

A Guide for Sustainable Off-Earth Travel

BUDDHIST ECOLOGICAL
PROTECTION OF SPACE



DANIEL CAPPER
Foreword by Bonnie Cooper

Buddhist Ecological Protection of Space

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Foreword

Where does our environment end? Is it 100 miles above the Earth's surface or 1 million miles? In this book, Daniel Capper demonstrates that our environment extends outward to include all that we are capable of influencing and advocates the application of Buddhist philosophy as a framework to guide our future actions as we advance into space. Although I began reading it with skepticism, this book has opened my eyes to a new way of looking at space exploration in a Buddhist context. Dr. Capper shows us that our scientific interest, our ethical concerns, and our quest for new opportunities are mutually supportive within a Buddhist framework.

I've spent my career as a lunar scientist advocating the use of the moon's resources, both for the benefit of humans and to conserve the Earth's biosphere. I have worked closely with NASA scientists and managers, whom I've found quite forward-thinking regarding conservation and rational use of other planetary bodies, even though religious philosophy wasn't on the agenda.

For example, in the 1970s NASA scientist Donald J. Kessler was among the first to publicize the inherent danger of orbital debris. NASA has funded and supported this research ever since. NASA also recognized the threat of *back contamination* of Earth before the first lunar samples were returned. The concern was that bacteria from other planetary surfaces could be harmful to life on Earth. Both samples and astronauts were quarantined for a while after the return of Apollo 11.

For another example, environmental conservation, even in non-living environments, is already a part of NASA's planetary exploration ethic, in alignment with Dr. Capper's ideas about conservation and responsible use of planetary assets. NASA's practical view is that new scientific instruments are continuously developed that can improve our knowledge of asteroids, moons,

and planets, but only if the material is still available in its original (“pristine”) condition at its original (“in-situ”) location.

The author points out that commercial space exploration has now become possible and with it are opportunities for humans to find and use resources in outer space. How will these efforts be governed? The Moon Treaty,¹ mentioned in this book, was never signed by the United States and therefore remains a set of guidelines only. As described in a book that I co-wrote,² private companies cannot justify the financial investment involved in producing resources on the moon if they have no certain legal claim to profits. Dr. Capper points out the need for a functioning legal system that protects commercial enterprises, other human interests, and the lunar environment. Because this legal framework doesn’t currently exist, he is concerned about the ungoverned extraction of space resources, which is a possibility under these conditions.

One of the connections the author makes between Buddhism and environmental protection is through the Buddhist teaching of “Dependent Origination”: the basic principle is that everything happens because of pre-existing causes. Everything we do has a result, including what we do to our environment. Thus, we have reason to care for our environment, not because we are sentimental but because any harm that we cause can ultimately harm us or our children.

Dr. Capper presents the case that Buddhism is the philosophy that is most in accord with science. A Buddhist lama once paraphrased the teaching on this point: “Don’t believe anything just because a Buddha said it; check it out for yourself.” Buddhism urges the practitioner to think independently. That aligns well with the skeptical and independent nature of all the scientists I know.

The author effectively shows that many of us in the Western world have been taught to think that religion and science are inherently in opposition. As a result, questions of religion are often omitted from discussions of space exploration and environmental science. It is refreshing to discover an author who has both the insight and the courage to propose an alternative idea that satisfies logic as well as inclination. This book does that.

Bonnie Cooper
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I first must thank the many helpful people from the ethnographic field. Without them, this book would not exist. It is their creative, caring, and insightful voices that provide the exciting and innovative responses to space environmental dilemmas. For the sake of ethnographic anonymity, I will not name names but still wish to extend my sincere gratitude.

The cover photo appears courtesy of Getty Images. The public domain photos of the moon used to create figures in chapter 2 appear courtesy of the National Aeronautics and Space Administration.

In terms of the text, Buddhist studies scholar Dr. Laurie Cozad offered quite useful feedback on an early version of the manuscript. Lunar expert Dr. Ian Crawford invaluablely helped to deepen and extend my understanding of commercial issues pertaining to our moon. Felicitously, the esteemed lunar scientist Dr. Bonnie Cooper not only supplied useful feedback on the book but also wrote a nice foreword that dynamically highlights the Buddhism and science dialogues found throughout this work. In addition, Trevor Crowell, my editor at Lexington Books, supported the project from its start and usefully provided helpful guidance. Michelle Weathersby provided effective editorial feedback on the manuscript. The voices of intelligent colleagues at conferences and in peer review naturally shape the material here, too. Of course, the mistakes that remain in the presentation are mine alone.

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Introduction

For a moment, please imagine that you are a planetary scientist deep underground in a cavern on Mars. Having endured the six-month trip from Earth, you finally can pursue the research that brought you to the Red Planet: looking for on-the-ground evidence of present microbial life. With the lamps on your helmet lighting your way past dark volcanic stones, you climb carefully amid the rough terrain that consists of outcroppings and jumbled ground rocks. As you descend through the shaft of the cave, the life-killing radiation of the surface of the planet disappears; further, you find temperatures rising enough to melt some of Mars's abundant water ice stores, leaving apparent moisture.

Then, like lightning, you make the scientific discovery of a lifetime. You locate a little pool of moisture whose multihued color and anomalous texture unmistakably reveal that it is the abode of a group of living microbial forms. Called chemolithotrophs by biologists, these microorganisms survive by harvesting mineral energy rather than by synthesizing sunlight.

