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Environmental Justice, 'Collapse' and the Question of Evidence

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INTRODUCTION

The papers assembled here represent the culmination of a recent workshop hosted at Franklin University Switzerland entitled Environmental Justice, 'Collapse' and the Question of Evidence. The interdisciplinary parameters for the workshop allowed us to include a broad range of contributions from the humanities, the social sciences and the natural sciences with the explicit goal of establishing potential overlaps between environmental justice and notions of collapse. The workshop aimed to explore the many forms of evidence that surface as scholars and scientists go about making claims on behalf of both justice and collapse. Most importantly, the workshop served to highlight what thinking across disciplinary lines could yield as it becomes increasingly obvious that single disciplines like politics, law or even science have failed to find the kinds of solutions we need to ward off disaster. During the workshop, several participants asked specifically what constitutes evidence for imminent collapse and how that evidence is produced for analysis. Others pointed to the enduring need to redress the profound inequities that surround environmental hazards and destruction in an effort to provide potential solutions to this complex set of questions.

A return to the literature reveals broad consensus that our societies are standing on the brink of various collapses. While the environmental justice literature has emphasized the implications and critical nature of climate change (Bryne and Portanger, 2014; Mohai, Pellow, & Roberts, 2009; Schlosberg 2013), climate catastrophes represent just one of many potential collapses that we currently face (Motesharrei, Rivas, & Kalnay, 2014; Turner, 2012). Further, insight into these collapses and the environmental justice issues that they engender comes from many disciplinary directions. The literary scholar Robert Nixon examines threats and changes to the environment which are difficult to discern, a phenomenon he terms "slow violence": the gradual and often invisible changes in the environment wrought by events such as toxic drift, oil spills, and the environmental aftermath of war (Nixon, 2013). This slow violence, Nixon argues, is often overlooked amidst the more sensational spectacles of erupting volcanoes and massive hurricanes, which determine how we receive narratives that allow us to see and interpret the environment; and this oversight exacerbates the vulnerability of ecosystems and of the poor. From an economic perspective, Naomi Klein's latest book *This Changes Everything* marshals evidence to show that a massive reduction of greenhouse gases will simultaneously reduce inequalities while addressing crumbling local economies (Klein, 2014). Geographer Gordon Walker, author of *Environmental Justice: Concepts, Evidence and Politics*, has written extensively on how notions of justice and evidence are framed within different discourses (Walker, 2012) and political scientist John Barry writes about the relationship between moral, political theory and the environment, with particular focus on ecofeminism, the implications of green theory for thinking about justice, and theories of political economy in relation to the environment (Barry, 2005; Barry and Farrell, 2012).

Not surprisingly, legal scholarship has also brought forth an important body of work on the conceptualization of justice and evidence. David Schlosberg (with his co-authors), for instance, has written extensively on the concept of justice in the history of the environmental justice movement and on the necessity of basing ideas of justice on notions of capabilities, participation, and recognition (Schlosberg, Zavestoski, & Shulman, 2009; also, Schlosberg, 2013). Jody Freeman and Michael Gerrard trace the efficacy of international climate control systems, such as the Kyoto Protocol, as well as legal systems at the state, national, and international levels designed to require pubic entities to mitigate their impact on climate change (Freeman and Gerrard, 2015). Additionally, Richard J. Lazarus analyses the gaps in implementation and coverage of environmental law with a focus on the legal, political, cultural, and scientific factors that have shaped—and sometimes hindered—the creation of effective pollution control

(Lazarus, 2011, Lazarus and Houck, 2005). In Europe, Michael Kloepfer has published a book in which he examines the usefulness of the mainly Anglo-American discussion surrounding environmental justice for German law (Kloepfer, 2006).

As a number of scholars and scientists have remarked, discussions of environmental justice have arrived much later in Europe (Kraemer, 2007; Laurent, 2011; Preisendörfer, 2014). These scholars note that environmental justice issues appear to fall more across social categories and immigration status in Europe compared to the strong racial and ethnic divides that characterize environmental justice in the United States. The ongoing refugee crisis will likely only exacerbate this divide in Europe. Thus, the European context represents a rich area of research with diverse and divergent experiences with environmental injustice and justice. Understanding, for example, how environmental burdens may or may not interact with the challenging integration of immigrant cultures into European countries presents an emergent field of research. The Middle Eastern and Asian contexts, in the meantime, present entirely different parameters in which to investigate environmental justice that emphasize, among other things, the effects of war and industrialization.

We see this volume as the opportunity to continue a critical conversation that transcends national and disciplinary borders and invites a fruitful dialogue among diverse actors from different fields and geographic contexts. In this spirit, we open this issue with a conversation between natural scientist Christoph Kueffer and artist Jillian Scott. Their exchange focuses on radically interdisciplinary approaches to evidence and collapse, highlighting the activist role of the arts in environmental problem solving. They also juxtapose notions of scientific objectivity and artistic subjectivity in an effort to call artists into the laboratory, and perhaps more daringly, scientists into the art world, and into the realm of subjectivity. Their interdisciplinary and multidisciplinary lenses help us reframe and rethink complex and pressing problems of justice and injustice, of different ways of thinking evidence, of public awareness, and subsequent public response.

Jillian Scott suggests that film is one way to raise public awareness via the artistic sphere, and video essayist Ursula Biemann does precisely that. Biemann's contribution speaks to her video essay *Deep Weather* (2013) and how the interdisciplinary nature of the evidence associated with collapse remains critical. In particular, Biemann uses her video essay to align diverse but intersecting local ecologies on the larger, planetary scale. We see the convergence of the geopolitical, the ecological, and a series of activist narratives that frame stark examples of the evidence of collapse.

Alison Pouliot's contribution, "A Meander in the Mycosphere," addresses the specific challenge that Kueffer and Scott lay out to scientists, asking them to consider the realm of the subjective. She proposes a multi-sensory approach to the understanding of collapse, inviting us to leave the confines of the classroom in favor of a foray into the natural world. The photos and images her essay provide bring us to the fundamental question that she and other workshop participants ask: how can evidence be experienced, narrated and represented in ways that transcend disciplines and existing frameworks of knowledge?

In their paper, "In Everybody's Backyard? Examining the Intersection of Invasive Alien Species and Environmental Justice," Brack Hale and Patrick Della Croce show that environmental justice serves to highlight the social and cultural dimensions of environmental problems that are often framed mainly as a problem of natural systems for natural scientists. Hale and Della Croce thus bring ecological discourse into the socio-cultural realm, emphasizing the potential consequences across disciplines of the value-laden terminology that characterizes our discussions of invasive

alien species (IAS). Further, they remind us of the evidence that the IAS provide for the evaluation and subsequent policies or action to be taken in areas of species containment and public health.

