

Whose apocalypse? Biosphere 2 and the spectacle of settler science in the desert
In *Geoforum* 124 (2021): 36-45

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Abstract. Deserts have a special prominence in apocalyptic visions of the future. As a trope, the desert frequently indexes apocalyptic visions of the warming planet and future challenges of securing food, energy, and water in a changing environment. This article considers how diffuse visions of “environmental apocalypse” are spun through narrative constructions of the desert as sites of utopia and dystopia – places where humanity is simultaneously portrayed as meeting its most dire possibilities of collapse, but also places where hopeful futures might be tested out and extremes overcome in an era of climate catastrophe. This article offers a genealogy of techno-scientific schemes in the Arizona desert and the “visioneers” behind them, focusing on the most iconic example of Biosphere 2. Initiated in the mid-1980s, Biosphere 2’s history illustrates how such projects are underpinned by multiple forms of spectacle, which draw on the ideals of science, technology, and environmental salvation to build settler colonial structures of exclusion and Indigenous dispossession. By centering the question of *whose* apocalypse we are being sold in such techno-centric “solutions” to ecological dilemmas, this article expands recent discussions of environmental injustice and settler colonial violence to show how ostensibly “progressive” ideals and initiatives are also violent and routinely overwrite histories and presents of colonial dispossession.

Keywords: apocalypse; deserts; settler colonialism; science and technology studies; Arizona; Biosphere 2

Introduction

When I was about 7 years old, I peered through a pane of glass that separated me from some curious-looking people tending plants on the other side. They were bottled up in what was essentially an oversized greenhouse and, I was told, had not been allowed to come out for almost two years. The array of hypermodern geodesic domes and glass panes that enclosed them was Biosphere 2, just outside of my hometown of Tucson, and this was the first human experiment at the facility (**fig. 1**). The project’s planners aimed to recreate the conditions of Biosphere 1 (Earth) as a closed system and test the ability



Figure 1. View of the Biosphere 2 facilities in Oracle, Arizona. Source: Author, December 2019.

of these people to maintain the ecosystem that kept them alive. Undergirding the premise of this experiment was the idea that an environmental apocalypse was nigh: people needed to find new technological solutions to the limits of Biosphere 1’s ability to sustain human life in the face of global ecosystem destruction and resource depletion. Biosphere 2 was to be a spectacle of techno-optimism, proof that science and human ingenuity could avert the looming eco-apocalypse.

At the time, I did not understand much about the relationship between science and spectacle, but almost 30 years after my first visit to Biosphere 2, I have learned that it is impossible to disentangle the two. In my subsequent academic research, I came to see spectacle as a technology of government, which actors use strategically to advance certain agendas and visions of the world (Koch, 2018). Developed in the 1980s by the company Space Biospheres Ventures in cooperation with the University of Arizona, Biosphere 2 was a consummate spectacle. And like many spectacles, it was designed to be a one-off. That is, it was always acknowledged to be an experiment only. As a kind of *utopian* spectacle to sell a techno-optimistic future, it was engineered to draw attention to possible solutions for the coming environmental apocalypse – itself a *dystopian* spectacle. Of course, the project never succeeded in engineering the world out of its environmental troubles, but did this speculative exercise actually do something more? Whose interests did it actually serve?

As this article shows, Biosphere 2's promoters were adept propagandists. Naturally, nobody had thought to seal a bunch of humans in a glass bubble before, but such experimental projects in the desert are not particularly new. Nor are they particularly progressive: the logic, I will argue, is quintessentially colonial. Imperial projects also have a long history of employing “experiments” or “models” to introduce their new mode of social ordering, and Euro-American imperialism was always interwoven with modern scientific technologies and concepts. Harnessing the discursive power of science, Biosphere 2's planners nimbly adapted the story of environmental apocalypse to sell their clichéd visions as *visionary*. In doing so, they also sold *themselves* as visionary. The colonial logic of modernist science has always discounted other ways of knowing, strategically constructing a particular kind of hero – the white male scientist – who has arrived to save the day. This supposedly enlightened or superior knowhow in turn works to justify settler control of Indigenous lands. In considering the case of Biosphere 2, then, we must ask *who* its promoters are and *whose* “apocalypse” are we being sold?

This last question has been powerfully posed by many Indigenous scholars, who point to the colonial undercurrent of apocalyptic environmental narratives, or what April Anson (2020: 63) refers to as “settler apocalypse” – “stories that tell of the end of the whole world but are, in reality, specific to white settlers.” Potawatomi scholar Kyle Whyte (2018: 225), extends this argument and stresses how “dystopian or postapocalyptic narratives of climate crises [...] can erase Indigenous peoples’ perspectives on the connections between climate change and colonial violence.” Speaking from the North American context, he notes how many Indigenous communities understand “their societies as already having endured one *or many more* apocalypses” (Whyte 2018, 236). Diné geographers Andrew Curley and Majerle Lister (2020) likewise describe these past and present apocalypses as a layering of “already existing dystopias,” which are also erased by narratives of settler apocalypse. That is,

With colonization, Indigenous peoples saw their lands taken and lives permanently altered. This constituted its own dystopia. Tribes later suffered through forced assimilation, continued land theft, and the creation of tribal institutions with legal and political rights strongly associated with the expansion of capitalism and extractive industries within and around Indigenous communities. Oil and gas fracking around Indigenous lands have witnessed the abduction and murder of Indigenous women who are ensnared into man camps. Coal created hundreds of jobs, a sense of economic dependency, and eventual collapse. These multiple, overlapping, and current dystopias are lost on most commentaries on climate change. (Curley and Lister, 2020: 260).

This article thus seeks to understand whose “apocalypse” was advanced in the project to build Biosphere 2 in the Arizona desert. It is built on a recognition that settler colonialism, as a system of structural violence, includes elements that are overtly destructive (e.g. displacement, genocide), as well as elements that are productive (e.g. scientific endeavors, economic “opportunities” for both settlers and Indigenous/nonwhite people who are enticed to participate in the same structures that oppress them). These negative and positive elements of systems of oppression are never separate (Foucault 1975), but analyzing an ostensibly

productive project in the American Southwest like Biosphere 2 requires a different analytical focus than analyzing the overtly destructive acts of colonial genocide and violence in the same place.