Hurray for you! You have found tiny life on Mars! Excitedly you cheer with delight at one of the greatest of scientific advances. Start writing your speech for the lecture circuit, because soon everyone will want to hear of your research!

But then your elation turns to concerned questions, since you do not know how to respond to this life ethically and you do not want to become famous for morally regrettable actions. Are you obligated to protect this life? Are you required actively to care for its habitat? Is it acceptable to take a few of these small beings home so that you can peer into their genetics with a microscope, even if this means killing living beings? These ethical issues can appear quite vexing at first.

After pondering these questions for a moment, you relax. You remember that you read this book and so know that a grounded and viable ethical solution in this situation consists of harming the life that you found as little as possible, damaging the habitat of that life as minimally as you can, but also studying that life to advance human science as long as you do so as nondestructively as feasible. Now armed with this dynamic moral compass, you gladly return to your celebration of a giant scientific find.

A handy Martian moral code like the one just described could emerge from many ethical backgrounds and perhaps be effective, but in this book Buddhism, especially in its American flavors, supplies this behavioral framework. As I will describe throughout this book, Buddhism's famed emphasis on *ahimsa*, or nonharm toward life, finds many intriguing applications off-Earth—in this case, as a substantial moral tool for the search for solar system life. Further, the Buddha's words distinctively inject into this extraterrestrial behavioral code some measures of respect for the habitats of life as well as for easing human suffering. To these teachings of the Buddha, present-day American Buddhists from the research field also contribute their own constructive voices to and approval for this moral approach toward unknown life, thus adding potent, fascinating, and time-spanning recontextualization to historical philosophical positions. As a result, values that originally arose in ancient Nepal and India find employment appropriately as a part of twenty-first-century Red Planet scientific spelunking. This tripartite ethic for searching for life on Mars thus fuses traditional Buddhist wisdom with innovative ecospiritual voices from the contemporary United States to produce an unprecedented, yet beneficial, ethical solution for an off-Earth environmental dilemma.

Having been honed and time-tested for more than 2,500 years, such Buddhist ethics provide us with a solid, respected foundation toward developing proper approaches to extraterrestrial ecologies. As I will explicate more fully throughout the rest of the book, Buddhist environmental principles such as nonharm or the interconnectedness of the universe, which undergird the tripartite ethic for the search for life, profitably respond to numerous ecological problems incited by space travel. Buddhist sources, for instance, help to propel the establishment on our moon of nimble, multipurpose nature reserves which at once support environmental protection, preservation for science, as well as future industry. Further, and in a pioneering way, in this book Buddhists argue against some traditional currents by morally protecting environments that lack life.

Yet here I make no claims that Buddhist ethics are the best; instead, I argue that in off-Earth environments Buddhist ethics can offer excellent moral and pragmatic benefits when set in conversation with other modalities of ethical argumentation. While I try to allow my reader to appreciate in a critical

manner the secular benefits that may emerge from a womb of Buddhist values, I make no effort to convert my reader to Buddhism, for this activity would distract from my priority, which is generating practical environmental ethics that anyone can adopt and that are suitable for the many wonders of our solar system. In this way this book reflects the words of the Dalai Lama, the leader of Tibetan Buddhists, who said that today, “Environmental ethics are more important than religion.”¹

Through rich Buddhism and science dialogues, over the rest of the presentation I offer a variety of environmental ethical solutions to space ecological trouble spots throughout our solar system. By following these moral guidelines that are grounded in sophisticated philosophical theory but also in moral voices from the living field, humanity can realize greater sustainability throughout the cosmos as well as at home on Earth. In order to maximize our sustainability, though, let us now more clearly understand some environmental ethical realities in space.

ENVIRONMENTAL TENSIONS IN OUR SOLAR SYSTEM

Encountering conceivable life on Mars like I just discussed does not represent the only event with a significant ethical horizon within today’s spacefaring. Besides this potential problem of finding tiny living beings elsewhere, in this book I richly explore other moral dilemmas within space environmental ethics engendered by our increasing human presence beyond Earth, including the ethics of dealing with the already-existent space debris that orbits our world, the permissibility of moon mining that is being developed by commercial entities, the desirability of establishing environmental and historical reserves in our solar system, and the suitability of changing the ecology of Mars planetwide as has been proposed frequently.

Current real-life moral quandaries in space like these provide the focus of this book, which investigates these issues by utilizing the lens of critical environmental ethics.² Today many private space companies such as SpaceX and Blue Origin join numerous potent national space programs as major drivers of a dramatic expansion of human presences in off-Earth locations. In order to direct this increased traffic in ecologically responsible ways, we need clear-sighted perspectives regarding not just environmental problems in space but also their solutions. This book supplies precisely this kind of insight and thereby guides our outreach as a critical manual for sustainable space travel.

