RESEARCH ARTICLE

Repairing the Broken Earth: N.K. Jemisin on race and environment in transitions

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Sustainability transitions tend to be seen as technical, not social, affairs. Mainstream scholars and practitioners do not very often acknowledge environmental and social justice in their transitions work. They seldom recognize rights for racially marginalized people, or the possible existence of rights of Earth. Nor do they query whether they are exaggerating the reach of scientific and technological solutions. By contrast, some recent ecological science fiction writing has begun to place these issues at the center of transitions. In the Broken Earth series, N.K. Jemisin explores Earth through the lens of racial and ecological injustice. She interrogates four themes relevant to transitions. How should we live in a climate-changed world? What role does racial and social subordination play in destroying the environment? What are the dangers of hubris in seeking out a fundamental change through science and technology that cannot be readily controlled after all? How should we think about Earth itself? I conclude with some thoughts on how Earth could be made ‘unbroken’ again through integrating recognition, humility, renewal, and redistribution into transitions.

Keywords: Sustainability transitions; Science fiction; Ecological justice; Race; Climate change; Technology

1. Introduction

Sustainability transitions tend to be seen as technical, not social, affairs. To feed the world’s rapidly burgeoning population, technical experts tell us, we must intensify agricultural production to provide 50 to 70 percent more food by 2050 (Royal Society, 2009; Godfray, 2010). To power the world without violently warming its atmosphere, we need to design workable carbon capture and storage technologies, and to manufacture solar panels and wind turbines more cheaply (Gibbons and Chalmers, 2008; Ellabban et al., 2014). Such transitions to sustainability are frequently analyzed in terms of processes of technological change, such as advancing from innovative ‘niches’ to ‘landscapes’ (Geels, 2002). Academic research, business strategies, and government policy can accelerate this movement. Yet mainstream researchers and practitioners do not very often acknowledge the importance of environmental and social justice in their transitions work. They seldom recognize rights for racially marginalized people, or the possible existence of rights of Earth. Nor do they query whether they are exaggerating the reach of their favored scientific and technological solutions.

By contrast, some ecological science fiction writing has placed these issues at the center of sustainability transitions, especially recently. Social and biophysical scientists, along with government policy-makers and community movements, can greatly expand their cognitive horizons by looking at ecological science fiction as a source of ideas, examples, and ‘modeling’ of situations. They can explore alternative pathways to understand more fully the diverse peoples and environments they are engaging with, and avoid assuming that a particular technological and economic direction is the only possible way ahead.

In the Broken Earth series (The Fifth Season, 2015; The Obelisk Gate, 2016; and The Stone Sky, 2017), N.K. Jemisin has written a profoundly original trilogy that explores Earth through the lens of racial and ecological injustice. The trilogy plunges readers into a society whose survival depends on exploiting a subordinate group with unique powers, and whose world is the legacy of technological and racial hubris. As an author who is African-American and who seeks to diversify writing perspectives, Jemisin represents a new frontier of ‘critical’ science fiction that refuses to follow the traditional conventions of technology-centered, “White” writing in this genre. According to her interviews, the books are situated on a parallel Earth some 40,000 years into the future. This Earth resembles our planet, and the societies, ecosystems, and landscapes are within our experience. Nonetheless, this world has been massively devastated by a sort of human-induced climate change, to the extent that humans have only a fairly tenuous hold on civilization. Earthquakes, famines, and atmospheric disasters recur continuously. Moreover, the surviving society has a subset of people who are genetically endowed with the neurological capability of “sessing”
(or feeling/acting upon) a wide variety of geological processes such as earthquakes and landslides. These people can divert quakes around a town and protect it—but are reviled for their difference.

The societal treatment of humans who can sense and act upon Earth and its rock allows N.K. Jemisin to interrogate four themes relevant to transitions. How should we live in a climate-changed world? What role does racial and social subordination play in destroying the environment? What are the dangers of hubris in seeking out a fundamental change through science and technology that cannot be readily controlled after all? How should we think about Earth itself? These themes are especially separated in scholarly analysis and public discourse but they are, in fact, closely intertwined because they pivot on how humans relate to non-human nature. In this article, I begin with a short overview of what we can learn from ecological science fiction and analyze several key dissonances in sustainability transitions thinking. I then work through each theme while simultaneously immersing readers in the world that Jemisin creates. I conclude with some thoughts on how Earth could be made ‘unbroken’ again through integrating recognition, humility, renewal, and redistribution into transitions.

2. Problematizing sustainability transitions through science fiction

Much scholarship on sustainability transitions focuses on the mechanics of bringing about system-wide change in situations where dominant technological and social forms are ‘locked in’. This work tends to assume (1) sustainable ought to be a desirable, shared goal/process for everyone to work toward; (2) ‘sustaining’ requires technological and societal progress while still maintaining or even improving material well-being; and (3) sustainability centers on human societies and their prudent use of natural resources (e.g. Rip and Kemp, 1998; Kemp and Rotsman, 2004; Geels, 2010; van der Bergh et al., 2011; Olson et al., 2014). A subset of researchers (e.g., Princen, 2014; Delina, 2016) add that urgent transitions are needed, as warnings environmental damage overtake sluggish societal decision-making capabilities. Dramatic, fast change is therefore justified, and politicians can interpret this to mean hasty, large-scale trials of untried technologies.

Yet, who has the power to envisage sustainability is seldom taken into account in mainstream transitions work (Shove and Walker, 2007). Much of the time, transitions are defined and analyzed by researchers and government policy-makers of privileged European backgrounds, education, and gender (including myself). We all have particular stances and histories that aren’t acknowledged, in portraying transition as a ‘science’ of change. The ways in which peoples have become racially, culturally, or economically subordinated to other peoples tend to be kept out of how socio-technological systems have historically been built, and how these currently operate (Lawhon and Murphy, 2012; Miller et al., 2013). Human (and ecological) suffering is sidelined, as is any idea of making reparations for injustice.

Transition thinkers often don’t ask what sort of world they are hoping to make, beyond feeding large, growing populations, or providing abundant energy without depleting resources and polluting ecosystems. The ecological modernization movement exemplifies this kind of thinking. In 2015, a group of scientists, business leaders, and environmentalists at the Oakland-based Breakthrough Institute released what they called the Eco-Modernist Manifesto. They declared, “Intensifying many human activities – particularly farming, energy extraction, forestry, and settlement – so that they use less land and interfere less with the natural world is the key to decoupling human development from environmental impacts” (Breakthrough Institute, 2015, p. 7). The authors added, “A good Anthropocene demands that humans use their growing social, economic, and technological powers to make life better for people, stabilize the climate, and protect the natural world” (p. 5). Like many other transition researchers, they assume sustainability is something that markets, technologies, and policies can deliver, instead of asking what/whose agency will help make it (e.g. Loorbach, 2007; Voss et al., 2009). Transitions are not about remaking power structures or finding ways to recognize difference. As a result, the stakes of sustainability may be depoliticized.

Over the past 15 years, social movements and some scholars have argued that sustainability and social justice cannot be separated (e.g., Dobson, 2003; Agyeman, 2008). Agyeman, Bullard, and Evans (2002, 78) write, “A truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity are integrally related to environmental limits imposed by supporting ecosystems.” Accordingly, they call for ‘just sustainability’ as a desirable endpoint. Nonetheless, this notion remains difficult to connect to the everyday experiences of humans.

Moreover, attaining sustainability implies control over nature, and expanding technological power. Human societies can be sustained without curtailing our standards of life, because we can always find means to achieve ‘eco-efficiency,’ ‘eco-modernism,’ and ‘sustainable intensification’ (DeSimone and Popoff, 2000; Baulcombe et al., 2009; Asafu-Adjaye et al., 2015). We can always conserve finite natural resources more deftly, or preferentially using renewable matter and energy. But these schemes pre-suppose that environmental conditions will actually permit such changes. In other words, transitions theorists often take it for granted that technology and science can provide potent, effective, precise solutions; the world is stable and known enough to permit controlled change; and humans will adapt to anything. Eco-modern suppositions, especially, are still based on a relationship of abusive extraction: a colonial relationship exists between humans and the biosphere, in which human wants prevail over ecological needs (Crist, 2016; Mathews, 2016). Since at least the Enlightenment, Western science has not only sought to prioritize reason; it has sought to achieve “dominion over nature” (Merchant, 1980). Much sustainability science maintains this orthodoxy; it is not about learning to relinquish human authority over nature. It certainly is not about recognizing Earth – as many indigenous traditions do – as having its own agency. Yet, this mindset blinds us to our own anthropocentric analysis.
2.1. Expanding the imaginations of sustainability science

In *The Great Derangement* (2018), novelist Amitav Ghosh laments that science fiction is one of the few literary genres that has considered climate change; serious literature has heavily neglected this topic. Yet he claims, “The Anthropocene resists science fiction: it is precisely not an imagined ‘other’ world apart from ours; it is not located in another ‘time’ or another ‘dimension’” (p. 72–73). Climate change (and other looming environmental catastrophes) must be written about in terms of realities on the planet on which we live – not through speculative, future-oriented writing. Such a position fundamentally misunderstands the character of ecological science fiction, which does tackle those realities in many ways.