Michael Egan brings a new voice and another discipline, the history of science, to the conversation with his article, "Confronting Collapse: Environmental Science at the End of the World." Egan coins the term survival science as an "organizing tool to bring together various labels and to stress the social significance of survival as a new environmental imperative." He crosses historical and disciplinary boundaries in an effort to show that discourses about collapse and the evidence that we attribute to that collapse have been swirling around our discussions of the environment for more than fifty years. As Egan eloquently points out, the way in which we measure health risks and other hazards share no clear and objective methodology, but instead are embedded in a series of cultural and socio-economic conditions that affect how the scientific community measures evidence. Indeed, his work suggests that the inherent subjectivity necessary for this analysis creates a challenge for perceived scientific objectivity.

Kimberly Ruffin's essay, "Biophilia on Purpose: A Declaration to Become an Ecosocial Citizen," returns to the origins of the environmental justice movement, demarcating inequalities of race. She uses the notion of self-certified biophilia to highlight the oppressed community's "ability to affirm their humanity and engage with the rest of the natural world outside of social systems that denied their humanness." Through biophilia, this same community confirms its ecosocial citizenship, thus restoring its humanity in the process. Ruffin's article responds to Philippe Forêt's workshop presentation on the world's super elite in order to take her analysis in a new direction. She fruitfully compares the situation of the disenfranchised to case of the ultra-wealthy, who can shop for passports in any nation state willing to sell citizenship to the highest bidder. Ultimately, she concludes that even those with ample amounts of economic capital will be unable to protect themselves from ecological and environmental collapse, suggesting that ecosocial citizenship, which elides race and social class, may indeed be the only way forward.

Marco Armiero's contribution, "Of the Titanic, the Bounty, and Other Shipwrecks," picks up where Ruffin leaves off, using class as a marker in examples of collapse throughout history and literature. Armiero suggests that stories of Noah, environmental cataclysm, and the Ark have conditioned our proclivity towards the shipwreck metaphor and the apocalypse. He then quotes Rob Nixon, reminding us that while we may be all in the Anthropocene, we are not all in it in the same way (Nixon, 2014). His reading of the Titanic and the Bounty narratives serve to highlight the enduring inequities that characterize disaster and our response to it. Further, Armiero's salient analysis of social class points to how those of the lower classes are disproportionately affected by issues of environmental collapse.

The articles collected here thus forge new paths in thinking about ways in which evidence and environmental justice are determined by race and class as well as epistemological and geographical boundaries. This volume and the contributions included herein strive to change the scripts of environmental justice and collapse. By examining the evidence we use and omit, by expanding the catalogue of evidence we allow to inform scholarly and public discussions, we seek to inform and perhaps reshape the discourse about these important issues. We argue that these multiple and diverse perspectives contribute to creating a clearer path to workable solutions. Finally, by reframing our own perspectives and subjectivities, we may find a way to marshal evidence that cuts across traditional understandings and stems (further) collapse.

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BIOGRAPHY

Brack W. Hale has a M.E.M. from the Nicholas School at Duke University and a Ph.D. in Land Resources from the University of Wisconsin-Madison. He is currently Associate Professor of Biology and Environmental Science at Franklin University Switzerland where he also co-directs the Center for Sustainability Initiatives on campus. His research includes non-native species, sustainability in higher education, and the ecology and management of floodplain ecosystems.

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Sara Steinert-Borella is Dean of Academic Affairs and Professor of Comparative Literary and Cultural Studies at Franklin University Switzerland. Her research interests focus on travel writing and gender in Switzerland and Europe, law and culture, and migration and human rights. Her book publications include *The Travel Narratives of Ella Maillart: (En)Gendering the Quest* (Peter Lang, 2006) and, together with Caroline Wiedmer and Priska Gisler, *The Intersections of Law and Culture* (Palgrave MacMillan, 2012). She is now at work on a study of discourses of human rights, race, and migration in Switzerland.

Caroline Wiedmer is Professor of Comparative Literary and Cultural Studies and Co-Director of the Center for Sustainability at Franklin University Switzerland. Her publications in the areas of gender and space, law and culture, memory studies and migration studies include *The Claims of Memory: Representations of the Holocaust in Contemporary France and Germany*; *Inventing the Past: Memory Work in Culture and History* (with Otto Heim); *Motherhood and Space* (with Sarah Hardy); and *Intersections of Law and Culture* (with Sara Steinert Borella and Priska Gisler). She is currently working on a book that focuses on the ways in which class, race and gender intersect with notions of sustainable belonging, humanitarian tradition, and legal and medial representation.

Environmental Justice, 'Collapse' and the Question of Evidence: what can the arts contribute? A Dialogue.

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ABSTRACT

In this article an artistic researcher and a natural scientist engage in a dialogue about the topics of environmental Justice, 'collapse' and evidence and their inter-linkages. They explore the different resonances that are possible between the work and thinking of ecologists and artists and discuss questions such as: How can we turn environmental issues into social issues and how can the concept of justice or rather injustice help? Does the idea of framing environmental problem as a justice issue work at the grand scale of planetary problems such as climate change or the global-scale degradation of soils, biodiversity and ecosystems that might eventually lead to a collapse of our society in its present form and of the functioning of the planetary ecosystem? What roles do different forms of evidence play for uncovering issues of justice and collapse but also for helping people to deal with them?

KEY WORDS: Artists who care, Environmental Collapse and Denial, Environmental Evidence, Environmental Justice and Injustice, Transdisciplinary Collaboration

Christoph Kueffer (CK): It is increasingly recognized that collaborations and exchanges of ideas between scientists and artists can be very productive in many ways and help us to address some of our most intractable environmental problems (Curtis et al., 2012; Hall et al., 2015). Fourteen years ago you founded the Swiss Artists-in-Labs program (1) and also a PhD program based on art and science (2). Plus, you are an artist working at the interfaces of art and the environmental sciences and more recently neuroscience (Scott and Stoeckli, 2012). A few years ago we started to collaborate on a number of teaching and artists-in-science intervention projects that addressed the question of 're-designing nature' in the Anthropocene. Our leading question was: How do ecologists and artists think about and represent the changing relationship between humans and nature, and what are the options for humans to shape nature and save threatened biodiversity and ecosystems? As a result, we wrote a book chapter together in the form of a dialogue that aimed to explore the different resonances that are possible between the work and thinking of ecologists and artists (Kueffer and Scott, 2015). I think that this dialogue format worked very well and so when I recently attended the international conference at Franklin University Switzerland in Lugano with the title "Environmental Justice, 'Collapse' and the Question of Evidence," I felt that another conversation with you on these topics might be very fruitful.

This conference brought three key questions about environmental debates together and explored their inter-linkages. First, how can we turn environmental issues into social issues and how can the concept of justice or rather injustice help? Second, does the idea of framing environmental problem as a justice issue work at the grand scale of planetary problems such as climate change or the global-scale degradation of soils, biodiversity and ecosystems that might eventually lead to a collapse of our society in its present form and of the functioning of the planetary ecosystem? Third, what roles do different forms of evidence play for uncovering issues of justice and collapse but also for helping people to deal with them? And here we were not only interested in evidences from the natural sciences but also other forms of evidences and their representations in the humanities, arts, literature, film or even comics. I would like to engage with you in a dialogue on these three overarching questions and then also the inter-linkages between them. I am interested in whether artists, or you as an individual artist, find these concepts interesting and relevant, how artists address them, and where you see alternative perspectives on these topics that artists or contemporary work of artists could contribute.

