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# Science Fiction, Global Warming and Environmental Education in the Capitalocene

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## Abstract

This essay explores ways in which environmental educators might break with their existing traditions of research and pedagogy by critically appraising climate histories and anticipated futures depicted by SF (science/speculative fiction) in print and audio-visual media. SF has engaged the politics of climate change for at least two centuries and, as a form of public pedagogy accessible to all generations, provides alternative visualisations of the problems arising from humanity's destructive transformations of Earth's climate and possible ways of ameliorating them.

**Keywords:** Climate change; culture; history; environmental education; informal education; literature

(T)he true “science fiction” of our time, peddled on talk radio and in the halls of Congress, is that global warming is a myth.

— Elizabeth Kolbert (2011, p. 10)

Today, . . . [p]ower is concentrated in the hands of a few independent corporations and states, each strong enough to escape environmental regulation, none with the will or mission to provoke change in themselves or others. Day after day, human activity fills the atmosphere with carbon, transforming Earth's climate, melting the polar ice caps, already destroying the homes and habitats of the planet's many creatures—including ourselves. Yet we lack the ability to visualize these problems, to locate their source in our own actions and lives, to tell and transform the stories of the interactions between our behavior and our biome. This is not a failing of science, the science is quite clear: it is a failing of culture. . . . To change this, we need to break with our existing traditions of art and media, even if that means rejecting some of the works we love most.

—Nick Admussen (2016, n.p)

Continuing Admussen's train of thought, and in the light of the complex and interrelated processes of global-scale economic-political organisation transforming Earth's climate, this essay explores ways in which environmental educators might break with existing traditions of research and pedagogy by critically appraising climate histories and anticipated futures depicted by SF (science/speculative fiction) in print and audio-visual media. SF has engaged the politics of climate change for at least two centuries and, as a form of public pedagogy accessible to all generations,

provides alternative visualisations of the problems arising from humanity's destructive transformations of Earth's climate and possible ways of ameliorating them.

Admussen's proposals echo the concerns that Amitav Ghosh (2016, pp. 7–8) expresses in *The Great Derangement: Climate Change and the Unthinkable*: “if the urgency of a subject were indeed a criterion of its seriousness, then, considering what climate change actually portends for the future of the earth, it should surely follow that this would be the principal preoccupation of writers the world over — and this, I think, is very far from being the case.” Ghosh (2016, p. 7) begins *The Great Derangement* by sampling a range of “highly regarded literary journals and book reviews” and observes that “when the subject of climate change occurs, it is almost always in relation to nonfiction.”

Ghosh might have looked in the wrong places. As I argued previously (Gough, 1993), the narrative strategies needed to make problems of human interrelationships with environments, such as global warming, intelligible (and, thus, amenable to resolution) are modelled more appropriately — and interrogated more critically — by much literary fiction, especially the complex and complicating textual strategies of science/speculative fiction (SF). I thus argue that critical readings of relevant SF texts should be integral to both science and environmental education and that the narrative strategies of SF should be incorporated into the storytelling practices of these subject matters. If Ghosh had looked in the SF shelves, he could have found many examples of “highly regarded” fiction dealing with the subject of climate change. Ghosh's oversight is puzzling, given that he is himself the author of a highly regarded SF novel, *The Calcutta Chromosome* (Ghosh, 1997), which received the Arthur C. Clarke Award for the best SF novel published in the UK during 1997<sup>1</sup>. By way of further preamble, I signal my support for Timothy Morton's (2013, pp. 8–9) preference for focusing on global warming rather than climate change:

climate change as a substitute for global warming is like “cultural change” as a substitute for Renaissance, or “change in living conditions” as a substitute for Holocaust. Climate change as substitute enables cynical reason (both right wing and left) to say that the “climate has always been changing,” which to my ears sounds like using “people have always been killing one another” as a fatuous reason not to control the sale of machine guns. What we desperately need is an appropriate level of shock and anxiety concerning a specific ecological trauma — indeed, the ecological trauma of our age, the very thing that defines the Anthropocene as such.