Broadly, ecological science fiction (including the fast-growing climate fiction genre) explores the manifold ways in which environmental and resource issues can configure human societies. Through making narratives about the future, this fiction can open new cognitive territory for readers. Scholars and practitioners can project how the world might change during sustainability transitions, and what it might look like afterwards. As Miller and Bennett (2008) and Nikoleris et al. (2017) point out, such fiction allows readers to experiment with different scenarios of change (e.g., urgent, top-down interventions compared to decentralized grassroots action) and thereby appreciate better how world-making may happen. This can happen through imagining a parallel Earth that is uncannily similar yet different to our Earth, as in Jemisin’s novels. Readers can also be introduced to unfamiliar social and technical innovations, such as the ‘still-suits’ in Frank Herbert’s *Dune* and the ecological economy in Kim Stanley Robinson’s *Mars Trilogy*. Because fiction is written from a narrator’s perspective, the story is gradually unfolding, partially seen, and often ambiguous as to what is happening. In this way, readers can ‘personalize’ complex phenomena like climate change transitions by seeing the everyday perplexity and trepidation of people who are living through times of widespread, perhaps chaotic change.

![Figure 1: The Vancouver Archipelago.](https://doi.org/10.1525/elementa.364.f1)
O'Neill (2018) adds that narratives of dystopic futures and catastrophic events can reveal the perils of not intervening to transform our societies into more sustainable forms. We can vicariously experience the likely consequences of contemporary trends in environmental degradation. By contrast, Milkeireit (2017, 2) contends that the lack of global progress in reducing carbon emissions reflects “difficulties in creating compelling, shared visions of alternative futures that can trigger social transformations.” For instance, the mass consumption of ecological science fiction might help build a collective desire for a solarized planet instead of a fossil fueled world. Discussing this fiction in many social forums – mass media, community salons, Twitter – can bridge from otherwise individual reading experiences to shared understandings, in ways that scientific models and technical scenarios are unable to. Historical examples of books (fiction and popular non-fiction) catalyzing new popular knowledge and subsequently leading to changes in communal perceptions and political institutions include Harriet Beecher Stowe's *Uncle Tom's Cabin*, Upton Sinclair's *The Jungle*, and Rachel Carson's *Silent Spring*. While no single ecological science fiction book can yet lay claim to this transformative influence, many millions of people read and watch science fiction worldwide (Miller and Bennett 2008).

Critically, ecological science fiction can also enable readers to begin questioning key assumptions, values, and choices inherent in the organization of a society, whether existing or imaginary (Otto, 2012; Pak, 2018; Streeby 2018). This genre can expose choices buried in the theory of sustainability transitions, by creating vantage points outside its elite and technocratic world-making. These viewpoints can be those of subaltern peoples, or even of the planet itself. Indeed, Whyte (2018) points out that Native American peoples take the perspective that climate change isn’t something dystopian that is coming; they have already lived through a dystopian transition/reality – that of settler colonialism and the US government devastating their customary ways of life, shepherding them into reservations, and weakening their relations with ecosystems, plants, and animals. Native American science fiction authors often begin with this premise. Those writers don’t necessarily adopt a linear sense of time – they may favor a “spiraling time” in which conversations span the centuries between contemporary tribe communities and their ancestors.

3. Living in a climate-changed world
Why would societies want to undertake a transition? If we embark on a transition, we may sacrifice many amenities that we have grown accustomed to over the past 60 years of easy consumption (Maniates and Meyer, 2010). We might endure periods of significant disruption to the economy, with job losses and factory closures. It’s not self-evident that transitions are necessary or beneficial, as they can have a “spiraling time” in which conversations span the centuries between contemporary tribe communities and their ancestors.

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myths exist about the past and what is known is the product of selective recollection—the filtered interpretations of survivors tasked with carrying on memories of lineages not their own. This stilted body of popular wisdom is transmitted between generations in writings and teachings. Known as ‘stonelore’, it provides not only a history of the Still but principles for surviving fifth seasons.

The fifth seasons potently evoke what climate change could bring to our lives. Over the past 30 years, climate scientists have made increasingly detailed, yet still imprecise, projections of climate change effects. The International Panel on Climate Change has long modelled effects—from scorching heatwaves to spreading dengue-bearing mosquitoes to declining agricultural crop yields (e.g. Stocker et al., 2013). Yet it remains taxing for most people to imagine what a climate-changed planet would be like (Moser and Dilling, 2011). Few want to talk about a ‘4DW’—a world that has experienced warming by 4°C, an outcome which seems more probable with each decade. In this scenario, the Middle East, the US southwest, and many equatorial zones may become uninhabitable during summers (Wynn, 2014; Christoff, 2013). Despite warnings from the IPCC and myriad climate justice movements, elites cling to a nativist faith in the capabilities of science and technology to rescue humanity. Capitalizing on the cognitive challenges of imagining incremental, disembodied crisis (Moser, 2010), political and business leaders assure us that technology will temper the worst through climate adaptations. Our scientists can genetically engineer crops with CRISPR-Cas9 technology to survive harsh conditions.
drought conditions and to provide better nourishment (Kole et al., 2015). Renewable energy technologies will cascade everywhere, mitigating greenhouse gases (Obama, 2017). The tundras will clean up the remaining gases with fast-growing lichens. Cities will be made habitable with giant tents, hermetically sealed skyscrapers, and underground tunnels. Preparations can, and will, be made.

By contrast to these prophecies, many ecological science fiction writers are coming closer to reality (Streeby 2018). They are poking a hole in the fantasy of technological utopianism and encourage us to imagine the actual experiences of climate change in the near term (i.e., within the next 50 to 150 years). Much of this work emphasizes dystopic impacts such as widespread flooding of low-lying lands, declining agricultural productivity, long-lasting droughts, and relentless hurricane bombardments. Much work also underlines the ability of humans to adjust and survive, despite these adverse circumstances. Paulo Bacigalupi has written about the ‘drowned cities’ of the Texan and Maryland coasts, in which the surviving population leads impoverished, violent, anarchic lives (Bacigalupi, 2011, 2013, 2017). Other cities further north, removed from both sea and heat, are thriving and still retain their modern technology, albeit adapted to a low-carbon society. Kim Stanley Robinson (2015)’s technologically sanguine Green Earth series follows the National Science Foundation’s attempts to coordinate GHG mitigation and adaptation efforts, as Washington DC is inundated by a storm surge. In his novel 2140, Robinson (2017) envisages a flooded lower Manhattan where residents cross between buildings on aerial walkways or ride boats along the new canals, just as Venetians have done for centuries. The idea is that civilization has now become so entrenched it will endure somewhere, somehow.

But what if climate change and biodiversity loss (coupled with all the other global environmental changes underway now) is more than what these necrofuturist (Canavan 2014) or dystopic-optimistic books reveal? The Broken Earth series adds to, and exceeds, this literature by picturing what it would be like to live in a world where cataclysm, unpredictability, and periodical die-backs define everyday reality for humans for many thousands of years. In this world, no planetary-scale, let alone national-scale, infrastructure can be built. No centralized authority can exert control over the Stillness; instead, numerous small towns and a few cities rule themselves. In Jemisin’s words, this is “a society that was shaped by its environment and that was shaped by the disasters that had preceded it” (Carroll, 2015). In an interview, Jemisin says, “I think the distinction that matters is that the Stillness is not post-apocalyptic. This isn’t what happens after normal goes away; the Seasons are their normal. So basically it’s a society of preppers whose paranoia and obsessiveness is actually justified” (Cunningham, 2017). The Broken Earth series demonstrates why we should desperately want to avoid transgressing the threshold at which vicious climate synergies begin.

Jemisin says she purposefully set out to destabilize the assumption of contemporary civilization that prediction

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**Figure 3: The Fukushima tsunami.** A tsunami reaches Miyako City, overtopping seawalls and flooding streets in Iwate Prefecture, Japan, after the magnitude 9.0 earthquake struck the area on March 11, 2011. The tsunami disaster overwhelmed the survival capabilities of cities and towns along this coastline – but a warning already existed in the form of tens of memorial stones from the 16th and 17th centuries recalling past tsunami influxes. These stones suggested the likely level of inundation and hence the ‘safe’ threshold at which villagers could build or gather. Credit: Mainichi Shimbun, Reuters. DOI: https://doi.org/10.1525/elementa.364.f3
and preparation will assure human survival (cf. Merchant, 2015). In her telling, no amount of hoarding food and water stocks, building defensive city walls, or maintaining stonelore will reliably safeguard comms. The chaotic fifth seasons occur despite efforts to foresee them. They are different each time, and they happen frequently. In other words, environmental change can be so messy that little can be done to fully prepare in advance. Many comms do disintegrate during a fifth season despite their assiduous preparations and prior strength.2 There is no way to guarantee a particular comm will last. Instead, humans can only strive to survive fifth seasons through comm-building, rather than by competition and exploitation. Most of the people who live are the ones who can adapt the most flexibly and who cooperate with each other. They do not erect strong walls against each other, as the stonelore erroneously recommends. Rather, new comms can emerge during fifth seasons as the remnants of existing ones join forces. People who behave like commoners endure.