While this article does not directly examine the violent history of Arizona's colonization (see Blackhawk, 2006; Crandall, 2019; Dunbar-Ortiz, 2014; Lahti, 2012), Biosphere 2 offers important insights about how the state's settler colonial power structure was developed with support from the discursive resources of science and environmentalism. I thus examine how certain environmental imaginaries are interwoven with scientific networks of power to sell apocalyptic visions of living in a changing planet, and by whom. Techno-fetishistic projects in the desert have a long history of using apocalyptic narratives to justify material interventions in environmental policy and exploration, and to deflect attention from their role in perpetuating (settler) colonial projects of violence and exclusion. Uniting insights from geography, environmental studies, STS (science and technology studies), and Indigenous studies, this article takes apocalyptic imaginaries seriously and asks how they "touch down" across history and diverse places around the world – whether deserts or not – and what role they play in re/configuring cross-scalar power relations.

To do so, I draw from a larger study on the politics and environmental history of empire in Arizona, which has included archival research, interviews, and fieldwork from 2018-2020 (Koch, forthcoming-a). My interviews for this broader project routinely touched on Biosphere 2, but none were on the record (per request or per legal constraints), so that data is not presented here. Instead I use textual analysis, paired with site visits in December 2019, to contextualize the history of Biosphere 2 within the longer genealogy of experimental projects in deserts. A great deal of secrecy still surrounds the project today and no archival records are accessible to the public.¹ As such, the textual analysis included a review of all published articles, books, podcasts, and other materials covering the history or commentaries about Biosphere 2 from 1991 to the present, collected via the author's institutional library databases and a systematic search of relevant materials online. Texts analyzed also included the accounts displayed in the Biosphere 2 visitor spaces, such as the museum-like entry foyer and inside the diverse facilities open to visitors. Although I have been to the site numerous times over 30 years, the site visits in 2019 allowed me to record how different tour guides presented the facilities and the history of the Biosphere 2 project and to gain access to additional materials not available online (e.g. promotional videos shown to visitors, activities designed for children, etc.). The discursive approach sheds light on how ostensibly "positive" or "progressive" ideals of science, technology, and environmental salvation are harnessed to build the settler colonial structures of exclusion and Indigenous dispossession. This story is not isolated to the U.S. Southwest, so by centering the question of *whose* apocalypse we are being sold, this article conceptually contributes to efforts to map contemporary forms of environmental injustice and settler colonial violence – which are not limited to the violent theft of land and life, but might also look like a gleaming white laboratory in the desert. That is, the seductive spectacle of settler science is a form of violence too.

Whose apocalypse? The desert, dystopia, and colonial mastery

Apocalyptic narratives have become a staple of Western discussions about climate change and environmental futures that seem to pose an existential threat to human existence (Anson 2020; Barker, 2020; Braun, 2015; Buell, 2010; Cassegård and Thörn, 2018; Fiskio, 2012; Garforth, 2018; Lilley et al., 2012; Mathews and Barnes, 2016; Skrimshire, 2010). As noted above, Indigenous and decolonial scholars have forcefully shown how these narratives bolster colonial logics that silence alternative views of harm, risk, danger, and the future (see also Davis and Todd, 2017; Erickson, 2020; Gergan et al., 2020; Mitchell and Chaudry, 2020). The challenge, Delf Rothe (2020: 146) notes, is that "the idea of a (single) future catastrophe and its underlying assumption that 'we are all in this together' conceals social antagonisms in the present," while disregarding the fact that huge portions of the world "have already lived through the ecological catastrophe brought about by European colonialism and its repercussions." These social and political divides must therefore be at the core of any analysis of "the" apocalypse.

The dramatic idea of apocalypse was central to producing Biosphere 2's spectacle, but so too was the Arizona desert where the facility was built. Deserts hold a special place in Western imaginations as

¹ For current facilities and research information, see <https://biosphere2.org/>

dystopias and places of extremes (Davis, 2016; Isenberg et al., 2019). They are frequently treated as a metaphor for global warming and the future challenges of securing food, energy, and water in a changing environment. Desert images thus index environmental collapse – perhaps the most cliched icon of climate change today is a photograph of a patch of parched soil. Their visibly limited natural resources makes deserts easy icons for fearful visions of scarcity, but the same traits have also make deserts popular places for scientists, state-builders and other colonial figures to showcase the marvels of modern science and human ingenuity in overcoming extreme climates.

These reductive narratives are not new: deserts have long circulated as a trope, rather than places to be experienced and understood in their full human and ecological complexity – reduced to barren wastelands, sparse in vegetation, and ostensibly depopulated. It is not surprising, then, that the desert-as-trope also figures prominently in imaginaries of environmental apocalypse. But how does such a broadly consistent coding come about? “In tracing how individual visions sometimes rise to the status of collectively held objectives,” Sheila Jasanoff (2015: 25) suggests, we need to attend “not only the material instruments that reformers are able to accumulate but also their uses of symbolic and cultural resources, such as images, texts, memories, metaphors, and language itself.” This multi-textual approach is needed because all environmental imaginaries are inherently political: descriptions of desert landscapes are never as simple as they seem.

Through images and rhetorical constructions, deserts fit into diverse political storylines about how particular people relate to one another and to the natural environment. This is especially apparent in how deserts are treated not only as dystopian, but also as otherworldly. Otherworldliness is especially apparent in visual references to desert landscapes in discussions about the end of human life on Earth and the need to travel and settle on other planets – and most specifically, Mars. On the one hand, environmental collapse or other forms of catastrophe that are said to make Earth uninhabitable are visually cued through desert landscapes. On the other, Mars is currently the place most commonly referenced as where humans should be preparing to settle when the apocalypse arrives. Yet Mars is consistently framed as a desert, with its famous red-rock landscape serving as visual evidence (Lane 2011).