Let me start with my first question: Is environmental justice, the idea that environmental degradation unequally affects people – and especially the poor, vulnerable and less educated – something that artists address in their work? How do they approach this question? And how do they understand justice? I am asking this third question because at the conference we had to deal with many different perspectives on what justice and environmental justice actually are. For instance, the affected people might perceive an 'injustice' differently than an outsider.

Jill Scott (JS): Artists do address the issue of environmental justice in various ways but not all artists do. The ones that do, think that the roles of artists in society need to be rethought. Justice is a matter of who is in the position to judge whom, and the designers always want to add that only when the public is happy with the results can things proceed in a positive direction. Some eco-designers are engaged in education programs that work with disadvantaged communities, citizen science groups and they certainly believe in environmental justice (3). Another big development can be found among eco-artists who conduct public art experiments. In the USA there are many such on-going projects, mostly spurred on by the fact that these artists are sceptical of their own government policies on the environment (4).

These artists do not fit the old-fashioned idea of the painter in the garage or studio working in isolation from society, un-networked and separate from other collaborators or influences. Thank goodness these times are passing! Instead we have new groups of artists who have either risen out of conceptual art practice in the 70s and feel responsible to raise public awareness, or younger ones who want to encourage stewardship and even provoke controversy. Others are aware of the controversies in sociology and anthropology about re-constructing methodologies and new processes of working in such groups. However, in the arts, one cannot easily generalize about the outcomes of their engagements, because of the wide range of approaches to sharing information with the public. For example, a documentary filmmaker might be total dedicated to raising education for all, while a sculptor may simply wish to provoke reflection through satire, a dancer might want people to have an ambiguous interpretation leaving the public to "think about it" and a designer might want to make something practical for the public like smart home technologies to monitor climate change data.

There is a growing community of artists who are interested in raising awareness in the public realm, and using poetic and visual metaphors to provoke thoughts about "environmental justice". These interventions often use the methods from citizen science processes by taking people outside to conduct their own fieldwork and learn about their own local environmental problems. One example of this is an active group of women artists who call themselves "The Weads" (5). Other artists like Eugenio Tiselli—together with the agroecologist Angelika Hilbeck at ETH Zurich—are using mobile technology to work with farmers in Africa to empower them with the means to swap and compare information about nature (6). These directions create new roles for artists and also provide access to environmental education for less educated people.

Some projects also aim to shift perception by encouraging people not "what to think" but "how to think" by providing thought-provoking cultural experiences. For example, it is well known that interactive environments by artists increase the learning curve of the general public (7). This requires artists to move beyond the elitist boundaries of the "me" generation and the postmodern dilemma, into a role where art can become a larger part of "life" and a realization that our environmental problems cannot be solved by single disciplinary perspectives. So, in the arts, we believe that new forms of communication hold the keys to the issue of environmental justice and that this will cause more dynamic changes in the very construction of knowledge. These dynamics should favour a bottom-up approach. I really believe that art can become a viable interpretative catalyst for scientific debate about such issues.

CK: I like your activist view of the role of the arts in environmental problem solving. I agree that the sciences need corrective of their approach that is often merely focused on diagnosis of problems rather than development of solutions and that is often very detached from the people that suffer or those that should act. I also appreciate your call to the arts and I assume that the humanities move beyond a self-referential discourse that does not take positions and "does not want to get their hands dirty"; you called it postmodern. There is a responsibility of the humanities and arts to get engaged, take a lead, rather than waiting for others to propose ideas and then deconstruct them.

Critical but constructive views of the arts and humanities are certainly needed in the debates about how we approach global-scale environmental issues; discourses that are nowadays often led under the heading of "the Anthropocene." This leads me to the second question of the conference that focused on such a grand-scale perspective, the question of collapse. In our previous dialogue about

"re-designing nature" (Kueffer and Scott, 2015) we also touched upon the global and grand scale of our environmental problems, and you said that "we [artists] are a little naïve about ecological collapse; the scale is too big to think about it clearly." Can you say a little bit more why it is so difficult to capture (global) collapse in artistic work? Do you see any ways through which artists are beginning to help us develop new images, metaphors, narratives or other forms of representations for engaging with the threat of global-scale environmental and thus societal challenges? I am asking this because at the conference we realized that we have a paucity of ways at hand for conversations about these imminent threats and how to deal with them as an individual, society, or culture. We talked about oppression of African-Americans in the United States, war experiences and traumas, migration and the reasons why people migrate or often decide not to migrate, local environmental disasters such as hurricanes (e.g. Hurricane Katrina in New Orleans), or shipwrecks (e.g. of the Titanic) but none of these situations appears to represent the situation we are in at the moment well.

JS: Here it might be interesting to talk about documentary filmmakers who are often very explicit about their interest to inform and eventually change our behaviour. They think that scare-tactics about environmental "collapse" are not working and they may never propel the public into action. I once criticised *An Inconvenient Truth*, the film with Al Gore, for the same reason (Scott, 2010). But documentary film is a very appealing format to think about in terms of raising awareness, education and eventually changing our behaviour. We only have to remember the impact of a film like *Food Inc.* by Robert Kenner. In most cases these filmmakers have the advantage of the film space—a dark room full of the undivided attention of the audience for an hour and a half. Filmmakers continue to collect stories that carry the most emotional weight for other communities to identify with.

Another tactic, one that I use myself, is to translate documents about climate change into an immersive film experience that the people can interact with and make their own poetic associations with based on what is called "an immersive experience" (8). The big challenge for any artist is to find a few powerful images that are packed with meaning and that everybody talks about afterwards. We call this "impact". A good example is an immersive installation about species' extinction by Brandon Ballangée, which was actually called "Collapse" (9).

I personally think that lessons can be very effective if artists focus on more thematic and local effects of climate change on human lives instead of the whole concept of environmental collapse. One place to encourage more innovative projects on a local level comes from do-it-yourself (DIY) technology groups. For example, in 2006, Beatriz da Costa, an artist at the University of California, Irvine, strapped a small bundle of sensors onto homing pigeons. Da Costa even helped to develop the instrument package, which measured carbon monoxide and nitrogen oxides and tracked the pigeons' movements using a Global Positioning System (GPS) receiver. She then published the data from her project, on PigeonBlog, with the aim of disrupting the status quo and giving the public a role in gathering data on pollution [10]. Here the idea is to give citizens the tools to work locally. Today, students learn many technical skills in art school and they can be utilized to help the pubic to engage with the problems directly in their backyards. Designers are also working with citizens to gather data to understand the conditions of specific local environments. In other words, these media artists are fascinated by providing "sensors for the people"!

