



Swansea University  
Prifysgol Abertawe



## Cronfa - Swansea University Open Access Repository

---

This is an author produced version of a paper published in:  
*Green Letters*

Cronfa URL for this paper:  
<http://cronfa.swan.ac.uk/Record/cronfa44464>

---

### **Paper:**

Pak, C. (2014). 'All energy is borrowed' – terraforming: a master motif for physical and cultural re(up)cycling in Kim Stanley Robinson's Mars Trilogy. *Green Letters*, 18(1), 91-103.  
<http://dx.doi.org/10.1080/14688417.2014.890527>

---

This item is brought to you by Swansea University. Any person downloading material is agreeing to abide by the terms of the repository licence. Copies of full text items may be used or reproduced in any format or medium, without prior permission for personal research or study, educational or non-commercial purposes only. The copyright for any work remains with the original author unless otherwise specified. The full-text must not be sold in any format or medium without the formal permission of the copyright holder.

Permission for multiple reproductions should be obtained from the original author.

Authors are personally responsible for adhering to copyright and publisher restrictions when uploading content to the repository.

<http://www.swansea.ac.uk/library/researchsupport/ris-support/>

“All Energy is Borrowed”. Terraforming as a Master Motif for Physical and Cultural Upcycling in Kim Stanley Robinson’s *Mars* Trilogy.

The creation of habitable planetary environments depends upon the ability to construct closed systems in which biogeochemical cycles conducive to life can be generated and maintained. These self-sustaining systems recycle elements within a contained environment in an attempt to mirror the “natural” cycles on Earth. Drawing on the insights of James Lovelock’s Gaia hypothesis since the 1980s, this process, known as terraforming, has become a master motif for environmental and ecological enquiry in science fiction (sf).

Terraforming narratives are preoccupied with the problem of creating a new human history that can escape, resolve or transcend the failures of the past. They engage in dialogue with other sf texts, often re-using narrative elements and tropes developed by earlier terraforming stories to do so. *Avatar*, a recent example of this tradition, exhibits this tendency toward the recycling of tropes, what sf critic Gary Westfahl calls an ‘enormous exercise in borrowing-and-giving-it-back’ (2009). Do terraforming narratives simply recycle aspects of earlier texts, or does the sf tradition move toward a productive upcycling in which the concerns expressed by prior works are transformed into something new?

Jed Rasula has reconceived the intertextual aspect of American poetry as a metaphor, specifically in terms of texts as a compost library. He argues that newness arises from the continual recycling of language, shaped by an author’s attentiveness to predecessor texts and by reader interaction: ‘[i]n the compost library books have a way of collapsing into each other, not in the improvements of more “authoritative” editions or versions, but by constant recycling. Not one but many energies shape the field. It is a vortex’ (2002, 17). Thierry Bardini argues that biological entities and processes are the ultimate junk (2011, 25), and that terraforming represents a prime example of this sense of biology and

ecology as amenable to upcycling into new forms (2012). Bardini's sense of junk is rhizomatic; it is 'all kinds of stuff that grows in stacks and patiently waits for a renewed use' (2011, 7). Rasula and Bardini explore the questions of the ecological imperative of American poetry on the one hand, and of junk as 'one of the signatures of this age' on the other, but both concepts, compost and junk, share this tendency towards "upcycling" in order to create newness in ways that add value (Bardini 2011, 24). Upcycling is a contemporary neologism, the first recorded use of which has been traced back to an interview with Reiner Pilz in 1995 (14).

Metaphorical examples of this process of upcycling for literary purposes are compatible with a Bakhtinian view of language and with Broderick's view of the megatext, but they emphasise the specifically ecological character of this intertextuality. Their coherence has been formulated in terms of a "parabola", described by Brian Attebery as a trajectory rooted in an iconic sf image that, appearing in a form subject to collaboration and jazz-like improvisation, is open to inventive variation: 'the sf scenario is an open curve, a swing toward the unknown' (2005, 14). The term joins this notion of a narrative trajectory to that of the parable, thus drawing attention to how the sf narrative 'combine[s] human interactions with scientific ideas and technological innovations in a meaningful way' (Attebery and Hollinger, viii).

Terraforming is a suitable motif for this view of the megatext as compost or junk: the emphasis that it places on the creation of soil, in stories such as Robert Heinlein's *Farmer in the Sky* (1950) through to James Lovelock and Michael Allaby's *The Greening of Mars* (1983) and Kim Stanley Robinson's *Mars* (1992-1996) trilogy establishes a connection to this notion of the fertility of the "composting" aspect of the library of texts: a fertility at once open and oriented toward the unknown. Percival Lowell's popularisation in the 1890s of his theory

that the *canali* of Mars identified by Giovanni Schiaparelli in 1877 were the traces of an irrigation system engineered by Martians in order to combat the scarcity of a dying planet adds another resonance to this notion of Mars and terraforming as a site for the composting of junk, that blend of romance and science that has informed the popular imagination of Mars since the late nineteenth century.<sup>i</sup>

