A SEASON OF CHANGE **Joëlle Gergis**

This was the first essay in a new series published by Griffith Review online across the 2020-21 summer. Bearing witness to the climate emergency, ***The Elemental Summer*** *navigated ideas and experiences of land, fire, water and air, and the science that tracks and explores them. This commission was a critical impetus for Joëlle Gergis's subsequent much-lauded book,* Humanity's Moment (Black Inc., 2022).

IT'S PITCH BLACK as I slip out of bed, trying not to wake my husband. It's 5.15 am on a Saturday in the dead of winter; the last thing I feel like doing is leaving my downy cocoon to talk about our destabilising world.

As one of the dozen or so Australian lead authors involved in the United Nations' Intergovernmental Panel on Climate Change (IPCC) *Sixth Assessment Report*, it's my job to review thousands of peer-reviewed scientific studies and distil their key findings. Our task in Working Group 1 is to provide the scientific foundation for understanding the risk of human-induced climate change, its potential impacts, and options for adapting to and avoiding dangerous levels of climate change. The cycle typically takes around six years to complete from initial scoping to final government approval. The work forms the technical foundation for trying to achieve the Paris Agreement targets of keeping global warming to well below 2 degrees above pre-industrial levels, and as close to 1.5 degrees as possible. It's the information that helps us figure out how to keep our planetary boundaries stable enough to support humanity.

The first volume of this global climate assessment report is due out in mid-2021, and this morning's meeting is one of many that have taken place since the process started back in June 2018. Our second draft has just come back from government and expert review; we now have 51,387 technical comments to address ahead of a Final Government Draft that will go to the UN for approval. Today's task is to come up with a strategy to respond to each comment assigned to our chapter and revise our text before a deadline of 12 March 2021.

Before embarking on the IPCC process, I had managed to remain emotionally detached from the work that I do. I could focus on my own research, reporting findings and not allowing their implications to sink in too deeply. I was okay as long as I didn't look at images of scorched animals, distressed farmers and ravaged landscapes long enough to feel the sting of it. My work felt clean, clinical, safely partitioned from my emotions. But being involved in a UN process reconfigures your worldview; it forces you to zoom out and take in the Earth as a whole. My chapter team alone spans scientists from Colombia to France, Russia to Cameroon, Israel to India. I'm lucky to form part of our group's trans-Tasman contingent, the Australia–New Zealand alliance; solid as always.

As I roll out of bed on this dark winter's morning, my nerves are shot: it's been a hell of a year. But if I don't get up, I'll miss the opportunity to represent Australia's scientific community in this global process. At the rate we're going, by the time the next IPCC report comes out – likely around 2030 – the world will have blown the carbon budget required to achieve the Paris Agreement targets. In my darker moments, I fear that we may have already crossed an invisible tipping point, pushing the planetary system past the point of no return. So as much as I might need the rest, sleeping in simply isn't an option. It's time to haul myself out of bed and take one for the team.

As I jot down my task list in the notepad on my desk, I listen to the pre-dawn chorus of birds – first the kookaburras, then the lorikeets, followed by the plaintive currawongs. By the time the meeting ends, my usual alarm clock – a huge flock of noisy corellas – has screeched overhead, heralding the start of a new day. Although I sometimes feel aggrieved by the terrible time zones of these meetings, more often than not I feel lucky to live in a landscape that still feels so alive. Over 200 bird species make this pocket of northern New South Wales their home. At these ungodly hours, nature thrives, reminding me that so much hangs in the balance in a country such as Australia. We are one of the planet's most biodiverse countries, with more unique plant and animal species found here than anywhere else on Earth. Like Brazil, Papua New Guinea and Madagascar, we are a biodiversity hotspot. As David Attenborough recently reminded Australians: 'You are the keepers of an extraordinary section of the surface of this planet…what you say, what you do, really, really matters.'

