, L., Lott, M., Lowe, R., Sewe, M., Martinez-Urtaza, J., Maslin, M., McAllister, L., Mikhaylov, S., Milner, J., Moradi-Lakeh, M., Morrissey, K., Murray, K., Nilsson, M., Neville, T., Oreszczyn, T., Owfi, F., Pearman, O., Pencheon, D., Pye, S., Rabbaniha, M., Robinson, E., Rocklov, J., Saxer, O., Schutte, S., Semenza, J., Shumake-Guillemot, J., Steinbach, R., Tabatabaei, M., Tomei, J., Trinanes, J., Wheeler, N., Wilkinson, P., Gong, P., Montgomery, H. and Costello, A., 2018c. The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come. Lancet, 392(10163): 2479-2514.

Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Capstick, S., Chambers, J., Dalin, C., Daly, M., Dasandi, N., Davies, M., Drummond, P., Dubrow, R., Ebi, K., Eckelman, M., Ekins, P., Escobar, L., Montoya, L., Georgeson, L., Graham, H., Haggar, P., Hamilton, I., Hartinger, S., Hess, J., Kelman, I., Kiesewetter, G., Kjellstrom, T., Kniveton, D., Lemke, B., Liu, Y., Lott, M., Lowe, R., Sewe, M., Martinez-Urtaza, J., Maslin, M., McAllister, L., McGushin, A., Mikhaylov, S., Milner, J., Moradi-Lakeh, M., Morrissey, K., Murray, K., Munzert, S., Nilsson, M., Neville, T., Oreszczyn, T., Owfi, F., Pearman, O., Pencheon, D., Phung, D., Pye, S., Quinn, R., Rabbaniha, M., Robinson, E., Rocklov, J., Semenza, J., Sherman, J., Shumake-Guillemot, J., Tabatabaei, M., Taylor, J., Trinanes, J., Wilkinson, P., Costello, A., Gong, P. and Montgomery, H., 2019a. The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. Lancet, 394(10211): 1836-1878.

Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Boykoff, M., Byass, P., Cai, W.J., Campbell-Lendrum, D., Capstick, S., Chambers, J., Dalin, C., Daly, M., Dasandi, N., Davies, M., Drummond, P., Dubrow, R., Ebi, K.L., Eckelman, M., Ekins, P., Escobar, L.E., Montoya, L.F., Georgeson, L., Graham, H., Haggar, P., Hamilton, I., Hartinger, S., Hess, J., Kelman, I., Kiesewetter, G., Kjellstrom, T., Kniveton, D., Lemke, B., Liu, Y., Lott, M., Lowe, R., Sewe, M.O., Martinez-Urtaza, J., Maslin, M., McAllister, L., McGushin, A., Mikhaylov, S.J., Milner, J., Moradi-Lakeh, M., Morrissey, K., Murray, K., Munzert, S., Nilsson, M., Neville, T., Oreszczyn, T., Owfi, F., Pearman, O., Pencheon, D., Phung, D., Pye, S., Quinn, R., Rabbaniha, M., Robinson, E., Rocklov, J., Semenza, J.C., Sherman, J., Shumake-Guillemot, J., Tabatabaei, M., Taylor, J., Trinanes, J., Wilkinson, P., Costello, A., Gong, P. and Montgomery, H., 2019b. The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. Lancet, 394(10211): 1836-1878.

Watts, N., Amann, M. and Ayeb-Karlsson, S., 2020b. The 2017 report of The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health (vol 391, pg 581, 2017). Lancet, 395(10239): 1762-1762.

Watts, N., Amann, M., Ayeb-Karlsson, S., Belesova, K., Bouley, T., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Chambers, J., Cox, P.M., Daly, M., Dasandi, N., Davies, M., Depledge, M., Depoux, A., Dominguez-Salas, P., Drummond, P., Ekins, P., Flahault, A., Frumkin, H., Georgeson, L., Ghanei, M., Grace, D., Graham, H., Grojsman, R., Haines, A., Hamilton, I., Hartinger, S., Johnson, A., Kelman, I., Kiesewetter, G., Kniveton, D., Liang, L., Lott, M., Lowe, R., Mace, G., Odhiambo Sewe, M., Maslin, M., Mikhaylov, S., Milner, J., Latifi, A.M., Moradi-Lakeh, M., Morrissey, K., Murray, K., Neville, T., Nilsson, M., Oreszczyn, T., Owfi, F., Pencheon, D., Pye, S., Rabbaniha, M., Robinson, E., Rocklov, J., Schutte, S., Shumake-Guillemot, J., Steinbach, R., Tabatabaei, M., Wheeler, N., Wilkinson, P., Gong, P., Montgomery, H. and Costello, A., 2018d. The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. Lancet, 391(10120): 581-630.

Watts, N., Amann, M., Ayeb-Karlsson, S., Chambers, J., Hamilton, I., Lowe, R., Pye, S., Owfi, F., Rabbaniha, M., Tabatabaei, M. and Latifi, A., 2018e. The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health (vol 391, pg 581, 2017). Lancet, 391(10120): 540-540.