Robinson's *Mars* trilogy explores the fusion between the physical adaptation of the environment and the transformation of social practices and institutions. It considers the terraforming motif and its emphasis on closed life support systems and soil, linking these physical parameters to an "eco-economic" system propounded by the Martian colonists of the trilogy. Exploring how this system upcycles elements from Earth's compost library of socio-economic and political practices and attitudes, this paper considers the role of the Martian landscape as a distorted mirror of Earth that offers to transform and revitalise a planet consumed by tensions that exacerbate the global ecological crisis on a near future Earth. Eric Otto discusses the trilogy's exploration of Aldo Leopold's "The Land Ethic", a classic work of environmental philosophy that proposes the extension of ethical consideration to non-human nature and which negotiates the space between science, economics, expediency and ethics. Responding to Ernest J. Yanarella's criticism that the polyphony of subject positions in the trilogy allows Robinson to avoid resolving the ethical debate surrounding terraforming, Otto argues that the work's multiple perspectives 'encourag[es] readers to synthesize continually a complex array of political positions' (2003, 132). More recently, Otto has explored the ways in which environmental science fiction intersects with transformative environmentalism, that collection of environmental movements arising from the wake of Rachel Carson's 1962 *Silent Spring*. These movements offer analyses of and solutions to environmental degradation, focusing, to use a cybernetic,

ecological paradigm , on the inputs that feed into environmentally destructive behaviour, rather than on outputs that would require a reaction to specific examples of degradation (2012, 1).

Carol Franko connects Bakhtinian dialogism, polyphony and the carnivalesque to elements of *Red Mars* and, while William J. Burling argues that Franko's insights cannot be usefully applied to the political process of *Blue Mars* (2005, 76), Robinson himself mentions in an interview that Franko offered 'a clear theoretical expression' of his aim that 'actually helped me in figuring out certain problems in *Blue Mars*' (McVeigh 4). In contrast, Burling argues persuasively for affinities between the political process outlined in *Blue Mars* and Ernesto Laclau and Chantal Mouffe's "radical democracy", points of contact that are coherent with notions of dialogism and polyphony and that extend Franko's analysis.

Approaching Robinson's work from the perspective of composting is fruitful for the connections between American ecological poetry and sf that he makes: as a former student of Gary Snyder and a dedicated burrower into a compost heap that includes American poets such as Thoreau and Emerson, Robinson states in an interview that 'I believe that science-fiction is one of the most powerful modes of poetry of all time. Science-fiction is just a metaphor for the world we live in and metaphor is one of the basic tools of poetry' (1993). The Martian colony's attempt to establish a sustainable environment on Mars involves the creation of new myths upcycled from experiences and systems of thought on Earth. In the context of the Martian environment these narratives are tuned to the new specificities of a developing compost library. The creation of new myths on Mars enshrines a Martian narrative that can offer the potential for feedback from the alien to the human in order to transform the multiple voices embedded in Earthbound history into new avenues for socio-cultural experimentation.

## On Closed Life Support Systems, Soil and Cybernetics

The scientist Martyn J. Fogg defines terraforming as ‘a process of planetary engineering, specifically directed at enhancing the capacity of an extra-terrestrial planetary environment to support life’ (2011). Fogg draws comparisons between contained biospheres, such as Arizona’s Biosphere-2, and the uncontained biosphere of Earth, arguing that the ultimate aim of terraforming would be to create a self-sustaining uncontained biosphere on another planet (1995). These uncontained biospheres rely on the physical cycling of elements within a closed system, such as hydrological cycles, various biotic cycles, and nutrient cycling via several processes. In *Red Mars* the scientific team responsible for agricultural work tinker ‘endless[ly with the] project of maximizing the closure of their biological life support system’, the success of which is measured against a formula,  $K=I-e/E$ . The formula itself, closure equals Hiroko’s constant minus the rate of incomplete closure divided by the rate of consumption in the system, expresses the simplicity of the closed cycle, the ideal of which would be  $K=I-1$ , or closure equals Hiroko’s constant minus 1. Since Hiroko’s constant is a fictional term, this equation is not important for its scientific veracity but as an ideal with powerful metaphorical implications for the Martian colonists. The ideal goal is acknowledged to be ‘unreachable, but asymptotically approaching it was the farm biologists’ favorite game, and more than that, critical to their eventual existence on Mars’ (Robinson 2001c, 85).

Physical life support systems connect with others in relations whose complexity is compounded by cultural elements that occupy multiple dimensions within a system of

subsystems, all of which are open. Since constituents of life support systems include cultural aspects, and as no system can obtain complete closure – Earth itself receives sunlight and radiation from the solar system, and leaks gases into space – physical and cultural systems retain a capacity for transformation. [Incomplete Closure-closure](#) in this context is tied to utopian thought, which Robinson redefines as a process involving continual change and not as a static blueprint. Robinson reflects that ‘Joanna Russ talks about changing the term from Utopia to Optopia, meaning “the optimum possible” - a continuous, dynamic process. Even HG Wells in his Utopian writing would often talk about this kinetic process rather than reaching any kind of stasis’ (Cooke 1995). This formulation chimes with one aspect of Rasula’s discussion of the compost library, which resists closure and continually reactivates paleolithic lore and historical voices in new contexts, partaking of the propensity for the sf parabola to offer a binocular vision that ‘allows us to view stories from two perspectives at once, as both literal description and metaphor’ (Attebery and Hollinger 2013, ix). Before further developing this connection between the terraforming motif and the compost library, it is necessary to consider the implications of the motif of compost and soil as it figures in Robinson’s terraforming trilogy.

