

Freezing Seeds and Making Futures: Endangerment, Hope, Security, and Time in Agrobiodiversity Conservation Practices

Rodney Harrison

Abstract

This paper considers the temporal practices inherent in the work of global agrobiodiversity conservation, drawing on ongoing research with the Nordic Genetic Resource Centre and the Svalbard Global Seed Vault. It contrasts the distinctive, future-making practices inherent in the work of ex situ cold seed storage, with the normative, entropic view of the relationship of species diversity with time that arises from the field of biodiversity conservation more generally. These differences point to the value of comparative studies of natural and cultural heritage conservation practices that focus on their politics and ontologies to reveal the heterogeneity of approaches across these fields, and the different worlds they each produce in conserving their endangered objects for the future. [biodiversity conservation, endangerment, futures, seed banks, hope, time]

Introduction

The aim of this paper is to consider the future-making practices inherent in the work of global agrobiodiversity conservation, drawing on ongoing research with the Nordic Genetic Resource Centre (NordGen) and the Svalbard Global Seed Vault (SGSV). I argue that “diversity,” as a normative conservation target within natural and cultural heritage conservation practices, is commonly understood to be inherently worthwhile and hence beyond question. Taking an ontological approach to heritage, which posits that futures are designed and that heritage

Rodney Harrison is Professor of Heritage Studies at the UCL Institute of Archaeology, University College London, and UK Arts and Humanities Research Council (AHRC) Heritage Priority Area Leadership Fellow. He is the principal investigator of Heritage Futures, an international, comparative, interdisciplinary research program that explores a range of natural and cultural heritage practices as distinctive forms of future-making.

practices of different kinds design different futures (Harrison 2015; Harrison et al. 2016), I suggest that such a view has impeded critical engagement with biodiversity conservation practices and with detailed exploration of the shape and form of the particular futures they are engaged in producing. It has also led to generalizing “biodiversity conservation” as a single field of practice, when it is in fact a diverse and heterogeneous field in which there is significant variability in approaches, conservation philosophies, techniques, and technologies. Asking critical questions of natural and cultural diversity conservation practices—“when,” “where,” and “what” is the diversity that such practices conserve, for example—reveals this heterogeneity as well as the value of a comparative approach to understanding them.

I suggest that unraveling the details of the temporal orientations of conservation practices and their underpinning sociotechnical and biopolitical processes helps us to understand the ways in which conservation practices of different kinds are not normative, but vary across time and space, actively shaping different kinds of future worlds. In doing so, I draw on approaches to the study of archives and collections, which emphasize the ways in which their collecting and ordering practices not only reflect but actively intervene within and shape the worlds they order (see further discussion in Bennett et al. 2017).

In this study, I examine the origins and implications of heritage conservation practices based on normative, “entropic” understandings of species diversity in relation to time. I then examine plant genetic resource conservation practices, specifically, and how the work of global agrobiodiversity conservation programs reveals the complexity of temporal aspects of biodiversity conservation, as well as the complicated ways in which conservation practices both “archive” diversity and generate and accumulate latent forms of biocapital¹ (Helmreich 2008; Sunder 2006) in their aim to secure genetic resources for the future. I conclude by

considering the work of the SGSV in relation to current anthropological interests in “hope”—interests that are embedded more generally in concerns with futures and future-making. In doing so, I suggest that the work of the SGSV in banking diversity could be viewed both as a way in which hope—as a form of biopolitical power which is here integrally connected with particular formations of biocapital—is generated and distributed and a specific form of anticipatory temporal disposition toward the future.

Conservation, Diversity, Endangerment, and Entropy

At the time of writing, we have just passed the midpoint of what the United Nations has named “the Biodiversity Decade” (2011–2020). Even though it has come to dominate the ways in which we understand, value, and care for the “natural” world, “biodiversity” as a concept is relatively young, only emerging as a specifically identified target for conservation activity during the late 1970s and 1980s (Heyd 2010; Sepkoski 2016; Takacs 1996). The First National Forum on Biodiversity held in Washington, D.C., in September 1986, organized by conservation biologists E.O. Wilson and Walter Rosen (see Wilson 1988), is commonly held to mark the entry of the concept into international public discourse. While the concept of *cultural* diversity as a normative principle has a longer pedigree, emerging in part as a result of UNESCO’s antiracism work in the 1950s (see discussion in Bennett et al. 2017), it nonetheless also gained significant traction through its connection to biodiversity as a concept throughout the 1980s and 1990s (see Heyd 2010; Maffi 2005, Takacs 1996). Today, the conservation of diversity—biological and cultural—mobilizes significant global resources.