Although I largely agree with Morton's sentiments, I prefer to characterise the present epoch as the Capitalocene — the age of capital — because, as Demos (2016, n.p.) writes (echoing Admussen's epigraph above), “it names the culprit, locating climate change not merely in fossil fuels, but within the complex and interrelated processes of global-scale economic-political organization.” With respect to alternative epochal names, Elizabeth de Freitas and Sarah Truman (2020, pp. 1–2) write:

Concepts like the Capitalocene and Plantationocene remind us that the Anthropocene has been manufactured by a portion of humanity invested in accelerated capitalist accumulation and white supremacy. Science has played a crucial role in shaping this “global” condition as a legacy of European imperialism. And yet it would be foolish to deny scientific knowledge as simply serving the white establishment, particularly today under neoliberal post-truth conditions. Science denialism is on the rise, allied with nationalist anti-establishment movements and libertarian free market interests.

<sup>1</sup>[https://www.sfadb.com/Arthur\\_C\\_Clarke\\_Award\\_1997](https://www.sfadb.com/Arthur_C_Clarke_Award_1997)

Regardless of which term best encapsulates our current crises, I share de Freitas & Truman's (2020, pp. 1–2) interests in “foregrounding speculative fiction as a way to open up scientific imaginaries . . . to think through the many pasts, presents, and futures of science.” SF is also a way to open up *political* imaginaries — to think through the many pasts, presents and futures of power relations and differentials in society and culture. Scientific and political imaginaries are abundant in popular media, especially (but not exclusively) in the storytelling genres signified by SF. Some audiences see popular artistry as ephemeral and/or inconsequential, but as J. G. Ballard (quoted in V. Vale & Andreas Juno, 1984, p. 155) observes, “pop artists deal with the lowly trivia of possessions and equipment that the present generation is lugging along with it on its safari into the future.” The SF works I discuss here can be construed as my recommendations for some of the “lowly trivia of possessions and equipment” that are worth “lugging along . . . into the future.”

Thinking through scientific and political imaginaries is not only important for environmental educators, but for all educators who agree with the late Ursula Le Guin's (2016, p. 4) standpoint:

The imagination is an essential tool of the mind . . .

We have to learn to use it, and how to use it . . . Young human beings need exercises in imagination as they need exercise in all the basic skills of life . . .

When children are taught to hear and learn the central literatures of their people, or, in literate cultures, to read and understand it, their imagination is getting a very large part of the exercise it needs.

Nothing else does quite as much for most people, not even the other arts. We are a wordy species. Words are the wings both intellect and imagination fly on . . . no art or skill is ever useless learning; but to train the mind to take off from immediate reality and return to it with new understanding and new strength, nothing quite equals poem and story.

Regrettably, the academic curricula of most Anglophone education systems and institutions in contemporary industrial nations tend not to offer “exercises in imagination” for people of any age, despite the crucial roles that imagination — literally the ability to produce images in one's mind — has played in the development of many disciplines. For example, *thought experiments* have been particularly significant in the history of physics. Indeed, the term “thought experiment” came to the English language in the late-19th and early-20th century via translations of papers by the Austrian physicist Ernst Mach (1897, 1905) in which he used the mixed German–Latin word *Gedankenexperiment* (literally, experiment conducted in the thoughts)<sup>2</sup>. Some of the best-known examples of thought experiments are those performed by the physicists who pioneered what we might now call postmodern physics in the late-19th and early-20th centuries. These experiments were often the subjects of conversations or correspondence with each other, and were used to get their points across and to dramatise the revolutionary and/or paradoxical aspects of their theoretical discoveries or explanations<sup>3</sup>. Erwin Schrödinger's cat (quantum mechanics) and Albert Einstein's elevator (general relativity) and train (special relativity) are now understood as significant *events* in the history of physics. As Le Guin (1979a, p. 156) writes, these scientific thought experiments are a species of fiction — stories fashioned along the lines of “let's say this or that is such and so, and see what happens . . .” Thus, for example, in *Frankenstein*, we can interpret Mary Shelley (1992/1818) as writing: let us say that a young doctor creates a human being in his laboratory . . . Similarly, in the film *The Day After Tomorrow*, we can interpret Roland Emmerich (2004) as saying: let us say that following a disruption of the North Atlantic Ocean circulation, catastrophic climatic effects lead to a

<sup>2</sup>Some authors (e.g. Martin Cohen, 2005, p. 55) credit Mach with coining *Gedankenexperiment*, but Johannes Witt-Hansen (1976) clearly establishes that Danish physicist and chemist Hans Christian Ørsted used the term in 1811.

