

EXPERT REPORT

**THE PSYCHOLOGICAL AND MENTAL HEALTH CONSEQUENCES OF CLIMATE
CHANGE IN SOUTH AFRICA**

Dated: 30 August 2021

by

Dr Garret Barnwell

Clinical Psychologist

PhD in Psychology (NMU) | MA Clinical Psychology (NMU) | MA Conflict Trans' & Mana' (NMU)

HPCSA: PS 0128317

Prepared for the Centre for Environmental Rights

TABLE OF CONTENTS

REVIEWERS	3
1. INTRODUCTION	4
2. QUALIFICATION AND COMPENSATION	7
3. EXPERT OPINION	8
3.1 CONTEXT OF CLIMATE-RELATED PSYCHOLOGICAL HARMS	8
3.1.1 Legacies of Apartheid, Poverty and Marginalisation	8
3.1.2 Looking Towards the Future: Children and Future Generations	10
3.2 THE MENTAL HEALTH AND PSYCHOLOGICAL CONSEQUENCES.....	11
3.2.1 Exposure to Natural Disasters.....	12
3.2.1.1 Floods	13
3.2.1.2 Drought.....	14
3.2.1.3 Wildfires	14
3.2.2 Water Scarcity.....	15
3.2.3 Temperature, Heat and Sun Exposure.....	16
3.2.4 Air Pollution.....	17
3.2.5 Associated Health Conditions	18
3.2.6 Financial Insecurity	19
3.2.7 Food Insecurity.....	20
3.2.8 Interpersonal Violence	20
3.2.9 Identity Disruptions and Loss	21
3.3 INSTITUTIONAL BETRAYAL	22
4. CONCLUSION	24
5. REFERENCE LIST	25
APPENDIX 1: CURRICULUM VITAE	34

REVIEWERS

The present expert report was peer-reviewed by internationally renowned colleagues for their expert experience on climate psychology, community psychology, and psychology and human rights. The first review version of this expert report was completed in February 2021, after which it was sent to the reviewers for review. Barnwell individually identified and contacted the reviewers. Barnwell made additional changes based on reviewer suggestions and further report engagement. The final report was shared with reviewers for their records. A short bio is provided below of each reviewer.

Prof Saths Cooper is a South African clinical psychologist with a focus on community psychology. He is the President of the Pan-African Psychology Union, an Honorary Fellow of the British and Irish Psychological Societies, and a former President and current Fellow of the Psychology Society of South Africa (PsySSA). He played a crucial role in the anti-apartheid struggle, was a confidant of Black Consciousness leader Steve Biko, and has been a pivotal part of South Africa's democracy and transitional justice.

Andy Fisher, PhD is a Canadian ecopsychologist with a background in psychotherapy and environmental studies. Fisher wrote the seminal text *Radical ecopsychology: psychology in the service of life* that focuses on the psychological relationships between person, nature and society. He is an advisor to the Climate Psychology Alliance in North America and teaches ecopsychology at Pacifica Graduate Institute.

Dr Lise Van Susteren is a general and forensic psychiatrist in Washington, DC, and an expert on climate change's physical and mental health effects. In 2011 she co-authored "The Psychological Effects of Global Warming on the U.S. - Why the US Mental Health System Is Not Prepared". Van Susteren serves on the Boards of Earth Day Network, Physicians for Social Responsibility and is a co-founder of "Climate Psychiatry Alliance," a group dedicated to promoting awareness and action on climate from a mental health perspective. Van Susteren is the expert witness on the psychological damages to young people from climate disruption in *Juliana v US*.

Dr Tony Wainwright is a British clinical psychologist and a senior lecturer at the University of Exeter. He chairs the Climate and Environmental Crisis steering group¹ of the British Psychological Society, is a past chair of the British Psychology Society's Ethics Committee and is a current member.

¹ <https://www.bps.org.uk/who-we-are/ethics-committee/workstreams>

1. INTRODUCTION

I, Garret Barnwell, am a clinical psychologist registered with the Health Professions Council of South Africa (HPCSA), and I have been retained by the Centre for Environmental Rights² (CER) to provide an expert report on the psychological and mental health impacts of climate change on current and future generations living in South Africa. Climate change poses an existential threat for this and future generations.³ My expert opinion is that climate change has profound adverse mental health implications for those living in South Africa. Climate change exposures follow the pathways of trauma and stress, leading to well understood psychopathologies.⁴ The traumatic and stressful events (exposures) can be experienced directly (e.g., natural disasters), vicariously through witnessing others suffer, the events may be experienced as anticipated harms (e.g., anticipated threats, loss and damages related to the future of climate change), and they may be accumulative, which is when a person may experience several traumatic or stressful events across their lifespan⁵. Table 1 is not exhaustive but highlights the extent and severity of psychological responses.

Table 1. Psychological responses associated with climate change and fossil fuel industries

Consequences	Psychological experiences and harms
Natural disasters (e.g., droughts, wildfires, flooding). (<i>See section 3.2.1</i>)	Depressive, anxiety, post-traumatic stress, somatization, substance use, self-harming behaviour, suicide, higher levels of distress, protracted feelings of fear, vulnerability and uncertainty, humiliation, shame, increased interpersonal conflict, coping resources overwhelmed, loss of self-efficacy, disruption of community identity, hopelessness, paranoia, experience of loss.
Water insecurity (<i>See section 3.2.2</i>).	Chronic psychological stress, health-related psychological distress, depression and anxiety, suicide, social isolation, despair, sadness, hopelessness, fear, worry, social stigma, shame, feeling mistreatment and humiliation, marginalisation
Temperature, heat and sun exposure (<i>See section 3.2.3</i>).	Chronic psychological stress, depression, anxiety, suicide, health-related psychological distress, exacerbation of common mental illness, interpersonal conflict, decreased work productivity, increased mental health hospital admissions.
Air pollution (<i>See section 3.2.4</i>).	Chronic psychological stress, childhood developmental delays, accelerated neurocognitive decline, dementia, cognitive impairment, sense of intrusiveness and constant worry, environmental health-related psychological distress, anxiety, depression, post-traumatic stress and suicide.
Associated health conditions (<i>See section 3.2.5</i>).	Reduced quality of life, loss of physical health and psychological wellbeing, carer burden, increased risk of poorer mental health outcomes, such as depression and anxiety.
Financial insecurity (<i>See section 3.2.6</i>).	Increased risk of common mental disorders, such as depression, anxiety and somatisation, suicidal thinking, social isolation.
Food insecurity (<i>See section 3.2.7</i>).	Increased common mental disorders, such as depression and anxiety, poorer cognitive performance, stunted psychological development in children, uncertainty, misery, despair, hopelessness, shame, poorer adult neurocognitive and psychomotor functioning, suicide.
Interpersonal violence (<i>See section 3.2.8</i>).	Increased psychological distress, identity disruption, substance use, depression, post-traumatic stress, emotional disorders in children, self-harming behaviour and suicide.
Identity disruptions and loss (<i>See section 3.2.9</i>)	Identity disruption and loss, decreased sense of self-worth, self-esteem and self-efficacy, disruptions to emotional bonds to place and ancestral bonds, trauma.

² The Centre for Environmental Rights is “a non-profit organisation and law clinic based in Cape Town, South Africa” that consists of “activist lawyers who help communities and civil society organisations in South Africa realise our Constitutional right to a healthy environment by advocating and litigating for environmental justice” (Centre for Environmental Rights, 2021). The organization is representing the plaintiffs in this case.

³ Scholes and Engelbrecht, 2021

⁴ Cianconi, Betrò & Janiri, 2020

⁵ International Society of Trauma and Stress Studies, 2021

There is clear scientific evidence that it is vital to keep global warming below 1.5 °C above pre-industrial levels⁶. In order to do so, scientists say that it would be necessary to halve our emissions by 2030 if we are to have a 50% chance of meeting this goal.⁷ Further efforts are needed if we are to stand a greater chance than 50%, and according to experts, South Africa is not on track to meet these goals.⁸

The planetary health implications of climate change are widely acknowledged. Moreover, research on the health consequences of climate change in southern Africa is rapidly growing due to global urgency and the particular vulnerabilities South Africa faces.⁹ I extrapolate on local and international evidence to formulate my expert opinion. Where South African studies are unavailable, international studies are used as corollary information.

This expert opinion is organised in a clinical framework that identifies predisposing vulnerabilities and the consequences of climate change to mental health and psychological wellbeing and exacerbating factors related to the government's response. Through this analysis, I offer a consolidated opinion of the potential future, if we do not prepare now to safeguard communities from climate change impacts.

South Africa is extremely vulnerable to climate change. Scientific reports and research show that the impacts of climate change are already being felt and will worsen considerably in the years to come.¹⁰ The literature included in this report is not exhaustive, but clearly portends profound negative climate change impacts. The impacts include increasing disease burden; intensifying water insecurity; worsening sun and heat exposure; growing financial insecurity and widening inequality; inflamed interpersonal violence, rising food insecurity; and exacerbating natural disasters. South Africa will experience increased droughts, wildfires, coastal and interior flooding, vicious storms, and rising sea levels that will have significant negative implications for the country, some of which we have already begun to experience¹¹. These climate change impacts will only intensify and become more frequent in the future. Moreover, the greenhouse gas-emitting power stations that contribute to climate change also add to poor air quality and associated structural violence for communities who may find themselves living within these sacrifice zones. The mental health implications are staggering and urgent action is required. The expert report highlights three areas, focusing on mental health consequences, vulnerabilities and institutional betrayal.

Section 3.1 *Context of Climate Change-related Psychological Harms* identifies specific individual and community vulnerabilities associated with climate change and mental health. The youth, children, women, those living close to power plants and rural communities of this and future generations are most at risk as they shoulder the global climate change's burdens. Furthermore, more than half of the total pollution of South Africa are living in poverty, and this socioeconomic vulnerability makes it extraordinarily difficult for the majority of South Africans to adapt to the advancing climate shocks, such as climate change-exacerbated disasters, water insecurity and economic losses.¹² The same social conditions that make individuals and communities more vulnerable to climate change also place them at higher risk of mental illness and psychological adversities.

Additionally, this section also looks towards the future of children and future generations that will bear the brunt of climate change's impacts over their lifetimes. Children and future generations are particularly vulnerable.

⁶ CSIR, 2019; Scholes and Engelbrecht, 2021

⁷ United Nations Environment Programme, 2021

⁸ United Nations Environment Programme, 2021; Holz, et al., 2021

⁹ Scholes & Engelbrecht, 2021

¹⁰ Scholes & Engelbrecht, 2021, See also: Council for Industrial and Scientific Research, 2019; United Nations Environment Programme, 2021

¹¹ Scholes & Engelbrecht, 2021; Council for Industrial and Scientific Research, 2019

¹² World Bank, 2020

Affected children are likely to have extra challenges at school as their concentration and emotional wellbeing are harmed. Children can turn these feelings inwards and experience profound sadness, loss, helplessness or hopelessness, or they can turn these feelings outwards in destructive ways. It is not only the negative experiences that the children and individuals have, but what these experiences can take away. Hope, happiness, a sense of self-worth and trust in the world can be challenged and dulled. Some may engage in destructive behaviour or try to self-soothe by resorting to overmedicating or drinking excessive alcohol.

Section 3.2 *Mental Health and Psychological Consequences* describes how changes will dramatically affect mental health and wellbeing. In many cases, climate change will be a root cause of psychological adversity and socio-economic challenges.¹³ Climate change is a threat multiplier that will worsen South Africa's social, economic and infrastructural challenges.¹⁴ Those most vulnerable living in low-resourced or previously disadvantaged communities in South Africa and those who are among the majority of people who are living in poverty will be affected the worst, particularly youth and future generations who will bear the brunt of the dire situation created by those entrusted to prevent such eventualities.

Each subsection draws on scientific studies on climate change's impacts on South Africa. Extrapolations on the mental health consequences are made based on the broad range of South African and international peer-reviewed literature and covered under subsections on natural disasters; water scarcity; temperature, heat and sun exposure; air pollution; climate-exacerbated health conditions, financial insecurity; food insecurity; and interpersonal violence. Cumulatively, these climate change impacts are shown to contribute to adverse psychological traumas and stress responses.

Climate change is traumatic and stressful, posing present and material threats to mental health. The climate-related events, such as natural disasters or socioeconomic losses, can cause considerable psychological distress and overwhelm people's coping strategies and community safeguards. Climate change increases the risk of depressive disorders and depressive features, including sadness, anger, helplessness, hopelessness, diminished interest and pleasure from life, disturbed sleep, fatigue or loss of energy and feelings of worthlessness, recurring thoughts of death and suicide attempts. Individuals may also be affected by increased anxiety, panic attacks, constant worry that is difficult to control, restlessness, difficulty concentrating and fatigue that may, together with other features, lead to a diagnosis of one of the anxiety disorders. The extreme stress of these situations can also lead to a number of somatic (e.g., excessive psychologically rooted physical pain) symptoms, excessive worry or distressing thoughts. The climate change impacts, regardless of whether they are sudden or slow and insidious, are extremely stressful or traumatic. One of the critical features of the climate crisis is an anticipated trauma that will likely exacerbate already challenging conditions. One of the most significant risks of the climate crisis is people killing themselves because they feel overwhelmed by distress, financial pressures, that there is no hope, and their sense of support, community and the world has transformed for the worse. The disasters that will be accelerated through the government inaction to address, or worse, exacerbate climate change impacts can disrupt people's sense of self, trust in others, and self-worth. Studies have shown that the climate disruptions are also threatening communities' intergenerational identity processes as land is lost, communities' social cohesion is fractured as land is not arable, and sacred natural sites are threatened by ecological degradation. This list is not exhaustive. However,

¹³ Van Susteren, 2020; International Society for Trauma and Stress Studies, 2021; United Nations Environment Programme, 2021

¹⁴ Huntjens & Nachbar, 2015; Scholes & Engelbrecht, 2021

the potential extent of consequences to mental health and wellbeing are profound and will likely be insurmountable for many, for no reason of their own except for the extent of stress they are exposed to.