Perhaps the controversies involved here may be further illuminated by describing another real-life space ethical scenario: the already problematic reality in orbit around Earth of space debris, otherwise known as *space junk*. Decades of rocket launches and deployments of satellites, many of which

now are defunct, have left millions of pieces of debris, varying in size from tiny screws to large rocket stages, in high-speed orbits around our planet.³ As I discuss more in chapter 1, this space debris has threatened astronauts in the International Space Station in reality rather than just in the fiction of the popular film *Gravity*, and humans persist on a trajectory to realize what some call the Kessler Syndrome, in which orbital debris makes space flight too dangerous and humanity thereby becomes grounded.⁴ But the danger of the space debris junkyard orbiting above our heads does not remain simply in space, since some large pieces imperil the ground, too, by not burning up completely upon reentry into Earth's atmosphere. Out of sheer luck, for example, the old U.S. space station Skylab missed hitting homes on its crash-landing in Australia.⁵ Alternatively, some nonvaporized debris materials descend into the sea and thereby threaten marine life with hazardous chemicals. While other bits of space debris do manage to completely vaporize, in so doing they leave behind trails of harmful molecules in the air that we all breathe when they are not introducing greenhouse gases into the upper atmosphere.

Despite the environmental problems presented by space debris, though, not much has been done to fix the array of orbiting garbage, in part because we lack moral guidance for this situation. Instead, we face questions. Is it ethical to have created this debris in the first place? Do we humans have a moral responsibility to clean up the mess? If we develop a dependable cleanup technology, are there ethical best practices in the custodial effort? These questions demand greater resolution, and, following the cues that are provided by U.S. residents in the ethnographic field, I will describe how Buddhists together strongly insist that humans are morally responsible for space debris and its cleanup. This insight supplies extra motivational push toward enacting real solutions. Buddhists from the field also inventively weave together a values combination that supports some current space policy recommendations and energizes technological solutions such as orbiting recycling centers.

The environmental justice tensions that I have discussed so far, from searching for microbial life to managing space debris, often have been ignored despite humanity's ever-expanding reach (even if only through robots at times) through the solar system. As a part of this spread of *Homo sapiens* through extraterrestrial places, the national space programs of several countries as well as private efforts seek to have humans physically present on Mars as soon as possible. Witnessing these aspirations, and in contemplation of humanity's generally dismal environmental record, we may wish to protect everywhere that humans go, whether that be to Mars, our moon, or Neptune's moon Triton. Indeed, protecting places before they become ecologically compromised marks a key virtue of proactive space environmentalism, since, unlike places on Earth, we still can ensure that Mars, our moon, and other treasures remain relatively pristine. In anticipation of such possibilities, in

this book I offer critical environmental ethics analyses relevant to contemporary space travel scenarios. The environmental ethicist Holmes Rolston insists that “a principal thing to get transformed in space is our earthbound value system,” and the narrative of this book arises with this aim.⁶

Buddhist ethics, as we will see, have much to offer in terms of upgrading our ethical dynamics in space. In every chapter of this book, one finds Buddhists from the ethnographic field who intertwine the value of nonharm with concepts of a universe that is vastly interconnected across space and time, thereafter wielding the environmental ethics combination of nonharm-in-interconnection to novel and productive ends. By this book’s conclusion you may appreciate just how potent and flexible the innovative ethic of nonharm-in-interconnection is in diverse solar system circumstances. As a part of the journey, you will find another moral contribution, too, which stresses the environmental nonseparation of Earth and space.

THE ENVIRONMENTAL NONSEPARATION OF EARTH AND SPACE

As the dinosaurs learned the hard way from a space projectile, the Earth’s environment does not end with its atmosphere, and the boundary of our planetary ecology in fact extends, in theory, at least 13.7 billion light years. Unfortunately, however, many of us do not think this way. Too frequently the word “environment” refers strictly to Earth, including streams and hills but not moons or asteroids. We thereby mentally separate Earth and space. We may join international standards in accepting that “space” begins at the Kármán Line at 100 kilometers of altitude, but we often forget that this is just a conventional agreement, not a physical barrier.

We see this false dichotomy between Earth and space occur in scholarship. For example, the authors of the book *The Environment: A History of the Idea* nicely probe how space travel historically has shaped our concepts of Earth’s environment, thereby hinting at the nonseparation that I am discussing. Yet, in turn, these scholars do not produce significant examples of a coherent concept of an “environment” that includes space ecologies along with earthly ones, thereby leaving themselves ecologically unable to discuss fully the last day of *Tyrannosaurus Rex*.⁷

Despite this failure, planets, moons, asteroids, comets, and other objects in our solar system form a vast but interlinked ecosystem, so that lessons from Mars also become tutorials for Earth. This dynamic manifests in the insightful work of space policy analyst Linda Billings, who emphasizes how the search for extraterrestrial life has reshaped our comprehension of Earth’s biosphere.⁸

This book therefore seeks to recognize and respect the environmental nonseparation of Earth and space. As a result, together we will find vividly that the examination of space ethics in this book additionally offers plenty of advances for critical environmental ethics as applied to our home planet, not just to space.⁹ Space ethicist James S. J. Schwartz stated, “Planetary research and terrestrial research are complementary,” and this book intentionally instructs us about the Earth as it does about off-Earth locations.¹⁰ Buddhists in this study, for example, indirectly minister to Earth by caring for lifeless lunar and Martian ecologies. As chapter 4 explores, this off-Earth concern can help us to struggle with nonliving dimensions of earthly global warming and therefore is a welcome environmental justice advance. We can better understand what this gain signifies, however, if I more fully clarify what the phrase “environmental justice” denotes.