<sup>3</sup>See, for example, Michael Frayn's (1998) play, *Copenhagen*, based on an a meeting between the physicists Niels Bohr and Werner Heisenberg in 1941.

new ice age. Likewise, in *Dune*, we can interpret Frank Herbert's (1965) novel and its filmic adaptation (Villeneuve, 2021) as saying: let us surmise that in a distant future massive desertification threatens a planet very like Earth . . .

Le Guin (1979b, p. 156; italics in original) insists that such thought experiments are neither extrapolative nor predictive — their form is not, “if this goes on, this is what will happen” — but, rather, are attempts to produce alternative representations of present circumstances and uncertainties; within stories so conceived, “thought and intuition can move freely within bounds set only by the terms of the experiment”:

The purpose of a thought-experiment, as the term was used by Schrödinger and other physicists, is not to predict the future — indeed Schrödinger's most famous thought experiment goes to show that the “future,” on the quantum level, *cannot* be predicted — but to describe reality, the present world. Science fiction is not predictive; it is descriptive.

Or, put more succinctly, as Donna Haraway (1985, p. 66) famously asserts in her cyborg manifesto: “the boundary between science fiction and social reality is an optical illusion.”

Thus, in this essay, I explore the generativity of selected examples of SF that produce alternative descriptions of the circumstances and uncertainties presented by global warming for educational theory and practice, by focussing specifically on the ways that such stories function as *object-oriented* thought experiments, and their implications for exercising imaginations and interrogating scientific imaginaries.

### SF stories as object-oriented thought experiments

Elsewhere (Gough, 1998, p. 411), I have documented the pervasive “object-orientation” of SF, manifested by its preoccupation with externalities and a corresponding de-emphasis of fine-grained characterisation. For example, much SF speculates on possible human responses to alternative circumstances, such as an overpopulated or climate-changed Earth, and this alternative environment often seems to take priority in the author's imagination rather than the characters that demonstrate how the imagined conditions might affect human and more than human lives. The object-orientation of SF has clear affinities with a number of relatively recent object-orientated philosophical positions, including Levi Bryant's (2008) “ontology of immanence,” Morton's (2013) conceptualisation of “hyperobjects,” Ian Bogost's (2012) speculations on “what it's like to be a thing” and Graham Harman's (2018) “object-orientated ontology” (often abbreviated as “OOO”). However, Iris van der Tuin (2014, p. 231) draws attention to “the androcentrism of much OOO” and Thomas Lemke (2017, p. 147) notes OOO's “disregard of feminist materialism.” Carol Taylor (2016, p. 205) observes that not only are the “founding fathers” of OOO — Harman, Bogost, Bryant and Morton — all male, but that they also engage with an exclusively male philosophical lineage with Immanuel Kant, Edmund Husserl and Martin Heidegger being the most prominent figures. Indigenous Canadian feminist Zoe Todd (2016) also makes a powerful argument for recognising that the so-called “ontological turn” in Eurocentric philosophy (see, e.g., Heywood, 2012) can be interpreted as a form of neo-colonialism. Elsewhere (Gough, 2024), I argue that demonstrating how ecofeminist SF stories can function as object-oriented thought experiments, not only opens up specific scientific imaginaries to interrogation, but also works to subvert any androcentrism or neo-colonialism that inhere in the ontological turn.