Jemisin doesn’t imply that preparation is entirely useless. Comms do have vastly improved chances to survive if they not only cooperate but heed the warnings of the past. Much of the knowledge we need to survive catastrophes—both creeping and acute—is embedded into our histories and can be seen in the signs and oral lore that previous societies have left behind. For example, following the Fukushima disaster in 2011, many Japanese villages on the coast belatedly realized they already had memorial stones from earlier tsunamis that marked the high point of sea-flooding (Fackler, 2011). They were meant to respect these stones and build above the line. Yet the villagers had disregarded the stones, and were subsequently obliterated. Some Australian Aboriginals communities remember rising sea levels inundating their coastal lands up to 9 to 11,000 years ago (Nunn and Reid, 2016). Similarly, the Still is populated with landmarks that hold meaning for those who are willing to perceive and learn from them.

Happily, Jemisin’s humans are still around even after such long-lasting turmoil: they don’t go extinct. Yet this persistence raises questions about what ‘sustaining’ may mean. If we think about sustainability as continuous technological progression, then the world we see in these books is regressive. The life the people of the Still lead is not high-consuming; it appears greatly impoverished as compared to the comfortable culture to which many real-Earth denizens currently aspire. On the other hand, 40,000 years is testament to a certain durability, even sustainability. Through limited impact, low resource-using economies, Jemisin’s populations have survived more than three times longer than our history of agriculture. Authors like Monbiot (2016) and Patel and Moore (2017), and steady state/degrowth scholars such as Daly (1991), Martínez-Alier et al. (2010), and D’Alisa, Emaria, and Kallis (2014) suggest that ceaseless economic growth is intrinsically unsustainable. Civilizational collapse, they argue, results from voracious, unrestrained expansion. Diverting more and more energy from basic ecological functions to human needs will lead to a fragile planet. Instead, those scholars suggest, ‘sustaining’ ought to be the ability to meet basic human needs and to live in an ecologically and physiologically healthy way (cf. Princen 2005).

Beyond a certain point, the Earth and human societies may shatter so much that little resilience is feasible (if measured by the ability to maintain our current technologies and social organizations). Given all the planetary boundaries that are being violated now (Rockstrom et al., 2009), it seems imperative to begin making transitions now, so as not to fall into the trap of technological hubris motivated by feelings of extreme urgency (see below). It also appears important to think about the quality of the communities that can help humans survive into the longer term.

4. Entwining racial justice with environmental sustainability

Is it politically possible—and ethically appropriate—to undertake a transition without including racial and social justice at its core? Who are the participants in making a transition, and in defining what sustainability means? Many analysts now agree with the need to be more inclusive of diverse social and economic groups—yet their assent may be only superficial. This is seen in the behavior of elite scientists and engineers (e.g. Silicon Valley technologists) who are creating a shiny future of artificial intelligence, electric cars, and synthetic meats. Distant from lived experiences of oppression, they don’t comprehend how minority groups and women can be excluded through their pursuit of technological progress. Indeed, they may be actually hostile to doing anything to remedy racial and gender inequality. The elite workforces of the high-technology industries are notoriously white and masculine in their composition, even as they rely on low-income workers of color for office cleaning and fabricating semi-conductor chips (Pellow, 2002; Mundy, 2017; Williams, 2018). In this section, I discuss how the Broken Earth books are a singular call for racial and social justice as a way to protect both human nature and non-human nature (Castree, 2013; Patel and Moore, 2017). Unusually for science fiction (with a few exceptions like Margaret Attwood, Sheri S. Tepper, and Ursula Le Guin), the books connect environmental degradation with racial subjugation, along with the more familiar human desire to master nature.

4.1. Shattering a dominant racial order

Jemisin describes the rich variety of racial groups that comprise the peoples of the Still. Some are explosive because they originate from near the coasts. Others are a mix of brown hues that are characteristic of the Somidlats region. Those with whiter skins tend to live in the Arctic and Antarctic regions. At the equator, the Sanzed people are descended from centuries of racial mixing in their empire. Both men and women are tall, physically imposing, bronze-brown skinned, and predisposed to putting on fat as a biological adaptation to famine dangers. They also have distinctive ashblow hair that is “acid-proof, waterproof, thick enough to help retain heat over any body part it covers, and coarse enough to be used as a filtration mask” (Jemisin, 2015, “Ashblow Hair”, Glossary, Appendix 2). Everyone has physical features, to some extent, that would be reckoned...
‘Black’ in our world. Based on her interviews, Jemisin set out to underline that the environmental conditions are what make humans different from each other in the Still, just as on Earth. Jemisin wanted to subtly subvert our assumptions about what comprises a race: what seems to be a race is actually the aggregate result of many races being mixed together over time.3 Perceiving race, then, is a matter of socially categorizing people as a distinctly existing group—a process that can change over time and place. In other words, race is not just biological—it is also culture, identity, and history, with tangible consequences for those who are sorted into specific races.

In the Still, there doesn’t appear to be such a rigid hierarchy of racial difference, compared to our world. But Jemisin has created a kind of ‘race’—the orogens, whose stigmatizing characteristic is their power of orogeny.4 Jemisin defines orogeny as “the ability to manipulate thermal, kinetic, and related forms of energy to address seismic events” (Jemisin, 2015, “Orogeny”, Glossary, Appendix 2). In a chaotic world dominated by fifth seasons, those people who are ‘orogens’ have extraordinary importance. They help protect communities from destructive earthquakes and allow humans to survive on the broken earth. Yet they are also a profoundly subordinated group who directly contribute to their own repression. The broad idea of orogeny is not novel by itself. Other authors have long narrated tales about humans mentally summoning tremendous energy fields to manipulate physical matter.5 Uniquely, Jemisin grounds this energy in a geological mentality. Orogens have the ability to sense—and act upon—rocky matter events such as tectonic shifts and tsunami-generating seabed collapses; they can feel the formation of fault lines and magma chambers; they know the contours of each creek, stream, and river. Jemisin meticulously constructs a whole culture around these sensory experiences of working with Earth and knowing its features.

Orogeny is not merely mystical. Jamison couches it in science—as something both genetically inherited and as a skill that must be refined through many years of practice. The power also has a physiological basis: the sessapinae tissue located around the brain stem, which allows orogens to ‘sess’ patterns deep in rock (a feeling called the sesuna). Depending on their ability, orogens can adjust friction inside fault lines to prevent earthquakes, tamp down volcanoes, raise coral beds, redirect watercourses, build dams, and construct buildings from stone. Throughout the series, Jemisin provides many glimpses into the experiences of using orogeny within the planetary matrix. For example, in Book 2, Nassun, a 12-year old girl, puts her consciousness into the earth: “At first there is only the usual impingement upon the ambient sesuna: the minute flex-and-contract of strata, the relatively placid churn of the old volcano beneath Jekity, the slow unending grind of columnar basalt rising and cooling into patterns” (p. 179).

Orogens are subject to discrimination that echoes the racial oppression historically found in the US, Australia, South Africa, and many other places. Inspired in particular by African-American experience, orogens could be any of numerous racial and ethnic groups that have been enslaved across human history. Fulcrum orogens occupy a position of great societal power in being entrusted with the defense of imperial territory from dangers like earthquakes, as well as with civil engineering tasks such as clearing blocked harbors. Yet they are also ostracized and feared because they are ‘different’ and they always pose a threat to non-orogens through their potential to attack without warning. Children can harm, even kill, other people or animals through becoming angry or apprehensive—and instinctively drawing energy from the ground to lash out. As a result, they can reveal themselves without comprehending their peril. A long history of narratives exists about rebellious orogens who have deceitfully destroyed communities, or who have caused ruinous quakes through their lack of training and self-regulation.

This stigmatization and segregation is accepted as ‘normal’ by most of the Fulcrum orogens and almost all of the Still peoples, helping maintain the dominant socio-political order. The Fulcrum is where orogens are taught to internalize their oppression, watched for any rebelliousness, and turned into a docile, reliable labor force that underwrites an entire political economy. Some orogens are essentially bred at a facility based, in part, on the 20th century's processes of racial classification.

Many artists who are fans of the books have imagined what leading characters may look like through their drawings, paintings, and sculptures. Syenite is depicted in the middle. Credit: spaceteatime. DOI: https://doi.org/10.1525/elementa.364.f4
century history of Australian Aboriginal peoples having their children stolen by paternalistic governments, and placed into orphanage schools to be taught white customs and language (Hanifin, 2015; see also, Moses, 2004). The most senior orogens are implicated in their race’s subordination, since they enforce the social norms that lock orogens into their peripheral place.

Jemisin brilliantly writes the series as a detective tale of gradual discovery, abrupt revelation, and multiple perspectives into this socio-political order. She does so by following the journey of a young orogene, Syenite, from her birthplace in the Somidialts to the Fulcrum, and through her discoveries as she carries out her work. Like her peers, she believes that orogens must stay ‘respectable’ and subservient to the Fulcrum and the ruling Sanzed Empire if they are to be safe from their own power. The turning point comes when the bureaucracy orders Syenite to accompany the most powerful Fulcrum practitioner, Alabaster. Only through her mission with Alabaster, does Syenite begin to comprehend the ways in which orogens are kept powerless. Late one night along the road, Alabaster panics and yokes Syenite’s orogenic power to his own to suppress a vast incipient earthquake about 200 miles away. At first dawn, Alabaster impatiently cajoles their horses to canter for two days to the next fort to ascertain what has happened there. Syenite discovers a half-grown, sedated, deformed orogen youth strapped into a wire chair that sustains him with tubes of liquid food, water, and antibiotics. He has had part of his brain destroyed to remove his volition, while still allowing involuntary reactions to geological events. Alabaster contemptuously explains to Syenite that she’s clueless about how things really do work in the Sanzed Empire. Hundreds of enslaved orogens are located all over the Stillness to regulate geological disasters, by diffusing small quakes and watching for large ones. Alabaster says the trigger for the earthquake was the boy, unconsciously rebelling against his violation.

