

ENVIRONMENTAL PHILOSOPHY AND THE ETHICS OF TERRAFORMING

MARS: ADDING THE VOICES OF ENVIRONMENTAL JUSTICE

AND ECOFEMINISM TO THE ONGOING DEBATE

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Questions concerning the ethics of terraforming Mars have received some attention from both philosophers and scientists during recent decades. A variety of theoretical approaches have been supplied by a number of authors, however research pursuant to this thesis has indicated at least two major blindspots in the published literature on the topic. First, a broad category of human considerations involving risks, dangers, and social, political, and economic inequalities that would likely be associated with efforts to terraform Mars have been woefully overlooked in the published literature to date. I attempt to rectify that oversight by employing the interpretive lens of environmental justice to address questions of environmental colonialism, equality in terms of political participation and inclusion in decision making structures, risks associated with technological progressivism, and responses to anthropogenic climate change. Only by including the historically marginalized and politically disenfranchised “voices,” of both humans and nonhumans, can any future plan to terraform Mars be deemed ethical, moral or just according to the framework provided by environmental justice. Furthermore, broader political inclusion of this sort conforms to what ecofeminist author Val Plumwood calls the “intentional recognition stance” and provides an avenue through which globally societies can include nonanthropocentric considerations in decision making frameworks both for questions of terraforming Mars and also for a more local, contemporary set of environmental issues. The second blindspot I seek to correct concerns motivations for attempting terraforming on Mars previously inadequately philosophically elaborated in the published discourse. Specifically, the nonanthropocentric considerations postulated in the second chapter by various authors writing about terraforming,

and elaborated in third with regard to environmental justice, reach their culmination in an ecofeminist ethic of care, sustainability, reproduction, and healthy growth which I uniquely elaborate based on a metaphorical similarity to the relationship between a gardener and a garden. Although at first glance, this metaphor may appear overly domineering, or uncritically paternalistic, I argue a deep understanding of its implications will be eminently beneficial for discussions of what is moral, good, right, and just to do regarding not only whether or not to terraform Mars, but for contemporary environmental concerns as well. Ultimately, extreme caution and a robust precautionary principle are the moral prescriptions arrived at in this thesis for the near term future. Until a sustainable civilization and just society can be established and effectively maintained, efforts to terraform and colonize another planet are practically certain to produce as much that is undesirable as that which might be good.

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CHAPTER 1

GENERAL INTRODUCTION

[T]he absence of space travel absolutely guarantees nonsurvival of life on Earth...in a few billion years (perhaps 5×10^9 years) the supply of hydrogen in the solar interior will be so reduced that the Sun will follow a type of evolution observed in certain other stars, increasing in luminosity and expanding its diameter until the Earth is engulfed and all life on it is destroyed.

—William K. Hartmann

When we have learnt the true nature of our beings as earth-dependent and have learnt both to cherish the earth and to go beyond it without damage, it may be time for us to try to leave for the stars—but not before.

—Val Plumwood

Terraforming is the process of technologically manipulating the climate of another planet, such as Mars, so that it becomes more Earth-like, making it possible for terrestrial life forms to survive and flourish there. The possibility of engaging in such a project has its roots in science fiction, though some scientists have attempted to examine whether or not such a feat of engineering on so massive a scale could indeed be successfully undertaken. In response to arguments in favor of terraforming, some philosophers have offered objections, based predominantly on the intrinsic value of the Martian environment. These debates, while esoteric, have continued back and forth in the pages of scholarly journals for many years now.

In this thesis, I attempt to add to that discourse primarily by correcting what my research has identified as a glaring oversight in the argumentative terrain. Preoccupied by the question of whether the Martian environment has a right to subsist in the face of human desires to manipulate it, the dialogue has failed to address the potential human costs of terraforming. Neglecting to weigh these factors when determining the ethics of terraforming can only result in

an erroneous judgment. A broad category of these costs can be highlighted by applying the insights and analytical tools of the philosophy of environmental justice to the hypothetical scenario of terraforming Mars. Doing so reveals the potential for inequity in terms of the distribution of environmental benefits and burdens associated with the colonization of Mars as well as the likelihood of perpetuating inequalities in the recognition of stakeholders and their participation in the decision-making structures that will decide if and how to terraform Mars. Ultimately, for terraforming to be just, the socio-economic scaffolding that makes it possible must not be unjust.

However, such an impasse need not serve as the final word on the subject. If these hurdles can be overcome, a feat at least twice as challenging as terraforming itself, is it possible to conceive of a way in which engaging in terraforming could be reasonably judged ethical and just? Yes, it is possible if an appropriate and suitable ethical framework is working to protect the project from going off track. Although the ecofeminist philosopher Val Plumwood warns that we should “abandon further projects of rationalist conquest ... such as space colonisation,”¹ her philosophy provides exactly the sort of roadmap needed to avoid the pitfalls of the oppressive conceptual frameworks endemic to technological progressivism. In the penultimate chapter of this thesis, I articulate an ethical motivation for terraforming based upon the relationship between the gardener and the garden which will satisfy her stringent moral criteria and be beyond the reproach of the various warranted criticisms she makes of patriarchal hegemony.

This thesis is divided into five chapters, of which the second examines the contemporary literature on the topic which constitutes the published discourse. This analysis reveals two broad camps of concern regarding the ethics of engaging in terraforming. One, populated mostly by

¹ Val Plumwood, *Environmental Culture: The Ecological Crisis of Reason* (London: Routledge, 2002), p. 240.

philosophers, argues that terraforming would infringe upon some basic intrinsic value that the primeval Martian environment has in its unperturbed state. The other, championed usually by scientists and engineers, believes for a variety of reasons uniquely catalogued in an appendix² to this thesis, that terraforming is on the whole, more desirable than not terraforming.

The third chapter examines potential terraforming scenarios in light of the new academic field of the philosophy of environmental justice. Applying a “bivalent”³ conception of environmental justice to the question of terraforming illuminates a broad spectrum of concerns that my research has shown is absent from the contemporary discourse on the ethics of terraforming. At one level of analysis, the intersection of the philosophy of environmental justice and the ethics of terraforming reveals a grave set of potentials for human harms, predicated on colonialism, the maldistribution of benefits and burdens within society, and the lack of recognition of both human and nonhuman value and dignity, all of which lead to a variety of injustices. However, although environmental justice is sometimes supposed to be predominantly anthropocentric, an exploration of the politics of recognition justice highlights what environmental ethicists usually identify as the non-anthropocentric implications which are latent but underexplored in contemporary justice theory.

Thus an esoteric examination of the ethics of terraforming becomes an inquiry into social values, reflexively and counter-intuitively allowing an analysis of hypothetical future ethical scenarios to shed light on contemporary ethical theory. This is to be expected, since the only way

² Appendix A provides a glossary of esoteric terms that are heavily utilized in this thesis. Appendix B provides abbreviated biographical information on some of the most important authors referenced in this thesis. Appendix C is a compilation of arguments both for and against terraforming as they appear in the published discourse.

³ Robert M. Figueroa, “Bivalent Environmental Justice and the Culture of Poverty.” *Rutgers University Journal of Law and Urban Policy* 1 (2003): 29, cites Nancy Fraser, *Justice Interruptus: Critical Reflections on the “Postsocialist” Condition* (New York: Routledge, 1997), and Nancy Fraser, “Social Justice in the Age of Identity Politics: Redistribution, Recognition, and Participation,” *Tanner Lectures on Human Values*, Vol. 19, ed. Grethe B. Peterson (Salt Lake City: University of Utah Press, 1996) for the term bivalent with regards to justice. I also make use of a bivalent conception of justice owing to that intellectual heritage.

to predict future ethical scenarios is to extrapolate from current trends. Therefore, this analysis not only requires a philosophy of technology, but one of society, politics, economics, justice and the environment as well. Ultimately, Plumwood's insight is most likely correct, that an unjust society will bring about unjust projects. The only way to ensure the morality of terraforming is to ensure the morality of the society that might want to engage in it.

For that reason, the fourth chapter deals with that which undergirds ethics, attempting to determine whether or not terraforming, and the society that pursues it, can be considered ethical, moral and just. Given the analysis provided in chapter two, the inequity and inequality which the philosophy of environmental justice identifies as plaguing our contemporary global societies precludes terraforming from doing anything other than exaggerating and exacerbating contemporary colonial injustices. However, in the penultimate chapter I identify an ecofeminist care ethic which counsels patience on the one hand, but may allow for terraforming, colonization, and/or ecopoiesis further down the line, provided the society that engages in it adheres to the strictest moral standards. Otherwise, the resulting morality of terraforming will be accurately criticized according to the degree to which it deviates from those criteria.

In the fourth chapter I attempt to articulate an ethic that at the same time provides rock-solid conceptual protections for those beings and values that deserve and require protection, while opening up an avenue for forward movement in terms of technology and society that is good, rather than uncontrolled. Kim Stanley Robinson, in his science-fiction account of the terraforming of Mars, attempts to identify the relationship between the gardener and the garden as a suitable ethic for the human presence on Mars. The difficulty, however, is avoiding the patriarchy, dominion, and absolute control over nature a gardening ethic might imply. I make the case that an ecofeminist ethic of care may be sufficient to support such a metaphor and safeguard

it against the ethic of technological progressivism inherent in contemporary industrial agriculture. Environmental ethics must not merely hold back progress in a nostalgia for a bygone era, it must progress thinking forward, working with the spirit of the age to create an altogether *better* ethic than what came before and led to the litany of environmental issues we lament today. Only in this way will environmental ethics accomplish its goals of transitioning society into a more sustainable, ecologically rational mode of existence. If it fails in this task, the consequences are dire for both human and nonhuman populations.

If this narrow needle can be threaded, the resulting ethic will actually provide a positive argument in favor of terraforming that may escape the legacy of injustice manifest in the history of colonialism like a launching rocket escapes the gravity of Earth. Both the philosophy of environmental justice and Plumwood's ecofeminist care ethic advise not rushing into a project such as terraforming, however, in the long term if viable options for terrestrial organisms to escape the death of our star the sun exist, then it can only be identified as misanthropy to suggest that those options should not be pursued. This sort of argument is hinted at within the published discourse on terraforming, but my research has shown that it has not been made explicit. Therefore, the second contribution this thesis makes to the dialogue on the ethics of terraforming has to do with making an argument in favor of terraforming based on the value that can be identified in organisms, ecosystems, and their descendants. Whereas a single organism can die and crumble to dust, a species has no apparent expiration date. However, our star does have a limited life span. Yet this is only a problem on a time-scale orders of magnitude larger than the entirety of human history.

Regardless, a casual observation of the trajectory global players in the space age are on reveals that patience is far from the minds of technocrats building robotic rovers to pave the way

for the first human footprints in the red sands of Mars. As the Earth becomes more and more overpopulated with humans, other planetary shores are going to look better and better. The trick will be to try to nudge this calamitous downward spiral off its current course and guide it to a new, sustainable path for humans and the environments and ecologies that they find themselves a part of. In identifying and recognizing both anthropic and non-anthropocentric values, we can have our cake and eat it too. Ironically, questioning the technological progressivism of terraforming results in the elucidation of a sustainable ecofeminist care ethic that constrains what is technologically feasible by what is morally acceptable. The ethic by which the gardener cares for and protects the garden has interesting implications for terraforming in the long term future, but in the present it provides a remedy to injustices and unsustainable practices here on Earth right now.

The relatively small number of articles and essays published on the topic of the ethics of terraforming makes it possible to examine them practically in their entirety and in exhaustive detail, comparing and contrasting different authors' points of view, arguments and opinions about the moral advisability of terraforming Mars. The third and fourth chapters, however, take at face value, not uncritically, the theories, analytical insights, and overarching themes of the philosophies of environmental justice and ecofeminism, and applies them to questions of the ethics of terraforming in order to reveal novel and unexamined facets that will be indispensable for determining the ultimate ethics of terraforming at some point in the future. Because justice theory, environmental philosophy and the traditional feminist critiques have such a rich and deep history, the detailed cross-examinations that constitute the bulk of the second chapter are left off in the latter half of this thesis, in favor of the articulation and elaboration of an ethic in a linear form that builds over the third chapter and comes to full fruition in chapter four. Whereas the

authors treated in the second chapter receive significant criticism, those in the latter chapters provide a launching point for a novel ethical framework that is beneficial not only for questions of terraforming ethics, but for contemporary environmental issues as well.

CHAPTER 2

REVIEW OF AND COMMENTARY ON THE PUBLISHED DISCOURSE

I. Introduction

In order to understand the full complexity of the discourse dealing with environmental ethics and the Martian environment, it is necessary to understand the literature that already exists on the topic. Although this area of concern is but a small niche field within the ever-broadening scope of environmental ethics and environmental philosophy, there is a surprisingly rich depth of discourse that has already occurred. Fortunately however, the publications concerning Martian environmental ethics are few enough that they can be examined practically in their entirety.

Martyn J. Fogg's thorough bibliography⁴ provides an excellent starting point for research into this esoteric discipline. There he catalogues nearly everything that has been written on the subject of terraforming, from both a technical and philosophical perspective. In addition, he has written articles attempting to summarize the various lines of argumentation that ethicists have used to argue against terraforming. However, my research has led me to conclude that Fogg has missed some poignant areas of concern that would actually strengthen his argument for terraforming from an environmental ethics perspective. Furthermore, in his zeal to combat the various environmental philosophers who have supplied arguments against terraforming Mars, he has neglected to summarize the types of arguments repeatedly used to justify terraforming Mars. Therefore, in this chapter I attempt to pick up where Fogg left off, categorizing, summarizing, and analyzing the publications and arguments for and against terraforming Mars so that later chapters of this thesis can fill in the philosophical blind spots in the discourse and attempt to add

⁴ Martyn J. Fogg, "Planetary Engineering Bibliography," *The Terraforming Information Pages* (January 2009), <http://www.users.globalnet.co.uk/~mfogg/biblio.htm>.

a novel way of dealing with competing value claims as they apply to extraterrestrial environments.

This chapter is structured around objections and responses to the proposal that Mars should be terraformed. To begin, I examine a unique objection to terraforming posed by Robert Sparrow and contrast it with an argument that can be used in favor of terraforming by William Hartmann. Then I analyze the majority philosophical consensus against terraforming as it is expressed by Holmes Rolston, III, Paul York, and Alan Marshall, attempting to compare and contrast these three authors' similar lines of argumentation. These objections to terraforming are met with a critical interrogation of the responses put forward by Chris McKay, Robert Haynes, and Martyn Fogg. This organization allows me to argue the case that certain philosophical arguments for terraforming have been overlooked, arguments that are vitally necessary for reaching an informed decision on the proper moral relationship between humans, the terrestrial biosphere, and the Martian environment.

II. Sparrow's Argument against Terraforming Contrasted with Hartmann's Arguments in Favor of Space Colonization

According to Robert Sparrow, terraforming involves at least two blameworthy vices: blindness to aesthetic value and the sin of hubris.⁵ He uniquely bases this critique on an "agent-based" Aristotelian virtue ethics which recommends that we "follow the example of the virtuous person."⁶ Those who wish to terraform Mars, to manipulate and destroy its environment, lack the virtue of respect for aesthetic value and instead display its opposite, the vice of blindness to that value. Similarly, those wanting to terraform suffer from the vice of hubris, or arrogance,

⁵ Robert Sparrow, "The Ethics of Terraforming." *Environmental Ethics* 21 (1999): 227-45.

⁶ *Ibid.*, p. 230.

believing themselves to be nearly god-like in their ability to transform the natural world to suit their human desires. This critique is not unfounded. Sparrow references the subtitle of Robert Haynes' oft cited treatise in the field, "Ecce Ecopoiesis: Playing God on Mars."⁷ Additionally, the same sentiment can be found in the last sentence of an article written jointly by Robert Haynes and another stalwart advocate of terraforming, Christopher McKay. They write, "To learn that ecopoiesis [creating an ecosystem] is feasible and achievable on another planet would provide an inspiring vision of the role of *Homo sapiens* as a participant in creation."⁸ Although religious overtones are latent in the last part of this statement, the critique Sparrow offers need not be confined to a theological response. Sparrow argues that the vice of hubris can be explained without the necessity of reference to religion as "the burning desire to transgress our limits."⁹ However, this sort of argument seems to advocate a strict adherence to the status quo. Although I have found no mention of such reasoning in my research, one might respond to Sparrow with the counterargument that ending war or sexual abuse seems to be beyond our limits as human beings; yet these are worthy goals and should be pursued anyway. Similarly, one could argue that terraforming Mars is beyond our limitations now, but pursuing such a goal is indeed a noble and worthwhile pursuit. However, many more arguments must be added to the scales before the balance of morality concerning the ethics terraforming Mars can be properly adjudicated.

In fact, Sparrow admits the possibility that terraforming Mars could be done in a way that overcomes the moral deficiencies he identifies with the project. He writes,

⁷ In *Moral Expertise: Studies in Practical and Professional Ethics*, ed. Don MacNiven (New York: Routledge, 1990), pp. 161-83; cited in Sparrow, "The Ethics of Terraforming," p. 236.

⁸ Robert Haynes and Christ McKay, "The Implantation of Life on Mars: Feasibility and Motivation," *Advanced Space Research* 12 (1992): 140.

⁹ Sparrow, "The Ethics of Terraforming," p. 237.

If, for instance, terraforming were a project undertaken with genuine reluctance, in full knowledge of what was being destroyed, because no alternative existed for the survival of the human race, then it would not demonstrate hubris—because hubris involves an enthusiasm for its projects. If it were the case that those involved were fully aware of the beauty that they were destroying and demonstrated genuine regret over the fact, then terraforming might not involve a blindness to beauty either.¹⁰

For Sparrow, it seems the only way a terraforming project could be undertaken is if “no alternative existed for the survival of the human race.” Yet, this is exactly the situation William Hartmann identifies when he argues that “the absence of space travel absolutely guarantees nonsurvival of life on Earth ... the Sun will follow a type of evolution observed in certain other stars, increasing in luminosity and expanding its diameter until the Earth is engulfed and all life on it is destroyed.”¹¹ For Hartmann and others, leaving the Earth is the only alternative to the hard and fast realities of stellar evolution.¹² Although Mars would not provide a permanent solution to the problem of stellar “senescence,” Fogg conceives of it as a stepping stone towards interstellar colonization.¹³ Yet, even Hartmann admits this problem is *very* far off in the future and necessitates no rush toward hastily terraforming Mars over the objections of ethicists.

However, Sparrow’s solution that “until we heal the Earth, we have no claim to any further space”¹⁴ seems far too conservative, retreating to the far opposite end of the spectrum as

¹⁰ Ibid., p. 240.

¹¹ William K. Hartmann, “Space Exploration and Environmental Issues,” *Environmental Ethics* 6 (1984): 235.

¹² For example, Martyn J. Fogg writes, “Yet our Solar System is middle aged and the Sun’s fiery senescence will ensure that the Earth will not remain habitable indefinitely. Total extinction of terrestrial life can thus only ultimately be avoided by vacating our planet for a more benevolent locale elsewhere in the cosmos,” in “Ethical Dimensions of Space Settlement,” *50th International Astronautics Conference* (Amsterdam: International Astronautical Foundation or the International Academy of Astronautics, 1999), p. 7. Similarly, Michael Noah Mautner writes, “Terrestrial Life will be doomed when the Sun becomes extinct,” in “Directed Panspermia: Technological Advances Toward Seeding Other Solar Systems and the Foundation of Panbiotic Ethics,” *Journal of The British Interplanetary Society* 48 (1995): 439. Although Mautner is specifically interested in “directed panspermia,” or the “seeding” of the universe with terrestrial life forms, terraforming accomplishes similar goals and may be considered a baby step toward his ends.

¹³ See Martyn J. Fogg, “Terraforming, as Part of a Strategy for Interstellar Colonisation,” *Journal of The British Interplanetary Society* 44 (1991): 183-92.

¹⁴ Sparrow, “The Ethics of Terraforming,” p. 239.

opposed to writers like Fogg, Haynes, and McKay. While healing the Earth is obviously one of the most essential goals that present and future generations should pursue, one that forms the foundational motivation for the environmental movement and its accompanying philosophy, waiting for the Earth to be healed before making backup plans may be tantamount to “a crazy man’s response to the fire chief’s warnings about fire hazards on a luxury liner. Instead of helping the passengers with lifeboat practice, he burns the lifeboats on the grounds that this will encourage the passengers to be more careful with matches.”¹⁵ This is the response Hartmann might give to arguments such as Sparrow’s, citing the dangerous possibility of catastrophic asteroids or diseases wiping out the only known life in the universe so long as it adheres on a single planet. Hartmann’s argument is the philosophical expression of the adage, “Don’t keep all your eggs in one basket.” Hartmann labels this the “insurance policy” argument and it is one of the most common arguments postulated in support of terraforming Mars.¹⁶

Other writers have provided additional reasons for advocating terraforming Mars sooner rather than later. Although Michael Mautner’s method for propagating terrestrial life forms is different from Fogg’s terraforming,¹⁷ his reason for pursuing it quickly is that “the longevity of this civilization is unknown. Most opinions, as in relation to the Drake equation, hold the lifetimes of civilizations to be finite, due to war or ecological collapse.”¹⁸ Essentially, Mautner fears that if the current civilization, with its space-faring technology, does not spread life to fertile soils throughout the solar system and nearby galaxy soon, the ability to do so may be lost forever. Hartmann echoes this bleak outlook when he envisions a possible future in which there

¹⁵ Hartmann, “Space Exploration and Environmental Issues,” p. 237.

¹⁶ See Hartmann, “Space Exploration and Environmental Issues;” Haynes and McKay, “The Implantation of Life of Mars;” and Fogg, “Ethical Dimensions of Space Settlement.”

¹⁷ See Fogg, “Ethical Dimensions of Space Settlement.”

¹⁸ Mautner, “Directed Panspermia,” p. 439.

is a “slow decay of a civilization that restricts itself to a finite Earth and either runs out of materials or is irreparably damaged by a cosmic accident.”¹⁹ This rationale does seem bleak and implies a faith in technological progressivism, a faith which many environmental philosophers would likely say is misplaced. However, the “insurance policy”²⁰ argument against keeping all of the known biospheric eggs in one planetary basket must at least take its place alongside other arguments for and against terraforming Mars.

III. The Philosophy of Rolston, III Applied to the Ethics of Terraforming: “Abiotic Intrinsic Value”²¹

Sparrow’s argument that terraforming Mars betrays the vice of aesthetic insensitivity has its fuller expression in the philosophies of Holmes Rolston, III, Paul York, and Alan Marshall. These three authors share a common style of reasoning, namely, that Mars should not be terraformed because it has intrinsic value even if nothing on Mars is alive.²² However, such ideas just go too far for the tastes of someone like Martyn Fogg. He sardonically writes, “And whilst it is reasonable to propose that animals with advanced nervous systems might have feelings, and therefore a point of view, surely it is *gross sentimentality* to propose such a thing for rocks.”²³ Yet, perhaps Holmes Rolston, III is on to something when he argues that even nonliving landscapes, abiota, can be said to have intrinsic value, if a person is willing to consider it.

¹⁹ “Space Exploration and Environmental Issues,” pp. 238-239.

²⁰ *Ibid.*, p. 236.

²¹ The terminology “abiotic ... intrinsic value” appears to come from Keekok Lee, “Awe and Humility: Intrinsic Value in Nature – Beyond an Earthbound Environmental Ethics,” *Philosophy and the Natural Environment*, ed. R. Attfield and A. Belsey (Cambridge: Cambridge University Press, 1994); cited in Paul York, “The Ethics of Terraforming,” *Philosophy Now* (October/November 2002), pp. 6-9.

²² While Holmes Rolston, III did not specifically write about the ethics of terraforming, his analysis of “Natural Value in the Solar System” is incredibly relevant for such a discussion. See Holmes Rolston, III, “The Preservation of Natural Value in the Solar System,” *Beyond Spaceship Earth: Environmental Ethics in the Solar System*, ed. Eugene C. Hargrove (San Francisco: Sierra Club Books, 1986), pp. 140-82.

²³ “Ethical Dimensions of Space Settlement,” p. 7 (emphasis added).

Rolston has been typified in the literature as a paragon of “cosmic preservationism,” the philosophy that “the cosmos has its own values ... and its mere existence gives it not only the right to exist, but the right to be preserved from any human intent.”²⁴ He approaches the problem of extraterrestrial abiotic intrinsic value not from the point of view of aesthetics as it relates to virtue specifically, as Sparrow does, but instead as the result of a long chain of extending ethical consideration from persons, to animals and plants and finally even to things. His argument is that non-living matter can be intrinsically valued because it is a project of “formed integrity.”²⁵ By this term he means that the Martian landscape is a product of astrophysical processes that create objects with integrity; they have a particular and unique shape, details, and are complete and whole on their own. He comes to this idea by attempting to prove that abiotic environmental entities can be valued intrinsically, not just instrumentally, which is in line with the main body of his work.²⁶ He begins by critiquing the idea that the only reason non-living things on the Earth are of value is because they resulted in the production of humans who are able to perceive value in those objects. Said another way, Rolston identifies what he believes is a common opinion that humans only value those things that were in the chain of events that caused them to be: the universe, the Sun, the Earth, the terrestrial environment. A place like Mars does not stand in that causal chain of events and therefore seems to be of no value to humans, since it played no part in bringing humans into existence. He identifies the tacit presupposition that, “None of the non-Earth places, unless they once stood in the causal chains that produced Earth or yet stand in support of Earth, are *of value*. They just *are*—brute matter or raw energy; they are only matter-

²⁴ Ibid., p. 6.

²⁵ Rolston, “The Preservation of Natural Value in the Solar System,” p. 154.

²⁶ See Holmes Rolston, III, *Environmental Ethics: Duties to and Values in the Natural World* (Philadelphia: Temple University Press, 1988).

in-motion; so never mind!”²⁷ This is essentially the argument Fogg makes when suggests that it is “gross sentimentality” to attribute intrinsic value to abiota in the same way an animal rights activists might consider a cow intrinsically valuable. However, Rolston examines the concept of randomness and begins to come to the argument that natural value exists in the solar system because of “projective nature.” Nature, he argues, has projects; it does things over time that result in something being created:

Nature is energetic and fertile, evidenced at length in life and mind. That does involve some accident, but it cannot be all accident; it is an immanent property of systemic nature that natural history results.... Projective nature is restless. There is a throwing forward of dynamic events that often culminate in natural kinds, products with wholeness—stars, comets, planets, moons, rocks, mountains, crystals, canyons, seas. The biological and psychological processes that on Earth culminate the astronomical and geological processes are still more impressive, but to be impressed with life in isolation from its originating matrix is to have but half the truth.... Systemic nature is valuable as a productive system, with Earth and its humans only one, even if perhaps the highest in richness or complexity, of its known projects... All the elevated forms have bubbled up “from down below,” and the basic stratum is of value for its projective tendencies, which are *value-able, able to produce value* wherever they result in formed integrity. Crystals, volcanoes, geysers, headlands, rivers, springs, cirques, paternoster lakes, buttes, mesas, canyons—these are also among the natural kinds. They are constantly being built, altered, and their identity is in flux.... they are recognizably different from their backgrounds and surroundings. They may have striking particularity, symmetry, harmony, grace, spatio-temporal unity and continuity, historical identity, story, even though they are also diffuse, partial, broken. They do not have wills or interests, but rather headings, trajectories, traits, successions, beginnings, endings, cycles, which give them tectonic integrity. They can be projects of quality.... Inventiveness in projective nature lies at the root of all value, including sentience and consciousness...there is a negentropic constructiveness.... These performances are worth noticing.... They are loci of value so far as they are products of natural formative process.... It is *productive power*, not merely *experiential power*, that produces value.²⁸

Not only can abiotic nature be valued instrumentally as the “originating matrix” from which the only known life in the universe has sprung, it can be valued intrinsically for the wondrous and fascinating projects it creates. The process of creation is worthy of value and respect without

²⁷ Rolston, “The Preservation of Natural Value in the Solar System,” p. 146.

