

EXPERT REPORT

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

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by

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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 is having devastating effects across the world and poses an existential threat for this and future generations.³ My expert opinion is that climate change has profound adverse psychological implications for those living in South Africa. Climate change exposures follow the pathways of trauma and stress, leading to well understood adverse psychological reactions.⁴ The traumatic and stressful events (i.e., the exposures/threats) 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 threat 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>) | Depression, 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, and see Intergovernmental Panel on Climate Change, 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 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 in areas with higher exposures to pollutants. The mental health implications are staggering and urgent action is required. The expert report highlights three areas, focusing on context, mental health consequences, 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 population 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 psychological adversities.

⁶ Council for Industrial and Scientific Research, 2019; Scholes and Engelbrecht, 2021; Intergovernmental Panel on Climate Change, 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; Intergovernmental Panel on Climate Change, 2021

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

¹² World Bank, 2020

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. Affected children are likely to have extra challenges at school as their concentration is impaired and they are emotionally overwhelmed. 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 experiences, 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 can 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 can overwhelm a person's ability to cope. The extreme stress of these situations can also lead to a number of somatic (e.g., excessive psychologically rooted physical pain) reactions, excessive worry or distressing thoughts. The climate change impacts, regardless of whether they are sudden or slow and insidious, are extremely stressful or may be 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

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

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

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, 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 focused on the psychological reactions 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 and a co-convenor of the Psychology Society of South Africa's (PsySSA¹⁵) Climate, Environment and Psychology (CEP) Group.

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

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 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.

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

¹⁷ Scholes & Engelbrecht, 2021; Additionally see: Council for Industrial and Scientific Research, 2019; Intergovernmental Panel on Climate Change, 2019, 2021;

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 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. Already 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-rooted threats that drive psychological distress.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 more psychological adversities and adverse reactions, including anxiety, depressive, and posttraumatic stress disorders.²³

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, Rotheron & Stansfeld, 2016

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 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. In summary, 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 psychological dissonance.²⁶ Distress associated with structural violence is expected and interventions should not only address threat responses, 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 direct 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 psychological distress owing to being exposed to climate change disruptions to routine and subsequently fearing future harms.

Psychological adversities in childhood are associated with poorer mental health 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, adult psychological and social adversities, 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

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

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

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 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, trust and security 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 reactions 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 This failure by the “adult world” can lead to psychological reactions, such as a sense of disenfranchisement, anger, meaninglessness, and exacerbate depression, anxiety and traumatic reactions.

3.2 The Mental Health and Psychological Consequences of Climate Change

This section outlines the general 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 traumatic and profoundly stressful, which, in turn, can may 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 depressive, anxiety, and post-traumatic stress disorders and reactions, 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. 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 also a collective trauma of potentially epic proportions,

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

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

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 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. These experiences can then be characterised by psychological adversities, such as anxiety, grief, loss, helplessness, hopelessness, hearing voices, alcohol and substance use, self harm, and a range of other threat responses. 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. The details of these conclusions are detailed in the follow subsections:

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

³⁸ Woodbury, 2019

³⁹ Woodbury, 2019

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

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 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 adverse psychological reactions and mental health conditions that take on a persistent, chronic nature. The sections that follow in this subsection will address the psychological adversities of current and expected climate change associated 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 reactions and depression than those not exposed to flooding during severe weather events.⁵⁴ Additionally, depressive reactions were 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 for those who have previously been exposed to psychological adversities.⁵⁷ These experiences of psychological adversities can be longlasting.⁵⁸ 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

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

⁴⁷ Clayton, 2020

⁴⁸ Erikson, 1995

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

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 reactions.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

3.2.1.2 Droughts

My expert opinion is that the climate change exacerbated droughts will increase the risk of profound adverse psychological reactions 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, anxiety, depression, and suicide.⁶⁷ For example, 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 depressive reaction 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 psychological 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

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

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, Kokic & 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

catastrophes. International research demonstrates some of the significant psychological implications of wildfires, such as substantial psychological distress, including higher rates of symptoms of paranoia, somatization, depressive, anxiety, rumination 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 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 in the Garden Route experienced considerable psychological distress, including depressive, anxiety and post-traumatic stress reactions. 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