United Nations' member countries put forward nominations for 911 regional experts to compile the IPCC's *Sixth Assessment Report*, all of us assessed by our contribution to published scientific research. From these nominations, 230 scientists from sixty-three countries were selected to serve as lead authors and provide the necessary expertise to conduct the assessment across a range of disciplines. Just over a quarter of us are women, with the south-west Pacific – which includes Australia – accounting for only 8 per cent of the voices at the table.

But no matter where we are from, all of us volunteer our time, working thousands of unpaid hours over the course of three relentlessly intense years drafting technical summaries of complex topics, including the causes of chronic drought, modelling sea-level rise and changes in global monsoons. Our work goes out for two rounds of expert and government review, after which we face the gruelling task of responding to tens of thousands of reviewer comments and attending meetings across several time zones to make sure the revisions get done.

All of this happens in the background of our regular day jobs – generally, positions as research scientists or university lecturers in world-leading institutions – and the immovable challenges of domestic life. The only funding is a small federal government travel allowance to cover the economy flights, standard accommodation and basic meals associated with attending four compulsory lead-author meetings in person.

The first three of these involved long-haul flights to China, Canada and France for incredibly intense five-day meetings. The last session done, I'd catch the first evening flight to begin the long journey home, often through multiple international airports, while trying to make a dent in the mountain of non-IPCC email that had accumulated during the week.

On the way home from our third lead-author meeting in France, a mix of anxiety and exhaustion has my mind racing. I can't sleep; I'm too overstimulated; my eyes are stinging. I pull out my journal to capture the rush of ideas, page after page. The last thing I wrote that night still haunts me:

It's extraordinary to realise that we are witnessing the great unravelling; the beginning of the end of things. I honestly never thought I'd live to see the start of what sometimes feels like the apocalypse.

The Earth is really struggling to maintain its equilibrium. It's possible that we are now seeing a cascade of tipping points lurching into action as the momentum of instability takes hold and things start to come apart. I honestly don't know what the future will bring.

When complete exhaustion sets in, I stare out the window, weeping at the sheer enormity of the challenge we face. It's a battle between crushing despair and belief in the power of true global citizenry that I've just experienced.

I continue to be blown away by the generosity shown by so many people involved in this IPCC process. When COVID-19 struck, our fourth meeting – slated for June 2020 in Chile – was postponed. Part of me welcomed the opportunity to avoid another long-haul flight. But the gathering was replaced by a dozen online meetings, often involving brutal time differences – all for me to attend while teaching a new climatology course for 120 students that was suddenly forced to shift online as the Australian National University's campus shut down.

During one meeting, Cyclone Nisarga slammed into western India – the strongest tropical cyclone to strike the western Indian state of Maharashtra since 1891. Despite this, the author based there managed to log in, apologising for being late:

Hello everyone – sorry for the delay. The internet and electricity was [sic] totally down due to a cyclone that passed over Pune just now. I am trying to reconnect using mobile hot spot. The connection is weak and intermittent.

In light of the lived immediacy of these struggles, my own challenges feel like First World problems.

The dedication shown by my fellow scientists is truly the stuff of legend. This summer, as most people enjoy their Christmas holiday, climate scientists across the world will be working around the clock to complete this monumental assessment of the global climate. For those of us from the Southern Hemisphere, it will be the third year in a row that we've worked through our summer break.

Gruelling workloads aside, we all enjoy the cultural exchange that goes with being part of a team of scientists gathered from so many countries, working in good faith to compile the most comprehensive global climate assessment humanly possible. My favourite lunch buddy is the lone delegate from Iceland with a name so unpronounceable that she graciously offers up a nickname. We figure out that we live about as far away from each other as is physically possible. We are completely fascinated by one another, managing to communicate warmly with our eyes when words fail us. Mealtime chats revolve around melting glaciers, the complexities of modelling sea-level rise and if Australia really has a proper winter.

Then there is the bleary-eyed camaraderie of my fellow Australians, people who immediately acknowledge the jet lag with a sympathetic glance. We exchange information over a cuppa, trying to knit together any gaps in coverage of our region that might come from Australian authors being scattered across thirteen different chapters.