It has long been observed that “heritage,” both “natural” and “cultural,” is generally defined within the context of some implicit or explicit threat to objects, species, landscapes, or practices that are perceived to hold a form of collective value (e.g., Holdgate 1999; Lowenthal 1985). One way in which modern societies manage the risk and uncertainty that arise from such implicit or explicit threat is through placing increased trust in “experts” and abstract “expert systems” over local forms of knowledge (Giddens 1991, 29–32). Risk functions in Foucault’s conception of modern societies as “a governmental strategy of regulatory power by which populations and individuals are monitored and managed” (Lupton 1999, 87). Risk is calculated and

defined by a range of “experts” who produce statistics and data that make risk calculable and hence manageable. Elsewhere, I have explored the links between the increasing bureaucratization and professionalization of heritage as “modern” strategies for the care and management of heritage “risk” or “endangerment” (Harrison 2013, 2016). Work by Rico (2015, 2016) and others (e.g., Meskell 2012, 2014) makes clear the connection between natural and cultural heritage conservation practices and the production of what Vidal and Dias (2016) refer to as a broader “endangerment sensibility” that is characteristic of the “risk society” (Beck 1992). This sensibility underlies efforts manifesting materially and discursively in the late twentieth and early twenty-first centuries to identify, calculate, and protect a range of threatened conservation targets. It unites and motivates a broad range of natural and cultural heritage conservation practices of many different forms, from the work of frozen zoos to museums, and from the conservation of biosphere reserves to the protection of world heritage sites (Vidal and Dias 2016). It is articulated by way of specific conservation practices: listing, classifying, ordering, specifying, managing, and preserving (see Harrison 2016). These practices can be studied not only historically, but also ethnographically, to explore the particular ways in which they enact and produce discrete (and often disparate) futures (Harrison et al. 2016). My exploration of the temporal aspects of *ex situ* cold agrobiodiversity conservation practices in this paper is one example of this approach.

Sepkoski (2016) has drawn attention to the significant discursive shift that occurred with the introduction of the concept of biodiversity, from a focus on individual species or landscapes as conservation targets to the combined contribution of these parts to a whole. Importantly, he situates this move historically within a new understanding of the nature of species extinction, itself derived from the “new catastrophism” of paleontology and evolutionary biology. He notes that in the nineteenth century, species extinction was commonly understood as a slow and normative process that contributed to the continuous renewal of a natural equilibrium: that as certain species went extinct, others, through processes of natural selection, would replenish “nature’s economy” (see discussion in Worster 1994) to maintain the balance of nature. Indeed, he notes that in this view, species extinction might even be viewed as progressive, weeding out “unfit” species in favor of more adaptive ones.

The number of species in the world was thus understood to always be maintained in a stable state or, alternatively, might be understood to be steadily *increasing* with time. During the 1970s and 1980s, within the context of the development of systems and chaos theory, and of Cold War fears of possible nuclear planetary annihilation, Sepkoski notes that paleontologists and evolutionary biologists began to question Darwinian models and the implication that extinction might be understood to be a function of the “imperfection” of less-fit species. This coincided with the development of new theories of mass prehistoric extinctions related to catastrophic events, such as that of a meteorite impact event approximately 65 million years ago, thought to have brought the Cretaceous period to its conclusion.

The implication of these new theories was that while the “natural” state of things was for species diversity to increase exponentially over time, the number of species had neither been *stable* nor had increased at a *stable rate* over the Earth’s history, and certain catastrophic mass extinction events had made a major impact on species diversity over time. Work on the nature of these mass extinction events suggested that the evolutionary lineages that survived such events tended to actually be more homogenous in other regards:

... even if diversity—as measured by the sheer number of species alive—has increased, it has become a more homogenous kind of diversity, since those species are clustered within fewer and fewer higher taxa (Sepkoski 2016, 77).

Sepkoski points to the influence of these ideas on E.O. Wilson’s work, in particular, in forming an accepted view of species extinction as an irreversible and potentially erratic and catastrophic process, where species diversity is endangered by the likelihood of such catastrophic processes and likely *decreases* with time. Importantly, this view of biodiversity as a normative target for natural heritage conservation activity gained traction from its connection with other apparatuses (cf. Harrison 2013, 2016) that were developed to address the endangerment sensibility, in particular those concerned with the measurement of the endangerment of cultural and linguistic diversity (Maffi 2005). I have already noted the somewhat earlier appearance of cultural diversity as an endangered object, conservation target, and field of intervention in the post-WWII work of UNESCO. Lévi-Strauss (1952) suggested that each

culture contributed a unique and “distinctive” part of a collective human diversity. As such, he suggested that human progress, understood in its most fundamental terms as entering into the experience of modernity, was to be measured as the result of the interactions of different cultural groups, rather than being conceived of as the outcome of any cultural, biological, or technological trait inherent to any of them. Progress was a function of intercultural knowledge, and thus, cultural diversity was integral to progress. But here, as Lentin (2005:387) points out, lay a contradiction, because such intercultural dialogue would ultimately lead to the erosion of cultural distinctiveness, and hence of cultural diversity, rather than strengthening it. Bennett et al. (2017) show how this contradiction led to the development of special categories of endangered personhood—in particular the transnational concept of “indigeneity”—which would require particular forms of conservation practices to maintain in the face of the inherent threats of intercultural dialogue.

I refer to the temporal implications of such a view of cultural and biological diversity—one in which *diversity naturally tends to decrease with time* and in which *time itself is perceived to represent an implicit threat to biological and cultural diversity*—as an “entropic” view of the relationship between diversity and time. While it is conventional to view both natural and cultural heritage conservation as relating generally to “modern” conceptions of linear, accelerating time (see Harrison 2013), I suggest that different temporal dispositions directly shape, and are in turn shaped by, specific conservation practices. In this perspective, I am influenced by Radin’s (2013) work on the “latent futures” conserved in frozen human blood and tissue samples, extracted from the bodies of Indigenous people (themselves understood historically by anthropologists and geneticists to represent a “frozen” or arrested state of humanity; see Bennett 2005; Bennett et al. 2017) as part of the International Biological Program (1964–1974).