THE MEANING OF ENVIRONMENTAL JUSTICE

Environmental justice initiatives generally seek to rectify troublesome events in which marginalized or poor humans together with their ecosystems face disproportionately negative ecological outcomes when compared to more prosperous realities. Some less developed nations face worse global warming outcomes than some more developed countries, for instance, despite the smaller contribution of greenhouse gases from less well-to-do people.

Within this book, finding environmental justice for such scenarios involves understanding outcomes in terms of environmental sociologist David Naguib Pellow’s concept of “socioecological inequality,” which underlines that “humans, ecosystems, and nonhumans are intertwined in the production of inequality and violence.”¹¹ The notion of socioecological inequality recognizes that gross inequities can result in regrettable and avoidable suffering not just interdependently across human classes, races, and genders but also distinctively across species and ecosystems. In perceiving and responding to the many occasions in which degradations of both powerless humans and voiceless nonhumans conjoin, socioecological inequality specifically and significantly embraces nonhumans along with humans within its justice scope.

Realizing environmental justice by avoiding, ending, or ameliorating unethical socioecological inequality, as I seek to do here, mandates that no space practice is environmentally just unless it cares for dispossessed humans without space programs as well as for rich people who own or maintain space institutions. In addition, outcomes for nonhumans need to be fairly considered along with those for human entities. A truly just environmental solution will respond with appropriate concern for nonhuman realities, if the needs of nonhumans call for such, rather than with misplaced human chauvinism.

As a brief example of realizing environmental justice by neutralizing unethical socioecological inequality, consider that affluent commercial entities soon may mine resources from our moon and in so doing possibly destroy the moon's integrity or deprive other humans of various lunar resources, including a lovely nighttime view. In this scenario some innocent human victims, through no fault of their own, lack the capital to start moon mining by themselves and thus have no voice in what amounts to a might-makes-right scenario. Is having executives of space corporations decide the moon's fate for everyone the most just arrangement for all humans and nonhumans alike? The moon remains the cultural inheritance of all humans; do not we all, therefore, get a say in our moon's future? Does not the moon deserve a better fate than mere thoughtless jackhammering at the command of the wealthy? What is the best environmental justice response to threats of socioecological inequality regarding marginalized humans and powerless lunar landscapes? Can we mine the moon responsibly?

This book responds to these questions in chapter 2 not by proposing mining bans but by calling for the establishment of circumspect international lunar nature reserves. Every chapter of this book, moreover, treats other space environmental issues similarly to those raised by moon mining in the sense of purposefully seeking to offer some voice to the human and nonhuman poor or oppressed who are connected in various ways, willingly or not, with space travel. This ecological justice spotlight on nondominant space actors harmonizes with some of the goals of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), which informs us, "Preserving the use of outer space for current and future generations . . . shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all humankind."¹²

As central as the notion of environmental justice is to this book, still a defining characteristic of this study is its implementation specifically of Buddhist environmental ethics rather than those of secular philosophies or Abrahamic faiths. Hence, we must inspect more deliberately the role of Buddhism in this book's arguments.

A BUDDHIST APPROACH

Following my training in religious studies, in this book I explore space ethics issues through the medium of Buddhist, and especially American Buddhist, environmental ethics. This method may require some commentary. Located at a secular state university, I am a scientist of religion whose job is to probe religions as objectively as, say, a geologist investigates

different types of minerals. It is not my task to promote Buddhism as a religion, which is a good thing, since I would do poorly at it. I instead utilize Buddhist thought and action as a framework for creating effective environmental ethics for space, all the while attending critically to the tradition's limitations as well.

For example, as I mention more fully in chapter 4, providing proper environmental protection for Mars as well as combating climate change on Earth involves ethically protecting stones and other mineral formations in ways that escape the provisions of some traditional Buddhist morals. Despite the religion's demonstrable moral concern for life forms, conventional forms of Buddhism offer little environmental protection for lifeless ecologies like those presumably manifesting among the stones on the surface of Mars.¹³ Therefore, in light of our relatively new understanding (since the 1970s) of the abiotic, or nonliving, character of Mars's rocks, Buddhist environmental ethics must learn to adapt to some novel scientific realities that inspire environmental respect for lifeless beings if morals from Buddhism are to inform our actions within twenty-first-century research.

Interestingly, as chapter 4 reveals, the contemporary American Buddhists that provide this study's ethnographic data inventively extend precisely the updated protection of stones that previously was lacking, thus providing an original bonus not just to Buddhist ethics but also to the environmental humanities as a whole. Prompted by a revised comprehension of the nature of Mars, voices from the field in turn innovatively reshape a new Buddhist appreciation for nonliving realities. Reflecting this dynamic but in larger scale, throughout this book a two-way religion and science dialogue appears in which space science ethics learn from Buddhism, but, in turn, space sciences additionally instruct Buddhism in terms of the empirical pragmatics of environmental protection. This dialogue reflects the dictum of Albert Einstein regarding science and religious ethics that "Science without religion is lame, religion without science is blind."¹⁴

Rather than promoting Buddhism, therefore, through rigorous and critical analysis I provide an informed focus that arises from the world of American Buddhist values. In this examination I offer a specialized approach specifically by taking, but never favoring, an environmental ethics path delineated by American Buddhism. Throughout the narrative I also add important texture at times by appreciating the perspectives of other religions of the world, including turning to my own work in comparative religious environmental ethics.¹⁵ Of course, I encourage similar future space ethics contributions from other, diverse, religious and nonreligious sources in order to stimulate pluralist ethical discussions for the benefit of us all. Indeed, even in this introductory chapter non-Buddhist approaches allow me to place my specialized focus on Buddhist ethics in larger context, as I do now.