Back in formal meetings, we spend hours listening to how the climate crisis is escalating all over the world. Warming deep in our oceans. Melting glaciers in densely populated lands. How rainfall zones are drifting away from some continents, slipping towards the poles. We talk non-stop about real-time examples of accelerating warming already observed in our unique part of the world. We worry about how quickly things are playing out, orders of magnitude faster than the natural processes of geologic and evolutionary time. The more I hear, the more I realise that the situation is much worse than most people can imagine. In truth, it's also hard for me to comprehend that it's our generation that is likely to witness the destabilisation of the Earth's climate.

It's a pressure-cooker environment; every conversation requires complete concentration and often follow-up action to meet relentless deadlines. Our face-to-face time together in the same room flies fast; by the end of the week, we're all shattered. We scatter back to our lives across the planet, with a long list of work to do, and the almighty psychological burden of understanding that the planet's equilibrium may have already been lost.

That's what really keeps us up at night. We wonder if we may have already pushed the planetary system past the point of no return, unleashing a cascade of irreversible changes that have built such momentum we can only watch as they unfold. It's becoming increasing clear that we are likely to sail through the Paris Agreement's targets in a handful of decades – perhaps as early as the 2040s, or maybe the 2050s, if global emissions start to slow down.

IT WAS IMPOSSIBLE to imagine what would unfold after our third lead-author meeting in late August 2019. Barely a week after sweltering through an extreme European summer heatwave, it was surreal to return home and find much of Australia's eastern seaboard engulfed in an unprecedented bushfires crisis, scarcely a week out of winter. Close to 150 fires were blazing as 98 per cent of NSW and 65 per cent of Queensland baked through one of the most punishing droughts in Australian history.

For me, the worst were the fires in the World Heritage rainforests of Lamington National Park in the Gold Coast Hinterland. This region is part of the Gondwana Rainforests of Australia, containing the world's largest remaining stands of subtropical rainforest and the most significant areas of warm temperate rainforest in the country. These usually moss-drenched forests are packed with the oldest elements of the world's ferns and primitive plant families dating back to the Jurassic era. Although they've clung on since the age of the dinosaurs, searing heat and bone-dry conditions saw these usually lush areas turn into fuel under catastrophic bushfires conditions.

These areas are close to my heart. The rainforests of northern NSW are where my husband spent much of his time growing up. Since we met over twenty years ago, he's taken me to explore the patches of these primordial forests where he played as a boy. Whenever we get the chance, we head for these relic forests, a reminder of a time when the Earth was still young. The forest blockades to protect the Terania Creek basin from logging in 1979 were the first of their kind in the Western world, and went on to inspire the better-known protests that saved the Franklin River in Tasmania during the early 1980s. These extraordinary rainforests were the birthplace of Australia's modern environmental movement.

They're where I go when I am burnt out and heartsick. They help me remember that the Earth is still alive, that there are areas worth saving. Perhaps more importantly, they remind me that these places still exist because humans cared enough to protect them. They reconnect me with what feels like the very best of humanity, something deeply profound, intergenerational.

When the Black Summer of 2019–20 finally came to its terrible end, fire had torn through Terania Creek, along with 53 per cent of the last of these ancient Gondwana Rainforests. When that news came through, I sat at my desk at work sobbing, knowing that these areas are likely to be lost forever.

Something inside me broke.

That horrendous summer saw over three billion animals incinerated or displaced by an arc of unimaginable destruction from the subtropical rainforests of Queensland through the temperate forests of southern NSW and eastern Victoria to the coastal bushland of South Australia and beyond to Western Australia. More than 20 per cent of Australia's forests burnt in a single bushfire season. The koala, our most iconic species, lost so much of its habitat during the fires that it now faces extinction in NSW as early as 2050.

That level of loss is too much to bear.