²⁸ *Ibid.*, pp. 154-57.

reference to whatever use it might have to humans, and irrespective of the fact that what nature creates it may eventually destroy. To recklessly hasten the destruction of a grandiose natural project such as the gradual formation of the landscape of Mars is to devalue the “formed integrity” that systemic nature has brought into being on that planet.

Rolston goes on to argue that diversity in biology, psychology, geomorphology, the solar-system, and the galaxy produces value from projective “formed integrity” on all of these levels.²⁹ Therefore, he is able to postulate six moral injunctions aimed at preserving natural value in the solar system. They are (1) respect any natural place spontaneously worthy of a proper name, (2) respect exotic extremes in natural projects, (3) respect places of historical value (meaning geological history more so than human history), (4) respect places of active and potential creativity, (5) respect places of aesthetic value, and (6) respect places of transformative value (by which he means “places that radically transform perspective”).³⁰ So it is clear that aesthetic value of the sort that is of primary importance to Sparrow is but one part of the vast value equation to Rolston. Projects of “formed integrity” create beauty which should be respected, but it is the process that is creating value that is important, not the merely incidental result which humans may deem as beautiful that is of primary concern.

Finally, Rolston provides some potentially positive arguments in support of space exploration. However, the applicability of these arguments to arguments for terraforming is less compelling, excepting only that terraforming may make it possible for more people to experience the transformative value of extraterrestrial environments. He writes,

Just as it was a good thing for medieval Europe to be dislodged from its insularity, challenged by the Enlightenment and the Scientific Revolution, it will be a good thing for Earthlings to be unleashed from Earth-givens. We can reduce human provinciality with

²⁹ Ibid., pp. 159-62.

³⁰ Ibid., pp. 172-78.

the diverse province of solar-planetary nature. In space, so much is scrambled—what counts as day or night, year or season, hot or cold, up or down, bizarre or normal, what counts as land, sea, sky, the feel of gravity. These disorienting, unsettling discoveries will expand our juvenile perspectives. For intellectual and moral growth one wants alien places that utterly renegotiate everything in native ranges. These will prove *radical* places to understand, not merely in the anthropic sense that our *roots* lie there, but in the nonanthropic sense that they *uproot* us from home and force us to grow by assimilating the giddy depths and breadth of being.... A principle thing to get transformed in space is our earthbound value system.... Space exploration must also be value exploration.³¹

Although Rolston's writings are considerably silent on the topic of terraforming *per se*, most of his work lends itself to the position that he would be strongly opposed to it, unless it could be shown to adhere to the most strict moral criteria—and even then, the wealth of scientific information that could be gleaned from exploring Mars without terraforming it would require a lengthy duration to fully study, necessitating no need to rush into drastically altering the landscape or atmosphere.

IV. Terraforming in the Cultural Imagination

Interestingly, though, his writing in the preceding passage is reminiscent of Robert Zubrin's, the terraforming enthusiast who argues just the opposite, that Mars should be settled as soon as possible (a sentiment shared by science-fiction enthusiasts, pop culture fanatics, and techno-scientific day-dreamers throughout the wider population). He writes, "Mars has what it takes. It's far enough away to free its colonists from intellectual or cultural domination by the old world, and unlike the Moon, rich enough in resources to give birth to a new branch of human civilization."³² The same sentiment is expressed in Kim Stanley Robinson's fictional account of

³¹ Ibid., pp. 178-79 (emphasis in original).

³² Robert Zubrin, *The Case for Mars: The Plan to Settle the Red Planet and Why We Must* (New York: The Free Press, 1996), p. 297.

humans arriving on the red planet. His magnum opus, *The Mars Trilogy*,³³ provides an intriguing picture of what future human interactions with Mars may look like. Robinson, like Zubrin, imagines that Mars will facilitate the creation of a better, more equitable society. For Zubrin, Mars embodies a new frontier,³⁴ a blank slate, not only environmentally, but socially and politically as well. Zubrin and Robinson both compare the formation of a democratic nation founded upon ideals of equality in eighteenth century America with the possibility of doing the same again on a twenty-second century Mars. Their idea is that a frontier creates the conditions for the possibility of a social revolution, a progression forward into a new era of equality, liberty, and rationality. Of course, things could turn out otherwise, as the U.S. constitution is not without its flaws, and it is just as likely we would export our own backwards, corrupt, rag-tag institutions as we would be to establish new ones that stand any chance of supplanting the old.

In Robinson's books, the harshness of the Martian environment facilitates a sort of communist revolution, heralding in an even more participative form of communal government than had existed on Earth.³⁵ Whether reality is likely to imitate fiction in that regard, only time can tell.

For Rolston a similar possibility is implied by the transformation of values. However, it is important to note that for Rolston, space exploration is the key—terraforming may be likely to do more harm than good. Terraforming Mars would likely destroy much of the “formed integrity” of the Martian natural “project.” In Robinson's fictionalized scenario, terraforming

³³ The “Mars Trilogy” consists of Kim Stanley Robinson, *Red Mars* (New York: Bantam Spectra Books, 1993); *Green Mars* (New York: Bantam Spectra Books, 1994); and *Blue Mars* (New York: Bantam Spectra Books, 1996).

³⁴ The frontier theme is similarly emphasized in Hartmann, “Space Exploration and Environmental Values,” pp. 230-1, where he writes, “the opportunity to explore space, changes one of the fundamental underpinnings of the environmental movement: it means the frontiers are not, after all, gone.”

³⁵ Robinson, *Blue Mars*, pp. 109-58. For commentary see, Eric Otto, “Kim Stanley Robinson's *Mars* Trilogy and the Leopoldian Land Ethic,” *Utopian Studies* (2003): 118-35.

literally melts the land all around the characters as temperatures rise towards what terrestrial life forms consider comfortable. One of the characters, Ann Clayborne, laments this wanton destruction of what Rolston would call the “formed integrity” of the Martian surface.³⁶ She is a “Red,” a faction opposed to terraforming projects that advocates preserving Mars in its pristine desert state.

It is unlikely terraforming Mars would stand up to the criteria set forth in Rolston’s “Preservation of Natural Value in the Solar System.” In Robinson’s book, the most visually stunning features of Mars are its gargantuan canyons, in places three times deeper than the Grand Canyon on Earth, and its enormous volcano, Olympus Mons, stretching higher than the Earth’s highest peaks. In the books, terraforming causes massive underground aquifers to burst forth onto the surface, filling low lands with floods of life-supporting water.

Supposing the incredible Valles Marineris were to be filled with water, like a dam creates a reservoir on Earth for agricultural use today, would that violate Rolston’s six injunctions against destroying the value of projects of formed integrity? It most certainly would! The Valles Marineris is (1) worthy of a proper name, (2) an exotic extreme, (3) a fantastic record of geological history, (5) it has great aesthetic value, and (6) experiencing it would undoubtedly be transformative. Therefore, drowning this magnificent canyon and melting its steep cliff walls would violate at least five of the six moral injunctions Rolston set forth. Therefore, if terraforming Mars destroys features such as the Valles Marineris, it would be unethical to do so, at least according to Rolston’s perspective. It is worthwhile to note that this parallels the

³⁶ Robinson, *Blue Mars*, p. 270.

arguments surrounding the creation of Lake Mead and the submerging of Glen Canyon, prompting the Sierra Club to sue, arguing that irreplaceable value was being destroyed.³⁷

Robinson finds a compromise in his fictional work between the advocates of terraforming and those opposed to it. The highest slopes of the ancient volcano, Olympus Mons become a sort of pristine natural park, too high to be subject to the changes terraforming brings at lower altitudes and therefore protected in its historic formed integrity. It is hard to tell whether Rolston would find this compromise acceptable. On the one hand, terraforming Mars would allow more people to experience its transformative value (6); yet it would likely destroy, or at least irreparably alter much, if not all, of the “formed integrity” that is already there.

Essentially, another author, Alan Marshall has argued for the same thing that Rolston has, that the abiotic intrinsic value of extraterrestrial environments, specifically Mars, should be respected.³⁸ However, Marshall spends more time than Rolston does bolstering his argument with the possibility that Mars may have indigenous microbial life, the intrinsic value of which is slightly easier to defend than that of abiota. This line of argumentation³⁹ has caused proponents of terraforming Mars to tirelessly insert caveats into their arguments that terraforming Mars should only be undertaken if Mars is indeed lifeless.⁴⁰

V. York’s Philosophical Analysis of the Ethics of Terraforming

Paul York parallels both Sparrow and Rolston in his argumentative reasoning. Like

³⁷ See Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water* (New York: Viking Penguin, 1993).

³⁸ Alan Marshall, “Ethics and the Extraterrestrial Environment,” *Journal of Applied Philosophy* 10 (1993): 227-36.

³⁹ Seen also in D. Balasubramanian, “Should Mars be Made Habitable?” *Current Science* 61 (December 1991): 712-14.

⁴⁰ See Fogg, “Ethical Dimensions of Space Settlement;” Haynes and McKay, “The Implantation of Life on Mars;” and Christopher P. McKay, “Bringing Life to Mars,” *The Future of Space Exploration, Scientific American Quarterly* (1999): 52-57.

Sparrow's analysis that terraforming would suffer from the vices of aesthetic insensitivity and hubris, York writes that terraforming would constitute a "massive act of vandalism."⁴¹ Furthermore, his argument that we should attribute abiotic intrinsic value to Mars based on the fact that it "is a beautiful and interesting place in its own right"⁴² bridges the gap neatly between Sparrow's aesthetically based value and Rolston's "formed integrity." However, York refers to Keekok Lee instead of Rolston for his "intrinsic value ethics" even though Rolston wrote his analysis of what I have called extraterrestrial abiotic intrinsic value eight years before Lee.⁴³

Regarding Hartmann's "insurance policy" argument, York's choice of words may invite criticism. Although none of the other authors I researched chose to take issue with this particular statement of York's, I believe there has been a missed opportunity to clarify why exactly terraforming Mars may indeed be philosophically defensible. York sums up Hartmann's "insurance policy" argument as follows, "One argument often used in favour of terraforming is that we should settle another planet (Mars) so that human civilization has a backup planet in case something should happen to the Earth."⁴⁴ However, York mistakenly identifies the motivation for terraforming Mars as exclusively anthropocentric. The fact is that many of the arguments put forward by non-philosophically trained scientists and engineers in favor of terraforming Mars are insightfully based on nonanthropocentric considerations. Fogg's reason for terraforming is that the "total extinction of terrestrial life can thus only be avoided by vacating our planet for a more benevolent locale elsewhere in the cosmos."⁴⁵ For Haynes and McKay, "A salubrious Mars, even

⁴¹ York, "The Ethics of Terraforming," p. 7.

⁴² *Ibid.*, p. 8.

⁴³ In fact, York makes no reference at all to Rolston in his article. York cites Lee, "Awe and Humility: Intrinsic Value in Nature—Beyond an Earthbound Environmental Ethics," though my research has revealed that Lee's article has not been commonly discussed in the published literature on this topic.

⁴⁴ York, "The Ethics of Terraforming," p. 7.

⁴⁵ Fogg, "The Ethical Dimensions of Space Settlement," p. 7.

if implanted only with microorganisms, would provide a refuge for life of some kind in the solar system in the event of prolonged nuclear winter or other global catastrophes on Earth.”⁴⁶ Even Hartmann’s “insurance policy” is based on the problem of the “nonsurvival of life on Earth.”⁴⁷ Thus, it is clear that most of the scientists advocating terraforming are expressing nonanthropocentric reasons for doing so. York’s assumption that the motivation for terraforming is anthropocentric is absolutely ungrounded in the literature and serves only to muddy up the real philosophical issues.

In particular Zubrin’s combination of anthropocentric and nonanthropocentric motivations for terraforming is fascinating because he alone among the scientists in my research advocates an argument in favor of terraforming Mars that could counter-intuitively be said to be based on abiotic intrinsic value. Zubrin’s ethical argumentation begins by emphatically stating that “*I would say that failure to terraform Mars constitutes failure to live up to our human nature and a betrayal of our responsibility as members of the community of life itself*,”⁴⁸ invoking some of the language of Leopold’s land ethic to implicitly support an “insurance policy” argument such as Hartmann’s. Even more interestingly, he goes on to write,

Mars could become a second home for life, all life; not only for humans, nor even just “the fish of the sea ... the fowl of the air, and every living thing that moveth upon the Earth,” but for a plentitude of species yet unborn. New worlds invite new forms, and in the novel habitats that a terraformed Mars would provide life brought from Earth could go forth and multiply into realms of diversity yet unknown.... This is the wondrous heritage that we can begin for future generations—not only a new world for life and civilization, but an example of what men and women of intelligence, daring, and vision can accomplish when acting upon their highest ideals. Gods we’ll never be. But the humanity that terraforms Mars will have shown that humans are more than just animals, that we are in fact creatures who carry a unique spark that is worthy of respect. No one will be able to look at the new Mars without feeling prouder to be human. No one will be

⁴⁶ Haynes and McKay, “The Implantation of Life on Mars,” p. 139.

⁴⁷ Hartmann, “Space Exploration and Environmental Ethics,” p. 235.

⁴⁸ Zubrin, *The Case for Mars*, pp. 248-49 (emphasis in original).

able to hear its story without being inspired to rise to the tasks that will lie ahead among the stars.⁴⁹

Not only does this provide further evidence that York was mistaken when he assumed that arguments for terraforming were predominantly anthropocentrically motivated, it introduces an argument based on proactive intergenerational ethics. The novel speciation Zubrin anticipates on a terraformed Mars reveals an ethic that values abiota. Just as Rolston argued that speciation is valuable in and of itself,⁵⁰ Zubrin is a scientist whose argument is actually based on abiotic intrinsic value since species are not technically living but are instead abstract amalgams of individual living organisms. However, this is certainly different from the abiotic preservationism of Sparrow, Rolston, Marshall, and York.

VI. “Moral Calculus”

Yet York’s misapprehension concerning the motivation for terraforming Mars does not invalidate the rest of his philosophical analysis of the moral terrain. In fact, he uniquely identifies a key insight into the ideal philosophical method of addressing the competing value claims. He argues that we will need “some moral calculus that weighs up the competing claims of Mars and humanity ... that will allow us to balance the rights of the various entities—for example, a method for weighing up the right of a stone to exist against the rights of a human being, should these two rights be in conflict.”⁵¹ In service of this proposed analytical tool, he invokes the language of “moral considerability” and “moral significance,”⁵² implicitly referencing Kenneth

⁴⁹ Ibid., pp. 270-71.

⁵⁰ See Rolston, *Environmental Ethics*.

⁵¹ York, “The Ethics of Terraforming,” p. 9.

⁵² Ibid., p. 7.

Goodpaster.⁵³ However, yet again, York casts his net too broadly and fails to realize the subtleties involved in the moral calculus. He pits exclusively human needs and desires against abiotic Martian intrinsic value. However, as should be clear from the words of the authors in favor of terraforming, it is not just human needs that are coming into conflict with abiotic Martian value, but instead the needs of the entire terrestrial biosphere which face utter oblivion if they do not eventually find a way to spread from the insularity of the home planet, Earth. It may indeed be possible to tally up a moral calculus for terraforming Mars, numerous authors have enumerated lists of arguments for and against the proposal.⁵⁴ However, deciding how much value to attribute to the needs of humans, the terrestrial biosphere, potential Martian biota, and Martian abiota continues to be debated. Goodpaster's schema for evaluating competing value claims is immensely useful here as it delineates moral considerability, the obligation we have to consider an entity in moral arguments, from moral significance, the various weights we put on various attributes that matter in making decisions. Goodpaster originally developed this system so that he could talk about how to adjudicate between competing moral claims where both claimants deserve moral consideration, but there are morally significant factors which will bear on the decision reached. For example,

Whether a tree, say, deserves any moral consideration is a question that must be kept separate from the question of whether trees deserve more or less consideration than dogs, or dogs than human persons. We should not expect that the criterion for having "moral standing" at all will be the same as the criterion for adjudicating competing claims to priority among beings that merit that standing.⁵⁵

⁵³ Kenneth Goodpaster, "On Being Morally Considerable," reprinted in *Environmental Ethics: Readings in Theory and Application*, 5th ed., ed. Louis P. Pojman and Paul Pojman (Belmont, CA: Wadsworth, Cengage Learning, 2008), pp. 154-63.

⁵⁴ See Balasubramanian, "Should Mars be made habitable;" Haynes and McKay, "The Implantation of Life on Mars;" Mautner, "Directed Panspermia;" and Martyn J. Fogg, "Terraforming: A Review for Environmentalists," *The Environmentalist* 13 (1993): 7-17.

⁵⁵ Goodpaster, "On Being Morally Considerable," p. 156.

Although Goodpaster only pushes the limits of moral considerability to living beings, biota, we can at least take at face value the claims Rolston and York put forth that Martian abiota also has at least some tentative claim to be considered in moral evaluation. However, although most environmental philosophers might agree with York that the non-survival desires of humans may be less morally significant than the abiotic intrinsic right of Martian landscapes to exist without unnecessary interference, I argue that the absolute survival needs of the terrestrial biosphere may take precedence over the right of abiotic Martian landscapes to remain in their primeval state because of the greater moral significance of living entities over non-living ones. This is exactly what McKay argues in his oft cited article, “I suggest that the primary motivation for this scenario [terraforming Mars] is rooted in the intrinsic value of life principle. Life has precedence over non-life, life has value. A planet Mars with a natural global-scale biota has value vis-à-vis a planet with only sparse life or no life at all.”⁵⁶ Although McKay’s statement lacks the philosophical rigor that might make it more convincing in philosophical realms, the insight appears valid and capable of standing up to the most intense ethical interrogation.

Colonizing and terraforming Mars would serve as a first step toward spreading terrestrial life out of the solar system and into the galaxy at large. In the long run, it satisfies Rolston’s and Sparrow’s criteria for an ethical choice; indeed, it is the only choice that in the end is acceptable ethically. To suggest otherwise may rightly be deemed misanthropic and therefore morally degenerate and worthy of derision.⁵⁷ For Rolston, as an environmental ethicist, life, as it exists now on Earth, is probably the *most* valuable thing in the universe because it represents the

⁵⁶ Christopher P. McKay, “Does Mars Have Rights? An Approach to the Environmental Ethics of Planetary Engineering,” in *Moral Expertise: Studies in Practical and Professional Ethics*, ed. Don MacNiven (New York: Routledge, 1990), p. 194.

⁵⁷ For this reason, Robert Zubrin has come out with a more recent and polemical book, *Merchants of Despair: Radical Environmentalists, Criminal Pseudo-scientists, and the Fatal Cult of Antihumanism* (New York: Encounter Books, 2012).

pinnacle⁵⁸ of “formed integrity.” Condemning all terrestrial life to a burned out coffin of an Earth when another alternative exists would constitute the utmost failure to preserve projective “formed integrity.” It would constitute an extreme blindness to the ultimate aesthetic value of life as the most rare instance of projective “formed integrity” in the known universe. In the long run, leaving the Earth and spreading the seeds of life to lifeless heavenly bodies is the only alternative for the indefinite preservation of the only known incidence of life in the known universe.

York is stereotypically philosophic in his final conclusion, refusing to argue patently against terraforming. Instead, he argues in favor of postulating a “cosmocentric” moral calculus that provides a method of arriving at an answer without providing the answer itself. Yet he is quick to point out the many flaws of arguments in favor of terraforming.

Rolston, Marshall and York all to greater or lesser degrees offer objections to arguments in favor of terraforming based primarily on the concept of abiotic intrinsic value. Rolston’s philosophy is well developed, displaying the foundations for his theory and providing clear moral injunctions deduced from his ethical principles. Marshall’s philosophy is less well developed and accordingly bolstered by the possibility of indigenous biotic intrinsic value on Mars. York’s views are similar to Rolston’s in that he leaves open the possibility of an ethical manipulation of extraterrestrial environments after appropriate moral calculations have been tallied. However, York’s arguments seem biased against terraforming based on his misapprehension that the motivation for terraforming is predominantly anthropocentric rather than non-anthropocentric as an examination of the literature clearly attests.

⁵⁸ Recall that Rolston writes, “Systemic nature is valuable as a productive system, with Earth and its humans only one, even if perhaps the highest in richness and complexity, of its known projects” in “The Preservation of Natural Value in the Solar System,” p. 155, suggesting the complexity of the Earth’s life grants it a higher degree of moral significance despite the egalitarian distribution of moral considerability to both living and non-living entities.

VII. Haynes' and McKay's Arguments in Favor of Terraforming

Four authors form the hard core of the response to objections against terraforming Mars. Neither Chris McKay, Robert Haynes, Martyn Fogg, nor Robert Zubrin appears to be philosophically trained; however, they propose arguments in favor of terraforming which thoroughly engage philosophical subjects such as ethics and environmental philosophy. Two of the authors, Haynes and McKay worked together to write an article which begins to broach the arguments they wish to put forward in favor of terraforming, though each author's individual articles on the subject provide a greater depth of insight into the intense philosophical debates relevant to the terrestrial engagement with the red planet. In this section of the chapter, I intend not only to identify the responses the authors give to the consensus "abiotic intrinsic value" argument put forward by Rolston, Marshall, and York, but also to present and analyze the various lines of ethical argumentation that the scientifically trained Haynes, McKay, Fogg, and Zubrin express in favor of terraforming. This method rounds out the breadth of the literature in the extraterrestrial environmental ethics discourse and makes it possible for me to fill in what my research indicates are oversights by the authors who have published on this debate in the following chapters.

In Haynes' and McKay's jointly written article,⁵⁹ they provide a list of a number of arguments for and against what has been termed "ecopoiesis"⁶⁰ which overlap considerably with terraforming, but differ in a few important ways. Terraforming is defined as "a process of global scale planetary engineering, whereby the environment of a planet is modified so that it can support life. The ultimate goal of a terraforming project would be to start with a world such as

⁵⁹ Haynes and McKay, "The Implantation of Life on Mars."

⁶⁰ A similar list of arguments for and against ecopoiesis is presented in Balasubramanian, "Should Mars be made habitable?" although little original thought occurs there concerning the ethics of the manipulation of the Martian environment.

Mars or Venus and make of it as near a duplicate of the Earth as possible.”⁶¹ This goal differs slightly from ecopoiesis, which technically means “the making of an abode for life,”⁶² implanting microbes, plants, and maybe even eventually animals on another planet in order to create a self-sustaining ecosystem. The first involves making a planet Earth-like, literally “terraformed,” whereas the second merely seeks to make some sort of life possible in a given environment in which there had been either little or no life before. Although sometimes these two are used interchangeably, the specific intention of either is not necessarily to create an ecosystem for the use of humans, but rather to create an ecosystem as an act that is intrinsically good for its own sake, as has been discussed in response to York’s objections.

VIII. Taking Intrinsic Value Too Far, Misapplications of Biocentrism

Haynes and McKay have a peculiar argument in favor of terraforming and ecopoiesis that is unlike anything else in the literature, at least as far as my research has revealed, which is based on a unique understanding of the implications of biotic intrinsic value they find in the works of Arne Naess, Bill Devall, George Sessions, and Tom Regan.⁶³ They write that “if potentially viable forms of life are found on Mars, then any program of planetary engineering should be directed toward the protection and enhancement of that indigenous biota.”⁶⁴ McKay in his individually authored article repeats the sentiment, writing, “Fundamentally humans should terraform Mars: they should undertake the technological activity that will enhance the survival of any indigenous Marian biota and promote global changes on Mars that will allow for maximizing

⁶¹ Fogg, “Terraforming: A Review for Environmentalists,” p. 7.

⁶² Haynes and McKay, “The Implantation of Life on Mars,” p. 133. See also the glossary (Appendix A) at the end of this thesis for Robert Haynes’ definition of ecopoiesis.

⁶³ McKay, “Does Mars Have Rights,” pp. 186, 189-90.

⁶⁴ Haynes and McKay, “The Implantation of Life on Mars,” p. 138.

the richness and diversity of these Martian life forms.”⁶⁵ Their understanding of the intrinsic value of living organisms seems to lead them to a peculiar conclusion. Their rationale seems to be that if some indigenous life on Mars is a good thing, then lots more indigenous life will be an even better thing! Therefore, if we can raise the temperature of Mars, thereby terraforming that planet, we can help that indigenous biota to flourish on Mars just as it flourishes now on Earth. Note that this view is based upon their understanding of the implications of biocentric intrinsic value. Moreover, Haynes and McKay are not alone in this sentiment. Although we have to go back over a hundred years and invoke religious motivations, John Stuart Mill similarly writes of the “religious duty of amending the world, and not solely the human part of it but the material; the order of physical nature”⁶⁶ Mill believed we might make the world better, improve upon the amorality of nature’s random distribution of destruction and death. However, most contemporary environmental philosophers would likely be repulsed by this idea, arguing that nothing we could do to nature could add to its majesty and wonder, only detract from it.

Haynes’ and McKay’s argument here likely has significant problems with it. Chief among those being the dubious supposition that indigenous Martian organisms adapted to survival in that extreme environment would be aided by the manipulation of that planet’s climate. However, far from being anthropocentrically motivated by the concerns of human civilization, at least these two scientists have firmly located themselves within the nonanthropocentric sphere. This particular conclusion drawn by a pair of scientists from a philosophical theory of value goes to show the intriguing potentialities of interdisciplinary debate. Although this particular argument for ecopoiesis and terraforming would likely be

⁶⁵ McKay, “Does Mars Have Rights,” pp. 193-94.

⁶⁶ John Stuart Mill, excerpts from *Three Essays on Religion* (New York: H. Holt, 1874), reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, p. 129.

unconvincing to philosophers, scientists, and the public alike, the fact that they drew such a conclusion shows their willingness to engage in what can sometimes be abstruse philosophical discourse.