Rich resources for environmental educators can be found in media that connect SF with environmental education, especially those which connect global warming with the material evidence locating it as an effect of complex interrelated processes of global-scale economic-political organisation. For example, recent developments in literary criticism and theory have sought what Richard Crownshaw (2017, p. 887) terms “an interpretive methodology for reading

the planetary and the geological in literature.” Focusing in particular on Paulo Bacigalupi’s (2015) novel *The Water Knife*, which imagines a near-future drought-affected American Southwest in which mountain snows have turned to rain, and rain evaporates before it hits the ground, Crownshaw argues that Bacigalupi’s future scenarios of climate change, ecological collapse and near-extinction

stage cultural memories of the unfolding aetiologies of the conditions imagined in the future but often subject to dissociation in our present. Conceptualising this fiction as the work of speculative memory, this essay finds in such acts of recall a self-reflexiveness as to the mediations of environmental remembrance. That is, in this futural work of cultural memory, the localisation of the planetary particularises the Anthropocene and foregrounds the ways that it is framed.

An example of such “mediations of environmental remembrance” appears near the beginning of *The Water Knife*. Bacigalupi (2015, 19) describes one of the main characters waking from a dream of rain, which becomes a commentary on the irony of the idea of Manifest Destiny<sup>4</sup>, given the ecological realities of the twenty-first century to which she has awoken:

The dream had seemed so real: the rain pouring down; softness in the air; the smell of plants blossoming. Her clenched pores and the tight clays of the desert all opening wide, welcoming the gift — the land and her body, absorbing the miracle of water that fell from the sky. Godwater, American settlers had once called it as they invaded slowly across the prairies of the Midwest and then pressed into the arid lands beyond the Rocky Mountains. Godwater. Water that fell of its own volition, right out of the sky.

As Crownshaw (2017, 903) comments: “This cultural memory of Manifest Destiny also recalls the fact that the geophysical agency of humanity now affects whether the rain falls, or not . . . The idea of Manifest Destiny remains a present absence in the text as a means of assessing the reality and tenability of this national narrative.”

In his introduction to a recent Special Issue of *Science Fiction Studies* on SF and the climate crisis, Brent Bellamy (2018, p. 417) makes similar points to Crownshaw’s concerning the roles of SF in staging “cultural memories of the unfolding aetiologies of the conditions imagined in the future but often subject to dissociation in our present”:

In a form of retroactive continuity, we can now look backward and see the seeds of the current conjuncture and the trajectories that have led to the current climate volatility. These trends may not have been visible before, but they are unmistakable now (despite the fact that some still quibble over their anthropogenic origins). This realisation is matched by a turn to our future fortunes . . . if we begin to behave differently now, how might this change affect the future of the Earth-system?

The gravity of the climate crisis has been steadily pulling genre fiction into its orbit. Global warming unfolds at a spatial scale and temporal rhythm that exceed the capacities of even the most robust literary imagination.

<sup>4</sup>Manifest Destiny held that the US was destined — by God, its advocates believed — to expand its dominion and spread democracy and capitalism across the entire North American continent. “Manifest Destiny,” a phrase coined in 1845 by journalist John O’Sullivan, expressed the philosophy that drove 19th-century US territorial expansion (see, for example, The Ohio State University History Institute’s lesson plan: <https://hti.osu.edu/history-lesson-plans/united-states-history/manifest-destiny-westward-expansion>).