A major part of an art school training is about visual semiotics: an analysis of the ways visual images communicate or interpret a message and the associated psychologies, signs and patterns of symbolism. This includes studies on behaviour and how it changes, including collective "grass roots" actions. It is a way of bringing together aesthetic form and content within the context of everyday

reality. So, often artists and filmmakers use local stories to humanise scientific information as a strategy to present more valuable chunks of digestible knowledge. Visual metaphors can also be used as a tactic to try to encourage some local public action (11). From our perspective, it seems necessary for everyone to link up and act promptly, a mammoth task even if the politicians agree. One piece of good news is that many designers believe that we can reach a 70 percent reduction of CO_2 emissions by 2050 by creating energy saving devices, by using an approach they call "Human-Centered Design" or HCD (12). This approach aims to match what the designer anticipates with the real world by involving people who are expected to be future users of the product.

Scientists often make the mistake of thinking that the best way to change peoples' minds is to slam the public with horror stories—the collapse of the Gulf Stream, unprecedented glacial melt, desertification or mass extinction. However, this tactic often fails to work. As psychologist Stanley Cohen says: when big scale problems are presented one after another on such a huge scale then this actually causes more denial. He argues that although denial is often perceived as a normal reaction, it causes an ability to see the truth. But to act accordingly is rare, whether in individuals or in governments (Cohen, 2013). The sheer information overload of addressing all these problems at once increases this denial. Instead Cohen thinks that people actually have to be dragged out of the reality away from the idea of collapse. Only then can they take some distance in order to be able to think more clearly and effectively. In semiotics it is well known that after watching many images of disaster without any possible solutions, people deny those problems outright, seek scapegoats, or deliberately engage in wasteful behaviour like trashing the streets during a parade. In some cases, they even totally shut down and say "who cares - we are all going to die one day anyway!". Therefore, climate science literacy does not benefit from the dissemination of facts and graphs about disaster—these often cause the general public to become less pro-active. In the arts, we believe that the people need personal stories, with implications and solutions rather than only facts to become pro-active. I believe that scientific information needs the immersive drama of well thought out audio-visual scripts, and I prefer these over genres like science fiction or comic books.

Also people rarely believe something that they cannot see. Therefore, scientific visualization has potentials for artists and designers. My approach however would be to use visualizations in an immersive environment where the public can, for instance, encounter the physical elements of the atmospheric gases as fascinating animated characters. Such a scenario has potentials to create a contemplative space where the viewers can experience knowledge about future problems. Immersion can engage all forms of bodily sensory perception—a more convincing experience.

John Magnuson suggested, society is "unable to sense slow changes directly," and so we are trapped inside what he calls "an invisible present," always living in an era of the moment—a place where the facts seem to lag behind the causes (Magnuson, 1990). This syndrome seems to be caused by a lack of insight. Is this a grave fault in the human species? Perhaps art and design can help to raise awareness here about the generational contract that our adult generation does not seem to be fulfilling.

CK: Your perspective resonates nicely with my reactions to the discussions at the conference. After the conference, I wrote a blog (13) and two of my conclusions were: first, we don't need more scientific statistics but real examples of actual positive change in the surroundings of people, and second, it is family, friends and neighbours that matter. Therefore, I argued, "change will only happen when doing the right thing for the environment also means being fair to family, friends and neighbours." It is interesting that you mention the generational contract because I end the blog with

a question that I pose to grandparents playing with their grandchildren on a playground. These grandparents profited from massive environmental exploitation through the economic wonder years of almost uninterrupted economic growth that accompanied their life, while their grandchildren will face a tough life in a world without oil and little or no wilderness left. Is this an issue of environmental consequences in our society and how can it be turned into some sort of social action and change? Maybe too big a question once again, but maybe something for artists to further explore.

Let me ask you a final question: What next? What potentials are there for future collaborations between artists and scientists on the issues we discussed? I think the question of evidence, which was also covered in the conference, might be particularly productive here. What roles do different forms of evidence play to uncover issues of justice and collapse but also to help people to deal with them? You touched upon the question of evidence several times before, and in particular you emphasized that we must make sure that evidence is rooted in the local context and allows people to immerse themselves in the process of understanding and addressing environmental problems. This sounded very interesting to me because I recently wrote a book chapter where we argued about this issue in connection with ecological research on environmental problems in the Anthropocene (Kueffer, 2015, section 2.4, pp. 27-32). One emerging characteristics of a new ecological science is that the way we collect, analyze and interpret ecological data is re-negotiated. I argue that this opens space for citizens, practitioners, amateur ecologists, and naturalists to engage in new and diverse ways in the collection, analysis and interpretation of ecological data. Amongst others, because ecological data are increasingly freely available on the web, and so is software to analyze and visualize them, do-it-yourself DIY ecology becomes possible on every laptop. This seems to be an area where artists and scientists could start to work together more intensively but also concretely together. But let me hear how you think about future collaborations and new ways of representing evidence?

JS: Yes, I think that some interesting possibilities lie in artists and scientists working in an interactive DIY way with communities. However, in the arts we are also aware of the rapid financial profit that DIY companies are making from these trajectories. When thinking in this direction, the very relationship between evidence and progress should be questioned and whether this idea of progress fits into our ideas of a generational contract. When we want to communicate scientific evidence, our question is, how to make it more digestible. In other words, we think about the relationship between evidence versus experience. For instance, can common sense also be called evidence?

Projects that attempt to re-design nature so that it can give people a kind of re-experience of the wonders of nature are one of the possible trajectories in this direction. For example, when I teach young artists, I would start with a set of abstract themes like “body”, “water”, “plant” or “air” and hope that they would go and make some research to find their own inspiration. Then I would give them examples of other artists who have conducted experiments under each of these themes. These examples would become my evidence because they prove that it can be done, and secondly they claim a place for these themes in (art) history. I would expect the students’ outcomes to be very diverse, innovative, and publicly accessible. Of course, for a scientist, the leading question would be based on understanding processes in the same four themes. There would need to be discussions, before the experiments can take place. The outcomes would then aim to generate facts that support other facts.

In a true transdisciplinary collaboration, scientists might have to include our subjective methods of interpretation. They might have to try out our kind of research processes, and shadow us. So far artists have been more interested in exploring how scientists work with quantitative methods to produce new knowledge. Therefore, we have been making art workshops for scientists and science communicators (Kueffer and Scott, 2015), and also we have been placing artists into science labs for residencies and we have documented their experiences through extensive reports (Scott, 2010).

Right now there is still a lot of confusion between objectivity and the value of subjectivity. Integration might be difficult. Both sides are concerned about what kind of evidence should be sustained and how it should be shared with others, but perhaps we can actually work together in new ways. The ultimate, take-home message is that our society needs to undergo a wholesome metamorphosis, so I am for seriously involving people in qualitative science and trying to create true dialogues. This means that we have to generate respect for each other's disciplines. In this way, our anthropomorphisms and artistic narratives may start to line up with our ideologies.