I will now turn to look in detail at the work of the SGSV and consider to what extent their specific conservation practices might be seen to contribute to, or conflict with, the construction of this entropic view of the relationship between diversity and time.

The Svalbard Global Seed Vault

The SGSV is currently the world’s largest secure seed storage facility, established in 2008 by the Royal Norwegian Ministry of Agriculture and Food; the

Global Crop Diversity Trust (now known as the “Crop Trust”), an independent international organization based in Germany (established as a partnership between the United Nations Food and Agriculture Organization (FAO) and the Consultative Group on International Agricultural Research); and the Nordic Genetic Resource Centre (NordGen). At a cost of US\$9 million to the Norwegian government, the construction of the SGSV began in 2005 as a result of the recommendations of the 2004 International Treaty on Plant Genetic Resources for Food and Agriculture, which created a global ex situ system for the conservation of agricultural plant genetic resource diversity. Situated on the remote island of Spitsbergen in the Norwegian Svalbard archipelago, high in the Arctic north, it received its first deposits of seeds in 2008. NordGen is responsible for the day-to-day operations of the facility and maintains a publicly accessible database documenting its samples. NordGen’s website (NordGen 2016) provides the details of its operations, as follows. The site reports that the SGSV holds in its frozen repository approximately 850 thousand accessions and 54.7 million seeds, provided by 233 countries and 69 depositor institutions. Each accession represents a sample taken of a specific living crop population from a specific geographic location at a specific point in time, and is usually made up of approximately 500 individual seeds. Depositing institutions first dry the seed accessions to limit their moisture content to 5-6%, and then seal them inside an individual airtight aluminum bag. These bags are packed into standard-sized crates and stacked on shelving racks within one of the three separate, identical storage vaults, each measuring approximately 9.5 × 27 meters, which are refrigerated to maintain a constant temperature of –18°C (Figure 1). These vaults have been excavated approximately 120 meters into the side of a sandstone mountain at a height of 130 meters above sea level; entry to the vaults is via a 100-meter entrance tunnel (Figure 2). Equal parts bunker and frozen “ark,” the dramatic façade (Figure 3) includes a commissioned artwork, *Perpetual Repercussion* by Dyveke Sanne, which “renders the building visible from far off both day and night, using highly reflective stainless steel triangles of various sizes” (Government of Norway 2015). The cold climate and permafrost ensure that even if power is lost, the storage vaults would remain frozen for a significant period of time, even taking into account the possible effects of climate and sea level changes.² “Designed for [a] virtually infinite lifetime,”

Figure 1. Interior of the central of three storage vaults at SGSV showing standardized storage crates on shelving units. Each box is individually bar-coded and registered on the SGSV database. Photograph by the author. [This figure appears in color in the online issue.]

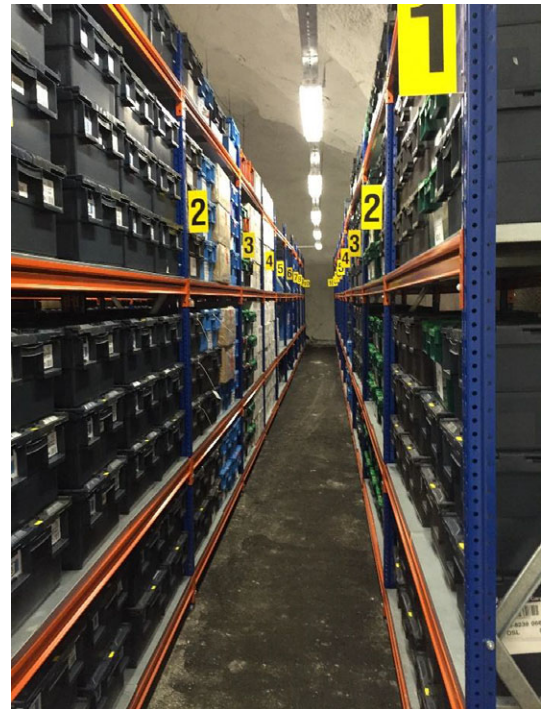


Figure 2. The “Svalbard tube”—the long entrance tunnel leading from the external concrete portal building into the mountainside to the three identical vaults. Photograph by the author. [This figure appears in color in the online issue.]



Figure 3.
The SGSV's dramatic concrete portal building and façade, including the artwork, *Perpetual Repercussion* by Dyveke Sanne. Photograph by the author. [This figure appears in color in the online issue.]



it is perceived to be “robustly secured against external hazards and climate change effects” (Government of Norway 2015).

The SGSV is not a conventional seed bank, but was conceived of as part of a global system to facilitate the secure storage of a duplicate “backup” of seed accessions held in national and regional repositories.

“Worldwide, more than 1,700 genebanks hold collections of food crops for safekeeping, yet many of these are vulnerable, exposed not only to natural catastrophes and war, but also to avoidable disasters, such as lack of funding or poor management. Something as mundane as a poorly functioning freezer can ruin an entire collection. And the loss of a crop variety is as irreversible as the extinction of a dinosaur, animal or any form of life” (Crop Trust 2016a).