One of the most significant and distinctive contributions that SF makes to our understandings of ecological precarity has been to represent the endless variety of ways in which life on earth can be destroyed. Stories of natural cataclysm and doom (supplemented by alien invasion, nuclear holocaust and collisions or near-collisions with other planetary bodies) comprise one of SF's most enduring themes. On the one hand, the plethora of plagues, deluges, droughts, glaciations and other global catastrophes imagined by SF writers can readily be interpreted as extended metaphors of our failed relationship with the earth — of our anxieties about, and alienation from, a threatening, hostile and even vengeful nature. On the other hand, I suggest that J. G. Ballard (1996, p. 209), author of *The Drowned World* Ballard (1963), *The Drought* Ballard (1965), and other stories of the earth in ecological ruin, is much nearer the mark when he asserts that stories of natural cataclysm are positive and constructive — that the authors of such stories use their imaginations to describe “the infinite alternatives to reality which nature itself has proved incapable of inventing. This celebration of the possibilities of life is at the heart of science fiction.” Although visions of nature gone awry are now firmly associated with SF, the type of literary imagination they represent is also exemplified in premodern stories, including the deluges in the Babylonian epic of Gilgamesh and the biblical tale of Noah's ark.<sup>5</sup> That natural catastrophe stories have become a species of SF reflects the cultural dominance of science in providing our basic understandings of nature. A contemporary story about the devastation wrought by a plague of locusts is more likely to offer a scientific (or plausibly pseudo-scientific) explanation for its occurrence than to suggest that it is a manifestation of the wrath of Yahweh or some other supernatural entity. But, rather than scientific explanations in themselves, it is the *questions* raised by science that tend to provide SF writers with their foci of speculation. From its earliest archetypes, including *Frankenstein* — which not only depicted the creation of monstrous life, but also invented and critiqued one of the first great myths of modern industrial society — SF has exhibited a deeply ambivalent attitude towards science as both a cultural practice and as a body of knowledge.

This ambivalence has become increasingly evident in contemporary culture and the fiction it produces, to the extent that the term “science fiction” has itself become problematic. Many writers and critics now take advantage of the inherent ambiguity of the initialisation SF and, like Haraway (1989, p. 5), use SF to signify “an increasingly heterodox array of writing, reading, and marketing practices indicated by a proliferation of ‘sf’ phrases: speculative fiction, science fiction, science fantasy, speculative futures, speculative fabulation.” Despite this ambivalence, SF as a form of environmental literature often displays explicit continuities with scientific discourses, especially among those authors who foreground the current truth claims of the natural sciences in their depictions of the earth and other worlds. Some writers represent these claims faithfully and work within their limitations, whereas others question their narrative authority and adequacy. For example, in such stories as Arthur C. Clarke's “The shining ones” (which speculates on the life that might be found at extreme depths in the Earth's oceans) and “A meeting with medusa” (which speculates on the life that might be found in Jupiter's atmosphere), both of which appear in Clarke's (1972) edited volume, *The Wind from the Sun*, the author appears to accept without question that the discourses of Western biological science provide appropriate languages for representing both terrestrial and extraterrestrial organisms. Authors such as Ursula Le Guin are more suspicious of such assumptions. Thus, for example, in “The author of the Acacia seeds and other extracts from the Journal of the Association of Therolinguistics” (1984), Le Guin satirises reductionist ethological constructions of animal behaviour, and in “She unnames them” (1987), she draws attention to the ways in which our cultural practices of naming might erode our senses of community with more-than-human organisms. Nevertheless, few SF stories ignore, flout or deny the evidence of science. If they do, then as Le Guin (1979b, p. 203) asserts, “the writer must know it, and defend the liberty taken, either with a genuine hypothesis or with a sound, convincing fake.”

<sup>5</sup>See also Nicholas Ruddick (1988) for an explanation of the significance of the deluge in twentieth-century SF.

## Climate, capitalism and SF: a short history

The imbrication of climate change, capitalism and SF, can (perhaps somewhat arbitrarily) be sourced to an extreme weather event, namely, the northern hemisphere's "wet, ungenial summer" of 1816 in which Shelley (1992/1831, p. vii) began composing *Frankenstein*, nominated by Brian Aldiss (2007, p. 353) as "the first real novel of science fiction," and unarguably the most celebrated and influential launching of a tradition of women's participation in writing SF. Often known as "the year without a summer" (see Mayer, 2018), this weather event has been traced to global climatic changes arising from the eruption of the Mount Tambora volcano in Indonesia the previous spring, which released massive clouds of sulphurous ash into the atmosphere, resulting in plunging temperatures, torrential rains, widespread crop failures and forced migrations. *Frankenstein's* reception in popular culture has tended to focus on its status as a cautionary tale that draws attention to the limits and dangers of pushing boundaries in medicine and biology and moral dilemmas in extending and prolonging and as a critique and indictment of masculine ambition, and the compulsions of masculine science.