Beyond this drawing of parallels, the deserts of the U.S. Southwest have been treated as a testing ground for astronauts for decades. As early as 1960, NASA started sending teams of astronauts for desert survival training in Nevada and Arizona (Fulmer, 2018; Ranson, 2019). More recently, a former NASA contractor and Mars Society president, Robert Zubrin, founded the Mars Desert Research Station in Utah. Funded by donations from the likes of SpaceX founder and Mars enthusiast Elon Musk, the site has been developed on the basis of its desert landscape. As Zubrin explained to the *Los Angeles Times*: “We wanted a large theater of operations uninhabited, unvegetated and geologically interesting that we could explore” (quoted in Kelly, 2020). The newspaper’s feature on the facility includes images of people romping around the Utah desert in space suits, with red rock formations in the backdrop, as if playing Mars – just like the astronauts 70 years before, themselves preparing to romp across the moon.

Regardless of whether this romping is best classified as genuine training or simply playing dress-up, the mediated spectacle of it all ultimately fuels a broader imaginary of Mars as a place to be colonized, which Jason Dittmer (2007) has noted in his analysis of media coverage of NASA’s Mars missions. The parallels noted between Mars and places on earth are not passive descriptions: they are imperial claims that naturalize the planet as a sphere of human activity and “part of a modern impulse to make nature conform to our desires” (Dittmer, 2007: 125; see also, Dunnett et al. 2019; Lane, 2011; Kirsch, 2020). Beyond naturalizing a colonial perspective of Mars itself, projects like the Mars Desert Research Station also naturalize colonialism in Utah and the United States. This is especially apparent in how they are constructed as laboratories for modernist techno-science – outside time, depopulated, and “blank slates” outside politics (Koch, forthcoming-b). That is, if Utah is to represent Mars, Mars is also imagined to be Utah: the romping white scientists are explorers of a foreign terrain ripe for colonial mastery.

But this is not Mars: here on Earth, and in the American West in particular, colonial mastery is not theater. It is history and present-day reality. A detailed account of U.S. imperial expansion is outside the scope of this article, but suffice it to say that the desert Southwest *is not* and *never was* a blank slate, but the homeland of numerous Indigenous groups. In imaginaries of the desert as an empty wasteland, the

human and spiritual presences are not just ignored, but actively erased – this being the imperial project of American expansion. So if environmental imaginaries are inherently political, is imperative to ask who is participating in constructing narrative constructions of the desert and what interests they are advancing (knowingly or unknowingly), but also whose voices and visions are ignored, silenced, or sidelined. It is precisely here that the imaginative violence of apocalyptic narratives meet the real violence of settler colonialism. If these communities have already experienced and continue to experience apocalypse, then the important question is *whose* apocalypse “we” are talking about.

Projects like the Mars Desert Research Station and, as we shall see, Biosphere 2, mobilize the desert aesthetic and its ostensible similarity to Mars to bolster the claims they make to preparing for human exploration and habitation of Mars. In justifying such projects, advocates constantly emphasize the need to “get ready now,” because of the impending environmental collapse of Earth. For example, in the much-touted tract justifying Biosphere 2, *Space Biospheres*, two of the men behind the project suggest that humanity faces a “historic imperative” of colonizing territories beyond Earth: “biospherics opens up, together with astronautics, the ecotechnical possibilities, even the historic imperative, to expand Earth-life into the solar system and beyond that to the stars and then in time’s good opportunity to the galaxies” (Allen and Nelson, 1987: 1). They were far off the mark when suggesting that this would be possible by 1995, but regardless, the survivalist narrative is limited to a techno-fetishistic vision of colonizing an elsewhere, while neglecting the colonialism of here: the settler colonial occupation of Indigenous lands in the U.S. Southwest and the colonial origins of this environmental devastation (Curley 2021; Curley and Lister 2020; Voyles, 2015; Whyte, 2018). Rather than recognizing these ongoing challenges, Biosphere 2’s “ecotechnical” storyline that humans will simply have to “abandon ship” forecloses conversations about how contemporary colonial systems actually perpetuate environmental ruin here on Earth.

Who, then, do promoters of projects like Biosphere 2 or the Mars Desert Research Station think will save us on this great adventure into our neighboring celestial bodies? Predictably, their techno-fetishistic visions assume a particular kind of colonial hero: the white male scientist. Now largely imagined in a white lab coat, the scientist-as-hero has long been an icon of modernist science. Whatever his specific accoutrements may be, he is white, male, Anglo-European, and committed to the principles of positivism and empiricism. In today’s genre of eco-catastrophism, this iconic scientist is not only the privileged voice warning of environmental collapse, but also the one who is imagined to have the solutions. Eco-catastrophism thus “draws on this universal subject position of ‘anthropos’ and rearticulates it through the figure of the planetary manager: a ‘rational’, scientific subject that manages the different parts of the Earth system on the basis of a comprehensive knowledge of the Earth system” (Rothe, 2020: 151). Like the Anthropocene and other related environmental crisis narratives, the universal image of the Anthropos “is itself a colonial figure” that bolsters “structures that privilege whiteness as the savior of our environmental future” (Erickson, 2020: 112; see also Cassegård and Thörn, 2018; Gergan et al., 2020; Yuen, 2012). Like all securitizing discourses, this masculinist vision of techno-expertise facing down environmental collapse comes with a pre-packaged set of solutions – what are today loosely labeled “eco-modernism.”

Visioneering: Eco-modernism and capitalizing on the apocalypse

Eco-modernism and eco-catastrophism are related phenomena, as Frederick Buell (2010) alludes to in his “short history of environmental apocalypse.” In the United States and other parts of the West, apocalyptic imaginaries around environmental challenges were launched into mainstream discourse following the sensational release of Rachel Carson’s (1962) *Silent Spring* and Paul Ehrlich’s (1968) *The Population Bomb*. Rooted in science and science fiction alike, eco-catastrophism’s fear-inducing narratives blossomed in the 1970s, but there was soon push-back and its purveyors were labeled as overly pessimistic “doomsayers” (Buell, 2010: 20). Some responded by imagining “green utopias” to define how society might be reconstructed “in tune with nature that would be more sustainable, more satisfying and more secure” (Garforth, 2018: 2). Others, and most famously Alvin Toffler (1970) in *Future Shock*, pointed to humanity’s ability to overcome resource limitations through geo-engineering and other technological interventions.