Through her interviews, N.K. Jemisin has said that she opposes the racially discriminatory world in which we live. She is upset by the ongoing killings of African-Americans by police. Indeed, much of the series was written during the growth of the Black Lives Matter movement in the US, born in 2013 as a reaction to the acquittal of George Zimmerman for Trayvon Martin’s murder in Florida (e.g. Hanifin, 2015). The series was inspired by a dream of a mountain following behind a furious woman; and that dream came from Jemisin’s feeling of wanting to throw a mountain herself. Historically, the genres of science fiction and fantasy have been fairly narrow in their scope. Jemisin complains much fantasy is populated with white characters wielding swords in a European mediaeval-like setting, while science fiction emphasizes technology and adventures in space. But as Jemisin notes, the reluctance of writers to “explore the people as well as the gadgets and the science never made sense to me. And that aversion is why it isn’t common to see these kinds of explorations of what people are really like and how people really dominate each other, and how power works” (Newkirk, 2016).

4.2. Connecting race to environment

Ample historical and contemporary evidence shows that social oppression is closely entwined with the making of ecological problems. Their precise relationships are not always clear-cut or one-directional: racism may not directly cause exposure to toxic pesticides, while living in a working-class community may not lead to the dumping of hazardous waste. Nonetheless, the same political, institutional, and economic conditions that beget social subjugation can also create or worsen ecological harm. Similarly, environmental degradation can spark or deepen class and ethnic conflict. Without undoing and repairing these structural conditions, it will be much harder to make a successful transition.

Our global industrial civilization is founded on racial and class injustice making it possible to degrade the environment. Historically, industrialization depended on exploiting impoverished and/or racially subordinated peoples as pools of cheap work (Patel and Moore, 2017). The progress of mass production in Britain from the 1820s onwards was enabled, in part, by wealthy landowners forcing peasants off their farmlands. “Freed” to sell nothing but their own skins, these low-cost workers were in turn sustained by the cheapening of agriculture, or low-cost bread (Patel and Moore, 2017). During this time, some European countries also labored to extract minerals, rubber, wood, cotton, tea, and other resources from their colonies across Africa and Asia. This pattern has been repeated numerous times over the past 150 years as countries have industrialized, reopening old and creating new frontiers of accumulation. Just in the last 30 years, millions of Chinese peasants have flooded into the factories around Shenzhen and Guangzhou, facing long hours and meager pay because of their vulnerable status as ‘illegal’ migrants without residence permits (Schoolman and Ma, 2012; Chen et al., 2013). This influx is associated with the rise of consumption societies, in which fast food, fashionable clothes, and electronics have come to signify membership of a global affluent class. The beneficiaries of this labor exploitation tend to be elite political and socio-economic groups: corporate executives, hedge fund managers, large landowners, politicians. In China and beyond, accelerating exploitation of workers in industry has contributed to mass deforestation, air pollution, hazardous waste dumping, and many other ecological traumas that cumulatively diminish the planet’s well-being (Bellamy Foster et al., 2011).

Industrialization also relies on externalizing environmental harm to certain communities, populations, and geographical regions societally regarded as ‘sacrifice zones’ (Kuletz, 1998; Hedges and Sacco, 2012; Edelman, 2018). Because of certain communities’ lack of political visibility, resources, and mobilization, they may be less able than their wealthier, better connected neighbors to withstand such abuses. To be sure, resistance movements have arisen to reclaim these sacrifice zones. In the 1980s, the US environmental justice movement emerged as a protest against the location of hazardous waste dumps in poorer, predominantly African-American and Latino neighborhoods (Bullard, 1993). More recently, the Silicon Valley Toxics Coalition and its transnational allies have targeted the
unfair burden imposed on villages that informally recycle electronic waste in Asian and African countries (Iles, 2004). Nonetheless, the social sinks for degradation are multiplying, due to the ability of fickle firms to readily switch their suppliers and raw material sources from place to place in contemporary supply chains that encircle the planet. These relations of subordination can be embedded into the design and work of government institutions, laws, and practices. For instance, the US and West Virginia state governments have long failed to regulate the coal mining industry stringently, leading to mountain-top removal, pervasive exposure to coal dust, and high rates of respiratory diseases (Thompson, 2017). In these many ways, social oppression contributes to creating and perpetuating environmental degradation.

Perhaps the most powerful insight in the Broken Earth series is that pervasive discrimination corrodes an entire society's character, norms, and collective cognition to the degree that exploitative and inhumane practices seem normal for everyone. Discrimination built into the structure of a society can lead to racially and socially oppressed peoples acting to strengthen their own disadvantage. Jemisin notes, “I set out to write a world in which people who are powerful, who are valuable, are channeled into systems of self-supported and externally imposed oppression” (Kehe, 2016). This sort of thinking can be found in our contemporary world in many forms. Underlying many of these forms is the internalization of neoliberal values over the past 30 years—“the first step,” DeAngelis suggests, “in attempting to define new subjects normalized to the capitalist market” (2004, 25). Such values blithely turn the environment into a commodity, climate change into a discount factor in cost-benefit analysis. Most people have come to treat Earth as something that can be mined for resources, and even hated as a cause of ‘natural’ disasters (which increasingly have an underlying human cause as well). Even most sustainability scientists and practitioners work to promote ideas like market mechanisms, ecosystem services, gene-editing, and electric cars to save the planet. They assume they are at the forefront of the sustainability movement but are still very much trapped inside a neoliberal discourse, where only certain things can be said, even imagined.

Moreover, in a world where so many people lead precarious lives, much trepidation comes from thinking ‘we’ may descend to ‘their’ ranks some day—not from worrying about everyone’s well-being. Rural farmers in India afflicted with heatwaves, African-American residents living near hazardous waste sites, and Puerto Ricans futilely struggling to revive their hurricane-devastated island—these peoples “confirm” (for those who are more socially and economically privileged) that there is a supposedly natural hierarchy of vulnerability to risks. It seems perfectly reasonable that those people are suffering while the wealthy and powerful are not, even though appalling levels of inequality driven by neoliberal policies are producing this extreme vulnerability.

Jemisin brilliantly shows why such thinking is so damaging and reductive, and why it enables the ongoing abuse of Earth. The ‘science’ of transitions currently doesn’t take account of how societies are already marked by long histories of racial-ecological exploitation. Without acknowledging and redressing the legacy of this pillage, transitions may only perpetuate dominant relations of inequality.

5. The pitfalls of technological hubris
To achieve a successful transition, must we inevitably depend on making scientific and technological advances? How should new sustainability technologies be launched
into everyday use? To what degree should their potential ecological and social consequences be evaluated when deciding on their adoption? Novel technologies, like self-driving cars and farm-sensing drones, are assumed to be so palpably advantageous that they ought to be used without any questioning. Seldom do technologists acknowledge that the values of human actors with particular racial and socio-economic backgrounds can greatly influence the trajectories of technology development. Those who create technologies frequently have a different racial/ethnic background compared to those who use it. In this section, I explore the hazards of taking a technologically optimistic view of transitions, and consider who should hold the power of deciding on planet-changing science and technology (S&T) developments.

In Book 3, Jemisin finally reveals that a high technological society, dubbed Syl Anagist, caused Earth’s catastrophe. With 250-plus ‘node’ cities around the planet, Syl Anagist was a strongly racially stratified culture built on engulfing diverse pre-existing cultures. Its scientists can put a large base on the moon, drill into Earth’s core, create new human-based life forms, and make crawling arthropod-like living vehicles. In contrast to our Earth, this planet’s infrastructure appears to be biologically founded, not metallurgically based. Syl Anagist is almost a metaphor for what 21st century industrial society could evolve into, if we pursue a bioeconomy pathway.

We learn that government, industrial, and academic elites among the Sylanagistines yearned for infinite power to fuel their energy-hungry global society. They thus initiated a vast, centuries-long endeavor to build an obelisk network, or technology to extract and store energy from Earth’s core. In doing so, the Sylanagistines committed many transgressions against their fellow humans. For example, they grew a crystalline obelisk (or quantum battery) to help power each city, with the goal of uniting them all into a network to greatly amplify their strength and thereby seize control over Earth’s own core energy. Crucially, the obelisks required orogeny to turn them on and to direct their use. Thus, Syl Anagist designed new kinds of humans with brains gene-engineered to ‘tune’ energy fields, stealing the genome of an indigenous people whom the Sylanagistines regarded as racially inferior. Those tuners worked to connect with obelisks and to coordinate these into a resonant harmony. Some weeks before the project is to come to fruition, Kelenli—an engineered early prototype—is brought in to fix the tuner team’s failure to harness the most powerful obelisks. Her hidden agenda is to teach the tuners ‘peoplehood’: that they, too, are humans. After realizing their betrayal, the enraged tuners begin querying why they should assist their oppressors. They spend days debating what to do, and decide to attack Syl Anagist when they are taken up to the moon to initiate the obelisk network. As a result, the vast energy is redirected against Syl Anagist’s cities, killing billions of humans while leaving Earth fairly intact.