The biotic modification of Mars, otherwise known as ecopoiesis, borrows from the insights of Lovelock’s Gaia theory, specifically the notion that organisms and their environment are involved in feedback systems that regulate the environmental parameters of a planet. This feedback system, understood as the institution of a life support system, must be managed on Mars. *‘[N]ew life fed on the compost of their ancestors, and reproduced again. Lived and died; and the soil and air left behind were different than they were before these millions of brief generations’* (Robinson 2001c, 245). Life is involved in a bootstrapping process in which organisms rely on the compost of their ancestors in order to

thrive and so change their environment. This image possesses a metaphorical parallelism when “life” is extended to include the colonists themselves, whose own ability to modify Mars builds upon the “compost” of their own ancestors. Bardini defines computer pioneer Douglas Englebart’s use of the term bootstrapping as ‘an iterative and coadaptive learning experience’, a notion that grows out of Norbert Wiener’s influential theorisation of cybernetics (2000, 24). In *Junkware*, Bardini undertakes a ‘(bio)semiotic’ examination of junk DNA in terms of ‘an inquiry into the cybernetic metaphor applied to the understanding of life, its modes of reference, and the question of “genetic insignificance”’ (2011, 21). *Junkware*, Bardini explains, ‘is the name I chose to give this ordeal, turning the modern industrial and postindustrial excretions into a new sense of what being human can mean, now’ (2011, 24). This aim resonates with that of the sf parabola, which builds on icons that are upcycled in ways that vacillate between literal and metaphorical signification without offering definitive resolution.

Lovelock’s view of Earth as a Gaian system builds on cybernetics and exploits the potential for analogies to be drawn between domains implicit in systems theory and its probabilistic approach to processes shared by a variety of structures. Rasula explores the metaphor of compost as a figure for a geographically bounded intertextuality exemplified by American poetry of the Black Mountain school, which he notes ‘was historically congruent with, and sometimes affiliated with, the interdisciplinary matrix gathered around what Norbert Wiener named “cybernetics”’ (2002, 3-4). Such intertextuality hinges on what he calls the biodegradable, transformative potential of language, and specifically of the trope:

In the tropics of American poetry, trope is the composting engine, a fundamental dislocation, forge or furnace of a different locus: the unpropertied space germane to language. Not the mysticism of another world, but another economy (another *oikos* or household) of language-in-production, words in



emanation, not nation. A tropical poetry is an agency of partial bodies, effluvia, surplus meaning: partial to polysemy, many seeding. (2002, 124)

A focus on language is fundamental to Wiener's conception of cybernetics, concerned as it is with both communication and control acting on a system's capability to generate feedback and so achieve homeostasis. Wiener explains that 'In control and communication we are always fighting nature's tendency to degrade the organized and to destroy the meaningful; the tendency, as Gibbs has shown us, for entropy to increase' (1988, 17). Rasula's description of another 'economy [...] of language-in-production', of a 'tropical poetry [...] partial to polysemy' and imbued with a transformative potential associated with its locus as an alien space can be brought to bear upon Robinson's treatment of the habitation of an alien planet and the development of living practices that are tied to place (2002, 124). The *Mars* trilogy narrates a colony's struggle to bootstrap and develop complexity in variety and structure as they terraform and learn to inhabit the planet. The trajectory of this bootstrapping process is structured like an sf parabola, as a movement toward the unknown and as ecological parable. The science-fictional trope, the motif of terraforming, is itself a composting engine in which a variety of domains of knowledge collide and are transformed.

Scientific discourse is applied to narrative considerations of soil, which sustain important nutrient cycles that determine the potential and the character of the organisms that are able to take root on Mars. '[D]ifferent soils encouraged or discouraged each cycle to different degrees'; understanding the ways in which micronutrients like 'iron, manganese, zinc, copper, molybdenum, boron, and chlorine' work, along with macronutrients such as 'carbon, oxygen, hydrogen, nitrogen, phosphorus, sulfur, potassium, calcium, and magnesium', becomes essential for the terraforming effort (Robinson 2001a, 340, 339). Given the complexity of soil composition, the polyphonic range of soil types and

the geologic span of time that it takes for organisms to create soil, the terraformers realise '[t]hey were going to have to construct soil just like they had the magnesium bars' (Robinson 2001c, 140). Despite the sophisticated technologies that the terraformers have at their disposal, such as space elevators, solettas (giant mirrors in orbit that reflect sunlight to the surface) and the like, 'manufacturing soil was one of the most difficult technical feats they had ever undertaken' (Robinson 2001a, 338). Soil construction quickly becomes the central terraforming technology; the creation of soil is therefore not an example of downcycling, in which constituents are rendered into their base elements, but a process of upcycling. Much of the narrative shifts towards issues of compost, agriculture and gardening, thus allowing a focus on landscape to dominate the text. The compost/soil motif is one of the core images of the *Mars* trilogy; it is redefined as polyphonic in terms of its vast range of types, which in turn support a range of different organisms and, with regard to the colonists, a multiplicity of lifestyles. It is both a literal life-support system for the colonists and a model that functions as a parable for productive cultural and political variation and diversity.