More alarming is what that Black Summer says about things yet to come. As scientists analysed the conditions observed during those months, they concluded that 'under a scenario where emissions continue to grow, such a year would be average by 2040 and exceptionally cool by 2060'. That is, a statistical outlier considered extreme in today's climate will become average in the future. Soon, searing temperatures over 50 degrees will become a regular feature of Australian summers.

The latest generation of climate models show that if we continue along our current path, Australia could warm by up to 7 degrees above pre-industrial levels by the end of the century. Under business as usual, Australia's average temperature could warm by 4.5 degrees, with a range of 2.7–6.2 degrees, by 2100. This level of heat will render large parts of our country uninhabitable. It will profoundly alter not only Australia, but all life on Earth.

Our Black Summer was a disturbing prelude to an apocalyptic future that now feels impossibly close. We've now experienced – firsthand – how unprecedented extremes play out abruptly and ferociously. For me, as an IPCC author, that horror summer is the clearest signal yet that our planet's climate is rapidly destabilising.

AS SOMEONE ON the frontline of the climate crisis, I try to help people make sense of the latest results coming out of the scientific community. But when the new climate projections were first published for Australia, I found it impossible to focus on my work.

So, I wrote my way through it and 'Witnessing the unthinkable', my response to this terrifying revision of Australia's future climate, was published in *The Monthly* in July 2020. I'd been afraid to publish such a personal piece, fearing my colleagues would think less of me for sharing my emotional response to our work. But I had recently come across an incredibly helpful quote by Rachel Carson, the American ecologist and author of the seminal book *Silent Spring*: 'It is not half so important to know as to feel.' Her words struck me to the core.

As scientists, we are often quick to reach for more facts rather than grapple with the complexity of our emotions. But over the past few years, I've come to realise that no amount of extra information is going to help people actually *feel* the grief of what we are facing. Although it's not really the done thing in our field, I had to share the immense loss I felt in the aftermath of our terrible summer somehow. Not just as a scientist, but as a human being. Perhaps if I'm honest about my emotional response to our work, it might help others feel something too. In the words of American civil rights activist Rosa Parks: 'Knowing what must be done does away with fear.'

When my article was published, I received an email from an IPCC colleague in a far-flung corner of the world. It was a climate scientist's #MeToo moment:

I've been deeply depressed since the meeting in Singapore… I almost lost my position here at the university because I could not care less about work knowing that we seem to be doomed. I just wanted to sleep and do nothing… I then realized I was depressed and…on a kind of autopilot, just doing the mere essential (of course that also included fulfilling the IPCC deadline in January) but everything looks black and void…and then I read your article, and I realize that I am not the only one in despair given how little time we have to make radical changes, and realizing that people are not keen at all to do so. I still worry, it's still on my mind most of the time, but I can function somewhat normally now. I wonder how many of us feel like that, and are able to actually say it?

It's a long-held myth that a credible scientist should be completely devoid of human emotion, presenting work rationally, without commentary. Given that humanity is facing an existential threat of planetary proportions, shouldn't that logically include acknowledging our sense of despair, anger, grief and frustration? If medical doctors aren't criticised for caring about their patients, why is a climate scientist dismissed as 'alarmist' if they express deep concern for the state of the world? Would anyone belittle an ER doctor for feeling despair if someone in their care had just died on their watch? Is it possible to witness the death of the Great Barrier Reef – the largest living organism on the planet – and not feel wild with desperation at the thought of it all?

MY INVOLVEMENT IN the IPCC process has been a life-changing experience. It's been overwhelming to get a complete sense of how the planet's climate is changing – on all levels, at all timescales, all over the world. Part of me wonders whether we have already set in motion changes that will be irreversible on human timescales. The problem is, we might only know we've crossed those planetary thresholds in hindsight. The warning signs include the rapid melting of polar regions, fires in the Amazon, the freshening of the North Atlantic Ocean and the intensification of El Niño – all known tipping points. You only need to read the news to realise that we are experiencing many of these things right now.