These backup sets of seeds are stored free of charge and are held as part of an international agreement in which the seeds remain the property of the depositing institution, and are available for withdrawal only by that institution, at any time. It is thus not an active genebank, but a literal “vault” containing a secure stock of duplicate accessions, which can be used if seed stocks from the depositing institution become depleted or lost. The need for such a facility seemed clearly demonstrated when, in September 2015, scientists from the International Centre for Agricultural Research in Dry

Areas (ICARDA) who had lost access to their genebank facility in Aleppo, Syria, requested the return of seeds deposited in the SGSV, to reconstruct their collection in a new facility in Lebanon. This first withdrawal of seed samples from the SGSV as a result of the ongoing conflict in Syria was reported widely in the media, and seemed to indicate that the SGSV was already fulfilling a purpose that had previously been assumed would arise in a more distant future (most often framed within the temporal horizon of medium- to long-term global climate change; see Fowler 2008), thus justifying the significant investment in this global “insurance policy.” The manager of the new ICARDA genebank facility in Terbol, Bekaa, was reported to have said of the withdrawal of seed samples “It [SGSV] was not expected to be opened for 150 or 200 years. . . It would only open in the case of major crises but then we soon discovered that, with this crisis at a country level, we needed to open it” (Alabaster 2015).

Banking Diversity, Making Futures, and Securing Hope

In explaining the need for such a repository, the SGSV’s mission is framed within what we might see as a fairly conventional articulation of the endangerment sensibility and its accompanying entropic view of the relationship between diversity and time. The Crop Trust, as the charitable organization responsible for funding the ongoing operations of the SGSV and the preparation and shipment of seed from developing countries, perhaps articulates this most clearly in its explanation of the SGSV’s purpose: “The purpose of the Svalbard Global Seed Vault is to provide insurance against both incremental and catastrophic loss of crop biodiversity held in traditional seed banks around the world. The Seed Vault offers ‘fail-safe’ protection for one of the most important natural resources on earth.” It continues: “Crop diversity is the resource to which plant breeders must turn to develop varieties that can withstand pests, diseases, and remain productive in the face of changing climates. It will therefore underpin the world food supply. . . the Seed Vault will ensure that unique diversity held in genebanks in developing countries is not lost forever if an accident occurs” (Crop Trust 2016b). In these statements, we see all of the conventional articulations of an entropic view of diversity, including the potential loss of diversity through catastrophic incidents and the need to build resilience in the face of such changes.

However, the situation becomes somewhat more complicated when we consider the operation of the SGSV in relation to the global system of agrobiodiversity conservation, and in particular, the relationship of the materials stored in the SGSV to the specific conservation targets of agrobiodiversity conservation practices. As Peres (2016) shows, seed banks were originally developed as part of a strategy to ensure the maintenance of crop genetic diversity in the face of widespread adoption of a small number of high-yielding crop varieties during the agricultural industrialization and modernization of the twentieth century. The freezing of seeds would enable the maintenance of agrobiodiversity without the need for ongoing cultivation of old crop varieties, resulting in an “archive” of the evolutionary histories of crop varieties that might be of use to future generations of agricultural scientists and farmers.

The notion of “genetic erosion” fundamentally underpins this global system. First coined at the 1967 FAO/International Biological Program Technical Conference on the Exploration, Utilization and Conservation of Plant Genetic Resources (Pistorius 1997, 2), the concept gained strength from its resonance with the by then, well-known concept of soil erosion, suggesting that the full range of both wild and domesticate genetic diversity, threatened with “erosion” by agricultural modernization programs, was fundamental to future food security (see Fenzi and Bonneuil 2016, 74-6). “Landraces,” localized genetic variants of crop species resulting from both cultural and natural selection processes, were seen to represent a bank of genetic diversity that held potential for future crop improvement to both mediate the effects of future climate change and develop resilience to future diseases (e.g., see further discussion in Hummer 2015).

Peres (2016), drawing on the work of Parry (2004) and van Dooren (2009), goes on to show that the present system of genebanks is the outcome of debates in the 1960s and 1970s surrounding the most appropriate methods of agrobiodiversity conservation—in situ or ex situ—in which the frozen seeds held in seed banks across the world came to act as “proxies” for crops. These debates were closely related to, and indeed stimulated, the development of broader technologies of ex situ cryogenic, as well as other cold and frozen preservation practices, across a large number of different fields of conservation (see Radin 2016, 2017; chapters in Radin and Kowal 2017). Elaborating on the temporal aspect of seeds as proxies, Peres argues that frozen

seeds could become records or “archives” of a crop’s evolutionary history, because they were preserved statically and latently, and as such, they might be “recalled” in the future (see also Bowker 2005a):

Seed banks can therefore be imagined as repositories that enabled the ‘recall’ of genetic diversity, both by committing it to memory and by allowing it to be recovered from cold storage for use. By evoking both these meanings, the concept of recall conveys how the conservation of old landraces is entangled with concerns regarding their future use. Seed banks thus function as archives that make records of the past of crops accessible in the future (Peres 2016, 102).