BUDDHIST ETHICS IN CONTEXT

Obviously, I cannot bring space sciences into dialogue with Buddhist ethics as I have delineated without giving my reader a sense of how Buddhist ethics fit with other forms of ethical argumentation. In this light, several conversations within space ethics began in 1980 when astronomer Carl Sagan issued an undeveloped secular ethic: “If there is life on Mars . . . Mars then belongs to the Martians, even if the Martians are only microbes.”¹⁶ Since then, numerous excellent pieces on space ethics have appeared, with most of these treatments arising from the world of Western philosophical ethics such as utilitarianism and Kantianism. The Abrahamic religions of Christianity, Judaism, and Islam have provided some ethical models as well.¹⁷ Whether philosophical or religious, though, these Western approaches remain interlinked in terms of sharing some attitudes toward the nonhuman environment, like values drawn from the Bible and Aristotle’s concept of a Great Chain of Being.¹⁸

As one will see throughout this book, though, Buddhist environmental efforts derive from alternative cultural traditions which can lead to results that diverge from Western forms, leaving Buddhism with plenty of useful new insights to add to space ethics discussions. As the environmental ethics scholar John J. Holder wrote, Buddhism “has some important ideas to contribute to the current conversations on environmental ethics—especially among the scientific community where naturalism (not theism) is a common conceptual framework.”¹⁹

Judaism, Christianity, and Islam, for example, each enshrine a passage from Genesis 1:20-31 in the Bible, with these teachings granting dominion or stewardship of the nonhuman environment to humans. God owns the natural world in this perspective, but humans remain the empowered managers of the natural world in God’s stead. Thus, in Abrahamic religious worlds, humans generally enjoy fairly unfettered power over nonhuman nature.²⁰ As a result of this empowerment of humans, an anthropocentric hierarchy emerges in which superior humanity embodies the pinnacle of creation while all other entities remain inferior.

To these biblical ideas of humanity’s ascendancy and relative environmental omnipotence cling varying philosophical versions of the Great Chain of Being, originally from the philosopher Aristotle, and its understanding of a layered universe with humans at the top, animals hierarchically lower than humans, plants even lower, and stones and water at the bottom of the cosmos in importance. This Great Chain of Being concept has been a philosophical part of Western cultures for so long that I and many of my readers often tacitly take it for granted as a presumption.

Versions of the philosophical concept of a Great Chain of Being as well as biblical notions of human superiority together have influenced Western

religions as well as Western secular philosophies, thereby creating some characteristic features of environmental relationships in Western cultural histories that bear ramifications for space ethics. For instance, biblical and Aristotelian attitudes join to privilege humanity while, perhaps, offering a small measure of respect for animals as sentient beings.²¹ These same attitudes, however, almost entirely exclude ethical respect for plants, mineral formations, bodies of water, and other entities at the bottom of the Great Chain of Being.²²

In terms of space ethics, such Western cultural attitudes a priori exclude all currently known space environments beyond Earth from substantial value in themselves, for at the time of this writing recognized space environments appear lifeless and thus lacking in ethical standing in the eyes of both biblical writers and of Aristotelians. In this way, Western philosophical and religious environmental ethics remain limited by their life-favoring presumptions, thus skewing space ethical deliberations.²³ Further, and going beyond lifeless landscapes, if we discover extant microbial life on Mars, in large measure the ancient biblical doctrine of stewardship will have restricted in advance the ethical respect that those microorganisms theoretically can enjoy.

Buddhist ethics, which arise from different cultural presumptions, provide sometimes quite powerful alternatives to Western approaches. Buddhism does not innately reverence the Bible, does not grant human beings stewardship over nature like the Bible does, and historically has not been influenced much by the Great Chain of Being. Instead, and being environmentally salient, unlike most biblical religions and Western philosophies, Buddhism posits a natural environment that consists of beings that reincarnate between human, animal, god, ghost, and hell realms.

A human birth is considered the best of these, since only humans, not even gods, can realize the religious goal of nirvana. This outlook leaves Buddhism with its own homegrown senses of human ascendance in the universe.²⁴ However, since humans and animals are reborn as each other in Buddhist viewpoints, this human superiority is relative, not final, and there exists a sense of kinship between humans and animals that is not found in biblical religions or the Great Chain of Being. In Buddhist theory, animals and humans remain more peerlike and less hierarchical in relationship, leaving the tradition to encourage its followers zealously to extend loving-kindness, compassion, and nonharm to animals, as chapters 1 and 3 of this book vibrantly demonstrate.²⁵ Because of such features, Buddhism represents one of the more animal-friendly religions in existence, since it in fact seeks to protect all sentient beings.²⁶

Therefore, if you find microbes on Mars as I portrayed at the beginning of this chapter, and if microbes should be treated like nonhuman animals (I will examine this controversy in chapter 3), Buddhism offers a moral standing for microorganisms that is different from results found using Western ethics.

Buddhist approaches create room for perspectives in which microbes are regarded more as colleagues of humans in the struggle for existence and less as opportunities for human domination.

