

**Abstract** This essay intervenes in current ecocritical debates about the relationship between fiction and environmental risk by analyzing the limits of risk theory in the deep time of the Anthropocene. Although contemporary ecocriticism argues that we must move from apocalyptic depictions of risk to realistic ones, this essay examines fictions of nuclear waste commissioned by the Department of Energy to show that a risk-based realism is used to maintain the status quo of settler colonialism. It then turns to a countermodeling of the futures of nuclear waste by Leslie Marmon Silko in *Almanac of the Dead* (1991), where uranium's *longue durée* future, impossible to imagine from a human perspective, recasts the present as a space in which the unlikely, implausible, and unrealistic saturate the everyday. For Silko, the apocalyptic futurelessness that nuclear waste seeds into our present is a vital formal resource for unsettling colonial realism in the contemporary United States.

**Keywords** risk, Anthropocene, nuclear waste, apocalypse, Native American literature

If contemporary ecocriticism has a shared premise about environmental risk, it is that genre is the key to both perceiving and, possibly, correcting ecological crisis. Frederick Buell's 2003 *From Apocalypse to Way of Life: Environmental Crisis in the American Century* has established one of the most central oppositions of this paradigm. As his title suggests, Buell (2003, 112, 78) tells the story of a discourse that began in the apocalyptic mode in the 1960s and 1970s, when discussions of the "imminent end of nature" most commonly took the form of "prophecy, revelation, climax, and extermination" before turning away from apocalypse when the prophesied ends failed to arrive. Buell offers his suggestion for the appropriate literary mode for life lived within a crisis that is both unceasing and

inescapable: new voices, “if wise enough, . . . will abandon apocalypse for a sadder realism that looks closely at social and environmental changes in process and recognizes crisis as a place where people dwell” (202–3). In a world of threat, Buell demands a realism that might help us see risks more clearly and aid our survival.

Buell’s argument has become a broadly held view in contemporary risk theory and ecocriticism, overlapping fields in the social sciences and humanities that address the foundational question of the “second modernity”: “*how do you live when you are at such risk?*” (Woodward 2009, 205, emphasis mine).<sup>1</sup> Such an assertion, however, assumes both that realism is a neutral descriptive practice and that apocalypse is not something happening now in places we might not see or hear. This essay argues for the continuing importance of apocalyptic narrative forms in representations of environmental risk to disrupt conservative realisms that maintain the status quo. Taking the ecological disaster of nuclear waste as my case study, I examine two treatments of nuclear waste dumps that create different temporal structures within which the colonial history of the United States plays out. The first, a Department of Energy document known as the futures report (Hora, Von Winterfeldt, and Trauth 1991) that uses statistical modeling and fictional description to predict a set of realistic futures for the site of the Waste Isolation Pilot Plant in New Mexico, creates a present that is fully knowable and a future that is fully predictable.<sup>2</sup> Such an approach, I suggest, perpetuates the state logics of implausibility that have long undergirded settler colonialism in the United States. In contrast, Leslie Marmon Silko’s (1991) contemporaneous novel *Almanac of the Dead* uses its apocalyptic form to deconstruct the claims to verisimilitude that undergird state realism, transforming nuclear waste into a prophecy of the end of the United States rather than a means for imagining its continuation. In *Almanac of the Dead*, the presence of nuclear waste introjects a deep-time perspective into the contemporary United States, transforming the present into a speculative space in which environmental catastrophe produces not only unevenly distributed damage but also revolutionary forms of social justice that insist on a truth that probability modeling cannot contain: that the future will be unimaginably different from the present, and the present, too, might yet be utterly different from the real we think we know.

Nuclear waste is rarely treated in ecocriticism or risk theory, for several reasons: it is too manmade to be ecological; its catastrophes

are ongoing, intentionally produced situations rather than sudden disasters; and it does not support the narrative that subtends ecocritical accounts of risk perception in which the nuclear threat gives rise to an awareness of other kinds of threat before reaching the end of its relevance at the end of the Cold War.<sup>3</sup> In what follows, I argue that the failure of nuclear waste to fit into the critical frames created by ecocriticism and risk theory to date offers an opportunity to expand those frames and overcome some of their limitations, especially the impulse toward a paranoid, totalizing realism that Peter C. van Wyck (2005) has described as central to ecocriticism in the risk society. Nuclear waste has durational forms that dwarf the human. It therefore dwells less in the economy of risk as it is currently conceptualized and more in the blown-out realm of deep time. Inhabiting the temporal scale that has recently been christened the Anthropocene, the geological era defined by the impact of human activities on the world's geology and climate, nuclear waste unsettles any attempt at realist description, unveiling the limits of human imagination at every turn.<sup>4</sup> By analyzing risk society through a heuristic of nuclear waste, this essay offers a critique of nuclear colonialism and environmental racism. At the same time, it shows how the apocalyptic mode in deep time allows narratives of environmental harm and danger to move beyond the paranoid logic of risk. In the world of deep time, all that *might* come to pass *will* come to pass, sooner or later. The endless *maybes* of risk become certainties. The impossibilities of our own deaths and the deaths of everything else *will* come. But so, too, will other impossibilities: talking macaws and alien visitors, the end of the colonial occupation of North America, or a sudden human determination to let the world live. The end of capitalism may yet become more thinkable than the end of the world. Just wait long enough. Stranger things will happen.

### **Realism and Risk in the *Longue Durée***

The nature of risk, as Ulrich Beck notes in his foundational *Risk Society* (1992, 72), is fundamentally antirealist; in the risk society, “dangerous, hostile substances lie concealed behind the harmless façades. Everything must be viewed with a double gaze, and can only be correctly understood and judged through this doubling. The world of the visible must be investigated, relativized and evaluated with respect to a second reality, only existent in thought and yet concealed in the

world.” The traumatic nature of living in a world of risk, exemplified in the canonical toxic-world novels *White Noise* (Don DeLillo, 1985) and *Gain* (Richard Powers, 1998), emerges from the way that the real world is no longer accessible to perception.<sup>5</sup> Risks become perceptible only when they are already no longer threats but events, a condition that makes risk itself appear in a fundamentally literary mode. As Susan L. Mizruchi (2010, 119) writes, “When improbable risks are actualized in catastrophe, the familiar becomes the uncanny.” What Mizruchi calls the uncanny, Lawrence Buell (2001) describes as the gothic; in both cases, Beck’s description of a second, real-er world beneath the phenomenological one finds a strong descriptor and a place in literary history as critics connect risk fiction to more established genres that account for what we cannot perceive and cannot understand. No longer haunted by falling helmets or animate dolls, the risk novel tries instead to theorize the connections between tumors and the factory that closed down two generations ago, between what we know of bioaccumulation and what we feel when we look at a carrot.