Toffler’s book fueled a new discourse of techno-optimism, which gathered steam as a series of scientific advances in the 1980s began to shift nature-society relations. These advances, including genetic

engineering, computing, and more, facilitated the eco-modernist approaches to environmental mastery, materially and rhetorically. But critically, the techno-optimists did not reject the environmental apocalypse. Rather, “they all sprang dialectically from it,” Buell explains:

Humanity’s heroic era of mastery of nature (thesis) was opposed by the belated, but powerful appearance of environmental apocalypse (antithesis); the new, boundless possibilities of society, just now being revealed as incorporating both the ideology of mastery and the logic of environmental crisis were the triumphant synthesis. Gloomy second-wave pessimism – which Toffler linked explicitly to *The Limits to Growth* – was transformed into an era in which pessimism was a “sin.” (Buell, 2010: 22-23)

So while Toffler and others acknowledged, and in many ways affirmed, the mainstream narrative of apocalypse, they proposed a different set of solutions. In short, they co-opted the apocalyptic discourse.

In the hands of the techno-optimists, environmental crisis became an opportunity: nightmares were transformed into “tradeable value” (Mathews, 2015: 206). Narrative constructions of crisis go hand-in-hand with how certain actors seek to profit from it (Klein, 2007). For some people, environmental and social disaster offers financial rewards, which is often interwoven with symbolic and cultural capital. As Sarah Amsler (2010: 138) notes, crisis thinking is a “political art” – “less a practice of critique and more as a discursive strategy in a cultural war of position.” The ability to define the contours of environmental crisis is thus an act of discursive power: “the texture of the future, like other facts, depends on how and by whom it is composed” – especially if these orators “seek to narrow down what the future can be to a relatively limited subset of possible registers” (Mathews and Barnes, 2016: 11). This process of narrowing can thus bolster the interests of some orators over others.

For the eco-modernists, controlling the environmental crisis narrative enabled them to sell their techno-scientific visions and proposals to engineer Earth and humanity out of its predicament. Here the scientist-as-hero reappears:

Eco-modernists take the resilience of human and natural systems as a given – rendering technological experimentation with the planet both feasible and legitimate. The related planet political project revolves around the figure of the planetary engineer – a venturesome, optimistic (privileged and male) subject, whose creativity is to be fostered through flexible and experimental governance. (Rothe, 2020: 153)

The techno-optimistic push-back against the early era of environmental catastrophism is a familiar dialectic today. Throughout history, their success has hinged on mobilizing the cultural resources of “science” (as well as the financial resources of institutions and individuals) to support their “experiments.” This experimental, speculative, future orientation can easily push the credible scientist-as-hero to the social fringe, however. Patrick McCray proposes the term “visioneer” to describe this genre of technological enthusiasts, who sit “at a ragged border between scientific fact, technological possibility, and speculation” (McCray, 2012a: 351). Combining “visionary” and “engineer,” McCray’s term captures the hybrid nature of their efforts to imagine and engineer radical new techno-futures (see also McCray, 2012b)

Visioneers have historically flourished in places like the United States, where “their liminal research and propagandizing, existing on the threshold of respectability and academic visibility, can still exert a considerable pull on the public’s imagination of the technological future” (McCray, 2012a: 370). This is precisely what I was looking at through the glass of Biosphere 2 that day I visited as a child. The project was the result of visioneers uniting with other futurists and entrepreneurs to produce a spectacle that would invite me to imagine a world of environmental collapse – where humans had to survive in an artificial environment of their own making (*the horror!*), but where humans harnessed modern technology and rose to the challenge (*the wonder!*). Marginal as they may be within the mainstream scientific establishment, visioneers are adept at drawing on the scripts of science (or more accurately, scientism) to *communicate* their vision of environmental futures and to *capitalize* on it:

Unlike armchair futurists, these people—many of whom had advanced training in science or engineering—also carried out detailed research and engineering studies in order to realize their ideas. They made critical connections between their technical expertise and their visions of a more expansive future that would be created by the technologies they studied, designed, and promoted. (McCray, 2012a: 350)

Many of the visioneers McCray discusses had affiliations with universities and other mainstream institutions. But due to their marginality within them, “funding often came from an ad hoc array of sources—venture capitalists, wealthy entrepreneurs, private foundations, curious citizens, and grassroots organizations,” which in itself consigned them to the “technological margins” (McCray, 2012a: 350-351)

So while visioneers may have operated outside funding systems typical to mainstream science, they found ways to profit from their future imaginaries – largely through generating splashy media coverage and forming broader “textual communities” of like-minded futurists and entrepreneurs. Through referencing a set of canonical writings about technological and future – including a strong dose of science fiction – these future aficionados use spectacle to promote their ideas. The audaciousness of spectacle is precisely what appeals to many consumers of science fiction and, indeed, the textual communities that developed around themes of eco-catastrophism in the 1960s and 70s were heavily influenced by the genre. One of the touchstone texts arising at this time was Frank Herbert’s (1965) novel *Dune*, which is set in the distant future and revolves around the story of a noble duke who is forced to relocate his family to a forbidding desert planet. The book emphasized the themes of resource finitude that were such sources of anxiety at the time of its publication. *Dune* did not meet instant success, but it eventually came to be seen as one of the most significant sci-fi texts of all time (Kunzru, 2015). Almost immediately, however, *Dune*’s apocalyptic vision became deeply influential among environmental activists in the late 1960s and 1970s, and it became an important part of the canon for the textual community of eco-catastrophist visioneers.² According to one University of Arizona researcher, Carl Hodges (1975: 35), who was later involved in the Biosphere 2 project, *Dune* was “evangelized as almost a new *Book of Revelations*,” and he used it to justify the spectacular (but lucrative) geo-engineering and controlled environment projects developed through his Environmental Research Laboratory at the university (see Koch, 2019, 2021).