Section 3.3 *Institutional Betrayal* details three main factors related to the government's response that can contribute to psychological harm and secondary trauma. The first factor is concerned with the government's known inaction despite profound negative consequences. Institutional betrayal is knowingly harming when there were options to do good. The second factor discusses the psychological harms of not urgently addressing the drivers of climate change and delaying the transition to renewable energy. The third factor relates to the current healthcare system's shortfall that will prevent the government from adequately responding to the psychological harms of climate change. These factors compound the sense of institutional betrayal and can worsen the psychological harms and damages. The lack of sufficient climate action by the 'adult world' is a threat to children, youth and future generations and contribute to psychological injuries. As with any psychological trauma or stressor, how society reacts to those affected will considerably impact the prognosis of trauma and psychological distress. Climate change will worsen South Africa's already difficult conditions that affect over half of the population and will, nevertheless, have profound impacts on the rest of the population. Individuals and communities entrust the government to do what is in their best interest and it is of utmost urgency to protect vulnerable communities.

Section 4. *Conclusion* concludes by offering recommendations to avert the severe and broad range of mental health impacts caused by the climate catastrophe.

2. QUALIFICATIONS AND COMPENSATION

I am an independent practice clinical psychologist registered with the HPCSA with over 7-years of clinical experience and more than 10-years international medical humanitarian sector and community psychology practice. Today, I work as a clinical psychologist in private practice in Johannesburg and a researcher with relative expertise in community psychology, climate change and environmental justice.

I trained as a clinical psychologist at Nelson Mandela University and graduated cum laude in March 2016. I have worked for the Department of Health at all levels of care across Elizabeth Donkin Hospital, Livingstone Hospital and Graaff-Reinet Community Health Centre in the Eastern Cape and Chris Hani Baragwanath Academic Hospital, Gauteng. Subsequently, I completed my PhD in Psychology at Nelson Mandela University in 2021. My doctoral research focuses on the psychological reaction and community responses to climate and environmental crises in South Africa. For this research, I received the prestigious Medical Research Council's Bongani Mayosi Scholarship and have published these findings for several peer-reviewed special issues, and have forthcoming book chapters, including in the International Handbook of Community Psychology. Additionally, I hold a masters in conflict transformation and management from the school of political studies at Nelson Mandela University, a professional diploma in humanitarian assistance from Liverpool School of Tropical Medicine in the United Kingdom and a certificate in Ecopsychology from Pacifica Graduate Institute in California. I am also on the editorial team of the international Climate Psychology Alliance's periodical. I am also a co-convenor of the Psychology Society of South Africa's (PsySSA¹⁵) Climate, Environment and Psychology (CEP) Interest Group.

The first project that I worked on in response to climate change was in 2011 in Somaliland with Doctors Without Borders/Médecins Sans Frontières (MSF) during the Horn of Africa crisis. The second was in response to the Syria conflict in 2012 with MSF in Lebanon and Turkey. The third was working in mine-affected communities

¹⁵ PsySSA was formed in 1994 and is "the professional body that represents psychologists in South Africa" (PsySSA, 2021).

on sexual and gender-based violence in Bojona Platinum District Municipality with MSF. Additionally, as the Deputy Head of Mission and a psychologist, I have conducted several assessments, including on the mental healthcare system and services in Lesotho, migrant access to healthcare in Pretoria, which subsequently led to opening MSF's migration project, and assessed and led the authorship of the Office of Health Standards Compliance complaint on inhumane healthcare conditions in Lindela Repatriation facility for MSF with Lawyers for Human Rights and the Treatment Action Campaign. For further information about my education, experience and publications, I have included a copy of my curriculum vitae in *Appendix 1: Curriculum Vitae*.

I wrote this expert report pro-bono due to the magnitude and urgency of climate change and the dramatic implications of the government's decision on people's psychological well-being and mental health and communities living in South Africa. My expert testimony and the conclusions reached are based on my clinical training, literature review, and experience in climate psychology and the public health and humanitarian sectors.

3. EXPERT OPINION

There is a scientific consensus that global greenhouse gas emissions from burning fossil fuels, including coal and natural gas, are driving climate change that will have considerable health and mental health consequences.¹⁶ What the experts tell us is straightforward. Climate change will have insurmountable negative repercussions for South Africa. Climate change's detrimental impacts include increased and prolonged severe drought, profound water scarcity and insecurity, rising sea levels and violent storms that batter coastal towns and flood South Africa's interiors, increased intensity and duration of wildfires, and hotter temperatures, food insecurity, economic loss and widening poverty gap.¹⁷ These climate threats – which we have witnessed recently – are overwhelming the ability of the current and future generations to cope and survive. These conditions take place in the context of extreme inequality and material deprivation that is rooted in the legacy of the apartheid regime. These factors compound to create a potentially vicious scenario that will cause and exacerbate mental suffering. As there is no mental health without environmental or planetary health, my expert opinion is that these negative climate change impacts contribute to significant psychological harms and result in the loss of psychological wellbeing.

3.1 Context of Climate-related Psychological Harms

Although climate change can contribute to psychological adversities for anyone, this subsection focuses on the specific context in South Africa. The section first focuses on the legacies of apartheid, poverty and marginalisation that make it extremely difficult for the vast majority of South Africans to adapt to climate change, which increases the risk of psychological adversities. The section then looks towards the future and considers the context of today's children and future generations who will shoulder the burden of climate change.

3.1.1 The Legacy of Apartheid, Poverty and Marginalisation

It is my expert opinion that the psychological harms of climate change will be profound in South Africa owing to the legacies of apartheid, gross levels of poverty, inequality and continued marginalisation of the vast majority of South Africans.

South Africa is more vulnerable to climate change owing to the histories of colonialism and apartheid. In South Africa, communities' vulnerabilities are rooted in apartheid's racialised political violence that has created

¹⁶ Intergovernmental Panel on Climate Change, 2019; Augustinavicius, et al., 2021

¹⁷ CSIR, 2019; Intergovernmental Panel on Climate Change, 2019; Scholes & Engelbrecht, 2021

grotesque economic, infrastructural, health and geospatial disparities. Climate change has already increased global inequality¹⁸ and is expected to widen these divisions further. Poverty is a legacy of the apartheid regime and is also a critical indicator of climate change vulnerabilities. More than half of South Africa's population lives in poverty: *"Approximately 55.5 percent (30.3 million people) of the population is living in poverty at the national upper poverty line (~ZAR 992) while a total of 13.8 million people (25 percent) are experiencing food poverty."*¹⁹ This, before considering the impacts of the pandemic. Suppose action is not taken to dramatically change the course of climate change and improve the conditions of those living in South Africa. In that case, the World Bank's statistic on poverty alone suggests that almost half of South Africa's population will be at increased risk of exposure to the impacts of the climate crisis and inequality is expected to widen.

Multiple South African communities are at considerable risk today from climate change.²⁰ In their study, the Council for Industrial and Scientific Research identifies certain factors that make communities more at risk of climate change. Vulnerable communities who experience financial insecurity, poverty and social, economic vulnerabilities, including low education, literacy, grant dependency, and unemployment, are most susceptible to climate change impacts today and will struggle to adapt and bear the worsening climate crises. On top of these conditions, children and families who are subject to poor housing conditions and where inferior building materials are used, such as corrugated iron or infrastructural issues, are more vulnerable to climate shocks, such as droughts, flooding, and wildfires. Additionally, a lack of access to essential services (e.g., electricity, water, sanitation, and refuse), inadequate healthcare access, emergency services, and adequate schooling also increases vulnerability to the impacts of the climate crisis.²¹

Many of the same conditions that make most South Africans vulnerable to climate change can also have adverse psychological and mental health implications. These realities are well-documented. In 1977, the World Health Organisation (1977) saw the prevailing situation brought on by the apartheid regime as an extraordinary obstacle to predominantly Black South Africans' health. Although the South African government has made strides in addressing the structural violence of apartheid, most South Africans are still faced with extraordinary conditions that are a significant source of psychosocial stress. For instance, poverty, a lack of employment, inadequate housing are common social determinants among mental disorders.²² Furthermore, lower economic status is positively correlated with suicidal thoughts and suicide. Also, those from materially more impoverished communities who identified as being disadvantaged by apartheid generally experienced poorer mental health outcomes, including common mental disorders, such as anxiety and depression, and posttraumatic stress disorders (PTSD).²³ Furthermore, the inequitable development of mental health care services has left some communities without care. For example, rural and historically disadvantaged communities are not only challenged by inadequate, and in some cases the absence of, basic services, but an extreme gap in mental health care services exists.²⁴

Thus, climate change does not occur in isolation. South Africa has specific factors that make more impoverished communities more vulnerable to experiencing adverse psychological and mental health consequences from climate change. Those who are more well off will likely be better resourced to adapt to the climate

¹⁸ Diffenbaugh & Burke, 2019

¹⁹ World Bank, April 2020, p. 1

²⁰ Council for Industrial and Scientific Research, 2019

²¹ Le Roux et al., 2019

²² Lund et al., 2018

²³ Burns, Tomita, & Lund, 2017; Das-Munshi, Lund, Mathews, Clark, Rothon & Stansfeld, 2016

²⁴ Docrat, Besada, Cleary, Daviaud, & Lund, 2019

breakdown, while the poor and those living in climate change vulnerable communities – the majority – will be in harm’s way owing to the lack of material means to adapt to adverse conditions. Notably, there is a positive relationship between socioeconomic status and health inequalities in South Africa.²⁵ The majority of those living in South Africa will likely be challenged by the changing climate, economy and community dynamics that could occur slowly and insidiously or come as a climate shock through natural disasters. These cumulative stressors described in detail in this report can overwhelm the ability to materially and psychologically cope for even the most adept individuals and communities. Poverty and the associated socio-economic vulnerabilities, including inadequate housing, education, unemployment and health inequity, make it harder to build back after disasters. The structural remnants of apartheid still play a profound role in the experience of psychological distress and it demonstrates some of the underlying social conditions that are being exacerbated under climate change and contributing to distress. Put plainly, most South Africans confront historic and ongoing psychic dissonance.²⁶ Distress associated with structural violence is expected and interventions should not only address symptoms, but deal with the root cause of distress, of which climate change is an escalating factor.²⁷

3.1.2 Looking Towards the Future: Children and Future Generations

It is my expert opinion that children and youth in the present and future generations – those disadvantaged by apartheid and not – are particularly vulnerable to climate change²⁸, as they are likely to experience the most severe impacts of climate change across their lifespans with some of the effects already being experienced today. They are at increased risk of poor mental health outcomes because of their exposure and owing to their increased knowledge and awareness of the crises.²⁹ Even those who do not come from historically disadvantaged backgrounds are likely to suffer from mental health harms from climate change impacts. For instance, children and youth living in Cape Town and other areas who experienced Day Zero may suffer mental health issues owing to being exposed to climate change disruptions to routine and fearing future harms.

Psychological adversities in childhood are associated with poorer mental health outcomes in adulthood.³⁰ Children are particularly vulnerable in the first few years of life to the harmful effects of stress and trauma.³¹ Adverse childhood experiences are linked to chronic health problems, mental illnesses, education shortfalls, job opportunity challenges and increase the risk of substance use in adulthood.³² However, it should be noted that adverse psychological experiences, including exposure to trauma, cumulative stress, toxic exposure and anticipated stress, can negatively impact mental health throughout an individual’s lifespan. The experiences can include direct exposure to traumatic events (e.g., natural disasters) and those experienced vicariously (i.e., witnessing the harms taking place to others), in anticipation (i.e., anticipating future climate change-related harms), or cumulatively (i.e., experiencing more than one stressful or potentially traumatic event across their lifespan).³³

Without adequate support, these experiences can impair the ability to function meaningfully at school, in social situations and challenge the ability to regulate emotional states. Climate change impacts – such as natural disasters – can also interrupt schooling and the ability to access peers and educational support. Affected children

²⁵ Omotoso & Koch, 2018

²⁶ Cooper, 2021

²⁷ Lund et al., 2018

²⁸ Le Roux et al., 2019

²⁹ International Society of Traumatic Stress Studies, 2021

³⁰ Lund et al., 2018; Centers for Disease Control and Prevention, 2021; International Society of Trauma and Stress Studies, 2021

³¹ International Society of Traumatic Stress Studies, 2021

³² Centers for Disease Control and Prevention, 2021

³³ International Society of Traumatic Stress Studies, 2021; Lawrence, et al. 2021

are likely to have extra challenges at school as their sleep is disrupted, concentration is negatively affected, worry, anxiety, and fear increase, and emotional wellbeing is harmed. Children can turn these feelings inwards and experience profound sadness, loss, helplessness or hopelessness, or they can turn these feelings outwards in destructive ways, such as engaging in violence or alcohol use. It is not only the negative experiences that the children and individuals have, but what these experiences can take away. Hope, happiness, a sense of self-worth and trust in the world can be challenged and dulled. Some may engage in destructive behaviour or try to self-soothe by resorting to overmedicating, drinking excessive alcohol or self-harming behaviour. Children are also more at risk of adverse pre-traumatic and post-traumatic symptoms because they are largely dependent on others for their survival and wellbeing.³⁴ What threatens children and youth is that the adult world fails to take sufficient climate action, while “criminalising, pathologizing and patronising their feelings and voices.”³⁵

3.2 The Mental Health and Psychological Consequences of Climate Change

This section outlines the main mental health and psychological consequences of climate change. In my expert opinion, the considerable threat that climate change poses to individuals, communities and humanity is potentially traumatic and profoundly stressful, which, in turn, can lead to negative mental health consequences.³⁶ Climate change is increasing potential exposure to adverse psychological events for people living in South Africa, particularly vulnerable individuals and groups and those highly exposed, including children and future generations. The negative mental health impacts arise from exposure to direct, vicarious, anticipated, and accumulative stressors and threats to life, which impact on the severity and frequency of stress-induced and post-traumatic experiences, such as depression, anxiety, and post-traumatic stress and can exacerbate pre-existing mental health conditions.³⁷ Some stressors are also related to the social conditions associated with climate change, such as poor health, food insecurity, financial insecurity, interpersonal violence, identity disruptions, and loss. Furthermore, perceived apathy and inadequate government responses, such as insufficient political will and the sense of institutional betrayal, can aggravate psychological distress and lead to secondary traumas, discussed further in 3.3 *Institutional Betrayal*. These potentially traumatic and stressful psychological experiences have been termed many names, such as “climate trauma,” “climate anxiety,” “ecological grief,” and “solastalgia,” among other terms. What they all have in common is the basic fact that climate change is negatively affecting mental health outcomes. As climate change increases in severity, the public becomes more aware of the possible climate realities and their direct harms and adversities. Thus, climate change is a collective trauma of potentially epic proportions, although not equally experienced.³⁸ I fear the psychological impacts that climate change will have, especially on our youth and future generations, who, through no fault of their own, find themselves inheriting their degraded environmental and material conditions. Today’s children – sons and daughters – and future generations will live with the cumulative harms that stretch across their lifespan. This reality is significant, and our decisions to address climate change directly impact their psychological well-being.