In addition to this unique argument in favor of terraforming and ecopoiesis, Haynes and McKay present a whole list of other arguments, though they do not spend the time to elaborate on each and every one. It suffices here to present the sorts of arguments they put forward to serve as a framework for the discussion of their arguments as well as compare their synopsis to the philosophies expressed by the other authors relevant in the discourse. Arguments against ecopoiesis include the difficulties of long time-scales, the exorbitant costs, the unnecessary diversion of resources, the possibility of life already on Mars, preservationism (such as that advocated by Rolston⁶⁷), the possibility of irreparable damage to the Martian landscape, the fact that “humans have made such a bad job of managing Earth that it is presumptuous to imagine that they can become wise and successful planetary engineers,”⁶⁸ future interplanetary war, the unexpected evolution of deadly pandemic pathogens (which is similar to fears about terrestrial forms of bioengineering and GMOs on Earth today), and the “hubris” of the scheme (similar to Sparrow’s argument⁶⁹). In favor of ecopoiesis, the authors cite the benefits of a breathable atmosphere to exploring astronauts and long-term human outposts, the “insurance policy” argument (similar to Hartmann’s⁷⁰), fostering of international cooperation, the advancement of ecological sciences which might aid in the solution of terrestrial environmental problems (although the authors do not elaborate, such problems might include species loss and climate

⁶⁷ See Rolston, “The Preservation of Natural Value in the Solar System.”

⁶⁸ Haynes and McKay, “The Implantation of Life on Mars,” p. 138.

⁶⁹ Sparrow, “The Ethics of Terraforming.”

⁷⁰ Hartmann, “Space Exploration and Environmental Issues.”

change), the postulate that “if living planets have greater intrinsic value than dead ones, then it should not be regarded as mere hubris that *Homo sapiens* should seek to propagate life in the solar system”⁷¹ (which stands in direct contradiction to Sparrow’s view and provides a possible solution to York’s “moral calculus”), the creation of a “communal purpose” for humans, and that it might “provide a peaceful form of adventure in the spirit of William James’s ‘moral equivalent of war.’”⁷² However, Haynes and McKay, provide a counter-point to their own argument, pointing out scenarios in which terraforming would be unethical just as Sparrow and Rolston imagined scenarios in which it would be ethical. They write,

... as pointed out by Pollack and Sagan,⁷³ some of the conceivable modes of planetary engineering would be so damaging to the planet, so destructive of irreplaceable sources of scientific information, and so uncertain in their consequences as to be ethically unacceptable. We subscribe fully to their conclusion that advocates of planetary engineering should first be advocates of the thorough scientific exploration of Mars and other bodies in the solar system. Much further exploration of Mars is in any case a necessary prerequisite for assessing the feasibility of ecopoiesis.⁷⁴

Sparrow, Rolston, Haynes and McKay are all trying to cover their moral bases, stipulating different criteria that would result in terraforming either being ultimately ethical or unethical depending upon the way in which it was carried out. Haynes’ and McKay’s argument attempts to make clear that they have heeded the ethical stipulations of Alan Marshall “that a planet with an indigenous biota should be left alone.”⁷⁵ This position is perhaps counter-intuitive since their conception of biotic intrinsic value leads them to propose bolstering indigenous Martian biota through technological means. However, they likely feel they are in line with Marshall and in fact

⁷¹ Haynes and McKay, “The Implantation of Life on Mars,” p. 139.

⁷² Ibid.

⁷³ J. B. Pollack and Carl Sagan, *Planetary Engineering* (at the time, in press, 1991), referenced in Haynes and McKay, “The Implantation of Life on Mars,” p. 138.

⁷⁴ Haynes and McKay, “The Implantation of Life on Mars,” p. 138.

⁷⁵ Marshall, “Ethics and the Extraterrestrial Environment,” p. 235. In response to this sentiment, McKay writes “If, and only if, there is no indigenous Martian life then humans should alter the global environment of Mars so that the maximum diversity of Earth life can be accommodated there.” McKay, “Does Mars Have Rights,” pp. 193-94.

doing him one better, instead of turning a cold shoulder while the fragile Martian life forms suffer the cruel vicissitudes of an apathetic universe, they promise the “protection and *enhancement*”⁷⁶ of indigenous extra-terrestrial organisms in recognition of our shared intrinsic value as living organisms. Furthermore, their argument is scientifically cautious, advocating the thorough exploration of Mars for indigenous life forms before hasty geo-engineering projects can destroy what would certainly be the most important discovery in human history, provided of course, that there is indeed some life there to be discovered. It is perhaps notable that these authors appeal to scientific information as a fundamental locus of value on Mars as opposed to the aesthetic and/or intrinsic value that Sparrow and Rolston and others identify.

IX. Two Metaphysical Implications of Evolutionary Biology:⁷⁷ Organicism and Reproduction

In the end they cap off their article by writing that “ecopoiesis ... would provide an inspiring vision of the role of *Homo sapiens* as a participant in creation. Perhaps the deepest reason for implementing ecopoiesis would be the consistency of this project with ... the reproductive and proliferative imperatives that characterize life itself.”⁷⁸ Although they merely end with this short kernel of insight, my research has led me to believe that there is significant and potent argumentative force that has yet to be elaborated hidden within this concluding intuition. These scientists seem to hint at a metaphysical possibility above and beyond the strict rigor of observation and experimentation that dominates their field. They suggest the possibility that essentially all living things, and even life itself when taken as an amalgam, do two things, they metabolize and reproduce. By helping the terrestrial biosphere to “reproduce” itself by

⁷⁶ Haynes and McKay, “The Implantation of Life on Mars,” p. 138.

⁷⁷ The title of this subheading is an homage to J. Baird Callicott’s “The Metaphysical Implications of Ecology,” which can be found in *In Defense of the Land Ethic: Essays in Environmental Philosophy* (Albany: State University of New York: 1989), pp. 101-114.

⁷⁸ Haynes and McKay, “The Implantation of Life on Mars,” p. 140.

establishing it on another planet, humans can intimately participate in a grandiose and meaningful way in what it most fundamentally means to be alive. Furthermore, by taking part in such a project humans show themselves to be aligned with the goals of life itself. Paradoxically, the hyper-technology that would make such a project possible is exactly the thing that brings humans into closer “harmony with nature.” This possibility seems absolutely contrary to the main thrust of environmentalism and environmental philosophy which tends to perceive high technology and industry as a major contributor to our contemporary environmental problems. Indeed, York criticizes Robert Zubrin, a scientist who wrote the preeminent book *The Case for Mars: The Plan to Settle the Red Planet and Why We Must*, for this very reason. York writes that Zubrin’s argument in favor of terraforming represents a faith in progress, “extolling the virtues of pioneering, development, and economic growth, a set of values that is deeply implicated in the Earth’s current environmental problems.”⁷⁹ However, this line of argumentation, that terraforming technology can harmonize humans with nature, is not intended to run contrary to the commonly held analysis of our environmental problems that York identifies, but merely to display the ambivalence of technology as a tool. Technology and industry have caused many of our environmental ills, but it is the way in which technology is used, not the technology itself, that determines the negative or beneficial consequences of that technology.⁸⁰

Haynes identifies a similar argument when he writes in his individually authored article that “it is possible that ecopoiesis on Mars could create a born-again Gaia on our sister planet.”⁸¹ Such a statement echoes the organicism expressed by Leopold when he wrote early in his career

⁷⁹ York, “The Ethics of Terraforming,” p. 8.

⁸⁰ I am indebted to Dr. David Kaplan for these insights gleaned from his seminar on the Philosophy of Technology (Fall 2009) at the University of North Texas. See his edited volume, *Readings in the Philosophy of Technology*, ed. David M. Kaplan (Lanham, MD: Rowman and Littlefield, 2004).

⁸¹ Haynes, “Ecce Ecopoiesis,” p. 173.

that “It is at least not impossible to regard the earth’s parts—soils, mountains, rivers, atmosphere, ect.—as organs or parts of organs, of a coordinated whole, each part with a definite function ... we would have all the visible attributes of a living thing.”⁸² Although McKay uses Christopher Stone’s article “Should Trees have Standing? Toward Legal Rights for Natural Objects” to address his title’s question of “Does Mars have Rights?” it is interesting to note that Stone also had organistic leanings. Stone writes, “I do not think it too remote that we may come to regard the Earth, as some have suggested, as one organism, of which Mankind is a functional part.”⁸³ Organicism, conceiving of the Earth as one living super-organism, seems to be a strong argument implicit in both Haynes’ and McKay’s publications in favor of terraforming Mars. Hopefully it is not too crass to broach the possible conclusions, but along this line of thinking humans with advanced interplanetary technology can be conceived of not only as the “mind” of the Earth with our capacity for language and rational thought, but also as the reproductive “organs” of the Earth super-organism. We have the unique ability through our technological savvy to intentionally do what stray meteorites do by pure randomness and chance; we can intentionally help spread life throughout the solar system and even eventually the galaxy. This line of argumentation has not been given philosophical interrogation at least as far as my research has suggested. It seems instead that environmental ethicists such as Sparrow, Rolston, Marshall, and York have been too entrenched in their conservatism and initial repugnance to the thought of terraforming to examine the intersections of Leopold’s and Stone’s organicism when applied to arguments Haynes and McKay have offered in support of terraforming. Likely the ubiquitous derogatory

⁸² Aldo Leopold, “Some Fundamentals of Conservation in the Southwest,” reprinted in J. Baird Callicott, “The Conceptual Foundations of the Land Ethic,” in *Companion to A Sand County Almanac: Interpretive & Critical Essays*, ed. J. Baird Callicott (Madison, WI: University of Wisconsin Press, 1987), p. 201.

⁸³ Christopher D. Stone, “Should Trees Have Standing? Towards Legal Rights for Natural Objects,” reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, p. 307.

connation such high technology has garnered in environmental philosophy, rightful as it may be, predisposed Rolston and others to argue against terraforming and ecopoiesis.

In addition to Haynes' and McKay's misapprehension regarding the obligations imposed by bio- and eco-centric ethics, and both Haynes' and McKay's gold nugget of an insight concerning the implications organicism has for arguments in favor of terraforming; Haynes provides a number of other unique arguments in favor of terraforming. With regard to the technical issues involved in terraforming and ecopoiesis, he concludes that such a project would be on par with great human achievements like the construction of the Pyramids at Giza or the Great Wall of China.⁸⁴ In response to objections that the timescales involved in terraforming are too great to be dealt with by humans, he notes that the storage of nuclear waste similarly involves such distant ethical time horizons.⁸⁵ His argument that the knowledge gained during projects of ecopoiesis would greatly enhance the human ability to deal with terrestrial environmental problems seems particularly convincing.⁸⁶

Furthermore, he identifies one major ethical issue that could work strongly against arguments in favor of ecopoiesis. Haynes insightfully reveals that in projects of ecopoiesis, living organisms would be used as means to an end rather than respected as ends in themselves.⁸⁷ Although he does not use this particular philosophical language, the philosophical concern he forthrightly acknowledges lends credence to his article and enriches the discourse on extraterrestrial environmental ethics. While the use of animals as means to an end is relatively widely socially accepted, philosophical arguments pointing out the ethical deficiencies in such

⁸⁴ Haynes, "Ecce Ecopoiesis," p. 170.

⁸⁵ Ibid., p. 171.

⁸⁶ Ibid., p. 180.

⁸⁷ Ibid., p. 179.

behaviors have been the bread and butter of the animal liberation movement and environmental philosophy as a whole. At least two possible future scenarios are conceivable concerning this particular facet of the debate. In one future, society has no ethical qualms about using living organisms as a means to an end, in effect mimicking our contemporary society. Presumably, this society would then have no problems with ecopoiesis—no problem because of the conflict Haynes identifies, that is. However, if animal liberation and environmental ethics change the perceptions of the society of today, turning the society of tomorrow into one less likely to accept as ethical the use of living organisms as mere means to an end, then that future society might not support projects of ecopoiesis. As a side note, if the future society is significantly utilitarian, the use of living organisms as means to an end might be acceptable if and only if this slight injustice is in service of what is perceived to be a larger benefit of spreading life to another planet.

X. Where Haynes Gets It Wrong: Abiotic Intrinsic Value is More Than Just a Straw Man

In addition to uniquely identifying this particular facet of the ethical implications of ecopoiesis, Haynes does, whereas McKay does not, directly deal with the abiotic intrinsic value/cosmic preservationism impasse. Unfortunately however, Haynes' response is unconvincing, setting up a straw-man argument that he easily knocks down. He is ultimately dismissive of Rolston's arguments, supposing that they lead to absurd results. Missing the subtlety of Rolston's philosophy, he writes,

Holmes Rolston (1986) has carried this line of thinking to its logical conclusion and would grant value and (I infer) moral considerability, to all objects of "formed integrity" in the cosmos, i.e. landscapes, seascapes, rocks, moons, planets, indeed anything "worthy of a proper name." Clearly such an ethic is neither homocentric nor geocentric. However, its strict application would prohibit not only the planetary engineering phase of ecopoiesis, but also much civil engineering here on Earth. It also raises the specter of a

possible moral obligation to prevent catastrophic collisions in space between, say, other planets and asteroids, should we acquire the technical capacity to perform such feats.”⁸⁸

What Haynes misses is that simply recognizing moral value does not necessarily imply that such value is absolutely untouchable by human hands. Just as Sparrow wrote that “if it were the case that those involved were fully aware of the beauty that they were destroying and demonstrated genuine regret over the fact, then terraforming might not involve a blindness to beauty,”⁸⁹ it is possible for humans to recognize the abiotic intrinsic value present on Mars even while they are manipulating it. The possibility that humans would be morally required to “prevent catastrophic collisions in space between ... other planets and asteroids” is an absurd straw man, not a logical conclusion derived from Rolston’s ethic. While both humans and asteroids are natural, humans have the capacity to behave in either morally responsible or morally reprehensible ways, whereas asteroids do not. Therefore human engagements with other extraterrestrial environments necessitate ethical deliberation whereas the interaction between amoral extraterrestrial entities does not. Haynes does his argument and all arguments for terraforming a disservice by not fully engaging in Rolston’s philosophy with good faith for his arguments. The same distinction between moral considerability and moral significance is necessary here. Although Rolston makes no mention of this differentiation in the publications I have researched, the obvious applicability of the concept to the moral quandary of abiotic intrinsic value is sufficiently captured by York⁹⁰ and implied by Rolston’s admission that some interaction with extraterrestrial environments can in fact be ethical so long as they recognize and respect the abiotic value. To dismiss the argument out of hand is to refuse to engage a legitimate ethical problem. Although some might use abiotic

⁸⁸ Ibid., p. 177.

⁸⁹ Sparrow, “The Ethics of Terraforming,” p. 240.

⁹⁰ Keep in mind that York, “The Ethics of Terraforming,” introduces the “moral calculus” involving moral considerability and significance in the extraterrestrial environmental ethics discourse.

intrinsic value to argue for an absolute hands-off approach to the Martian environment as Marshall does,⁹¹ Sparrow and Rolston both admit the possibility that some manipulation of abiotic intrinsic value may be possible provided that the engagement acknowledges that value.

One might make the pragmatic argument that it makes no difference whether future Martian terraforming crews acknowledge the existence of abiotic intrinsic value if it does nothing to prevent the destruction of that value. Perhaps doing so will be convincing to some die-hard opponents of terraforming, but I believe there is no need for extremism or reactive fundamentalism and retrenchment. As Sparrow writes, it is the “character flaw” that allows such blindness to value that is morally blameworthy. Rolston provides the advice that “our forefathers would have left us a better New World had they been concerned sooner about preserving what they found there.”⁹² He is not entirely against the utilization of extraterrestrial environments; rather, he fears the wholesale and wanton destruction of projects of formed integrity. Here it is necessary to remember Kant’s second formulation of the categorical imperative, which although it was originally applicable only to humans, has been extended to cover biotic and even abiotic environmental entities. “So act as to treat humanity, whether in thine own person or in that of any other, in every case as an end-withal, never as a means *only*.”⁹³ For Kant, using people as a means to an end without any regard for their fundamental dignity as rational beings was a breach of the categorical imperative. However, using people as a means to an end, all-the-while respecting them also as rational beings deserving of moral worth, should not be considered a breach of moral appropriateness. As biota and abiota comes to be considered worthy of moral

⁹¹ Marshall, “Ethics and the Extraterrestrial Environment.” Although Marshall does retreat slightly to the more easily defended position that Martian microbes may potentially exist on the planet, the biotic intrinsic value of which should be respected.

⁹² Rolston, “The Preservation of Natural Value in the Solar System,” p. 171.

⁹³ Immanuel Kant, “Foundations of the Metaphysics of Morals,” reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, pp. 62-65 (emphasis added).

consideration, the same obligations apply. Thus we can use abiotic extraterrestrial environments as a means to an end while still respecting their worth as ends in themselves. One way this might be accomplished is by preserving representative portions of extraterrestrial environments as natural parks, in which extraterrestrial projects of formed integrity can be experienced in their primeval configuration.⁹⁴ More on the topic of recognizing and respecting abiotic intrinsic value is explored in the following chapters of this thesis.

Haynes' dismissal of abiotic intrinsic value through a straw-man argument does not negate the validity of the rest of the work he and McKay did to attempt to philosophically engage extraterrestrial environmental ethics. All of these arguments, McKay's strange argument that valuing Martian microbes obliges us to aid them in flourishing, the insightful intersections organicism may have with terrestrial/Martian ethical interactions, and the analysis that ecopoiesis involves using life forms as a means to an end, represent the ethical response scientists have formed to the objections to terraforming philosophers have raised revolving predominantly around abiotic intrinsic value. Yet one scientist stands head and shoulders above the rest when it comes to dealing with philosophers on their own turf. Fogg's passion for terraforming and philosophical competence make him a formidable opponent for the likes of Sparrow, Rolston, Marshall and York.

XI. Fogg's Case for Terraforming as Morally Desirable and Good

Fogg's article, "The Ethical Dimensions of Space Settlement"⁹⁵ is the most comprehensive analysis of the varieties of ethical domains impacting potential future space

⁹⁴ See Marshall, "Ethics and the Extraterrestrial Environment," p. 235; and Rolston, "The Preservation of Natural Value in the Solar System," p. 170ff.

⁹⁵ In this article Fogg summarizes, expands upon, and places into wider context the earlier work on the topic, including Don MacNiven, "Environmental Ethics and Planetary Engineering," *Journal of the British Interplanetary*

settlement scenarios. He identifies four ethical theories, each of which arrives at a distinct ethical conclusion regarding space settlement. While his reductionistic categorization of the varieties of environmental ethics may reflect his training as a scientist, essentially his insights about the relevance of different moral frameworks for space settlement are sound. He creates a table (Table 1) which is reprinted below, outlining his analysis of what he considers to be the four relevant ethical points of view.⁹⁶

Table 1: Four Relevant Ethical Points of View

<i>Ethical Theory</i>	<i>Central Moral Principle</i>	<i>Basis of Intrinsic Value</i>
Anthropocentrism	Categorical Imperative	Rational and Moral Capacity
Zoocentrism	Principle of Utility	Individual Consciousness
Ecocentrism	Principle of Respect for Life	All Life
Preservationism	Principle of the Sanctity of Existence	Uniqueness or “Formed Integrity”

He identifies Kant as the preeminent moral exponent of anthropocentrism, accurately naming rationality as the defining factor that separates humans from non-humans in Kant’s philosophy. He then proceeds to determine the relevance and conclusions that can be drawn for space settlement based on such an ethical framework. This methodical application of ethical theories to the moral quandary of space settlement combines the best of scientific rigor with the clear philosophical examination of fundamental principles. Each ethical theory is like a variable to be tested in the thought experiment of terraforming Mars. For Kant’s anthropocentric categorical imperative, Fogg deduces that space settlement would be good if it benefits the

Society 48 (1995): 441-43, which is by a philosopher. Another minor article uses a similar framework, Robert Pinson, “Ethical Considerations for Terraforming Mars,” *Environmental Law Reporter* 32 (November 2002): 11333-341, but that author’s conclusion that “The most applicable environmental ethic to terraforming Mars is anthropocentrism. It puts our interests at the forefront while ensuring the existence of all life. It seems obvious that we should give ourselves the highest level or intrinsic worth since we are the ones placing the value” (p. 11341) seems to lack insight, depth, and careful consideration and therefore will not be discussed further.

⁹⁶ Reproduced from Fogg, “Ethical Dimensions of Space Settlement,” p. 3.

human race and only bad “if the expense of space settlement could be shown to incur a net detriment to human well-being.”⁹⁷ This insight is unique to Fogg’s analysis, appearing nowhere else in the literature and attracting merit for Fogg’s philosophical rigor. However, Fogg’s analysis stops there, neglecting to probe deeper into the ways in which such “net detriments” may occur. Neither does he evaluate the likelihood of such scenarios coming to pass. This vacancy seems to be an oversight in Fogg’s article and in the discourse on extraterrestrial environmental ethics in general.

My research has revealed that there is a glaring lack of discussion regarding the human consequences that manipulating the Martian, or for that matter any extraterrestrial environment might have. Although Fogg’s rigorous method identifies this realm of concern, the fact that he leaves the consequences of this conclusion unexamined opens a niche which I believe a certain area of environmental philosophy can snugly fill. The next chapter of this thesis is an attempt to correct this oversight utilizing the unique insights of the environmental justice movement in both activism and philosophy. The calcification of the debate on extraterrestrial environmental ethics around abiotic intrinsic value has distracted all of the publishing authors from a thorough examination of the human consequences of terraforming, in terms of procedural justice, participative justice, recognition justice and distributive justice. Furthermore, an environmental justice critique exposes additional problems in terms of identity recognition, environmental colonialism, and has poignant implications for questions of anthropocentric climate change, and how to count abiotic intrinsic value. Environmental justice looks at the ways in which humans affect the environment, which in turn affects other humans. An example on Earth might be the disproportionate impact petroleum refineries have on disenfranchised communities living in

⁹⁷ Ibid., p. 4.

“Cancer Alley” along the Mississippi.⁹⁸ On Mars a similar situation could occur in which racial minorities and the poor are lured into dangerous jobs for higher wages under false assumptions about safety. The next chapter will attempt to expose, catalog and analyze the various potential environmental injustices that may occur because of the manipulation of the Martian environment, comparing potential future scenarios to their analogs in Earth’s recent history. By attempting to foresee future inequitable distributions of environmental benefits and burdens associated with terraforming Mars, the ethical discourse concerning extraterrestrial environmental philosophy can be broadened and deepened. Further considerations for dealing with nonanthropocentric and abiotic intrinsic value will continue through the third chapter and into the fourth.

The next level of ethical theory Fogg analyzes is what he calls “zoocentrism,” although it seems he simply should have labeled this utilitarianism. This, he correctly determines, is a form of ethical “extentionism”⁹⁹ of the type mentioned earlier with regard to Rolston’s abiotic intrinsic value theory. Fogg cites animal liberationists such as Tom Regan,¹⁰⁰ though Peter Singer would have been a better exemplar of an animal liberationist whose central moral principle is utility. It seems that Fogg’s analysis is lacking in that the relevance of “zoocentrism” for space settlement is the least thoroughly developed. It may be the case that he merely included the concept since it fit so logically between anthropocentrism and ecocentrism, both of which are more fully explored. According to Fogg’s summary, zoocentrism is only concerned with the “higher animals”¹⁰¹ and thus the ethical judgment regarding space settlement merely depends

⁹⁸ See, for example, the movie *Blue Vinyl*, directed by Daniel B. Gold and Judith Helfand (2002).

⁹⁹ Fogg, “Ethical Dimensions of Space Settlement,” p. 5.

¹⁰⁰ *Ibid.*, pp. 4-5.

¹⁰¹ *Ibid.*, p. 5.

upon its effect on these particular organisms. Hence, if space settlement benefits humans and higher animals, it is moral; if it does the opposite, then it is not moral. Basically, he writes, zoocentrism implies the same ethical stance as anthropocentrism when it comes to space settlement.

XII. Delineating Ecocentrism and Biocentrism

However, ecocentrism creates an entirely different ethical response to the question of space settlement. Fogg conflates ecocentrism and biocentrism, assuming the two to be similar enough not to merit differentiation. This misperception may have some significance for extraterrestrial environmental ethics, though the severity of this mistake is likely rather small. Specifically, biocentrism is an ethical theory that takes living organisms to be of central moral concern. A premier example might be Albert Schweitzer's "reverence for life" ethic which goes so far as to give the example of a man who "should he pass by an insect which has fallen into a pool, he spares the time to reach it a leaf or stalk on which it may clamber and save itself."¹⁰² This can be contrasted with the ecocentrism of Leopold which considers ecosystems and whole species to be of fundamental moral concern. Leopold was an avid hunter who had no qualms about letting individual organisms die or be killed so long as the ecosystem remained healthy.¹⁰³ Applied to extraterrestrial environmental ethics, this distinction may be of some small value. The way in which a biocenterist's viewpoint may differ from an ecocentrist's might be elucidated best by an example. As was discussed earlier, Haynes identified the potential for moral objection to the use of life as a means to an end were ecopoiesis to be pursued. Consider a scenario in

¹⁰² Albert Schweitzer, "Reverence for Life," reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, p. 133.

¹⁰³ See particularly the chapter "Thinking like a Mountain" in Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (Oxford: Oxford University Press, 1949).

which genetic engineers engaged in active ecopoiesis create and spread one type of microbe that synthesizes naturally occurring carbon-dioxide into a synthetic chlorofluorocarbon that more effectively traps heat as a greenhouse gas, warming the temperature of Mars and making more life possible. Then suppose after some time scientists manage to create a microbe that is much more efficient at doing the same thing. They release this microbe onto the planet which quickly replaces the earlier microbe. The biocentrist might find doing so unethical since the value of the first microbe is not respected when scientists get rid of it in favor of a new life form. However, the ecocentrist might have no problem since the result is the creation of a more self-sufficient ecosystem.

Nonetheless, Fogg conflates the two, basing his categorization on Leopold's land ethic.¹⁰⁴ Applying this conflated eco-/biocentrism to the terraforming thought experiment then, Fogg concludes that "terraforming Mars is only moral if it is truly a barren world."¹⁰⁵ If there is life on Mars, then eco-/biocentrism has two potential counsels. One is that the value of that indigenous life obliges us to help it to flourish, which is the argument McKay and Haynes make. The second is that if life exists on Mars, then we should respect its right to exist unperturbed in its natural state, precluding any modification of its environment. However, if there is no life on Mars, then eco-/biocentrism would counsel that we should terraform the planet in order to maximize the potential of terrestrial life forms that could flourish on the surface. Fogg makes an argument similar to Hartmann's "insurance policy" idea here,¹⁰⁶ but seems to miss an area of extreme potential.

¹⁰⁴ Fogg, "Ethical Dimensions of Space Settlement," p. 5.

¹⁰⁵ Ibid., p. 6.

¹⁰⁶ Ibid., pp. 5-7.