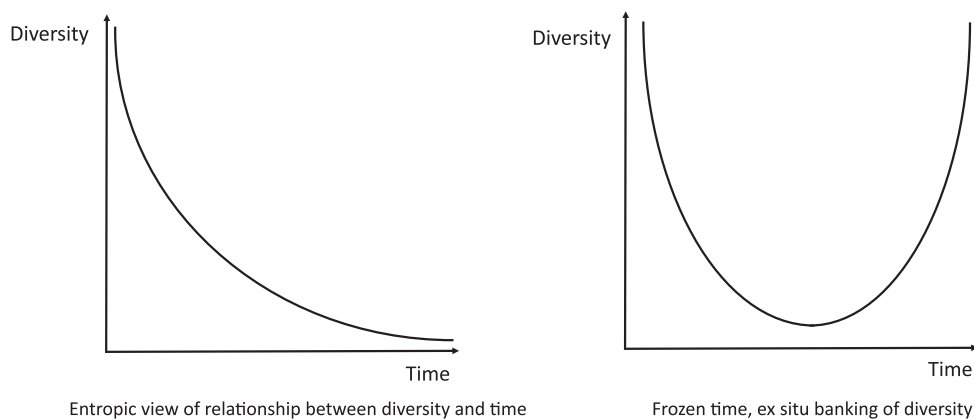
It is worth thinking through in more detail the concepts of the archive and of the relationship between the seed, its genetic material, and the biosocial record of a crop’s evolutionary history. Peres (2016) suggests that seeds are individual records of a crop’s evolutionary history; from this framing, I extrapolate that the seed functions as the “document” within the accession “folder”, which is a component of the genebank as “archive”. However, I want to suggest a more complicated, nested relationship in which we might consider each seed to also function as a form of biosocial archive in its own right. I suggest this is the case in the sense that each seed holds within its genetic material records of localized crop experimentation and natural and cultural selection, which, although partial and iterative, describe histories of agricultural activity that may extend back in time to the earliest prehistoric experimentation with domestication of crop species.³ These seeds could thus be characterized, as van Dooren (2007:83) suggests as archives of “inter-generational, inter-species, human/plant kinship relations.” In relation to the ICARDA accession withdrawal, the genebank manager was also quoted as saying “When you trace back the history of these seeds, [you think of] the tradition and the heritage that they captured. . . They were maintained by local farmers from generation to generation, from father to son and then all the way to ICARDA’s genebank and from there to the Global Seed Vault in Svalbard” (Alabaster 2015). While each individual seed may only record the *outcomes* of particular processes of natural and cultural selection, in the sense that these are “inscribed” in the genetic material of the seed itself, holding these seeds at low temperatures would potentially halt the genetic

erosion that might occur in situ through a combination of natural and cultural processes. Thus, the cumulative (meta-)archive of the SGSV conserves not only genetic agrobiodiversity, but also individual archives (seeds) that contain a series of specific biological-historical accounts (genes) of multispecies biosocial relations.

If the nature of the SGSV is complicated by this articulation of a more intricate, nested relationship of document to folder to archive, it is even further complicated by its relationship with time, and with the forms of diversity it holds in its repository. In freezing crop seeds as archives that map global genetic diversity from different points in time, each of which contains echoes or fragments of the diversity of past multispecies biosocial processes, the SGSV intervenes in the normative, entropic decay of diversity, “banking” a record of past and present genetic diversity in frozen, arrested time. As in Radin’s (2013) account of frozen blood and tissue samples discussed earlier, the values of these collections are banked as latent values that are only to be realized at some future moment in time. In conjunction with ongoing processes of in situ agrobiodiversity maintenance, themselves subject to continuing processes of natural and cultural selection that alter contemporary global agrobiodiversity, the vault’s collection reverses the entropic process of diversity decay by *increasing* global crop genetic diversity. It does this because in situ conservation (working through time) goes on producing other, new forms of agrobiodiversity while ex situ conservation (working through frozen time) maintains older diversity into the future, thus increasing global diversity overall (see Figure 4).

The Crop Trust suggests that “the Vault is the ultimate insurance policy for the world’s food supply, offering options for future generations to overcome the challenges of climate change and population growth. It will secure, for centuries, millions of seeds representing every important crop variety available in the world today. It is the final back up” (Crop Trust 2016a). But the notion of a “backup” here, which implies that duplicate accessions remain (biologically and socially) functionally equivalent, belies the complicated biosociotechnical and discursive shifts that occur within the repository, which, along with the possibility of further genetic changes within cold storage (e.g., Soleri and Smith 1999), mean that that which is deposited is fundamentally transformed by the process, creating something significantly different in ex situ conservation when compared to that which is conserved in situ. In this sense, the operations of the SGSV seem to hold much in common with other archives, where the materials contained are reconfigured and acquire new forms of significance through their archival deposition (e.g., Stoler 2009). They also have in common the idea of the archive as a place in which different forms of relations are ordered and shaped, and which in turn shape and order the worlds to which these archives refer (e.g., Bennett et al. 2017; Bowker 2005a; Joyce 1999). As such, the SGSV as meta-archive also constitutes its own biosocial record of specific, historically embedded, neoliberal practices of multispecies relationships, that is, the attempts to mediate modernized agriculture through ex situ conservation that emerged in the latter part of the twentieth century. This, in turn, contributes to the *accumulation* of forms of biocapital by SGSV that

Figure 4. Diagrammatic depictions of (left) the normative entropic view of the relationship between biological diversity and time, and (right) the accumulation of diversity as banked biocapital produced in the work of the SGSV. Author’s elaboration.



are different to those values that accrue within the national and regional genebanks providing their “duplicate” samples to the SGSV. These biocultural values draw not only on the added prestige derived from belonging to the “global” seed vault—as part of the “final” backup—and from the specific stories (e.g., the Syrian withdrawal) associated with objects contained within it, but also, through processes of genetic shift, to the addition of novel forms of biodiversity to the frozen, latent life contained within its archive. If the metaphor of a “backup” is only partially accurate, then its designation as a “bank” in this process of the creation and accumulation of new forms of biocapital seems far more apposite (see also Bowker 2000, 2005b).