Beyond the direct and accumulating traumatic and stressful impacts of natural disasters and degradation, climate change forever alters conceptions of what their life could hold.³⁹ Instead, the fear of the future becomes a

³⁴ International Society of Trauma and Stress Studies, 2021; Lawrence, et al 2021

³⁵ Hickman, 2020

³⁶ Woodbury, 2019

³⁷ International Society for Traumatic Stress Studies, 2021; Van Susteren & Al-Delaimy, 2020

³⁸ Woodbury, 2019

³⁹ Woodbury, 2019

predominant feeling that is pervasive in all areas of life and loss is being experienced or anticipated as people are aware of the reality of climate change.⁴⁰ This fear and loss include ecological breakdown, poorer health, financial and food insecurity, interpersonal violence and disruptions to social identity. The distress that proliferates a person's experience can become debilitating if not properly processed. These experiences can then be characterised by features of anxiety, grief, loss, helplessness and hopelessness. In South Africa, climate-related distress and trauma are interconnected with other historical and current social stressors and worsen adverse psychological circumstances.⁴¹ Thus, climate change can multiply and worsen the ongoing intergenerational traumas that many still endure in South Africa owing to apartheid's violent legacy. For instance, in Rustenburg, mining, pollution, heat, water insecurity, challenges accessing services, violence, poverty, patriarchy, and gender-based violence intersect to create conditions that significantly challenge mine-affected communities to prepare for worsening environmental conditions. Climate change is also producing new mental health adversities for all those living in South Africa, whether these stressors be at the forefront of people's thinking or masked by the cumulative stressors of South African society. Nevertheless, climate change is a threat multiplier for individuals already living on society's margins and will profoundly impact the whole of South African society as conditions worsen. Finally, climate change will likely lead to more severe and complex mental health conditions within this context as the climate change stressors and traumas accumulate throughout people's lives⁴².

3.2.1 Exposure to Natural Disasters

My expert opinion is that profound psychological harms will occur owing to increased exposure to natural disasters as a result of climate change. The traumatic and stressful events from these disasters can be dramatic, such as the threat of death or loss of property, or slow and insidious violence, such as the breakdown of a family's or community's cohesion, the shifting sense of belonging and a breakdown in place attachments – the cognitive and emotional relationship to place.⁴³ The rate of mental disorders, such as anxiety, depressive and post-traumatic stress disorders, substance use disorders and suicidality, increase after disasters.⁴⁴ Families and communities in low-income settlements may have difficulty recovering after disasters, struggling to build back quickly and safely due to a lack of financial resources, no access to insurance, and their settlements lacking essential services.⁴⁵ Forced displacement, financial insecurity, and an unsafe environment can lead to experiences of a person's life being threatened, uncertainty, and fear and concern for the future that contribute to trauma, depression, and anxiety, for instance.⁴⁶ Furthermore, after disasters, individuals and communities may experience protracted feelings of fear, vulnerability and uncertainty that similar disasters would occur again.⁴⁷

In my experience with humanitarian assistance, the negative psychological impacts of environmental harms are often compounded by infrastructural failures and a lack of foresight to safeguard communities from exposure to these risks. These structural failures to protect communities from damage contribute negatively to recovering from traumatic events.⁴⁸ Extended durations for community recovery from a disaster is also associated

⁴⁰ Cunsolo, & Ellis, 2018; Woodbury, 2019

⁴¹ Barnwell, Watson & Stroud, 2020a

⁴² International Society of Trauma and Stress Studies, 2021

⁴³ Albrecht et al., 2007; Barnwell et al., 2020

⁴⁴ Clayton, 2020

⁴⁵ Le Roux, van Huyssteen, Arnold, & Ludick, 2019

⁴⁶ Vins, Bell, Saha, & Hess, 2015; International Society for Trauma and Stress Studies, 2021

⁴⁷ Clayton, 2020

⁴⁸ Erikson, 1995

with increased psychosocial distress.⁴⁹ There is a positive relations between longer times taken for communities to recover and higher levels of mental disorders and psychosocial distress.⁵⁰ Marginalised groups with physical and mental health challenges are at higher risk, and these challenges are made worse after natural disasters.⁵¹ Furthermore, those who experience multiple losses are in the hardest-hit areas tend to experience the worst mental health consequences.⁵² Moreover, social determinants such as lower education levels and less access to social support underpin post-disaster chronic mental disorders. The subsections that follow will address the different mental health impacts of specific expected natural disasters (i.e., flooding, droughts and wildfires).

3.2.1.1 Flooding

Experts show an increase in the intensity and frequency of storms and flooding, and these conditions experts explain are expected to worsen within the next ten years.⁵³ In my expert opinion, flooding is creating conditions that increase psychological injuries and lead to multiple losses. During extreme flooding events, those directly exposed to flooding are more likely to develop depressive symptoms and depression than those not exposed to flooding during severe weather events.⁵⁴ Additionally, depression was more likely in those who experienced more financial insecurity. Flooding can also contribute to the development and exacerbation of anxiety and post-traumatic stress disorders.⁵⁵ In the aftermath of mass flooding, those who have experienced flooding directly have higher rates of depression, anxiety and post-traumatic stress disorder than those who have not experienced flooding up to three years after the event.⁵⁶ Furthermore, suicidality can also increase after floods, especially in those with pre-existing mental health conditions.⁵⁷ These harms can be longlasting⁵⁸. Additionally, sea-level rise combined with increased storm frequency and intensity will increase coastal flooding.⁵⁹ Storm surges and flooding is expected to lead to mass infrastructural damage. Cities, such as Cape Town and Durban, are impacted and are expected to be harmed by coastal storms and flooding.⁶⁰ For example, the 2019 Durban Easter weekend floods resulted in 71 deaths caused by natural hazards and the destruction of infrastructure in KwaZulu-Natal. The municipality was unable to meet community needs months afterwards.⁶¹ Sea level rise has been shown to cause fear and worry to individuals and communities.⁶² Storm surges that may be experienced as a direct or indirect threat to self or others may also contribute to the development of trauma and anxiety symptoms.⁶³ Flooding is also expected to lead to experiences of identity disruptions and psychological experiences of loss, as place and coastal ecosystems that have to be abandoned or degraded may have psychological and identity importance.⁶⁴

⁴⁹ Clayton, 2020

⁵⁰ Clayton, 2020; Erikson, 1995

⁵¹ Benevolenza & DeRigne, 2019

⁵² Clayton, 2020

⁵³ Scholes & Engelbrecht, 2021. See also: Le Maitre, Kotzee, Le Roux, & Ludick, 2019; Saulnier, Ribacke, & von Schreeb, 2017; World Health Organisation, 2021b; Le Maitre, Kotzee, Le Roux, & Ludick, 2019

⁵⁴ Fitzgerald, Pit, Rolfe, McKenzie, Matthews, Longman, & Bailie, 2020

⁵⁵ Amstadter, Sumner, Acierno, Ruggiero, Koenen, Kilpatrick, ... & Gelernter, 2013; Taylor, 2020; Koenen, Amstadter, Ruggiero, Acierno, Galea, Kilpatrick, & Gelernter, 2009

⁵⁶ Mulchandani et al., 2020

⁵⁷ Kølves, Kølves & De Leo, 2013.

⁵⁸ Mulchandani et al., 2020

⁵⁹ Lück-Vogel, Le Roux, & Ludick, 2019

⁶⁰ Lück-Vogel et al., 2019

⁶¹ Government of South Africa, 2019

⁶² Asugeni, MacLaren, Massey & Speare, 2015

⁶³ Amstadter et al., 2013; Taylor, 2020; Koenen et al., 2009

⁶⁴ Cunsolo & Ellis, 2018; Sherley, Ludynia, Dyer, Lamont, Makhado, Roux, ... & Votier, 2017

3.2.1.2 Droughts

My expert opinion is that the climate change exacerbated droughts will increase the risk of psychological adversities and mental disorders in South Africa.⁶⁵ Scientists show that climate change is already worsening dry conditions in South Africa, and droughts are projected to progressively increase in frequency and severity over the next 34 years pushing drought conditions beyond coping capacity.⁶⁶ Droughts make it harder to sustain lifestyles and contribute to food insecurity and the loss of livelihoods, particularly for rural farmers (industrial or subsistence). Subsequent forced changes and loss can lead to mental health issues, such as increased psychological stress, humiliation, shame, depression, anxiety, and suicide.⁶⁷ Furthermore, climate variability, particularly drought, and socio-economic insecurity have worsened mental health and increased suicide among rural men.⁶⁸ Suicides in communities that depend on agricultural industries and other rural lifestyles and industries increase during drought.⁶⁹ Droughts may also drive generalized anxiety and depression in rural communities.⁷⁰ Additionally, extreme droughts can disrupt community identities and contribute to profound levels of distress that are linked to the changes to social and psychological relationships with the deteriorating ecosystem.⁷¹ These changes can include a loss of hope for the community's future, feeling of being misunderstood and significant levels of psychological distress.⁷² Droughts can also contribute to food, water and financial insecurities that are covered in other subsections – all of which contribute to profound mental health distress.

3.2.1.3 Wildfires

My expert opinion is that climate-exacerbated wildfires will drive psychological distress and exacerbate mental health difficulties where communities are exposed.⁷³ According to experts, dryer conditions also elevate South African wildfires' risk.⁷⁴ Wildfires are common in South Africa and can have devastating consequences, such as the Garden Route fires of 2017 and 2018 that caused significant infrastructural damage, economic loss, displacement, injuries and deaths.⁷⁵ These changes will continue to drive psychological suffering for exposed communities who have lost property, suffered the death of a family member or friend, or been displaced by these catastrophes. International research demonstrates some of the significant psychological implications of wildfires, such as substantial psychological distress, including higher rates and symptoms of paranoia, somatization, depression, anxiety and suicidal thinking⁷⁶. Experts show that wildfires also have considerable physical health implications (e.g., asthma, chronic pulmonary disease and death), exacerbating mental health challenges.⁷⁷ Communities that have fewer resources do not usually have insurance or are underinsured. Such communities and those who are underinsured are more likely to have difficulties getting back on their feet. For instance, after the 2018 Knysna fires, materially poorer families who lost their houses owing to the fires were still stuck in temporary container housing one year on. Even wealthier Western Cape communities that are susceptible to perennial forest

⁶⁵ Scholes & Engelbrecht, 2021. See also: Beraki, Le Roux, & Ludick, 2019; Pascale et al 2020; IPCC, 2019; Pascale et al 2020;

⁶⁶ Scholes & Engelbrecht, 2021. See also: Beraki, Le Roux, & Ludick, 2019; Pascale et al 2020; IPCC, 2019; Beraki, Le Roux, & Ludick, 2019; Pascale et al 2020.

⁶⁷ Vins, Bell, Saha, & Hess, 2015

⁶⁸ Alston, 2012

⁶⁹ Hanigan, Butler, Kovic & Hutchinson, 2012

⁷⁰ O'Brien, Berry, Coleman & Hanigan, 2014

⁷¹ Albrecht, Sartore, Connor, Higginbotham, Freeman, Kelly, ... & Pollard, 2007

⁷² Barnwell, Watson & Stroud, 2020; Sartore, Kelly, Stain, Albrecht & Higginbotham, 2008

⁷³ Scholes & Engelbrecht, 2021. See also: Forsyth, Le Maitre, Le Roux, & Ludick, 2019.

⁷⁴ Forsyth, Le Maitre, Le Roux, & Ludick, 2019.

⁷⁵ Forsyth, Le Maitre, Van den Dool, Walls, Pharoah & Fortune, 2019

⁷⁶ Brown et al., 2019; Papanikolaou et al., 2011

⁷⁷ Reid et al., 2016; Cascio, 2018;

fires suffer physical and psychological displacement. Less endowed communities will suffer indelible harm from which they are unlikely to recover without massive government support. Several family members who I interviewed in 2019 experienced considerable psychological distress, including depressive, anxiety and PTSD features. Suicidal ideation and hopelessness were also reported.