*Frankenstein* has also proved to be a generative text in critiques of capitalism. For example, the Marxist literary critic, Moretti (1982, p. 67), describes Frankenstein's disfigured monster as a symbol of the dehumanising effects of the industrial revolution: "Between Frankenstein and his monster there is an ambivalent, dialectical relationship, the same as that which connects Capital with wage-labour." Shelley stages the Marxist critique of capitalism in the relationship between Frankenstein (symbolising the bourgeoisie) and his monster (representing the proletariat). Frankenstein becomes consumed by his creation, virtually enslaving himself to his object in a similar way to what Marxist theory identifies as the products of labour. The monster, in turn, becomes powerful and takes a stand against his creator, who he regards as unfamiliar and antagonistic. This dynamic resembles the bourgeoisie/proletariat condition, as Frankenstein has created something that he cannot understand or ultimately even control.

More recently, both the depth and breadth of scholarship that explores the versatility and interdisciplinary applications of *Frankenstein* in areas such as science, technology, alchemy, hypertext, dance, art, post-humanism and computer games, can be found in works such as *Global Frankenstein* (Davison & Mulvey-Roberts, 2018), *Frankenstein: The First Two Hundred Years* (Frayling, 2017) and *Frankenstein: Annotated for Scientists, Engineers, and Creators of All Kinds* (Guston et al., 2017).

Of particular note is Hannah's (2019) edited collection, *A Year Without a Winter*, which explores relationships among climate, crisis and creativity by bringing SF, history, visual art and expeditions to extreme geographies (inspired by the weather events that gave birth to *Frankenstein* in 1816 and the record high temperatures recorded globally in 2026), together with the utopian architecture of Soleri (1969), a fusion of architecture with ecology for which he coined the term "arcology," and began to model at Arcosanti, an experimental town in the Arizona desert. *A Year Without a Winter* can be understood as a collective thought experiment retracing an inverted narrative of climate extremes from 1816 to 2016. The book begins with accounts of the experiences of the four friends (Percy Shelley, his lover Mary Godwin [later Shelley], Lord Byron and his physician John Polidori) who, while confined by the inclement weather to Byron's rented Villa Diodati near Lake Geneva, accepted Byron's "dare" to write a ghost story<sup>6</sup>. By way of contrast, in 2016 four SF authors were invited to participate in a writing retreat held at Soleri's Arcosanti. Their responses, including the stories they created, are juxtaposed with excerpts from *Frankenstein*, contemporary accounts of the Tambora eruption, and critical essays on matters ranging from British Romantic writing of Shelley's period to discussions of how climate change is

<sup>6</sup>As Hannah (2019, p. 11) notes, Byron and Percy Shelley abandoned their own attempts to write ghost stories, but Polidori penned *The Vampyre*, the story of a bloodthirsty nobleman (a thinly disguised portrait of Byron). When first published, it was incorrectly attributed to Byron, but it is now recognised as "the first story successfully to fuse the disparate elements of vampirism into a coherent literary genre" (see Christopher Frayling, 1992, p. 108).

now affecting the world's oceans. *A Year Without a Winter* brings together SF, history, visual art, architecture and exploration in ways that reframe relationships among climate, crisis, creativity and the Capitalocene.