### **On Eco-Economics and the Landscape as Mirror**

Speaking of his alliance with a formulation of scientific socialism that rejects nineteenth century scientism, Robinson claims that 'the "scientific" returns as a way of talking about providing some kind of ecological basis to economy. That way, economy is not just the astrology of the ruling class but actually a way of calculating true costs and benefits in a way that could be agreed on and quantified, and therefore making clear what we are really doing – whether it is sustainable or not over the long haul' (Buhle 2002, 89). It is this dislocation

and movement toward another economy, one of creation rather than depletion, that underlies John Boone's call for seeing the terraformation and habitation of Mars in terms of an eco-economic system, in a speech he delivers to his fellow colonists in *Red Mars*:

“Look,” he said, “here we are on Mars!” (Laughter) “That’s our gift and a great gift it is, the reason we have to keep giving all our lives to keep the cycle going, it’s like in eco-economics where what you take from the system has to be balanced by what you give in to it, balanced or exceeded to create that anti-entropic surge which characterizes all creative life and especially this step across to a new world, this place that is neither nature nor culture, transformation of a planet into a world and then a home.” (Robinson 2001c, 443)

A revolution for independence from Earth becomes the main narrative trajectory of the trilogy, and eco-economics becomes the basis from which this revolution is conducted, ‘a change in practice’ from revolution conceptualised as war (Robinson 2001b, 451). As its creators Vlad Taneev and Marina Tokareva explain, eco-economics involves consideration of issues of carrying capacity, coexistence, counter adaptation, legitimacy mechanisms and ecologic efficiency, among other ecologically oriented issues, and involves the recognition of the coexistence of both cultural and natural domains: the practice of economics on Earth is described as a ‘deformed offshoot’ of ecology (Robinson 2001c, 351). It is a ‘synthesis of systems’ ‘based [as Vlad explains] on models from Terran history, and its various parts have all been tested on both worlds, and have succeeded very well’ ([Robinson 2001a, 148](#)). Many of these economic systems have been upcycled from real world systems currently practised on Earth. The microeconomics of eco-economics is borrowed from the ‘Mondragon region of Spain[,] [while] [t]he different parts of the macroeconomy have been used in the pseudo-metanat Praxis [a fictional corporation], in Switzerland, in India’s state of Kerala, in Bhutan, in Bologna Italy, and in many other places, including the Martian underground itself’ (Robinson 2001a, 148). Eco-economics is supplemented by a barter and gift system, the

former of which is based on a 'hydrogen peroxide economy, where things are priced by calculations of their caloric value', the latter 'a nitrogen standard' covering 'two planes, the need and the gift' (Robinson 2001b, 463).

This system ties the economic practices of the Martian government directly to the life support system of the planet. They are slowly pieced together from a variety of economic systems from Earth in a manner that resonates with Rasula's notion of "w reading", 'the collaborative momentum initiated by certain texts, like the Maximus Poems, in which the reader is enlisted as an agent of the writing', or a 'nosing into the compost library' (2002, 11, 18). Vlad and Marina explore the compost library of economic systems, carefully selecting and upcycling examples into a new Martian economy that brings the ecological aspects of human dependency on nature to the fore. Others are also involved in developing and testing components of this system in a dialogic process that leaves the act of creation open. To Boone eco-economics sounds like "echo economics", an ambiguity that emphasises the recycling of practices from Earth's compost library, namely echoes of Terran history that are given new life in the context of a new planetary ecological system (Robinson 2001c, 351).

There is a danger that using the Martian landscape as a space with which to compile a new culture from Earth's compost library will overwhelm Mars' alien otherness and undermine its own status as an independent and autonomous nature. Ann Clayborne warns that the result of terraforming will be that "Mars will be gone and we'll be here, and we'll wonder why we feel so empty. Why when we look at the land we can never see anything but our own faces" (Robinson 2001c, 190). She sees the planet as a space with its own meaning: '[t]o see the landscape in its history, to read it like a text, written by its own long past; that was Ann's vision, achieved by a century's close observation and study, and by her