3.2.2 Water Scarcity and Insecurity

My expert opinion is that water scarcity and insecurity, which experts are certain is becoming more common in South Africa due to climate change, will negatively affect mental health and contribute to lives lost. Water insecurity is a dangerous feature of climate change and increases the number of water insecure people in South Africa.⁷⁸ Furthermore, future economic developments associated with coal and gas must consider the likelihood of psychological harm that they may cause by possibly increasing and worsening water insecurity.

Water is crucial for mental health. Indeed, it is a vital – albeit diminishing – essential for life as we know it. Limited access to safe drinking water and sanitation is negatively associated with mental wellbeing.⁷⁹ Water deprivation and poor water access consequently can harm mental health.⁸⁰ Decreases in precipitation have also been associated with increased suicide rates.⁸¹ Studies have shown that increased scarcity may lead to poorer hygiene, increased spread of infectious diseases, all of which place a significant mental health burden on individuals, families and communities, and the ability to protect oneself against illness, like COVID-19.⁸² Water insecure people are also at increased risk of becoming physically ill, which, in turn, increases people's risk of mental illness. Furthermore, perceived environmental threats increase environmental health-related distress.⁸³

Water scarcity is marginalising for those living on the edge of daily survival and can cause psychological suffering.⁸⁴ These experiences of marginalisation are accompanied by “chronic psychological stress, social isolation, intra-community conflicts, despair, feelings of sadness and hopelessness, and symptoms of depression and anxiety”.⁸⁵ Social meanings are attached to communities' experiences of water insecurity. Several studies have demonstrated that water insecurity is highly stressful and compounds social stigma, feelings of shame and mistreatment.⁸⁶

A recent population-based survey in Uganda showed that women who experience water insecurity have an increased risk of depression.⁸⁷ Furthermore, increased anxiety and depression is associated with experiences of self-stigma and hygiene humiliation, as the absence of water makes it impossible to live up to social hygiene norms.⁸⁸ Young children are particularly vulnerable to water insecurity because they rely on adults to meet their material needs and are also more susceptible to adverse health impacts of deprivation. Gender constraints make it more difficult for women to adapt to climate change, and associated social challenges contribute to depression, distressing thoughts and overwhelming emotions.⁸⁹

⁷⁸ Scholes & Engelbrecht, 2021. See also: Beraki, Le Roux & Ludick, 2019; Cole, Bailey, Cullis & New, 2018; Cullis, et al. 2019

⁷⁹ Truong & Ma, 2006

⁸⁰ Wutich, Brewis & Tsai, 2020

⁸¹ Nicholls, Butler & Hanigan, 2006

⁸² Stanke, Kerac, Prudhomme, Medlock & Murray, 2013

⁸³ Barnwell, Stroud & Watson, 2020b

⁸⁴ Ženko & Menga 2019

⁸⁵ Ženko & Menga 2019, p. 15

⁸⁶ Wutich, Brewis & Tsai, 2020

⁸⁷ Cooper-Vince et al., 2018

⁸⁸ Caruso et al., 2018; Mushavi et al., 2020

⁸⁹ Mushavi et al., 2020

Furthermore, those living in water-scarce areas report psychological distress attributed to the fears of their inability to adapt to climate change and the competition for water resources that may arise in the future.⁹⁰ I have personally witnessed this psychological distress in rural areas of the Vhembe district in Limpopo province and in the platinum mining belt of Bojanala Platinum District, where communities view local industries associated with agriculture and mining as competing with them for water resources. These experiences raise considerable distress, fears, worries and feelings of hopelessness. They also mobilise action and increase tensions between industrial and agricultural industries and affected communities. Additionally, South Africa and Lesotho's mountainous areas account for over half of South Africa's water supply, which are coming under increased threats from coal mining for coal-fired power stations.⁹¹ Therefore, future economic developments need to consider these scarce resources and competing demands between industries and communities affected by water insecurity.⁹² This includes addressing climate change more broadly and safeguarding South Africa's water resources more specifically to ensure that future generations have life-ensuring access.

3.2.3 Temperature, Heat and Sun Exposure

My expert opinion is that increased temperatures and heat waves will have adverse mental health and attendant socioeconomic implications. South Africa is particularly vulnerable to global warming because the country's rate of temperature increase is supposed to double that of global heating.⁹³

Several studies demonstrate the link between increased temperature, heat waves and sun exposure and adverse health conditions and death.⁹⁴ These studies show that health conditions may include heat stress, decreased work productivity, increased admissions for cardiovascular, respiratory and kidney diseases during extreme heat, and skin cancer from exposure to UV. Of the cancers, most South Africans are susceptible to skin cancer, and largely go untreated in the most vulnerable communities. Furthermore, increased land and sea temperatures in certain areas can change disease patterns and outbreaks, such as malaria, cholera, and listeriosis that cause diarrheal diseases, adding to the burden of illness and increased psychosocial stressors. Depression is more common in patients with cardiovascular diseases than in the general population.⁹⁵ Depression and anxiety are also higher for people living with respiratory and kidney diseases.⁹⁶ There is also a vicious cycle, as those living with a mental disorder are at increased risk of developing cardiovascular disease.⁹⁷ Those living with chronic health conditions are at greater risk of developing mental disorders and following through with suicide. Furthermore, people living with cancer and mental disorders are at increased risk of suicide and mental illness.⁹⁸

It is not only through physical health pathways that the climate crisis is expected to increase mental health-related illness and deaths from increased temperatures, heat stress and sun exposure. Adverse heat exposure is directly associated with poorer mental health.⁹⁹ For example, increased temperatures and heat stress can have indirect psychological harm, such as decreasing work productivity, resulting in a loss of income and food and water

⁹⁰ Barnwell et al 2020b

⁹¹ Oloolade, Esterhuysen & Levine, 2017; Simpson, Badenhorst, Jewitt, Berchner & Davies 2019; World Wildlife Fund, 2011

⁹² Mvundaba et al., 2019

⁹³ Scholes & Engelbrecht, 2021. See also: Engelbrecht et al., 2015; Hoegh-Guldberg et al., 2018; Wright et al., 2019

⁹⁴ Garland et al. 2015; Wright et al., 2020; Behera et al., 2018; Bornman, Schlemmer, Van der Walt, Van Dyk & Bouwman, 2012; Chersich, et al. 2018; Boeckmann et al., 2019; Chersich, Scorgie, Rees & Wright, 2018; Kalinda, Chimbari, Grant, Wang, Odhiambo & Mukaratirwa, 2018; Mendelsohn & Dawson, 2008; Thompson, Matamale & Kharidza, 2012

⁹⁵ Hare, Toukhsati, Johansson & Jaarsma, 2014

⁹⁶ Fan, & Meek, 2014; Palmer et al., 2013; Huang et al., 2020

⁹⁷ Michal & Beutel, 2021

⁹⁸ Choi, Park, Kim, and Han, 2020

⁹⁹ Burke et al., 2018; Thompson, Hornigold, Page & Waite, 2018

insecurity, leading to further psychological upheavals.¹⁰⁰ Extreme heat has been shown to increase suicides.¹⁰¹ Moreover, high ambient temperatures increase mental health-related hospital admissions, and some studies suggest that mental illness symptoms may be exacerbated during these periods.

3.2.4 Air Pollution

Many greenhouse gas emitting activities that give rise to climate change, such as coal-fired power generation and mining, are also sources of conventional air pollution. It is my expert opinion that communities, particularly fence line communities, that experts show are already being exposed to adverse living and environmental conditions, such as air pollution, are subject to psychological harms.

For instance, a South African-based modelling study of air quality impacts on health effects of sizeable stationary source emissions shows that coal-fired power plants contribute to unhealthy pollution levels in and around South Africa's Mpumalanga Highveld Priority Area.¹⁰² It is estimated that between 305 and 540 early deaths from PM_{2.5} - 2.5 micrometres or less diameter particles that remain in the air for long - occurred in the area in 2016.¹⁰³

High levels of air pollution are positively associated with a decline in mental health.¹⁰⁴ Exposure to air pollution across the lifespan, including *in utero* (in pregnancy), can contribute to childhood neuro-developmental delays and accelerated neurocognitive decline in adult populations.¹⁰⁵ A review of epidemiological evidence suggests that air pollution is associated with an increased risk of dementia, cognitive impairment, and cognitive functioning decline.¹⁰⁶ Moreover, cognitive impairments are present in some of those living with respiratory diseases associated with air pollution.¹⁰⁷ Air pollution can harm the central nervous system, and increased exposure is correlated with a higher prevalence of depressive disorders and suicide.¹⁰⁸ Furthermore, increased age places older individuals at higher risk of neurocognitive disorders, such as dementia associated with air pollution. All of the above conditions can have a severe burden on health and psychological wellbeing.

Participants living in mine-affected communities or industrial areas exposed to air pollution express a sense of intrusiveness and are distressed about their health.¹⁰⁹ Air pollution's boundaries are unseen and insidious, contributing to environmental health-related distress.¹¹⁰ A person does not know when they have been exposed owing to air pollution's invisibility, which adds to the sense of uncertainty and worry, which in turn impact psychological health and wellbeing. It is also challenging to control industrial air pollution at a household level when the air pollution boundaries of exposure are unclear and households do not have the technological or financial means to prevent exposure. Furthermore, those on the fencelines of coal and gas power stations and extractive settings encounter multiple forms of violence, such as gender-based violence, interpersonal violence, political oppression and extreme inequality and exploitation.¹¹¹

¹⁰⁰ Burke et al., 2018; Thompson, Hornigold, Page & Waite, 2018; Lundgren, Kuklane, Gao & Holmer, 2013

¹⁰¹ Burke et al., 2018; Thompson, Hornigold, Page & Waite, 2018; Lawrance, et al. 2021

¹⁰² Gray & Gray Sky Solutions, 2019

¹⁰³ Gray & Gray Sky Solutions, 2019

¹⁰⁴ Xue, Zhu, Zheng & Zhang, 2019

¹⁰⁵ Clifford, Lang, Chen, Anstey, & Seaton, 2016

¹⁰⁶ Delgado-Saborit, Guercio, Gowers, Shaddick, Fox & Love, 2020

¹⁰⁷ Fan, & Meek, 2014

¹⁰⁸ Gładka, Rymaszewska & Zatoński, 2018

¹⁰⁹ Barnwell et al. 2020b

¹¹⁰ Barnwell et al 2020b, Vyner, 1988

¹¹¹ Brisbois et al., 2019; Gray & Solutions, 2019; Mactaggart, McDermott, Tynan & Whittaker 2018; Orris, 2019

In my experience, I have worked with community members who have expressed a sense of constant psychological distress about the inability to prevent exposure as they live in highly air polluted communities without having the means to move because of their socio-economic status. There is also psychological distress associated with a potentially negative physical diagnosis that could be given in the future owing to perceived prolonged exposures to harmful substances, and challenges in accessing treatment compound these fears.

Air pollution can also negatively impact the body's ability to cope with other illnesses. For instance, A recent editorial has shown that air pollution alters respiratory defence mechanisms and increases co-morbid noncommunicable diseases that both worsen the severity of COVID-19.¹¹² COVID-19 has significant impacts on mental health, increasing the risk of depression, anxiety disorders and PTSD.¹¹³ Chronic obstructive pulmonary disease, type-2 diabetes, and ischemic heart disease have also been attributed to air pollution associated with burning fossil fuels.¹¹⁴ Moreover, air pollution increases the risk of depression significantly for people living with pre-existing diabetes, asthma or cardiovascular disease.¹¹⁵

3.2.5 Associated Health Conditions

It is not only through air pollution that the burning of greenhouse gases will hurt citizen's health, but climate change is also directly altering the South African population's health profile.¹¹⁶ My expert opinion is that the rise of health conditions, increased deaths, and a life living in less than full health from climate change will have adverse psychological impacts and contribute to increased mental health disorders for individuals and carers, and negatively affect all of South African society. Studies show that some of the worst climate change impacts will be on people's health. These include the increase and spread of heat-related conditions and deaths,¹¹⁷ cancers,¹¹⁸ diarrhoeal, gastrointestinal and waterborne diseases,¹¹⁹ malnutrition,¹²⁰ malaria,¹²¹ asthma and allergies¹²² and injury and death from interpersonal violence.¹²³ Thus, climate change is expected to increase the disease burden in South Africa, which in turn will have direct socioeconomic and mental health consequences. Those affected by or living with health conditions may also experience more than one health stressor at a time owing to climate change. For instance, a young mother who experiences water insecurity may also experience heat-related conditions because she is exposed to more sun when she goes to fetch water for her household. She may be exposed to more water-borne diseases or malaria due to the changing disease vectors where she lives and the deteriorating quality of her water sources. This might compound undernutrition or malnutrition if she was already experiencing food insecurity. She may also be placed at greater risk of gender-based violence when she fetches water. These multiple social and health stressors are potential psychological adversities that interact with one another and can increase psychological distress. Psychological wellbeing and physical health are inseparable. The illnesses mentioned above are shown to lead to premature death, and life lived in less than full health, also known as disability-adjusted life-

¹¹² Brauer, Casadei, Harrington, Kovacs, Sliwa & WHF Air Pollution Expert Group, 2021

¹¹³ Taquet, Luciano, Geddes & Harrison, 2021

¹¹⁴ Landrigan et al., 2018; Schraufnagel et al., 2019a,b

¹¹⁵ Cho et al., 2014

¹¹⁶ Wright, et al. 2021

¹¹⁷ Garland et al., 2015; Scovronick, Acquaotta, Garzena, Fratianni, Wright & Gasparrini, 2018

¹¹⁸ Wright, du Preez, Millar, & Norval, 2020; Wright et al., 2019

¹¹⁹ Boeckmann et al., 2018; Kalinda, Chimbari, Grant, Wang, Odhiambo, & Mukaratirwa, 2018; Mendelsohn & Dawson, 2008; Thompson, Matamale, & Kharidza, 2012