⁷⁶Brown et al., 2019; Papanikolaou et al., 2011; Powell, Wegmann & Backode, 2021

⁷⁷ Reid et al., 2016; Cascio, 2018;

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

A recent population-based survey in Uganda showed that women who experience water insecurity are at 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

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 Depressive and anxiety symptoms are also more severe for people living with respiratory and kidney diseases compared to the general population.⁹⁶ There is

⁸⁷ Cooper-Vince et al., 2018

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

⁸⁹ Mushavi et al., 2020

⁹⁰ Barnwell et al 2020b

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

⁹² Mvandaba 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

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 and drive psychological adversities 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 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 adverse psychological reactions, such as anxiety, sadness, hopelessness, aggression, irritability, 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.¹⁰⁸ Air pollution can harm the central nervous system, and increased exposure is correlated with a higher prevalence of depressive disorders and suicide.¹⁰⁹ 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.

⁹⁷ Michal & Beutel, 2021

⁹⁸ Choi, Park, Kim, and Han, 2020

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

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 Gładka, Rymaszewska & Zatoński, 2018

Participants living in mine-affected communities or industrial areas exposed to air pollution express a sense of intrusiveness and are distressed about their health.¹¹⁰ Air pollution's boundaries are unseen and insidious, contributing to environmental health-related distress.¹¹¹ 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.¹¹²

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-19.¹¹³ COVID-19 has significant impacts on mental health, increasing the risk of depression, anxiety and post-traumatic stress disorders.¹¹⁴ Chronic obstructive pulmonary disease, type-2 diabetes, and ischemic heart disease have also been attributed to air pollution associated with burning fossil fuels.¹¹⁵ Moreover, air pollution significantly increases the risk of depressive reactions for people living with pre-existing diabetes, asthma or cardiovascular disease.¹¹⁶

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.¹¹⁷ 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 adverse psychological reaction 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,¹¹⁸ cancers,¹¹⁹ diarrhoeal, gastrointestinal and waterborne diseases,¹²⁰ malnutrition,¹²¹ malaria,¹²² asthma and allergies¹²³ and injury and death from interpersonal violence.¹²⁴ Thus, climate change is expected to increase the

¹¹⁰ Barnwell et al. 2020b

¹¹¹ Barnwell et al 2020b, Vyner, 1988

¹¹² Brisbois et al., 2019; Gray & Solutions, 2019; Mactaggart, McDermott, Tynan & Whittaker 2018; Orris, 2019

¹¹³ Brauer, Casadei, Harrington, Kovacs, Sliwa & WHF Air Pollution Expert Group, 2021

¹¹⁴ Taquet, Luciano, Geddes & Harrison, 2021

¹¹⁵ Landrigan et al., 2018; Schraufnagel et al., 2019a,b

¹¹⁶ Cho et al., 2014

¹¹⁷ Wright, et al. 2021

¹¹⁸ Garland et al., 2015; Scovronick, Acquotta, Garzena, Fratianni, Wright & Gasparini, 2018

¹¹⁹ Wright, du Preez, Millar, & Norval, 2020; Wright et al., 2019

¹²⁰ Boeckmann et al., 2018; Kalinda, Chimbari, Grant, Wang, Odhiambo, & Mukaratirwa, 2018; Mendelsohn & Dawson, 2008; Thompson, Matamale, & Kharidza, 2012

¹²¹ Lloyd, Kovats, & Chalabi, 2011; Mugambiwa & Tirivangasi, 2017

¹²² Behera et al., 2018; Bornman, Schlemmer, Van der Walt, Van Dyk & Bouwman, 2012; Chersich, et al. 2018a,b

¹²³ Berman, 2011; Davies et al., 2021

¹²⁴ Chersich, et al 2018b

disease burden in South Africa, which in turn will have direct socioeconomic and adverse psychological 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 physical and psychological adversities mentioned above are shown to lead to premature death, and life lived in less than full health, also known as disability-adjusted life-years.¹²⁵ These adversities 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.¹²⁶ Furthermore, increased psychological distress can suppress the immune system, making someone more susceptible to becoming sick.¹²⁷ 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, depressive or anxiety reactions, among other psychological experiences.¹²⁸