He does not recognize that eco-/biocentrism may actually hold within its theoretical purview the potential to create a strong argument in favor of terraforming. Either of these ethical theories, ecocentrism or biocentrism, may actually be an environmental philosophy in good standing in the philosophical community which supports the position that Mars should be terraformed. This is both ironic and counterintuitive since most of the philosophers engaging the topic of terraforming have allied themselves against its implementation. So for a well respected and developed environmental ethic to actually logically necessitate terraforming is quite a role reversal that works in favor of the scientists defending terraforming as a moral desideratum. Yet none of the authors in my research have made more than tentative forays into eco-/biocentrism as a strong foundation for arguments in favor of terraforming. McKay hints at the possibility when he writes, “if, however, Mars has no life and we believe that life in itself has intrinsic worth, then a Mars replete with life could be considered of more value than today’s Mars, beautiful but lifeless.”¹⁰⁷ This view provides a possible solution to York’s desire for a moral calculus, deciding that life is of more moral significance than non-life. Zubrin offers an insightful kernel, writing “*I would say that failure to terraform Mars constitutes failure to live up to our human nature and a betrayal of our responsibility as members of the community of life itself.*”¹⁰⁸ The Leopoldian language implies an obligation to engage in terraforming as a moral good based on an ecocentric concern for the intrinsic value of terrestrial organisms and ecologies. Although this statement may borrow considerably from the same sentiment that motivates Hartmann’s “insurance policy” argument, it seems the responsibility implied here is proactive rather than just reactive in the face of threats to the future continuation of life. Giving back to the terrestrial biosphere which gave rise to our human being by helping it to span the vacuous expanses of

¹⁰⁷ McKay, “Bringing Life to Mars,” p. 57.

¹⁰⁸ Zubrin, *The Case for Mars*, pp. 248-49 (emphasis in the original).

space in order to find fertile new homes seems to be the nature of the responsibility advocated here by a non-philosophically trained scientist. However, Zubrin's statement is just that, a single sentence italicized but without elaboration in his book-length treatment of the topic of terraforming Mars. In order to understand the full ethical implications that bio- and ecocentrism may be said to have for terraforming Mars, we must embark upon a thorough philosophical investigation. We might appeal to that paragon of ecocentrism Leopold, as Fogg does and consider the applicability of his paramount ethical maxim to terraforming. In that sense then, would terraforming "preserve the integrity, stability, and beauty of the biotic community?"¹⁰⁹ If terraforming provides an insurance policy, ensuring that terrestrial life forms could be preserved in the face of an astronomical catastrophe, then it would seem that terraforming does satisfy Leopold's criteria for being morally "right." However, it is possible to imagine an opposite scenario coming to pass of the sort York seems to fear in which in a rush of technological progressivism to terraform Mars, we end up causing more climate change on Earth with increased rocket launches and driving more species to extinction, thereby failing to "preserve the integrity, stability, and beauty of the biotic community." Such scenarios are evaluated in the subsequent chapters of this thesis. Yet Zubrin is hopeful that terraforming can be conducted in a way that is right, ethical and just. In this way his argument seems to align itself with Fogg, Haynes, and McKay, hinting but doing little further to elaborate the underdeveloped bio-/ecocentric argument that we value the value of life by helping it to flourish.

XIII. Valuing the Value

¹⁰⁹ Leopold, *A Sand County Almanac*, p. 224-25.

In effect the argument runs that humans show how valuable life is to them by helping to spread it into the universe. At the risk of becoming pedantic, the difference between the word *value* as a verb and *value* as a noun may capture the subtleties of the relationship between humans and nonhuman life in this context. Thus, humans value (*verb*) the value (*noun*) of life by protecting and promoting it in the universe. Tellingly this claim dovetails nicely with Leopold's ecocentric maxim, "a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."¹¹⁰ Although none of the authors make this connection quite so explicitly, it seems Leopold's maxim could be used in great service of arguments in favor of terraforming. Essentially this approach is what Hartmann and Fogg's "insurance policy" argument does. In order to ensure that the terrestrial biota is preserved in the face of cosmic catastrophes, taking all of our life's "eggs" out of our single terrestrial "basket" is the right thing to do according to Leopold's criteria. However, it is possible to do Leopold one better: although none of the authors I have researched have made the argument this explicitly, not only can we *preserve* biotic community, we can *promote* it. After all, Fogg writes, "maximising the diversity of life is one of the principles of ecocentrism."¹¹¹ Terraforming and ecopoiesis not only preserve the biotic community, they act with the biotic community's interests in mind. Specifically, it acts with the interest in reproduction in mind, reproduction at the level of whole species and ecosystems instead of individual organisms. The eco-/biocentric ethic Fogg hints at combines with the organicism that Haynes and McKay hint at to produce an inductive sorites along the lines of:

Premise 1.) The genetic goal of all living organisms is to reproduce.

¹¹⁰ Leopold, *A Sand County Almanac*, pp. 224-25, cited in Fogg, "The Ethical Dimensions of Space Settlement," p. 5.

¹¹¹ Fogg, "The Ethical Dimensions of Space Settlement," pp. 5-6.

Premise 2.) The Earth is like an enormous living organism. (Organicism)

Intermediate Conclusion 1.) Therefore, the degree to which the Earth's ecologies resemble one super-organism is the extent to which the Earth can be said to have an inherent goal, teleology, drive or impulse to reproduce.

Premise 3.) Terraforming Mars could accomplish the goal of reproducing the terrestrial biosphere.

Intermediate Conclusion 2.) Therefore, terraforming Mars can be said to be in line with the Earth's ecologies' inherent teleologies.

Premise 4.) Being "in line with the Earth's ecologies' inherent teleologies" is a good thing to do.

Final Conclusion) Therefore, terraforming Mars would be a good thing to do.

Fogg hints at this argument when he quotes Frederick Turner, "In this work [terraforming], we may become the seed-vectors and pollinators of the universe."¹¹² This position parallels Haynes' and McKay's hope of becoming a "participant in creation."¹¹³ Obviously, there are hurdles to be overcome before this argument can be accepted. The argument is based on a metaphor, the strength of which can be debated. Furthermore, the teleological characteristic of living organisms could be critiqued. However, the possibility of technology paradoxically bringing humans into closer alignment with nature's inherent goals and teleologies recurs consistently in the philosophical arguments of the scientists engaging extraterrestrial environmental ethics.¹¹⁴ Thus, I believe it is accurate to say that Fogg missed an opportunity to make his argument stronger in his discussion of eco-/biocentrism. The penultimate chapter picks up on these themes and introduces a twin ethical pairing consisting of ecologically sustainable gardening, and safeguarding biosystemic integrity, both of which are founded upon an ecofeminist ethic of care.

¹¹² Frederick Turner, "The Invented Landscape," in *Beyond Preservation: Restoring and Inventing Landscapes*, ed. A. D. Baldwin et al. (Minneapolis: University of Minnesota Press, 1994), pp. 35-66, quoted in Fogg, "The Ethical Dimensions of Space Settlement," p. 3.

¹¹³ Haynes and McKay, "The Implantation of Life on Mars," p. 140.

¹¹⁴ Ibid.

This paired ethic attempts to safeguard projects of ecopoiesis, which must out of necessity use life as a means to an end, from destructively homogenizing biologically diverse ecosystems by insisting upon deep intrinsic value for everything from nonliving ecosystem components, to plants and animals, including humans and even species in its moral reckoning.

XIV. Fogg's Fundamental Misapprehension

Fogg, however, presents a form of “enlightened self-interest” based upon a more anthropocentric form of what was originally an eco-/biocentric position. He recommends Heffernan’s reinterpretation of Leopold’s land ethic that “the survival needs of humans outweigh the survival needs of non-humans, but the survival needs of non-humans outweigh the non-survival needs of humans.”¹¹⁵ Specifically, this applies to biota, but there is some relevance that can be found in the maxim for abiota as well. The first half of the maxim purports to express the nested realms of moral concern that Callicott derives from Leopold in which priority is given to moral patients based on proximity.¹¹⁶ For example, if a mother had to choose between feeding the family dog and feeding her infant, the infant should be fed because the survival needs of the human infant outweigh the survival needs of the nonhuman dog.¹¹⁷ However, the second half of the maxim expresses the claim that human preferences should not be given preference when they come into conflict with the basic life necessities of nonhumans. For example, consider the case

¹¹⁵ James D. Heffernan, “The Land Ethic: A Critical Appraisal,” *Environmental Ethics* 4 (1982), quoted in Fogg, “The Ethical Dimensions of Space Settlement,” p. 5. The same idea is articulated elsewhere, such as in Arne Naess, “Ecosophy T: Deep Versus Shallow Ecology,” reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, pp. 219-28; and Goodpaster, “On Being Morally Considerable,” p. 162.

¹¹⁶ See Callicott, “The Conceptual Foundations of the Land Ethic.”

¹¹⁷ See also Naess, “Ecosophy T,” pp. 225-6, for a similar example from which this one is adapted.

of a human wanting to build a shopping mall over a wetland.¹¹⁸ Building the shopping mall will destroy the wetland and presumably the creatures that depend upon it as a habitat. The second half of the maxim counsels us not to build the mall because it is a non-survival need; it is a mere desire that is not absolutely necessary to have fulfilled. However, the needs of the wetlands creatures for a habitat are survival needs and should therefore take precedence over the non-survival needs of humans. This position can be pushed further and applied to both Martian biota and Martian abiota. If life is found on Mars, the maxim may be ruthless in its application. If the survival needs of humans are deemed to come into irreconcilable conflict with the survival needs of Martian biota, then according to this maxim, humans should win out. It is important to note that humans only win out if there are no other alternatives than to come into conflict with Martian biota. However, the stubbornly grim anthropocentrism of this maxim makes its ethical acceptability at least suspect, if not ill-advised. Yet, when push comes to shove, it might be considered misanthropic to suggest that Martian biota, or any other nonhuman entity, should have its interests considered over and above those of humans. Nonetheless, this hypothetical scenario of irreconcilable conflict between humans and Martian microbes is probably rather unlikely. Should there be no life found on Mars, this maxim may still be applicable, though the definition of “survival” will have to be stretched a little bit to mean something more along the lines of “right to continue without human interference or manipulation.” Assuming no life is present on Mars and we are concerned about abiotic intrinsic value, this maxim would counsel that the survival needs of humans should outweigh the “survival” needs of the Martian abiotic landscape. If human survival is at stake, then human interests outweigh the interests of abiotic intrinsic value to exist unperturbed. However, the maxim further counsels that the “survival”

¹¹⁸ This example is adapted from one found in J. Baird Callicott, “The Pragmatic Power and Promise of Theoretical Environmental Ethics: Forging a New Discourse,” *Environmental Values* 11 (2002): 14.

needs of the Martian abiota supersede the non-survival needs of humans. In this case, the mere human desire to terraform Mars is not enough to morally overcome the necessity of respect for the right of the abiotic intrinsic value of Mars to exist without human interference. Hartmann's "insurance policy" argument, which Fogg also makes, is quite important here because the essential argument of the "insurance policy" position is that the survival needs of both humans, *as well as* nonhuman terrestrial life ultimately depend upon spreading life to other solar systems. Note, however, that this position in no way necessitates rushing into anything. Acceptance of anthropocentrism and revulsion from misanthropy motivate Fogg to posit such a counter-argument to the eco-/biocentric ethic which he perceives as hell-bent on preserving indigenous Martian microbes. Yet he mentions the possibility of eco-/biocentrism supporting arguments in favor of terraforming though he does not flesh such arguments out. This is probably because Fogg was too busy worrying about critiquing the abiotic intrinsic value theory put forward by Rolston and his compatriots.

The last "variable" Fogg inserts into the ethical thought experiment is what he calls *cosmic preservationism*, his term for the philosophies of Rolston and Marshall; York would be included as well but for the fact that he wrote his article three years after Fogg. Ultimately, Fogg argues that cosmic preservationism is a "misanthropic," "fictional," "gross sentimentality...." After all, a sentimental terraforming enthusiast might propose that, far from the rocks on Mars existing in a state of "blissful satori"¹¹⁹ (as a preservationist would have it), they might instead be "crying out for life." Both arguments are unedifying. Rocks don't think, don't act and don't care. They cannot have values of their own."¹²⁰ This is exactly the sort of position that Rolston argued so strongly against thirteen years prior to the publication of Fogg's article. Marshall

¹¹⁹ This refers to a statement written in Marshall, "Ethics and the Extraterrestrial Environment," p. 234.

¹²⁰ Fogg, "The Ethical Dimensions of Space Settlement," p. 7.

quotes Rolston's writing that "humans who belittle concern for other species, for ecosystems and for landscapes need pity, for they cannot see beyond the narrow limits of their own affairs."¹²¹

Yet Fogg replies with the rejoinder that preservationism,

amounts to saying that humans actually have the *lowest* degree of intrinsic worth of any class of formed object. Rocks are free to rust and crumble over the aeons, asteroids and meteorites free batter the Martian surface, and microbes free to hitch a ride if they can survive the trip and there to evolve in to new forms that are Martian. Only humans should be constrained from fulfilling their evolutionary potential according to this philosophy.¹²²

Essentially, Fogg's fundamental misapprehension is the same one John Stuart Mill critiqued over a century ago. Tellingly, Haynes makes the same sort of argument, writing that his cosmocentric ethic "would recognize also that the physical artifacts of humanity are as much a part of the universe as are stars, planets, plants and animals,"¹²³ implying that humans are natural, and therefore whatever they do is natural; and furthermore that therefore whatever they do is good. Mill identifies a common form of fallacious reasoning through the counter-example method, writing that "Either it is right that we should kill because nature kills; torture because nature tortures; ruin and devastate because nature does the like; or we ought not to consider at all what nature does, but what it is good to do."¹²⁴ Similarly, Fogg's response to Rolston's "preservationism" is that nature changes things, humans are natural, therefore humans should change things. The rationale defines Hume's is/ought fallacy perfectly. Interestingly, Rolston makes a similar argument in his work trying to defend his claim that value exists in nature objectively, not just subjectively dependent on human valuers. There he writes, "we [humans]

¹²¹ Rolston, *Environmental Ethics: Duties to and Values in the Natural World*, is cited in Marshall, "Ethics and the Extraterrestrial Environment, p. 235.

¹²² Fogg, "The Ethical Dimensions of Space Settlement," p. 8 (emphasis in the original).

¹²³ Haynes, "Ecce Ecopoiesis," p. 177.

¹²⁴ Mill, in excerpts from *Three Essays on Religion*, reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, p. 131.

are a part of nature and not apart from nature.”¹²⁵ However, the difference is that Rolston uses this premise to support a factual statement about value in nature, whereas Fogg and Haynes use a similar premise to support a moral way in which people ought to behave, thus committing a fallacy.

The philosophical response to Fogg’s irate reaction to Rolston’s abiotic intrinsic value is that while it is true that humans are natural, that fact tells us nothing about what is good—only ethical deliberation and moral reasoning can tell us what is good to do, following mere nature as our guide will certainly cause us to err. Therefore, Fogg must give some account for why and how Rolston’s abiotic intrinsic value, or “preservationism” is not good. He attempts to do so by saying that it is “misanthropic.” Certainly some applications of preservationism could be perceived as misanthropic if they strictly adhere to harsh restrictions without acknowledging legitimate human needs. However, in and of itself, there is nothing that necessitates that preservationism be misanthropic, especially to the extent that it merely attempts to put the brakes on unbridled technological progressivism. The mere recognition of the moral considerability of abiotic intrinsic value should be conceived of as a good. This is a compromise that might reconcile Fogg’s and Rolston’s philosophies through the mediation of York’s moral calculus. Fogg might admit that abiotic intrinsic value may indeed exist, be worthy of at least moral consideration, and even deserve to be preserved in situations where the right of abiotic environments to exist without interference or modification by humans outweighs the non-survival needs of both humans and the rest of the terrestrial biosphere. In order to make the exchange even then, Rolston might admit that certain projects of formed integrity, such as scientifically and aesthetically mundane abiotic landscapes, may be less morally significant than

¹²⁵ Holmes Rolston, III, “Naturalizing Values: Organisms and Species,” reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, p. 111.

certain other projects of formed integrity, such as humans and the terrestrial biosphere. It seems that Rolston has already made this graciously accommodating compromise within his publications, all that remains is for Fogg to do the same.

XV. Conclusion

Fogg's rigorous combination of scientific methodology with philosophical analysis yields a thorough approach to the ethics of terraforming. However, his entrenchment in opposition to what he calls Rolston's "cosmic preservationism" blinds him from seeing the potentially positive arguments in favor of terraforming that eco-/biocentrism has to offer. Furthermore, his critique of abiotic intrinsic value falls prey to Hume's is/ought fallacy and fails to avoid the trap Mill warned of over a hundred years before. The argument that humans are natural, therefore whatever they do is natural, and that therefore furthermore whatever they do is morally good must be replaced with the simple question of "what is good to do?" If respecting abiotic intrinsic value is good, then it should be done, regardless of arguments based on what is or isn't natural. Correspondingly, then, if terraforming and ecopoiesis are good to do, then they should be done, but only so long as they are truly good (moral, right, just, equitable). Such themes are explored in detail in the following chapter. York's analysis reveals itself as absolutely luminary for its insightful insistence that a moral calculus be debated based on differential attributions of moral considerability and significance. However, York provides us with no more than a hint at what the answer to his calculus problem may be, and moreover provides no mechanism by which to determine the proper attribution of moral significance to competing claims of environmental value. Perhaps here also, the contributions of environmental justice may be beneficial. Specifically, the insistence that various stakeholders be given voice in a public forum to

participatively debate the merits of competing claims of value.¹²⁶ The “voices” of nonhumans and abiota are significantly more challenging to recognize, in fact legal guardians¹²⁷ may have to be decided upon in order to safeguard the interests of those that cannot speak for themselves in terms of human decision-making procedures. Or, at least, the attention of the prevailing dominant cultural and environmental identities will have to be attuned to listen more attentively and critically to what nonhuman “voices” “have to say.” I feel more than confident that Rolston, Marshall, York, and a host of other philosophers would be more than willing to step in and speak up for the consideration and significance of otherwise voiceless abiotic Martian interests.

In addition to the participative decision-making necessity provided by environmental justice and the language of moral considerability and significance applied to the discourse by York, I would like to suggest one further tidbit gleaned from an environmental science class that was presciently required by my philosophy department. In the class titled “Introduction to Environmental Impact Assessment,” most of the material concerned modeling sources of air and water pollution. But one of the last sessions introduced a variety of methods of scientifically polling a group of debating individuals to come up with a democratically created system of weighted values for a range of variables. Two approaches, the scientifically standard “Delphi Method” and “Pairwise Comparison” provide two potential methods for evaluating alternatives which have traditionally been applied when science intersects with public policy.¹²⁸

¹²⁶ Consider for example Starhawk, *The Fifth Sacred Thing* (New York: Bantam Books, 1993), a work of utopian fiction in which direct democratic town government meetings provide for human stakeholder participation and proxy consideration for non-human interests. In the third and fourth chapters of this thesis, I further develop these themes.

¹²⁷ Stone, “Should Trees Have Standing?” advocates such guardians. In the fourth chapter of this thesis I further develop notions of guarding, guardianship, safeguarding and protection according to an elaboration of an ecofeminist care ethic.

¹²⁸ See Larry W. Canter, *Environmental Impact Assessment* (New York: McGraw-Hill, 1996), chap. 15.

I began this chapter by examining the objection to terraforming posed by Sparrow in contrast to the views posited by Hartmann. Sparrow's critique was that terraforming manifested the "vice of blindness to aesthetic value" and the "sin of hubris." Hartmann's argument was based primarily on the idea of having an "insurance policy" which the scientists Haynes, McKay, Fogg, and others also articulated. Rolston, Marshall, and York all would object to terraforming on the grounds that even abiota has value that should be respected. Rolston does his most to defend this point of view, identifying its foundations in projective nature's "formed integrity," and postulating six ethical injunctions relevant to space exploration. Marshall buttresses his argument with warnings about the value of indigenous Martian life forms, should any be found to exist. York serves as a less biased mediator, advocating the creation of a moral calculus that weighs competing claims of moral significance.

Haynes and McKay provide a strange argument in favor of "amending nature" or making it better by engaging in projects of ecopoiesis in order to bolster indigenous Martian life forms based upon what they perceive to be nothing more than following bio-/ecocentrism to its logical conclusions. Their arguments based on organicism reveal their paradoxical hope that high technology may counter-intuitively bring humans into closer harmony with nature. However, Haynes' response to abiotic intrinsic value or cosmic preservationism is revealed to be a straw man. Fogg's response to abiotic value and preservationism commits Hume's is/ought fallacy, although he hints at the possibilities of bio-/ecocentrism providing strong philosophical arguments in favor of terraforming and ecopoiesis. The penultimate chapter of this thesis picks up where Fogg left off, articulating an ecofeminist ethic of care, guardianship, and gardening in an effort to more fully elaborate philosophically the sorts of biocentrically and ecocentrically based arguments Fogg, Haynes, Zubrin, and McKay seem to desire to make.

The debate between scientists and philosophers on the morality of terraforming within the field of environmental ethics is predominantly lacking in two ways. It neither elucidates the potential for environmental injustice in future engagements with the Martian environment nor provides a strong philosophical foundation for the implications of bio- and ecocentrism in support of terraforming based on the greater moral significance of terrestrial biota over and above the significance of at least some Martian abiota. In the rest of this thesis I further elaborate on these missing themes, in the hopes of contributing worthwhile additions to the ethics of terraforming discourse.

CHAPTER 3

SUSTAINABILITY, ENVIRONMENTAL JUSTICE, TERRAFORMING

More recently, we find the justice of recognition camp emerging from principles of self-determination, identity recognition, and democratic participation. According to this camp, justice requires us to recognize differences among social collectivities through the equal and fair participation in social and political processes. From this viewpoint, cultural institutions and habits determine the conditions for the distribution of material goods and burdens.

—Robert Melchior Figueroa

I. Introduction

The following two chapters of this thesis grow out of and respond to the critiques identified in chapter two; however, they of necessity cannot be as exhaustive as the second chapter in scope. Whereas the published literature on the ethics of terraforming is small and new enough that it can be examined practically in its entirety, environmental justice grows out of a long history of justice theory and environmental philosophy; and ecofeminism, discussed in the penultimate chapter, has a long history, as well—owing to at least three waves of feminist critique. For this reason, chapters three and four cannot hope to be exhaustive enumerations of the complexity and varieties of ways the philosophies and theories of environmental justice and ecofeminism intersect with questions of the ethics of terraforming Mars. Instead, my hope is to provide a broad outline of the types of concerns each discipline uniquely brings to the table regarding terraforming ethics. However, another reason the latter half of this thesis cannot be exhaustive, but merely hope to open up a space for continued and further dialogue about the ethics of terraforming, planetary engineering and ecopoiesis, is that until all the relevant stakeholders are at the table, and their voices are not only admitted, but sought out, and fully and equally included in the procedural decision-making structures that will determine how humans will or will not engage with the red planet, all other discussions are unbalanced, necessarily

culturally biased, and inadequate for providing a sufficient framework for ultimately determining what the ethics of terraforming Mars are. Therefore, in this chapter I lay out in broad outline the types of concerns the philosophy of environmental justice might define as relevant for the ethics of terraforming Mars. The nature of environmental justice is such that, because environmental injustices continue to subsist in and between cultures around the world, its first order of priority is remedying the inequity and inequality rampant in human societies around the world today, before either exporting or exacerbating those problems by introducing a novel and dangerous new environmental context. As environmental justice continues to influence academia, politics, and the broader culture at large, chastening it continuously in pursuit of an equitable and truly just society—addressing issues not only of pollution and distribution but of identity recognition, participative, procedural and restorative justice, up to and including even questions of climate change and post-colonial intercultural dynamics, its relevance for questions of the ethics of terraforming will continue to undergo metamorphoses – growing in response to the character of global cultures according to the specific needs of each. My offering here, while preliminary, is meant to broadly cover the bases, leaving room for further philosophical and ethical exploration, but attempting to define the major categories which any future debate about the advisability of terraforming or *ecopoiesis* must address if justice, equality, respect, and dignity are to be anything more than mere shibboleths. In fact, due to the enormity of the numbers of cultures and interests which must of necessity be participatively included with regards to questions about terraforming, according to the strictures of environmental justice as a theoretical context, it may be more proper to speak of environmental *justices*, or environmental justice philosophies. Whereas environmental justice does have its own particular canon, its main thrust is pluralistic. The ultimate environmental justice or injustice of either deciding whether or not to terraform

Mars, or potentially going through with it, will be determined by the situated epistemologies and political inclusion of those environmental identities which are directly and indirectly affected. However, this is not an inescapable lapse into cultural relativism; rather, it is an admission that more voices will need to be heard if environmental justice is to have been served regarding the ethics of terraforming Mars. Therefore, what follows is but one of many possible applications of environmental justice (and ecofeminism, in the next chapter) to questions of the ethics of terraforming Mars. My desire is primarily to shift the terms of the debate such that questions of environmental justice and ecofeminism are brought to the forefront, which is eminently beneficial not only for questions of how we relate to and with other planets, but more importantly, how people behave here on this one.

One justice theorist, Nancy Fraser seeks to rectify what she sees as an inaccuracy in the way environmental justice is perceived with regards to its fundamental theoretical structure. She writes that although “It is often assumed that the politics of redistribution is exclusively concerned with injustices of class, whereas the politics of recognition, reductively equated with ‘identity politics,’ is exclusively concerned with injustices of gender, sexuality, and ‘race,’”¹²⁹ a bivalent conception of justice or “perspectival dualism” overcomes such narrow dichotomous thinking. In the words of another author who makes use of her distinction, a bivalent conception of environmental justice works by “disclosing and deconstructing the economic features of [an] injustice typically assumed to be cultural, as well as disclosing and deconstructing the cultural features of that injustice typically assumed to be economic.”¹³⁰ For example, “environmental

¹²⁹ Nancy Fraser, “Social Justice in the Age of Identity Politics,” p. 6.

¹³⁰ Robert Melchior Figueroa, “Bivalent Environmental Justice and the Culture of Poverty,” *Rutgers University Journal of Law and Urban Policy* 1 (2003): 35.

racism”¹³¹ can be said to be a social phenomenon that creates negative economic consequences for those who suffer from it. Conversely, what some¹³² might call the side-effects of otherwise purely rational socio-economic decision-making can be shown to be just as much if not more the product of institutional racism—even if that racism is covert rather than overt, or thinly veiled rather than outright.¹³³ Either way, the “doctrine of double effect” is predicated on a moral system that sees the logic in redistributing on to others environmental burdens one would not wish to endure one’s self.¹³⁴ What the ecofeminist author Val Plumwood, whose work provides the groundwork for the next chapter of this thesis, calls an “ecological crisis of reason”¹³⁵ is founded upon a moral corruption that is at the heart of the dominant Western cultural identity—a malignant tumor that begs to be excised before it can topple the entire system. Environmental justice and ecofeminism both go a long way toward identifying and attempting to excise this corruption; the remainder of this thesis will attempt to draw out the implications of that dynamic as it has relevance for determining the ethics of potentially terraforming Mars.

Environmental justice, conceived of in terms of identity politics and the justice of recognition, deals in tricky moral territory which some scholars might prefer to avoid altogether so as not to become bogged down in sticky questions of race, class, gender, and historical and

¹³¹ Ibid., p. 32ff.