The books therefore warn against recklessly embarking on large-scale technological projects with the potential for irreversibly transforming the planetary environment, or for undermining fundamental ecosystem functions. Already, a growing number of policy-makers, scientists, and fossil fuel industry actors are insisting that geoengineering is essential to safeguarding the planet’s welfare. If climate change will inevitably change our planet, then we must resort to gigantic geoengineering projects such as pouring sulfate particles into the atmosphere to reduce solar irradiation, or feeding the oceans with iron to stimulate phytoplankton take-up of carbon (Burns, 2010; MacMartin et al., 2018). This sentiment is grounded in a widespread desire not to compromise the most affluent lifestyles in human history, at least among industrial countries and elites everywhere. Those of us with oil-fueled cars, air conditioners, and inexpensive, petrochemically nourished foods don’t want to abandon these marvels. Moreover, many powerful corporations are unwilling to surrender their lucrative businesses even if those contribute directly to climate change. Nonetheless, critics of geoengineering point not just to the governance deficits (who gets to decide) but to the obscured fact that such industrialized measures generally require continuous inputs of energy, aerosols, and other resources (Burns, 2010). If by any chance geoengineering technologies should fail, global warming would rebound and accelerate, because the underlying fossil fuel economy would only have continued to grow in the meantime (Preston 2013). It could be near-impossible to rescue the situation by urgently turning to alternative pathways that should have been developed long before.

The books also point to the potential perils of engineering new life forms and technologies that may eventually rebel against human demands (cf. Baum and Wilson, 2013; Church and Regis, 2014; Caplan et al., 2015). As we saw, the tuners turned on their human makers, asserting that they, too, were human. Syl Anagist thought it was simply manufacturing a new class of tools capable of coordinating the obelisk batteries. The Sylanagistines presumed they had complete access to, and control over, the tuners, but never understood they were inventing an entirely novel consciousness. This theme of rebellious human-made artifacts goes back to Mary Shelley’s Frankenstein creature and to the golems that mediaeval Jewish cultures feared. It still resonates because every new scientific and technological development is implicitly assumed to be controllable precisely because humans have designed and overseen it.

But science and technology studies scholars have shown that virtually any such development is inevitably accompanied by social and ecological effects that were unforeseen (or more accurately, discounted, or even disbelieved). Seemingly inert technologies always have their own agency (Bijker et al., 2012): they are capable of behaving in ways that take on their own life and momentum, thus remaking the world beyond human expectation (if not potential foresight). Mobile phones exemplify this phenomenon: while they were first used to enable people to make calls from cars or in the streets, they have rapidly and surprisingly changed our behavior dramatically. Mobile phones have turned into portable, wearable, ‘alive’ computers that we carry around and peer at constantly; we even sleep with our phones. It appears mobile phones are affecting socialization of humans from very early on in life. Educators
and psychologists (like Sherry Turkel) are worried that we are learning to “be alone together” and that youth in particular may be suffering greater depression and anxiety (Turkel, 2017). We may even be rewiring the very way our species thinks, reducing our capacity for concentrated, deeper thought.

The themes of technological hubris and inadequate prior screening of risks are familiar staples of the science fiction genre. Numerous novels explore how human societies succumb to the illusion of controlling artificial intelligence, biology, or nature, only to discover these are more recalcitrant than they suppose. This approach could be relatively low-cost and quickly implemented, in theory, it would require constant infusions of aerosols for hundreds of years which may be politically and technically challenging to maintain. A rebound effect could happen, in which global warming speeds up again, because greenhouse gases would need to be removed in the meantime but are likely not to be. Credit: Funnel, Inc., for Harvard Magazine. DOI: https://doi.org/10.1525/elementa.364.f6

Figure 6: Solar radiation management through sulfates. Geoengineering researchers have proposed a variety of possible technologies and approaches to reduce either global greenhouse gas levels or atmosphere radiative forcing. One approach is to release sulfate aerosols into the atmosphere, via airplanes, high-altitude balloons, and other means, to mimic the effects of very large-scale volcanic eruptions by reflecting 1 percent of sunlight and thereby cooling the atmosphere. While this approach could be relatively low-cost and quickly implemented, in theory, it would require constant infusions of aerosols for hundreds of years which may be politically and technically challenging to maintain. A rebound effect could happen, in which global warming speeds up again, because greenhouse gases would need to be removed in the meantime but are likely not to be. Credit: Funnel, Inc., for Harvard Magazine. DOI: https://doi.org/10.1525/elementa.364.f6

5.1. Knitting structural racism and technological hubris together
This is where Jemisin goes beyond most STS scholarship. She not only critiques technological hubris, but sees the ways in which technology is itself racialized, and how class and status and politics run through seemingly sterile tools. She exposes the theory that a particular people or group is so self-evidently knowledgeable and expert, that it should be entrusted with the decision-making power for a society. The Syl Anagist elites arrogantly assumed they could control the fate of the entire planet, for all of humanity, and they located their legitimacy in their racial superiority. Subsequently, the Guardians, Sanze ruling class, and Fulcrum leaders together presumed they could impose an order on their world that entailed the enslavement of orogens. This mentality is analogous to that of many technical experts, Silicon Valley innovators, and political/economic elites who perceive themselves as peculiarly authoritative. Those oligarchs—often found at the World Economic Forum in
Davos—believe their wealth to come attached to privileged scientific and technological stature, leading many people to defer to them. Such an attitude often results in devastating, incompetent practices and decisions because it ignores vital knowledge, imposes a false coherence on a complex planet, and is, at base, self-interested.

There are a few scholars who are doing the work of knitting structural racism and technological hubris together. Rajagopalan et al. (2017) and Hess et al. (2017) show how apparently impartial and pristine S&T knowledge often conceal racially parochial worldviews and experiences. As they show, there is a widespread faith in circulating S&T as a civilizing power but in reality this S&T helps classify populations into racial groups, eradicate traditional knowledge in favor of Western expertise, and enclose natural resources formerly ‘owned’ by indigenous people (see also Rodríguez-Muñiz, 2016). Much of this work builds on antecedents such as Winner (1986) who argued more than 30 years ago that racial values and perspectives permeate the design and use of many technologies. Many of the historical examples of ‘technology-gone-wrong’ happened through the choices that higher class, white technologists initially made in Europe and North America, before spreading worldwide through enlisting local allies and working through circuits of imperial control and corporate capital.

A transition, then, cannot be founded on technological hubris, nor on the choices of a few particularly powerful actors. Without technological humility and diverse societal inputs, transitions are more likely to collapse. By hastily rushing to build automated agricultural systems or sulfate aerosol injection infrastructures, elites can set the world on a damaging path that is difficult to escape.

6. Recognizing Earth’s rights

When activists and philosophers suggest that the environment has its own rights, they are frequently ridiculed as raising an impossible, even blasphemous, idea. But why should transitions put human needs ahead of those of the Earth? The notion of “sustainable development” – generally founded on a utilitarian goal of preserving resources for future human generations – is supposedly the foundation of modern environmental science. In practice, exploitation of both humans and Earth underpins almost every sustainability technology or practice in industrialized countries. In this section, I consider the evidence that Earth is a living, acting planet that demands its own existential status and justice.

When the Sylangistines were building their obelisk network, and the tuners were planning their insurrection, no-one knew that Earth itself was alive and angry. Its curiosity piqued by the tumult of tunneling deep into its magic energy-infused core, Earth had sent tendrils of iron into the obelisk sockets to puzzle out what humanity was scheming to do. It found that its core was about to be stolen and enslaved as the network’s primary source of energy. Jemisin’s story about how Syl Anagist strove to master Earth’s magic is not a novel science fiction theme. But the way she narrates how Syl Anagist hopes to continue devouring Earth is terrifying. She points to the ways in which ill-understood, extractive technological projects can reinforce the tendency of industrial production and mass consumption to demand more and more from Earth. “Better the Earth, Syl Anagist reasons. Better to enslave a great inanimate object that cannot feel pain and will not object... But this reasoning is still flawed, because Syl Anagist is ultimately unsustainable. It is parasitic; its
hunger for magic grows with every drop it devours. Earth’s core is not limitless. Eventually, if it takes fifty thousand years, that resource will be exhausted, too. Then everything dies.” (Book 3, p. 334). Our contemporary societies are equally parasitic in mining resources and energy.

As the network powers up, Earth shocks the tuners by interfering with their handling of the network, and seizes a subset of the obelisks, already contaminated with infiltrating iron. Instead of letting Syl Anagist abuse it, Earth plans to devastate the biosphere to remove all life from its crust and thereby become safe from any possibility of abuse. To Earth, the tuners are as human—and culpable—as the Sylanagistines. But one tuner still feels love for other humans, and battles to reverse Earth’s ‘burndown’ command back into the moon to protect humanity. In the resulting wrestle, the moon is thrown out of its orbit, and Earth grows even more incensed because its tilt becomes unstable and its tides grow wildly chaotic. It gains vengeance against still-extant humanity by turning the world into an unending sequence of Fifth Seasons through its geological processes. Earth also punishes the tuners and their descendants by transforming them into near-immortal stone-based life-forms, called “stone eaters”.