For many critics, as for Frederick Buell, the gothic terror of a world of risk produces apocalypticism as a symptom and realism as a solution.<sup>6</sup> Even when apocalypse is recognized as a potentially valuable tool for approaching risk—as in Ursula K. Heise’s (2008, 141) insight that in a world of world-threatening danger “apocalyptic narrative . . . can appropriately be understood as a form of risk perception”—the potential benefit of apocalypse is to be used as the most realistic genre for representing a scenario that is genuinely apocalyptic (as in the exponentially increasing flood of contemporary apocalypse novels depicting climate change, for example).<sup>7</sup> As van Wyck has argued, however, the realist commitment to describing the totality of the world’s relations produces its own set of epistemic anxieties in a world defined by risk:

Contemporary ecological threats can come to make ecological thought itself look like a particularly advanced form of cultural paranoia. I mean this in the sense that once we say that everything is connected in this fashion, we mean that everything is, if not already, then at least potentially integrated into a framework of understanding. And it isn’t. To make everything connected is to see the fissures and cracks rendered by ecological threats—whether

the threats posed by wastes or the threats retroactively discovered through accidents—as a kind of recompense for a failure to have properly understood the connections. *The real punishing the epistemic for its sins of omission.* (2005, ix)

Realism, in van Wyck's account, becomes visible as itself a symptom of the paranoid mindset that the risk society tends to produce, a mindset that insists, as Eve Kosofsky Sedgwick (2003, 130) writes concurrently with van Wyck, "there must be no bad surprises." In such a mode, comfort comes not from ameliorating the danger that produced the original discomfort but rather from constructing a model of the world that can give an illusion of totality (133–36). A realist approach to representing risk thus has real-world consequences in second modernity, "blotting out any sense of the possibility of alternative ways of understanding or things to understand" (131). Such consequences can be seen nowhere more clearly than in the government experiment with realism that goes by the unglamorous name of the Waste Isolation Pilot Plant (WIPP), where the realism is that of the settler-colonial state and the alternative ways of understanding are those of the native nations who are most vulnerable to the site's dangers.<sup>8</sup>

The story of the WIPP is convoluted and full of acronyms. By the end of the Cold War, nuclear waste storage had reached a point of crisis that threatened to shut down the nuclear industry if the issue could not be resolved with safe, long-term facilities for storing radioactive materials. The US Department of Energy (DOE) therefore charged Sandia National Laboratories (SNL) with proving that burying waste in the 250-million-year-old salt flats of New Mexico would provide an adequately secure disposal method. In order to comply with section 191.14(c) (the assurance requirements) of the 1985 Environmental Protection Agency (EPA) regulation 40 CFR 191 (the standard), SNL was required to address the security of the WIPP and its future human coinhabitants not only in space, by containing radioactive materials, but also across time. In the standard, the US government took responsibility for ensuring that the probability of inadvertent human intrusion into the WIPP was less than 1 in 10,000 for the next ten thousand years. To calculate this probability, SNL convened the "futures panel," whose work was published as *Expert Judgment on Inadvertent Human Intrusion into the Waste Isolation Pilot Plant* (Hora,

Von Winterfeldt, and Trauth 1991). Four teams of experts spent months imagining potential futures for the WIPP site. The teams then assigned a numerical probability to the likelihood of intrusion into the site over the next ten thousand years to each of the scenarios, which were added together to produce a scale model of the deep-time future of the WIPP.<sup>9</sup>

The statistical model used to map out the WIPP's potential futures, however, produced specific restrictions on what it means, in this state imaginary, to model deep time. The standard required that "the performance assessment will be assembled into a complementary cumulative distribution function (CCDF)" (Guzowski 1991, 2). The choice of the CCDF as the required output determined how the various dangers facing the WIPP would be conceptualized. For such a graph to emerge, "the procedure for developing scenarios must produce a comprehensive set, so that no important scenarios are omitted. In addition, the scenarios must be mutually exclusive, so that the cumulative releases and the probability of occurrence can be combined in a CCDF" (2). Since the probability in a CCDF cannot equal more than 1, overlapping, impossible, or incomplete scenarios would produce unmappable probabilities and thus must—in this particular method of predicting the future—be ignored. Scenarios were defined for the futures panel "as sets of naturally occurring and human-induced events and processes that represent *realistic* future changes to the repository" (2, emphasis mine). The list of events produced was then organized to establish its completeness before being "screened to eliminate those that are not pertinent"; the screening criteria were "physical reasonableness, probability of occurrence, and consequence" (2). At the WIPP, any event that was determined to be unlikely or impossible was excluded from scenario development.

The mathematics of the WIPP was therefore based on a probability model that required certain assumptions of reasonableness, likelihood, and causality. If we can establish a consensus reality, this model suggested, then based on the information we have we can foresee how the future will play out by calculating the different probabilities of chains of events extending forward in time. This has long been the structuring logic behind theories of probability. Statistical pioneer Pierre-Simon Laplace wrote in his 1795 *Philosophical Essay on Probabilities*, "Given for one instant an intelligence which could comprehend all the forces by which nature is animated and the respective

situation of the beings who compose it—an intelligence sufficiently vast to submit these data to analysis— . . . for it, nothing would be uncertain and the future, as the past, would be present to its eyes” (quoted in Hacking 1990, 10–11). For this kind of statistical realism, a sufficiently detailed description of reality allows a viewer with enough computing power to model the future with perfect confidence along various chains of probability. Surprise becomes impossible, and the paranoid’s ultimate fantasy is fulfilled.

The problem that SNL ran into with the inadvertent human intrusion requirement was one of data: it, like Laplace’s statistical deity, needed to extrapolate from certain data points. Data were available from decades of nuclear testing about the effects of radiation on salt and metal and from other sciences about the likelihood of tectonic plates shifting or rivers rerouting. What the performance assessment lacked was data about the future of humanity. This lack of data about the future was understood by the standard, and by SNL, as itself a specific kind of risk. Section 191.14(c) was passed into law “to reduce the potential harm from some aspect of our uncertainty about the future” (Hora, Von Winterfeldt, and Trauth 1991, ES-1). The state was confident, as it laid out its regulations for environmental protection, that it could control risk by modeling what is likely to happen in the present and the near future. It was thrown into a spin, however, by its own ten-thousand-year requirement: it did not have the data to feed into the assessment, and so uncertainty haunted the model, exposing the standard to the risk of failure resulting from its inability to include all potential scenarios in its model, to add up to 1.<sup>10</sup>

This is where the futures panel came in: to provide data that would structure the uncertainty of the deep future and to minimize risk to within acceptable boundaries. Its role was to translate the unknown unknowns of the distant future into known unknowns that could be contained within a probability model. This task was understood by Hora, Von Winterfeldt, and Trauth (1991, II-1) to be an aesthetic one: “in the present study of future societies . . . the experts are required to employ substantial creative effort in structuring their analyses.” The futures panel was asked to compose realistic narrative fictions that would become data within a probability function: “six futures [that] could be considered as exhaustive for most practical purposes” (IV-27). The kinds of fictions that were produced under this rubric worked hard to give even their least possible-sounding scenarios an

air of plausibility. The scenario “A Feminist World, 2091,” produced by the Boston team, for example, was written not in the future tense or subjunctive mood that would more properly denote speculation but rather in the descriptive past tense, while each of its details was carefully tied to a recognizable condition in the present. According to the scenario, the outlines of the “feminine mystique” that define the new canons of science, art, and literature in the feminist future “were visible as early as the late 1960s,” while the prediction/description that scientific “knowledge” (scare quotes in the original) would be understood as “erroneous masculine definitions, constructions, and representations of reality” is carefully backed up with citations from feminist thinkers (Gordon et al. 1991, C40). The future may be different, in such scenarios, but it is not so different that it cannot be known, understood, and predicted by the present. By imagining the future in a way that is consonant with our beliefs about the present such that the imagined future passes a kind of verisimilitude test, a test of its realism, the futures report (Hora, Von Winterfeldt, and Trauth 1991) thus tamed the uncertainty of risk, of the unknowable future in deep time.

The argument made by SNL here is that fiction written in a realistic mode is functionally equivalent to probability modeling: that realism represents the real world, and that verisimilar depictions of the future can provide a totality of representation that will cover all *realistic* scenarios.<sup>11</sup> Such an equivalence may seem counterintuitive at a moment when literature and science are generally conceptualized as opposites. But as Rüdiger Campe (2012) has demonstrated in his transformative intellectual history of probability, both mathematical probability and realist fiction developed from the same origins in Greco-Roman poetological and logical theories and underwent related trajectories of change in the Enlightenment. In its original rhetorical form, probability was opposed to the “true knowledge of science” (2). “Between 1660 and 1800,” however, “probability constituted itself as a measurement of scientific knowledge and as a theory of aesthetic semblance” (9). These two reconstitutions were bound up with each other in the concept of verisimilitude. As Campe writes, “The traditional rhetorical and poetical concept of the *-similis* in *verisimilis* can be understood as a kind of likelihood that implies the semblance of truth. Eighteenth-century aesthetic thinking increasingly begins to conceptualize the *-similis* instead as appearance, an appearance that



may be either false or true but that is seen as the way things manifest themselves” (196). Mathematicians and aestheticians took from the ancients the idea that probability was conceptually indistinguishable from verisimilitude, but they reinvented both concepts: both probability and verisimilitude would no longer *seem* like reality but rather would be reality *appearing* in aesthetic or mathematical form. Thus can the futures report operationalize realist fictions into data: under the post-Enlightenment logic of probability, plausible representations (fictions with enough verisimilitude) can be taken as manifestations of reality and used to make calculations about the real world and its future.