It is perhaps no coincidence that the conservation target of such activity is the seed. It acts here both as physical container for genetic material and as poignant symbol of latent potential and hope in securing uncertain futures. By intervening directly in “natural” processes of entropic diversity decay and providing “fail-safe” protection for “one of the most important natural resources on earth” (Crop Trust 2016b), the SGSV offers “options” to future generations in responding to climate and population change.

The power of seed can be explosive, not just because it can force its way through rock-hard soil to reach the sunlight, but also because it is at the center of many political processes. The rights relating to the genetic material of plants, animals, and microorganisms have been a key issue of contention between industrial and developing countries (Statsbygg 2008, 8).

Hage (2003) discusses the state’s capacity to distribute hope as a form of governmental power. Similarly, in offering a sense of hope and security against uncertain global futures, agrobiodiversity banking is also a practice that is caught up in processes of the generation and differential distribution of forms of power. The biopolitical concerns articulated in these processes contribute to the management of risk and uncertainty by establishing certain frameworks for intervening in, and shaping, the future through the maintenance of a “bank” of genetic materials that might form the basis for future crop experimentation, and thus future forms of life. While the global system (of which the SGSV is a part) is one in which there are significant regulatory frameworks for the sharing of plant genetic resources for food and agriculture, it is

nonetheless one in which the authority to determine access to those resources is vested in national governments. Here, this global system’s objective to conserve a universal, biosocial archive for humanity is disrupted by issues of national sovereignty in ways that echo those of other international conservation instruments, such as the UNESCO World Heritage List (e.g., see Harrison 2013; Meskell 2014).

Conclusion

In commenting on what they term the recent “hope boom” in anthropology, Kleist and Jansen (2016) suggest that the current, accelerating interest in the topic reflects an increasing global sense of crisis, insecurity, and uncertainty. Importantly, they note that hope arises from, and creates, specific dispositions toward the future; that specific formations of hope constitute discrete forms of temporal reasoning. Similarly, Appadurai (2013) has suggested that the politics of hope forms the foundation for an anthropology of the future. In the work of the SGSV, we see specific forms of hope and security generated through practices of banking genetic diversity, in response to conditions of future global uncertainties regarding climate and population. This work produces new possible futures through intervening directly in what might be perceived to be a normative, entropic process of biological diversity loss, providing components for future agricultural innovation. The SGSV is perceived to both bank existing forms of biocultural diversity—this diversity being itself a biosocial archive of millennia of cultural and natural experimentation—and accumulate the results of slow processes of genetic shift that might also produce new, innovative forms of future crop diversity and hence future human life. The forms that its biocapital takes are thus both genetic and biosocial. An exploration of the specific temporal dispositions generated in and through the work of SGSV points toward the heterogeneity of the future worlds that biodiversity conservation practices of different kinds produce, and the value of developing a more nuanced and comparative approach to diversity conservation practices more generally.

Acknowledgments

I thank Trinidad Rico, Kathryn Lafrenz Samuels, three anonymous reviewers, and Stephanie Paladino for comments on earlier versions of this manuscript

that helped me make significant improvements to its arguments. The research presented in this article draws on field visits, interviews, and ongoing collaborations with SGSV and NordGen staff undertaken by the author and Sefryn Penrose as part of a broader comparative study of natural and cultural diversity conservation practices, one of four major areas of thematic foci for the Heritage Futures research program. Heritage Futures is funded by an Arts and Humanities Research Council (AHRC) "Care for the Future: Thinking Forward through the Past" Theme Large Grant (AH/M004376/1), awarded to Rodney Harrison (principal investigator), Caitlin DeSilvey, Cornelius Holtorf, Sharon Macdonald (co-investigators), Antony Lyons (senior creative fellow), and Nadia Bartolini, Sarah May, Jennie Morgan, and Sefryn Penrose (postdoctoral researchers), and assisted by Esther Breithoff (postdoctoral researcher) and Hannah Williams. It receives generous additional support from its host universities and partner organizations. See www.heritage-futures.org for further information.

Notes

1. Biocapital is defined simply here, following Helmreich (2008), as the surplus values generated by the commodification and circulation of forms of biological life within economic systems. Helmreich points out, however, that biocapital is understood and deployed in a number of different ways by scholars across science studies and itself may manifest in a range of different forms, as parts of different sociomaterial assemblages.
2. In May 2017, it was reported by a number of media outlets that climate change-induced melting of permafrost had caused major flooding and damage to the entrance chamber to the SGSV. A joint statement issued by The Royal Norwegian Ministry of Agriculture and Food, the Crop Trust, and NordGen on May 21, 2017, noted that while no damage had been done to the facility, measures would be taken to further secure the vault against future water ingress. Sefryn Penrose wrote about the incident and what these global fluctuations in water and ice mean for SGSV's mission to secure diverse futures on our website at <https://heritage-futures.org/is-it-doomsday-yet/>
3. For a summary of recent approaches to plant domestication studies and their implications, see Larson et al. 2014 and Boivin et al. 2016.