Weber, E., 2016. Trade agreements, labour mobility and climate change in the Pacific Islands. Regional Environmental Change.

Weesie, R., 2019. Towards Adaptive Commons: A Case Study of Agro-Pastoral Dams in Northern Ghana. Sustainability, 11(2).

Weesie, R. and Garcia, A.K., 2018. From Herding to Farming under Adaptation Interventions in Southern Kenya: A Critical Perspective. Sustainability, 10(12).

Wehner, M., Stone, D., Krishnan, H., AchutaRao, K. and Castillo, F., 2017. The Deadly Combination of Heat and Humidity in India and Pakistan in Summer 2015. Bulletin of the American Meteorological Society, 97(12): S81-S86.

Weinberg, J. and Bakker, R., 2015. Let them eat cake: Food prices, domestic policy and social unrest. Conflict Management and Peace Science, 32(3): 309-326.

Weinberger, K.R., Haykin, L., Eliot, M.N., Schwartz, J.D., Gasparrini, A. and Wellenius, G.A., 2017. Projected temperature-related deaths in ten large U.S. metropolitan areas under different climate change scenarios. Environment International, 107: 196-204.

Weinberger, K.R., Kirwa, K., Eliot, M.N., Gold, J., Suh, H.H. and Wellenius, G.A., 2018. Projected Changes in Temperature-related Morbidity and Mortality in Southern New England. Epidemiology (Cambridge, Mass.), 29(4): 473-481.

Weinthal, E., Zawahri, N. and Sowers, J., 2015. Securitizing Water, Climate, and Migration in Israel, Jordan, and Syria. International Environmental Agreements-Politics Law and Economics, 15(3): 293-307.

Weirich, C.A. and Miller, T.R., 2014. Freshwater harmful algal blooms: toxins and children's health. Curr Probl Pediatr Adolesc Health Care, 44(1): 2-24.

Weisent, J., Seaver, W., Odoi, A. and Rohrbach, B., 2014. The importance of climatic factors and outliers in predicting regional monthly campylobacteriosis risk in Georgia, USA. International Journal of Biometeorology, 58(9): 1865-1878.

Weiss, M.I., 2015. A perfect storm: the causes and consequences of severe water scarcity, institutional breakdown and conflict in Yemen. Water International, 40(2): 251-272.

Weitensfelder, L. and Moshammer, H., 2019. Evidence of Adaptation to Increasing Temperatures. International journal of environmental research and public health, 17(1): 97.

Wells, M.L., Karlson, B., Wulff, A., Kudela, R., Trick, C., Asnaghi, V., Berdalet, E., Cochlan, W., Davidson, K., De Rijcke, M., Dutkiewicz, S., Hallegraeff, G., Flynn, K.J., Legrand, C., Paerl, H., Silke, J., Suikkanen, S., Thompson, P. and Trainer, V.L., 2020. Future HAB science: Directions and challenges in a changing climate. Harmful Algae, 91: 101632.

Wells, M.L., Trainer, V.L., Smayda, T.J., Karlson, B.S.O., Trick, C.G., Kudela, R.M., Ishikawa, A., Bernard, S., Wulff, A., Anderson, D.M. and Cochlan, W.P., 2015. Harmful algal blooms and climate change: Learning from the past and present to forecast the future. Harmful Algae, 49: 68-93.

West, J.J., Smith, S.J., Silva, R.A., Naik, V., Zhang, Y., Adelman, Z., Fry, M.M., Anenberg, S., Horowitz, L.W. and Lamarque, J.-F., 2013. Co-benefits of Global Greenhouse Gas Mitigation for Future Air Quality and Human Health. Nat. Clim. Chang. 3(10): 885-889.

Westaway, K., Frank, O., Husband, A., McClure, A., Shute, R., Edwards, S., Curtis, J. and Rowett, D., 2015. Medicines can affect thermoregulation and accentuate the risk of dehydration and heat-related illness during hot weather. Journal of clinical pharmacy and therapeutics, 40.

Weyant, C., Brandeau, M.L., Burke, M., Lobell, D.B., Bendavid, E. and Basu, S., 2018. Anticipated burden and mitigation of carbon-dioxide-induced nutritional deficiencies and related diseases: A simulation modeling study. PLoS Med., 15(7): e1002586.

Whaley, A.L., 2009. Trauma among Survivors of Hurricane Katrina: Considerations and Recommendations for Mental Health Care. Journal of Loss & Trauma, 14(6): 459-476.

Wheeler, N. and Watts, N., 2018. Climate Change: From Science to Practice. Curr Environ Health Rep, 5(1): 170-178.

Whitmee, S., Haines, A., Beyrer, C., Boltz, F., Capon, A.G., Dias, B., Ezeh, A., Frumkin, H., Gong, P., Head, P., Horton, R., Mace, G.M., Marten, R., Myers, S.S., Nishtar, S., Osofsky, S.A., Pattanayak, S.K., Pongsiri, M.J., Romanelli, C., Soucat, A., Vega, J. and Yach, D., 2015. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation-Lancet Commission on planetary health. Lancet, 386(10007): 1973-2028.