In its orientation toward the far future, the futures panel combined early realism’s commitment to verisimilitude with a later, Lukácsian theory of realism: the futures report, like the realist novel, “is the epic of an age in which the extensive totality of life is no longer directly given, in which the immanence of meaning in life has become a problem, yet which still thinks in terms of totality” (Lukács 1971, 56). The ability of fiction to represent complete realities is no longer assumed, but it can certainly be strived for—and, in the case of SNL, achieved through probability modeling that successfully accounts for uncertainty, that includes the unknown in the totalizing remit of the known. The probability model’s Laplacian ability to predict the future from a fully accurate account of the present provides a mathematical analogue to Lukács’s later theory of realism as prophecy: true realism, a total realism that portrays “man in the whole range of his relations to the real world,” “captures tendencies of development that only exist incipiently and so have not yet had the opportunity to unfold their entire human and social potential” (2007, 48). Realist fiction and probability modeling share a function as well as a history here: to describe the present with a large enough degree of verisimilitude that the future may be extrapolated from the description. In SNL’s literary theory of statistical realism, realist fiction is the equivalent of the CCDF graph, and both narrative forms fulfill the paranoid desire for risk control: with the present, the future, and the unknown drawn into the total description, there will indeed be no bad surprises.

If the history of statistics reveals the conceptual underpinnings of SNL’s statistical realism, however, then it also discloses the limits of its claim to descriptive totality. The pronoun used by Laplace to refer to his demon, *it*, manifests the relationship between statistics and

state building that began with the birth of statistics and continued to operate at the WIPP. Campe (2012, 395–96) indicates that the knowledge-producing subject for Laplace is no longer the individual, who could never hope to accumulate and process the required amount of data, but rather the state-run statistics bureau. Throughout the eighteenth century, European nation-states increasingly combined diachronic histories of their own development with synchronic statistical representations of their current situation to define national identity. States gathered statistics about themselves to define the nature of their statehood, and in so doing they defined the object of statistical representation as the state; in such a situation “no statistics are possible without reference to a political unity, whose reflection it is supposed to provide in high resolution” (202). The abjected others of the territorial state, in statistics as elsewhere, became those peoples whose social organization is not recognized as that of a nation-state. According to Johann Christoph Gatterer in his 1773 *Ideal of a Universal World Statistics* the so-called fourth world “savage,” as well as “subject” or “tributary” peoples, could not be the object of either statistics or history because such people “do not constitute any particular body politic themselves” (quoted in Campe 2012, 354).

The history of the nuclear complex in North America demonstrates the continued power of the conceptual relationship between statistics and state sovereignty to determine what can be accepted as knowledge. Even when indigenous nations have produced their own statistical data to counter the Department of Energy’s analysis of reality on its own terms, the US state remains the final arbiter of whose statistics can count as truth. In the ongoing struggle over the remediation of the Hanford plutonium plant, for example, the Yakama and Umatilla nations have countered EPA risk assessments, which use aggregated data based on a white suburban lifestyle, with their own statistical models based on more accurate accounts of their likely exposure to radioactive waste (Cram 2015). In an interview with geographer Shannon Cram (2015, 11), however, an EPA staff member explains, “For us, we can’t choose [the Umatilla scenario] because it’s not credible.” For the US nuclear state, as for Gatterer, statistics count only when they are produced by the state to represent itself. The plausibility that subtends statistical realism is born out of and defined by the operations of colonialism, as the state becomes that which can authorize statistics as credible truth while the colonized subject can be counted but can never be significant, can be described but can never be data.

SNL resolved the apocalyptic threat of nuclear waste by turning to a probabilistic realism that provided the plausible illusion of a knowable future, but the stakes of its verisimilitude were high and were deeply bound up with the settler-colonial state. At the WIPP, the future could be imagined only in terms of the colonial state's present, a present that would have to continue unchanged in order for the state's statistical self-description to continue to signify; it is the perfect neoliberal waste disposal technology, foreclosing futures of possible difference, including decolonial futures, into an ongoing, unchanging *now*.<sup>12</sup> Imagining a future, even ten thousand years from now, that is not qualitatively different from the present contains the epistemological challenges posed by deep time. In this version of living in risk, the past in which the waste was produced and the future in which it kills us are transformed into pillars of salt, frozen in place as we watch the present burn, forever.

### Decolonizing Risk

At the end of the Cold War, then, the official discourse of nuclear risk and its environmental dangers seems to have made the switch recommended by Frederick Buell: it transitioned from a discourse of apocalypse, of imminent, global destruction, to one of sober realism, addressing the long-term residues of a nuclear apocalypse that failed to arrive as predicted. The realism of probability modeling, however, while it successfully manages the *risk* of nuclear waste as it is felt and perceived, does little to manage its *danger*. The fantasy of the ancient salt beds, frozen in time, that might metonymically impart the same stability to the transuranic waste interred therein is a powerful one; it was certainly powerful enough to make the WIPP plausible to legislators, and the facility received its first shipments of waste in 1999. And yet in February 2014, some fifteen years into that ten-thousand-year future, the WIPP was closed after radiation was found to be leaking into the atmosphere from two of its storage chambers.<sup>13</sup> An SNL employee and docent at the National Museum of Nuclear Science and History in Albuquerque told me in early 2015 that word was going around that the leak contained plutonium ions, which is interesting, he said, because plutonium waste is of a higher grade than is legally allowed to be stored at the WIPP. The totalizing power of the probability model makes everything not entered into its initial data-world

unthinkable; when the unthinkable happens, it punctures the boundary of the reality effect and transforms science into—or reveals it to have been—less of an absolute descriptive power than a rumor mill. The irradiated chambers of the WIPP were too hot to be approached; they could no longer be seen or described in ways that were understood to be realistic. Instead, scientists speculated about unforeseen interactions from the surface. Nuclear telemetrists gossiped with visitors in museums. When risk turns into danger, nuclear materials challenge the terms of their confinement, exposing the limits of probabilistic risk analysis as the epistemological basis for dealing with threat.

The use of statistical realism to manage the risk of nuclear waste must thus be seen as an operation of force in the present rather than as a means of protecting the future. As Charles Perrow (1999, 12) writes of risk assessment more broadly, “The issue is not risk, but power.” The language of risk is a rhetorical one whose function is to distribute danger unevenly across bodies and spaces; discourses of acceptable risk frequently lie behind decisions whose outcomes become visible as environmental racism, the massive weighting of toxic exposure toward the third and fourth worlds, people of color, and the poor across the globe. The officially established  $10^{-8}$  percent chance of the WIPP leaking did not stop the leak from happening, but it allowed billions of dollars to be spent on researching and opening the facility, millions of tons of salt to be moved, and the ongoing operations of the global nuclear complex to continue.