The overall narrative arc of the series turns on whether this broken Earth can be rehabilitated in both ecological and social senses. As Essun learns from Alabaster when they are reunited in an orogen-led comm hiding underground, three factions are struggling over Earth’s future. Earth and many stone eaters want all life gone; the Guardians aim to retain the status quo; and some regretful stone eaters desire humanity to have another chance. The series asks, above all, whether Earth’s fury can be mollified to permit compromise to take place. Essun’s mission is to learn from Alabaster how to restart the obelisk network to finish bringing back the moon into orbit, but she confronts stone eaters, Guardians, and Earth trying to inhibit her from doing so. Once the moon is recaptured, beginning the healing of Earth’s many damaged geological, tidal, and environmental cycles, the sympathetic stone eaters successfully intercede with Earth to attain a wary truce. Much uncertainty exists about the world the orogens will live in but they can now destroy the prevailing racially stratified culture and build a novel one.

The books evoke an ecocentric perspective in which Earth’s presence and power must be respected, not despoiled. Earth has long been a missing agent in the politics, legal systems, and economies of contemporary industrial societies. It is quickly disappearing from the consciousness of the middle classes and wealthy elites in industrializing countries such as India and China, as they intensify their consumption. Amidst the sprawling cities and roads, between the millions of cell phones and cars, the fact we live on a planet is usually forgotten. Moreover, although many environmentalists declare humans must conserve “wilderness”, they treat nature as something that exists outside of humanity (Cronon, 1996) and as something that is benevolent or innocuous (Hale, 2016).

Much humanities and social science scholarship shows the myriad ways in which industrial societies have evolved a philosophy/epistemology of unbounded exploitation.

Figure 8: The Brazilian Amazon rainforest. In the past two decades, new research has illuminated the central role that the Amazon region plays in Latin America and globally. This huge rainforest zone not only contains exquisite biological diversity but helps maintain many fundamental global environmental cycles, such as the carbon and water cycles. These cycles are at the core of what some scientists have termed the Gaia hypothesis: the idea that Earth is effectively a single, self-regulating, complex system that sustains the conditions for life through its geological, biological, and environmental processes. Credit: http://grupolng.com.br/pt. DOI: https://doi.org/10.1525/elementa.364.f8
Environmental historian Richard White (1995) writes about how the human builders of gigantic dams dotting the US Pacific-Northwest sought to conquer turbulent, wild rivers as an act of supremacy. Likewise, Carolyn Merchant (1980) traces the long-swinging ambition of Western science and technology to seize imperial control over nature, putting it into human service. Thomas Princen (2015) sketches the values underlying fossil fuel culture, including abundant energy use and the complaisance of Earth in absorbing the resulting pollution. Marxist scholars like John Bellamy Foster (2011) point to the progressively advancing “enslavement” of Earth’s resources through industrial manufacturing and, more recently, financial speculation.

By turning her attention to Earth’s subterranean dynamics, Jemisin suggests the reality of Earth far surpasses human sagacity. We hardly know Earth itself, inferring its structure, properties, and geology from scientific experiments, studies of rock brought to the surface, and seismic records of quakes propagating across and inside the planet. We do know a fair amount about the terrestrial surface and about phenomena such as fault lines and volcanoes. Yet, we’re oblivious to what lies beneath us. We didn’t know that thermophilic, anaerobic microbes might live down in the crust (Shanker, 2016). We don’t even know whether the inner core is a plasma or a solid, whether it contains siderophile elements like gold and platinum, and whether it rotates faster than the rest of the planet. We are only now glimpsing how life has reshaped the physical world (e.g., how large forests could attract water through creating an atmospheric vapor gradient (Loomis, 2017), and how plants have helped make more soils over geological epochs). Given this ignorance, humans should have humility when interacting with the planet, whether rock, forest, or ocean. We should heed the signs of a changing biosphere – even, a living planet – that extends from inside the crust out to the troposphere. In the 1970s, James Lovelock proposed the Gaia hypothesis, which suggested that Earth was an entity capable of regulating itself through its environmental and biological cycles. For many decades, most scientists rejected this possibility but much evidence is building to support it (Jahr, 2019). We can discern the pollution and waste of industrial production but we don’t easily notice the complex systems buried underground and aloft in the sky. What are we doing when we cover so much of the planet with asphalt and mines and cities? When we weaken thriving soil fauna (microbes, earthworms) through industrialized agriculture practices? When we interrupt the exchanges of nutrients and water throughout soil, ocean, and air?

Earth also has its own implacable agency, which can depose humanity at any point (Hamilton, 2017). Earth provides the ecosystems, weather, and habitable planet that we rely on, without any reference to our existence as a species. Indigenous peoples, local farming communities, and ancient societies from the Greeks to the Inca have long regarded Earth as a nurturing maternal entity (Merchant, 2012; Preston, 2017). Some have even experienced their gods as pantheistic Earthly presences in their cultural worlds. Gaia, Mother Earth, and La Pachamama are only some of the many names humans have given this being. The Inca understood Pachamama, their ‘World Mother’, as a source of fertility, embodying the mountains, bearing harvests of potato and coca leaves, and supporting their unique vertical agriculture system (with diverse crops and livestock grown across the steep altitude gradient of the Andes) (Di Salvia, 2013). But Earth can be destructive. Even if humans grow increasingly powerful in subjugating the planet, we remain vulnerable to floods, heatwaves, and volcanic eruptions. In Indigenous cosmvisions, Mother Earth can get angry and retaliatory too (Allison, 2015). This is partly why the Inca also offered ritual human sacrifices to appease their sun god Inti at times of famine and drought.

In the Broken Earth series, Jemisin unusually portrays Earth as malignant, at least towards humanity. For example, a key episode turns on the journey that Essun takes through the giant shaft that Syl Anagist drilled into the planet, emerging on the opposite side. She encounters Earth’s core, which is roiling hot, furious, and dangerous. Essun is lucky to survive the stone eaters and tendrils of magic that Earth sends to attack her travelling party. However, Jemisin shows Earth can make a powerful argument to vindicate its revenge. When Earth seizes control over the obelisk network, a tuner realizes: “We were all guilty. All complicit in the crime of attempting to enslave the world itself.” (Book 3, p. 335) For Earth, it is justice to remove all vestiges of humanity. The assumption is that—like animals and plants and fishes—Earth won’t feel pain and can’t object. But what if this notion is greatly flawed? Already much new science is demonstrating that, impossibly, numerous organisms can feel emotions and can experience pain, even crustaceans (e.g. De Waal, 2016; Wohlleben, 2017). It’s possible that Earth does feel something analogous to agony from all the physical reshaping, all the disruption to its environmental cycles, that have taken place (Jahr, 2019; also, Harding, 2006). And it’s possible that Earth is beginning to warn us that our collective depredations will no longer be tolerated – it may be furious with us, after succouring us for many millennia.30

Jemisin implicitly poses the question of whether Earth should not be recognized as having its own rights (cf. Cullinan 2011; Burdon 2011). Earth has every reason to resent the many ways in which we collectively have appropriated its resources and ecosystems, to the extent we are denying other species their fair share of the Earth’s ecological space, are using resources that require at least 1.6 Earths, and are inflicting dramatic changes such as the Sixth Extinction Era. In 1973, the American law professor Christopher Stone argued that trees should have their own legal standing to sue in human courts (Stone 2010). If companies legally have their own personhood, shouldn’t Earth and its many lifeforms also have legal status, especially as they nurture our existence, whereas corporations are unable to? Such theories have since largely been disdainfully dismissed as ‘crackpot’ in the courts and by government authorities. But change may now be coming.

Constitutions in several Latin American countries (e.g. Bolivia and Ecuador) not only call for the human right to a healthy environment but acknowledge Earth as having
its existential rights (Daly, 2012). In 2017, after lengthy negotiations with local Māori people, the New Zealand government agreed to recognize the Whangerei River (or Te Awa Tupua) as having “its own legal identity with all the corresponding rights, duties and liabilities of a legal person” (Roy, 2017).1 In Australia, the Victorian state government has enacted the Wilip-gin Birrarung Murrun Act 2017, which recognizes the Yarra River and its surrounding lands in Melbourne and beyond as an integrated system (Gleseson-White, 2018). Many of these laws or rulings still affirm human rights—a back-handed kind of anthropocentricism, which may be strategically prudent but assumes that nature is only worthy of protection to the extent it is like humans. There are many ways in which truly Earth-centered rights can be defined and applied in, ironically, human institutions. In September 2017, a ‘deep green’ NGO began suing the State of Colorado for transgressing the Colorado River’s “right to exist, flourish, regenerate, be restored, and naturally evolve” (Turkewitz, 2017). Rivers, forests, ecosystems, seas, and even the whole planet could be afforded rights of existence and renewal, according to the pertinent scale of human decision-making and environmental functioning.

In making a transition, finding ways to put Earth at the center of our deliberations—and consultations—will be a key passage point. Indeed, the ability to even complete such a transition may turn on whether we can agree to affirm Earth as having its own rights. Humans cannot and should not “own the world”. Such an attitude underpins the unrestrained ecological extraction and economic growth that is ultimately disrespectful and destructive to the planet.