¹³² Vicki Been, “Market Force, Not Racist Practices, May Affect the Siting of Locally Undesirable Land Uses,” *At Issue: Environmental Justice*, ed. J. Petrikin (San Diego: Greenhaven Press, 1995), p. 41; and Peter S. Wenz, “Just Garbage,” *Faces of Environmental Racism: Confronting Issues of Global Justice*, 2nd ed., ed. L. Westra and B.E. Lawson (Landham: Rowman & Littlefield Publishers, 2001), both of which are cited in Figueroa, “Bivalent Environmental Justice and the Culture of Poverty,” p. 33.

¹³³ “For instance, in Kettleman City, California, the Latino/Hispanic community was dramatically impacted by the language discrimination that occurred when Environmental Impacts Reports for a proposed hazardous waste incinerator were released in English to the predominantly mono-lingual Spanish speaking community,” according to Figueroa, “Bivalent Environmental Justice and the Culture of Poverty,” p. 37, which cites Dick Russell, “Environmental Racism: Minority communities and their battle against toxics,” *Amicus Journal* 11 (Spring 1989): 22; and Luke Cole and Sheila Foster, *From the Ground Up: The Rise of Environmental Racism and the Environmental Justice Movement* (New York: New York University Press, 2001).

¹³⁴ Figueroa, “Bivalent Environmental Justice and the Culture of Poverty,” p. 40.

¹³⁵ The subtitle and overarching theme of her 2002 book *Environmental Culture*.

institutional inequalities. However, precisely because these difficulties are so intractable speaks to the importance of addressing them according to the most applicable framework that is available. In this case, the politics of identity recognition provides exactly the sort of prescription that is needed to prevent projects of terraforming from suffering from endemic institutional injustices, precisely because failures of recognition are likely so fundamentally to blame for the environmental injustices from which contemporary societies suffer.

The “remoteness,”¹³⁶ or what a continental philosopher might call “phenomenological distance,” modern technological society affords humans with regard to the means of production and the distribution of waste is largely to blame for the sorts of moral shortcomings plaguing advanced capitalistic societies around the world today. The separation an affluent resident of the United States or Northern Europe enjoys from the factory farms that produce his or her food is akin to the yawning gulf that insulates the owners and operators of automobiles from the effects of the greenhouse gases their vehicles produce on people living in distant parts of the world, or people who will exist at distant points in time.¹³⁷ When paired with a failure to adequately and institutionally recognize the value and dignity, and ensure the respect of otherwise disempowered environmental identities, this is a recipe for disaster. Future generations will not have the benefits of a global common carbon sink in the form of a conducive atmosphere into which greenhouse gas pollutants can be inexhaustibly dumped. When people, their environments, and the historical relationship between the two is neither recognized nor respected, the stage is set for the perpetration of an injustice. Two case studies at the end of this chapter bear this point out in a context that is entirely contemporary, but ominously forebodes of

¹³⁶ Ibid., p. 71ff.

¹³⁷ Steve Gardiner analyzes the difficulties created by such considerations as they affect the ethics of climate change in “A Perfect Moral Storm: Climate Change, Intergenerational Ethics and the Problem of Moral Corruption,” *Environmental Values* 15 (2006): 397-413.

similarly unjust situations in the near-term future. Modern technology, industrialized society and Western science, without malicious intent originally, have bathed the planet in a sticky solution that so far has exceedingly difficult to slough off. Technological progressivism has an internal dynamic—and considerable inertia and momentum carried with it—that has baptized the globe with fire, and true to Promethean form has provided some great benefits, though such conveniences often come with costs that may go unrecognized, unnoticed, or unconsidered by those who benefit most from the prevailing socio-economic system.

My purpose in this chapter is to ask, what it is good to do regarding terraforming, colonizing or attempting to perform ecopoiesis on Mars? My aim is to predict and proactively analyze the likely justices and more importantly, injustices that one may reasonably foresee proceeding from attempts to colonize and/or terraform Mars without full and thorough consideration, discussion and solution to the litany of the ethical issues at play. The insightful analysis the philosophy of environmental justice can bring to questions of terraforming ethics is completely absent from the published discourse of scholarly articles in philosophical and technical journals that have been published to date. This thesis, and this chapter in particular, is intended to correct for that unintentional oversight by considering the full ramifications of environmental justice so that Paul York's "moral calculus"¹³⁸ can be accurately tabulated. To wit, before any attempt to terraform and/or colonize Mars is made, our globalized culture must become sufficiently more sustainable; otherwise, we are more likely to export our unjust institutions and perpetuate global inequalities, inviting whatever benefits that might result from terraforming to accrue into the hands of the few and the wealthy, and likely further impoverish those who already have such a small share of our global opulence. Principles of justice and

¹³⁸ York, "The Ethics of Terraforming," p. 9.

equality can prevent our society from making a Faustian bargain that trades long-term security for short-term gains that are likely to evaporate as quickly as they had materialized. We progress forward at our own peril if we do not take the time to fully ethically deliberate and make any and all attempts to rectify the contemporary injustices that plague our society.

Fascinatingly, such an investigation turns out not to be an esoteric foray into the heights of abstraction, but conversely points out specific, timely, and morally weighty concerns that are eminently relevant to contemporary dialogues on climate change, environmental ethics, and the trajectory our society is headed on—locally, nationally, and writ large at the global scale. Now as never before the world is increasingly interconnected by technological media which bring home the effects of anthropogenic climate change, show us the variety of livelihoods in other parts of the world, and display the majesty of the world's environments at the click of a button. Furthermore, now as never before the global consequences of individual actions are beginning to become clear as the effects of climate change on sea ice and various threatened species; and the effects of other forms of pollution on habitats, environments, and people can be brought into a living room or displayed on a computer screen, slicing through the remoteness and phenomenological distance that has traditionally permitted what could otherwise only be judged unconscionable, morally deficient and reprehensible behaviors.

In this chapter I present environmental justice as an interpretative lens through which to address questions of the ethics of terraforming or colonizing the planet Mars. I begin by analyzing the cognitive and material disconnect between the monocultural homogenization¹³⁹ of the world's cultures and environments from calls for ecological (and cultural) sustainability.

¹³⁹ Themes of hegemonical homogenization and cultural backgrounding (sometimes also referred to as a 'denial of dependency') owe to an ecofeminist intellectual heritage, though the aims of environmental justice and ecofeminism are regularly allied. See Val Plumwood, *Feminism and the Mastery of Nature* (London: Routledge, 1993), pp. 13-14 and 48-55.

Ironically, the technological progressivism that seeks to terraform Mars is often motivated by a desire for cosmic sustainability—the disconnect however, involves instantiating that sustainability locally and contemporaneously here on Earth. If technological progressivism is left to its own devices and continues on its homogenizing trajectory, we may be able to institute a colony on Mars, but what good will that be if the home planet, Earth is so dramatically environmentally impoverished and culturally unjust that populations living there are exposed to extreme suffering and hardship, even as spacecraft ply uncharted interplanetary expanses? If we wish to avoid such a dystopian future (or counteract the dystopian features of the present), replacing technological progressivism’s globally homogenizing internal logic with one of ecological and cultural sustainability is the only way to go.

Such considerations lead the way into an analysis of anthropogenic climate change, its ramifications for the ethics of terraforming and colonizing Mars (which are also conspicuously absent from the published discourse). Furthermore, an elaboration of the implications of radical identity politics, as they apply both to Earth and to Mars, illuminates the path to achieving not only a sustainable society, but a just one. Indeed, it may be reasonable to claim that only a sustainable society can be truly just, or at least that would be the case if issues of intergenerational justice carry any weight. By dealing in these terms, categories of illegitimate and unjustifiable harms to both humans and nonhumans come into prominence—issues that must be adequately addressed if the ethics of terraforming Mars are to be fully considered. The last half of this chapter corrects for the glaring inadequacy of the contemporary ethics of terraforming debate by (1) looking at case studies that are not only relevant in a contemporary context, but highlight the types of injustices which are already associated with low-Earth orbit infrastructure; and (2) introducing a radical identity politics which makes use of the idea of

recognizing marginalized and disenfranchised “voices” in a political/institutional decision-making framework in order to counteract the current participative injustice of the prevailing dominant socio-political paradigm. The steam-rolling progressivism inherent in both the global economy and its incredible technology has dangerous and unjustifiably marginalizing effects on the world’s peoples and environments. Examining and attempting to remedy the deleterious effects of their inherent teleology in the present holds the possibility of overcoming their significant inertia and momentum in the near-term future, rather than farther off, or frighteningly not at all.

A post-colonial critique rounds out the end of this chapter, extrapolating from historical and contemporary injustices what inexorable ethical difficulties are likely to result from attempts at interplanetary colonialism, in terms of economics, culture, and the environment. Our home planet, the Earth, is increasingly overpopulated and confronted with species extinction to a degree unprecedented in human history. If we hope to leave environments and cultural institutions that are good, decent, just and advantageous for future generations, learning from the environmental justice movement and pursuing absolute sustainability are indispensable not only to questions about the advisability of terraforming Mars, but for terrestrial environmental issues as well.

II. Sustainability

Worldwide the destruction, pollution and impoverishment of environments, ecosystems and habitats has driven countless species already to extinction and exerts itself as a monumental hazard to the biodiversity, integrity, and resilience of the global ecological system. The spread of Western culture, industrialized agriculture, pesticide use and genetically modified organisms

(GMOs) has swathed the world in a tidal wave of monoculturalism that has not left a single corner of the planet unaffected. Arguments attempting to legitimate the human effect on the rest of the living environment as “natural”¹⁴⁰ miss the point J. S. Mill made in 1874, “Either it is right that we should kill because nature kills; torture because nature tortures; ruin and devastate because nature does the like; or we ought not to consider at all what nature does, but what it is good to do.”¹⁴¹

I argue, first and foremost, before any questions of terraforming or colonizing any other planet can be entertained, that a sustainable ethic be made the first priority for the world’s governments and peoples. Without doing so, any hope of expanding the world’s cultures and organisms to distant planetary shores are without a doubt doomed to failure. This reasoning, which is founded broadly on a wide and diverse reading of environmental justice philosophy, is overtly prudential and pragmatic and cannot be emphasized strongly enough. In terms of the equitable distribution of environmental benefits and burdens in a society, sustainability emerges paradoxically as a prerequisite and end-point goal. In order to prevent the overburdening of environments and populations that rely on them, products must be sustainably produced with specific care and attention to detail given to wastes, by-products, and/or shadowy environmental externalizations which attempt to sneak pollution under the rug—a hiding place that leaves something to be desired, as unsightly externalities have a way of failing to go unnoticed there for

¹⁴⁰ For example, Martyn Fogg writes, “Rocks are free to rust and crumble over the aeons, asteroids and meteorites free to batter the Martian surface, and microbes free to hitch a ride if they can survive the trip and there to evolve in to new forms that are Martian... if spacefaring is a legitimate activity for microbes, why should it not be so for humans?” in “Ethical Dimensions of Space Settlement,” pp. 8-9. Robert H. Haynes makes a similar point when he writes, “the physical artifacts of humanity are as much a part of the universe as are stars, planets, plants and animals,” in “Ecce Ecopoiesis,” p. 177.

¹⁴¹ From ed. Pojman and Pojman, *Three Essays on Religion*, reprinted in *Environmental Ethics: Readings in Theory and Application*, p. 131.

very long.¹⁴² In terms of recognition, the affording of respect, dignity, and participative political inclusion of otherwise disenfranchised environmental identities predicates a sustainable social structure, in the sense that the sustenance of those most likely to be left out or overlooked is ensured by making sure everyone has a place at the table in terms of politics and economics, and furthermore that inclusion at the table mandates an attitude of respect via an accurate recognition of value.

Some arguments in favor of terraforming rely on an implicit desire that terraforming should be a sort of panacea; in fact, even Hartmann's "insurance policy"¹⁴³ argument can be used to make just such a point. Whereas Hartmann was concerned more with cataclysms in the wake of errant asteroids obliterating the Earth's living populations, a similar line of reasoning advocates terraforming in a sort of "disposable Earth" mentality: the idea that if we mess this planet (and its ecology) up, we would have a "backup." Such sentiments could not be further removed from the truth. The life on this planet appears, as far as present-day science and technology can inform us, to be perfectly unique in the universe. Supposing it can be transplanted to Mars (an enormous "if," indeed), that in no way ensures that the destruction of life on Earth would not spell disaster for whatever life subsisted nearby—not to mention the incalculable loss of value the annihilation of life on Earth would entail! Because terrestrial life forms evolved under terrestrial conditions, one would expect that Mars will be incredibly inhospitable to Earth-evolved organisms. Even if the climate of the planet can be manhandled

¹⁴² Anthropogenic climate change suffers from just such cost externalizations in the forms of unrestricted greenhouse gas emissions into an open-air common carbon-sink in the form of our global atmosphere. Other cost externalizations, such as those which couple with misrecognition of the value and dignity of marginalized environmental identities, create an especially tragic scenario for the Tuvalu and Carteret Islanders whose island homes are threatened by rising sea levels (See Robert M. Figueroa, "Indigenous Peoples and Cultural Losses," in *The Oxford Handbook of Climate Change and Society*, ed. John S. Dryzek, Richard B. Norgaard et al., [Oxford: Oxford University Press, 2011], p. 241). However, other forms of cost externalizations are common in the geopolitical dynamic. Most forms of pollution likely fall within this category.

¹⁴³ Hartmann, "Space Exploration and Environmental Issues." p. 236.

into a regime more conducive to life on its surface, without the Earth to support the tentative foothold life may achieve on another planet, conditions would likely quickly relapse into their pre-terraforming “default settings.” Thus, terraforming involves an interplanetary colonialism heretofore unexamined by the published literature on the topic. The implications of this facet of the ethics of terraforming are discussed later in this chapter.

III. Radical Identity Politics

In addition to counter-intuitively pointing questions of ethics back toward sustainability on Earth, an interrogation of the ethics of terraforming has relevance for the ethics of climate change, which introduces questions of participatory parity, inclusion and equality in a global legislative framework. Use of environmental justice in such a novel, speculative context actually highlights deficiencies in terms of global economic justice, post-colonial international dynamics, and race, gender and class relations both domestically and abroad. One might not expect that such an esoteric moral quandary would have so much relevance for contemporary geopolitical log-jams, but encapsulating global problems in response to an interplanetary dynamic winnows complex emergent moral phenomena down into definite, definable categories that can be deconstructed and examined to determine their legitimacy, desirability, and mutability in a global dialectical context.

Terraforming involves taking a planet like Mars (or Venus, or one or more of the moons of the gas giants Saturn or Jupiter), and technologically manipulating the temperature so that terrestrial life forms could survive and flourish there. Arguments have been made identifying the pristine Martian landscape as a locus of value and a repository of otherwise unattainable scientific information. The absolute first point anyone should make with regard to terraforming is

that there is not only no need to rush into irrevocably altering the face of an unexplored planet without meticulously cataloguing relevant and unique scientific data. In fact, there is a positive argument against terraforming based on the destruction of landscapes that can never be recovered once they have been changed. For example, Mars is home to the most grandiose known canyon system in the observed solar system, *Valles Marineris*. In Kim Stanley Robsinson's science-fiction imagination of the human terraforming and colonization of the red planet, in the course of warming the planet's temperature, vast water and ice flows burst forth from frozen depths and disintegrate canyon walls that had stood for eons before human actions brought them down.¹⁴⁴ In the second chapter of this thesis, the loss of such value was subsumed under the heading "abiota," which is still applicable, but can be expanded and utilized in a novel way as questions of the environmental justice (or injustice) of terraforming are considered.

The term *identity* in its normal, day-to-day context is typically used to refer to politically defined groups, collectivities, or coalitions that share some economic, social, or cultural features that are relevant to understanding and influencing public policy, debate, and decision-making.¹⁴⁵ Noted ecofeminist philosopher and author Val Plumwood pushes the politics of recognition further when she advocates an "intentional recognition stance" as a remedy for narrow anthropocentric thinking in her 2002 book *Environmental Culture: The Ecological Crisis of Reason*. There, she writes, "Adopting the intentional recognition stance is one of a number of counter-hegemonic practices of openness and recognition able to make us aware of agentic and dialogical potentialities of earth others that are closed off to us."¹⁴⁶ In her terms, we might push the concept of environmental identity even further and insist on legal standing not only for all

¹⁴⁴ Robinson, *Blue Mars*, p. 270.

¹⁴⁵ See Figueroa, "Bivalent Environmental Justice and the Culture of Poverty," for example.

¹⁴⁶ Plumwood, *Environmental Culture*, p. 177.

members of our own species, but for members of other species and even non-living environmental entities such as rivers, lakes, the atmosphere, and to the land itself. On Earth this has radical implications for governmental and social institutions, when it is applied to the questions of the ethics of terraforming, the voice for Mars that philosophers were searching for in the second chapter may finally be heard.¹⁴⁷

If our goal is a sustainable society, civilization and culture, perhaps J. Baird Callicott offers the best advice when he writes, “What form should a self-consistent anthropocentrism take? Paradoxically, it should take the form of non-anthropocentrism—a proper respect, as a “moral being,” for our fellow denizens of the Earth and for the Earth itself.”¹⁴⁸ His reasoning, in a bit a prescient sagacity, depends not upon altruism or selfless intentions, but rather is expressly prudential—if we are to avoid becoming “a society like that of John Burroughs’ potato bug, which exterminated the potato, *and thereby exterminated itself*,” we must become “a society decently *respectful of its own and all other life*, capable of inhabiting the earth without defiling it.”¹⁴⁹ I suggest the ecofeminist author Starhawk has the right idea in her utopian/dystopian novel *The Fifth Sacred Thing* where she envisions a considerably more sustainable social structure in which animals, plants, air and water are provided “Voices” in the local governing framework because “every decision should take them into account.”¹⁵⁰

¹⁴⁷ Note the similarity between Plumwood’s project and that of Christopher Stone, in “Should Trees Have Standing?” pp. 298-308.

¹⁴⁸ J. Baird Callicott, *The Land Ethic and the Earth Ethic: A New Moral Philosophy for a Time of Climate Change* (Oxford: Oxford University Press, *forthcoming*).

¹⁴⁹ Aldo Leopold penned these words at the end of his essay, “Some Fundamentals of Conservation in the Southwest” (1923), which appeared in the Summer 1979 edition of *Environmental Ethics*, as well as in Susan L. Flader and J. Baird Callicott, eds., *The River of the Mother of God and Other Essays by Aldo Leopold* (Madison, WI: University of Wisconsin Press, 1991), p. 97, as well as in Callicott, *The Land Ethic and the Earth Ethic* (*forthcoming*).

¹⁵⁰ Starhawk, *The Fifth Sacred Thing*, p. 46.

IV. Technological Salvationism, “Messiah Complex”

Yet today our governing socio-political institutions do not even take all human “voices” into account. The hegemony and plutocracy of the current political and economic structure preclude the inclusion of systematically disenfranchised voices—human, animal and otherwise. The swirling expanses of trash drifting in the pacific; the uprooting of the rainforests; the extinction of species great and small can put up little resistance against the steam-rolling juggernaut of imperialistic capitalism, technological progressivism and runaway industrialization. Vocal terraforming enthusiast Robert Zubrin derisively labels environmentalists “Merchants of Despair” for what he perceives as radical misanthropy and obstructionism in opposition technological progressivism.¹⁵¹ What he fails to comprehend, however, is that an environmental agenda is a human agenda—and a wise a prudent one, at that—even if Edward Abbey was once foolish enough to remark he would “rather shoot a human than a snake.”¹⁵² The Faustian bargain technological progressivism presents asks the world to pony up its soul as collateral for its future—a false dichotomy if ever there was one. If the world sacrifices what makes it wonderful, unique and beautiful so that some small percentage of its people can enjoy luxury the likes of which have never before been seen, and will likely never again be reproduced, would it not be clear that more will be lost than could ever hoped to be gained?

Terraforming and colonizing Mars must not in any way be presented as a technological “messiah,” lest we analyze the world and its peoples as suffering from a “technological salvationism complex,” a mass paranoid and psychotic delusion based on the misconception that

¹⁵¹ From the title of his most recent book, Robert Zubrin, *Merchants of Despair: Radical Environmentalists, Criminal Pseudo-scientists, and the Fatal Cult of Antihumanism* (New York: Encounter Books, 2012).

¹⁵² See Kristen Shrader-Frechette, *Environmental Justice: Creating Equality, Reclaiming Democracy* (Oxford: Oxford University Press, 2002), p. 4.

technology can save us from either itself, or more poignantly, from ourselves. It is not the technology here that is to blame, but rather the society that is blameworthy or commendable based on its actions, its institutional structure and its justice.

V. “If You Don’t Know the Risks, You Don’t Know the Justice”¹⁵³

Because terraforming involves intentional climate change, there exists another danger in that “research programs”¹⁵⁴ directed toward technologically managing the climate of another planet might titillate scientists, engineers and technocrats on Earth with the tantalizing possibility of using similar technologies here at home to rectify the undesirable changes brought about by anthropogenic global warming. Already Dale Jamieson has enunciated extreme caution against “geoengineering” projects in response to terrestrial climate change based on a lack of ability to precisely and accurately predict and control the consequences of such global technologies. Furthermore, the lack of an equitable participative framework for actually politically including those people living around the world that are likely to be affected by such a schema means progressing forward without allowing disenfranchised identities to have their voices heard would violate principles of procedural justice. The “cascading uncertainties” and unforeseeable consequences likely to result from technologies that cannot be tested in the lab or controlled under experimental conditions would necessitate the free and informed consent of the world’s populations be given prior to moving forward with the project in order to safeguard the world’s most vulnerable communities from being unjustly harmed.¹⁵⁵ The lack of any such adequate

¹⁵³ The heading for this chapter are the words of my thesis advisor, Dr. Robert Figueroa, who spoke them in discussions pertaining to issues with earlier drafts of this chapter, Feb. 28, 2011.

¹⁵⁴ See, for example, Imre Lakatos, “History of Science and its Rational Reconstructions,” in *Scientific Revolutions*, ed. Ian Hacking (Oxford: Oxford University Press, 1981), p. 115ff.

¹⁵⁵ Dale Jamieson, “Ethics and Intentional Climate Change,” in *Climatic Change* 33 (1996), p. 323-36.

institutional governmental framework for justly including those voices must prevent their implementation from moving forward.

The risks inherent in extraterrestrial space travel also receive astoundingly little discussion in the literature that has been published on the ethics of terraforming to date. The risk of harm one is committed to when tilling a piece of land for farming, or the dangers involving in something like fishing in the lake or the sea are far smaller than those one invites when hospitable terrestrial shores are abandoned in favor of barren, unforgiving, vacuous extraterrestrial environments such as the vacuum between planets or the mortifyingly frigid planetary surface of Mars. The incredible risks people would have to take with their lives in order to travel to, to colonize, and/or to attempt ecopoiesis on Mars seems hardly justified compared to the recalcitrant resistance with which their efforts would likely be met, even if all the technological infrastructure permitting terrestrial organisms to travel to Mars and set up shop on the surface works exactly as planned. Just as Blaise Pascal, at least according to the popular conception, appeals to cool, dispassionate logic in his well-known ‘wager,’ where the risks are enormous and the rewards are few, the logic of attempting such technological stunts appears tragically flawed and inherently misguided upon closer inspection. Imagine even that terraforming is possible, and the colonization of a salubrious Mars is proceeding with considerable vigor, the danger of shady corporations passing off substandard equipment to unwitting interplanetary colonists presents a possible, if not likely injustice. Small though it may be, it is possible to ask the question whether terraforming and colonizing Mars would be worth the loss of even one innocent life? Would the danger of greed and corruption have the same or worse effect on people colonizing Mars as it does on Earth? Here, corporate and governmental greed and moral corruption wreak untold havoc on people around the globe. Take for example,

the case of the 2008 earthquake in Sichuan, China, where, “a rush to build schools during the country’s recent economic boom might have led to shoddy construction that resulted in the deaths of thousands of students”¹⁵⁶ because government officials and contractors had skimmed a little off the top and cut corners to save a buck for themselves, tragically cutting short far too many lives. If such greed and moral corruption is commonplace on Earth, how much worse will it be when customers are a million miles away and have made a one-time investment in shipping themselves and all their Earthly possessions to another planet?

Even more disturbingly, suppose ecopoiesis is in full swing and not only humans but a myriad of other terrestrial life forms subsist for the first time on the surface of an alien planet. Then suppose some quintessential technological subsystem or equipment malfunctions, breaks down, or is subject to a temporary interruption of service when the nearest repair shop is a multi-month rocket-trip away. Not only would the technology to support human life on the surface (greenhouses, filtration systems and the like) be of the utmost importance, technological systems supporting other life forms on the planet would play an incredible role in preserving nonhuman life on the surface as well. For example, consider one of the most common plans for artificially raising Martian temperatures by placing colossal reflectors or mirrors in orbit around the red planet in order to direct solar rays that would otherwise have passed Mars by toward its frozen polar ice caps. If those technologies are put suddenly or unexpectedly out of commission, not only may unprepared humans suffer, but any nascent ecosystem trying to gain a tentative foothold on a planet it was never meant to inhabit might collapse overnight, killing hundreds,

¹⁵⁶ Edward Wong, “China Admits Building Flaws in Quake,” *The New York Times*, 4 September 2008 (<http://www.nytimes.com/2008/09/05/world/asia/05china.html>).

thousands or millions of living organisms and threatening the organisms they support in a human-managed Martian ecological context.¹⁵⁷

Whether the malfunction is the result of an error, an accident, sabotage, corruption, or just bad luck—those organisms and ecosystems which depend upon the proper functioning of complex and interconnected technological subsystems will be in an incredibly perilous situation. The potential for both human and nonhuman suffering imparts significant ethical *gravitas* and provides eminent occasion for consideration and pause for reflection before any person or group of people lightly endeavors to implant life on the red planet.

Along the same lines, a very real and dangerous possibility that provides further cause for ethical consideration involves the likelihood of war, militarism, conflict and strife if Martian land, its environment and resources are to be opened up for human exploitation. Consider the toll of war on this planet where conditions for life are ideal, then imagine the death toll if our capacity for violence within our own species plays out in spectacularly deadly alien environments.

VI. The Principle of Prima Facie Political Equality (PPFPE), Case Studies

The only solution to the long list of ethical reservations a thorough analysis of the ethics of terraforming presents is a real, full, and thorough worldwide adoption and pervasive implementation of the principle of prima facie political equality, or PPFPE to use Kristen Shrader-Frechette's acronym. The PPFPE "ought to require that, all things being equal, rich and poor, colored and white, educated and noneducated, be treated equally in the distribution of society's environmental benefits and burdens. Otherwise, geographical distribution of

¹⁵⁷ Kim Stanley Robinson imagines apex predators like polar bears living on a terraformed Mars (*Blue Mars*, p. 261ff). Imagine the wanton destruction of value if a whole ecosystem collapses because of a technological glitch. If humans are responsible for putting life on Mars, they are responsible for what comes of it, for good or for ill.

environmental goods may be merely a matter of accident, money, or corrupt use of power.”¹⁵⁸ In the tradition of environmental justice, a picture is worth a thousand words, so I provide a pair of case studies that display clearly and succinctly exactly how environmental injustices are likely to occur as a result of terraforming and interplanetary colonialism by examining how a technological progressivism associated with contemporary space exploration and utilization stands up to a post-colonial critique.