If realism has historically been pressganged into supporting the logics of risk assessment, however, literature at the close of the Cold War took up the relationship of realism to risk and power as an object of critique. The relationships among plausibility, colonial power, nuclear waste, and narrative form are a central concern of one of the most important novels to have emerged from the post-Cold War moment, Leslie Marmon Silko’s *Almanac of the Dead* (1991). Silko’s novel describes in detail the realities that the futures report excludes: the history of settler and nuclear colonialisms in the New World and a sense of historical time that stretches for millennia into the past and the future. Set primarily in the areas around Tucson, Arizona, and Tuxtla Gutiérrez, Mexico, *Almanac* follows an interweaving cast of more than seventy characters as they negotiate the turn-of-the-millennium Americas. While the wealthy and well connected continue to extract as much value from the land and its inhabitants as possible,

the poor and disenfranchised organize against their exploitation in increasingly interconnected ways. The novel ends with an indigenous army walking north from Mexico, promising to retake the land peacefully in fulfillment of the ancient prophecies written in the “Almanac of the Dead,” a fifth, fictional Mayan codex circulating within the novel that foretells the end of Euro-American domination of the Americas. Juxtaposing a secular vision of an earth apocalyptically destroyed through the activities of a Euro-American culture devoted to exploiting resources in every possible way with an equally apocalyptic, sacred vision of the age of the coming of the fifth world in which the culture of destruction will pass away, Silko depicts a world in which apocalypse saturates the everyday, undoing the realism of the nuclear complex by positioning it in a different timeline that has a different past, a different future, and a different present to anything that the nuclear state might think to contain in even its most totalizing attempts to model the world.

The narrative form of *Almanac of the Dead* is dazzlingly complex, bringing together a number of different temporal structures, including Marxist dialectics, Christian millennialism, capitalist/colonialist/scientific apocalypticism, indigenous forms of spiral time, and the prophetic time of the almanac, into variously colliding and conflicting combinations that determine the reality of the world at any given moment.<sup>14</sup> *Almanac*'s narrative form is defined by the multiplicity of forms that it contains and juxtaposes, and this multiplicity is the form of its revolutionary content. As Ann Brigham (2004, 304) writes, a wide array of criticism has “repeatedly recognized *Almanac*'s conceptualization of time as its form of critique.” By challenging hegemonic constructions of history and time and offering alternative temporal structures from a variety of perspectives, including those of indigenous peoples, women, and landscapes, Silko creates a world in which reality as it is seen from within a Euro-American colonialist timeline is only one of a number of competing realities—one whose time is running out.

One formal element that has yet to receive critical attention as such, however, is the novel's frame narrative. What frames this novel, and what I suggest establishes the conditions of possibility for its temporal resistance to the operations of US settler colonialism, is nuclear waste. *Almanac of the Dead*, unlike Silko's earlier novel *Ceremony* (1977), is rarely read as a nuclear novel, reflecting a larger tendency

in nuclear criticism to magnify the conditions of the atom bomb's detonations in wartime or an imagined future over those of its production and disposal. Containing *Almanac's* spectacular array of temporalities, however, is a very simple story: a giant stone snake emerges next to and possibly from a mound of uranium tailings. No one knows what it means when it appears; after 758 pages of action-packed narrative across five hundred years, its meaning becomes legible. This entire novel, the worlds that it makes and unmakes, serves in the frame a single purpose: it allows Sterling, a Laguna Pueblo Indian working in Tucson, to return home to the reservation and understand the meaning of the snake's appearance.

Sterling has found himself in Tucson, we learn in the novel's opening chapter, after being banished from the reservation for failing to keep a Hollywood film crew away from a giant stone snake that has recently appeared "at the foot of mountains of grayish [uranium] mine tailings" (1991, 35). The tailings themselves are the result of an earlier fall from grace as a result of the Cold War arrival of the nuclear complex on tribal land:

Sterling had already gone away to Barstow to work on the railroad when uranium had been discovered near Paguate Village. He had no part in the long discussions and arguments that had raged over the mining. In the end, Laguna Pueblo had no choice anyway. It had been 1949 and the United States needed uranium for the new weaponry, especially in the face of the Cold War. That was the reason given by the federal government as it overruled the concerns and objections the Laguna Pueblo people had expressed. . . . So the Tribal Council had gone along with the mine because the government gave them no choice, and the mine gave them jobs. They became the first of the Pueblos to realize wealth from something terrible done to the earth. (34)

The colonial practices of the nuclear age seem, here, to be located in the past; until his banishment, Sterling believes that he has sidestepped both the moral and the bodily harms of the uranium mine because he lived off-reservation at the time of the decision and for most of its operation.<sup>15</sup> He "had never dreamed that one day his own life would be changed forever because of that mine" (35). Sterling has misread the parameters of possibility of nuclear waste, assuming that because it has been produced by the settler-colonial state it will

inhabit the causal temporality of Western realism. But the threats of radioactive materials are impossible to contain in specific times and places and are not limited to predictable transmission routes. In this regard, Silko suggests, the uncanny temporalities of radiation align instead with the indigenous temporalities inhabited by the “old ones” of the Laguna: “trouble” will come from the mine, they argue, which “would not necessarily appear right away; it might not arrive for twenty or even a hundred years. Because these old ones paid no attention to white man’s time” (35).<sup>16</sup> Sterling realizes after being banished that the probabilistic model of cause and effect that he has assumed to define his relationship to the mine is inadequate: “Those old folks had been right all along. The mine had destroyed Sterling’s life without Sterling’s ever setting foot near the acres of ruined earth at the open pit” (35).

In the opening pages of the novel Silko establishes the alignment of native and nuclear temporalities through their shared ability to disrupt plausible causality by importing longer durations and unpredictable consequences into the everyday presentism of “white man’s time.” This, however, recedes into the background for seven hundred pages and reemerges only at the end of the text. In the novel’s final sentence Sterling, closing the frame that has contained within it the genocide and destruction of five hundred years of colonialism in the Americas, “knew why the giant snake had returned now; he knew what the snake’s message was to the people. The snake was looking south, in the direction from which the twin brothers and the people would come” (763). Sterling’s decolonial epiphany is the sudden apprehension of a reversal of scale or timescale: it is not the nuclear complex that will swallow the people and the land, but the people and the land that will swallow the nuclear complex.

If nuclear waste has been pushed to the edges of *Almanac*, then, its marginal position does not make it any less important to the novel’s structure or to its decolonial commitments. On the contrary, it is out on the margins that nuclear waste is able to become the frame—the part of the narrative that establishes the conditions of possibility for the narratives that it contains and whose meaning is in turn reframed by those narratives when we return to it at the novel’s close. The stone snake, as a frame object, produces a specific kind of narrative and a specific kind of world in the novel that takes place within its frame.<sup>17</sup>

The world of *Almanac of the Dead*, like that of the futures report, can therefore be seen as the world that nuclear waste makes. This world, however, differs significantly from the unchanging present of the WIPP; here, nuclear waste sets very different conditions of possibility. If the world of nuclear waste is defined in the futures report as one that has no real historical consciousness, in *Almanac* it is nuclear waste that kick-starts the deeply embodied and embedded relationship to history that constitutes the novel's political critique of a Euro-American modernity that is resolutely ahistorical: "In the Americas the white man never referred to the past but only to the future. The white man didn't seem to understand he had no future here because he had no past, no spirits of ancestors here" (Silko 1991, 313). After a brief opening chapter set in the present, the story of the snake's emergence is the first analeptic turn to the past that we encounter in a novel that spends much of its time telling stories embedded in different points in history. In a 1993 interview with Laura Coltelli, Silko described her use of flashback as central to the novel's political aim of rewriting the present's relationship to the past: "I used flashbacks because I wanted the moments of the past to be as alive as they really are; I wanted the reader to be there and to see and feel the aliveness of the past. The past does not die. The past is alive, side by side with the present" (Coltelli 2000, 125–26). *Almanac of the Dead* not only tells the story of the past but also brings it into the present, creating a particularly embodied form of historical consciousness in the reader, who "feel[s] what the characters felt so the reader cannot distance himself from the history the almanac recounts" (126). As the material embodiment of the past of both the Laguna Pueblo, for whom the stone snake served as a protector before being drowned by their enemies, and of the colonial nuclear complex, from whose waste the snake reappears, the stone snake simultaneously represents an embodied form of history and initiates the material appearance of the past in the present as a narrative technique, one that comes to define both the decolonial politics and the form of the novel.