7. Discussion and Conclusions
The phrase sustainability transitions’ dominates any technical discussion of how to make civilizations more ecologically and socially viable. It is rooted in whatever is meant by sustainability, a word that is notoriously ambiguous and sometimes coopted into supporting perpetual industrial growth. Journalist George Monbiot (2017) contends that most of the language specialists use to describe environmental trends is dry and inadequate. Numerous scientific and bureaucratic words denote world-changing patterns without conveying what is happening. For example, biologists use ‘extinction’ to name the disappearance of a species; climatologists invoke ‘sea level rise’ to identify one impact of climate change. In other words: the death of all corroboree frogs; coastal suburbs flooding with every second tempest. Monbiot (2017) muses: “So why do those who seek to protect the living planet – and who were doubtless inspired to devote their lives to it through the same sense of wonder and reverence – so woefully fail to capture these values in the way they name the world?”

Building on Jemisin’s world-making, I argue that transition thinkers and practitioners can think in terms of ‘transitions to an unbroken Earth’ instead of sustainability transitions. The series title that Jemisin chose is telling: The Broken Earth (emphasis added). This is true of our own planet—where many environmental trends are well past alarming, where billions of people live hardscrabble lives. Such an unbroken planet allows humans to fully recognize one another’s diverse realities without elite groups of technologists, politicians, and business leaders seizing control; humans and millions of other species can co-exist; and the biosphere is healthy. Earth in the book series is threatening because it’s highly volatile without the moon and has broken loose of its stable biosphere bounds/cycles. Jemisin’s destabilized planet is endangering itself and its life forms. Here and now, we aren’t just trying to make our societies more efficient in using resources and more resilient in surviving heat waves and biodiversity loss. We need to find ways to regain the planet on which we were, and are being, born.

How may societies begin a transition to the unbroken Earth? Many people would concur at a broad level that societies should achieve greater sustainability, justice, and resilience as part of that transition. These seem like inoffensive outcomes to work toward. But once people begin to truly discuss what sort of world to make, they start to realize that, in fact, there is not necessarily wide agreement on what can be kaleidoscopically different pathways of development, change, and revolution. Many dissenting voices and divergent experiences may show up. Subaltern groups may claim an accounting for their suffering that elites are unwilling to allow. Humans may face demands from Earth that they don’t really want to meet. By inviting our entry into radically different, inimicable ways of being, Jemisin’s novels help us to understand that we must live with peoples and ecosystems, and transitions are not smooth – they require social (and ecological) struggle. Without claiming to provide a complete roadmap, I suggest that we can glean from Jemisin’s writing at least four key elements for ‘unbroken earth transitions’: recognition, humility, renewal, and redistribution. These elements are based in part on Patel and Moore (2017) who propose five actions to help us collectively escape a world-ecology built on the cheapening of life.

Recognition. Throughout the books, we see systematic denigration of orogenes as a dangerous, treacherous racial group in need of constant supervision. Earth, too, is described in everyday discourse as an “evil” being causing human suffering for eons. In the Syl Anagist era, Earth was reduced to a seemingly inanimate, unfeeling object. Yet these stereotypes—and the harmful consequences—are rooted in denying the worth and nourishing potential of both orogenes and Earth. The Fulcrum is built on diminishing the extraordinary ways in which orogenes experience, and act upon, Earth through their neuro-geological organ. Orogenes are given no practical say over how they wish to lead their lives. This is analogous to the many cases on our Earth where powerful governments and corporations now interfere with, and dismiss, the lives of indigenous peoples, favela dwellers, minority races, working class, and other social groups. Elites obviously don’t want a world where everyone has the same homogeneous characteristics like them—but they insist that subordinate groups must manifest certain differences, insofar as these maintain social hierarchies within the system they dominate. To do so, the elites ignore the full depth, knowledge, and power of all the differences that subaltern peoples care about, express, and experience.
N.K. Jemisin reflects in an interview: “The question that should be being asked is, ‘why aren’t you more willing to accept these people’s difference?’” (Wei, 2016). She adds, “You could accommodate that difference, you could find a way to wrap your society around that difference and make it healthier and safer for everybody instead of shoving some into a horrible place or genociding them” (ibid). Many commentators argue that refugees should be welcomed because they are just like the people already inside a nation and can learn to assimilate prevailing social norms. A much deeper shift, however, comes when extending compassion to refugees because they are not like existing citizens—because they are different and do not (or cannot) conform. Such a perspective amounts to what environmental justice scholar David Schlosberg (2004, p. 524) describes as “a call for recognition and preservation of diverse cultures, identities, economies, and ways of knowing.” Similarly, political theorist Nancy Fraser (2000) argues, peoples demand their own recognition in order to gain authentic social and political status. They want to express their situated perspectives and cultural knowledge without being silenced.

I suggest recognition can happen through many mechanisms, such as participatory political institutions, legal rights and anti-oppression enforcement, and investment in community-led innovations. Social movements may lead the way in building these mechanisms, not relying on governments that may be beholden to entrenched interests. Critically, recognition involves not just relations between human communities, but between humans and Earth. The planet must be understood as having its own being and integrity; it is not simply providing the habitat in which we live and the resources we use—it is a being in its own right. Earth’s health directly affects our collective welfare (Schlosberg and Collins 2014). Recognizing diverse peoples and Earth together can broaden the voices shaping a transition, and frame sustainability quite differently from how elite groups might see it.

Humility. Jemisin traces Earth’s fracturing to technological hubris and to the ways in which S&T are inherently racialized. Syl Anagist eagerly saw in Earth only a limitless source of energy to propel its growth and empire-building—not the risks of building a potentially uncontrollable planet-wide technology. The civilization’s decision-making institutions failed to anticipate the consequences of basing this technology on racial subjugation, or to hold its scientific and political elites accountable for creating the risks. Similarly, technologists in our world can be overly confident in the power of S&T to achieve sustainability. Leveraging their economic and legal strength, agribusiness companies have already introduced many technologies such as antibiotics, GM crops, GPS-equipped harvesters, and ‘Big Data’ systems without consulting with farmers or consumers, without thinking about the possible effects on ecosystem health and on agricultural systems that have learned to live with environmental fluctuations. These companies, moreover, are indifferent to whether rural communities are being exposed to rapidly escalating herbicide use.

To deal with such hubris, Sheila Jasanoff (2003) argues, societies should adopt ‘technologies of humility’, or “institutionalized habits of thought, that try to come to grips with the ragged fringes of human understanding – the unknown, the uncertain, the ambiguous, and the uncontrollable” (p. 227). These social technologies should also “make explicit the normative that lurks within the technical; and … acknowledge from the start the need for plural viewpoints and collective learning” (p. 240). Though Jemisin doesn’t talk about precaution, it is implicit in her world-making. The precautionary principle calls for careful anticipation of what might happen as a result of taking a particular course of action – of whether significant, irreparable risks may exist even though there is limited, even uncertain, evidence they do exist and the likelihood of their happening is apparently low (McGee et al. 2002). Precaution also asks us to think about real
alternatives to what is being proposed, and about whether decision-makers actually include the full range of people who would be affected. Creating technologies as part of a transition need not be damaging for those who are less powerful and visible – those technologies must not be rooted in mistaken assumptions about human power and in efforts to assert racial and social superiority. Humans must admit they can’t control the planet, and their efforts to expand technological power endlessly must be brought within the logic of sufficiency (namely, only just enough production and development to support human and planetary well-being while adapting to ecological constraints: Princen 2005).

Renewal. The Broken Earth series shows what can happen if an extractivist economy/politics manages to shatter environmental cycles at scales from the local to the planetary. Ecological functions have collapsed so much that humans are continually subjected to planetary catastrophes. The resulting disruption can be so extreme that the technological civilizations to which we have grown accustomed (and which we foresee through projections of S&T promises into the future) are no longer feasible. Our planet has already encountered at least five mass biodiversity extinction eras in its history, with a sixth one currently underway (Kolbert 2014). For the past 70 years in particular, extraction has accelerated at historically unprecedented rates, such that—for example—8.3 billion tons of plastics have been manufactured from 1950 to 2015, with roughly half in just the last 13 years (Geyer et al., 2017). This production is founded on attacking Earth, along with local communities and peoples that have intimate kinship with their air, water, and land, thus undermining their ability to nurture these biosphere foundations.

Traditionally, Fulcrum orogenes are “taught only to think of power in terms of energy and equations and geometric shapes” (p. 363, Book 2). They believe they are channeling Earth’s motion and heat through their will and concentration. In many ways, the dominant framing of orogeny as energy redistribution has strong parallels with how our industrialized world relies on the use of fossil fuels, extractive and waste-making economies, and brown chemistries, all of which are really about moving matter around and using up energy without thinking about what happens (Woodhouse and Breyman 2005; Princen 2015). By contrast, a thread running throughout the books is that orogenes could learn to work with the biosphere, because they can regenerate biological materials and life-forms, not just manipulate geological processes and resources.