So, to react to one of your questions about new forms of working with (quantitative) ecological evidence, yes it might be interesting to swap roles for a while and ask the scientist to present his or her findings as questions or to ask the artists to start with an hypothesis. Researchers in the art context are no longer confined to the realms of entertainment and inspiration, and besides we do share something else in common: we both have to deal with conflicts of interest in our respective professions! So come over and take a walk on the wild side and see what we are doing. Don't be surprised if you find very wild, provocative alternatives of environmental science made out of semi-living materials or visual metaphors and interactive models that attempt to stimulate new associative thought or documentary films full of personal stories or DIY energy solutions that you may not have ever seen before!

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(2) www.z-node.net
(3) http://www.findhorncollege.org/programmes/ecovillageeducation/designforsustainability.php
(4) http://greenmuseum.org/content/artist_content/ct_id-106__artist_id-18.html
(5) The Weads at http://weadartists.org/about-us
(6) See "The Voice of the Farmers" at http://sautiyawakulima.net/bagamoyo/about.php?l=1
(7) "Art as a way of Knowing" in 2011 at the Exploratorium in San Francisco at https://www.exploratorium.edu/knowing/
(8) Dermaland by Jill Scott, a project about UV damage on the environment at http://www.jillscott.org/homepage.html (chose 'Europe. Project 1992-2015' in the menu bar
(9) Brandon Ballangée: http://brandonballengee.com/collapse/
(10) http://www.nature.com/news/environmental-science-pollution-patrol-1.16654?WT.ec_id=NATURE-20150108
(11) See fishyfood at http://areweeatingfishyfood.com/art-is-activism-for-new-fishy-food-cars/
(12) See for instance http://www.designkit.org/human-centered-design
(13) https://www.ethz.ch/de/news-und-veranstaltungen/eth-news/news/2015/11/why-environmental-justice-matters.html

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Jill Scott is Professor for Art and Science Research in the Institute of Cultural Studies in the Arts, Zürich University of the Arts (ZhdK) and founder of the Artists-in-Labs Program, which places artists into scientific laboratories from all disciplines. She is also Vice Director of the Z-Node PhD program on art and science at the University of Plymouth, UK. Her own artwork spans 40 years of production about the human body, behaviour and body politics, while in the last 10 years she has focused on the construction of interactive mediated sculptures based on studies she has conducted in collaboration with neuroscience labs.

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Deep Weather

Ursula Biemann

In many of my video essays, the movements of people and resources in a rapidly globalizing world converge into complex human geographies; my focus has been on the social reorganization of these geopolitical spaces. More recently, I have turned to transformations that have been playing out in the background of these scenarios all along but which I hadn't paid much attention to, that is the changes occurring in the physical and chemical composition of the Earth due to the massive geo-engineering that has been going on in the last decades. *Deep Weather* (2013) is among my recent video essays exploring the ecologies of forest, oil, ice and water, which in many ways form the undercurrent narrations to current environmental dynamics. The attempt is to connect on the same visual plane minutely observed local ecologies with larger planetary dimensions.

As we scoop out fossil and mineral matters from deep geological strata into the daylight and out into the atmosphere, climate change makes us think in deep time. In this short text about the shortest of my video essays, I will address the long temporalities of the planetary scale that *Deep Weather* (2013) evokes. The video does this by depicting two remote sceneries: first, the aerial images of the extraction sites of heavy tar sands in Northern Canada, and second, a delta community in Bangladesh stemming the rising sea levels—two remote and simultaneously occurring scenes connected through their atmospheric chemistry.

The contradiction inherent in tackling dimensions of geological time by means of a medium universally used for instant video messages and breaking news clips is one of the troubling conditions of this time. The short paced social and journalistic video practices engulf us in an image world that is instantly in the making. Slow and subtle processes don't register. Yet climate change has evolved in a creeping temporality. Timothy Morton defines global warming as a hyperobject, imperceptible as a whole yet legible through the many imprints it leaves behind. In phasing in and out of human timeframes, global warming appears eclipsed from our field of visibility. The claim for authenticity is challenged by the difficulty of precisely localizing causal effects. In the absence of mental tools that would truly make us comprehend these invisible forces and extra-large timeframes,

global warming is commonly rendered by scientists in time-lapse sequences, a mode of imaging that translates slow and hardly noticeable processes for the reception of the metropolitan mind always pushed for time. The advantage of this technical type of encoding of the image is that it makes a threatening reality look more manageable. In their bewildering beauty, the fast motion visualizations of gathering storms or melting ice keep us at a safe distance from any visceral and bodily experience of climate impact. At the other aesthetic extreme, we encounter the sad lingering images of destroyed landscapes and flushed away neighborhoods of a bad social realist variety. This made me think about how realism would have to be redefined in times of global warming. In response to the postmodern dissipation of labor and materials across the globe, the central realist figure has been the worker's body and later the migrant's body. One could conceivably turn now to the citizen fronting natural disasters, like the Bangladeshi communities in *Deep Weather* who are building mud embankments in large-scale social action. For sure, this new figure effectively embodies the uneven geographies of global warming as a subject of climate justice. But this shift in focus cannot be the full answer to the issue at hand, for it would remain firmly in the human-centric regime of representation. A more fundamental question needs to be asked, namely what realism we want to construct now that the human is decentered from its privileged position and the social no longer the prime subject of reference. In this post-humanist realism, what relationship do we want to build between the audiovisual text and the transforming physical world?

Unlike a natural realism that wants to be a direct imprint of the world, this realism entails a process of construction. Neither a utopia nor a simple projection into the future, this constructive endeavor articulates localized realities with the Earth system in a cosmopolitical motivation to build a common sphere. I'm with Isabelle Stengers and Bruno Latour here who assert that this cosmos, this common world, does not already exist but needs to be fabricated. Beyond the complexity of a global social and economic reorganization, this realist project attends to the scale of intra-biospheric dynamics. In many cases, this process moves along the outer rim of representability.

Resource extraction generates a two-directional movement. Fossil and mineral materials, in order to be converted into exchangeable commodities, are stripped of the context within which they occur both in terms of their social histories of labor and displacement, and their natural histories of local ecologies and consumed landscapes. They experience the homogenizing time of commodity exchange. Hence to tie the materials back to their multiple histories and reveal the intractable character of raw materials is an effective aesthetic intervention in these trends. Moreover, *Deep Weather* turns to a second dynamic that is playing out not at the extractive but the exhaustive end of fossil fuel production that part which goes up into air at the short moment of consumption and that creates a lasting if undesirable future on its own. The view abruptly jumps from the tar sands to Bangladesh. There, the rising sea level and progressively violent cyclones demand of delta communities the hard manual labor of building protective infrastructures. We cannot represent climate change, but we can read it videographically through such sceneries. The crucial gesture here is to link the two remote sites through the atmosphere that is driving greenhouse gases around the planet. It is the voice-over that draws the otherwise invisible causal connection between the sites of extraction and the effects of exhaustion, a whispered voice breathing the narrative scraps into the air, intimate and visceral, diffusing with the atmospheric chemistry. The open questions documentary viewers might have about labor conditions or social realities of first nation communities in Alberta or populations in the Ganges delta remain unanswered. The vistas on these vast construction scenes are just that, sites of global warming at the far ends of a planetary relation. *Deep Weather* aspires to the recalibration of our sense of cause and temporalities in view of attuning

to such remote causalities. For what becomes increasingly evident is that the passage from a diffused soft cause to hard consequences is what defines the contemporary planetary condition.