¹²⁰ Lloyd, Kovats, & Chalabi, 2011; Mugambiwa & Tirivangasi, 2017

¹²¹ Behera et al., 2018; Bornman, Schlemmer, Van der Walt, Van Dyk & Bouwman, 2012; Chersich, et al. 2018a,b

¹²² Berman, 2011; Davies et al., 2021

¹²³ Chersich, et al 2018b

years.¹²⁴ These conditions can contribute to a reduced quality of life for affected individuals and families. Essentially, physical illnesses may increase the risk of poorer mental health outcomes.¹²⁵ Furthermore, increased mental distress can suppress the immune system, making someone more susceptible to becoming sick.¹²⁶ However, most people caring for ill people know that the challenges are often shared within a family, and a carers' health can also be affected. Carers of severely sick people also often have poorer mental health outcomes, experiencing burnout and common mental health challenges, such as depression or anxiety.¹²⁷

3.2.6 Financial Insecurity

Research evidence shows that climate change is expected to have major socio-economic impacts¹²⁸ and my expert opinion is that these consequences will have significant mental health implications for communities. Climate change will increase mental health distress due to worsening individual and community financial insecurity, layered on the “historic and persisting psychosocial and economic deficits that most confront in South Africa”.¹²⁹ Climate change is expected to worsen the global and local gap between rich and poor owing to economic loss that countries in the Global South will face.¹³⁰ Communities that lack a diversified market or are dependent on declining sectors may be more economically vulnerable to the climate change-associated structural changes across sectors of the economy.¹³¹ Structural changes in these industries may lead to low-skilled job losses and alterations in income distribution in the country, which will likely widen inequality and poverty.¹³²

In my expert opinion, not averting or addressing climate change adequately (e.g., increasing fossil fuel capacities in the future), safeguarding communities, and building new skills for workers, may contribute to increased psychological distress within communities owing to worsening financial insecurity that will come from the consequences of climate change. Financial insecurity has compounding effects that can lead to food insecurity, adverse health outcomes, challenges in accessing healthcare services and create further vulnerabilities. Additionally, individuals may experience increased frustration about the perceived opportunities lost and worsening conditions within communities.¹³³ These mounting frustrations can place more pressure on individuals, families and the broader community.

A systematic review of poverty and common disorders in low- and middle-income settings helps to extrapolate the negative psychological implications of the socio-economic stressors for South Africa.¹³⁴ Most studies found a positive association between poverty indicators, such as lower income, lower education, increased financial stress, poor housing, food insecurity and unemployment, with common mental disorders. These conditions include depression, anxiety and somatic disorders, which may include persistent pain and other physical conditions that are psychologically rooted.¹³⁵ Furthermore, studies show that worse economic status and diminished health were positively associated with suicidal thinking and suicidal behaviour.¹³⁶

¹²⁴ Myers & Frumkin, 2020; World Health Organisation, 2021a

¹²⁵ Cianconi, Betrò & Janiri, 2020

¹²⁶ Clayton, 2020

¹²⁷ del-Pino-Casado, Espinosa-Medina, López-Martínez & Orgeta, 2019; Scherer, Verhey & Kuper, 2019

¹²⁸ Scholes & Engelbrecht, 2021. See also: Ngepah, Djemo, Le Roux & Ludick, 2019

¹²⁹ Cooper, 2021

¹³⁰ Intergovernmental Panel on Climate Change, 2019.

¹³¹ Le Roux, van Huyssteen, Arnold & Ludick, 2019

¹³² Council for Industrial and Scientific Research, 2019; Ngepah et al., 2019

¹³³ Wutich, Brewis, & Tsai, 2020

¹³⁴ Lund et al., 2010

¹³⁵ Lund et al., 2010

¹³⁶ Iemmi et al., 2016

Socioeconomic stressors and mental health form a vicious cycle. Individuals experiencing severe financial strain from unemployment, poverty and other socioeconomic struggles are at high risk of mental illness and psychological distress.¹³⁷ Individuals who struggle with poorer mental health are also more vulnerable to drift into poverty and inevitably experience increased social isolation.¹³⁸ Furthermore, mental health challenges are accompanied by high economic costs.¹³⁹ Increased financial challenges can make it more difficult to access mental health services, as resources are prioritised to cover basic needs.¹⁴⁰ This is especially true for those living in rural areas that need to spend more money on transport to cover the costs of travelling long distances between services or pay for private services where there is a gap in public services. Climate change can also weaken social support systems that, in turn, leads to poorer mental health outcomes.¹⁴¹

3.2.7 Food Insecurity

My expert opinion is that heightened food insecurity will have detrimental impacts on South Africans' mental health. Studies show that climate change will exacerbate food insecurity in South Africa, which will increase the number of South Africa's food-insecure individuals and families.¹⁴²

Food insecurity increases the risk of common mental disorders, such as depression and anxiety, poor cognitive performance, and stunted psychological development in children.¹⁴³ Exacerbated food insecurity is likely to increase common mental disorders in South Africa through several mechanisms. First, there is a link between the lack of micronutrients and common mental disorders.¹⁴⁴ Second, the increased pressure that food insecurity places on households and communities can develop and increase psychological distress and common mental disorders. The unpredictable nature and uncertainty further compound the profound psychological misery that food insecurity causes people.¹⁴⁵ Another systematic review conducted, for instance, found that psychological distress is common across the 16 epidemiological studies that they reviewed.¹⁴⁶ Depression, despair, increased stress, helplessness and hopelessness, anxiety and shame were all reported in these studies.

Cognitive functioning is also affected by food insecurity. Those who have experienced food insecurity early or later in life are at higher risk of poor adult neurocognitive functioning, including decreased executive functioning and memory abilities.¹⁴⁷ Children who grow up in higher food insecure households are at more significant developmental risks of cognitive vocabulary and mathematic deficits than those who do not experience food insecurity.¹⁴⁸ The more food insecure, the higher the likelihood that a child may experience poorer motor development and have school readiness challenges. Hunger can also contribute to depression and suicidality in youth.¹⁴⁹

3.2.8 Interpersonal violence

In my expert opinion, climate change is expected to have negative implications for mental health owing to increases in interpersonal violence. Violence places a significant economic, social and health toll on South

¹³⁷ Lund et al., 2018

¹³⁸ Lund et al., 2010

¹³⁹ Clayton, 2021

¹⁴⁰ Bourque & Cunsolo Willox, 2014

¹⁴¹ Clayton, 2020

¹⁴² Scholes & Engelbrecht, 2021; See also: Kovats & Chalabi, 2011; Mugambiwa & Tirivangasi, 2017

¹⁴³ Lund et al., 2018; Pourmotabbed et al., 2020

¹⁴⁴ Weaver & Hadley, 2009

¹⁴⁵ Pourmotabbed et al., 2020; Weaver & Harley, 2009

¹⁴⁶ Weaver & Hadley, 2009

¹⁴⁷ Na., et al., 2020

¹⁴⁸ de Oliveira et al., 2020

¹⁴⁹ Davison, Marshall-Fabien, & Tecson, 2015; Koyanagi et al., 2019; McIntyre, Williams, Lavorato & Patten, 2013

Africa.¹⁵⁰ Interpersonal violence and social disruptions will rise as a result of warming, natural disasters, increased scarcity and competition, and intra-family and community social tensions.¹⁵¹ Furthermore, according to scientists, the number of hot days is expected to increase by mid-century.¹⁵² Studies show that violence may increase in South Africa's future on hot days and violence may become more intense in specific violence 'hot spots'.¹⁵³ This is concerning, as interpersonal violence is already significantly high. According to a population-based survey, the lifetime prevalence of intimate partner physical or sexual violence for women living in South Africa's mining towns is 50%.¹⁵⁴ Globally, 1 in 3 women has experienced intimate partner physical or sexual violence in their lifetimes.¹⁵⁵ Considering the significance and prevalence of violence in South Africa, the heat-violence nexus is concerning. Additionally, climate-exacerbated disasters may also lead to interpersonal violence and domestic violence owing to social disruptions and increased economic stressors.¹⁵⁶ Climate change-induced household and family tensions may increase stress and conflicts, as family and community unsettling identities through, for instance, migration, altered relationships with place and community and financial insecurity increases.¹⁵⁷ Furthermore, women are vulnerable owing to gender roles, patriarchal structures and gender-based violence.

Exposure to violence at any point across a person's lifetime can increase the risk of psychological difficulties, including alcohol or drug use disorders, depression, PTSD, self-harming behaviour, and suicide. Children who are exposed to violence struggle with specific mental health challenges. Higher degrees of childhood exposure to violence can lead to emotional disorders, self-harming behaviour and increase social burdens.¹⁵⁸ Furthermore, exposure to multiple types of violence at home, at school or within the adolescent's broader community can disrupt treatment adherence, as shown in adolescents living with HIV.¹⁵⁹ These disruptions in treatment increase the risk of becoming ill.

3.2.9 Identity Disruptions and Loss

In my expert opinion, psychological experiences of loss are prominent features of climate change trauma and stress, which deserve special attention.¹⁶⁰ All the above traumas and stressors described also result in loss. The psychological losses associated with climate change are significant through the loss of belongings, but also the loss of future prospects and the generativity of an environment. Environmental impact assessments most often concentrate on introducing ecological harms and neglect these insurmountable losses¹⁶¹ and detrimental psychosocial sequelae. However, for communities, this experience of loss is haunting and intractable. Several other factors can also lead to identity loss, such as altered social, community and family structures and dynamics, altered relationships with place, migration, and environmental degradation.¹⁶²

In my expert opinion, climate change is disrupting activities that provide a sense of meaning and survival and ensure identity continuity over time. For communities, climate change can have a profoundly negative impact on intergenerational identities through environmental degradation that disrupts livelihood functions (e.g., farming),

¹⁵⁰ Fang et al., 2017

¹⁵¹ Chersich et al., 2019; Schumacher, Coffey, Norris, Tracy, Clements & Galea, 2010; Vins, Bell, Saha & Hess, 2015; Schumacher et al., 2010

¹⁵² Garland, et al. 2015

¹⁵³ Chersich et al., 2019

¹⁵⁴ Steele et al., 2019

¹⁵⁵ World Health Organisation, 2021c

¹⁵⁶ Schumacher, et al., 2010

¹⁵⁷ Chersich, et al 2019; Vins, Bell, Saha & Hess, 2015

¹⁵⁸ Fang et al., 2017; Stansfeld et al., 2017

¹⁵⁹ Cluver, Meinck, Toska, Orkin, Hodes & Sherr, 2018

¹⁶⁰ Cunsolo & Ellis, 2018

¹⁶¹ Schlosberg, Rickards & Byrne, 2018

¹⁶² Vins, Bell, Saha, & Hess, 2015

rituals (e.g., water reservoirs threatened) or force people to migrate to find work (e.g., climate migration). Self-esteem can be threatened through the loss of self-efficacy, which is the confidence in oneself to manage the circumstances dealt with. For instance, research on droughts has shown that climate change can overwhelm communities' coping abilities, undermining self-efficacy and negatively impacting members' sense of self-worth. Through this loss, a person can also experience the loss of social belonging and a sense of personal value. Furthermore, the environment that has affirmed intergenerational community identities can change to the point that it is not psychologically affirming and, conversely, can become harmful.¹⁶³ For instance, a smallholding's produce that once gave life to a family can be disastrously affected by drought or families may be stifled by the construction of new coal-fired power stations. These identity threats can contribute to the experience of trauma and psychological distress. Unwanted change to a place can result in increased psychological distress – what has been termed solastalgia.¹⁶⁴

Losses associated with climate change extend to the loss of traditional knowledge systems, ancestral and ecological connections – what has been referred to as place severing.¹⁶⁵ For instance, South Africa's sacred sites – including the South Africa Heritage Resource Agency's first declared national cultural landscape, Lake Fundudzi in Vhembe district – will be negatively impacted by climate change through water scarcity and possible exposures to natural disasters.¹⁶⁶ Damages done to these sites exacerbate intergenerational traumas where communities have already been dispossessed of their land by colonial and apartheid-era policies. Therefore, climate change is likely to continue to erode and unsettle community identities through environmental degradation and increased social stressors that contribute to the psychological experience of place severing. My expert opinion and ongoing research show that disruptions to the sanctity of sacred sites and burial sites are traumatic. Furthermore, ecological degradation can hinder the relational, cognitive and emotional bonds that people and communities have to places that shape community identities.¹⁶⁷ In my expert opinion, these disruptions create considerable individual- and community-level psychological distress.