How might renewal figure into a transition? Again, there are many paths to renewal and renewal can apply to many things: matter, knowledge, culture, and organisms. Above all, societies should prioritize the capacity to renew and regrow well ahead of purely extractive activities (Klein 2014; Princen 2018). This calls for the purposeful weakening and eventual elimination of ‘brown’ productive systems and knowledge practices in favor of ‘green’ forms (see Figure 9). For example, agroecological and organic agriculture can be emphasized instead of industrial agriculture; making clothes from natural fibers can be prioritized ahead of synthetic fabrics when appropriate. All humans—not only indigenous peoples—must be brought back into direct contact with the places, animals, and environmental cycles that historically nourished them. Patel and Moore (2017, p. 210) write: “To do that, you need land, places where humans can connect with extrahuman life, zones of engagement where humans can daily renew their relationships with the web of life.” Building on this idea, local communities and peoples must be given space to (re)develop workable processes for replenishing soil, making things for daily use, growing food, and other activities. Humans can also re-focus on reproducing their communities, lands, and livelihoods – instead of simply seeking paid work, they can enjoy building and passing on their knowledge, skills, and memories to others and to the next generations.

Redistribution. The Syl Anagist era was marked by tremendous consolidation of political and economic power in a wealthy people that set itself apart from other peoples and races. Those people ruled the entire planet. Much later, the Stillness era featured a similar concentration of control around the Fulcrum and Sanzed Empire. While the empire exercised a monopoly on orogenic energy and restrained orogens from sharing their knowledge freely, it also discouraged the development of other political systems beyond the comm level. On our Earth, neoliberal economics and corporate consolidation have contributed to rapidly growing inequality across industrial countries, while reinforcing age-old inequalities in other countries (Harvey, 2007). Competition between people and individual responsibility are exalted as desirable, indeed inevitable. Thus, many climate change dystopias are imagined in which people will descend into brutal, Hobbesian rivalry with each other for scarce resources. To undermine these inequalities and entrenched power structures, we need to embark on redistribution: the making of fair, collaborative, evenly shared capabilities across all sorts of populations.

Redistribution can happen through many processes; here, I focus on commoning and making reparations. Commensual arrangements are much more commonplace than neoliberal thinkers would like to admit. In recent years, we have seen the beginnings of a resurgence of the commons, an ancient form of social organization to govern resources and communities (Bollier and Helfrich, 2014). Commons of seed, food, water, energy, and other contents are showing up in both industrial and developing countries. David Bollier (2014) writes about commoning: people can remake their cultural identities and social norms through converging around a commons. Similarly, one key message from the books is that people are more likely to survive extremely difficult conditions, such as famines and earthquakes, if they form collectives (i.e. comm) to pool their resources and knowledge. By sharing, they can non-linearly expand their memory and their material strength beyond what competitive individuals are capable of reaching. Here, the Castrima comm is an intriguing experiment in beginning to picture a different world that could grow out of the Still. In Book 2, while wandering, Essun accidentally stumbles on the new comm, which is forming underground in an abandoned dead civ city. What distinguishes it is that orogenes and stills are actually cooperating together, and a orogen has been given authority to lead the
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Reparations by governments, companies, and societies are another path toward redistribution (Coates 2014). To change power structures that underwrite ecological and social damage, we must address the suffering these structures have long caused. While reparations cannot be made for all the suffering in history, they can at least begin redressing the underlying economic and political drivers of this damage (Warlenius, Pierce, and Ramasar, 2015). Reparations can take varied forms: they can be money payments to peoples whose lands and forests have been lost or polluted. They can also be returning land and resources; restoring a habitat for its creatures; or giving up certain consuming practices such as buying the latest electronics. Patel and Moore (2017, p. 209) suggest: “understanding the full range of damage caused by capitalism’s ecology, on whom and what that damage was inflicted, will require not just money but the imagining of nonmonetary redistribution”. Societies should ask oppressed peoples—and Earth—what they want, instead of trying to force them to take what is currently on offer. In the books, reparations are made to Earth by (1) sacrificing the Earth-using society to start over; (2) bringing back the moon to re-stabilize Earth’s cycles; and (3) agreeing not to take Earth’s magic without its permission and guidance. While we don’t need to relinquish our society outright, we should think more seriously about what it means to make reparations.

In conclusion, the Broken Earth series offers profound insights that can help inform the environmental politics of today. These insights, moreover, must be taken into account when thinking about, and carrying out, transitions to an unbroken Earth. What are the stakes for achieving these transitions? Is it possible that our world might change so much that no transition is possible? Can geo-engineering and gene drives provide the solutions for our environmental degradation? What if Earth is angry with humans to the point where it’s starting to refuse to allow us to continue our exploitative practices? Why does it matter to integrate ecological and racial/social justice into a transition? Reading the books provokes us to engage in these critical conversations.

Moreover, as Jemisin shows, storytelling itself can be a radical act of transition to an unbroken Earth, in helping us get out of the Cartesian frame and neoliberal commonsense inside which we are currently stuck. Storytelling can reveal the words, ideas, concepts, beliefs, and strategies we can’t even fathom because we never say, speak, or hear it. For a start, we can see that pervasive racial and ecological subjugation colors the whole of a civilization, as in Syl Anagist. It warps collective cognition and norms to the point where these are permissive of many types of oppression. An effective transition will depend on fighting to rebuild a society’s social structure and cognitive space around justice for both Earth and humans. To unbreak Earth, many powerful, comfortable humans must cede the hierarchies they have depended on, making reparations from their wealth, opening space for many others to say what they want. Technologists must step back and let peoples worldwide debate and decide on what different pathways of development to explore. Humans must accept extraction is a failing logic that ought to be replaced with a renewal paradigm. Earth must be an equal partner. Earth can be unbroken but it will take courage—the sort that N.K. Jemisin pictures in her books.

Data Accessibility Statements
I don’t have a data accessibility statement, as this paper was not based on primary scientific data.

Notes
1 Jemisin makes it clear that she considers herself as primarily writing in the fantasy genre (Wei, 2016). However, the lines are blurry and many readers (including this author) see the series as straddling the borders between fantasy and ecological science fiction. Each book has been awarded the Hugo Prize for best science fiction or fantasy book of the year. It is also important to know that Jemisin sees herself as an African-American writer but prefers to express her views as an author who happens to be African-American. In a recent interview with a black Washington Post journalist, she says, “As a black writer, I have a responsibility to try and create more space for black characters. I don’t always do so. I also want to retain the space to write whatever I want to write because there is always the danger of black authors being forced to write black characters and that has literally happened in some genres. And I refuse to let that happen to me” (Mason, 2018).

2 In an interview, Jemisin says, “A comm might have sturdy walls but falter from the inside as some of its members turn out to be selfish or abusive. It might have adequate food stores, but then the trigger for the Season turns out to be a huge fungal bloom that destroys the stores” (Cunningham 2017).

3 Importantly, a ‘ruling’ race or people doesn’t have to be white: innumerable cases of racist oppression exist, for example, in African, Asian, and Latin American societies. In many African countries, ethnic and tribal groups are frequently antipathetic to one another for historical and cultural reasons. In China, a clear racial hierarchy stretches from the dominant Han people to the Uighurs and Tibetans on the supposed periphery of Chinese society.

4 Orogeny is a real word meaning “a process in which a section of the earth’s crust is folded and deformed by lateral compression to form a mountain range.” Jemisin has conducted extensive research into geology: she has spoken with professional geologists, walked through and around the volcanoes on the Hawaiian islands; and read tracts about rock formation and geological activity (Wei 2016).

5 For example, in his Foundation and Earth novels, Isaac Asimov invented the Solarians, a people who genetically engineered themselves to have brain lobes that could transduce energy to run their extensive farmlands.
N.K. Jemisin sometimes gives interviews about her books to science fiction bloggers, publisher sites, newspapers like the Washington Post, and magazines like WIRED. She is selective in choosing who to speak with, and appears to prefer to interact with well-informed journalists and bloggers who have clearly reviewed her previous interviews and who are asking questions she considers to be respectful of her time. In those interviews, she frequently addresses issues of race, environment, and science fiction writing. Nonetheless, she generally emphasizes the characters in her books, and says she set out to write about people, not heavy themes such as oppression.

Geoengineering illustrates how a relatively small elite of scientists and engineers are building alliances with wealthy technologists and business people dependent on the fossil fuel industry’s survival. Temple (2017) describes how Harvard professor David Keith plans to embark on a solar radiation management experiment in the sky above Arizona with funds from Bill Gates, the Sloan Foundation, and others. Gates has also invested in Keith’s geoengineering start-up.

Jemisin writes: “There is no word for such a catastrophe. It would liquefy the surface of the planet, vaporizing the oceans and sterilizing everything from the mantle up. The world, for us and any possible creature that might ever evolve in the future to hurt the Earth, would end. The Earth itself would be fine, however.” (p. 339, Book 3).

Jemisin is personally not so uncompromising. She writes, “Remember, too, that the Earth does not fully understand us. It looks upon human beings and sees short-lived, fragile creatures, puzzlingly detached in substance and awareness from the planet on which their lives depend, who do not understand the harm they tried to do—perhaps because they are so shortsighted and fragile and detached.” (p. 341, Book 3).

This is not to say that Earth is actively embarking on ‘attacks’ against humans. Rather, the disruption of ecological cycles and the weakening of ecosystems may lead to countless warning signals that the biosphere is being destabilized (Hamilton 2017).

To implement the treaty, two guardians will be appointed to act on behalf of the Whanganui river, one from the New Zealand government and sees short-lived, fragile creatures, puzzlingly detached in substance and awareness from the planet on which their lives depend, who do not understand the harm they tried to do—perhaps because they are so shortsighted and fragile and detached.” (p. 341, Book 3).

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