In two places in the world right now, the effects of “environmental colonialism”¹⁵⁹ are being felt because of the global economic incentive to put telecommunication satellites into orbit at the lowest cost possible. Alcantara, Brazil and Kourou in French Guiana are located on a global latitude near the equator that makes them ideal for launching rockets into orbit more efficiently due to the increased rotational velocity imparted to the rocket by launching from someplace near the equator. In the case of the former, Brazilian military aspirations have given way to a “rent-a-pad” concept in which foreign companies and nations pay to use Brazil’s conveniently located spaceport. The only catch is the local inhabitants, described as “descendants of former slaves” who subsist on fishing in the Atlantic Ocean have had their village relocated inland some miles in order to make room for the burgeoning rocket facilities.¹⁶⁰ Robert Figueroa makes use of the term *environmental identity* to denote that

the amalgamation of cultural identities, ways of life, and self-perceptions that are connected to a given group’s physical environment. And ... *environmental heritage* pertains to meanings and symbols of the past that frame values, practices, and places peoples wish to preserve as members of a community. Environmental heritage is the

¹⁵⁸ Shrader-Frechette, *Environmental Justice*, pp. 24-5.

¹⁵⁹ Robert M. Figueroa makes use of this term in “Indigenous Peoples and Cultural Losses,” in *The Oxford Handbook of Climate Change and Society*, ed. John S. Dryzek, Richard B. Norgaard et al., (Oxford: Oxford University Press, 2011), p. 235ff.

¹⁶⁰ Steve Kingston, “Brazil spaceport threat to villages,” *BBC News*, 9 November 2004 (<http://news.bbc.co.uk/2/hi/science/nature/3985229.stm>).

expression of an environmental identity in relation to the community viewed over time.¹⁶¹

Without a doubt the substitution of interior-based agriculture for coastal fishing dramatically overturns and unravels the fabric of a community, inciting resentment and constituting an environmental injustice without question. A severe lack of political equality and recognition are latent in just such a scenario, and the consequences—marginalization, repression, and disenfranchisement—are all too real. Although the concept of identity recognition may seem somewhat intangible at first glance, the material consequences of identity recognition are anything but illusory. Social attitudes and institutional dispositions have a very concrete affect on people's lives as well as the natural world.

A similar misrecognition of value, environmental identity, dignity, and culture occurs at Kourou, where the European Space Agency (ESA) and the French company Arianespace utilize favorable launching conditions at the equator at the expense of, and without much benefit to, the local inhabitants for whom the island is home. A journalist there reported,

Milling workers, echoing opinions widely heard among Creoles, complained how the preoccupation of France with space supposedly blinded it to social problems in Guiana. "The French come here for two or three years to make their money and go back to France," a striker said. "They don't care about the Guianese people, and if it weren't for their rockets, they wouldn't care about Guiana."¹⁶²

The post-colonial dynamics of a former colonial power exploiting its historical legacy to derive benefits for itself and its citizens without much regard for the people whose land it makes use of begs for moral examination.

¹⁶¹ Figueroa, "Indigenous Peoples and Cultural Losses," p. 233.

¹⁶² Howard W. French, "Kourou Journal; Space Center or Not, Some Say It's Still a Jungle," *The New York Times*, 26 April 1991, p. 2 (<http://www.nytimes.com/1991/04/26/world/kourou-journal-space-center-or-not-some-say-it-s-still-a-jungle.html>).

One could make the argument that if the Guianese locals derive benefit from using cell-phones made possible by satellites that Arianespace put into orbit, then they have no reason to complain. This line of thinking suffers tragically from misconceptions about the indispensability of political participation, self-determination, and actual equity and equality (major considerations in Shrader-Frechette's PPFPE). Unless the native inhabitants of so-called "French" Guiana are included in decision-making institutions *from the outset*, principles of procedural and participative justice will have been violated. No amount of redistribution, compensatory payments or other derived benefits, environmental or otherwise, can make up for the irreplaceable loss of unique and priceless environmental identities. Likely, the only way to accurately describe what is happening is to refer to it as covert inter-cultural paternalism at play on the world's stage. It is for this reason that the environmental justice and ecofeminist critiques are absolutely necessary to discussions of even bigger questions such as the ethics of terraforming and/or colonizing Mars, lest similar or more expansive marginalizations be conjured into existence. It is not enough merely for indigenous, disenfranchised and/or marginalized environmental identities to be offered a spot at the table if their voices carry no weight, are not respected, or have no real or meaningful influence on the outcomes of the process. Only by committing to real, full, and thorough recognition of historically marginalized and disenfranchised identities, a prerequisite for meaningful political participation, can there be said to be any justice in the institutional and procedural contexts that govern socio-economic (and environmental) decision making. Not only are these concerns eminently relevant for questions of ethics and justice not only for post-colonial power dynamics but for a host of other environmental and political imbroglios on Earth, they will determine ultimately whether any future interaction with the red planet can be deemed to be just.

VII. Colonialism, “Space Elevators”

Interplanetary colonialism brings with it a host of dangers and possible injustices, too. Mars and its populations may struggle at first to feed and sustain even a small biological presence on an otherwise uninhabitable world. Mars, then, as a colony of Earth, would be dependent upon its parent planet for sustenance and support. If this dynamic overburdens the Earth or its population, taking food or resources that might otherwise sustain terrestrial populations in order to prop up a technologically progressive environmental experiment on another planet, surely that would constitute an injustice. Or, conversely, if planetary engineering successfully manipulates the Martian climate such that great flowing fields of “amber waves of grain” spring up across the Martian landscape, an overpopulated, malnourished, environmentally impoverished terrestrial population may seek to requisition the Martian bounty to feed its starving multitudes. Unlikely as this dynamic may seem, without a sustainable culture in place before anyone attempts to colonize Mars, there is no reason to expect that the problems we wrestle with on Earth will not follow us to the stars. Such considerations highlight the potential for extreme distributive injustices associated with interplanetary colonial machinations proceeding from any attempts to terraform Mars.

One final wrinkle remains to be ironed out before this preliminary survey of the broad categories of environmental justice considerations can be allowed to move on to unique issues stemming from readings of ecofeminism explored in the following chapter. Once again, anthropogenic climate change of the sort that was unintentionally initiated on Earth with the industrial revolution, and of the type terraforming enthusiasts would like to see instantiated on Mars, creates at least one further moral quandary that should be addressed before these

preliminary discussions of the environmental justice (or injustice) of terraforming are brought to a close.

Because anthropogenic climate change has, by and large, ceased to be something we think we can prevent, and transitioned into something we are going to have to try to adapt to, further structural inundations of the terrestrial atmosphere with excessive greenhouse gases are exceedingly inadvisable. Therefore, it is not too much to imagine that, owing to a desire not to further contribute to greenhouse gas pollution, future technocrats and engineers may look for a way to access the low-Earth orbit extraterrestrial environment without adding further greenhouse gas pollution to the atmosphere from increased rocket launches.

According to an environmental impact statement produced for NASA's new "Constellation" program of heavy-lift vehicles capable of extending technological capacity beyond low-Earth orbit (the range to which the space shuttle was limited) and out further again to the moon, asteroids, Mars and beyond, the primary byproduct of chemical rockets is water vapor—which, while seemingly innocuous, is considered a greenhouse gas.¹⁶³ While NASA predicts no massive detrimental effects from its rockets for global warming, as extraterrestrial transportation technologies become more widely available, economical and desirable, the aggregated impact on the global climate regime may cease to be negligible.

As if this facet were not damning enough when technological progressivism brushes into contact with calls for sustainability, even further technological feats of engineering beckon for attention from the minds of science-fiction enthusiasts and techno-junkies alike. One way around chemically fueled rocket travel might be the production of a "space elevator." The space elevator is a science-fiction fantasy that, unless moral argumentation has any effect on arresting the

¹⁶³ *Final Constellation Programmatic Environmental Impact Statement* (Washington, D.C.: National Aeronautics and Space Administration, January 2008).

momentum of technological progressivism, someone may one day dare to construct. The idea is to extend a gargantuan cable down from a geostationary orbit allowing elevator cars to transport cargo from the surface of a planet into space without the need for traditional chemical rocket launches. Various authors have imagined it and speculated about its possibility, and nothing indicates that such a feat of technological engineering is anything close to likely anytime within the lifetimes of existing generations. However, should it appear to some future engineers someday to be possible, what would ethics stipulate as necessary in order for the project to get full go-ahead from an environmental justice point of view?

Just as Jamieson asserts in his article “Ethics and Intentional Climate Change,” a broad, politically inclusive decision-making framework must be instituted from the beginning in order to ensure that the free and informed consent of all relevant and potentially affected stakeholders is sought out because of the massive attendant risks, dangers and threats of significant harms associated with such a project should even the slightest thing go wrong.¹⁶⁴ Some feasibility studies for space elevators involve capturing an asteroid and bringing it into orbit around the planet, a monumentally dangerous prospect given the potentiality for catastrophe resulting from even minor miscalculations. In Kim Stanley Robinson’s trilogy, the moons of Mars themselves are mined to extend a cable down to the surface of the planet. For Robinson’s characters the most logical place to anchor such a cable is at the summit of *Olympus Mons*, in the caldera of the solar system’s largest prehistoric volcano. Imagine the environmental uproar if the same thing was attempted on the peak of Mt. Everest in the Asian Himalayas! Supposing the natural value and inherent dignity of such a unique location in the universe can be co-opted without objection or infringement of its historic, cultural and scientific identity, are there any dangers to constructing

¹⁶⁴ Jamieson, “Ethics and Intentional Climate Change.”

such a colossal technological wonder? If fiction provides any sort of guide to the probabilities and outcomes proceeding from such technological machinations, the answer is a resounding, “Yes!” Untested and un-testable technologies on so enormous a scale produce massive dangers, risks, and threats of harm that no amount of political inclusion, free and informed consent, or economic compensation could ever likely overcome. Robinson imagines interplanetary colonial strife resulting in a violent, world-changing sabotage which sees the sinuous elevator cable come crashing down across the red planet, wrapping around it twice and annihilating anything in its path in a hyper-sonic explosion, “that no one close enough actually to see the cable hit survived it.... For the final thousands of kilometers of the fall, there were no witnesses.”¹⁶⁵ Martin Heidegger quoted the poet Holderlin, writing, “But where danger is, grows / The saving power also.”¹⁶⁶ However, such ethical interrogations cast some considerable doubt on the veracity of such a sentiment.

As the previous section indicated, if you don’t know the risks, you don’t know how to evaluate the justice of a given scenario. Looking at the exorbitant risks, then, the justice of the scenario seems plain as day—unless the global population is actively included in the decision making, and non-anthropocentric considerations are taken into account, any attempt to pursue such a project can only be identified as unjust.

VIII. Conclusion

Not even during the reign of the gargantuan dinosaurs did anything on Earth come close to the monumental scale with which humans are now relatively well-versed. Internet, television,

¹⁶⁵ Robinson, *Red Mars*, p. 508.

¹⁶⁶ “The Question Concerning Technology,” in *Martin Heidegger: Basic Writings*, ed. David Farrell Krell (New York: HarperCollins, 1993), p. 340.

radio, cell-phones; industrial agriculture, industrial fishing; pesticide use, deforestation; climate change: the human impact on the globe has made ours a much smaller planet than previous generations had enjoyed. Human culture, expressed through technology, is changing the composition of the planet atmospherically, and in terms of biodiversity to a degree which some distant future archaeologist may find immediately recognizable as representative of a dramatic bio- and geological upheaval having to do with the advancement of human technology on Earth and the corresponding ecological impoverishment that followed shortly after it. Like the K-T boundary or the great Permian extinction, the expansion of human presence on the Earth will correspond with significant loss in biodiversity, an unmistakable layer of detritus the world over, and an alteration in the composition of the atmosphere caused in large part by our technological artifact *par excellence*, the automobile.¹⁶⁷ Barely a century since its introduction, a fraction of a second in geological time, and already our culture has had to move away from crude oil toward natural gas as the carbon sequestered for untold eons beneath the Earth's surface is churned up into the atmosphere—and it will be eons before it again makes its way back down below.

Terraforming provides no panacea; nor hardly even a decent escape outlet or release valve¹⁶⁸ for problems of overpopulation, environmental destruction, and dangerous anthropogenic climate change on Earth. Instead, a thorough investigation of the ethics of terraforming directs one's attention back toward Earth and necessitates urgency for replacing the unsustainable, overly consumeristic, unrestrainedly capitalistic “tragedy of the commons” approach our Western techno-scientific culture has taken towards the natural environment and

¹⁶⁷ Not to mention the effect of fossil fueled electricity—a sticky situation that will become all the more intractable as the numbers of “plug-in” electric vehicles rises and creates further strain on an already maxed-out fossil fueled infrastructure.

¹⁶⁸ Zubrin, for example, hopes Mars colonization will provide exactly this type of outlet. See *The Case for Mars*, p. 270.

ecology which sustains it. Furthermore, it mandates a broad, politically inclusive “Earth Ethic”—promoting sustainability, equality, participation, and precaution with regards to our technology and cultural effects on the ecosystem on which we depend for our survival.

CHAPTER 4

GUARDING THE GARDEN: CAN ECOFEMINISM AND ECOPOIESIS COEXIST?

I. Introduction

Were humans to terraform Mars, undoubtedly the project would suffer from the same attendant failures and shortcomings to which all human endeavors are heir. Greed, selfishness, apathy, and a hundred other human weaknesses beleaguer such a dream before it can ever see the hope of reality. The environmental justice discourse adds but another accretion to the mountain of reasons why terraforming should be considered inadvisable at any point in the near future. Indeed, it seems that the addition of fears highlighted by the history of the environmental justice movement in society and philosophy would be the final nail in the coffin of terraforming as goal worth pursuing at any point in the future of human undertakings, adding its strength to the abiotic intrinsic value argument put forward by Rolston, York, and Marshall.¹⁶⁹

Yet, it remains to be determined, how heavily these concerns weigh when compared to the arguments in favor of terraforming and ecopoiesis. The most common arguments¹⁷⁰ put forward in defense of terraforming in the published literature seem immaturely adhering to a faith in technological progressivism, blindly crying out for a manifest destiny on the ochre frontiers of Mars. I submit that such arguments are of middling merit and carry with them as much that is undesirable as that which may be good. Therefore, I leave off their defense in favor of arguments that may prove to be more fruitful.

Particularly, I submit the following: that terraforming and the process of ecopoiesis, specifically of and on Mars, can be considered morally good and desirable for the following

¹⁶⁹ See chapter two.

¹⁷⁰ See Appendix C for an aggregated list of arguments put forward in the published literature both for and against the prospect of terraforming Mars.

reasons: (1) life is of unique value in the universe, and therefore deserves protection; (2) terraforming is a suitable intermediate step to exploring nearby star systems in the not-too-distant future; and (3) terraforming also serves as a sufficient intermediate step to making it possible for terrestrial biological evolution to continue on after the Sun exhausts its fuel, explodes and cools making continued life on Earth practically impossible. Although such concerns are mind-bogglingly far in the future, as living, evolved creatures ourselves, it is good, noble and worthwhile for us to seek to perpetuate the eternal renewal of life, even past the death of our Sun if such capacities exist and can be engaged in both justly and equitably. (4) Terraforming may provide considerable longevity for our society, civilization and culture—a form of sustainability made possible by sustainability on Earth, so that sustainability in the broader cosmos ceases to be a pipe-dream and comes considerably closer to becoming a reality. Such sustainability is desperately needed as a remedy for the myopia of a point of view that has difficulty thinking and acting in relation to time spans on the order of human cultures rather than individual lives. Furthermore, if cultural diversity is valued through identity recognition politics and frameworks, in the same way biodiversity is valued for ecosystemic integrity, a plurality of cultural and environmental heritages can be sustained as the inheritance for future generations, as opposed to the perpetuation of unsustainable, domineering and homogenizing environmental and cultural identities, which are exceedingly adept at sowing the seeds of their own destruction, though they regularly fail to realize the extent to which this is so. Finally, (5) terraforming may be judged morally acceptable if Mars truly does turn out to be barren and seems conducive to supporting a warmer atmosphere.¹⁷¹ In that case, humans may choose to transplant themselves and their

¹⁷¹ Recall in the second chapter makes the argument that “*the absolute survival needs of the terrestrial biosphere may take precedence over the right of abiotic Martian landscapes to remain in their primeval state because of the greater moral significance of living entities over non-living ones,*” provided no other alternative exists for the perpetuation of terrestrial evolutionary trajectories (p. 24 in this thesis, and the text corresponding to footnote 115).

ecologies, or perhaps even ecologies without insistence on human subsistence. Mars could be set up as a bio-preserve, a global seed-bank and test-bed for terrestrial evolution to run its course when introduced to a harsh, uninhabited frontier in which it might produce “endless forms most beautiful.”¹⁷²

However, such daydreams may be more likely manifest as waking nightmares—with whole biotic communities enslaved to production of biomass for the exclusive support of human beings. Or genetically engineered foodstuffs might run amok and supplant any local biodiversity. Or, perhaps most frighteningly, genetically modified organisms custom engineered for colonizing Mars may “back-contaminate” the Earth, hitching a ride on an interplanetary spacecraft and wreaking unimaginable damage on the genetic heritage and biodiversity that has been the historical hallmark of life on Earth. Such are the problems and factors to consider when questioning whether or not it would be morally right, legitimate, and justified to terraform Mars—considering both human and nonhuman concerns.

I believe, and argue in this thesis, that at some point in the future, determinable by a set of ecofeminist and environmental justice criteria, humans may be able to terraform Mars without violating any major or minor ethical principles. Such a statement is particularly challenging considering the discussion and attribution of value insisted upon by environmental philosophers (as delineated in chapter two). However, even if Martian “abiotic” “voices” are politically included, socially respected, and broadly valued, it may be possible to bring life to Mars and thereby *add* to the value of that planetary system rather than detract from it.¹⁷³

¹⁷² To quote the famously poetic last line of Charles Darwin, *On The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (London: John Murray, 1859), p. 490.

¹⁷³ Christopher McKay articulates just such a sentiment in “Bringing Life To Mars: Feasibility and Motivation.” This chapter expands on the ideas that are nascent there but lack full philosophical elaboration.

The major difficulty with this notion is that it appears to perpetuate the patriarchy, hegemony, and dominion humans presently unsustainably exert over the terrestrial bio-system. I conjecture, however, that we can define a more environmentally advantageous cultural identity in the post-modern era that overcomes a simplistic revulsion from technology and identifies a human *ethos* that takes account of the incredibly forcefulness of human rationality, intellect, and civilization within the world and puts it on a decidedly more rational and ecologically sustainable trajectory.

The prevailing dominant, ecologically unsustainable, Western techno-scientific cultural rationality suffers from its inability to conceive distant horizons in time sufficiently, or to take into account the implications and consequences of choices and actions in the present that have a distant effect in space or time.¹⁷⁴ In an earlier era it was possible to consider only immediate causes, effects, and consequences. However, the modern understanding and embellishment of the globe's interconnected character in terms of its societies, cultures and environments is remarkably unprecedented in human, or even evolutionary, history. Language, culture, and even the industrial revolution have within a split-second in geological and evolutionary time vastly exploded our population numbers and effectively bookended the human domination of planet Earth as, for all intents and purposes, complete.

Now, we in this time period have to live with the consequences of this broad biological and intellectual evolutionary history and somehow attempt to steer an enormous "spaceship Earth" through treacherous waters and narrow fjords, taking into account its colossal inertial momentum, and dealing all the while with internal political struggles and socio-economic strife. Not only are all the passengers smoking in the lounge making the air increasingly hazardous to

¹⁷⁴ See, Steve Gardiner "A Perfect Moral Storm."

everyone's health, there are increasingly smaller amounts of food to feed the growing numbers of passengers, of whom there are so many that whole groups of nonhuman passengers are beginning to be thrown overboard at a more and more alarming rate all the time. Of course, I refer to species extinction resulting from human behaviors, a tragedy and ominous harbinger of distressingly environmentally impoverished times to come.

In the subtext of this metaphor is the supposition that humans really are at the helm rather than just along for the ride.¹⁷⁵ Imagine the terror of passengers on an aircraft if they opened the cockpit door during a crisis and found not only no pilots at the wheel, but no wheel, gauges, or devices by which to steer their plane to safety. This is precisely our challenge, not only is the “train off its rails,” there were never any rails to begin with. If we understand the philosophical implications of evolutionary biology, we are left to consider a world that is ruthless in its absolute apathy towards biochemistry. Across the biological spectrum, offspring suffer from accidents and predation to a staggering degree. A great part of the genius of humanity is the incredible care parents shower upon their children. However, such care exists for a reason. It is a direct result of the considerable danger, risk, and uncertainty that is unavoidable for living organisms. Because things matter for us in a way they do not for rocks, living organisms have to take care with themselves, their young and each other. Our contemporary failure to do so in an environmental context assuredly invites calamity. Therefore, this chapter offers, in line with ecofeminist philosophy, ethics of care, guardianship, nurturing, and an ecologically sustainable framework for production and reproduction drawn out of ecofeminist literature. These themes are like piers at a wharf, supporting a more delicate superstructure with heavy, stable and

¹⁷⁵ According to Val Plumwood, “Our best hope is to change the basis of democracy so that more fully egalitarian forms of democratic economy and culture can give everyone an equal stake in the benefits and an equal risk of adverse consequences. We must aim for fairer inputs in steering the ship, determining its directions in ways that are rational for everyone. We need too structures of working life that encourage us to exercise responsibility and care for one another and for the natural world.” From *Environmental Culture*, pp. 239-40.

anchored timbers. If there is any way in which terraforming or ecopoiesis can ever be considered worthwhile, moral and just, it will only be by emphasizing the ecologically rational ethical themes uniquely identified in this chapter with regards to their relevance for questions of terraforming ethics, in order to overcome the crippling critiques ecofeminism has levied against the dominant and oppressive hegemonic culture that presently exercises power, influence, authority and control in our contemporary global context.

A human goal throughout history, suffused in our present and continuing into the future, is safety, protection, and security. In only a few generations since slavery in the Americas, genocide in Europe and the first humans travelling to the moon, we have come a long way towards establishing an equitable and just society. Continuing that project is of the greatest philosophical and social importance. Terraforming and ecopoiesis can work in pursuance of that goal, but only if they avoid the sorts of problems identified specifically in chapter three of this thesis. Therefore, this chapter provides a motivating *ethos* founded upon ecofeminist ideals that protects projects of ecopoiesis from becoming unjustifiably oppressive by seeking what one environmental justice author has called,

Transformative remedies ... that strive to destabilize and deconstruct cultural identities that perpetuate socially constructed attitudes and collectivities, which maintain forms of discrimination and oppression.... The first candidate should be the dominant culture, which is an economistic, consumerist, and discriminatory culture that ... thrives like this with an opportunism that rivals hypnotic greed. *This* level of culture should be transformed and destabilized, while we realign and deconstruct current procedures and attitudes of political inclusion.¹⁷⁶

In this chapter I articulate a consistently bio- and ecocentric ethic that can ultimately be used in favor of terraforming and ecopoiesis. In this regard, it attempts to pick up where Fogg, Haynes, Zubrin, and McKay left off and articulate a rationale for terraforming Mars that is not quite as

¹⁷⁶ Figueroa, "Bivalent Environmental Justice and the Culture of Poverty," p. 39.

beholden to the influence of technological progressivism in that it urges sustainability rather than unsustainable growth, and care, respect, and dialogue in place of control, dominion, or sterility in terms of a putative scientific disinterestedness, dispassionateness, or any other unattainable objectivity. Recognizing our continuity with other living organisms that share our ecology, and the universal substrate that makes it up removes illusions of “hyperbolized autonomy” and accurately takes account of the unique human position in the terrestrial ecological biosphere.

This ethic counsels prudence, patience, and precaution in the short term, and deliberation and extreme care in longer time frames. Furthermore, certain features of this ethic require defense from criticisms that they perpetuate oppressive conceptual hierarchies or are too weak to make any difference. These objections will be dealt with in turn, resulting in the broader articulation of an ecofeminist ethic that overcomes the “use/respect” dualism that sometimes paralyzes contemporary environmental discourse by means of an ecofeminist spirituality conceptually anchored in the intentional recognition stance.

II. Terraforming and Ecopoiesis

What is the difference between terraforming and ecopoiesis, both in their implementation and their implications? Although these terms have been used somewhat interchangeably throughout this thesis up until this point, they actually denote different things and the implications of each result in very different ethical conclusions being drawn about their advisability. Taking the words apart then in a simplistic way that highlights their immediate cognitive dissonance, to “terraform” is to form something into a likeness of *terra*, or the Earth. So “terraforming” is the process by which a planet or other suitable body is manipulated such that its climactic conditions come to mirror that of the Earth. “Ecopoiesis,” however, refers to the

fabrication of an ecosystem. Whereas terraforming suggests a sort of violence, a radical reshaping of a unique planet in order to bring it into conformity with an anthropocentrically conceived instrumentality, *ecopoiesis* is the nurturing of fragile biotic communities in novel environments not merely as a means to human ends, but as an end in itself.

Furthermore, the connection between *-poiesis* and *poetry* is not lost. *Ecopoiesis* could be engaged in as an art form, not merely a sort of play using living organisms as a painter might use pastels on a canvas, but an art that really and truly matters because lives are on the line. It is the dramatic struggle to survive, to lay down roots in stony soils, to heed the call and obey the drive that all living things hear to reproduce themselves, to bear the next generation and set them on their path down the tireless march of centuries. The ideal of *ecopoiesis* in its most noble form is an artistic way of looking at life; a recognition of its beauty, whether it was crafted by a divine creator or gradually formed over the generations like trickling water creates stalactites and stalagmites in an underground cavern.

Undoubtedly, there would be an artistic component to the execution of *ecopoiesis* with scientists balancing and modulating populations as a conductor might quiet one group of instruments so that another can be heard. However, this is not the most important feature of *ecopoiesis* as a concept. Rather, it is the nurturing character of the *ecopoet*,¹⁷⁷ if such a term can be used, that excites such optimism for *ecopoiesis* as a trajectory.

Perhaps Kim Stanley Robinson puts it best in a conversation between one of his main characters, Sax Russell, and a friend out on the living, breathing future plains of Mars,

“I’m used to thinking of Mars as a kind of wilderness,” he said, as he looked up the etymology of the word *garden*. French, Teutonic, Old Norse, *gard*, enclosure. Seemed to share origins with *guard*, or keeping.... “You know—get things started, let

¹⁷⁷ *Ecopoet*, and *ecopoetry* already have an accepted usage in environmental literature. The *ecopoet* that engages in *ecopoiesis* may be differentiated by adding the term, *scientific* before it as a qualifier.

loose the seeds, then watch it all develop on its own. Self-organizing ecologies, you know.”