At the same time, the snake's nuclear components position it as a figure not only of the past but also of the deep future, as its 4.5-billion-year lifespan dwarfs even the five hundred years of the novel's epic diegesis. The snake has both analeptic and proleptic qualities, but its two temporal orientations work in significantly different ways. As a material revenant of native history, it operates as a figure for fixed



historical referents even if they have been lost to popular awareness. Its proleptic function, however, is to point us toward a future that is not only unknowable but also completely unimaginable. The snake establishes two proleptic horizons at the end of the novel. Although the horizon of the novel's characters marching to decolonize the near future may be conceptually available to us, that of the uranium snake, some 4,500 million years from now, is not. This is a peculiar use of a proleptic tropism, deploying the form of a flash-forward while holding the content of that forward glimpse empty. The disjuncture between form and content here is the formal incorporation into the novel of nuclear waste's *longue durée* apocalypse: it thrusts us into a distant future, but there is no *there* there, no sense that we know what that future might hold. Our proleptic encounter with the future of nuclear waste reveals only the impossibility of that future within a human perspective.

*Almanac*'s wildly expanded, radically futureless historical consciousness redefines the terms of realism, verisimilitude, and plausibility in action at the WIPP and beyond. Sven Birkerts's (1991, 39) review in the *New Republic* is exemplary of many initial responses to the novel and maintains the distinction between realism and apocalypse, calling the novel's "paper apocalypse" fatally implausible. As Caren Irr (1999, 224) has argued, much of the critical blowback against *Almanac* from the white literary establishment stems from the insult that the novel poses to the critics' sense of the realistic and the plausible, of the "opposition between the plot of 'wish-fulfillment scenarios' and a social reality in which strikes, rebellions, and revolutions are apparently impossible." Such an opposition, Irr suggests, is based on a specific "metaphysics of time" in which "change does not happen, since history is the repetition of self-identical defeats. . . . Any suggestion otherwise . . . violates the initial premise of temporal consistency and must be disallowed" (224). Silko's assertion that a different historical consciousness might lead to a revolutionary future is, within such a temporal metaphysics, laughably unrealistic.

Birkerts's (1991, 41) dismissal of a decolonial future for North America as something "so contrary to what we know both of the structures of power and the psychology of the oppressed that the imagination simply balks" is consistent with a much longer history of colonial rhetoric and practice that rejects native land claims as impossible or unrealistic. The Supreme Court's invocation in its 2005 *City of*

*Sherrill v. Oneida Nation* (544 US 197 [2005]) decision of the “impossibility doctrine” that governs the “impracticability of returning to Indian control land that generations earlier passed into numerous private hands” (quoted in Rifkin 2009, 4) demonstrates the ongoing power of a white-defined realism to distinguish possible from impossible actions with regard to its own practices of settler colonialism. In this view, for the United States to abide by the terms of its treaties with native nations is unthinkable; it falls beyond the limits of plausibility that define possible actions. And as Mark Rifkin (2009, 4) has argued, the idea of native sovereignty is not just unrealistic but an epistemological challenge to the real itself, to the construction of reality that maintains life as we know it in the United States. The “sadder realism” called for by Frederick Buell must not, therefore, be taken as the neutral generic option in dealing with risk but rather recognized as one that relies on standards of verisimilitude and plausibility that perpetuate the oppression of indigenous communities whether they are applied directly to nuclear risk or to the legal standards that define the limits of native self-determination.

Redefining the real, “draw[ing] attention to the possible by showing the contingent dimension of the actual” (Revel 2009, 52), thus becomes a strategy of decolonization. Realism, in this context, is a self-fulfilling prophecy: the return of native land is regarded as impossibly implausible by the United States, and so it fails to appear in the imaginable scenarios at key moments of legal and political decision making and does not come to pass. Consequently, as Ward Churchill (1992, 174) writes, all “anti-colonial fighters . . . accepted as their agenda a redefinition of reality in terms deemed quite impossible within the conventional wisdom of their oppressors”; any decolonial movement will require a counter-realist political and aesthetic strategy. *Almanac* suggests that apocalypse remains a potent force in redefining reality against colonial norms even as the novel re-forms our traditional understanding of nuclear apocalypse. *Almanac* gives us the *longue durée* apocalypse of nuclear waste, an apocalypse defined not by the sudden absence of the future but rather by the impossibility of constructing any mechanism by which we might imagine a specific future or futures.

Such an apocalypse is neither a sudden ending nor a revelation of eternal truth but rather a narratological shift that transfigures the present through a radical futurelessness. Apocalypse stands, in

*Almanac*, against the futurological equivalent of what Michael André Bernstein (1994) has critiqued as “backshadowing”: the historiographical tendency to construct the past backward from the present, occluding the contingency of the present, limiting the presents that could have been to one, and including in the historical narrative only those factors that gave rise to this specific outcome. A predetermined future, as Bernstein’s subtitle “Against Apocalyptic History” suggests, does exactly the same thing: it binds the present to the future with a single unfrayed rope and makes the present the necessary, unchangeable precursor to a known future. These imagined futures, despite their virtuality, have significant material effects in the present, making certain things possible and rendering others unthinkable, as we saw at the WIPP, where a plausible set of future scenarios allowed the repository to open and foreclosed the possibility of shutting down nuclear manufacturing. In an indigenous context, meanwhile, the historical determinism instantiated by the imagined futures of the nuclear state has rendered native nations paradoxically futureless, since indigenous lands and communities are by far the most damaged by the ongoing mining, processing, testing, and dumping practices of the nuclear-military-industrial complex.<sup>18</sup>

Apocalypse, then, becomes visible in Silko’s novel not as a model of linear historical determinism, as in the Genesis-to-Revelation teleology that has long subtended Christian historiographies, but rather as a narrative form that explodes such determinism to reveal the contingent nature of the present and to allow for other possibilities in both the present and the future. The epistemological challenges to human understanding posed by the deep time of nuclear waste are taken up by Silko to reveal not simply the multiplicity of possible futures—a conceptual leap that, as Annie McClanahan (2009) and R. John Williams (2016) have shown, was made within the nuclear-military-industrial complex and has been profitably taken up by global corporations to deeply conservative ends—but the absolute impossibility of imagining any specific future at all.

Exploding the reservoir of probable futures that traditionally structures the novel form (Kermode 2000) transforms the novel’s present in much the same way that, in radical historiography, telling a different story about the past does. In contrast to the ineluctable presentism that defines the nuclear complex at the WIPP and beyond, the native/nuclear temporalities that the snake occupies are those of a

*longue durée* that spirals and returns from both the past and the future, in which “these days and years were all alive, and all these days would return again” (Silko 1991, 247). The qualitatively different future whose possibility is so vigorously unimagined at the WIPP is, in *Almanac*, an inescapable future that is, in the novel’s nonlinear time frame, also a part of the present. Actions and objects have a different reality effect in this light. When macaws speak of revolution, when opals bleed and grant visions, when ghosts weigh down a donkey, none of these things is unrealistic or even magically realistic. Rather, they are all manifestations of deep-time temporalities, simultaneously native and nuclear, producing impossible juxtapositions of space-time (dead riders on a live mule, the future projected on an opal screen) within the Western chronology of the novel form. Silko, bound to damaged and damaging futures by the nuclear complex as it intersects with the other histories of damage left in the wake of colonial modernity, uses apocalypse to transfigure the present: to see the other possibilities that reside in it and to couple those possibilities to their own pasts and their own futures, constructing not only a transfigured instant but wholly transfigured timelines, worlds with a solidity of their own.