WHO, 2013. Global action plan for the prevention and control of noncommunicable diseases 2013-2020, Geneva, Switzerland.

WHO, 2014. Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. WHO. Geneva.

WHO, 2015a. Waterborne Diseases - MDGs-SDGs2015.

WHO, 2015b. WHO estimates of the global burden of foodborne diseases World Health Organization.

WHO, 2016. WHO household energy database.

WHO, F.a., 2020. . Report of the Expert Meeting on Ciguatera Poisoning, Rome.

Wiebe, K., Sulser, T.B., Mason-D’Croz, D. & Rosegrant, M.W., 2017. Wiebe, K., Sulser, T.B., Mason-D’Croz, D. & Rosegrant, M.W., 2017. The Effects of Climate Change on Agriculture and Food Security in Africa. Chapter 2 in De Pinto, A. & Ulimwengu, J.M. Eds. A Thriving Agricultural Sector in a Changing Climate: Meeting Malabo Declaration Goals through Climate-Smart Agriculture. ReSAKSS Annual Trends and Outlook Report 2016. Washington, DC: International Food Policy Research Institute.

Wiederkehr, C., Beckmann, M. and Hermans, K., 2018. Environmental change, adaptation strategies and the relevance of migration in Sub-Saharan drylands. Environmental Research Letters, 13(11).

Wiegel, H., Boas, I. and Warner, J., 2019. A mobilities perspective on migration in the context of environmental change. Wiley Interdisciplinary Reviews: Climate Change, 10(6): e610.

Wilbanks, T. and Ebi, K., 2014. SSPs from an impact and adaptation perspective. Climatic Change, 122(3): 473-479.

Willet, K.M. and Sherwood, S., 2012. Exceedance of heat index thresholds for 15 regions under a warming climate using the wet-bulb globe temperature. International Journal of Climatology, 32: 161-177.

Willett, K.M. and Sherwood, S., 2012. Exceedance of heat index thresholds for 15 regions under a warming climate using the wet-bulb globe temperature. International Journal of Climatology, 32(2): 161-177.

Willett, W., Rockstrom, J. and Loken, B., 2019a. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems (vol 393, pg 447, 2018). Lancet, 393(10191): 2590-2590.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L.J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J.A., De Vries, W., Majele Sibanda, L., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl, T., Singh, S., Cornell, S.E., Srinath Reddy, K., Narain, S., Nishtar, S. and Murray, C.J.L., 2019b. - Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. - 393(- 10170).

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L.J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J.A., De Vries, W., Majele Sibanda, L., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl, T., Singh, S., Cornell, S.E., Srinath Reddy, K., Narain, S., Nishtar, S. and Murray, C.J.L., 2019c. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet, 393(10170): 447-492.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L.J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J.A., De Vries, W., Majele Sibanda, L., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl, T., Singh, S., Cornell, S.E., Srinath Reddy, K., Narain, S., Nishtar, S. and Murray, C.J.L., 2019d. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet, 393(10170): 447-492.

Williams, G.H., 2003. The determinants of health: structure, context and agency. Sociol. Health Illn. 25: 131-154.

Williams, J.M., 2018. Stagnant Rivers: Transboundary Water Security in South and Southeast Asia. Water, 10(12).

Williams, M.L., Lott, M.C., Kitwiroon, N., Dajnak, D., Walton, H., Holland, M., Pye, S., Fecht, D., Toledano, M.B. and Beevers, S.D., 2018. The Lancet Countdown on health benefits from the UK Climate Change Act: a modelling study for Great Britain. Lancet Planet Health, 2(5): e202-e213.

Williams, M.S., Golden, N.J., Ebel, E.D., Crarey, E.T. and Tate, H.P., 2015. Temporal patterns of Campylobacter contamination on chicken and their relationship to campylobacteriosis cases in the United States. Int J Food Microbiol, 208: 114-21.

Willox, A.C., Harper, S.L., Ford, J.D., Edge, V.L., Landman, K., Houle, K., Blake, S. and Wolfrey, C., 2013. Climate change and mental health: an exploratory case study from Rigolet, Nunatsiavut, Canada. Climatic Change, 121(2): 255-270.

Willox, C., Stephenson, E., Allen, J., Bourque, F., Drossos, A., Elgarøy, S. and MacDonald, P., 2015. Examining relationships between climate change and mental health in the Circumpolar North. Regional Environmental Change, 15(1): 169-182.

Wilmsen, B. and Webber, M., 2015. What can we learn from the practice of development-forced displacement and resettlement for organised resettlements in response to climate change? Geoforum, 58: 76-85.

Winne, J.D. and Peersman, G., 2019. The impact of food prices on conflict revisited. Journal of Business & Economic Statistics: 1-14.