“Yes,” Tariki said, “but wilderness too is a garden now. A kind of garden. That’s what it means to be what we are.” He shrugged, his forehead wrinkled; he believed the idea was true but did not seem to like it. “Anyways, ecopoiesis is closer to your vision of wilderness than industrial terraforming ever was.”

“Maybe,” Sax said. “Maybe they’re just two stages of a process. Both necessary.”¹⁷⁸

The act of nurturing when universalized as an environmental ethic appears both desirable and advisable. It is the ethic of “care” that is practically ecumenically advised from all noble human traditions. Horizontally and vertically, across human cultures and from every domain within those cultures, care arises as a quintessential human good, a noble goal worthy at all times of pursuit. Not only is it encouraged, care is often mandated as what ought to be done; its moral status is practically unquestionable. The commandment to “care” is not merely an option which one can either opt to perform or not to. It is not the case that one can live a good life without caring, but a better life by caring. Caring may be analyzed according to certain traditions as something that must be done in order to live a good life, whether that mandate is prudential or deontological.¹⁷⁹

We find care in Christian “creation-care”¹⁸⁰ and the commandment to “love your neighbor as yourself.”¹⁸¹ We see it in feminist and ecofeminist treatises.¹⁸² For example,

¹⁷⁸ Robinson, *Blue Mars*, pp. 89-90.

¹⁷⁹ Specifically, Kantian deontology is rather “care-less,” because the obligation to do one’s duty to the good applies rationally rather than emotively. However, the elaboration of a more broadly inclusive, ecologically aware and sensitive version of the categorical imperative that extends moral considerability into the nonhuman realm can be said to be in line with counter-hegemonical post-feminist critiques embodied in ecofeminist care ethics.

¹⁸⁰ See, for example, Blaine Harden, “The Greening of Evangelicals,” *The Washington Post*, 6 February 2005 (<http://www.washingtonpost.com/wp-dyn/articles/A1491-2005Feb5.html>).

¹⁸¹ Mark 12:31, New International Version.

¹⁸² Val Plumwood writes, “among the main sources of irrationality in the rationalist economy are hyperbolised concepts of individual ‘autonomy’ and hegemonic constructions of agency that legitimate unjust appropriation and denials of dependency on others, including nature ... and marginalise ethics and emotionality, including care for human others and for nature. Many feminists have critiqued these, emphasising as alternatives care perspectives that

ecofeminist author Karen Warren provides a first-person narrative account of a rock-climber who came to experience,

an overwhelming sense of gratitude for what [rock-climbing] offered me—a chance to know myself and the rock differently, to appreciate the unforeseen miracles like the tiny flowers growing in the even tinier cracks in the rock’s surface, and to come to know a sense of being in relationship with the natural environment...I felt myself *caring* for this rock.¹⁸³

Such sentiments expressed in narrative form are the basis for her ecofeminist ethic. Martyn Fogg may attempt to discount such relations as “gross sentimentality,” but he overlooks the incredibly beneficial environmental ethic that blossoms forth from such understandings. Later in the same article, Warren recounts the teachings of Sioux elders regarding the appropriate relationship between the hunter and the hunted. She writes that she was,

struck by the power of the environmental ethic that grows out of and takes seriously narrative, context, and such values and relational attitudes as care, loving perception, and appropriate reciprocity.... A *re-conceiving* and *re-visioning* of both feminism and environmental ethics, is, I think, the power and promise of ecofeminism.¹⁸⁴

Toward that end, in this chapter I attempt to articulate an ecologically rational, environmentally sustainable ecofeminist ethic of care that will prove beneficial not only for questions of terraforming Mars, but for contemporary environmental imbroglios as well.

III. The Guardian of the Garden

Specifically, the mentality of the gardener is both useful and instructive for framing the new sort of environmental ethic I wish to elaborate. The gardener intimately cares whether or not the garden succeeds, both for the gardener’s own sake, because of all the time and effort that the

stress emotional and dispositional forms of care for nature, as a more-than-instrumental basis of concern,” in *Environmental Culture*, p. 35.

¹⁸³ Karen Warren, “The Power and the Promise of Ecological Feminism,” *Environmental Ethics* 12 (Summer 1990), reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*, p. 38.

¹⁸⁴ *Ibid.*, p. 45.

gardener has put into the garden, and for the plants themselves, because the gardener has nurtured these lives, coaxed them into being and supported their struggles to survive and flourish. The gardener is like a proud parent, raising a crop of vegetables rather than raising children. The significance of nurturing, healthy growth, and maternal care are not lost in such an ethic; conversely they are emphasized, correcting for the hegemonic domination of patriarchy in some agricultural metaphors (such as those involving the widespread distribution of a single type of seed, or the violence of bringing the Earth under the till associated with contemporary industrial agriculture). However, a certain detachment from one's expectations about the fruits of one's labor may also be advisable. The gardener probably should not grow pumpkins with the expectation that her pumpkins will be the largest at the state fair, this will likely only lead to disappointment. However, to be totally apathetic would almost certainly only have negative results on the garden and the harvest. Therefore there is a certain perfect mean for caring, as if it would be most properly analyzed as an Aristotelian virtue.

In this thesis I propose that ecopoiesis is advisable, given a certain set of precautions particularly elaborated in chapter three, specifically dealing with participatory parity, actual equality and understanding the effects of terraforming on marginalized identities, situated epistemologies, as well as its likely effect on climate change. It is not because such an ethic establishes a proper, moral, and beneficial relationship with Mars, but rather because it does exactly those things with the Earth—a change desperately needed in times of ecological upheaval such as these.

To see how ecopoiesis on Mars could facilitate the creation of an ethic that has beneficial effects on Earth, an illustration of how ecopoiesis would be performed on Mars as well as an understanding of the motivation for ecopoiesis may prove instructive. Ecopoiesis is a nurturing

of living communities in the same way a gardener cares for his or her garden. The gardener clears the plot, works the soil, plants the seeds, and waters them. But a wise and intelligent gardener also protects the plants from pests and parasites and extremes of weather. The smart gardener is also a good guardian of the garden. Kim Stanley Robinson attempted to establish the connection between the roots for the words *guard* and *garden*, but the hold is tenuous at best. Nonetheless, we may invoke the benefit of a conceptual link between the two, if nothing else, coincidentally aided by the similarity of the words in English. The good gardener guards the garden. The garden is the thing guarded. Living organisms, whether they be lichens or sheaves of wheat on a terraformed Mars, would be guarded with the highest technology humans have available. Gardens on Mars would not be mere novelties or hobbies, but the very means as well as end of being there. Our gardens on Mars would facilitate life, but furthermore they would be the point of life there. The goals of terraforming and ecopoiesis are not merely to make life possible on a barren planet, but to establish a foothold for living organisms there. Yes, humans are there to explore and even extract resources to further supplement their industrial production and pursuit of leisure, but they may be there for another reason, a more noble reason.

In chapter two, I showed how various authors writing in opposition to terraforming supposed the purpose of terraforming was for human benefit, but this conception is naïve and shallow. Just as the decision to have a child involves a significant economic investment, so too pursuing ecopoiesis on Mars would require significant material as well as psychological commitment of resources. Bringing a dead planet to life is no doubt an extremely difficult and costly process, but the benefits associated with it may at least balance out the costs, if not exceed them. The same is true of the parent and child. Children regularly instill considerable happiness

in their parents, if not an overwhelming sense of joy. Perhaps even more importantly, the bearing and rearing of children also provides a considerable sense of fulfillment.

Terraforming and ecopoiesis have the possibility of providing a similar form of fulfillment to generations of people living and working on planet Earth. It brings that fulfillment because it is a worthwhile endeavor, because it is creating life, nurturing it, and helping it to grow and flourish. Taken to its conceptual conclusion then, to terraform is not just to “form into the likeness of the Earth” it is in fact to *reproduce* the Earth. From the viewpoint of organicism toyed with by Leopold and Stone,¹⁸⁵ this reproduction of the Earth mirrors the reproduction of any organism, writ large. Yet it is entire ecosystems that are being reproduced, just as it is an entire diversified organism, replete with heart and hands, appendix and brain, differentiated, specialized organs unified in a self-contained whole.

So if terraforming can instantiate the right conditions of atmosphere and temperature on Mars, then it will be fertile, ready to receive seed, ready to be impregnated. This is the task set before the ecopoets, to act as midwives to the reproduction of what is not improperly called “Mother” Earth.

This moment seems grandiose, and it is! It would mark the first known incidence of a self-contained set of ecosystems, traversing the void of interplanetary space, and laying down roots on another planetary body. Just as ancestors of the aborigine people voyaged over the watery horizon to what is now Australia, we send modern humans and our faithful robots in air-tight cylindrical ships to distant planetary shores, across the inky vastness of space.

But merely bringing up this comparison does nothing to defend its legitimacy and says nothing of its moral appropriateness. What makes terraforming and ecopoiesis good things to do,

¹⁸⁵ See footnotes 82 and 83 in chapter two.

as opposed to merely something possible, is the ethic of the guardian of the garden. Terraforming and ecopoiesis engaged in with this mindset or guiding ethical framework hold the greatest promise for at least coming close to that ideal of nobility that humans seem so readily capable of conceiving, yet so infrequently capable of achieving, much less maintaining.

The greatest feature of this proposed novel ethical framework is that it safeguards against the destruction of the home-planet for the needs of the colony. Imagine a gardener with a perennial garden plot, ripe with fruits and vegetables of all varieties. This gardener desires to expand his or her garden and after prepping a nearby plot begins to transplant seedlings from the first plot to the new one. The gardener's first concern is the health of the entire gardening endeavor, and only a foolish gardener would work the new plot at the expense of the old. All of the plants in each of the plots are the gardener's concern, his or her duty and desire are to guard them from coming to harm, as he or she has raised them as if they were his or her own children. One of the difficulties of the metaphorical ethic is that there is not simply one gardener when it comes to terraforming, but a whole population of humans, acting over multiple generations, without a central agent on whom to exclusively place responsibility for executing the actions of a good gardener. But, were the ethic to be universalized, consider the implications. It would be contradictory to engage in terraforming and ecopoiesis at the expense of the health of Earth's ecosystems,¹⁸⁶ according to a kind of "throw-away Earth" mentality, because not only is the new-born, fragile Martian ecosystem conceived of as a garden, but the Earth is conceived of as garden as well—albeit one with a natural origin rather than an artificial one, as any sort of "garden" on Mars might be. Nevertheless, both demand guardianship.

¹⁸⁶ For example, consider the dangers of increased rocket launches from Earth exacerbating anthropogenic climate change (Chapter 3, section VII: Colonialism, "Space Elevators").

The most exciting aspect of this ethic is that we need not engage in terraforming or ecopoiesis at all in order to begin embodying the guardian of the garden. Conceiving of ourselves as humans as guardians of the Earth-garden is a beneficial ethical framework, irrespective of interplanetary designs. Such a blatantly hierarchical conception may invoke wariness in my audience, suffering as it does from Lynn White, Jr.'s famously addressed problem of placing humans in dominion over the Earth.¹⁸⁷ Yet perhaps this is precisely the Nietzschean turn that could be beneficial. White, like the lion, tears down the old ethic, slays the dragon, and we, with the innocence of children create a new ethic from the scattered glittering scales littering the floor.¹⁸⁸

I argue that humans should take up the responsibility of the guardians of the Earth-garden. Ironically, this first and foremost means guarding our garden from ourselves. Our work boots are massive and trample species without a thought as a careless gardener might squash seedlings under foot. So it is for us to become careful gardeners, embracing sobriety whereas before we have been drunk on our own power. Another one of the benefits of this ethic is that it replaces the traditional Western domineering patriarchal relationship with the land with one more exemplary of a mother's relationship with a child. Or perhaps even more appropriately it blends them in a more harmonious balance than has been seen before. Whereas power and control have been the dominant characteristics of technological progressivism, nurturing, and care are emblematic of the ethic of the guardian of the garden. This role-reversing re-conception of the

¹⁸⁷ "The Historical Roots of Our Ecological Crisis," *Science* 155 (10 March 1967): 14-21, reprinted in ed. Pojman and Pojman, *Environmental Ethics: Readings in Theory and Application*.

¹⁸⁸ A reference to Friedrich Nietzsche's famous "three metamorphoses," which can be found in *Thus Spake Zarathustra* [*Also Sprach Zarathustra*, 1891], Part I, trans. Thomas Common, 6th ed. (London: Routledge, 1906), reprinted in *Western Philosophy: An Anthology*, John Cottingham, ed., 2nd ed. (Malden, MA: Blackwell, 2008), pp. 786-90.

human/Earth hierarchy sets the stage for a sustainable social and ecological trajectory to be achieved.

However, it cannot be stressed strongly enough that the guardian component of this ethic absolutely mandates that wildness, wild places, and wild things are protected too, and that planet Earth is not conceived of as a single, enormous fallow field, waiting to be plowed under at the hands of human gardeners. Rather, humans are as much creatures of the garden as any other ecosystem component, and therefore from an attitude of strict logical consistency, nonhumans *must* be allowed to express their inherent, particular agency. By which I mean, there are some parts of this cosmic tropical paradise we call Earth that should be left hands off, so that Earth others have the space to express their evolutionary and genetic potential just as humans seek to do the same. Preserving, protecting and safeguarding wild places grow out of an ethic of care, wise ecological stewardship and sustainability, and approach that which the paradoxically anthropocentric/nonanthropocentric “Earth Ethic” of J. Baird Callicott advocates.¹⁸⁹

The primary difference between the ethic I arrive at in this thesis, and that advocated in the edited volume *Environmental Restoration: Ethics, Theory, and Practice*¹⁹⁰ by Frederick Turner involves Turner’s implicit environmentally oppressive anthropocentrism, his lack of an analysis of the sort of broadly based environmental justice arrived at in chapter three of this thesis, and dodges the tricky philosophical foil that chastises the debate between ecological restorationists as opposed to ecological preservationists. In that same volume, G. Stanley Kane criticizes Turner, arguing instead that “[f]ellow members of a community, in contrast, are on more equal footing; they enjoy more independence and autonomy than any of the nonhuman

¹⁸⁹ Callicott, *The Land Ethic and the Earth Ethic*.

¹⁹⁰ Frederick Turner, “A Field Guide to the Synthetic Landscape: Toward a New Environmental Ethic,” in *Environmental Restoration: Ethics, Theory, and Practice*, ed. William Throop (New York: Humanity Books, 2000): 195-203.

participants in the lords-of-creation scenario,”¹⁹¹ a reference to a phrase in an earlier work of Turner’s.¹⁹² Whereas Kane concludes with references to “care” and familial relationships,¹⁹³ and “a nurturing relationship with wild nature” is seen in William R. Jordan, III’s “ ‘Sunflower Forest’: Ecological Restoration as the Basis for a New Environmental Paradigm”¹⁹⁴ in the same volume, only Turner refers to the “distant successors” of “the ecological restorationists” which will “be like the bees, serving as the gentle pander and reproductive vector of other species—participant-gardeners of nature.”¹⁹⁵ Although he does an excellent job of establishing a worthwhile and beneficial intergenerational ethic, his inability to escape the criticisms leveled against ecological restoration as an unmitigated ethical good hampers his work and prevents me from endorsing it whole-heartedly.

Because “restoration” necessarily involves not only a nostalgia for lost environments, species or landscapes, but also a propensity for violence, invasiveness, and overt human management and control of otherwise “natural” environments, preservationists have criticized its paradigm and recommendations for being unjustifiably oppressive and/or domineering.¹⁹⁶ However, the preservationist paradigm suffers from the danger of turning the Earth into a mausoleum—a humidity controlled wax museum in which “nature” is intensely managed to

¹⁹¹ G. Stanley Kane, “Restoration or Preservation? Reflections on a Clash of Environmental Philosophies,” in *Environmental Restoration: Ethics, Theory, and Practice*, ed. William Throop (New York: Humanity Books, 2000), p. 226.

¹⁹² Frederick Turner, “Cultivation of the American Garden: Toward a Secular View of Nature,” *Harper’s* 271(1985): 51.

¹⁹³ Kane, “Restoration or Preservation?” p. 234. Similar ideas are present in Turner, “A Field Guide to the Synthetic Landscape,” p. 198

¹⁹⁴ A quotation from Steve Packard, “No End to Nature,” *Restoration and Management Notes* 8 (1990): 72, in William R. Jordan, III, “ ‘Sunflower Forest’: Ecological Restoration as the Basis for a New Environmental Paradigm,” in *Environmental Restoration: Ethics, Theory, and Practice*, ed. William Throop (New York: Humanity Books, 2000): 214.

¹⁹⁵ Turner, “A Field Guide to the Synthetic Landscape,” p. 203.

¹⁹⁶ See Kane, “Restoration or Preservation?” p. 226, for Kane’s criticism of Turner.

conform to an elegiac homeostasis, antithetical to any conception of nature as evolving and in a state in which the only constant is flux. Thus, the roots of just such a debate harken back to Heraclitus' original "panta rhei," that the only constant is change. However, if this means acquiescing to either the destruction of nature, or the destruction of humanity, no one can in good faith support such misanthropy. The dominant hegemonic framework that constitutes the industrialized West's relationship with nature is in need of a structure that insists on justice both in anthropocentric, as well as nonanthropocentric terms—which I believe is accomplished in chapter three of this thesis by means of Starhawk's system for including nonhuman "voices" in community decision making, which complements what Plumwood referred to as the "intentional recognition stance." Furthermore, whereas "nurturing," "relationships," "gardening," and occasionally "care" pepper the language throughout the final chapters of Throop's edited volume, only my thesis establishes the fundamentally counter-hegemonic standpoint of ecological feminism and the ethics of care as of preeminent value for contemporary and future discussions of environmental ethics.

Finally, in this thesis I sidestep the divide between philosophies of preservation in opposition to philosophies of restoration by advocating an entirely novel *creation*, in the form of an environmentally just, ecologically sustainable, radically egalitarian ecopoiesis on Mars, so long as no other living organisms have prior claim to those ochre soils. Haynes and McKay, likely without being explicitly aware of the debates and language characteristic of the philosophical discourse between preservationists and restorationists, advocated engaging humanity as "participants in creation," by attempting to terraform and foster life that originally evolved on Earth in the alien atmosphere of Mars. Whereas on Earth, people may be philosophically divided over whether to attempt to restore what has been lost ecologically, or to

try to preserve what little “wild” nature we have left; on Mars, so long as no life already exists there, we are not limited to such a narrow confine. Future ecologists may have the opportunity to “play,” to “invent,” and express the creativity that is one of the greatest hallmarks and wonders of our species.

True to Heideggerian form, however, with such knowledge of how to manipulate environments on Mars, future societies may wish to exert similar control over the Earth and its ecologies. In the end, this may be a good result if it means the sustainability not only of the human population, but of the fellow species with which we share this planet. However, the awesome power and incredible uncertainty associated with the ability to genetically modify organisms and their DNA in order to serve some human end threatens ominously as a boon with the potential for massively catastrophic ramifications. Therefore, I advise the ethics of care, uniquely, not only in order to promote responsive and dialogic relationships with nature, but also to advise cautiousness. Science must become *careful*, in the sense that it is wary of placing too much faith in its own efficacy at bending the rest of the natural world to suit our human wills.

IV. Why Mars?

The question of, “why Mars?” is answered easily enough by a casual survey of the literature published on terraforming. Mars appears to terraforming enthusiasts more easily manipulated than Venus, and much more so than the moons of the gas giants, Jupiter or Saturn, never mind the frigid outliers Neptune or Uranus. But it matters not whether it is Mars, or Venus, or any other body in the solar system; the point is the proof of principle. Once it has been shown that humans can transport and grow ecologies as a gardener might transplant seedlings, the implications are monumental.

This process creates the possibility that the life processes that began on Earth some three-and-a-half billion years ago, may continue beyond that time at which the stellar evolution of our Sun results in the inundation of the Earth as the Sun expands to a red-giant before it shrinks and cools to a white dwarf star. This is exactly the hope that Fogg has for terraforming,¹⁹⁷ though he misses the corresponding non-anthropocentric motivating ethic that provides the extra push he is looking for to make terraforming and ecopoiesis appealing to environmental ethicists. This motivation, to push the lifespan of terrestrial evolution beyond the lifespan of our Sun, necessitates no rush to action, just as only the hasty gardener would plant seedlings too early in the season. In fact, the ethic of the guardian of the garden may advise emphasis on the health and stability of the Earth/home-garden before our attentions should be divided by multiple gardens, one on a difficult plot of land.¹⁹⁸ What it does highlight, however, is the unique value of the terrestrial evolutionary trajectory, manifest in the gene lines of each organism on our planet. The guardian of the garden not only protects the garden from herself, the gardener, but protects her plants from the coming winter by preparing for them a place that is warm when at long last winter comes. For the gardeners, this may be a greenhouse, but what greenhouse can keep hale the Earth's organisms when the Sun has first baked them in its fires then frozen them to the bone? If the descendants of organisms living today, who are themselves descendents of the first organisms on this planet, are to continue to reproduce beyond the death of the Sun, they must do so on planetary shores orbiting other stars.

One might ask, "Why? Why should we desire for Earth organisms to continue to propagate beyond the death of our Sun? Why should not Earth life, like all living things die out?"

¹⁹⁷ See Fogg, "Terraforming, as Part of a Strategy for Interstellar Colonisation;" and Fogg, "Ethical Dimensions of Space Settlement."

¹⁹⁸ Sparrow makes a similar point in his article, "The Ethics of Terraforming."

After all, the Earth is our home, it's only natural for living things to expire when the Earth expires." But this is a category mistake. Whereas individual organisms die, and even species may go extinct, there is no intrinsic expiration date for a gene line as there is for a single organism's body. I may live to be a hundred, a tree to four-thousand years, but the species crocodile, is millions of years old and in at least decent health. Like the famous vortex in water example,¹⁹⁹ individual organisms come into being and disintegrate, but the species line continues unbroken. Unlike an individual organism, which so far as our technology is concerned, is iron-bound to its mortal fate, the evolving species-line appears to contain the possibility of immortality. In fact it is the closest thing in existence to a perpetual motion device. So long as energy is input from the warmth of a nearby star or other suitable battery, autotrophs can make food and support ecologies. To say that the Earth is our natural home and that we would be out of place elsewhere is to fall prey to the is/ought fallacy that Hume famously analyzes. The insight of J. S. Mill is just as relevant here as it was in the second chapter, "We ought not to consider at all what nature does, but what it is good to do."²⁰⁰ Similar to Hartmann's luxury-liner analogy,²⁰¹ to propose that the captain (and all the crew) go down with the ship when there is a rescue boat within reach just on the horizon would be absurd if not down-right evil.

Life on Earth is the only known life in the universe; to sullenly will its destruction is tantamount to the betrayal of Caesar by Brutus, of Jesus by Judas.²⁰² This incredible value, vaunted to the highest extremes by its perfect rarity may be the only thing that can

¹⁹⁹ "The vortex is a structure made of an ever-changing group of water molecules. It does not exist as an entity in the classical Western sense.... In the same sense the structures out of which the biological entities are made are transient ... dependent on a constant flow of energy to maintain form," from Harold J. Morowitz, "Biology as a Cosmological Science," *Main Currents in Modern Thought* 28 (1972):156, quoted in Callicott, *In Defense of the Land Ethic: Essays in Environmental Philosophy*, p. 108.

²⁰⁰ Mill, from excerpts from *Three Essays on Religion*, p. 131.

²⁰¹ Hartmann, "Space Exploration and Environmental Issues," p. 237.

²⁰² Dante in his *Inferno* reserves the lowest level of Hell for betrayers.

counterbalance the weight of potential negatives associated with the project of terraforming and ecopoiesis. The abiotic intrinsic value argument has its weight, though the arguments based on human survival needs outweighing nonhuman, nonsurvival needs counterbalances it at least to a certain degree. However, the potential for various harms, uniquely identified in this thesis through the lens of the environmental justice movement weighs quite heavily against advising terraforming or ecopoiesis as a moral action. But the continuation compared to the cessation of the only known life in the universe I believe manages to tip the scales in favor of terraforming and ecopoiesis as a moral good and as suites of actions that people would be advised to engage in. Of course this view comes with the ubiquitous caveats of do as little harm as possible and resist rushing into anything. Nonetheless, considering all the arguments, terraforming and ecopoiesis can be considered advisable.

Terraforming and ecopoiesis are advisable because they provide a stepping stone to immortality for the evolutionary trajectory we both experience and are ourselves a part of on Earth. Terraforming and performing ecopoiesis on Mars are stepping stones because life on Mars alone cannot guarantee the continuation of life beyond the death of the Sun. But if the experiences gained on Mars make it possible to transplant living organisms to lifeless planets orbiting longer-lived stars, then genetic and/or evolutionary “immortality” may be achieved.

V. Final Remarks

But, one might object, this is not immortality, this is just the prolonging of the trajectory of species, it does nothing to help the descendants of Earth organisms outlive the heat death or big freeze of the universe. Of course, this is true, and immortality has been used somewhat loosely. The running down of the universe like a clock, the final discharge of its numerous

batteries, the stars, threaten a final end to the perpetual motion of life. Yet the end of the universe is orders of magnitude more distant than the extinguishing of our particular star. So “immortality” is perhaps best written with an asterisk, denoting the hyperbolic character of its claim. However, the ethic and advisability of terraforming and ecopoiesis remain unchanged. If life can find a way to outlive the death of our Sun, the time in which we live now will be considered our infancy. To murder a child in its infancy for failure to see its potential to mature is unquestionably degenerate.

For better or worse we humans are both its guardians and often that from which it needs guarding. The questions of terraforming and ecopoiesis are secondary to the problem of establishing an appropriate moral relationship with the environment we find ourselves in power over. Perhaps this extreme long view necessitates the reexamination of our economic system which is supposed to rely upon growth and expansion without reference to ecological limitations. Sustainable growth that preserves the health, “integrity, stability, and beauty of the biotic community”²⁰³ is desirable. Rapid expansion and subsequent collapse, it should go without saying, are undesirable.

Yet ecopoet guardians must be wary the terraforming is not simply a ploy for more resources, more unsustainable expansion. Hopefully the ethic of the guardian of the garden will instill a respect for principles of ecological soundness, for the cycling of waste through a system. Hopefully the guardian will abandon the pursuit of wealth for wealth’s sake for the pursuit of a good life, for herself and all her fellow travelers down through the waters of time. The conception of “life” elucidated in this thesis is broader, granting ontological status to species- and gene-lines rather than only to the individual organisms that are commonly called “alive.” To

²⁰³ Leopold, *A Sand County Almanac*, pp. 224-5.

be sure, individual organisms are alive, but when we say “Life,” we mean an unbroken chain of self-organizing, order-maintaining, organisms, with emphasis on the plurality, which unlike its constituent organisms, has no necessity of dying. The process of reproduction, at the level of the individual organism and at the level of the entire Earth ecosystem, maintains the perpetual motion machine on its journey, chugging along down the corridor of years, its forms in continuous metamorphosis despite the continuity of its inherent order.