In fact, *Dune* sits at the middle of a dense web of iconic projects, cultural references and environmental imaginaries that link techno-scientific visions of the deserts of Arizona and Arabia. The book itself draws directly from the famous writing about the Arabian desert from colonial explorers like T.E. Lawrence (1926) and Wilfred Thesiger (1959), particularly with respect to their descriptions of local Bedouin tribes. These British writers depicted the desert as a hostile place, where only the strong could survive and where non-locals could only survive by adopting local customs to deal with the dystopian conditions of hyper-aridity and extreme temperatures. The unearthly and foreign character of the desert, which Herbert constructed in *Dune* circulated most widely through its influence on the *Star Wars* franchise. As Hari Kunzru (2015) argues, the *Star Wars* universe is littered with “all manner of borrowings from *Dune*” and indeed, “Herbert knew he’d been ripped off.” In any case, the iconic images of the desert planet of Tatooine in the films are now among the most common reference points for cultural discussions about colonizing Mars – like the parallels drawn with the U.S. desert southwest, references and stills of Tatooine are a staple of reporting about space exploration and the harsh challenges that face humanity in the event of environmental apocalypse.

But the web of this textual community spiraling out from *Dune* doesn’t end there. In one more curious twist, the built structures that are found in Tatooine were inspired by the architecture of the Arizona commune, Arcosanti (Lubell, 2015). Another response to the environmental apocalypse narratives of the late 1960s, Arcosanti was a model city developed by the Italian-American architect Paolo Soleri beginning in 1970, where he dedicated his life to showcasing his “arcology” concept of harmonizing architecture and

² Herbert was himself part of this techno-enthusiast environmentalist community, building a home in Oregon that he described as an “ecological demonstration project,” and at one point describing himself as a “technopeasant” (Kunzru, 2015).

the natural environment (Oberhaus, 2017). As one travel writer describes it, “Arcosanti is a winding, pedestrian-oriented ‘laboratory,’” populated with dome- and bubble-shaped buildings, pierced by cantilevered concrete slabs, appear to be influenced by, among other things, 1970s Modernism, sci-fi futurism, Italian hillside towns and Middle Eastern villages” (Lubell, 2015; see **fig. 2**). Tellingly, residents of Arcosanti today are still referred to as “Arconauts.” Indeed, one need not even visit Arcosanti to see the inspiration: a quick look through Soleri’s (1969) stunning and renown text, *Arcology: The City in the Image of Man* transports one immediately to the *Star Wars* universe (see **fig. 3**). But it also would have transported anyone in this textual community, within and beyond architecture, to the “Spaceship Earth” concepts popularized by Buckminster Fuller. In this respect, and others, Arcosanti was the direct predecessor of Biosphere 2, which also arose from this broader textual community of eco-modernists in who had learned to capitalize on catastrophe in Arizona’s desert. As this case study shows, such stories of environmental apocalypse cannot be understood apart from the violence of settler colonialism – even when those stories are told from a settler perspective that recasts the colonizers as saviors, and reframes the brutality of colonialism as a positive story of scientific salvation.



Figure 2. View of Arcosanti from inside the community’s café. Source: Author, December 2019.

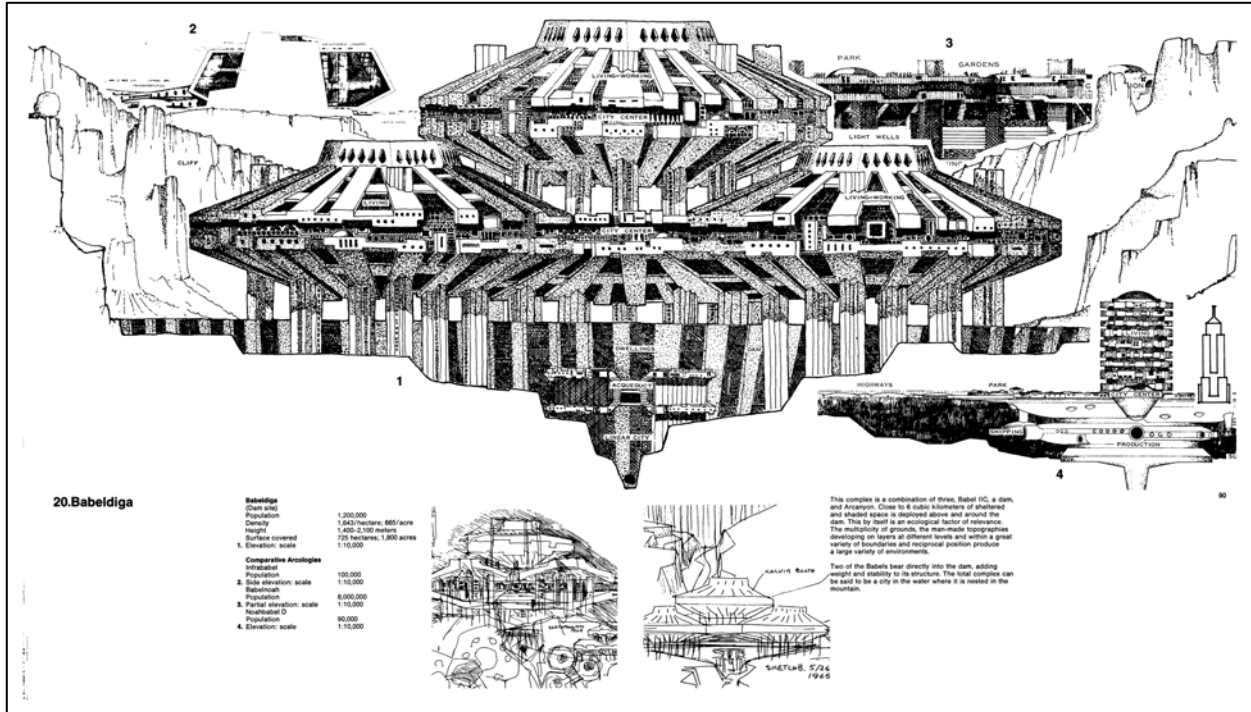


Figure 3. BABELDIGA. Arcology Design from *Arcology - City in the Image of Man*, author Paolo Soleri (1970). Source: Cosanti Foundation - Archives at Arcosanti.