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BIOGRAPHY

Ursula Biemann is an artist, writer and video essayist based in Zurich. Her artistic practice is strongly research oriented and involves fieldwork in remote locations where she investigates the ecologies of oil and water. Biemann published several books, her video installations are exhibited at international art biennials and museums worldwide and she is part of the collective art and media project World of Matter. www.geobodies.org

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A Meander in the Mycosphere

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KEY WORDS
fungi, environmental justice, aesthesis, photography, metaphor

Environmentally-themed conferences are taking place all around the world as I type. More often than not, discussions occur within the confines of soporific seminar rooms, far from the actual environments discussed. As part of the *Environmental Justice, "Collapse" and the Question of Evidence* Workshop held in Switzerland in September 2015, I proposed a foray through local nature reserves as a way of enriching conversations – both through multisensory engagement and the catalyzing effect of movement, of walking. Multi-sensory perception – or aesthesis – enables us to consider the environment not as an inert background to discussions, but as intrinsic to dynamic and creative thinking.[1] *In situ* discussions expose the spaces-in-between, reminding us that issues of environmental justice extend beyond *Homo sapiens*. They also foster opportunity to explore the intersections of wonder and understanding.

In taking advantage of the "natural" surrounds and autumn season, I overlaid another theme as we wandered and wondered: *Environmental Justice for Unregarded Others*, focusing on the literal and symbolic significance of fungi. These occupants of the interstices are largely unregarded because they slip through the net of environmental justice, as well as concepts of nature, biodiversity and conservation, overshadowed by *Homo sapiens* and other charismatic fauna. Fungi provide the connective fibre between all kingdoms through intimate underground alliances, underpinning almost every terrestrial ecosystem on the planet. How can we be serious about environmental justice for all life including *Homo sapiens* when an entire kingdom of organisms and their interactions are overlooked? How can we begin to talk about evidence and what Rob Nixon refers to as the hushed havoc and injurious invisibility of environmental violence if we are not attuned to the ancient yet modern mode of appreciation, of aesthesis?[2]

Slow wandering opens opportunity for exuberant interactions while connecting with environments, landscapes, weather and other species. It allows for a heightening of perception and sensitivity to nuance. Movement itself is a catalyst.[3] As anthropologist Tim Ingold notes, "Locomotion, not cognition, is the starting point for the study of perceptual activity."[4] The richest experiences often arise from serendipitous opportunities and unexpected encounters; through sensate engagement, rather than detached speculation. Given the diversity of workshop participants' disciplines, Karen Barad's optical metaphor of diffraction as a methodology that augments insights from multiple disciplines seemed fitting. Such an approach acknowledges entanglements by reading insights through one another diffractively, allowing for changes in meaning in different contexts and opening up new meanings, enabling a more subtle vision.[5] As well as examining the entangled nature of difference, most critically, it also links values and responsibility and hence possibilities for making a difference in issues of environmental justice.

The foray was not defined by a "goal" or "objective" or desired outcomes. Rather, it was about being open to the unforeseen. To the questions not yet formulated. It is a process that begins not with logic

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[1] John Ryan, "Towards Intimate Relations: Gesture and Contact Between Plants and People," *Philosophy Activism Nature* 9 (2012): 29-36.

[2] Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (London: Harvard University Press, 2011).

[3] Much as been written about the benefits and synergies of walking and thinking in stimulating ideas. A few recent titles include: Frédéric Gros, *A philosophy of Walking* (London: Verso: 2014); Robert Macfarlane, *The Wild Places* (London: Granta Books, 2007); Robert Macfarlane, *The Old Ways: A Journey on Foot* (London; Penguin Books, 2013); Rebecca Solnit, *Wanderlust: A History of Walking* (London: Verso, 2002).

[4] Tim Ingold, *Being Alive: Essays on Movement, Knowledge and Description* (New York: Routledge, 2011).

[5] Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (London: Duke University Press, 2007).

but with not knowing, informed by intuition and responsiveness.[6] How might evidence exist in other forms, in processes, in ways previously unimagined? How can evidence be experienced, narrated and represented in ways that transcend disciplines, allow multiple translations, and re-examine existing knowledge frameworks in a rapidly changing world?

Thinking and sensing with fungi provided another way to reimagine conference themes, for example, of collapse, evidence, justice, aesthesis and semiotics, translating them into other contexts and scales. The following photo essay offers an impression of the mycosphere of our foray. The images are visual metaphors. They are not meant to be understood in any way other than how the viewer chooses. They are intended to inspire rather than necessarily inform, to newly inflect these themes. A single word accompanying each image prompts the viewer. For example, emerging sporebodies (mushrooms) play with the idea of what constitutes evidence, providing just a hint of their clandestine activities in the subterrain. A log being decomposed and recycled by unseen fungi, challenges concepts of collapse, as something that regenerates life. Mushroom caps lightly dusted with spores remind us that knowing is also sensorial.

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BIOGRAPHY

Alison Pouliot is a Ph.D. student at Australian National University. As a freshwater ecologist, she endeavors to understand the processes that shape and transform ecosystems; as an environmental photographer, she aspires to capture their intricacies and obscurities in documenting environmental change. Shifting to the terrestrial subterrain, her current research addresses the disconnect between the diversity and ecological significance of fungi and the lack of attention to their conservation.

[6] Margaret Somervillle, " 'Waiting in the Chaotic Place of Unknowing': Articulating Postmodern Emergence," *International Journal of Qualitative Studies in Education* 21, no. 3 (May-June 2008): 209-220.


A forest foray


Connectivity


Affiliations


Collapse


Evidence


Metaphor


Aesthesis


Sensation


Semiotics


Justice

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In everybody's backyard? Examining the intersection of invasive alien species and environmental justice

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ABSTRACT
This paper explores the development of scholarship examining invasive alien species and their impacts from an environmental justice perspective. As the scope of the environmental justice field grows to encompass considerations of ecological integrity, invasive alien species should be part and parcel of this discourse, because they have the potential to harm human health directly and interfere with ecosystem services upon which vulnerable groups sometimes rely. Further, invasive alien species might cause environmental justice issues at the international level, as developing countries are likely at greater risk from their impacts. We propose that research should investigate the distribution of direct impacts from invasive alien species, as well as those via changes of ecosystem functioning and services, across different socioeconomic populations. We highlight the need for a holistic approach to understanding these impacts that includes environmental justice concerns and recommend the development of a framework that would enable consideration of cultural, ecological, economic, and social issues involved in the management of invasive alien species.