3.2.6 Financial Insecurity

Research evidence shows that climate change is expected to have major socio-economic impacts¹²⁹ 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”.¹³⁰ 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.¹³¹ Scientists tell us that 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.¹³² 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.¹³³

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

¹²⁵ Myers & Frumkin, 2020; World Health Organisation, 2021a

¹²⁶ Cianconi, Betrò & Janiri, 2020

¹²⁷ Clayton, 2020

¹²⁸ del-Pino-Casado, Espinosa-Medina, López-Martínez & Orgeta, 2019; Scherer, Verhey & Kuper, 2019

¹²⁹ Scholes & Engelbrecht, 2021. See also: Ngepah, Djemo, Le Roux & Ludick, 2019

¹³⁰ Cooper, 2021

¹³¹ Intergovernmental Panel on Climate Change, 2019.

¹³² Le Roux, van Huyssteen, Arnold & Ludick, 2019

¹³³ Council for Industrial and Scientific Research, 2019; Ngepah et al., 2019

conditions within communities.¹³⁴ These mounting frustrations can place more pressure on individuals, families and the broader community.

A systematic review of poverty and mental health in low- and middle-income settings helps to extrapolate the negative psychological implications of the socio-economic stressors for South Africa.¹³⁵ 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.¹³⁶ Furthermore, studies show that worse economic status and diminished health were positively associated with suicidal thinking and suicidal behaviour.¹³⁷ Financial insecurity can also lead to experiences of social marginalisation, social isolation, shame and a sense of institutional betrayal.

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 experiencing psychological adversities.¹³⁸ Individuals who struggle with poorer mental health are also more vulnerable to drift into poverty and inevitably experience increased social isolation.¹³⁹ Furthermore, mental health challenges are accompanied by high economic costs.¹⁴⁰ Increased financial challenges can make it more difficult to access mental health services, as resources are prioritised to cover basic needs.¹⁴¹ 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 profound psychological adversities.¹⁴²

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.¹⁴³

Food insecurity increases the risk of psychological adversities, such as depressive and anxiety reactions, poor cognitive performance, and stunted psychological development in children.¹⁴⁴ Exacerbated food insecurity is likely to increase mental health adversities in South Africa through several mechanisms. There is a link between the lack of micronutrients and mental health.¹⁴⁵ Second, the increased psychosocial stress that food insecurity places on households and communities can increase psychological stressors, psychological adversities and stress reactions, such as anxiety, depressive and post-traumatic stress. The unpredictable nature and uncertainty further compound the profound psychological misery that food insecurity causes people.¹⁴⁶ Another systematic review conducted, for instance, found that psychological distress is common across the 16 epidemiological studies that they reviewed.¹⁴⁷

¹³⁴ Wutich, Brewis, & Tsai, 2020

¹³⁵ Lund et al., 2010

¹³⁶ Lund et al., 2010

¹³⁷ Temmi et al., 2016

¹³⁸ Lund et al., 2018

¹³⁹ Lund et al., 2010

¹⁴⁰ Clayton, 2021

¹⁴¹ Bourque & Cunsolo Willox, 2014

¹⁴² Clayton, 2020

¹⁴³ Scholes & Engelbrecht, 2021; See also: Kovats & Chalabi, 2011; Mugambiwa & Tirivangasi, 2017

¹⁴⁴ Lund et al., 2018; Pourmotabbed et al., 2020

¹⁴⁵ Weaver & Hadley, 2009

¹⁴⁶ Pourmotabbed et al., 2020; Weaver & Harley, 2009

¹⁴⁷ Weaver & Hadley, 2009

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.¹⁴⁸ 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.¹⁴⁹ The more food insecure, the higher the likelihood that a child may experience poorer motor development and have school readiness challenges. The threat of hunger can also contribute to depression and suicidality in youth.¹⁵⁰

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 Africa.¹⁵¹ 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.¹⁵² Furthermore, according to scientists, the number of hot days is expected to increase by mid-century.¹⁵³ 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'.¹⁵⁴ 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%.¹⁵⁵ Globally, 1 in 3 women has experienced intimate partner physical or sexual violence in their lifetimes.¹⁵⁶ 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.¹⁵⁷ 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.¹⁵⁸ 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, depressive and post-traumatic stress reactions, 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 dysregulation, self-harming behaviour and increase social burdens.¹⁵⁹ 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.¹⁶⁰ These disruptions in treatment increase the risk of becoming ill.