own native gift, her love for it' (Robinson 2001a, 98). Its geologic and climatic processes, while not part of a life support system of its own, leave traces of a "voice" that can be read with the appropriate scientific knowledge. The Martian landscape itself has another history, '*the history of Mars in the human mind*', or the Martian megatext, that compost library constructed in part by science and sf and in part by older forms of knowledge about Mars (Robinson 2001c, 13). The Martian landscape is in part a palimpsest written upon by physical and intellectual landscaping processes; alternately, it is, from the perspective of some colonists, a tabula rasa without its own history, a landscape of 'immense potential [... a] blank red slate' (Robinson 2001c, 108). The struggle over Mars' meaning is the main issue at stake in the *Mars* trilogy, and it subsumes the narrative of revolution that constitutes much of its political engagement. Nirgal, one of the first generation of Mars born colonists, gives a speech on the occasion of his visit to Earth in which he suggests that "'Mars is a mirror [...] in which Terra sees its own essence'". As an expression of "'Terran thought and Terran genes'" Nirgal sees the purifying voyage to Mars as an opportunity for the colonists to "'help the home planet by serving as a way for you to see yourselves. As a way to map out an unimaginable immensity'". Mars offers a space in which a new composting library of practices and institutions can be explored, ideas that have been developed via the colonists' various relationships to Mars. Their physical relationship to the new planet prompts the development of new socio-economic relationships and new philosophies to meet the requirements of habitation of the planet. "'As people learn more, [says Nirgal] they understand better their dependence on each other and on their world. On Mars we have seen that the best way to express this interdependence is to live for giving, in a culture of compassion'" (Robinson 2001a, 178). This view works as a counter to Earth's interests, whose own politico-economic structures, dominant on Mars throughout the narrative of

*Green Mars*, are overthrown to make way for the sifting and upcycling that goes into creating a new human relationship to the planet during *Blue Mars*.

Thomas J. Morrissey accounts for the relationship between Mars and Earth, in many of the stories of the Martian megatext, as one in which they are 'bound like jealous siblings or inconstant lovers, alternately brought together or torn asunder by intelligent but often conflicting visions, often expressed in metaphor' (2000, 372). Earth's ecological failures form a background and foil for economic developments on Mars, and in the *Mars* trilogy eco-economics offers a challenge to Earth's own economic systems. Earth's practices are described as a 'cycle of madness,' a life support system that is detrimental to continued habitation (Robinson 2001b, 637). One character says of Earth that "[w]e have been liquidating our natural capital as if it were disposable income, and are nearing depletion of certain capital stocks, like oil, wood, soil, metals, fresh water, fish, and animals. This makes continued economic expansion difficult" (Robinson 2001b, 100-101). That many of the multi-nationals who invest in Mars intend for the planet to become a field for further capitalist expansion, given the dwindling capital and field for growth on Earth, is testified by their movement of corporate security forces onto the planet and their aggressive and intrusive interference in the lives of the workforce that they ship to Mars. Earth's governments see the red planet as a site for the relief of the population surplus and as an answer to ecological crisis and conflict on Earth. One character notes that "carrying capacity was a very fuzzy abstract concept, depending on an entire recombinant host of complexities such as soil biochemistry, ecology, human culture" (Robinson 2001a, 346). Carrying capacity is thus an ecological principle that illustrates the interdependency of physical and cultural parameters in determining the appropriate level of strain that a life support system can bear. Earth and the multinationals push for increased immigration quotas in order to satisfy

the problem of overpopulation and to create a new market for economic expansion on Mars. Morrissey summarises these values and practices as part of what he calls a “Dominant Social Paradigm” that received widespread representation in the stories of the Martian megatext prior to the late 1980s-1990s, after which many texts move toward what he characterises as the “New Environmental Paradigm,” of which Robinson’s own *Mars* trilogy is exemplary (2000, 386).

Against this background, the Martian revolution aims to establish new expectations for habitation and economic practice based on scientific, ecological principles: ‘[s]cience is creation,’ argues Sax (Robinson 2001c, 213). As the narrator notes, ‘[m]etropolitan capitalism’s track record at this point did little to support it; in the last century it had precipitated a massive war, chewed up the Earth, and torn its societies apart. Why should they not try something new, given that record?’ (Robinson 2001a, 148). Examples of this movement away from the economic systems of the past include the pseudo-metropolitan corporation Praxis, mentioned briefly above. This corporation aims to develop new possibilities for economic relationships on Earth, and they ally themselves to the Martian revolutionaries in order to learn from the social experiments taking place there during and after the revolution. They establish new industries on Mars that engage in ecologically oriented industrial practices: one industry, a local Praxis salvage subsidiary fittingly named Ouroboros, provides an example of an economic endeavour tuned to the necessities of maintaining a life support system on Mars: ‘there was not a large garbage output on Mars; almost everything was recycled or put to use in creating agricultural soil, so each settlement’s dump was really more of a holding facility for miscellaneous materials, awaiting their particular reuse’ (Robinson 2001b, 131). Ouroboros ‘transforms waste into resource’ through “green” nanotechnology, which Colin Milburn argues is ‘the symbol of

corporate domination' and which, in this example, 'is remade and remobilized as "power from below"' (2012: 73). Upcycling offers a political metaphor for this mobilisation of power. Milburn argues that 'Robinson shows us that science fiction is itself an instrument of environmental nanopolitics, a molecular technology for terraforming our world and ourselves' (2012: 57). The mythic image of Ouroboros offers an economic metaphor for a science-fictional composting library oriented toward the upcycling and transformation of elements that establish a New Environmental Paradigm.