References

Alabaster, Olivia. 2015. "Syrian civil war: Svalbard 'doomsday' seeds transferred to Lebanon to preserve Syria's crop heritage". The Independent Newspaper, 10th October 2015, accessed August 15, 2016, <http://www.independent.co.uk/news/world/middle-east/>

- syrian-civil-war-svalbard-doomsday-seeds-transferred-to-lebanon-to-preserve-syrias-crop-heritage-a6689421.html
- Appadurai, Arjun. 2013. *The Future as a Cultural Fact*. London: Verso.
- Beck, Ulrich. 1992. *Risk Society: Towards a New Modernity*. London: SAGE.
- Bennett, Tony. 2004. *Pasts beyond Memory: Evolution, Museums, Colonialism*. London and New York: Routledge.
- Bennett, Tony, Fiona Cameron, Nélia Dias, Ben Dibley, Rodney Harrison, Ira Jacknis, and Conal McCarthy. 2017. *Collecting, Ordering, Governing: Anthropology, Museums and Liberal Government*. Durham and New York: Duke University Press.
- Boivin, Nicole L., Melinda A. Zeder, Dorian Q. Fuller, Alison Crowther, Greger Larson, Jon M. Erlandson, Tim Denham, and Michael D. Petraglia. 2016. "Ecological Consequences of Human Niche Construction: Examining Long-term Anthropogenic Shaping of Global Species Distributions." *Proceedings of the National Academy of Sciences* 113(23): 6388–96.
- Bowker, Geoffrey C. 2000. "Biodiversity Datadiversity." *Social Studies of Science* 30: 643–84.
- . 2005a. *Memory Practices in the Sciences*. Cambridge, M.A.: MIT Press.
- . 2005b. "Time, Money and Biodiversity." In *Global Assemblages: Technology, Politics and Ethics as Anthropological Problems*, edited by A. Ong, and S. J. Collier. Cambridge, M.A.: Blackwell.
- Crop Trust. 2016a. "Svalbard Global Seed Vault". accessed August 15, 2016, <https://www.croptrust.org/what-we-do/svalbard-global-seed-vault/>
- Crop Trust. 2016b. "FAQ About the Seed Vault". accessed August 15, 2016, <https://www.croptrust.org/what-we-do/svalbard-global-seed-vault/faq-about-the-vault/>
- van Dooren, Thom. 2007. "'Terminated Seed: Death, Proprietary Kinship and the Production of (Bio)Wealth'". *Science as Culture* 16(1): 71–94.
- . 2009. "Banking Seed: Use and Value in the Conservation of Agricultural Diversity." *Science as Culture* 18(4): 373–95.
- Fenzi, Marianna, and Christophe Bonneuil. 2016. "From "Genetic Resources" to "Ecosystems Services": A Century of Science and Global Policies for Agrobiodiversity Conservation." *Culture, Agriculture, Food and Environment* 38(2): 72–83.
- Fowler, Cary. 2008. *The Svalbard Global Seed Vault: Securing the Future of Agriculture*. The Global Crop Trust.
- Giddens, Anthony. 1991. *Modernity and Self-Identity: Self and Society in the Late Modern Age*. Cambridge: Polity Press.
- Government of Norway. 2015. "Svalbard Global Seed Vault: More about the physical plant". Last updated February 23, 2015, <https://www.regjeringen.no/en/topics/food-fisheries-and-agriculture/landbruk/svalbard-global-seed-vault/mer-om-det-fysiske-anlegget/id2365142/>
- Hage, Ghassan. 2003. *Against Paranoid Nationalism. Searching for Hope in a Shrinking Society*. Annandale: Pluto Press.
- Harrison, Rodney. 2013. *Heritage: Critical Approaches*. Abingdon and New York: Routledge.
- . 2015. "Beyond "Natural" and "Cultural" Heritage: Toward an Ontological Politics of Heritage in the Age of Anthropocene." *Heritage and Society* 8(1): 24–42.
- . 2016. "World Heritage Listing and the Globalization of the Endangerment Sensibility." In *Endangerment, Biodiversity and Culture*, edited by F. Vidal, and N. Dias, 195–217. Abingdon and New York: Routledge.
- Harrison, Rodney, Nadia Bartolini, Caitlin DeSilvey, Cornelius Holtorf, Antony Lyons, Sharon Macdonald, Sarah May, Jennie Morgan, and Sefryn Penrose. 2016. "Heritage Futures." *Archaeology International* 19: 68–72.