I would betray my own critical methods if I said that these alternative Buddhist approaches are better than those from other sources, but this claim is not needed anyway. Here I highlight that, because of the cultural conditioning that I have described, Buddhist ethics deserve a seat at the table as one of our many space ethics advisors due to their efficacious alternative perspective. To this point Western philosophical and religious ethics have dominated moral approaches in astrobiology, but astrobiology benefits by hearing the enriching voices of Buddhists as well. This book offers Buddhist ethics the ability to enter into space ethics conversations, and some intriguingly novel outcomes thereby spring forth from Buddhist contributions. However, there exists another reason why Buddhism deserves a seat in space ethics deliberations, this time concerning its relative friendliness with science like that practiced in space.

BUDDHISM AND SCIENCE

Understanding the generally congenial relationship between Buddhism and science requires a brief peek at the Buddhist path. The Buddha taught a unique religious code during his lifetime around 500 BCE in what is today Nepal and India. Eschewing notions of a monotheistic creator deity like one finds with Abrahamic religions, the Buddha purveyed a nontheistic form of spirituality. Considering concerns with gods and the creation of the universe to be spiritually distracting, the Buddha taught that our universe is eternal, limitless, and cyclic. To be sure, the Buddha reflected his time and place in believing in a variety of invisible spirits. Yet, to him, these deities were as in need of the experience of nirvana, or the Buddhist enlightenment experience in which suffering is said to cease, as human beings. The Buddha thereby taught his followers never to rely on gods or spirits and always to rely on themselves as humans in order to resolve their very human existential problems.²⁷

The main shortcoming faced by human beings, according to the Buddha, is known as *dukkha* in the scriptural Pāli language, which means something similar to suffering, imperfection, or unsatisfactoriness. We humans crave happiness that will not fade, taught the Buddha, but this happiness remains elusive in the face of inexorable realities such as sickness, old age, and death. Since we want lasting happiness despite a guarantee of suffering, the Buddha said, we need to alter our minds regarding how we experience the world. Rather than engaging in reality from a self-centered, first-person perspective,

the Buddha emphasized, one should identify instead much more broadly with the infinite web of interconnections that embraces all things in the material universe.

In the perspective of the Buddha, we never are separate in time or space from anything else in the universe despite our perceptual inclinations to the contrary. The Buddha taught that we are interconnected in some way with everything else phenomenal. Buddhist scriptures classically utilize a tripod to demonstrate this idea. Imagine that three sticks are placed in relatively vertical positions so that their mutual leaning on each other creates a tripod. Take just one stick away and the tripod collapses. Thus, even while standing at the beginning, the tripod is not independent in time or space but arises from the precise time and space placement of sticks. The tripod arises as an inherently interconnected reality. For their parts, the sticks are not fully independent either, since together they shape a tripod at one moment. They, too, therefore exist only within a web of connections. Further, if we ask where the sticks came from, theoretically we can trace interconnections across time and space between the tripod, the sticks, and absolutely everything else in the material universe all the way back to the Big Bang. In other words, rather than existing or acting independently in time and space, the tripod, like all physical things, arises from various external causes and creates a variety of external effects. Thus, all phenomenal existents in Buddhist philosophical perspective are *paṭicca-samuppāda* in the scriptural language of Pāli (or arise in interconnected dependence on each other). I will follow a common path in referring to this interconnected universe concept in English as *dependent arising*.

If I describe this dependent arising perspective of the Buddha temporally in terms of today's astronomy, rather than in terms of a tripod, I offer that, despite a seeming time gap, we are not separate from the Big Bang 13.7 billion years ago, since ultimately it brought us here, nor by extension are we separate from anything anywhere that has happened since the Big Bang. We Milky Way residents are not separate from our neighboring Andromeda galaxy, for instance, since we and that galaxy similarly are children of the Big Bang. In turn, the Big Bang is not temporally separate from us, since we represent the outcomes of its activities.

Moreover, and looking in this instance spatially rather than temporally, the Andromeda galaxy technically tugs on us gravitationally as I write these words, even if you and I do not feel the force from 2.5 million light years away.²⁸ Like with this gravitational pull, in the Buddha's perspective we are interconnected with everything else across vast cosmic distances. I can continue adding Buddhism-and-astronomy examples in which the Andromeda galaxy, Big Bang, or other physical cosmic entities are not separate from us in terms of either spatial or temporal points of view regardless of our ordinary

perceptions to the contrary. The Buddhist universe thereby manifests completely interconnected across time and space.

Given situations of dependent arising like our nonseparation from the Andromeda galaxy, why not, then, encouraged the Buddha, experience reality from the point of view of the interconnected whole rather than just from the first-person singular? The more one manages deeply to experience the universe as a vast web of connections, urged the Buddha, the more suffering disappears and lasting happiness explodes forth in the goal experience of nirvana, in which felt distress is said to be blown out of the psyche forever.

In calling for an awareness of being a part of a phenomenal interconnected whole, Buddhism manifests great concern for attending to one's empirical experiences of reality. One realizes nirvana by gaining deeper insight into the workings of one's own interconnected empirical experiences.