By aligning a future of decolonization with nuclear waste, Silko both establishes the shared ground of the native and nuclear and rewrites that ground as a different kind of prophecy: not of the perpetuation of the nuclear-colonial complex, as at the WIPP, but of its inevitable, unimaginable destruction. In this way, Silko’s novel reverses the prophetic form of statistical realism that oils the gears of the nuclear complex at the WIPP. In the futures report, a totalizing description of the real allows for the projection of a future that will not be qualitatively different from the present. In *Almanac*, the reverse is true. Including the impossible, the implausible, and the incalculable (from a colonial perspective) within her accounting of the real, Silko reveals the apocalyptic overturning of the actual at work within the days of the present, an overturning prophesied by the nuclear materials that are supposed to maintain the present of the United States at the expense of its unimagined communities. Forcing us to inhabit the *longue durée* by their own unthinkable durability, the byproducts of the nuclear complex situate us as inhabitants of an impossible world—one in which the United States does not last, one in which apocalypse, or revolution, or decolonization is not only thinkable but inevitable.

### The Ends of Risk

Perhaps unexpectedly, the futures report itself contains something like a minority report that shares Silko's critique of statistical realism as a model for deep time. Here, too, an approach to nuclear waste from a deep-time perspective produces what we might call, for want of a better term, an aesthetics of the extremely unlikely. One of the four teams of experts, the Southwest team, has two obvious features that distinguish the team from its peers: members of the Southwest team live in the region under discussion, and they count a science-fiction author as a member.<sup>19</sup> In the team's report, pleasingly titled "Ten Thousand Years of Solitude?" the team members characterize themselves as both more literary and more situated within the territory than members of the other three teams. The WIPP site is not, for the Southwest team, a collection of lines on a map or a compound cumulative data function, but it is "an ancient land, and one where the impact of U.S. control is light and, possibly, transient" (Benford et al. 1991, D6). This perspective manifests in two ways in "Ten Thousand Years of Solitude?" The first is a refusal to play the game mathematically: the Southwest team was the only team that refused to preemptively assign numerical probabilities to its scenarios (instead the team designated the probabilities as low, medium, and high). In place of the numerical probability assignments required by SNL, the Southwest team offers apocalyptic science fiction. Pushing the requested fictional descriptions of the future to the point of absurdity, the team opens each section of its report with a short description of the future in a resolutely nonrealistic mode: "Zzyg lifted his eyes from the visual scanner eyepieces on the survey ship orbiting the blue-green world and said, 'It looks like another pre-conscious race didn't make it through their atomic age.' . . . He sighed and brushed a tear from his center eye with his third-left tendril" (D24). The expert judgment methodology requires, as we have seen, an adherence to realism in its fictions: the scenarios have to be believable, to extend out from the known, and to bring the unknown into SNL's field of control. The Southwest team, however, includes pointedly antirealist fictions throughout its report, on the same narrative level as its more plausible accounts of automatic mole miners or the development of the Free State of Chihuahua.

Such a juxtaposition is a form of argument: in an attempt to imagine future societies over ten thousand years, heuristics such as probability and realism fail to apply. This argument reflects the epistemological challenge that deep time makes to statistical realism, particularly to the claim that statistical realism can be used to manage risk. In his analysis of complex systems, Perrow (1999, 5) concludes, “Multiple and unexpected interactions of failures are inevitable. This is an expression of an integral characteristic of the system, not a statement of frequency.” What we consider “accidents,” defined by their unforeseeable nature, must now be considered an inevitable part of the system itself. In van Wyck’s (2005, xx) terms, “The practice contains the accident, not simply as a *possibility*—as that which may or may not happen—but fully and completely as *virtuality*.” The only thing that separates the system from its failure, the possible from the actual, is time; the only reason that there have not been more catastrophic meltdowns, Perrow (1999, 5) writes, is that “we simply have not given the nuclear power system a reasonable amount of time to disclose its potential.” The meltdown at the Chernobyl plant in 1986—itself experienced, in the words of Barbara Adam (1998, 198), as “the materialization of the impossible”—illustrates the accuracy of Perrow’s analysis. Probability becomes certainty over a long enough timescale; in the timescale of nuclear waste, “probability models of containment failure converge on certainty” (van Wyck 2005, 19). In deep time, the Southwest team suggests, the alien that reads the WIPP as a monument to humanity’s failure to evolve is no less plausible than the long-term survival of the United States—indeed, the “USA forever” scenario is discounted quickly in “Ten Thousand Years of Solitude?” because of its absolute implausibility.

By inserting apocalyptic science fiction into the more realistic descriptions of plausible futures in “Ten Thousand Years of Solitude?” the Southwest team writes the impossible future into the present as an expression of the existence of the virtual in the actual. In so doing, the team establishes a nonrealistic form of fiction as a weapon against a state-sponsored realism that insists on the impossibility of radical change and that fails to grasp “the most difficult realization about the future”: “that it can be qualitatively different” (Benford et al. 1991, D26). Like Silko the team brings the apocalyptic future—impossible to imagine from a human perspective and narratable only by aliens—into the present through the discarded materials of the nuclear

complex in order to disrupt the claims to realism and totality that keep business going as usual in nuclear and other forms of colonialism.

Reading these two texts as analyses of nuclear waste, risk, and colonial power thus produces a different critical heuristic to the paranoid epistemology described by van Wyck (2005) and practiced by Hora, Von Winterfeldt, and Trauth (1991). Although paranoid ecocriticism experiences risk as a bad surprise to defend against with a totalizing-enough, realism-based understanding of the present, Silko and the Southwest team conceptualize risk within the deep temporality of nuclear waste in which, promising to long outlive the human, radioactive materials push the probabilistic epistemology that subtends our thinking about risk beyond the limits of its reach. As risk approaches 100 percent probability it can no longer be shunted into the future as a possible occurrence and instead becomes a part of the present as an active danger, a threat in urgent need of redress. By bringing an apocalyptic future into a present defined by the state as unchangeable, Silko and the Southwest team reveal the imbrication of risk theory with colonial logics and suggest that a full inhabitation of risk and its impossible futures is required to overturn the actual and to move beyond those logics in a nuclear age that we can never escape.

Nuclear waste is bigger than us, more dangerous than us, and it will outlive us. It is our own self-created predator. At the same time, however, it challenges the terms of the reality that produced it: a capitalist/colonialist present that can imagine the future only in the terms of its own continuation. At the end of *Minima Moralia*, Theodor Adorno (2005, 247) calls for perspectives to be fashioned “that displace and estrange the world, reveal it to be, with its rifts and crevices, as indigent and distorted as it will appear one day in the messianic light.” Nuclear waste inhabits the future that Adorno evokes here, appearing in our world like a time traveler from 4.5 billion years from now, its form only temporarily concealed within that of a glove, or a hairnet, or a barrel. Lives lived at risk are not undamaged lives, flowing smoothly until they are disrupted by catastrophic events. Lives lived at risk are already damaged, and discourses of “acceptable risk” mandate that some lives are worth damaging in this way. For those whose lives are sacrificed to the real, nuclear waste offers a perspective within which that reality is revealed in all of its indigence and distortion as a crumbling diorama, a mutated, nonviable cell: contingent, futureless, and open to change beyond all imagining.