Morrissey notes that Robinson's *Mars* trilogy is engaged in a 'search for a vision that can sustain us in the future' (2000, 386). Mars, as Nirgal suggests, cannot save Earth by functioning as a safety valve for immigrants wishing to escape from the Dominant Social Paradigm of Earth, but it can function as a way to revitalise Earth's socio-economic and political institutions via the developments generated by the Martian compost library. As Sax tours the expanding cultivated areas of Mars, he speculates that the gardens 'must have been an aesthetic journey, filled with allusions and subtle variants of tradition that were invisible to him. Hiroko would have called it areoformation, or the areophany' (Robinson 2001a, 91). These gardens represent the colonists' experimentation with the gardening practices of the past, a palimpsest of various aesthetic principles that speak of the legacy left to the Martians by Earth. These scenes are themselves part of the compost heap of the science-fictional megatext, upcycling poet Frederick Turner's depiction, in his 1988 epic poem of terraforming, *Genesis*, of a garden on Mars built on the aesthetic practices of a multiplicity of cultures and stances toward the landscape. The soil for this riot of gardening techniques, however, is imported from Earth, illustrating another dimension to the colonists' continuing dependence on their home planet, despite the level of political and economic independence they have achieved at this stage (Robinson 2001a, 90).



The two planets have always been connected, despite the claims of some of the hardliners amongst the revolutionaries. There are two dimensions to the challenge of this reconnection: the relationship between Earth and Mars must be redefined, as Nirgal attempts to do, and the “Red/Green” debate on Mars must be resolved. This debate pivots on the disagreement regarding terraforming itself, with those calling themselves Reds supporting a preservationist stance toward Mars’ natural otherness while Greens urge for the transformative potential that life offers to the colonists. The narrative moves toward a synthesis between these two opposed positions as much as it attempts to resolve the relationship between Mars and Earth. Sax, initially the strongest proponent of a heavy industrial terraforming model, finds that his preferences for the Martian planet are transforming as he discovers Mars’ own voice expressing itself through the new life being introduced to its surface: ‘[f]arther on lay some tangles, red-stalked, greenneedled, like beached seaweed in miniature. Again that intermixture of red and green, right there in nature staring at him’ (Robinson 2001a, 67). As Earth’s compost library is sifted through by the colonists, the Martian landscape offers metaphors for a synthesis between opposed positions, offering a symbolic point of reconnection between the compost libraries of the two planets.

### **Conclusion: On Martian Myths**

Commenting on Bud Foote’s description of the ‘self-conscious intertextuality’ of *Red Mars* as drawing attention to itself as an artefact that encompasses older stories, Franko notes that ‘Mars itself is the nexus of many of these embedded stories, from science fictions to fictional canals to ancient myths of Mars inspired by its redness and erratic revolution’ (59).

Mars is the iconic basis of the parabolas explored in the trilogy, with terraforming functioning as a second-order cluster of icons that modify the trajectory of the parabola in various ways, those relevant to the motif of soil and compost being the subject of this investigation. Several characteristically Martian myths dominate the imagination of the colonists, all of which are interlinked and build upon the compost library of Earthbound myth and science in the new context of the Martian landscape:

*stories have naturally blossomed to fill the gap, just as in Lowell's time, or in Homer's, or in the caves or on the savannah—stories of microfossils wrecked by our bioorganisms, of ruins found in dust storms and then lost forever, of Big Man and all his adventures, of the elusive little red people, always glimpsed out of the corner of the eye. And all of these tales are told in an attempt to give Mars life, or to bring it to life. Because we are still those animals who survived the Ice Age, and looked up at the night sky in wonder, and told stories. (Robinson 2001c, 14)*

The little red people of Mars, often seen in the corner of the eye but never directly, upcycles sf tales of “little green men” and tells of an indigenous people who adapt to the influx of colonists and their ecologies. As ants are introduced as part of the project of soil construction, a story arises that mythologises this event via the tale of the little red people's encounter with these creatures: they ‘were just the right size to ride, it was like the Native Americans meeting the horse. Tame the things and they would run wild (Robinson 2001a, 113). The ability of the little red people to adapt to the colonists is testified in tale after tale, until in *Green Mars* some of the colonists begin identifying themselves with the myth: one character reflects that ‘[t]hey were ants in such a landscape, they were the little red people themselves’ (Robinson 2001b, 326), while at a political convention designed to reach a consensus over the governmental system of Mars, an anonymous individual writes the slogan “However: We Are the Little Red People” on a public message board (Robinson 2001a, 156). The official Martian constitution operates, Burling argues, as a referential

framework, 'a provisional set of shared beliefs' that makes a radical democracy on Mars possible (2005, 80). The myth of the colonists who become Martians complements this official political document with another referential framework, a mythic origin story of transformation from a colonial, capitalist annexe of Earth to an environmentally transformative society that shapes its values around the demands of living on Mars in such a way as to extend ethical considerations to Mars' non-human nature.