In the wake of *Frankenstein*, as Asselin (2018, p. 440) observes, the next major locus of climate-change SF in the late nineteenth and early twentieth centuries “already integrates climate into an economic rhetoric that views climate policy as a zero-sum competition between rival nations.” In SF from this period, climate change occurs principally as a result of large-scale human geoengineering projects aimed at transforming the world (see e.g., Fleming, 2012). Asselin's examples of this deliberate anthropogenic climate change include novels by Jules Verne (1889), Griffith (1906), and Twain (1924). SF writers at this time found ways to monetise previously unincorporated aspects of nature, including climate, as resources for the market economy. Access to resources was depicted as part of the economic and political balance of power between state entities. Several SF novels from this period featured outlandish (and implausible) plots<sup>7</sup> to disrupt, control and monopolise climate conceptualised as grandiose capitalist schemes capable of unleashing significant collateral damage. For example, in Verne's (1889) *Sans Dessus Dessous*, the protagonists purchase the North Pole in order to access the coal reserves under the Arctic ice. To do so, they seek to “correct” the tilt of the planet's axis of rotation to bring the current Arctic territories further south, where the heat of sunlight will melt the icepack for them. However, this would also trigger massive tidal waves and reshape the surface of the world, with the result that many populations and nations would be wiped out (a foretaste of many capitalist corporations' disregard for the consequences of their actions on the welfare of others). Many of the wealthy nations affected seem to be willing to tolerate the disaster so long as it only affects indigenous and other non-western populations, but uncertainty over what kind of climate or topography their country would be left with generates their stringent opposition. Thus, Verne presciently links global climate change to the perpetual quest for industrial growth based on fossil fuels that are ever more difficult to obtain and to an anticipated energy crisis. Nevertheless, many of these early SF novels present geoengineering as laudable entrepreneurship operating out of legitimate economic self-interest. At one extreme, several stories weaponize the weather and convert climate change into military might, with the same kind of technological brinksmanship that defines the contemporary arms race. Asselin (2018, p. 440) argues that the economics of early climate-change fiction foreshadows, and potentially conditions us, to view climate as a contested resource.

For further exploration of the significance of SF in critiquing the Capitalocene, I recommend Sparks' (2018) relatively recent doctoral thesis, which begins with Sparks' creative works (a suite of her own short SF stories) followed by an exegesis grounded in a critical appreciation of some of the key works of climate-focused SF by established authors (including Poul Anderson, Paolo Bacigalupi, J.G. Ballard, Harry Harrison and Ursula Le Guin, among others).

Critiques of capitalism have continued to be features of several acclaimed SF novels, with Le Guin's (1974) *The Dispossessed* (in later printings subtitled *An Ambiguous Utopia*) arguably providing one of the starkest juxtapositions of capitalism with an imagined political alternative. *The Dispossessed* is set in the twin inhabited planets of Anarres and Urras orbiting the star Tau Ceti, whose societies have long been divided by political rifts. Anarres, which is sometimes described as a “moon” of Urras and, like Earth's moon, has an arid landscape that appears to be inhospitable to human inhabitation is populated by a society based in anarcho-syndicalism<sup>8</sup>, an ideological system that prioritises the worker and seeks to abolish the wage system. Urras, on the

<sup>7</sup>Both Twain's (1924) and Verne's (1889) novels can be read as satires of overreaching capitalist ambition.

<sup>8</sup>Anarcho-syndicalism upholds the central role of trade unions in the class struggle and seeks to replace the state with a free association of producers. Its historical roots are in the anarchist faction of the International Workingmen's Association (IWA, 1864–1876), which sought to replace the state with a free association of producers as opposed to the Marxist faction's argument for seizing state power by a political party. Noam Chomsky is a contemporary advocate of anarcho-syndicalism (see Chomsky & Foucault, 2006).



other hand, is split between two warring factions: a capitalist, patriarchal state and a closed-off, authoritarian government. Unlike Anarres, Urras is a wealthy planet, with abundant agriculture and industry, large cities, numerous universities and a multitude of different cultures. In *The Dispossessed*, Shevek, a physicist from Anarres, seeks to peacefully unite Anarres and Urras, and end a centuries-old tradition of hate and mistrust. But Shevek has difficulty in accepting two things about Urras. First, its inequity: people go hungry even when there isn't a famine; the people who have food do not or will not share it. Second, he goes to a university to work with other physicists and finds himself surrounded by men. His male colleague explains this by saying what Shevek knows from his experience on Anarres to be untrue — that women aren't intellectually equal. *The Dispossessed* stages the disparities between capitalism and an alternative political philosophy through the efforts of Shevek to reconcile them. Reflecting on the genesis of *The Dispossessed*, Le Guin (2017) writes:

*The Dispossessed* started as a very bad short story . . . but the book had to wait for me . . . to understand my own passionate opposition to the war that we were, endlessly it seemed, waging in Vietnam, and endlessly protesting at home. If I had known then that my country would continue making aggressive wars for the rest of my life, I might have had less energy for protesting that one. But, knowing only that I didn't want to study war no more studied peace. I started by reading a whole mess of utopias and learning something about pacifism and Gandhi and non-violent resistance. This led me to the non-violent anarchist writers [with whom] I felt a great, immediate affinity. They made sense to me . . . They enabled me to think about war, peace, politics, how we govern one another and ourselves, the value of failure, and the strength of what is weak. So, when I realised that nobody had yet written an anarchist utopia, I finally began to see what my book might be. And I found that its principal character, whom I'd first glimpsed in the original misbegotten story, was alive and well — my guide to Anarres.

In the light of the plenitude of Urras's resources and their scarcity on Anarres, what, then, makes Anarres "an ambiguous utopia"? Bierman (1975, p. 250) writes:

What strikes the visitor to Anarres is not the familiar institutions but the setting. On Anarres the scene, . . . continually described and referred to, determines the act. For this utopia is built on scarcity, almost deprivation. A moral choice for communion created and still sustains this . . . community, but brute necessity enforces much of the functioning of the institutions. It is a necessity based on a desert landscape; Thus, in simplest terms, Le Guin's allegory says that the more ideal place, contrary to the whole utopian record and all man's [sic] paradises, need not and should not be built on plenty. Perhaps she would not argue that scarcity is a sufficient or even a necessary condition. But to call a land without green leaf a utopia is surely to cast ambiguity over the term, over the whole idea. It is an ambiguity that, like all others, carries its own creative impulse. It forces the reader beyond the "soft primitivist" and other fantasy images to weigh the meaning of plenty.

Le Guin depicts the absence of plenty in crucial details of Shevek's biography, which takes the reader from his birth through childhood, parental conditioning and adolescent learning that prepares us for the solitary mediator who tries to use his knowledge to reshape the relations between Urras and Anarres. The first hurdle in Shevek's quest comes in his formal education as a physicist: his talent soon outgrows the limited facilities of impoverished Anarres. There is more here than a plea for a world community of science to replace super-patriotic, nationalistic institutes. It may be possible to contend that a beneficent social order does not require a beneficent natural environment. But the case of Shevek makes clear that the nurture of genius-scientific

progress requires the materials and opportunity for social interaction that come from a supported community of science, and the leisure of plenty.

The ambiguity of Le Guin's story is in calling a place where genius cannot flourish a utopia. It is an ambiguity that utopians have often ignored. As Bierman (1975, p. 250) writes: "Utopias make good citizens, good soldiers, but when have they shown us flourishing geniuses other than founders?" Thus, Anarres is an ambiguous utopia because it demonstrates many traditionally "good" institutions in a setting that imposes an absence of the goods that are the traditional means of fulfilment. *The Dispossessed* thus reminds us that utopia is a verbal artefact. As Suvin (1973, p. 132) writes:

Utopia is the verbal construction of a particular quasi-human community where sociopolitical institutions, norms and individual relationships are organised according to a more perfect principle than in the author's community, this construction being based on estrangement arising out of an alternative historical hypothesis.

This characterisation of utopia will surprise no-one who is familiar with Suvin's (1972, p. 372) longstanding argument for understanding SF as "the literature of cognitive estrangement."

My reading of *The Dispossessed* suggests that avoiding a "world without a winter" might require us to eschew plenty and abandon many of the aspirations endemic to capitalist ideals. Although I accept that this might presently seem to be an unrealistic goal, it might be possible to educate for scaled-down expectations. We should at least be able model alternative ways of thinking about our use of fossil fuels. For example, can we imagine that one day we might use "cooking *without* gas" as a colloquialism for making very good progress or doing something very well?

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