This empirical focus, in turn, has helped Buddhism in recent decades to enjoy comradeship in conversation with science as a result of science's grounding in empiricism.²⁹ For just one example, the Fourteenth Dalai Lama, the leader of Tibetan Buddhists, states, "One fundamental attitude shared by Buddhism and science is the commitment to keep searching for reality by empirical means and to be willing to discard accepted or long-held positions if our search finds that the truth is different."³⁰ Hence, the Dalai Lama repeatedly has convened meetings with scientists to discuss the nature of consciousness, the effects of climate change, or humanity's place in scientific astronomy's universe.³¹

Granted, this Buddhism and science companionship does have some tensions, such as concerns about how evolution and karma work together, the appropriateness of killing of animals in scientific experiments, or disagreements about the origin of consciousness.³² Nevertheless, because Buddhism does not assert resistance toward science like one may find from other religious forms, Buddhism can provide space sciences with powerful collaboration, as the space scholars Traphagan and Traphagan have noted.³³ One should not be surprised that a Pew Research Center poll indicated that Buddhists are more likely to accept the parameters of a scientific theory like that of evolution than are followers of any other American religion.³⁴ Through the rest of the book my reader will find that Buddhism's relative friendship with science proves useful in avoiding some otherwise potentially sticky issues in religion and science dialogue.

SECULARIZED SPACE ETHICAL CONTRIBUTIONS

Buddhism's authority as a solid foundation for ethics supplies another reason why exploring Buddhism in space ethics enriches our astrobiological

initiatives. Ethics, even secular ethics like those practiced in a scientific experiment, must always be built on some cultural moral presumptions that carry substance, respectability, and durability. For 2,500 years, Buddhist ethics have exhibited these traits with success, thereby providing firm moral ground for argumentation. If a chain is only as strong as its weakest link, Buddhist ethics provide us with a capable and well-regarded first link.

However, while I employ Buddhist ethical notions as an authoritative foundation, my goal in this book is to engage space sciences in dialogue and, as such, I must by design follow secular paths. The proper pursuit of space science involves values that are not religiously partisan, but, instead, in the words of the philosopher Charles Taylor, are secular in the sense that “the considerations we act on are internal to the ‘rationality’ of each sphere.”³⁵ Because of this need for secularity in the practice of science, the ethical first step in this book is a religious one toward Buddhism, as I have described, but the principles involved lose their religious dimensions and become secularized by the time they finish their dialogue with science.

Thankfully, one of the most important of Buddhist concepts within this book, the notion that we already have seen of an interconnected, dependent arising universe, requires little secularization despite its being a basic doctrine of the religion. In the Buddhist world dependent arising is a simple fact, not a holy thing in itself. It nevertheless is an ecologically powerful concept that plays a major environmental ethics role in every chapter in this book.

We get a better sense of what I mean by a secularizing dynamic if we turn instead to the ethical value of nonharm, or ahimsa, toward living beings, which appears within the tripartite ethic for the search for life that we saw previously. Emerging in some form within all religious traditions arising from India, in this book ahimsa derives from Buddhist sources. Ahimsa, the “absence of the desire to kill or harm,” encourages refraining from hurting any living being in any way, for to all animate beings “no one is dearer than self.”³⁶

Despite its origin in religion, this prominent value of nonharm supplies a useful secularized value in dialogue with many others in space ethics discussions in this book. I believe that my reader will see the helpfulness for space ethics of a secularized version of nonharm for protecting environments for ecological or scientific reasons, regardless of whether my reader personally adopts Buddhist values. If a critical conversation determines that originally Buddhist values like nonharm provide benefit in themselves to space science ethics, then pragmatically it will not matter that the source of those values is religious. Hence, through the crucible of critical analysis I will transform originally Buddhist values into ones upon which theoretically anyone in a

secular setting can agree. In addition, I critically hold Buddhism accountable if it does not offer viable ethical tools.

Through its moral contributions Buddhism provides useful new approaches in the world of space ethics while, in turn, the Buddhist environmental ethical tradition itself enjoys some enrichment and development. But, in understanding these dynamics regarding Buddhism, we also contend with some historical limits to utilizing Buddhist environmental ethics in space, as I now will examine.

AMERICAN BUDDHIST STUDIES IN CONTEXT

Throughout this book I consult scriptures from the three major sects of Buddhism—Theravāda, Mahāyāna, and Vajrayāna—as a qualitative fountainhead for ethical deliberations. However, and unsurprisingly, 2,000-year-old texts have little to say directly about how to act when practicing science on Saturn’s moon Titan. Therefore, along with extensive scriptural support, the Buddhist environmental ethical arguments found in this book primarily arise from the helpful voices of some contemporary American Buddhists, who renovate the tradition by remaining practical experts in applying Buddhist ethics to everyday twenty-first-century life.

In turning to living Buddhist voices to teach us about how Buddhism may be applied to current and future space realities, I never ask Buddhists questions about space policy issues, because these Buddhists, while being generally intelligent and educated, overall have minimal expertise in professional space policy. Instead, I seek to understand the considered moral values that Buddhists, already savvy in navigating the twenty-first century with Buddhist ideals, choose to bring to space ethics situations as well as their reasons for applying those values. Expressed both quantitatively through a space ecology survey and qualitatively through narrative comments, these present-day Buddhist perspectives help Buddhist values to avoid theoretical confinement in ancient India and to enjoy relevance within the twenty-first-century space age.