3.3 Institutional Betrayal

This section discusses how these psychological harms may be exacerbated owing to the experience of institutional betrayal, i.e., psychological harm and damages. When communities are dependent on the government to meet their needs, including safety and health, and their government continues to perpetuate harm, this can create a breach of trust and contribute to secondary traumas.¹⁶⁸ Furthermore, when people know that their government is aware of the negative impacts of climate change and action is not taken, this can contribute to a sense of institutional betrayal and secondary trauma. Institutional betrayal can occur through the failure to prevent harm. A lack of transparency (e.g. covering up mistakes or non-disclosure of severity), procedural and participatory injustices (i.e. not being included in decisions that are being made that have a direct impact on communities) and not taking corrective action, delaying action or mitigating harms when potential harms are well known can also exacerbate psychological stressors and traumas. Institutional betrayal makes recovering from trauma or living with psychological distress worse. Governments and institutions can avoid institutional betrayal by telling the truth,

¹⁶³ Edelstein, 2018

¹⁶⁴ Albrecht, et al., 2007; Ebhuoma, et al., 2021

¹⁶⁵ Barnwell, et al. 2020; Barnwell, et al. 2021; Cunsolo & Ellis, 2018; Ebhuoma, et al., 2021

¹⁶⁶ Barnwell, Makaulule, Stroud, Watson & Rubson, 2021a; Midgley, Petrie, Chapman, Whande, & Parker, 2013

¹⁶⁷ Albrecht et al., 2007; Askland & Bunn, 2018; Barnwell et al. 2020b; Barnwell et al 2021a

¹⁶⁸ Smidt & Freyd, 2018; Smith, 2017

taking proportional action not only to reduce greenhouse gas emissions, but also by preparing communities, upskilling and transitioning economies to protect workers, capacitating the healthcare system and moving to a green economy. The South African society is dependent on the decisions that government institutions make to meet their needs. The South African government has recognised and articulated the severity of climate change on human health across its official public policy documents.¹⁶⁹ Thus, people place trust in government to make decisions, take actions in their best interest, and avoid harm, including the profound mental health consequences of climate change.¹⁷⁰ South African citizens' psychological wellbeing is particularly reliant on government decisions and actions with large-scale issues related to mining, energy procurement and climate change. Failure of 'the adult world' – including the government – to address climate change sufficiently is an institutional betrayal that causes children and youth tremendous psychological distress and may exacerbate harm.¹⁷¹

The first factor that contributes to institutional betrayal is that although the government is well aware of the harms of climate change, regrettably the actions not only appear to neglect to avert South Africa's contributions to climate change, but the Climate Action Tracker (2021) suggests that the current measures would worsen climate breakdown, which would contribute to a range of adverse psychological outcomes for communities.

The second factor that is likely to exacerbate distress is how the transition from fossil fuels to renewable energy is handled. In my expert opinion, transitional failures (that may create stranded assets and communities, job losses and increased climate change health consequences) contribute further to the experience of institutional betrayal and harm.¹⁷² Transition failures displace the burden of climate change on future generations unfairly, sacrificing the wellbeing of future generations for short-term gains and inaction. The extent to which workers and their communities will be impacted is based on the extent that countries safeguard communities, and transition the electricity sector to prevent the burning of fossil fuels that contribute to climate harms.¹⁷³

The third factor that perpetuates psychological distress is the possible healthcare shortfalls in responding to climate change. In my expert opinion, not adequately addressing the climate change impacts (such as the government's decision to procure more fossil fuels in the future) will also contribute to significant psychological harm. The healthcare shortfalls load the sense of institutional betrayal because the decision will shift the negative health consequences onto individuals who will need to access an unequipped public mental healthcare system where the vast majority of people are already falling into a profound treatment gap. The broader community, including its public institutions, play a critical role in providing support to those that have or are experiencing ongoing psychological stressors and traumas.¹⁷⁴ However, South Africa's public mental health "treatment gap" for people living with mental disorders, epilepsy and intellectual disabilities is around 92%.¹⁷⁵ Only 5.8% of outpatient care were for mental health services users below 18 years old of these available public services. The provision of mental health care services in South Africa is woefully inadequate and of direct concern to the decisions regarding coal and gas power. Those experiencing psychological stressors and traumas owing to the energy-related decisions that are made will, under the current context, struggle to access public mental healthcare - let alone other - services. Thus, in my professional opinion, this psychological context contributes to a sense of institutional betrayal.

¹⁶⁹ Department of Environmental Affairs, 2012; the Republic of South Africa, 2019

¹⁷⁰ Smith, 2017

¹⁷¹ Hickman, 2020

¹⁷² Ngepah, 2019; International Society of Trauma and Stress Studies, 2019

¹⁷³ International Trade Union Confederation, 2021

¹⁷⁴ Erikson, 1995

¹⁷⁵ Docrat, Besada, Cleary, Daviaud, & Lund, 2019

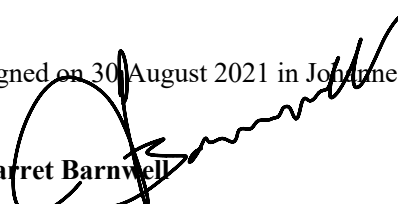
4. CONCLUSION

Scientists agree that the continued burning of greenhouse gas-emitting fossil fuels for electricity will negatively impact climate change. It is my expert opinion that such climate change impacts will, in turn, have profound negative psychological and mental health consequences for those living in South Africa.

Climate change has the potential to deepen the wounds of historical injustices, and the literature suggests that it will have profound mental health, wellbeing and societal consequences. The consequences of climate change are being experienced now and will only accelerate in the future, placing today's children and future generations in harm's way. Some of the worst impacts referenced in this report are expected to be amplified within the next few years. The Western Cape and Eastern Cape's water crisis, Garden Route wildfires, flooding in KwaZulu Natal, Limpopo and Mpumalanga provinces, and the historical droughts in the Northern Cape, Eastern Cape, Limpopo and Mpumalanga provinces already demonstrate some of the dramatic impacts on people living in South Africa. The climate breakdown is well-acknowledged by the South African government,¹⁷⁶ and the state has a world of high-quality research at its disposal that shows that action needs to be taken now. Furthermore, numerous studies that have been cited show that greenhouse gas-emitting energy sources have detrimental physical, mental, and neurocognitive consequences. As we know from the COVID-19 pandemic, preparation and proportional response is everything, and in the case of climate change, we know that it is already with us and will determinately affect those most vulnerable in South Africa.

In my expert opinion, the government's decision to not adequately avert the mental health impacts of climate change contribute to the psychological experience of institutional betrayal and secondary trauma for current and future generations. The institutions that are supposed to safeguard communities make decisions that will have irreversible and profound consequences for their mental health and wellbeing. We cannot escape the fact that climate change impacts pose an existential threat to individuals, families, and communities that are psychologically - and otherwise – harmful.

Signed on 30 August 2021 in Johannesburg, South Africa,


Garret Barnwell
Clinical Psychologist

PhD in Psychology (NMU) | MA Clinical Psychology (NMU) | MA Conflict Trans & Mana (NMU)
HPCSA: PS 0128317 | info@garretbarnwell.com

¹⁷⁶ Department of Environmental Affairs, 2012

5. REFERENCE LIST

- Albrecht, G., Sartore, G. M., Connor, L., Higginbotham, N., Freeman, S., Kelly, B., ... & Pollard, G. (2007). Solastalgia: the distress caused by environmental change. *Australasian psychiatry*, 15(sup1), S95-S98.
- Alston, M. (2012). Rural male suicide in Australia. *Social science & medicine*, 74(4), 515-522.
- Amstadter, A. B., Sumner, J. A., Acierno, R., Ruggiero, K. J., Koenen, K. C., Kilpatrick, D. G., ... & Gelernter, J. (2013). Support for association of RORA variant and post traumatic stress symptoms in a population-based study of hurricane exposed adults. *Molecular psychiatry*, 18(11), 1148-1149.
- Askland, H. H., & Bunn, M. (2018). Lived experiences of environmental change: Solastalgia, power and place. *Emotion, Space and Society*, 27, 16-22.
- Asugeni, J., MacLaren, D., Massey, P. D., & 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_suppl), 22-25.
- Augustinavicius, J. L., Lowe, S. R., Massazza, A., Hayes, K., Denckla, C., White, R. G., Cabán-Alemán, C., Clayton, S., Verdeli, L., Berry, H. (2021). *Global climate change and trauma: An International Society for Traumatic Stress Studies Briefing Paper*. Retrieved from: <https://istss.org/public-resources/istss-briefing-papers/briefing-paper-global-climate-change-and-trauma>
- Barnwell, G., Stroud, L., & Watson, M. (2020a). Critical reflections from South Africa: Using the Power Threat Meaning Framework to place climate-related distress in its socio-political context. British Psychology Society. In Clin. Psychol. Forum (Vol. 332, pp. 7-15).
- Barnwell, G. C., Stroud, L., & Watson, M. (2020b). “Nothing green can grow without being on the land”: Mine-affected communities’ psychological experiences of ecological degradation and resistance in Rustenburg, South Africa. *Community Psychology in Global Perspective*, 6(2/2), 87-109.
- Barnwell, G., Makaulule, M., Stroud, L., Watson, M., & Dima, M. (2021a). “Mupo is life”: intergenerational community identity and safeguarding sacred natural sites in Limpopo Province, South Africa. *Ecopsychology*. <https://doi.org/10.1089/eco.2020.0058>
- Behera, S. K., Morioka, Y., Ikeda, T., Doi, T., Ratnam, J. V., Nonaka, M., ... & Minakawa, N. (2018). Malaria incidences in South Africa linked to a climate mode in southwestern Indian Ocean. *Environmental development*, 27, 47-57.
- Benevolenza, M. A., & DeRigne, L. (2019). The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature. *Journal of Human Behavior in the Social Environment*, 29(2), 266-281.
- Beraki, AF., Le Roux, A. & Ludick, C. 2019. *Green Book. The impact of climate change on drought*. Pretoria: CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=42ef0ab1e90b4c09b3f4e17cf0ab2550>.
- Berman, D. (2011). Climate change and aeroallergens in South Africa. *Current Allergy & Clinical Immunology*, 24(2), 65-71.
- Boeckmann, M., Roux, T., Robinson, M., Areal, A., Durusu, D., Wernecke, B., ... & Chersich, M. F. (2019). Climate change and control of diarrhoeal diseases in South Africa: Priorities for action Connections between temperature and diarrhoeal disease. *SAMJ: South African Medical Journal*, 109(6), 359-361.
- Bornman, M., Schlemmer, L., Van der Walt, T., Van Dyk, C., & Bouwman, H. (2012). Implications for health education and intervention strategies arising from children’s caregivers concerns following successful malaria control. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 106(7), 408-414.

- Bourque, F., & Cunsolo Willox, A. (2014). Climate change: the next challenge for public mental health?. *International Review of Psychiatry*, 26(4), 415-422.
- Brauer, M., Casadei, B., Harrington, R. A., Kovacs, R., Sliwa, K., & WHF Air Pollution Expert Group (2021). Taking a Stand Against Air Pollution—The Impact on Cardiovascular Disease: A Joint Opinion from the World Heart Federation, American College of Cardiology, American Heart Association, and the European Society of Cardiology. *Journal of the American College of Cardiology*.
- Brisbois, B. W., Reschny, J., Fyfe, T. M., Harder, H. G., Parkes, M. W., Allison, S., ... & Oke, B. (2019). Mapping research on resource extraction and health: A scoping review. *The Extractive Industries and Society*, 6(1), 250-259.
- Brown, M. R., Agyapong, V., Greenshaw, A. J., Cribben, I., Brett-MacLean, P., Drolet, J., ... & Kitching, D. (2019). After the Fort McMurray wildfire there are significant increases in mental health symptoms in grade 7–12 students compared to controls. *BMC psychiatry*, 19(1), 18.
- Burke, M., González, F., Baylis, P., Heft-Neal, S., Baysan, C., Basu, S., & Hsiang, S. (2018). Higher temperatures increase suicide rates in the United States and Mexico. *Nature climate change*, 8(8), 723-729.
- Burns, J. K., Tomita, A., & Lund, C. (2017). Income inequality widens the existing income-related disparity in depression risk in post-apartheid South Africa: Evidence from a nationally representative panel study. *Health & place*, 45, 10-16.
- Caruso, B. A., Cooper, H. L., Haardörfer, R., Yount, K. M., Routray, P., Torondel, B., & Clasen, T. (2018). The association between women's sanitation experiences and mental health: A cross-sectional study in rural Odisha India. *SSM – Population Health*, 5, 257–266
- Cascio, W. E. (2018). Wildland fire smoke and human health. *Science of the total environment*, 624, 586-595.
- Centers of Disease Control and Prevention. 2021. Preventing Adverse Childhood Experiences. Retrieved: <https://www.cdc.gov/violenceprevention/aces/fastfact.html>
- Centre for Environmental Rights. (2021). Environmental groups take government to high court over violation of Constitutional right to clean air. Retrieved on January 2021 here: <https://cer.org.za/news/environmental-groups-take-government-to-high-court-over-violation-of-constitutional-right-to-clean-air>
- Chersich, M. F., Scorgie, F., Rees, H., & Wright, C. Y. (2018a). How climate change can fuel listeriosis outbreaks in South Africa. *South African Medical Journal*, 108(6), 453-454.
- Chersich, M. F., Swift, C. P., Edelstein, I., Breetzke, G., Scorgie, F., Schutte, F., & Wright, C. Y. (2019). Violence in hot weather: Will climate change exacerbate rates of violence in South Africa?. *SAMJ: South African Medical Journal*, 109(7), 447-449.
- Chersich, M. F., Wright, C. Y., Venter, F., Rees, H., Scorgie, F., & Erasmus, B. (2018b). Impacts of climate change on health and wellbeing in South Africa. *International journal of environmental research and public health*, 15(9), 1884.
- Cho, J., Choi, Y. J., Suh, M., Sohn, J., Kim, H., Cho, S. K., ... & Shin, D. C. (2014). Air pollution as a risk factor for depressive episode in patients with cardiovascular disease, diabetes mellitus, or asthma. *Journal of affective disorders*, 157, 45-51.
- Choi, J. W., Park, E. C., Kim, T. H., & Han, E. (2020). Mental disorders and suicide risk among cancer patients: a nationwide cohort study. *Archives of suicide research*, 1-12.
- Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: a systematic descriptive review. *Frontiers in psychiatry*, 11.
- Clayton, S. (2021). Climate Change and Mental Health. *Current Environmental Health Reports*, 1-6.