Wischnath, G. and Buhaug, H., 2014. Rice or riots: On food production and conflict severity across India. Political Geography, 43: 6-15.

Wise, R.M., Fazey, I., Smith, M.S., Park, S.E., Eakin, H.C., Van Garderen, E. and Campbell, B., 2014. Reconceptualising adaptation to climate change as part of pathways of change and response. Global Environmental Change-Human and Policy Dimensions, 28: 325-336.

Witmer, F.D., Linke, A.M., O'Loughlin, J., Gettelman, A. and Laing, A., 2017. Subnational violent conflict forecasts for sub-Saharan Africa, 2015–65, using climate-sensitive models. Journal of Peace Research, 54(2): 175-192.

Witt, C., Schubert, J.A., Jehn, M., Holzgreve, A., Liebers, U., Endlicher, W. and Scherer, D., 2015. The Effects of Climate Change on Patients with Chronic Lung Disease. Deutsches Aerzteblatt Online.

WMO, W., 2015. Heatwaves and Health: Guidance on Warning-system Development. World Meteorological Organization.

Wobus, C., Gutmann, E., Jones, R., Rissing, M., Mizukami, N., Lorie, M., Mahoney, H., Wood, A., Mills, D. and Martinich, J., 2017. Climate change impacts on flood risk and asset damages within mapped 100-year floodplains of the contiguous United States. Natural Hazards and Earth System Sciences, 17: 2199-2211.

Wolf, T., Chuang, W.-C. and McGregor, G., 2015. On the Science-Policy Bridge: Do Spatial Heat Vulnerability Assessment Studies Influence Policy? International journal of environmental research and public health, 12(10): 13321-13349.

Wolf, T., McGregor, G. and Analitis, A., 2014. Performance Assessment of a Heat Wave Vulnerability Index for Greater London, United Kingdom. Weather, Climate, and Society, 6(1): 32-46.

Wolkinger, B., Haas, W., Bachner, G., Weisz, U., Steininger, K., Hutter, P. and Reifeltshammer, R., 2018. Evaluating Health Co-Benefits of Climate Change Mitigation in Urban Mobility. International Journal of Environmental Research and Public Health, 15(5).

Wondmagegn, B., Xiang, J., Williams, S., Pisaniello, D. and Bi, P., 2019. What do we know about the healthcare costs of extreme heat exposure? A comprehensive literature review. Science of the Total Environment, 657: 608-618.

Wood, R.M. and Wright, T.M., 2016. Responding to catastrophe: Repression dynamics following rapid-onset natural disasters. Journal of Conflict Resolution, 60(8): 1446-1472.

Woodcock, J., Abbas, A., Ullrich, A., Tainio, M., Lovelace, R., Sá, T.H., Westgate, K. and Goodman, A., 2018. Development of the Impacts of Cycling Tool (ICT): A modelling study and web tool for evaluating health and environmental impacts of cycling uptake. PLoS Med., 15(7): e1002622.

Woodruff, T.J., Parker, J.D., Kyle, A.D. and Schoendorf, K.C., 2010. Disparities in exposure to air pollution during pregnancy. Paediatric & Perinatal Epidemiology, 15(4): A26-A26.

Woodward, A., Baumgartner, J., Ebi, L., Gao, J., Kinney, L. and Liu, Q., 2019. Population health impacts of China's climate change policies. Environmental Research, 175: 178-185.

World Health Organization, 2015. Operational framework for building climate resilient health systems. World Health Organization, Geneva, Switzerland.

World Health Organization, 2016. Sanitation safety planning: manual for safe use and disposal of wastewater, greywater and excreta. Geneva, Switzerland.

World Health Organization, 2018. WASH and Health working together: a 'how-to' guide for neglected tropical disease programmes, Geneva.

World Health Organization & International Water Association, 2009. Water safety plan manual: step-by-step risk management for drinking-water suppliers. Geneva, Switzerland.

Wrathall, D. and Suckall, N., 2016. Labour migration amidst ecological change. Migration and Development, 5(2): 314-329.

Wu, F., Bhatnagar, D., Bui-Klimke, T., Carbone, I., Hellmich, R., Munkvold, G., Paul, P., Payne, G. and Takle, E., 2011. Climate change impacts on mycotoxin risks in US maize. World Mycotoxin J., 4(1): 79-93.

Wu, J., Yunus, M., Islam, M.S. and Emch, M., 2016a. Influence of Climate Extremes and Land Use on Fecal Contamination of Shallow Tubewells in Bangladesh. Environ Sci Technol, 50(5): 2669-76.

Wu, J., Yunus, M., Streatfield, P.K. and Emch, M., 2014. Association of climate variability and childhood diarrhoeal disease in rural Bangladesh, 2000-2006. Epidemiol Infect, 142(9): 1859-68.

Wu, X., Jeuland, M. and Whittington, D., 2016b. Does political uncertainty affect water resources development? The case of the Eastern Nile. Policy and Society, 35(2): 151-163.