¹⁴⁸ Na., et al., 2020

¹⁴⁹ de Oliveira et al., 2020

¹⁵⁰ Davison, Marshall-Fabien, & Tecson, 2015; Koyanagi et al., 2019; McIntyre, Williams, Lavorato & Patten, 2013

¹⁵¹ Fang et al., 2017

¹⁵² Chersich et al., 2019; Schumacher, Coffey, Norris, Tracy, Clements & Galea, 2010; Vins, Bell, Saha & Hess, 2015; Schumacher et al., 2010

¹⁵³ Garland, et al. 2015

¹⁵⁴ Chersich et al., 2019

¹⁵⁵ Steele et al., 2019

¹⁵⁶ World Health Organisation, 2021c

¹⁵⁷ Schumacher, et al., 2010

¹⁵⁸ Chersich, et al 2019; Vins, Bell, Saha & Hess, 2015

¹⁵⁹ Fang et al., 2017; Stansfeld et al., 2017

¹⁶⁰ Cluver, Meinck, Toska, Orkin, Hodes & Sherr, 2018

3.2.9 Identity Disruptions and Loss

In my expert opinion, psychological experiences of loss are prominent reactions to climate change trauma and stress, which deserve special attention.¹⁶¹ 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 losses.¹⁶² 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.¹⁶³

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), 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.¹⁶⁴ 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 profound psychological distress.¹⁶⁵

Losses associated with climate change extend to the loss of traditional knowledge systems, ancestral and ecological connections – described often as 'severing' from the historical relationship with place, including ancestral dimensions.¹⁶⁶ 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.¹⁶⁷ 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.¹⁶⁸ In my expert opinion, these disruptions create considerable individual- and community-level psychological distress.

¹⁶¹ Cunsolo & Ellis, 2018

¹⁶² Schlosberg, Rickards & Byrne, 2018

¹⁶³ Vins, Bell, Saha, & Hess, 2015

¹⁶⁴ Edelstein, 2018

¹⁶⁵ Albrecht, et al., 2007; Ebhuoma, et al., 2021

¹⁶⁶ Barnwell, et al. 2020; Barnwell, et al. 2021; Cunsolo & Ellis, 2018; Ebhuoma, et al., 2021

¹⁶⁷ Barnwell, Makaulule, Stroud, Watson & Rubson, 2021a; Midgley, Petrie, Chapman, Whande, & Parker, 2013

¹⁶⁸ Albrecht et al., 2007; Askland & Bunn, 2018; Barnwell et al. 2020b; Barnwell et al 2021a

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.¹⁶⁹ Furthermore, when people know that their government is aware of the negative impacts of climate change and action is not taken, this can also 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 not 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, 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.¹⁷⁰ 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.¹⁷¹ 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 is likely to exacerbate other trauma reactions.¹⁷²

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.¹⁷³ 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.¹⁷⁴

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

¹⁶⁹ Smidt & Freyd, 2018; Smith, 2017

¹⁷⁰ Department of Environmental Affairs, 2012; the Republic of South Africa, 2019

¹⁷¹ Smith, 2017

¹⁷² Hickman, 2020

¹⁷³ Ngepah, 2019; International Society of Trauma and Stress Studies, 2019

¹⁷⁴ International Trade Union Confederation, 2021

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.¹⁷⁵ However, South Africa's public mental health "treatment gap" for people living with 'mental disorders, epilepsy and intellectual disabilities' is around 92%.¹⁷⁶ 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 traumas and stressors 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.

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,¹⁷⁷ 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.

¹⁷⁵ Erikson, 1995

¹⁷⁶ Docrat, Besada, Cleary, Daviaud, & Lund, 2019

¹⁷⁷ Department of Environmental Affairs, 2012

Signed on 31 August 2021 in Johannesburg, South Africa,

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