- Clayton, S. (2020). *Mental health on a changing planet*. In Myers, S., & Frumkin, H. (Eds). *Planetary health: Protecting nature to protect ourselves*. Island Press.
- Clifford, A., Lang, L., Chen, R., Anstey, K. J., & Seaton, A. (2016). Exposure to air pollution and cognitive functioning across the life course—a systematic literature review. *Environmental research*, 147, 383-398.
- Climate Action Tracker. (2021). *South Africa Climate Action Tracker*. Accessed here: <https://climateactiontracker.org/countries/south-africa/>
- Cluver, L., Meinck, F., Toska, E., Orkin, F. M., Hodes, R., & Sherr, L. (2018). Multitype violence exposures and adolescent antiretroviral nonadherence in South Africa. *AIDS (London, England)*, 32(8), 975.
- Cole, M. J., Bailey, R. M., Cullis, J. D., & New, M. G. (2018). Spatial inequality in water access and water use in South Africa. *Water Policy*, 20(1), 37-52.
- Cooper, S. (2021). Personal communication with reviewer and clinical psychologist Prof Saths Cooper on 30 March 2021.
- Cooper-Vince, C. E., Arachy, H., Kakuhikire, B., Vořechovská, D., Mushavi, R. C., Baguma, C., ... & Tsai, A. C. (2018). Water insecurity and gendered risk for depression in rural Uganda: A hotspot analysis. *BMC Public Health*, 18(1), 1-9.
- CSIR. (2019). *Green book project: adapting South African settlements to the impacts of climate change*. Retrieved on January 2021 here: <https://bit.ly/3oraW9a>
- Cullis, J. & Phillips, M. 2019. *Green Book. Surface Water Supply. Water supply climate risk narrative for South Africa*. Pretoria: Aurecon & CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=60437bfd1bc947d48f9b00c9a0990c3f>
- Cunsolo, A., & Ellis, N. R. (2018). Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change*, 8(4), 275-281.
- Das-Munshi, J., Lund, C., Mathews, C., Clark, C., Rothon, C., & Stansfeld, S. (2016). Mental health inequalities in adolescents growing up in post-apartheid South Africa: cross-sectional survey, ShaW study. *PloS one*, 11(5), e0154478.
- Davies, J. M., Berman, D., Beggs, P. J., Ramón, G. D., Peter, J., Katelaris, C. H., & Ziska, L. H. (2021). Global Climate Change and Pollen Aeroallergens: A Southern Hemisphere Perspective. *Immunology and Allergy Clinics*, 41(1), 1-16.
- Davison, K. M., Marshall-Fabien, G. L., & Tecson, A. (2015). Association of moderate and severe food insecurity with suicidal ideation in adults: national survey data from three Canadian provinces. *Social psychiatry and psychiatric epidemiology*, 50(6), 963-972.
- Delgado-Saborit, J. M., Guercio, V., Gowers, A. M., Shaddick, G., Fox, N. C., & Love, S. (2020). A critical review of the epidemiological evidence of effects of air pollution on dementia, cognitive function and cognitive decline in adult population. *Science of The Total Environment*, 143734.
- del-Pino-Casado, R., Espinosa-Medina, A., López-Martínez, C., & Orgeta, V. (2019). Sense of coherence, burden and mental health in caregiving: A systematic review and meta-analysis. *Journal of Affective Disorders*, 242, 14-21.
- De Oliveira, K. H. D., de Almeida, G. M., Gubert, M. B., Moura, A. S., Spaniol, A. M., Hernandez, D. C., ... & Buccini, G. (2020). Household food insecurity and early childhood development: Systematic review and meta-analysis. *Maternal & child nutrition*, 16(3), e12967.
- Department of Environmental Affairs. (2012). *National climate change response white papers, Republic of South Africa*. Retrieved on January 2021 here: <https://www.sanbi.org/documents/national-climate-change-response-white-paper/>

- Department of Environment, Forestry and Fisheries, Republic of South Africa. (2019). *National climate change adaptation strategy, Republic of South Africa. Version UE10*. Retrieved on January 2021 here: <https://bit.ly/2YLjJYV>
- Department of Health, Republic of South Africa. (2014). National Climate Change & Adaptation Plan 2014-2019. Retrieved on January 2021 here: <https://bit.ly/3pJLa1m>
- Diffenbaugh, N. S., & Burke, M. (2019). Global warming has increased global economic inequality. *Proceedings of the National Academy of Sciences*, 116(20), 9808-9813.
- Docrat, S., Besada, D., Cleary, S., Daviaud, E., & Lund, C. (2019). Mental health system costs, resources and constraints in South Africa: a national survey. *Health policy and planning*, 34(9), 706-719.
- Ebhuoma, O. O., Gebreslasie, M., Ebhuoma, E. E., & Leonard, L. (2021). 'The future looks empty': embodied experiences of distress triggered by environmental and climatic changes in rural KwaZulu-Natal, South Africa. *GeoJournal*, 1-17.
- Edelstein, M. (2018). *Contaminated communities: Coping with residential toxic exposure*. Routledge.
- Engelbrecht, F., Adegoke, J., Bopape, M. J., Naidoo, M., Garland, R., Thatcher, M., ... & Gatebe, C. (2015). Projections of rapidly rising surface temperatures over Africa under low mitigation. *Environmental Research Letters*, 10(8), 085004.
- Erikson, K. T. (1995). *A new species of trouble: The human experience of modern disasters*. WW Norton & Company.
- Fan, V. S., & Meek, P. M. (2014). Anxiety, depression, and cognitive impairment in patients with chronic respiratory disease. *Clinics in chest medicine*, 35(2), 399-409.
- Fang, X., Zheng, X., Fry, D. A., Ganz, G., Casey, T., Hsiao, C., & Ward, C. L. (2017). The economic burden of violence against children in South Africa. *International journal of environmental research and public health*, 14(11), 1431.
- Fitzgerald, K. C., Pit, S. W., Rolfe, M., McKenzie, J., Matthews, V., Longman, J., & Bailie, R. (2020). Cross sectional analysis of depression amongst Australian rural business owners following cyclone-related flooding. *Journal of occupational medicine and toxicology*, 15, 1-15.
- Forsyth, G., Le Maitre, A., Le Roux, A., & Ludick, C. 2019. *Green Book. The impact of climate change on wildfires in South Africa*. Pretoria: CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=cf30c5ee571a4e5f8509773325451cd3>.
- Forsyth, G., Le Maitre, D., Van den Dool, R., Walls, R., Pharoah, R., & Fortune, G. (2019). The Knysna fires of 2017: learning from this disaster. *Stellenbosch: CSIR, Stellenbosch University and Santam*.
- Garland, R. M., Matooane, M., Engelbrecht, F. A., Bopape, M. J. M., Landman, W. A., Naidoo, M., ... & Wright, C. Y. (2015). Regional projections of extreme apparent temperature days in Africa and the related potential risk to human health. *International journal of environmental research and public health*, 12(10), 12577-12604.
- Gray, H. A., & Gray Sky Solutions. (2019). Air Quality Impacts and Health Effects due to Large Stationary Source Emissions in and around South Africa's Mpumalanga Highveld Priority Area (HPA).
- Gładka, A., Rymaszewska, J., & Zatoński, T. (2018). Impact of air pollution on depression and suicide. *Int J Occup Med Environ Health*, 31(6), 711-721.
- Government of South Africa. (2019). Cooperative Governance classifies KwaZulu-Natal floods as provincial disaster. Available at: <https://www.gov.za/speeches/kwazulu-natal-floods-classified-provincial-disaster-3-may-2019-0000>
- Hanigan, I. C., Butler, C. D., Kokic, P. N., & Hutchinson, M. F. (2012). Suicide and drought in new South Wales, Australia, 1970–2007. *Proceedings of the National Academy of Sciences*, 109(35), 13950-13955.

- Hare, D. L., Toukhsati, S. R., Johansson, P., & Jaarsma, T. (2014). Depression and cardiovascular disease: a clinical review. *European heart journal*, 35(21), 1365-1372.
- Hickman, C. (2020). We need to (find a way to) talk about... Eco-anxiety. *Journal of Social Work Practice*, 34(4), 411-424.
- Hoegh-Guldberg, O., Jacob, D., Bindi, M., Brown, S., Camilloni, I., Diedhiou, A., ... & Zougmore, R. B. (2018). Impacts of 1.5 C global warming on natural and human systems. *Global warming of 1.5 C. An IPCC Special Report*.
- Holz, C., Kartha, S., & Athanasiou, T. (2021). New coal power in South Africa in light of South Africa's Climate Fair Share. Climate Equity Reference Project.
- Huang, C. W., Wee, P. H., Low, L. L., Koong, Y. L. A., Htay, H., Fan, Q., ... & Seng, J. J. B. (2020). Prevalence and risk factors for elevated anxiety symptoms and anxiety disorders in chronic kidney disease: A systematic review and meta-analysis. *General Hospital Psychiatry*.
- Huntjens, P., & Nachbar, K. (2015). Climate change as a threat multiplier for human disaster and conflict. *The Hague Institute for Global Justice*.
- Iemmi, V., Bantjes, J., Coast, E., Channer, K., Leone, T., McDaid, D., ... & Lund, C. (2016). Suicide and poverty in low-income and middle-income countries: a systematic review. *The Lancet Psychiatry*, 3(8), 774-783.
- Intergovernmental Panel on Climate Change. (IPCC) (2019). Special report: Global warming of 1.5 °C January 2021 here: <https://www.ipcc.ch/sr15/>
- International Society of Trauma and Stress Studies (ISTSS). (2021). Briefing paper: Global Climate Change and Trauma. April 2021 here: <https://istss.org/public-resources/istss-briefing-papers/briefing-paper-global-climate-change-and-trauma>
- International Trade Union Confederation. (2021). Just transition centre. Retrieved in January 2021 here: <https://www.ituc-csi.org/just-transition-centre>
- Kalinda, C., Chimbari, M. J., Grant, W. E., Wang, H. H., Odhiambo, J. N., & Mukaratirwa, S. (2018). Simulation of population dynamics of *Bulinus globosus*: Effects of environmental temperature on production of *Schistosoma haematobium* cercariae. *PloS neglected tropical diseases*, 12(8), e0006651.
- Koenen, K. C., Amstadter, A. B., Ruggiero, K. J., Acierno, R., Galea, S., Kilpatrick, D. G., & Gelernter, J. (2009). RGS2 and generalized anxiety disorder in an epidemiologic sample of hurricane-exposed adults. *Depression and anxiety*, 26(4), 309-315.
- Kölves, K., Kölves, K. E., & De Leo, D. (2013). Natural disasters and suicidal behaviours: a systematic literature review. *Journal of affective disorders*, 146(1), 1-14.
- Koyanagi, A., Stubbs, B., Oh, H., Veronese, N., Smith, L., Haro, J. M., & Vancampfort, D. (2019). Food insecurity (hunger) and suicide attempts among 179,771 adolescents attending school from 9 high-income, 31 middle-income, and 4 low-income countries: A cross-sectional study. *Journal of affective disorders*, 248, 91-98.
- Landrigan, P. J., Fuller, R., Acosta, N. J., Adeyi, O., Arnold, R., Baldé, A. B., ... & Zhong, M. (2018). The Lancet Commission on pollution and health. *The lancet*, 391(10119), 462-512.
- Lawrance, D.E., Thompson, R., Fontana, G., & Jennings, D.N. (2021). The impact of climate change on mental health and emotional wellbeing: current evidence and implications for policy and practice. Available at: <https://www.imperial.ac.uk/grantham/publications/all-publications/the-impact-of-climate-change-on-mental-health-and-emotional-wellbeing-current-evidence-and-implications-for-policy-and-practice.php>
- Leach, M., MacGregor, H., Scoones, I., & Wilkinson, A. (2021). Post-pandemic transformations: How and why COVID-19 requires us to rethink development. *World Development*, 138, 105233.

- Le Maitre, D., Kotzee, I., Le Roux, A. & Ludick, C. 2019. *Green Book. The impact of climate change on flooding in South Africa*. Pretoria: CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=3da8eefc440e47cfbe43796a8ba5e64a>.
- Le Roux, A., van Huyssteen, E., Arnold, K. & Ludick, C. 2019. *Green Book. The vulnerabilities of South Africa's settlements*. Pretoria: CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=cbe48f255b95435fb12146f382a3ec6b>.
- Lloyd, S. J., Kovats, R. S., & Chalabi, Z. (2011). Climate change, crop yields, and undernutrition: development of a model to quantify the impact of climate scenarios on child undernutrition. *Environmental health perspectives*, 119(12), 1817-1823.
- Lück-Vogel, M., Le Roux, A. & Ludick, C. 2019. *Green Book. The impact of climate changes on coastal zones*. Pretoria: CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=167c6e4cdd784527b5291b642ed73531>.
- Lund, C., Brooke-Sumner, C., Baingana, F., Baron, E. C., Breuer, E., Chandra, P., ... & Saxena, S. (2018). Social determinants of mental disorders and the Sustainable Development Goals: a systematic review of reviews. *The Lancet Psychiatry*, 5(4), 357-369.
- Lundgren, K., Kuklane, K., Gao, C., & Holmer, I. (2013). Effects of heat stress on working populations when facing climate change. *Industrial health*, 51(1), 3-15.
- Mactaggart, F., McDermott, L., Tynan, A., & Whittaker, M. (2018). Exploring the broader health and well-being outcomes of mining communities in low-and middle-income countries: A systematic review. *Global public health*, 13(7), 899-913.
- McIntyre, L., Williams, J. V., Lavorato, D. H., & Patten, S. (2013). Depression and suicide ideation in late adolescence and early adulthood are an outcome of child hunger. *Journal of affective disorders*, 150(1), 123-129.
- Mendelsohn, J., & Dawson, T. (2008). Climate and cholera in KwaZulu-Natal, South Africa: The role of environmental factors and implications for epidemic preparedness. *International journal of hygiene and environmental health*, 211(1-2), 156-162.
- Michal, M., & Beutel, M. (2021). Mental disorders and cardiovascular disease: what should we be looking out for?. *Heart*.
- Midgley, S., Petrie, B., Chapman, M., Whande, W., & Parker, R. (2013). The Limpopo River Basin system: Climate impacts and the political economy. Retrieved on January 2021 here: <https://bit.ly/3on4sYT>
- Mugambiwa, S. S., & Tirivangasi, H. M. (2017). Climate change: A threat towards achieving 'Sustainable Development Goal number two' (end hunger, achieve food security and improved nutrition and promote sustainable agriculture) in South Africa. *Jàmbá: Journal of Disaster Risk Studies*, 9(1), 1-6.
- Mulchandani, R., Armstrong, B., Beck, C. R., Waite, T. D., Amlôt, R., Kovats, S., ... & Oliver, I. (2020). The English National Cohort Study of Flooding & Health: psychological morbidity at three years of follow up. *BMC public health*, 20, 1-7.
- Mushavi, R. C., Burns, B. F., Kakuhikire, B., Owembabazi, M., Vořechovská, D., McDonough, A. Q., ... Tsai, A. C. (2020). "When you have no water, it means you have no peace": A mixed-methods, whole-population study of water insecurity and depression in rural Uganda. *Social Science & Medicine*, 245, 112561.
- Mvandaba, V., Mwenge Kahinda, J-M., Hobbs, P., Nzuza, P., Le Roux, A. & Arnold, K. 2019. *Green Book. The impact of climate change on South Africa's future groundwater availability*. Pretoria: CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=6f1b33975a99452cbcb6778d6d7fcf99>.
- Myers, S., & Frumkin, H. (2020). *Planetary health: Protecting nature to protect ourselves*. Island Press.