In terms of the geographical field of my informants, Buddhism first reached American shores in the mid-nineteenth century primarily through emigration from China and Japan, and today you can find Buddhist centers in every state in the United States.³⁷ California and New York supply two concentrated “Buddhist Belts,” but Buddhist centers additionally inhabit the “Bible Belt” of the southeastern United States, the field focus of this study. In this region Buddhist centers tend to be fewer in number as well as smaller in population sizes than in other regions of the country.³⁸ I mention for interested readers that a description of the demographics of my field subjects appears in appendix A.

Compared to other religions and even compared to other forms of Buddhism, American Buddhism long has been known for an environmentalist sensibility.³⁹ Energetically combining their spiritual and ecological preservationist impulses in word and action, American followers of the Buddha generally manifest as an “ecocentric” *sangha*, or environmentalist group of religious practitioners, according to the scholar of American Buddhism Richard Seager.⁴⁰ This environmentalist sensibility made my fieldwork among American Buddhists easier, since many Buddhists were genuinely pleased to participate in a project about environmental ethics.

Between March and June 2019, I undertook quantitative and qualitative ethnographic fieldwork intentionally across a diversity of Buddhist forms. In the field I obtained statistically significant samples from all three of Buddhism’s major branches of Theravāda (classically found in places like Sri Lanka, Thailand, or Burma), Mahāyāna (the Buddhism stemming from East Asian locations like China, Japan, Vietnam, or Korea), and Vajrayāna (in Asia commonly encountered in Tibet, Bhutan, Mongolia, or Japan), for a total sample size of 121 American Buddhists.

Within the Buddhist world, the most fundamental scriptural ethics derive from the *Vinaya*, or rules for monastics. Each of the three great schools of Buddhism possesses its own slightly different *Vinaya* version, but in terms of the monastic rules consulted in the writing of this book, the various versions remain in agreement in terms of their narrative injunctions. Moreover, this book’s quantitative data arise without significant differences across Buddhist schools. Because of this nonsectarian unity in the qualitative ethical sources as well as in the quantitative data, in this book I generally will treat American Buddhism as a whole, rather than as a sectarian manifestation, although I will attend to differences across sects when relevant.

So that we may discern specifically Buddhist voices from more generally American ones, I further gathered a control data set from seventy-eight randomly selected university students from a variety of religions. These control sample members live within the same region as the Buddhist centers in the study.

Because part of my method includes some quantitative analysis, I state for readers who are not statistically inclined that I follow common and uncontroversial methods for understanding numerical data and their relationships. This book’s innovations are ethical, not mathematical. In an alternative rhetorical voice for the statistically oriented, I mention that throughout the presentation I test mathematical independence between Buddhist and control groups as well as across Buddhist groups using pairwise two-tailed Fisher’s exact statistical tests. I do not employ chi-squared tests for the sake of uniformity and in light of the presence of some zeros in the data.

PLAN OF THE BOOK

In chapter 1, I bring American Buddhist voices to bear on an often-overlooked but nonetheless already problematic environmental dysfunction involving the presence of space debris around Earth. What I find is that American Buddhists, armed with notions of an interconnected universe as well as the ideal of nonharm, morally help to provide beneficial momentum toward policy changes regarding space debris. Voices from the field implicitly stress ideas like establishing orbiting recycling centers while they also care for innocent human and nonhuman victims of space debris in distinctive ways. Chapter 2 then probes efforts to establish mining on our moon in the near future. Rather than prohibit mining, American Buddhists instead express moral support for the establishment of multipurpose ecological and historical reserves at strategic locations on our moon, thus creating room for both commercial desires and ecological protection. After delineating lunar land reserves in chapter 2, in chapter 3 I provide moral direction for the search for possible extant microbial life on Mars. As I mentioned, Buddhists supply effective ethical guidance for developing a morality that affirms default nonharm to potential microbes, default nonharm to microbial habitats, but also limited and respectful scientific study of microorganisms to benefit humanity. Chapter 4 thereafter engages contentious arguments about the moral permissibility of terraforming, or manipulating ecologies planetwide, with a focus on controversies surrounding Mars. In the course of this chapter we will find American Buddhists spurring inventive advances in environmental ethics methodologies regarding lifeless locales and thereby enriching environmental moral thinking. Finally, the concluding chapter traces important steps in understanding space ethics from a Buddhist point of view, in orienting religion to space ethics perspectives, and in probing some of the dynamic interactions of religion, science, and space travel in current American culture that are relevant to this book's data. Because of the multidisciplinary character of the presentation, I also define and clarify some necessary terms in the Glossary that comprises appendix B.

CONCLUSION

In this book I trace Buddhist environmental ethical relationships with a variety of space entities. Reflecting this reality as well as the pre-Buddhist nature religiosity of ancient South Asia, the *Candāba Jātaka* story in the Theravāda Buddhist scriptures contains a quite remarkable passage that enjoins space nature mysticism. In this short tale, an ancient Hindu forest sage counsels his

spiritual disciples that the way to Radiant Realms, or heaven, emerges from meditating on our moon and our sun and thereby enjoying ecstatic experiences of “moonlight and sunlight.”⁴¹ Perhaps this religious adoration of bright celestial entities inspires my reader, as it does me, to begin contemplating the meaning of the luminous objects of our sky such as our moon, our sun, streaking meteors, and—falling space garbage? Let us now turn to the problematic issue of space debris.

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