KEY WORDS
developed countries, developing countries, ecological integrity, ecosystem services, environmental justice, invasive alien species

As the field of environmental justice continues to grow and expand, there is increasing interest in examining how anthropogenic changes to the environment are playing out across human communities typically affected by environmental justice concerns. Recent papers by Neimanis et al. (2012) and Schlosberg (2012) have sought to expand the scholarship of the environmental justice discourse by integrating the concept of "ecological integrity". Within the context of a recent workshop entitled, *Environmental Justice, 'Collapse' and the Question of Evidence*, we examine the possible intersections between the fields of invasion science and environmental justice. Invasive alien species (IAS) represent complex problems in the field of conservation biology and are often seen as a threat to ecological integrity. The term IAS reflects the potential threat these species pose to biodiversity and human well-being, but their impacts are not always negative (e.g., Gozlan et al. 2010; Schlaepfer et al. 2011). The Neimanis et al. (2012) paper performed a review of the environmental justice literature and found that ecological considerations in general are rarely used to define environmental justice**.** As that study did not specifically examine IAS, we performed an informal survey of the literature using the keywords "invasive species" and "environmental justice" using Google Scholar and our institution's EBSCO[7] subscription and found very few studies that discuss IAS within an environmental justice perspective (or vice versa), indicating that these two fields have yet to be linked in a significant way.

This paper is intended to be an initial exploration of the potential overlaps between the fields of invasion science and environmnental justice. After a brief explanation of the various terms used in the fields, we draw on existing studies to examine how the direct impacts of IAS could affect vulnerable populations. We then explore how IAS affect ecological integrity and what that can (could) mean for environmental justice. Lastly, we consider the positive effects IAS may sometimes have and the role these could play in future scholarship. In so doing, we strive to identify possible areas of research which could enrich both fields and help us better understand and manage the challenges related to IAS in a manner that is cognizant of environmental justice issues.

EXPLAINING TERMINOLOGY

As a first step in this exploration, we provide some background on the various terminologies often encountered in the two literatures. In invasion science, different terms are used to describe species in various stages of establishing themselves in new environments. For the most part, the terms *non-native*, *introduced*, *alien*, *exotic* refer to organisms introduced via human activity to areas not considered part of their native habitat or dispersal range (Falk-Petersen, Bøhn, & Sandlund, 2006; Humair, Edwards, Siegrist, & Kueffer, 2014; Sax, Stachowicz, & Gaines, 2005). Once a group of non-native organisms has begun to reproduce and create a self-sustaining population, it is considered *established* or *naturalized* (Falk-Petersen et al., 2006; Sax et al., 2005; Walther et al., 2009). *Invasive* species are a sub-group of those established organisms that are spreading rapidly in new habitats and causing some type of damage to ecosystems, economic infrastructures, or human health (Humair et al., 2014; Info Flora, 2015; Sax et al., 2005). This aspect of causing harm makes biological invasions arguably relevant for environmental justice as impacts are likely not distributed equally across different social groups. The term *invasive alien species* highlights those species that are both non-native and invasive, to differentiate such species from native species that display invasive characteristics after other changes in their local environments (Valery, Fritz, Lefeuvre, & Simberloff, 2009). We will use the term invasive alien species (IAS) in this paper.

The term *environmental justice* describes a field of inquiry that developed out of the realization that certain groups in society often bear a disproportionate burden of environmental problems, such as pollution (Mohai, Pellow, & Roberts, 2009). These groups are neither responsible for the problems they have to

[7] EBSCO is a subscription-based search engine for scholarly articles commonly used by research libraries and is run by EBSCO Industries (www.ebsco.com).

deal with nor do they have the political capital to fight against the groups responsible for the problems. Even though environmental justice issues existed long beforehand, the field itself developed out of a controversy caused by a planned hazardous waste landfill in a predominately African-American county in the rural United States. The outcry over the landfill in Warren County, North Carolina inspired studies that found that poor minority communities were shouldering a large share of America´s hazardous waste (e.g. USGAO 1983; United Church of Christ Commission for Racial Justice 1987; Lee 1992). Scholarship in the field grew rapidly and environmental justice scholarship uncovered issues affecting other types of vulnerable groups, such as children, the elderly, and indigenous communities, in other regions of the world, and involving other environmental issues, such as climate change (Mohai et al., 2009; Schlosberg, 2013).

HUMAN HEALTH IMPACTS

The early environmental justice scholarship examined the direct impact of certain environmental problems (primarily exposure to toxic waste) on vulnerable communities. Similarly, we start our exploration with an examination of the direct human health impacts of IAS and how they (could) appear through an environmental justice lens. IAS can directly affect human health in a variety of ways, such as by transmitting disease, causing physical harm, triggering allergies, and creating toxins (Pyšek & Richardson, 2010). Thus, it can be insightful to examine the potential impacts of IAS on local vulnerable communities. In Switzerland, 15 of the 40 plant species listed as invasive in 2015 have the potential to harm human health (Info Flora, 2015). These include the common ragweed (*Ambrosia artemisiifolia*), whose pollen is a potent allergen, and the giant hogweed (*Heracleum mantegazzianum*), which contains a compound that can cause severe skin irritations. The effects from these plants do not discriminate per se: allergenic pollen floats through the air and toxic plants can affect all who come into contact. Nonetheless, there are likely environmental justice issues embedded in these effects. First, many of the listed plants are ornamental and have been intentionally brought into the country to decorate public and private spaces. Specific groups are likely responsible for their introduction but may not be the same groups bearing the impacts from the introductions. Further, as previous research has found that economically disadvantaged populations in Switzerland experience health inequalities, including higher risks for respiratory disorders (Reich, Wolffers, Signorell, & Blozik, 2014), there is arguably a need to assess if the health impacts from IAS represent an unfair burden to the already disadvantaged populations. Important aspects that assessments need to consider include what access different groups have to (a) information about the risks associated with these invasive species, particularly with respect to education level, and (b) medical care to deal with health impacts resulting from exposure.

ECOLOGICAL IMPACTS

Invasive alien species are perhaps more known for their ecological impacts. They can affect local ecological communities in various ways, such as via direct predation on, or competition and hybridization with native species, by introducing new diseases, and altering nutrient availability (Halverson, 2010; Rhymer & Simberloff, 1996; Simberloff et al., 2013). These interactions can lead to the disruption of or loss of members from the native community and can eventually change the affected ecosystem. For example, invasive lake trout (*Salvelinus namaycush*) prey heavily on native Yellowstone cutthroat trout (*Oncorhynchus clarkii bouveri*) in Yellowstone Lake in Yellowstone National Park (Gresswell, 2009). Besides being the major cause of the decline of cutthroat trout in the lake, lake trout has interrupted the energy flow between the lake and its surroundings habitats. Cutthroat trout represented an important food source for several species in the Park such as the grizzly bear (*Ursus arctos horribilis*), the bald eagle (*Haliaeetus leucocephalus*), and the American white pelican (*Pelecanus erythrorhynchos*), all of which have now moved to other areas to find other food sources. The brown tree snake (*Boiga irregularis*) is another well-known example of ecological impacts. The snake's introduction to the island of Guam led

to the extinction of the majority of the island's original species and greatly simplified its food webs (Fritts & Rodda, 1998).