Wu, Y., Qiao, Z., Wang, N., Yu, H., Feng, Z., Li, X. and Zhao, X., 2017. Describing interaction effect between lagged rainfalls on malaria: an epidemiological study in south-west China. Malar J, 16(1): 53.

Xiang, J., Hansen, A., Liu, Q., Tong, M.X., Liu, X., Sun, Y., Cameron, S., Hanson-Easey, S., Han, G.S., Williams, C., Weinstein, P. and Bi, P., 2018a. Association between malaria incidence and meteorological factors: a multi-location study in China, 2005-2012. Epidemiol Infect, 146(1): 89-99.

Xiang, J., Hansen, A., Liu, Q., Tong, M.X., Liu, X., Sun, Y., Cameron, S., Hanson-Easey, S., Han, G.S., Williams, C., Weinstein, P. and Bi, P., 2018b. Impact of meteorological factors on hemorrhagic fever with renal syndrome in 19 cities in China, 2005-2014. Sci Total Environ, 636: 1249-1256.

Xiao, H., Tian, H.Y., Gao, L.D., Liu, H.N., Duan, L.S., Basta, N., Cazelles, B., Li, X.J., Lin, X.L., Wu, H.W., Chen, B.Y., Yang, H.S., Xu, B. and Grenfell, B., 2014. Animal reservoir, natural and socioeconomic variations and the transmission of hemorrhagic fever with renal syndrome in Chenzhou, China, 2006-2010. PLoS Negl Trop Dis, 8(1): e2615.

Xiao, J., Liu, T., Lin, H., Zhu, G., Zeng, W., Li, X., Zhang, B., Song, T., Deng, A., Zhang, M., Zhong, H., Lin, S., Rutherford, S., Meng, X., Zhang, Y. and Ma, W., 2018. Weather variables and the El Nino Southern Oscillation may drive the epidemics of dengue in Guangdong Province, China. Sci Total Environ, 624: 926-934.

Xie, L. and Jia, S.F., 2017. Diplomatic water cooperation: the case of Sino-India dispute over Brahmaputra. International Environmental Agreements-Politics Law and Economics, 17(5): 677-694.

Xie, Y., Dai, H., Xu, X., Fujimori, S., Hasegawa, T., Yi, K. and Kurata, G., 2018. Co-benefits of climate mitigation on air quality and human health in Asian countries. Environment International, 119: 309-318.

Xu, C., Kohler, T., Lenton, T., Svenning, J.-C. and Scheffer, M., 2020. Future of the human climate niche. Proceedings of the National Academy of Sciences, 117: 201910114.

Xu, J., Wang, Z., Shen, F., Ouyang, C. and Tu, Y., 2016a. Natural disasters and social conflict: a systematic literature review. International journal of disaster risk reduction, 17: 38-48.

Xu, L., Stige, L.C., Chan, K.S., Zhou, J., Yang, J., Sang, S., Wang, M., Yang, Z., Yan, Z., Jiang, T., Lu, L., Yue, Y., Liu, X., Lin, H., Xu, J., Liu, Q. and Stenseth, N.C., 2017. Climate variation drives dengue dynamics. Proc Natl Acad Sci U S A, 114(1): 113-118.

Xu, Z., Bambrick, H., Yakob, L., Devine, G., Lu, J., Frentiu, F.D., Yang, W., Williams, G. and Hu, W., 2019a. Spatiotemporal patterns and climatic drivers of severe dengue in Thailand. Sci Total Environ, 656: 889-901.

Xu, Z., FitzGerald, G., Guo, Y., Jalaludin, B. and Tong, S., 2016b. Impact of heatwave on mortality under different heatwave definitions: A systematic review and meta-analysis. Environment International, 89-90: 193-203.

Xu, Z., Hu, W., Zhang, Y., Wang, X., Zhou, M., Su, H., Huang, C., Tong, S. and Guo, Q., 2015. Exploration of diarrhoea seasonality and its drivers in China. Sci Rep, 5: 8241.

Xu, Z., Sheffield, P.E., Su, H., Wang, X., Bi, Y. and Tong, S., 2014. The impact of heat waves on children's health: a systematic review. Int. J. Biometeorol., 58(2): 239-247.

Xu, Z., Tong, S., Cheng, J., Crooks, J.L., Xiang, H., Li, X., Huang, C. and Hu, W., 2019b. Heatwaves and diabetes in Brisbane, Australia: a population-based retrospective cohort study.

Xuan le, T.T., Van Hau, P., Thu do, T. and Toan do, T.T., 2014. Estimates of meteorological variability in association with dengue cases in a coastal city in northern Vietnam: an ecological study. Glob Health Action, 7: 23119.

Yactayo, S., Staples, J.E., Millot, V., Cibrelus, L. and Ramon-Pardo, P., 2016. Epidemiology of Chikungunya in the Americas. J Infect Dis, 214(suppl 5): S441-S445.