The myth of Paul Bunyan and his big blue ox Babe upcycles the classic American pioneer myth but transplants these tall tales to Mars. [Bunyan and Babe are characters who feature in several traditional pioneer tales, one of which describes how Bunyan finds the calf Babe during a winters day, amidst drifts of blue snow. He adopts Babe and the calf, affected by one of the properties ascribed to Bunyan's camp, grows to gigantic proportions.](#) The most detailed [appropriation of these figures story in the Mars trilogy](#) concerns Bunyan's encounter with Big Man from big planet, with whom he engages in a contest of strength. In an echo of some Australian Aboriginal myths, their contest transforms the landscape of Mars by creating many of the named geological features from Argyre and Hellas to Nirgal Vallis, Ceraunius Tholus and the Elysium massif. The contest kills Bunyan,

*But his own bacteria ate him, naturally, and they crawled all around down on the bedrock and under the megaregolith, down there going everywhere, sucking up the mantle heat, and eating the sulfides, and melting down the permafrost. And everywhere they went down there, every one of those little bacteria said I am Paul Bunyan.* (Robinson 2001c, 454)

Bunyan, representative of America and its pioneer past, is bested by something even bigger than him, Big Man, who stands for the vastness of the wider solar system. Their struggle mythologises the struggle of the colonists on Mars, while the death of Bunyan symbolises the death of America, and indeed nations, as the dominant players with interests in the interplanetary colony, a role that is taken by the multinationals in the later parts of the

trilogy and that is later superseded by the rise of the Martian government. Bunyan's transformation into bacteria mirrors the human colonisation of Mars; just as the bacteria colonises Mars, the colonists transform the Martian landscape via ecopoietic means. The metaphor embedded in this tale reaches toward a vision of consensus, in which the Martian landscape is changed through the combined efforts of a multitude. Little red people or the bacteria of Bunyan, these tales are structured as parabolic arcs that embody the upcycling of stories into new myths that function as metaphors for the creation of a new society embedded in their landscape. They rework elements from the compost library of Earth within the context of a terraformed Mars.

Bardini's notion of junk and its tendency to resist closure, and Rasula's notion of the compost library, offer ways to consider what is characteristic of the science-fictional motif of terraforming. Centred on the creation of life support systems on other planets, terraforming Mars depends upon the initial modification of the atmosphere, but ultimately on the construction of soil, or compost. These physical parameters form the essential basis of a Martian eco-economics that ties both the physical and socio-economic aspects of the colony into a whole. The Martian landscape is threatened not only physically but intellectually, in the sense that the projection of human interests onto the planet poses the risk that its nature will be overlooked in favour of using its landscape solely as a field for autological speculation and a recycling of Earth's practices that threaten to close possibilities for creating new, more ecologically sound, modes of habitation. Nevertheless, when the eco-economic system is tuned to the specificities of the Martian landscape, the potential for feedback from the alien to the human offers to transform the multiple voices embedded in Earthbound history into new avenues for socio-cultural experimentation. Burling notes that this experimentation is provisional and possible only through struggle,

requiring the continual revision of previously stable points of social and political agreement in contexts that are subject to change (2005, 83). The challenges to Earth's socio-economic systems posed by the innovations in social thought developed on Mars offers in turn to revitalise the compost library of Earth.

Rasula states that, '[a]mong available modes of discourse, poetry is unique in favoring utopia as transient occasion, not universal city. Poems effectively consume all the energy they generate' (2002, 71). Robinson's use of terraforming to explore the junction between ecology, politics and society favours transience of another sort, a utopia of process. Robinson explains in an interview that

I will always remain a science fiction writer because we live in a giant collaborative science fiction novel that we are all writing together. It is the realism of our time, especially in the industrial West, but more and more everywhere. (Buhle 2002, 90)

This view of sf as an integral part of a wider dialogue that includes economic, scientific and technological knowledge and its impact on socio-political practices, lifestyles and thought positions the science-fictional compost library as an indispensable ecological literature.

Robinson's focus on the impact of science and technology on society offers the reader a way of thinking about sustainable ecological processes, the extent to which they can be modified, and the possible outcome of these modifications. Attentiveness to the science-fictional compost library is also an attempt to engage with the world outside of the sf megatext through a collaborative writing process that takes as its basis a distrust of static utopias, favouring instead the openness of utopia as a continual process. The parables of Robinson's terraforming narrative connect scientific ideas and their practical implications to metaphors for social and political philosophies that model an ecological approach to habitation, thus working in environmentally transformative ways to critique the limits of

contemporary society's economic, political and social institutions. Investment in such a dynamic utopia finds in the motif of the life support system, and in terraforming, a figure that embodies ideas of upcycling, junk, cybernetics and open feedback mechanisms that emblematises the psychic and social interventions of human communities with their environments. The *Mars* trilogy engages in ideas of bootstrapping as an iterative, co-adaptive learning process, not just for the colonists of the text, but for contemporary (w)readers of sf, whose vacillation between literal and metaphorical readings of the narrative creates a feedback loop that offers, itself, to upcycle and thus generate new perspectives on nature and society that cannot be reduced to the initial sf motifs underpinning the narrative. Upcycling is thus a process that, like Attebery's parables of science fiction, generates new and creative ways of exploring ecologically oriented modes of habitation.