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### Notes

- 1 I take the term “second modernity” from Beck (1992), who uses it to describe the period following modernity that is defined by an overwhelming awareness of the risks of modernization.
- 2 The futures report was prepared by Sandia National Laboratories for the US Department of Energy under contract DE-AC04-76DP00789.
- 3 See, for example, Lawrence Buell (2001) and Heather Houser (2014), who both describe the fear of a toxic world as taking its shape from an earlier nuclear threat but no longer taking its primary orientation from it. Molly Wallace (2016, 1) offers an elegant alternative in her theorization of the present as the “second nuclear age.”
- 4 Nuclear waste is, along with climate change, one of Timothy Morton’s (2013, 1) exemplary hyperobjects: “things that are massively distributed in time and space relative to humans”; it also demands the kind of deep-time reading that Wai Chee Dimock (2006, 5) calls for to address “historical phenomena [that] . . . need hundreds, thousands, or even billions of years to be recognized for what they are.” As Dipesh Chakrabarty (2009, 197) has argued, however, massively distributed temporal objects pose a challenge to such analysis because trying to think beyond human life “can precipitate a sense of the present that disconnects the future from the past by putting such a future beyond the grasp of historical sensibility.”
- 5 For theories of risk fiction based on these two novels, see Mizruchi 2010, F. Buell 2003, and Heise 2002. Their canonicity is such that Houser (2014) has to explain in the introduction to *Ecosickness* why she does *not* use them.
- 6 Mizruchi (2010, 129), for example, doubles down in favor of our existing realism-based Enlightenment rationalism when she argues, “While modern history is the source of the narrative of risk, it also holds the possibility of a social order founded on more rational, more benevolent principles.”
- 7 Heise (2008, 124–36) gives a comprehensive overview of the history of risk theory.
- 8 The Mescalero Apache Reservation is located on the greater WIPP site, and convoys of nuclear waste pass through ten different native nations on their way to the repository. Despite the increased exposure of these



- indigenous communities to the danger of the WIPP, no native nations were involved in the consultation or planning processes and no WIPP documents or transcripts from the public consultation process were published in Native American languages or Spanish (Phillips 1983, 13).
- 9 The work of SNL's second panel, the markers panel, has received much more attention than that of the futures panel (see, for example, van Wyck 2005). The task of the markers panel, to design the markers and passive institutional controls that would communicate the same message over ten thousand years, caught the attention of the press, and the *Expert Judgment on Markers to Deter Inadvertent Human Intrusion into the Waste Isolation Pilot Plant* contains both theories of communication and pictures of the "Landscapes of Thorns" and "Menacing Earthworks" that are undeniably fascinating (Trauth, Hora, and Guzowski 1993). But the work of the futures panel, while its graphs are less exciting, evidences strong theories of our relationship to risk, to the future and the real, and the actual and the plausible that are put into crisis by the question of the deep-time management of nuclear waste.
  - 10 Lindsay Thomas (2016, 163–64) has demonstrated the difficulties that the scenario form, developed during the Cold War to imagine events rather than situations, runs into when it is used to model ongoing, slow-moving catastrophes such as climate change over even the course of a decade. I address what happens to the narrative elements of the SNL scenarios in the ten-thousand-year projection in the final section of this essay, but it is worth noting here that SNL's turn to probability models as the second step in modeling the deep future compensates for the inadequacy of the scenario form in the *longue durée*, allowing for the postcatastrophe resolution that cannot be reached in narrative form to be reached mathematically in the present instead. If the futures panel calculates a probability of inadvertent human intrusion as less than 1 in 10,000, then there is officially no catastrophe at all.
  - 11 For the importance of verisimilitude in determining which representations of the real are believable, see Todorov 1977.
  - 12 I take my conception of the temporal horizons of neoliberalism from Lauren Berlant's (2011) analysis of the stretched-out present that defines historical consciousness and forecloses a sense of the future as different from the present in the neoliberal age. Fredric Jameson (2005) also frames the neoliberal present in this way.
  - 13 A number of reports on the "radiological event" at the WIPP as well as updates on its reopening can be found at [www.wipp.energy.gov/wipprecovery/recovery.html](http://www.wipp.energy.gov/wipprecovery/recovery.html).
  - 14 Some of the best analyses of temporality in *Almanac of the Dead* are Adamson 2001, Huhndorf 2009, Powers 1999, Muthyala 2003, and Reed 2009.

- 15 The ecological devastation of land and human and animal life that has resulted from the United States' commitment to nuclear weapons has fallen heavily on indigenous communities, both within North America and beyond it. The logic behind the positioning of the Nevada test site was openly colonial/capitalist: by placing the site close to reservation lands and only testing when the wind was blowing toward the Pueblos, officials at Los Alamos calculated that radioactive damage would be limited to "low-use segments of the population" (quoted in Williams 1991, 283). Even when uranium is not extracted from native land, the ecologically disastrous processing is carried out there; at the height of the uranium boom in the 1970s, "100 percent of all federally controlled uranium production accrued from the contemporary reservation land base" (Churchill and LaDuke 1992, 242).
- 16 The stakes of Silko's juxtaposition of native and nuclear temporalities are high. From the perspective of the nuclear complex, nuclear materials and Native Americans are connected through a logic of metonymy; their material proximity on unironically named "nuclear reservations" means that one comes to stand in for the other, as research "kivas" replace those of the Pueblos and Zuni, Yuma, and Tewa missiles are detonated in the Pacific while their eponymous tribes are decimated in the Southwest (Masco 2006, 119–22). The linear timeline that undergirds both settler colonialism and Euro-American technomodernity makes this metonymic slippage possible, as the historical positioning of the "vanishing Indian" leaves the present and the future available for the Indian's replacement by the nuclear complex. Silko's juxtaposition of the native and the nuclear offers a radically different interpretation of the relationship between the two. The nuclear complex, in the figure of the uranium snake, does not succeed the Indian on a linear timeline that consigns Native Americans to a vanishing past but rather forms a hybrid of the nuclear and the native that betokens a revolutionary future within a "'contaminated' narrative form appropriate to the history of colonial encounter" (Regier 1999, 187).
- 17 Although not a diegetic narrator telling a metanarrative story, as Gérard Genette (1983) defines a traditional frame narrative, the snake does share some of the qualities of the frame narrative: it sets the conditions of possibility of the world being described, establishing its ground rules and practices as possible within the confines of the story.
- 18 Richard Grusin (2010, 60–61) theorizes "premediation as the remediation of virtuality or potentiality" whereby possible futures impact the present; while the plausible futures of the futures report premeditate the future in this way, Silko's *longue durée* future is impossible to mediate, having no content. *Almanac* impacts the present, rather, by seeding impossibility into it.
- 19 The members of the Southwest team were Gregory Benford, Craig W. Kirkwood, Harry Otway, and Martin J. Pasqualetti.

## References

- Adam, Barbara. 1998. *Timescapes of Modernity: The Environment and Invisible Hazards*. London: Routledge.
- Adamson, Joni. 2001. *American Indian Literature, Environmental Justice, and Ecocriticism: The Middle Place*. Tucson: Univ. of Arizona Press.
- Adorno, Theodor W. 2005. *Minima Moralia: Reflections from Damaged Life*. Translated by E. F. N. Jephcott. London: Verso. First published 1951.
- Beck, Ulrich. 1992. *Risk Society: Towards a New Modernity*. London: Sage.
- Benford, Gregory, et al. 1991. "Ten Thousand Years of Solitude? On Inadvertent Intrusion into the Waste Isolation Pilot Project Repository." In Hora, Von Winterfeldt, and Trauth 1991, D1–D44.
- Berlant, Lauren. 2011. *Cruel Optimism*. Durham, NC: Duke Univ. Press.
- Bernstein, Michael André. 1994. *Foregone Conclusions: Against Apocalyptic History*. Berkeley: Univ. of California Press.
- Birkerts, Sven. 1991. "Apocalypse Now." *New Republic* 205, no. 19: 39–41.
- Brigham, Ann. 2004. "Productions of Geographic Scale and Capitalist-Colonialist Enterprise in Leslie Marmon Silko's *Almanac of the Dead*." *Modern Fiction Studies* 50, no. 2: 303–31.
- Buell, Frederick. 2003. *From Apocalypse to Way of Life: Environmental Crisis in the American Century*. New York: Routledge.
- Buell, Lawrence. 2001. *Writing for an Endangered World: Literature, Culture, and Environment in the U.S. and Beyond*. Cambridge, MA: Belknap Press of Harvard Univ. Press.
- Campe, Rüdiger. 2012. *The Game of Probability: Literature and Calculation from Pascal to Kleist*. Translated by Ellwood H. Wiggins Jr. Stanford, CA: Stanford Univ. Press. First published 2002.
- Chakrabarty, Dipesh. 2009. "The Climate of History: Four Theses." *Critical Inquiry* 35, no. 2: 197–222.
- Churchill, Ward. 1992. "The Earth Is Our Mother: Struggles for American Indian Land and Liberation in the Contemporary United States." In *The State of Native America: Genocide, Colonization, and Resistance*, edited by M. Annette Jaimes, 139–88. Boston: South End Press.
- Churchill, Ward, and Winona LaDuke. 1992. "Native North America: The Political Economy of Radioactive Colonialism." In *The State of Native America: Genocide, Colonization, and Resistance*, edited by M. Annette Jaimes, 241–66. Boston: South End Press.
- Coltelli, Laura. 2000. "Almanac of the Dead: An Interview with Leslie Marmon Silko (1993)." In *Conversations with Leslie Marmon Silko*, edited by Ellen L. Arnold, 119–34. Jackson: Univ. Press of Mississippi.
- Cram, Shannon. 2015. "Becoming Jane: The Making and Unmaking of Hanford's Nuclear Body." *Environment and Planning D: Society and Space* 33, no. 5: 796–812.