- Na, M., Dou, N., Ji, N., Xie, D., Huang, J., Tucker, K. L., & Gao, X. (2020). Food insecurity and cognitive function in middle to older adulthood: a systematic review. *Advances in Nutrition*, 11(3), 667-676.
- Ngepah, N., Djemo, C.R., Le Roux, A. & Ludick, C. 2019. *Green Book. The impact of climate change on economic production and growth*. Pretoria: CSIR. Available at: <https://pta-gis-2-web1.csir.co.za/portal2/apps/GBCascade/index.html?appid=12711d7cf4e4468f81ae2934f0d79868>
- Nicholls, N., Butler, C. D., & Hanigan, I. (2006). Inter-annual rainfall variations and suicide in New South Wales, Australia, 1964–2001. *International Journal of Biometeorology*, 50(3), 139-143.
- O’Brien, L. V., Berry, H. L., Coleman, C., & Hanigan, I. C. (2014). Drought as a mental health exposure. *Environmental Research*, 131, 181-187.
- Ololade, O. O., Esterhuyse, S., and Levine, A. D. (2017). *The Water-Energy-Food Nexus from a South African Perspective. Water-Energy-Food Nexus*. Washington, DC: John Wiley and Sons, Inc., 127–140.
- Omotoso, K. O., & Koch, S. F. (2018). Assessing changes in social determinants of health inequalities in South Africa: A decomposition analysis. *International Journal for Equity in Health*, 17(1), 1-13.
- Orris, P. (2019). Effects due to large stationary source emission in and around South Africa’s Mpumalanga Highveld Priority Area (HPA). Retrieved here: <https://www.groundwork.org.za/Documents/AirQuality/Peter-Orris-Report.pdf>
- Palmer, S., Vecchio, M., Craig, J. C., Tonelli, M., Johnson, D. W., Nicolucci, A., ... & Strippoli, G. F. (2013). Prevalence of depression in chronic kidney disease: systematic review and meta-analysis of observational studies. *Kidney international*, 84(1), 179-191.
- Papanikolaou, V., Adamis, D., Mellon, R. C., & Prodromitis, G. (2011). Psychological distress following wildfires disaster in a rural part of Greece: a case-control population-based study. *International journal of emergency mental health*.
- Pascale, S., Kapnick, S. B., Delworth, T. L., & Cooke, W. F. (2020). Increasing risk of another Cape Town “Day Zero” drought in the 21st century. *Proceedings of the National Academy of Sciences*, 117(47), 29495-29503.
- Pourmotabbed, A., Moradi, S., Babaei, A., Ghavami, A., Mohammadi, H., Jalili, C., ... & Miraghajani, M. (2020). Food insecurity and mental health: a systematic review and meta-analysis. *Public health nutrition*, 23(10), 1778-1790.
- Reid, C. E., Brauer, M., Johnston, F. H., Jerrett, M., Balme, J. R., & Elliott, C. T. (2016). Critical review of health impacts of wildfire smoke exposure. *Environmental health perspectives*, 124(9), 1334-1343.
- PsySSA (Psychology Society of South Africa). (2021). What is PsySSA? Retrieved on January 2021 here: <https://bit.ly/2XRZ2u8>
- Sartore, G. M., Kelly, B., Stain, H., Albrecht, G., & Higginbotham, N. (2008). Control, uncertainty, and expectations for the future: a qualitative study of the impact of drought on a rural Australian community. *Rural and Remote Health*, 8(3), 1.
- Saulnier, D. D., Ribacke, K. B., & von Schreeb, J. (2017). No calm after the storm: a systematic review of human health following flood and storm disasters. *Prehospital and disaster medicine*, 32(5), 568-579.
- Scherer, N., Verhey, I., & Kuper, H. (2019). Depression and anxiety in parents of children with intellectual and developmental disabilities: A systematic review and meta-analysis. *PloS one*, 14(7), e0219888.
- Schlosberg, D., Rickards, L., & Byrne, J. (2018). Environmental justice and attachment to place: Australian cases. R. Holifield, J. Chakraborty and G. Walker (Eds.) *The Routledge Handbook of Environmental Justice*. Routledge, United Kingdom.
- Scholes, R., & Engelbrecht, F. (2021). Climate impacts in southern Africa during the 21st Century. Report for Earthjustice and the Centre for Environmental Rights. Global Change Institute, University of Witwatersrand.

- Schraufnagel, D. E., Balmes, J. R., Cowl, C. T., De Matteis, S., Jung, S. H., Mortimer, K., ... & Wuebbles, D. J. (2019a). Air pollution and noncommunicable diseases: A review by the Forum of International Respiratory Societies' Environmental Committee, Part 1: Air pollution and organ systems. *Chest*, 155(2), 409-416.
- Schraufnagel, D. E., Balmes, J. R., Cowl, C. T., De Matteis, S., Jung, S. H., Mortimer, K., ... & Wuebbles, D. J. (2019b). Air pollution and noncommunicable diseases: A review by the Forum of International Respiratory Societies' Environmental Committee, Part 2: Air pollution and organ systems. *Chest*, 155(2), 417-426.
- Schumacher, J. A., Coffey, S. F., Norris, F. H., Tracy, M., Clements, K., & Galea, S. (2010). Intimate partner violence and Hurricane Katrina: predictors and associated mental health outcomes. *Violence and victims*, 25(5), 588-603.
- Scovronick, N., Sera, F., Acquafatta, F., Garzena, D., Fratianni, S., Wright, C. Y., & Gasparri, A. (2018). The association between ambient temperature and mortality in South Africa: A time-series analysis. *Environmental research*, 161, 229-235.
- Sherley, R. B., Ludynia, K., Dyer, B. M., Lamont, T., Makhado, A. B., Roux, J. P., ... & Votier, S. C. (2017). Metapopulation tracking juvenile penguins reveals an ecosystem-wide ecological trap. *Current Biology*, 27(4), 563-568.
- Simpson, G. B., Badenhorst, J., Jewitt, G. P., Berchner, M., & Davies, E. (2019). Competition for land: the water-energy-food nexus and coal mining in Mpumalanga Province, South Africa. *Frontiers in Environmental Science*, 7, 86.
- Smidt, A., & Freyd, J. (2018). Government-mandated institutional betrayal. *Journal of Trauma and Dissociation*, 19, 491-499.
- Smith, C. P. (2017). First, do no harm: institutional betrayal and trust in health care organizations. *Journal of multidisciplinary healthcare*, 10, 133.
- Smith, C. P., & Freyd, J. J. (2014). Institutional betrayal. *American Psychologist*, 69(6), 575.
- Stanke, C., Kerac, M., Prudhomme, C., Medlock, J., & Murray, V. (2013). Health effects of drought: a systematic review of the evidence. *PLoS currents*, 5.
- Stansfeld, S. A., Rotheron, C., Das-Munshi, J., Mathews, C., Adams, A., Clark, C., & Lund, C. (2017). Exposure to violence and mental health of adolescents: South African Health and Well-being Study. *BJPsych open*, 3(5), 257-264.
- Steele, S. J., Abrahams, N., Duncan, K., Woollett, N., Hwang, B., O'Connell, L., ... & Shroufi, A. (2019). The epidemiology of rape and sexual violence in the platinum mining district of Rustenburg, South Africa: Prevalence, and factors associated with sexual violence. *PloS one*, 14(7), e0216449.
- Taquet, M., Luciano, S., Geddes, J. R., & Harrison, P. J. (2021). Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. *The Lancet Psychiatry*, 8(2), 130-140.
- Taylor, S. (2020). Anxiety disorders, climate change, and the challenges ahead: Introduction to the special issue. *Journal of Anxiety Disorders*, 76, 102313.
- Thompson, A. A., Matamale, L., & Kharidza, S. D. (2012). Impact of climate change on children's health in Limpopo Province, South Africa. *International Journal of Environmental Research and Public Health*, 9(3), 831-854.
- Thompson, R., Hornigold, R., Page, L., & Waite, T. (2018). Associations between high ambient temperatures and heat waves with mental health outcomes: a systematic review. *Public Health*, 161, 171-191.
- Truong, K. D., & Ma, S. (2006). A systematic review of relations between neighborhoods and mental health. *Journal of Mental Health Policy and Economics*.
- United Nations Environment Programme. 2021. Making peace with nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies. Nairobi. <https://www.unep.org/resources/making-peace-nature>

- Van Susteren, L., & Al-Delaimy, W. K. (2020). Psychological Impacts of Climate Change and Recommendations. In *Health of People, Health of Planet and Our Responsibility* (pp. 177-192). Springer, Cham.
- Van Susteren, L. (2021). Personal communication with reviewer and forensic psychiatrist Prof Lise Van Susteren on 28 March 2021.
- Vins, H., Bell, J., Saha, S., & 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.
- Vyner, H. M. (1988). *Invisible trauma: The psychosocial effects of invisible environmental contaminants*. Lexington Books/DC Heath and Com.
- Weaver, L. J., & Hadley, C. (2009). Moving beyond hunger and nutrition: a systematic review of the evidence linking food insecurity and mental health in developing countries. *Ecology of food and nutrition*, 48(4), 263-284.
- Woodbury, Z. (2019). Climate trauma: Toward a new taxonomy of trauma. *Ecopsychology*, 11(1), 1-8.
- World Bank. (April, 2020). *Poverty and Equity Brief*. Retrieved January 2021, here: <https://bit.ly/37Tzrq5>
- World Health Organization. (1977). *Apartheid and mental health care* (No. MNH/77.5). World Health Organization.
- World Health Organization. (2021a). *The top 10 causes of death*. Retrieved on January 2021 here: <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>
- World Health Organization. (2021b). Technical guidelines, humanitarian health action: *Floods and communicable diseases fact sheets*. Retrieved on March 2021 here: https://www.who.int/hac/techguidance/ems/flood_cds/en/
- World Health Organisation. (2021c). *Devastatingly pervasive: 1 in 3 women globally experience violence*. Retrieved here: <https://www.who.int/news/item/09-03-2021-devastatingly-pervasive-1-in-3-women-globally-experience-violence>
- World Wildlife Fund. (2011). *Coal and water futures in South Africa: the case for protecting headwaters in the Enkangala grasslands*. Retrieved in January 2021 here: <https://www.wwf.org.za/?7000/coal-and-water-report>
- Wright, C. Y., Kapwata, T., Wernecke, B., Garland, R. M., Nkosi, V., Shezi, B., ... & Mathee, A. (2019). Gathering the evidence and identifying opportunities for future research in climate, heat and health in South Africa: The role of the South African Medical Research Council. *South African Medical Journal*, 109(11b), 20-24.
- Wright, C. Y., Norval, M., Kapwata, T., Du Preez, D. J., Wernecke, B., Tod, B. M., & Visser, W. I. (2019). The incidence of skin cancer in relation to climate change in South Africa. *Atmosphere*, 10(10), 634.
- Wright, C. Y., Kapwata, T., Du Preez, D. J., Wernecke, B., Garland, R. M., Nkosi, V., ... & Norval, M. (2021). Major climate change-induced risks to human health in South Africa. *Environmental Research*, 196, 110973.
- Wright, C. Y., du Preez, D. J., Millar, D. A., & Norval, M. (2020). The epidemiology of skin cancer and public health strategies for its prevention in Southern Africa. *International journal of environmental research and public health*, 17(3), 1017.
- Wutich, A., Brewis, A., & Tsai, A. (2020). Water and mental health. *Wiley Interdisciplinary Reviews: Water*, 7(5), e1461.
- Xue, T., Zhu, T., Zheng, Y., & Zhang, Q. (2019). Declines in mental health associated with air pollution and temperature variability in China. *Nature communications*, 10(1), 1-8.
- Zhang, Y., Held, I., & Fueglistaler, S. (2021). Projections of tropical heat stress constrained by atmospheric dynamics. *Nature Geoscience*, 14(3), 133-137.
- Ženko, M., & Menga, F. (2019). Linking water scarcity to mental health: Hydro-social interruptions in the Lake Urmia Basin, Iran. *Water*, 11(5), 1092.