- Helmreich, Stefan. 2008. "Species of Biocapital." *Science as Culture* 17 (4): 463–78.
- Heyd, David. 2010. "Cultural Diversity and Biodiversity: A Tempting Analogy." *Critical Review of International Social and Political Philosophy* 13(1): 159–79.
- Holdgate, Martin. 1999. *The Green Web: A Union for World Conservation*. London: Earthscan Publications.
- Hummer, Kim E. 2015. "In the Footsteps of Vavilov: Plant Diversity Then and Now." *Horticultural Science* 50(6): 784–8.
- Joyce, Patrick. 1999. "The Politics of the Liberal Archive." *History of the Human Sciences* 12(2): 35–49.
- Kleist, Nuaja, and Stef Jansen. 2016. "Introduction: Hope over Time—Crisis, Immobility and Future-Making." *History and Anthropology* 27(4): 373–92.
- Larson, Greger, Dolores R. Piperno, Robin G. Allaby, Michael D. Purugganan, Leif Andersson, Manuel Arroyo-Kalin, Loukas Barton, Cynthia Climer Vigueira, Tim Denham, Keith Dobney, Andrew N. Doust, Paul M. Gepts, Thomas P. Gilbert, Kristen J. Gremillion, Leilani Lucas, Lewis Lukens, Fiona B. Marshall, Kenneth M. Olsen, Chris J. Pires, Peter J. Richerson, Rafael Rubio de Casas, Oris I. Sanjurc, Mark G. Thomas, and Dorian Q. Fuller. 2014. "Current Perspectives and the Future of Domestication Studies." *Proceedings of the National Academy of Sciences* 111(17): 6139–46.
- Lentin, Alana. 2005. "Replacing 'Race', Historicizing 'Culture' in Multiculturalism." *Patterns of Prejudice* 39(4): 379–96.
- Lévi-Strauss, Claude. 1952. *Race and History*. Paris: UNESCO.
- Lowenthal, David. 1985. *The Past is a Foreign Country*. Cambridge: Cambridge University Press.
- Lupton, Deborah. 1999. *Risk*. London and New York: Routledge.
- Maffi, Luisa. 2005. "Linguistic, Cultural, and Biological Diversity." *Annual Review of Anthropology* 34(1): 599–617.
- Meskill, Lynn. 2012. *The Nature of Heritage: The New South Africa*. Maldon, Oxford and Chichester: Wiley-Blackwell.
- . 2014. "States of Conservation: Protection, Politics, and Pacting within UNESCO's World Heritage Committee." *Anthropological Quarterly* 87(1): 217–43.
- NordGen. 2016. "Seed Portal of the Svalbard Global Seed Vault". accessed August 15, 2016, http://www.NordGen.org/sgsv/index.php?page=sgsv_information_sharing
- Parry, Bronwyn. 2004. *Trading the Genome: Investigating the Commodification of Bio-Information*. New York: Columbia University Press.
- Peres, Sara. 2016. "Saving the Gene Pool for the Future: Seed Banks as Archives." *Studies in History and Philosophy of Biological and Biomedical Sciences* 55: 96–104.
- Pistorius, Robin. 1997. *Plants, Scientists and Politics: A History of the Genetic Resources Movement*. Rome: International Plant Genetic Resources Institute.
- Radin, Joanna. 2013. "Latent Life: Concepts and Practices of Human Tissue Preservation in the International Biological Program." *Social Studies of Science* 43(4): 484–508.
- . 2016. "Planning for the Past: Cryopreservation at the Farm, Zoo, And Museum." In *Endangerment, Biodiversity and Culture*, edited by Fernando Vidal, and Nélia Dias, 218–38. Abingdon and New York: Routledge.
- . 2017. *Life on Ice: A History of New Uses for Cold Blood*. Chicago and London: University of Chicago Press.
- Radin, Joanna, and Emma Kowal, ed. 2017. *Cryopolitics: Frozen Life in a Melting World*. Cambridge, M.A: MIT Press.
- Rico, Trinidad. 2015. "Heritage at Risk: The Authority and Autonomy of a Dominant Preservation Framework." In *Heritage Keywords: Rhetoric and Redescription in Cultural Heritage*, edited by Lafrenz K. Samuels, and T. Rico, 147–62. Boulder: University Press of Colorado.
- . 2016. *Constructing Destruction: Heritage Narratives in the Tsunami City*. Abingdon and New York: Routledge.
- Sepkoski, David. 2016. "Extinction, Diversity and Endangerment." In *Endangerment, Biodiversity and Culture*, edited by F. Vidal, and N. Dias, 62–86. Abingdon and New York: Routledge.
- Soleri, Daniela, and Steven E. Smith. 1999. "Conserving Folk Crop Varieties: Different Agricultures, Different Goals." In *Ethnoecology: Situated Knowledge/Located Lives*, edited by V. D. Nazarea, 135–54. Tucson: University of Arizona Press.
- Statsbygg. 2008. *Svalbard Global Seed Vault, Longyearbyen, Soalbard: New Construction*. Oslo: Statsbygg.
- Stoler, Ann Laura. 2009. *Along the Archival Grain: Epistemic Anxieties and Colonial Common Sense*. Princeton and Oxford: Princeton University Press.
- Sunder, Rajan K. 2006. *Biocapital: The Constitution of Postgenomic Life*. Durham and London: Duke University Press.
- Takacs, David. 1996. *The Idea of Biodiversity: Philosophies of Paradise*. Baltimore: John Hopkins University Press.
- Vidal, Fernando, and Nélia Dias. 2016. "Introduction: The Endangerment Sensibility." In *Endangerment, Biodiversity and Culture*, edited by F. Vidal, and N. Dias, 1–38. Abingdon and New York: Routledge.
- Wilson, Edward Osborne ed. 1988. *Biodiversity*. Washington, D.C.: National Academy Press.
- Worster, Donald. 1994. *Nature's Economy: A History of Ecological Ideas*, 2nd ed. Cambridge and New York: Cambridge University Press.