- Dimock, Wai Chee. 2006. *Through Other Continents: American Literature across Deep Time*. Princeton, NJ: Princeton Univ. Press.
- Genette, Gérard. 1983. *Narrative Discourse: An Essay in Method*. Translated by Jane E. Lewin. Ithaca, NY: Cornell Univ. Press. First published 1972.
- Gordon, Theodore J., et al. 1991. "Inadvertent Intrusion into WIPP: Some Potential Futures." In Hora, Von Winterfeldt, and Trauth 1991, C1–C70.
- Grusin, Richard. 2010. *Premediation: Affect and Mediality after 9/11*. Basingstoke, UK: Palgrave Macmillan.
- Guzowski, Robert V. 1991. *Preliminary Identification of Scenarios for the Waste Isolation Pilot Plant, Southeastern New Mexico*. Albuquerque, NM: Sandia National Laboratories.
- Hacking, Ian. 1990. *The Taming of Chance*. Cambridge: Cambridge Univ. Press.
- Heise, Ursula K. 2002. "Toxins, Drugs, and Global Systems: Risk and Narrative in the Contemporary Novel." *American Literature* 74, no. 4: 747–78.
- . 2008. *Sense of Place and Sense of Planet: The Environmental Imagination of the Global*. Oxford: Oxford Univ. Press.
- Hora, Stephen C., Detlof Von Winterfeldt, and Kathleen M. Trauth. 1991. *Expert Judgment on Inadvertent Human Intrusion into the Waste Isolation Pilot Plant*. Albuquerque, NM: Sandia National Laboratories.
- Houser, Heather. 2014. *Ecosickness in Contemporary U.S. Fiction: Environment and Affect*. New York: Columbia Univ. Press.
- Huhndorf, Shari M. 2009. "Picture Revolution: Transnationalism, American Studies, and the Politics of Contemporary Native Culture." *American Quarterly* 61, no. 2: 359–81.
- Irr, Caren. 1999. "The Timeliness of *Almanac of the Dead*, or a Postmodern Rewriting of Radical Fiction." In *Leslie Marmon Silko: A Collection of Critical Essays*, edited by Louise K. Barnett and James L. Thorson, 207–44. Albuquerque: Univ. of New Mexico Press.
- Jameson, Fredric. 2005. *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions*. New York: Verso.
- Kermode, Frank. 2000. *The Sense of an Ending: Studies in the Theory of Fiction*. New ed. Oxford: Oxford Univ. Press. First published 1967.
- Lukács, Georg. 1971. *The Theory of the Novel: A Historico-Philosophical Essay on the Forms of Great Epic Literature*. Translated by Anna Bostock. Cambridge, MA: MIT Press. First published 1914.
- . 2007. "Realism in the Balance." In *Aesthetics and Politics*, by Theodor Adorno et al., 28–59. London: Verso. First published 1938.
- Masco, Joseph. 2006. *The Nuclear Borderlands: The Manhattan Project in Post-Cold War New Mexico*. Princeton, NJ: Princeton Univ. Press.
- McClanahan, Annie. 2009. "Future's Shock: Plausibility, Preemption, and the Fiction of 9/11." *Symploke* 17, nos. 1/2: 41–62.
- Mizruchi, Susan L. 2010. "Risk Theory and the Contemporary American Novel." *American Literary History* 22, no. 1: 109–35.

- Morton, Timothy. 2013. *Hyperobjects: Philosophy and Ecology after the End of the World*. Minneapolis: Univ. of Minnesota Press.
- Muthyala, John. 2003. "Almanac of the Dead: The Dream of the Fifth World in the Borderlands." *Literature Interpretation Theory* 14, no. 4: 357–85.
- Perrow, Charles. 1999. *Normal Accidents: Living with High-Risk Technologies*. Princeton, NJ: Princeton Univ. Press.
- Phillips, Richard Hayes. 1983. "Radioactive Dumping: The State of the Art." In *Waste Isolation Plant, Construction: Environmental Impact Statement*, appendix D, by US Department of Energy. Albuquerque, NM: US Department of Energy.
- Powers, Janet M. 1999. "Mapping the Prophetic Landscape in *Almanac of the Dead*." In *Leslie Marmon Silko: A Collection of Critical Essays*, edited by Louise K. Barnett and James L. Thorson, 261–72. Albuquerque: Univ. of New Mexico Press.
- Reed, T. V. 2009. "Toxic Colonialism, Environmental Justice, and Native Resistance in Silko's *Almanac of the Dead*." *MELUS* 34, no. 2: 25–42.
- Regier, Ami M. 1999. "Material Meeting Points of Self and Other: Fetish Discourses and Leslie Marmon Silko's Evolving Conception of Cross-Cultural Narrative." In *Leslie Marmon Silko: A Collection of Critical Essays*, edited by Louise K. Barnett and James L. Thorson, 185–206. Albuquerque: Univ. of New Mexico Press.
- Revel, Judith. 2009. "Identity, Nature, Life: Three Biopolitical Deconstructions." *Theory, Culture, and Society* 26, no. 6: 45–54.
- Sedgwick, Eve Kosofsky. 2003. *Touching Feeling: Affect, Pedagogy, Performativity*. Durham, NC: Duke Univ. Press.
- Silko, Leslie Marmon. 1991. *Almanac of the Dead: A Novel*. New York: Simon and Schuster.
- Thomas, Lindsay. 2016. "Forms of Duration: Preparedness, the Mars Trilogy, and the Management of Climate Change." *American Literature* 88, no. 1: 159–84.
- Todorov, Tzvetan. 1977. *The Poetics of Prose*. Ithaca, NY: Cornell Univ. Press.
- Trauth, Kathleen M., Stephen C. Hora, and Robert V. Guzowski. 1993. *Expert Judgment on Markers to Deter Inadvertent Human Intrusion into the Waste Isolation Pilot Plant*. Albuquerque, NM: Sandia National Laboratories.
- van Wyck, Peter C. 2005. *Signs of Danger: Waste, Trauma, and Nuclear Threat*. Minneapolis: Univ. of Minnesota Press.
- Wallace, Molly. 2016. *Risk Criticism: Precautionary Reading in an Age of Environmental Uncertainty*. Ann Arbor: Univ. of Michigan Press.
- Williams, R. John. 2016. "World Futures." *Critical Inquiry* 42, no. 3: 473–546.
- Williams, Terry Tempest. 1991. *Refuge: An Unnatural History of Family and Place*. New York: Random House.
- Woodward, Kathleen M. 2009. *Statistical Panic*. Durham, NC: Duke Univ. Press.