Biosphere 2: Selling techno-futures in the Arizona desert

The world is now populated with countless flashy eco-centric design projects and iconic laboratories aimed at redefining nature-society relations. But when Biosphere 2 was initially conceived in the mid-1980s, it was audacious and unexpected. Biosphere 2 was the brainchild of John P. Allen, an Oklahoma-born dilettante and eccentric with a Bachelor's degree in metallurgy and a Harvard MBA. He became enchanted by the work of Buckminster Fuller, the American architect and futurist, and was drawn to his "Spaceship Earth" concept, which a number of scholars have examined as a central trope in crisis narratives about Earth's resources being finite that took hold in the late 1960s (Anker, 2010; Günel, 2016, 2019; Höhler, 2015; Selcer, 2018; Vetesse, 2020).³ Fuller's response to these apocalyptic narratives was firmly in the techno-optimist camp, as seen in his 1969 manifesto, *Operating Manual for Spaceship Earth*:

In organizing our grand strategy we must first discover where we are now; that is, what our present navigational position in the universal scheme of evolution is. To begin our position—fixing aboard our Spaceship Earth we must first acknowledge that the abundance of immediately consumable, obviously desirable or utterly essential resources have been sufficient until now to allow us to carry on despite our ignorance. Being eventually exhaustible and spoilable, they have been adequate only up to this critical moment. This cushion-for-error of humanity's survival and growth up to now was apparently provided just as a bird inside of the egg is provided with liquid nutriment to develop it to a certain point. But then by design the nutriment is exhausted at just the time when the chick is large enough to be able to loco mote on its own legs. And so as the chick pecks at the shell seeking more nutriment it inadvertently breaks open the shell. Stepping forth from its initial sanctuary, the young bird must now forage on its own legs and wings to discover the next phase of its regenerative sustenance. (Fuller, 1969: 18)

³ This research shows how Spaceship Earth circulated in United Nations programs as well as elite cultural and scientific circles. But as the case of Biosphere 2 highlights, the ability of these elites to use the trope to such great effect depended on its fusion with the eco-catastrophism, which had profound popular resonance in the 1960s-80s.

For Fuller, that “next phase” was rooted in human ingenuity and engineering prowess. Picking up Fuller’s Spaceship Earth concept, John Allen became determined to lead the charge in imagining new techno-fixes to overcome the problem of resource finitude and “step forth” from earthly limits. “Western civilization isn’t simply dying. It’s dead. We are probing into its ruins to take whatever is useful for the building of the new civilization to replace it,” he once said (quoted in Zimmer, 2019).

In the 1970s, Allen was leading a counterculture “ecovillage” commune in New Mexico, Synergia Ranch, where he met the wealthy Texas businessman Ed Bass.⁴ The two shared an interest in the theme of environmental collapse and in Bass, Allen found a receptive ear as he proposed to engineer artificial “biospheres” to prepare for the looming apocalypse and colonize Mars. Ultimately contributing around \$150-200 million to the project, Bass pledged an initial \$30 million in 1984 to fund Biosphere 2 and became chair of the company to develop it, Space Biospheres Ventures (Cooper, 1991; Zimmer, 2019). Space Biosphere Ventures built the structure between 1987 and 1991 and the project’s leadership came from an exclusive crowd of Synergia insiders, widely understood to be part of an actual cult. The basic idea of the project was to develop a miniature world: a mock-biosphere consisting of thousands of plants and animals, seven biomes, a complicated water and gas exchange system, and of course, the human-managers. Or, as one particularly skeptical journalist said of Biosphere’s “scientific” recipe: “Take three or four thousand variables, enclose them in a glass container, throw in eight humans, shake ‘em up like a margarita for two years, and in the end you’ll get a nice, smooth blend” (Cooper, 1991). Although the project’s premise was for the Biospherians to be completely sealed off from outside inputs, it never was a closed system: they were secretly consuming food not grown inside (stored in advance in special reserves), and they eventually had to take in other vital supplies, including oxygen. The project has thus been widely condemned as mere theatrics and far from anything resembling “science” (Cooper, 1991; Trufelman, 2019; Zimmer, 2019), though the project’s indefatigable visioners and acolytes continue to insist it was not “science, not a stunt” (Dempster, 2017).

Rather than fixating on what does or does not count as science, it is useful to return to the bigger question I have posed in this article: *whose* apocalypse is imagined and mobilized in justifying the Biosphere 2 project? And whose interests did it serve? John Allen and his long-time Synergia associate Mark Nelson explained in their early treatise on the project, *Space Biospheres*, “The major motivation behind creating Biosphere 2 and developing the capacity to create other microscale viable biospheric systems is to assist the Biosphere to evolve off planet Earth into potential life regions of our solar system” (Allen and Nelson, 1987). According to them, colonizing Mars was just around the corner and Biosphere 2 was supposed to be the first major step in that direction. Biosphere 2’s visioners were wrong in countless ways, but they were nonetheless highly successful at mobilizing the apocalyptic narrative of environmental collapse to realize the project. In so doing, the Biospherians reaped significant rewards – including not just financial but also symbolic capital, as many used their newfound fame to promote themselves, their anxious visions of environmental collapse, and their books (see e.g. Nelson, 2018b; Poynter, 2006; Reider, 2009).

Biosphere 2’s visioners also entrenched the techno-scientific vision of the desert as a “laboratory” for white men and women to teach humanity “a number of important lessons for improving our relationship with Earth’s biosphere,” as Nelson later wrote, including that “the technosphere can be redesigned to support life without harming it” and that “we as a species have to learn how to become responsible participants of our biosphere, to come of age in our new Anthropocene” (Nelson, 2018a). He goes on: “The outmoded and false mythology of humans being uniquely ‘above nature’ is giving way to a new appreciation of our responsibility to our fellow species. On our beautiful and intricately connected ‘Spaceship Earth’, we must make it work for everyone. Buckminster Fuller reminded us: ‘It has to be everybody or nobody’” (Nelson, 2018a). Here we have the construction of the universal Anthropos conjured by the colonial scientist-as-hero. If Nelson and Allen’s dreams of colonizing Mars fell by the wayside or

⁴ Started in 1969, it still operates today as a conference center and farm: <https://synergianranch.com/>

didn't, and if Biosphere 2 involved real science or not, we are nonetheless assured that our enlightened engineers can redesign the "technosphere" to ensure our common survival – so long as they work in their own self-interest.⁵ This capitalist idealism of the project is not surprising in that self-proclaimed visionaries like Nelson, Allen, Bass, and Fuller all subscribe to the eco-modernist's techno-fetishism from which they derive personal and professional rewards.