## Bibliography

Allaby, Michael and James Lovelock. 1984. *The Greening of Mars*. New York: St. Martin's Press.

Attebery, Brian. 2005. "Science Fiction, Parable, and Parabolas." *Foundation: The International Review of Science Fiction* 34 (95): 7-22.

Attebery, Brian and Veronica Hollinger. 2013. "Parabolas of Science Fiction." *Parabolas of Science Fiction*, ed. Brian Attebery and Veronica Hollinger. Middletown, CT: Wesleyan University Press, xii-xiv.

Bardini, Thierry. 2000. *Bootstrapping: Douglas Englebart, Coevolution, and the Origins of Personal Computing*. California: Stanford University Press.

—. 2011. *Junkware*. Minneapolis: University of Minnesota Press.

—. 2012. "Decompicultures: Decomposition of Culture and Cultures of Decomposition." Paper presented at the biennial meeting for the *Association for the Study of Literature and the Environment - UK and Ireland (ASLE-UKI)*, Worcester, September 5-7.

Buhle, Paul. 2002. "Kim Stanley Robinson: Science Fiction Socialist." *Monthly Review: An Independent Socialist Magazine* 54 (3/4): 87-90.

Burling, William J. 2005. "The Theoretical Foundation of Utopian Radical Democracy in Kim Stanley Robinson's *Blue Mars*." *Utopian Studies* 16 (1): 75-96.

Carson, Rachel. 2002. *Silent Spring*. Boston: Houghton Mifflin.

Cooke, Sebastian. 1995. "Sebastian Cooke Talks to Kim Stanley Robinson."  
[http://eidolon.net/old\\_site/issue\\_13/13\\_stan.htm](http://eidolon.net/old_site/issue_13/13_stan.htm).

Crossley, Robert. 2011. *Imagining Mars: A Literary History*. Middletown, CT: Wesleyan University Press.

Fogg, Martyn J. 2011. *The Terraforming Information Pages*. 'Planetary Engineering Bibliography'. <http://www.users.globalnet.co.uk/~mfogg/biblio.htm>.

—. 1995. *Terraforming: Engineering Planetary Environments*. Warrendale: SAE International.

Franko, Carol. 1997. "The Density of Utopian Destiny in Robinson's *Red Mars*." *Extrapolation* 38 (1): 57-65.

Heinlein, Robert A. 1967. *Farmer in the Sky*. London: Pan Books.

Leopold, Aldo. 2002. "The Land Ethic." *Environmental Ethics: What Really Matters, What Really Works*, ed. David Schmidtz and Elizabeth Willott. Oxford: Oxford University Press, pp. 27-32.

Marzahl, Kevin. 2003. "Poetry and the Paleolithic, or, The Artful Forager." <http://pmc.iath.virginia.edu/text-only/issue.503/13.3marzahl.txt>.

McVeigh, Kevin. 1995. "Red Prophet, Green Man, Blue Adept: Kim Stanley Robinson in Conversation with Kevin McVeigh." *Vector* 189: 3-9.

Milburn, Colin. 2012. "Greener on the Other Side: Science Fiction and the Problem of Green Nanotechnology." *Configurations* 20 (1.2): 53-87.

Morrissey, Thomas J. 2000. "Ready or Not, Here We Come: Metaphors of the Martian Megatext from Wells to Robinson." *The Journal of the Fantastic in the Arts* 10 (4): 372-394.

Otto, Eric. 2003. "Kim Stanley Robinson's *Mars* Trilogy and the Leopoldian Land Ethic." *Utopian Studies* 14 (2): 118-135.



—. 2012. *Green Speculations: Science Fiction and Transformative Environmentalism*.

Columbus: The Ohio State University Press.

Rasula, Jed. 2002. *This Compost: Ecological Imperatives in American Poetry*. London:

University of Georgia Press.

“Reiner Pilz”. 1995. *Salvo Monthly*, 11 October.

<http://www.salvoweb.com/files/salvonews/sn99v3.pdf>.

Robinson, Kim Stanley. 2001a. *Blue Mars*. London: Voyager.

—. 2001b. *Green Mars*. London: Voyager.

—. 2001c. *Red Mars*. London: Voyager.

Wiener, Norbert. 1988. *The Human Use of Human Beings*. New York: Da Capo Press.

Westfahl, Gary. 2009. “All Energy is Borrowed: A Review of Avatar.” *Locus Online*.

<http://www.locusmag.com/Reviews/2009/12/all-energy-is-borrowed-review-of-avatar.html>.

---

<sup>i</sup> Robert Crossley in *Imagining Mars: A Literary History* (2011) provides an excellent and extensive examination of the compost library of the Martian megatext, and of the meaning of Mars as created by a complex relationship between science and the literary and popular imagination.