According to Val Plumwood, the global market economy has stripped both the public and the private sphere of

collective good ... care, compassion and personal relationship ... as an ethics-free zone, one that cannot even be imagined as caring and compassionate, testifies to its essentially sado-dispassionate character.... Recipes for escaping our situation ... include the development of critical forms of rationality that are able to undertake the critique of maladapted forms. We must replace sado-dispassionate stances of rationality with caring and life-affirming ones that can work to realize a harmonious and joyful co-existence with our planetary partners. Among our objectives should be the development of a culture that can create alternative strategies and concepts to the oppressive rationalist and dualistic structures that make oppression pervasive in everyday life under globalization. At the level of economy, an integrative struggle against the systemic excision of ethics and ecology from our economic lives would aim beyond the dualisms of the rationalist imaginary for “a cultural reconnection of home, workplace and polity that recognizes the reproductive, productive and political aspects of most human activities.”²⁰⁴ The growing exclusion of justice, care and ecological responsibility from the economic sphere in the interests of global competition affects all of us in different ways, but these different ways can still bring us together into the larger struggle for ecological and ethical forms of rationality as they affect both human and non-human spheres.²⁰⁵

And although she writes that “Promethean projects ... like terraforming Mars” “conspire to conceal from us our dependency on nature, to overestimate our autonomy and manipulative ability, to claim invincibility so we believe we have no limits,”²⁰⁶ her ecologically feminist

²⁰⁴ Val Plumwood cites A. L. Jennings, “Public or Private?” in *Beyond Economic Man*, ed. M.A. Ferber and J.A. Nelson (Chicago: University of Chicago, 1993), pp. 109-29; and explains in her footnote, “We can take the reproductive sphere to include the ecological, as in Carolyn Merchant, *The Death of Nature* (London: Wildwood House, 1980).

²⁰⁵ Plumwood, *Environmental Culture*, p. 36.

²⁰⁶ *Ibid.*, p. 35.

version of rationality advocates an abundant care for each other—each human other and each Earth- or nonhuman Other. At the same time, it provides an impetus for cultural and environmental sustainability, and motivates an intimate concern for all living organisms. This absolute care for terrestrial biology motivates such scientists as Haynes and McKay to advocate protecting the value of this life by promoting its flourishing in the universe at large. Likely the same curiosity and wonder at the majesty of creation led these scientists to investigate nature’s mysterious inner-workings. They write, “Perhaps the deepest reason for implementing ecopoiesis would be the consistency of this project with ... the reproductive and proliferative imperatives that characterize life itself.”²⁰⁷

What could be more “life-affirming” and “harmonious” than that? If ecopoiesis is pursued according to an ecologically rational and sustainable ethic that intimately cares for biota, takes into account the considerations of abiota, and rather than denying or backgrounding the human dependency on ecology, reinforces it by making it the central focus of concern, ecopoiesis may be justifiable and legitimate even according to an ecofeminist ethic.

VI. Conclusion

The magic of photosynthesis maintains the ordered spherical bubble of the algae cell against the entropy of the universe. Cells congregate into multi-cellular organisms; ecologies are diversified. Life rolls along like an unbroken spherical bubble, perfect as the idea of a circle, atop the rolling seas of chaos and entropy. We sit at the helm of this ideal even as we are a part of it. We, unique among our fellow living beings, who are as a class apparently unique within the universe, have the capacity for language, and the capability of foresight which is its boon. We

²⁰⁷ Haynes and McKay, “The Implantation of Life of Mars,” p. 140.

see the evidence of fertile land over the horizon, but the waters are treacherous without a doubt. I call the proposal that terraforming and ecopoiesis should be engaged in noble, because that is most accurately what a certain conception of it is. It is all too likely that such a pursuit would result in all the problems identified in chapter three, and more besides. But with caution, and a steadfast ethical framework based on care, guardianship, nurturing and ecological sustainability, the Earth can be healed and humans can live up to their highest conceptions of themselves, directing the ship of life forward even as they yearn to understand how their consciousness and ability to decide are predicated on the same mindless principles that bind the Earth to the Sun and the atom to itself.

What looms as a possibility is the creation of a partnership between humans and Life that embodies the ideal partnership between the gardener and the garden. The gardener toils under the hot Sun just as the plants toil according to their nature to produce their fruits. The relationship is both reciprocal and ecological. The garden supports the gardener as the gardener supports the garden. They, as all of us, are in a symbiotic relationship. We use the Earth and its life as a means to an end, but if philosophy has given us any wisdom, and Kant's categorical imperative is expanded not just to include humans, but sentient animals and even plants, rocks, and ecosystems, then we will at the same time respect life, the Earth, and Mars as ends in themselves. Thus, the abiotic intrinsic value objection is overcome.

At least two issues remain that need of consideration before this thesis can be concluded. The first involves the use of genetically modified organisms (GMOs) in ecopoiesis during the process of terraforming Mars and the possible back contamination of the Earth. The risk of GMOs designed for Mars accidentally outcompeting native species on Earth with catastrophic results cannot be underplayed. However, the debates currently raging regarding the ethical

suitability of GMOs on Earth, without regard to interplanetary ecopoiesis, provide a hope that these concerns will not slip through the cracks unnoticed.

Second, the yearning for utopian ecology may introduce quirky ethical quandaries. Namely, consider whether or not there should be fire ants on Mars. Famed naturalist E. O. Wilson is a lover of ants, but the rest of us likely are not. Would it be just to simply leave fire ants behind? Would that be unfair given that they are currently winners of the evolutionary race just as much as we are? Doubtless some intrepid ecologist, or more appropriately ecopoet, might argue that fire ants provide some irreplaceable function in a healthy and diverse ecosystem. But what about “stickers,” those nasty little burrs that stick to shoes, pant-legs, and prick into my foot painfully after being lodged in my carpet, surely we can do without those? More importantly what about real pests like *e. coli*, can we justly do without these? These will be the ethical questions for the ecopoets to answer, though it can only help by bringing them up now.

What is worthwhile, however, is an imagination of how much more deeply we will understand and be able to guard our own Earth ecology if we understand how to build one from the ground up, as on a terraformed Mars. Yet, future people must beware not to succumb to their hubris in their ability to manipulate and control ecologies, giving them a false hope in their ability to work their wills with fluid ecologies. Suppose a thousand years from now life is flourishing on Mars and a handful of other planets orbiting longer-lived stars, and suppose that on none of them are my bane “stickers” growing, their life being deemed unnecessary for the support of a vibrant ecology on each of these worlds. Suppose then that those future people get it in their mind that stickers can be eradicated from Earth without consequence, or that at the very least we can modify their genes to remove their hated thorns. Suppose even then that this could be done and is done, miraculously without consequence to the rest of the ecology, would it have

been the right thing to do? Or more likely would it have been disrespectful of the sticker plant as a marvel of evolutionary ingenuity?

In this chapter, the argument that terraforming and the process of ecopoiesis, specifically of and on Mars, provide a sort of stepping-stone to immortality for the miracle commonly referred to as Life, has been thoroughly defended. In addition, a novel ethical metaphor has been proposed which is advantageous irrespective of the engagement in terraforming and ecopoiesis. The ethic of the guardian of the garden has much to commend it as a worthwhile ethical framework which accomplishes both Nietzschean and ecofeminist exhortations to re-conceive morality.

The prospect of terraforming Mars based on the motivation to perpetuate life beyond the death of the Sun necessitates no immediate action. However, what it does do is open up an avenue of interrogation that has led to the formulation of an ethical metaphor which has great potential for meeting our environmental obstacles head-on. This thought experiment on terraforming highlights the contemporary problems which the philosophy of environmental justice seeks to rectify as well as broadens and deepens the discourse of environmental ethics, albeit from an esoteric starting point. I hope to see within my lifetime the first human footprints on red Martian soil, but whether that is a reality is inconsequential. My life, as all of our lives, are part of the process, a speck in the vortex, spinning feverishly forward ever into the future. I am benefitted none by the “immortality” or more properly longevity of the descendants of living organisms, but I can be in solidarity with them as members of the community of life.

CHAPTER 5

GENERAL CONCLUSION

So, at final analysis, terraforming may indeed be said to be ethical, moral, and just according to the degree to which it participates in the ethic of the guardian of the garden and avoids perpetuating and exacerbating inequalities in political participation, identity recognition and distribution of material wealth and resources identified in chapter three.

The debate in the published literature concerning the ethics of terraformation has been stagnated by a particular emphasis by philosophers on abiotic intrinsic value. This myopia has blinded them to questions of human harms, participatory justice, post-colonial critiques and identity recognition uniquely elaborated in chapter three of this thesis. This is particularly dangerous considering the history of inequality and injustice which the philosophy of environmental justice highlights. Furthermore, the analytical tools of the philosophy of environmental justice; the principle of commensurate benefits and burdens in the face of maldistributive inequities and the concept of recognition justice, provide useful tools for foreseeing colonialistic hazards and ideally avoiding them should the process of terraforming be engaged in. Introducing these relevant ethical issues into the debate regarding the morality of terraforming is vital to ensuring that an informed decision can be made concerning whether or not terraforming is advisable considering not only its feasibility but its moral appropriateness. The creation of the ethic of the guardian of the garden, inspired by a passage from Kim Stanley Robinson's *Mars Trilogy*, is doubly beneficial. Not only does it provide a possible motivation for and manner of performing terraforming and ecopoiesis that is moral, ethical and just, it is an advantageous ethic to advocate regardless of whatever bearing it has on terraforming and ecopoiesis. It is one of the great advantages of discussing and debating terraforming that it

creates the condition for the possibility of inventing and conceptualizing a new ethical relationship between humans and the rest of the life forms that we share this planet with. Thus the esoteric thought experiment of whether or not terraforming is ethical results in the manifestation of a substantive new ethical theory whose broad ranging appeal transcends its origin in science fiction to await approval or reprobation on its own merits as a potential suitable and universalizable environmental ethic in its own right. Particularly, the reason why the ethic of the guardian of the garden makes terraforming and ecopoiesis potentially moral is based on the motivation of preserving “Life,” which is of the highest intrinsic value because of its unparalleled rarity in the known universe. Just as the deep ecologists dispensed with the need for an altruistic environmental ethic by expanding the identity of the self to include the environment, the guardian of the garden requires only an instinct for self-preservation as there is an ecological understanding that the health of the gardener is inseparable from the health of the garden, thus necessitating its protection.

Regarding Mars, terraforming and ecopoiesis, the likelihood that Mars will soon be terraformed is greatly diminished by the current economic recession and its detrimental impact on funding for space exploration. Furthermore, the immense scope and expense of such a project no doubt stand as the greatest obstacles to its coming to fruition. Perhaps most importantly, there is the possibility that if at some point humans possessed the technology such that they could terraform, they may decide that the moral costs outweigh the expected benefits and a project in terraforming should be delayed until a more beneficial situation can reasonably be achieved. Thus, the question of the moral appropriateness of terraforming seems irrelevant in an era of climate change and global economic and environmental unsustainability. However, if such moral questions are not asked until after a project is already in the pipeline, there is little hope they will

be asked at all. If we are to avoid repeating and perpetuating a tendency towards inequality and injustice, such questions must be raised early, when they can be debated, resolved and have a meaningful influence on the project, as opposed to a tacked-on, make-shift, retrofitted solution to an endemic problem inseparable from the project itself.

Terraforming and ecopoiesis have the potential to be the greatest projects ever engaged in by human-kind. However, they also have the potential to perpetuate the injustices of the society in which we presently find ourselves inundated. Regardless, by addressing the questions of terraforming and its morality, a novel ethical framework has come to light, a framework that begs to be considered as a beneficial one which can and should be expanded, explored and applied to our contemporary, terrestrial environmental issues.

APPENDIX A

GLOSSARY

Ecofeminism – A philosophical movement that analyzes the correlations between oppression of women and oppression of the natural environment. Ecofeminist authors cited in this thesis include Val Plumwood and Karen Warren. Both authors provide voluminous lists for further reading introducing the topics and themes of ecological feminism.

Ecopoiesis – A neologism coined by Robert Haynes to denote “the fabrication of a sustainable ecosystem on a currently lifeless, sterile planet, thereby establishing a new arena in which biological evolution ultimately might proceed independent of further human husbandry.”²⁰⁸

Environmental identity – The “amalgamation of cultural identities, ways of life, and self-perceptions that are connected to a given group’s physical environment.”²⁰⁹

Environmental Justice – According to Robert Figueroa, environmental justice is “broadly construed as the conceptual connections, causal relationships, and strong correlations that exist between environmental issues and social justice. Environmental justice frames social issues (including cultural contexts and political economies) as environmental issues. Social and environmental issues are inseparable, co-causally related, and always in a context that requires political interpretation; in particular, such a consideration of justice accounts for power dynamics and socio-environmental practices that maintain historical relations, as well as the remedies for injustices.”²¹⁰

Intentional recognition stance – A position of openness towards a dialogic interaction with the nonhuman environment that “aims for the greatest sensitivity to earth others ... to re-animate nature both as agent in our joint undertakings and as potentially communicative other.”²¹¹

Monoculture – A term sometimes used to refer to the use of a single crop on a vast expanse of agricultural land in order to maximize production. In chapter three of this thesis it is used to denote the homogenizing features of Western culture and science which eliminate cultural diversity in favor of a standardized, globally dominant super-culture.

Planetary engineering – The manipulation of the climate of a planet by technological means such as orbiting reflectors or mirrors. Whereas terraforming attempts to alter another planet’s climate to more closely resemble that of the Earth, schemas have been proposed to use planetary engineering on Earth to counteract climate change, or it could be used on another planet either to make it more Earthlike or to change its climate in some other way.

PPFPE – According to the distributive side of the Principle of prima facie political equality, its goals are “to help ensure equal distribution of environmental impacts and to place the burden of

²⁰⁸ Haynes, “Ecce Ecopoiesis,” p. 180.

²⁰⁹ Figueroa, “Indigenous Peoples and Cultural Losses,” p. 233.

²¹⁰ Ibid.

²¹¹ Plumwood, *Environmental Culture*, p. 177.

proof on those attempting to justify unequal distributions.”²¹² On its participative side, its goal is to give equal weight to both “stakeholder and expert deliberation.”²¹³

Recognition justice – According to Robert Figueroa, recognition justice emerges “from principles of self-determination, identity recognition, and democratic participation. According to this camp, justice requires us to recognize differences among social collectivities through the equal and fair participation in social and political processes. From this viewpoint, cultural institutions and habits determine the conditions for the distribution of material goods and burdens.”²¹⁴

Space elevator – Any proposed plan to put a geo-stationary satellite into orbit (natural or artificial) and extend a cable down to the surface of a planet so that elevator cars can transport passengers and cargo from the surface of a planet into space without the need for traditional chemical rocket launches.

Technological progressivism – An uncritical faith and adherence to the idea that technology is generally good, beneficial and constantly progressing towards a perpetually higher and better form.

Terraforming – Martyn Fogg defines terraforming as “a process of global scale planetary engineering, whereby the environment of a planet is modified so that it can support life. The ultimate goal of a terraforming project would be to start with a world such as Mars or Venus and make of it as near a duplicate of the Earth as possible.”²¹⁵

²¹² Shrader-Frechette, *Environmental Justice*, p. 27.

²¹³ *Ibid.*, p. 28.

²¹⁴ Figueroa, “Bivalent Environmental Justice and the Culture of Poverty,” p. 29.

²¹⁵ Fogg, “Terraforming: A Review for Environmentalists,” p. 7.

APPENDIX B

BIOGRAPHICAL INFORMATION FOR REFERENCE PURPOSES

Robert M. Figueroa – A professor at the University of North Texas and author of two works that have been invaluable for articulating the theoretical foundations and analytical structures of environmental justice in this thesis.

Martyn J. Fogg – an “independent researcher and free-lance science writer”²¹⁶ who has published multiple articles on the ethics of terraforming and maintains an online bibliography of articles relating to terraforming at *The Terraforming Information Pages*, <http://www.users.globalnet.co.uk/~mfogg/biblio.htm>.

William K. Hartmann – an astronomer and writer from Tucson, Arizona who wrote a crucial early essay on extraterrestrial environmental ethics titled, “Space Exploration and Environmental Issues,” where he articulated an ‘insurance policy’ argument that has served as a major touchstone for discussions throughout this thesis.

Robert H. Haynes – A biologist who has authored a few articles on terraforming ethics, one with Chris McKay, and another in an edited volume by Don MacNiven.

Christopher P. McKay – A planetary scientist who has written numerous articles examining the ethics of terraforming and arguing in favor of pursuing terraforming.

Val Plumwood – Ecofeminist philosopher, particularly noteworthy for articulating what she calls the “intentional recognition stance” (see glossary).

Kim Stanley Robinson – Science-fiction author wrote the *Mars Trilogy* (*Red Mars*, *Green Mars*, *Blue Mars*) imagining how terraforming and performing ecopoiesis on Mars might proceed.

Holmes Rolston, III – A long-time environmental philosopher wrote the book, *Environmental Ethics: Duties to and Values in the Natural World*, and also contributed the essay “The Preservation of Natural Value in the Solar System,” to Dr. Eugene Hargrove’s 1985 conference and 1986 edited volume *Beyond Spaceship Earth: Environmental Ethics and the Solar System*. He has been typified as an exponent of “cosmic preservation” by Martyn Fogg and argued in favor of what has been termed “abiotic intrinsic value” in this thesis.

Kristen Shrader-Frechette – A professor of philosophy and biological sciences at Notre Dame who wrote the 2002 book, *Environmental Justice: Creating Equality, Reclaiming Democracy* and coined the Principle of Prima Facie Political Equality (PPFPE).

Robert Sparrow – A political philosopher who wrote an article critical of arguments in favor of terraforming, titled “The Ethics of Terraforming” in *Environmental Ethics* 21 (Fall 1999).

Paul York – According to his 2002 article in *Philosophy Now*, Paul York “is an information systems architect...working on a PhD on the ethics of terraforming, at the University of

²¹⁶ According to Fogg, “Terraforming: A Review for Environmentalists,” p. 7.

Queensland, Australia.”²¹⁷ In this thesis he is notable for advocating a ‘moral calculus’ for determining the ethics of terraforming.

Robert Zubrin – A scientist, engineer and fierce advocate for terraforming Mars sooner rather than later. His books include *The Case for Mars: The Plan to Settle the Red Planet and Why We Must* (New York: The Free Press, 1996), and *Merchants of Despair: Radical Environmentalists, Criminal Pseudo-Scientists, and the Fatal Cult of Antihumanism* (New York: Encounter Books, 2012).

²¹⁷ York, “The Ethics of Terraforming,” p. 9.

APPENDIX C

LISTS OF ARGUMENTS FOR AND AGAINST TERRAFORMING MARS COMPILED
FROM THE DISCOURSE AND AMENDED BY ORIGINAL RESEARCH

Notes about the following:

- Listed in order according to frequency of occurrence in the literature.
- List of sources at end of lists.
- Source letters in red denote the source from which direct quotations were taken.

Arguments against Terraforming and/or Ecopoiesis

- Biotic Intrinsic Value: “It is impossible to prove conclusively that Mars is totally devoid of life; thus, the project should not be initiated for fear of extinguishing some hypothetical biota.” [a, b, j, k, m, o]
- The “Abiotic Intrinsic Value/Cosmic Preservationism” Argument. [a, d, f, i, j, k]
- “Ecopoiesis is a sinful Faustian scheme meriting divine retribution; even to study ecopoiesis is to open ‘Pandora’s box.’ As Adam and Even discovered to their sorrow, there are some things that humans were not meant to know, or should not know.” [a, b, f]
- “Humans have made such a bad job of managing Earth that it is presumptuous to imagine that they can become wise and successful planetary engineers.” [a, b, d]
- “If ecopoiesis should be successful, Mars might then become a tempting target for military and/or economic exploitation; this could generate even more sociopolitical problems on Earth than we have at present.” [a, b, y]
- Environmental injustice potentials. [k, y]
- “The time scale involved is very long, perhaps longer than the lifetimes of the governmental institutions and world economic order needed to maintain the necessary commitment to such a project.” [a, b]
- “There are no significant economic benefits, especially in the short-term, that would be commensurate with the cost and effort entailed.” [a, b]
- “Scarce human talent, as well as economic resources, would be diverted from other worthy projects such as ameliorating present social and environmental problems.” [a, b]
- “It is more desirable to preserve Mars in its present state for scientific exploration, and perhaps even aesthetic reasons, or alternatively, for possible uses by future generations, uses that our imaginations are too limited to conceive.” [a, b]
- “Insurmountable political and/or legal roadblocks either exist, or would soon arise, once it became clear that some nation was seriously contemplating a project of this kind.” [a, b]

- “The evolution of the Martian biosphere would entail many contingent, unpredictable developments. For example, a very feeble biota might be generated that future generations would feel obligated to preserve, or alternatively, very robust, highly dangerous organisms might evolve which would make Mars an even more hazardous place for astronauts than it is at present. Finally, highly pathological ‘Andromeda Strains’ might emerge, get to Earth and destroy us all.” [a, b]
- Ecopoiesis uses life as a means to an end. [e, y]
- “Something might go wrong in the course of the project that could damage Mars ‘beyond repair;’ and in any case, it cannot be guaranteed that a warm, wet, and stable CO₂ atmosphere can be produced free of unanticipated feedback effects or other unplanned consequences.” [a]

Arguments Supporting Terraforming and/or Ecopoiesis

- “A commitment to ecopoiesis would provide a new frontier, replete with healthy challenges to human imagination and ingenuity, especially at a time when some social observers argue that people have no exalted sense of communal purpose, that we are ‘running out of futures’, and that the ‘end of history’ cometh nigh.” [a, b, c, g, h, l, i, n]
- The “insurance policy” argument; “A salubrious Mars, even if implanted only with microorganisms, would provide a refuge for life of some kind in the solar system in the event of prolonged nuclear winter or other global catastrophes on Earth.” [a, b, c, g, h, k, l]
- Bio-/Ecocentrism; “*The value of Life* as the apex of complex structures created by Nature.” [a, c, e, k, m, y]
- “Reproduction of ‘Gaia’: additional evidence that the Earth’s biosphere functions as a living organism.” [a, e, k, l, y]
- “Locally generated biomass would be an important source of energy, food and perhaps other useful materials for astronauts.” [a, b, g, l]
- “If living planets have greater intrinsic value than dead ones, then it should not be regarded as mere hubris that *Homo sapiens* should seek to propagate life in the solar system.” [a, m, y]
- “Relevance to interstellar colonization, SETI, and a possible destiny of terrestrial life.” [c, g, l, y]
- “Much of the research involved would be highly relevant to environmental problems on Earth and the understanding of its biosphere. It can be argued that we will not understand the development and ‘physiology’ of Earth’s biosphere until we have at least attempted to design and construct another one.” [a, b, l]

- “Ecopoiesis would provide a useful and desirable long-term project for humans on Mars.” [a, b, g]
- “Solar system exploration and development is far less life-threatening than, and as worthwhile economically as, military development and any arms race. Indeed the implementation of ecopoiesis would encourage international understanding, dialogue and cooperation even after large-scale disarmament has been achieved. It would be an investment in the future of humanity, and provide a peaceful form of adventure in the spirit of William James’s ‘moral equivalent of war.’” [a, b, g]
- “Debate – opens up new issues in technology, environmental ethics and philosophy.” [i, I]
- “Exploration – requirement for better data provides additional motivation for further planetary exploration.” [h, i, I]
- Humans are natural, therefore whatever they do is natural, terraforming is natural, therefore terraforming is good, since whatever is natural is good. [e, k]
- “*The unity of all Life*, in the basic structures of DNA and proteins, metabolic pathways and membrane processes, which are shared from prokaryotes to humans.” [c, y]
- “Even a CO₂ atmosphere, if it were sufficiently thick and warm, would simplify life for future astronauts who might then be able to move about on the planet in something akin to scuba gear rather than bulky space suits or enclosed vehicles.” [a, b]
- Ecopoiesis is an essential prerequisite for any thought of human colonization on a terraformed Mars.” [a, b]
- “Even a feasibility study of ecopoiesis, let alone its implementation, would generate important scientific and technological advances, stimulate new education developments and economic activity, and foster international cooperation.” [a, b]
- “If ecopoiesis is not impossible, it surely will be initiated someday by someone.” [a]
- “*The unique value of Life* as a phenomenon that is made possible only by a precise coincidence of the basic laws and constants of matter.” [c]
- “Education – an entertaining way for students to apply and integrate a range of scientific subjects to a problem.” [I]
- “Research – promotes ‘lateral thinking’ in planetology and alternate ways of looking at habitable planets and the past, present and future habitability of the Earth.” [I]
- “Media – terraforming is a peripheral area of planetology potentially very appealing to the public.” [I]
- “Reconstruction of ancient biocompatible environments on Mars and Venus.” [I]

- Cosmic Preservationism is merely sentimentalism. [k]
- Anthropocentrism and/or Zoocentrism conclude that terraforming and ecoopoiesis is moral so long as the net detriment to morally relevant entities is not prohibitively high. [k]
- The appropriate ethical relationship between humans and non-human terrestrial life forms should be one of guardian to a garden. [y]

Sources:

- a.) Haynes and McKay, “Implanting Life on Mars: Feasibility and Motivation,” 1991.
- b.) Balasubramanian, “Should Mars be Made Habitable?” 1991.
- c.) Mautner, “Directed Panspermia 2. Technological Advances Toward Seeding Other Solar Systems, and the Foundation of Panbiotic Ethics,” 1995. (Arguments here apply specifically to “directed panspermia,” of which Terraforming and Ecoopoiesis could be considered a part, although the author is not concerned with that possibility in this article.)
- d.) York, “The Ethics of Terraforming,” 2002.
- e.) Haynes, “Ecce Ecoopoiesis: Playing God on Mars,” 1990.
- f.) Sparrow, “The Ethics of Terraforming,” 1999.
- g.) Zubrin, “The Case for Mars: The Plan to Settle the Red Planet and Why We Must,” 1996.
- h.) Hartmann, “Space Exploration and Environmental Issues,” 1984.
- i.) Rolston, “The Preservation of Natural Value in the Solar System,” 1984.
- j.) Marshall, “Ethics and the Extraterrestrial Environment,” 1993.
- k.) Fogg, “Ethical Dimensions of Space Settlement,” 1999.
- l.) Fogg, “Terraforming: A Review for Environmentalists,” 1993.
- m.) McKay, “Does Mars Have Rights? An Approach to the Environmental Ethics of Planetary Engineering,” 1990.
- n.) Robinson, *The Mars Trilogy*; 1993, 1994, 1996.
- o.) McKay, “Bringing Life to Mars,” 1999.
- y.) Arguments uniquely identified or significantly elaborated in this thesis.

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