A colonial logic has always pervaded Biosphere 2, but it is perhaps best captured in a photograph that ran in the *Arizona Daily Star* in September 1991, marking the beginning of the first sealed human trial. The image is captioned: "Dan Old Elk, a Crow Indian from Montana, gives a blessing to the people of the Biosphere II program, during a brief ceremony before entering the facility which will be home for the next two years" (Eubank, 2018; see **fig. 4**). Why a member of a tribe so far from the Sonoran desert was chosen for this ceremony is unclear. The symbolic effect *is* clear, however: the very act of enlisting such an individual, dressed in traditional Indigenous garb and headdress, to "bless" the group of eight white men and women, dressed in their space-style jumpsuits, visually entrenches colonial hierarchies of power, knowledge, future and past, science and tradition. Dan Old Elk here becomes not just an icon of tradition, but also an icon of the white man's environmental mastery and reaffirms the "structures that privilege whiteness as the savior of our environmental future" (Erickson, 2020: 112). In the more literal sense of a structure, we also see that Biosphere 2 privileges the colonial vision of techno-science through the building itself.

Architecturally, Biosphere 2's geodesic domes referenced Bucky Fuller's Spaceship Earth concept. Space Biosphere Ventures hired one of Fuller's former associates, Peter Jon Pearce, to design Biosphere 2 with a 3.14 acre floor area and to develop its special airtight sealing system. In addition to referencing the Spaceship Earth idea, Biosphere 2 was part of a broader trend in U.S. higher education to position the Southwest as a region specializing in advanced scientific research related to space and astronomy (Lane, 2011; Webb, 2002). Beginning as early as 1894, when the Lowell Observatory was first opened in Flagstaff, Arizona, domed observatories quickly became icons for the region's new academic institutions to frame the Southwest as a kind of natural laboratory for high-tech observations: "Each new bulbous structure was a sign that science was on the rise in the region (Conrad, 2014: 606). By 1922, the University of Arizona campus in Tucson had opened the Steward Observatory, and over decades, scientific leaders worked with political leaders and other boosters to advance the image of Arizona as a special place for space-related research (Webb, 2002).

This trend was amplified during the Cold War-era "Space Race," as the state was increasingly promoted as the home of cutting-edge research on all things space and solar – exemplified most vividly in the *Arizona Highways* (1975) special issue "Solar Center, Arizona, U.S.A.." (**fig. 5**). This magazine vividly illustrates how space aesthetics and future imaginaries started to permeate cultural life more generally,



Figure 4. Photograph in the *Arizona Daily Star* in September 1991, when the Biospherians were beginning the first closed system experiment, with Crow leader Dan Old Elk giving a ceremonial "blessing." Source: Courtesy Arizona Daily Star, © 1991.

⁵ "Self-interest" is a somewhat dubious characterization here, though, because as some of the early reporting on the project suggests, there was controversy among any serious researchers who were asked to participate in the project because they were asked to sign contracts giving Space Biosphere Ventures "worldwide, royalty-free irrevocable" rights to any "idea, concept, invention, patent or discovery" related to their work (Cooper, 1991). The narrative of working in one's self interest, while actually setting up a system to exploit to (intellectual) labor of the staff is nonetheless consistent with the capitalist orientation of the project and its designers.

stretching from research to design to science fiction. It was precisely this vision of techno-futures in the Arizona desert that Biosphere 2 was drawing on and extending. It was, subtly but forcefully, part of the larger project of colonizing the desert West through advancing the techno-futures touted by the scientific establishment – the desert was a convenient backdrop to naturalize what was essentially a sales pitch about the region’s “natural” advantages for this industrial world-making and colonial world-taking. Furthermore, by harnessing the tool of spectacle, Biosphere 2 affirmed the Anglo-American vision of the desert as a “natural” part of U.S. territory – and “rightly” so because of the great advances settlers were imagined to have brought to the land.



Figure 5. Front and back cover of a 1975 *Arizona Highways* magazine special issue about solar power and space research in the desert. Source: *Arizona Highways*, 1975.

This colonial assertion of moral rectitude through the tropes of techno-fetishism fits into a much longer history. In his analysis of the 1915 Panama-California Exhibition in San Diego, Chase Smith (2012: 21) shows how spectacle was used to broadcast the celebratory narrative of modernization in the American West by white settlers: “In the hands of the ‘right’ settlers,” the narrative went, the region could be transported “out of its premodern, precapitalist past into its rightful place at the frontier of progress.” In contrast to previous residents, Indigenous, *mestizo*, and Mexican property owners, the Exposition reframed white settlers’ acts of dispossession through a narrative of moral righteousness, heralding new technologies as the means to secure “positive social change” that only they could bring (Smith, 2012: 21). Biosphere 2’s visionaries also knew the power of spectacle in this respect, but also drew from the colonial toolkit of using a tokenistic mascot – Dan Old Elk – to whitewash their self-interested motives in developing the project.

In addition to the multi-million dollar grants and other funding that Biosphere 2 was able to generate around mobilizing the imagery of techno-futurism, the structure further served its capitalist profit-making motives in the early days as a tourist attraction. This was bolstered by the PR-machine employed by Space Biosphere Ventures, as well as the University of Arizona’s Environmental Research Laboratory, run by Carol Hodges – an eccentric with a similar orientation to Allen and an early and trenchant supporter of Biosphere 2 (on Hodges and this laboratory, see Koch, 2019, 2021). Despite all the flashy newspaper

headlines (e.g. “Desert Dreamers Build a Man-Made World”), and despite the site being routinely touted as a “must see” icon for Tucson visitors, few tourists visit Biosphere 2 today. When it first opened, however, thousands of visitors came each month and paid hefty entry fees. There were even discussions about developing a theme-park around it, though that never came to fruition (Cooper, 1991; Zimmer, 2019).