Yan, X., Zhao, X., Li, J., He, L. and Xu, M., 2018. Effects of early-life malnutrition on neurodevelopment and neuropsychiatric disorders and the potential mechanisms. Progress in Neuro-Psychopharmacology and Biological Psychiatry, 83: 64-75.

Yang, J., Yin, P., Zhou, M., Ou, C.Q., Li, M., Liu, Y., Gao, J., Chen, B., Liu, J., Bai, L. and Liu, Q., 2016. The effect of ambient temperature on diabetes mortality in China: A multi-city time series study. Sci Total Environ, 543(Pt A): 75-82.

Yardley, J.E., Stapleton, J.M., Sigal, R.J. and Kenny, G.P., 2013. Do Heat Events Pose a Greater Health Risk for Individuals with Type 2 Diabetes? Diabetes Technology & Therapeutics, 15(6): 520-529.

Yates, J.S., Harris, L.M. and Wilson, N.J., 2017. Multiple ontologies of water: Politics, conflict and implications for governance. Environment and Planning D-Society & Space, 35(5): 797-815.

Yeeles, A., 2015. Weathering unrest: The ecology of urban social disturbances in Africa and Asia. Journal of Peace Research, 52(2): 158-170.

Yeni, F. and Alpas, H., 2017. Vulnerability of global food production to extreme climatic events. Food Res Int, 96: 27-39.

Yorifuji, T., Kashima, S., Diez, M.H., Kado, Y., Sanada, S. and Doi, H., 2017. Prenatal exposure to outdoor air pollution and child behavioral problems at school age in Japan. Environment International, 99: 192-198.

Younan, D., Tuvblad, C., Franklin, M., Lurmann, F., Li, L., Wu, J. and Chen, C., 2018. Longitudinal analysis of particulate air pollutants and adolescent delinquent behavior in Southern California. Journal of Abnormal Child Psychology, 46(6): 1283-1293.

Young, A.J., Sawka, M.N. and Pandolf, K.B., 1996. Physiology of Cold Exposure. In: Marriott, B.M. and C. S.J. (Editors), Nutritional Needs In Cold And In High-Altitude Environments: Applications for MilitaryPersonnel in Field Operations. National Academies Press, Washington.

Young, H.S., McCauley, D.J., Dirzo, R., Nunn, C.L., Campana, M.G., Agwanda, B., Otarola-Castillo, E.R., Castillo, E.R., Pringle, R.M., Veblen, K.E., Salkeld, D.J., Stewardson, K., Fleischer, R., Lambin, E.F., Palmer, T.M. and Helgen, K.M., 2017. Interacting effects of land use and climate on rodent-borne pathogens in central Kenya. Philosophical Transactions of the Royal Society B-Biological Sciences, 372(1722).

Youssouf, H., Liousse, C., Roblou, L., Assamoi, E.M., Salonen, R.O., Maesano, C., Banerjee, S. and Annesi-Maesano, I., 2014. Non-accidental health impacts of wildfire smoke. Int J Environ Res Public Health, 11(11): 11772-804.

Yu, S., Xia, J.J., Yan, Z.W., Zhang, A.Z., Xia, Y., Guan, D.B., Han, J.R., Wang, J., Chen, L. and Liu, Y.K., 2019. Loss of work productivity in a warming world: Differences between developed and developing countries. Journal of Cleaner Production, 208: 1219-1225.

Yuan, L., Shin, K. and Managi, S., 2018. Subjective Well-being and Environmental Quality: The Impact of Air Pollution and Green Coverage in China. Ecological Economics, 153: 124-138.

Yun, J., Greiner, M., Höller, C., Messelhäusser, U., Rampp, A. and Klein, G., 2016. Association between the ambient temperature and the occurrence of human Salmonella and Campylobacter infections. Sci Rep, 6: 28442.

Zander, K., Richerzhagen, C. and Garnett, S., 2019. Human mobility intentions in response to heat in urban South East Asia. Global Environmental Change-Human and Policy Dimensions, 56: 18-28.

Zawahri, N. and Michel, D., 2018. Assessing the Indus Waters Treaty from a comparative perspective. Water International, 43(5): 696-712.

Zeitoun, M., Elaydi, H., Dross, J.P., Talhami, M., de Pinho-Oliveira, E. and Cordoba, J., 2017. Urban Warfare Ecology: A Study of Water Supply in Basrah. International Journal of Urban and Regional Research, 41(6): 904-925.

Zemmer, F., Karaca, F. and Ozkaragoz, F., 2012. Ragweed pollen observed in Turkey: Detection of sources using back trajectory models. Science of the Total Environment, 430: 101-108.

Zhang, B., Li, G., Ma, Y. and Pan, X., 2018a. Projection of temperature-related mortality due to cardiovascular disease in Beijing under different climate change, population, and adaptation scenarios. Environmental Research, 162: 152-159.

Zhang, J., Pang, L., Cao, X., Wanyan, X., Wang, X., Liang, J. and Zhang, L., 2020. The effects of elevated carbon dioxide concentration and mental workload on task performance in an enclosed environmental chamber. Building and Environment, 178: 106938.