The geologic record suggests that 1.5–2 degrees of warming is enough to seriously reconfigure our climate. In the past, such changes triggered substantial long-term melting in Greenland and Antarctica, unleashing 6–13 metres of global sea-level rise that lasted for thousands of years. With the 1.1 degrees of warming we've experienced so far, an alarming proportion of the world's coral reefs have already experienced large-scale die-off. Between 2016 and 2017, the Great Barrier Reef lost approximately 50 per cent of its shallow-water corals following unprecedented back-to-back mass bleaching events. It is still too soon to know exactly how much more died during the third mass bleaching that struck the reef again in March 2020, the most widespread bleaching event recorded.

If we could achieve that most ambitious goal of limiting warming to 1.5 degrees, we would still see the destruction of 70–90 per cent of reef-building corals compared with today. With 2 degrees of warming, an astounding 99 per cent of tropical coral reefs disappear. At such high levels of warming, an entire component of the Earth's biosphere – our planetary life-support system – will be destroyed. The domino effect on the quarter of all marine life that depends on these areas will be immeasurable.

Right now, current global emission-reduction policies are estimated to result in a 3.4–3.9 degree increase in the Earth's average temperature by 2100. This represents a catastrophic overshooting of the Paris Agreement targets that were specifically developed to avoid 'dangerous anthropogenic interference with the climate system'. The world needs to *triple* current emission-reductions pledges to restrict warming to 2 degrees above pre-industrial levels. Global pledges would need to increase *fivefold* to restrict global warming to 1.5 degrees.

We have a hell of a job ahead of us.

SOMETIMES I'M UNSURE of how to best live my life in the face of the catastrophe that is currently unfolding. I've worked at three of Australia's leading universities over the past twenty-three years, but teaching in the aftermath of the Black Summer was particularly confronting. In light of all that happened, the current generation of students seem indifferent to their own education. I'm lucky if half of my 120 climatology students turn up to class. Sometimes the number is as low as twenty. Are we placing our hope in a demoralised, disengaged generation with a dangerously fractured attention span?

While they are undoubtedly the most information-rich generation that has ever lived, they are disturbingly very wisdom-poor. These digital natives have lost touch with the collective wisdom that comes about from being part of a physical human tribe. What I've learned from working with some of the most respected elders in the climate science community is that it is impossible to Google the wisdom they carry. There is no substitute for the face-to-face transfer of knowledge from one generation to the next. By disconnecting from society's elders, the next generation is losing touch with something profoundly human – and that diminishes us all.

As for me, between IPCC, teaching, research and grieving for my country, there's nothing more I can offer them. I have nothing more to give.

In the winter of 2020, as coronavirus lockdowns lift and national parks reopen, the first thing we do is pack the car and head for the rainforest. Driving up the windy access road of the Border Ranges National Park feels like going to check in with family after a disaster – we're afraid of what we might find. As we stand at our favourite lookout, I find it hard to see through tears. My husband pulls me in close and whispers, 'It's still here. It's still here.' This immense valley drenched in brilliant green; the rainforest we love so much.

These magnificent forests have survived for millions of years. My hope is that they can hang on, that the cavalry is on its way.

As a climate scientist, I am doing everything I possibly can – in every waking moment – to respond to the distress signals from our natural world. If I live to look back at this troubled time, I want to say that I did all that I could, that I was on the right side of history.

This work originally appeared in 2021 as part of an online-exclusive series, *The Elemental Summer* (published with support from McLean Foundation). It is reproduced on the Climate Justice Observatory with permission of the author and thanks to Griffith Review.

Joëlle Gergis is an award-winning climate scientist and writer at the Australian National University. Her first book –*Sunburnt Country: The History and Future of Climate Change in Australia* – was published in 2018 (MUP); her latest is *Humanity's Moment: A Climate Scientist's Case for Hope*, published in 2022 (Black Inc.).

climate justice observatory

GRIFFITH UNIVERSITY