Instead, the management of Space Biosphere Ventures under John Allen started to haemorrhage money and became increasingly embroiled in controversy. After the project’s expert advisory board quit *en masse* in 1993, Ed Bass brought in Steve Bannon (yes, that Steve Bannon – at this point working as an investment banker specializing in takeovers) to overhaul the company. Bannon removed Allen and his supporters in 1994, and arranged a deal with Columbia University to take over and run the project – which it did until 2003, when it too became mired in controversy (Arensen, 2003; Murphy, 2016; Steller, 2019; Zimmer, 2019). Spectacle, it turns out, cannot be sustained when it erodes, rather than expands, the financial and symbolic capital of its stewards (Koch, 2018: 39). That is, experimental projects like Biosphere 2 all need to be sold – to financiers, to ideologues, to political advocates, and to the broader public they are allegedly serving. To pull in these multiple audiences, stretching across many different scales, spectacle is a particularly useful tool. Spectacle unites discourses and advertises a particular vision of the world. But spectacle is not an abstract phenomenon: it must be crafted in the hands of certain actors, and they must find a utility in doing so.

Conclusion: Visioneers and the spectacle of settler science in the desert

Biosphere 2 still operates today, albeit on entirely shaky financial grounds and without the same imaginative pull of spectacle as before. Now run by the University of Arizona, its supporters nonetheless continue to justify it on the basis of some of the same tropes of “environmental apocalypse.” And it is still populated by the same colonial scientist-as-hero figures as before, who promise to use the “natural” advantages of the desert setting to inspire hope and rework the “technosphere” to engineer futures to overcome contemporary challenges in an era of climate catastrophe. It is hard to know if Biosphere 2’s visioneers and its contemporary University of Arizona backers really believe that they will engineer their way of the apocalypse, but the people and institutions that benefit from spectacle often knowingly sell a false vision. That is, they know their “experiments” will never be scaled up, that nobody will seek to replicate their miniature model or pilot project. Some might do so unwittingly or naively believe in their own sales-pitch. Regardless, they can reap huge rewards from these projects all the same – whether those include the material benefits of a securing grant money or other financial rewards, advancing one’s scientific career, gaining access to a platform to broadcast an ideological or political agenda, securing personal or institutional prestige, assuaging settler colonial guilt or denying it entirely. Whatever the rewards may be, the experiment becomes an end in itself. Spectacle is an important tool for selling the product as something more than science fiction.

Visioneers such as those discussed in this article learned how to use the spectacle of “science” to advance their interests and to sell their impressive new schemes for the future: “For them, the present was merely a prototype, a provisional plan of what would become the magnificent and eventual future” (McCray, 2012a: 52). In linking present and future, the anticipatory politics of visioneers works through the prototype. It may never serve as a model, but it uses *realism* to suggest that the idea is *realistic*. The model allows observers to “see (or at least imagine)” that the techno-futures on display could actually be realized (Smith, 2012: 29), even if they are theatrical. Biosphere 2, for example, never was a “closed system.” The spectacle of the prototype is indifferent to the “reality” of the vision on display; rather, it is designed to amplify the message or critique that it advances. Working in the same way as iconic utopias, such models pose a challenge to the status quo by defining (and in some cases building) an alternative order/ing of society (de Geus, 1999; Garforth, 2018; Jameson, 2005). In disrupting the imagined “fixity” of the present, “the same goes for dystopias: they are negative blueprints of undesirable futures that speak to the present, calling our attention to specific aspects of contemporary society” (Arias-Maldonado, 2020: 1027). The ecomodernist utopias proliferating in the current era of climate change actually toggle back and forth between the themes of utopia and dystopia, using spectacle and sensationalism to call attention to their cause and their message, just as visioneers have long done before.

Deserts have a special prominence in apocalyptic visions of the future and environmental conditions that might threaten human existence. Whether seen in techno-science dreams that have actually been put into action or simply imagined, the desert as a metaphor for environmental catastrophe has inspired a vast array of environmental interventions across time and space. Sometimes the desert trope is self-consciously mobilized to produce spectacle – such as the case of Biosphere 2 explored here – and sometimes it is treated as a mere backdrop for the anxious visions of a waterless world and climate extremes. “As environmental analyses and activism changed,” Buell notes, “so have the concepts behind the rhetoric of environmental apocalypse. This tradition has not been cast aside; its reinvention has been part of the reinvention of environmentalism today” (Buell, 2010: 27).

Indeed, environmentalisms are constantly in flux. But the curious consistency of the desert in these apocalyptic imaginaries poses important questions about who specifically draws on these tropes and narrative threads and, in turn, *whose* apocalypse “we” are being sold. In the case of Biosphere 2’s visioners and the textual communities in which they are situated, we still find the scientist-as-hero preparing an amorphous Anthropos for salvation from an imagined future environmental apocalypse – all the while continuing to silence the “already existing dystopias” (Curley and Lister, 2020) of Indigenous communities in the U.S. Southwest. This article thus contributes to a deeper understanding of how the ostensibly “positive” or “progressive” narratives of techno-science and environmental consciousness can nonetheless re/entrench the violent and unjust power structures of imperialism and settler colonialism, which are felt around the world. The spectacle of settler science is thus part of a colonial narrative that reworks the negative stories of dystopia into a positive story that positions colonizers not as source of the environmental apocalypse but its benevolent heroes. Therefore, when we interrogate *whose* apocalypse we are being sold, we can see that the spectacle of settler science is apocalyptic in more ways than techno-modernists and the Western scientific establishment more broadly would care to admit.

Acknowledgements. Research for this project was supported by a CUSE Grant from the Syracuse University Office of Sponsored Programs and an SSRC Transregional Research Fellowship Consolidation Grant. I am grateful for the feedback from Andrew Curley, Neha Vora, Jesse Swann-Quinn, Meredith DeBoom, and Feras Klenk. All mistakes, omissions, and opinions are my own.

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