Zhang, N., Song, D., Zhang, J., Liao, W., Miao, K., Zhong, S., Lin, S., Hajat, S., Yang, L. and Huang, C., 2019a. The impact of the 2016 flood event in Anhui Province, China on infectious diarrhea disease: An interrupted time-series study. Environ Int, 127: 801-809.

Zhang, W., McManus, P. and Duncan, E., 2018b. A Raster-Based Subdividing Indicator to Map Urban Heat Vulnerability: A Case Study in Sydney, Australia. International Journal of Environmental Research and Public Health, 15(11).

Zhang, W., Spero, T.L., Nolte, C.G., Garcia, V.C., Lin, Z., Romitti, P.A., Shaw, G.M., Sheridan, S.C., Feldkamp, M.L. and Woomert, A., 2019b. - Projected changes in maternal heat exposure during early pregnancy and the associated congenital heart defect burden in the United States. - 8(- 3).

Zhang, Y., Beggs, P., Bambrick, H., Berry, H., Linnenluecke, M., Trueck, S., Alders, R., Bi, P., Boylan, S., Green, D., Guo, Y., Hanigan, I., Hanna, E., Malik, A., Morgan, G., Stevenson, M., Tong, S., Watts, N. and Capon, A., 2018c. The MJA-Lancet Countdown on health and climate change: Australian policy inaction threatens lives. Medical Journal of Australia, 209(11).

Zhang, Y., Isukapalli, S., Bielory, L. and Georgopoulos, P., 2013. Bayesian Analysis of Climate Change Effects on Observed and Projected Airborne Levels of Birch Pollen. Atmos. Environ., 68: 64-73.

Zhang, Y., Peng, M., Wang, L. and Yu, C., 2018d. Association of diurnal temperature range with daily mortality in England and Wales: A nationwide time-series study. Science of the Total Environment, 619-620: 291-300.

Zhang, Y., Smith, J., Bowden, H., Adelman, Z. and West, J., 2017a. Co-benefits of global, domestic, and sectoral greenhouse gas mitigation for US air quality and human health in 2050. Environmental Research Letters, 12(11).

Zhang, Y., Xiang, Q., Yu, Y., Zhan, Z.Y., Hu, K. and Ding, Z., 2019c. Socio-geographic disparity in cardiorespiratory mortality burden attributable to ambient temperature in the United States. Environmental Science and Pollution Research, 26: 694-705.

Zhang, Y., Yu, C. and Wang, L., 2017b. Temperature exposure during pregnancy and birth outcomes: An updated systematic review of epidemiological evidence. Environ Pollut, 225: 700-712.

Zhang, Y.Q., Peng, M.J., Wang, L. and Yu, C.H., 2018e. Association of diurnal temperature range with daily mortality in England and Wales: A nationwide time-series study. Science of the Total Environment, 619: 291-300.

Zhang, Y.Q., Xiang, Q.Q., Yu, Y., Zhan, Z.Y., Hu, K.J. and Ding, Z., 2019d. Socio-geographic disparity in cardiorespiratory mortality burden attributable to ambient temperature in the United States. Environmental Science and Pollution Research, 26(1): 694-705.

Zhao, C., Liu, B., Piao, S., Wang, X., Lobell, D.B., Huang, Y., Huang, M., Yao, Y., Bassu, S., Ciais, P., Durand, J.-L., Elliott, J., Ewert, F., Janssens, I.A., Li, T., Lin, E., Liu, Q., Martres, P., Müller, C., Peng, S., Penuelas, J., Ruane, A.C., Wallach, D., Wang, T., Wu, D., Liu, Z., Zhu, Y., Zhu, Z. and Asseng, S., 2017. Temperature increase reduces global yields of major crops in four independent estimates. 114(35): 9326-9331.

Zhao, Q., Li, S., Cao, W., Liu, D.L., Qian, Q., Ren, H., Ding, F., Williams, G., Huxley, R., Zhang, W. and Guo, Y., 2018a. Modeling the Present and Future Incidence of Pediatric Hand, Foot, and Mouth Disease Associated with Ambient Temperature in Mainland China. Environ Health Perspect, 126(4): 047010.

Zhao, Q., Li, S., Coelho, M.S.Z.S., Saldiva, P.H.N., Hu, K., Huxley, R.R., Abramson, M.J. and Guo, Y., 2019. Temperature variability and hospitalization for ischaemic heart disease in Brazil: A nationwide case-crossover study during 2000–2015. Science of the Total Environment, 664: 707-712.

Zhao, T., Markevych, I., Romanos, M., Nowak, D. and Heinrich, J., 2018b. Ambient ozone exposure and mental health: A systematic review of epidemiological studies. Environmental Research, 165: 459-472.

Zhao, X., Cao, M., Feng, H.H., Fan, H., Chen, F., Feng, Z., Li, X. and Zhou, X.H., 2014. Japanese encephalitis risk and contextual risk factors in southwest China: a Bayesian hierarchical spatial and spatiotemporal analysis. Int J Environ Res Public Health, 11(4): 4201-17.

Zheng, S., Wang, J., Sun, C., Zhang, X. and Kahn, M., 2019. Air pollution lowers Chinese urbanites' expressed happiness on social media. Nature Human Behaviour, 3.

Zhong, S., Minghui, P., Hung, C.H., Jegasothy, E., Clayton, S., Wang, Z. and Huang, C., 2020. Assessing the effectiveness and pathways of planned shelters in protecting mental health of flood victims in China. Environmental Research Letters.

Zhong, S., Yang, L., Toloo, S., Wang, Z., Tong, S., Sun, X., Crompton, D., FitzGerald, G. and Huang, C., 2018. The long-term physical and psychological health impacts of flooding: A systematic mapping. Sci Total Environ, 626: 165-194.

Zhu, C., Kobayashi, K., Loladze, I., Zhu, J., Jiang, Q., Xu, X., Liu, G., Seneweera, S., Ebi, K.L., Drewnowski, A., Fukagawa, N.K. and Ziska, L.H., 2018. Carbon dioxide (CO₂) levels this century will alter the protein, micronutrients, and vitamin content of rice grains with potential health consequences for the poorest rice-dependent countries. 4(5): eaaq1012.

Zickgraf, 2019a. Keeping People in Place: Political Factors of (Im)mobility and Climate Change. Social Sciences, 8: 228.

Zickgraf, C., 2018. Immobility. In: R. McLeman and F. Gemenne (Editors). Routledge, London.

Zickgraf, C., 2019b. (Im) mobilities & climate Change: Locating environmental immobility in theory and in practice.

Zickgraf, C., Vigil, S., de Longueville, F., Ozer, P. and Gemenne, F., 2016. The impact of vulnerability and resilience to environmental changes on mobility patterns in West Africa. World Bank, Washington, DC.

Zinsstag, J., Crump, L., Schelling, E., Hattendorf, J., Maidane, Y., Ali, K., Muhummed, A., Umer, A., Aliyi, F., Nooh, F., Abdikadir, M., Ali, S., Hartinger, S., Mausezahl, D., de White, M., Cordon-Rosales, C., Castillo, D., McCracken, J., Abakar, F., Cercamondi, C., Emmenegger, S., Maier, E., Karanja, S., Bolon, I., de Castaneda, R., Bonfoh, B., Tschopp, R., Probst-Hensch, N. and Cisse, G., 2018. Climate change and One Health. Fems Microbiology Letters, 365(11).

Ziska, L.H., 2020. - An Overview of Rising CO2 and Climatic Change on Aeroallergens and Allergic Diseases. - 12(-5).

Ziska, L.H., Makra, L., Harry, S.K., Bruffaerts, N., Hendrickx, M., Coates, F., Saarto, A., Thibaudon, M., Oliver, G., Damialis, A., Charalampopoulos, A., Vokou, D., Heiđmarsson, S., Guđjohnsen, E., Bonini, M., Oh, J.-W., Sullivan, K., Ford, L., Brooks, G.D., Myszkowska, D., Severova, E., Gehrig, R., Ramón, G.D., Beggs, P.J., Knowlton, K. and Crimmins, A.R., 2019. Temperature-related changes in airborne allergenic pollen abundance and seasonality across the northern hemisphere: a retrospective data analysis. Lancet Planet Health, 3(3): e124-e131.

Zografos, C., Goulden, M.C. and Kallis, G., 2014. Sources of human insecurity in the face of hydro-climatic change. Global environmental change, 29: 327-336.

Zuo, J., Pullen, S., Palmer, J., Bennetts, H., Chileshe, N. and Ma, T., 2015. Impacts of heat waves and corresponding measures: a review. Journal of Cleaner Production, 92: 1-12.

Åström, C., Åström, D.O., Andersson, C., Ebi, K.L. and Forsberg, B., 2017. Vulnerability Reduction Needed to Maintain Current Burdens of Heat-Related Mortality in a Changing Climate—Magnitude and Determinants. International Journal of Environmental Research and Public Health, 14(7): 741-741.

Åström, D.O., Forsberg, B., Ebi, K.L. and Rocklöv, J., 2014. Reply to 'Adaptation to extreme heat in Stockholm County, Sweden'. Nature Climate Change, 4(5): 303-303.

Åtland, K., 2013. The security implications of climate change in the Arctic Ocean, Environmental Security in the Arctic Ocean. Springer, pp. 205-216.

Ürge-Vorsatz, D., Cabeza, L.F., Serrano, S., Barreneche, C. and Petrichenko, K., 2015. Heating and cooling energy trends and drivers in buildings. Renewable Sustainable Energy Rev., 41: 85-98.

Ürge-Vorsatz, D., Herrero, T., Dubash, K. and Lecocq, F., 2014. Measuring the Co-Benefits of Climate Change Mitigation. Annual Review of Environment and Resources, 39(6): 549-582.