As IAS disrupt the functioning of an ecosystem, so too do they disrupt the ecosystem services upon which human communities rely. Both Schlosberg (2012) and Neimanis et al. (2012) discuss the concept of "ecological integrity" with respect to environmental justice. Ecological integrity as a term refers to the quality of a given ecosystem and its ability to function effectively. Schlosberg (2012) in examining the application of the capabilities approach to climate justice and ecological integrity reasons that "it is the disruption and increasing vulnerability of the integrity of ecosystems that is at the heart of the injustice of climate change, both in terms of its impact on vulnerable human communities and nonhuman nature (178)." Yet, as mentioned above, Neimanis et al. (2012) found that the term "ecological integrity" was rarely a quality used to define environmental justice and they challenged the field "to create space and a place for the integration of ecological dependencies in environmental justice discourse (360)." Indeed, this call has not gone unheeded, as two recent studies examined environmental justice issues related to ecological integrity in urban (green) spaces (Berland, Schwarz, Herrmann, & Hopton, 2015; Wolch, Byrne, & Newell, 2014).

Research on invasive species and their potential impacts on ecological integrity represents another important addition to the field of the environmental justice scholarship. For example, certain groups depend more heavily on local natural resources for their well-being, such as communities in developing societies that rely upon local food or fuel sources (Nuñez and Pauchard 2010), a dependency that could be threatened by IAS. Further, ecosystem services, such as pollination of subsistence crops or water purification, can be subject to disruption by IAS, which in turn can disrupt the societies that depend on said services. It will be important for research to clarify how vulnerable groups are being affected by IAS, be it on a global or local level, and whether they are bearing an unfair burden of the impacts of species introduced by other, more politically powerful groups.

Environmental justice issues involving IAS also exist at the international level. Drake and Keller (2004) posit that the impacts from marine IAS introduced from ballast water fall much more heavily on developing countries than developed ones. Whereas developed countries benefit most from the international trade, developing countries lack the resources to deal with the unwanted impacts of the introduced species. Their paper also emphasized the need for further research and more data to understand and elucidate the levels of invasion and impacts. Nuñez and Pauchard's (2010) study supports Drake and Keller. It found that developing countries appear to have higher proportions of IAS, are more dependent on natural resources that can be affected by IAS, and have lower levels of education. Further, it discussed cases where projects in developing nations, sponsored by developed nations, employ IAS to achieve development objectives. Such projects may be rooted in good intentions, but could result in serious problems for local human and ecological communities. A related issue is the regulation of the export of potential or known IAS. For instance, a recent study of the international trade of plant IAS found that some developed countries with strong regulations on the import of IAS serve as sources for the export of known IAS to other countries (Humair, Humair, Kuhn, & Kueffer, 2015).

COMPLEXITY OF IMPACTS

Hitherto we have discussed only the negative impacts of IAS. However, there is recognition that IAS can also provide benefits to invaded systems (e.g. Schlaepfer et al., 2011). As Larson (2005) pointed out, the language surrounding species invasion and management often highlights IAS as the "enemy" while ignoring the fact that many species are introduced to new habitats by humans and that human disruption of said habitats has often enabled the "invasion". Viewing an IAS in purely negative way may prevent the recognition of potential positive values. For example, IAS may be important parts of novel ecosystems

that help maintain stability, such as the cinnamon (*Cinnamomum verum*) in the Seychelles, which has helped protect against further invasions (Kueffer & Kaiser-Bunbury, 2014).

The perception of the negative impacts that IAS often cause can also be subjective and vary among different stakeholders (García-Llorente et al. 2008; Simberloff et al 2013; Humair et al 2014). For example, the windmill palm (*Trachycarpus fortunei*) in southern Switzerland is valued as an ornamental tree by locals and is highlighted by the regional tourist industry. Yet, the palm is listed as an invasive species on Switzerland's Black List due to its potential to harm local forest biodiversity (Info Flora, 2015; Vogelaar & Hale, 2013). Additionally, non-native species can be simultaneously harmful and beneficial, even for the same group of stakeholders. Gozlan (2010) argues that the Nile perch (*Lates niloticus*) in Lake Victoria can be seen both as an environmental cataclysm (its introduction might have been responsible for the extinction of hundreds of endemic fish species) as well as an economic boon for the region (fisheries have grown exponentially in Lake Victoria since the establishment of the Nile perch in the lake). Similarly, invasive polychaetes (*Marenzelleria* spp.) are contributing to the displacement of native species in shallow areas of the Baltic Sea, but are also actively contributing to the improvement of the water quality by reducing bottom-water hypoxia (Norkko et al., 2012). Beyond the economic and ecological impacts, Pfeiffer & Voeks (2008) examined how IAS influence local cultural practices and traditions. They conclude that IAS can be classified according to whether their impacts can enrich, facilitate, or impoverish local human cultures, again highlighting the various types of impacts of IAS can have.

MANAGEMENT OF IAS

Preventing introductions in the first place is arguably the best way to manage IAS (Simberloff et al., 2013). Once IAS have been introduced, proper management requires a framework to address the complex issues related to the introduction that can examine and evaluate impacts as well as prioritize actions. Kueffer (2013) provides such a framework that allows the integration and production of information from across disciplines to deal with IAS. Although this framework is very useful, we recommend that it also include an explicit call to examine IAS, their full range of impacts, and possible courses of action from an environmental justice perspective. For example, it goes without saying that the removal or management of IAS is often costly economically (Leung et al., 2002). On the other hand, not managing IAS can be expensive as well, in terms of dealing with impacts to local ecosystems, vulnerable communities, and economic infrastructure. In both cases, the costs associated with the IAS are potentially being borne by third parties, which may include ones vulnerable to environmental injustices. This recognition is vital to reduce the chances of unnecessary impacts on vulnerable groups.

Management actions should also be weighed against other potential needs of a vulnerable or affected community. Sometimes, the goals of IAS control and community improvement might work together. For example, IAS control or removal programs can provide local employment, such as the Working for Water program in South Africa (Nuñez & Pauchard 2010). They can also serve to help develop a better connection of locals to their environment, develop a local sense of community, and assist in greening urban areas (Krasny & Tidball, 2012). However, other removal programs might result in conflicts that involve justice issues. A review of 28 case studies of conflicts involving IAS removal programs discussed several programs where local communities who valued IAS for various reasons were at odds with scientists and resource managers who desired to remove the species for conservation reasons (Estévez, Anderson, Pizarro, & Burgman, 2015). An examination of the different groups involved in these and other cases that includes an understanding of the power differential across stakeholders, the kinds of impacts being caused by the IAS, and the distribution of impacts across groups would be essential to ensure a management that does not create more problems than it solves.

OTHER POTENTIAL AREAS OF SCHOLARSHIP

An expansion of the environmental justice field along the lines of ecological integrity opens up other possibilities for fields of research. These are generally beyond the scope of this paper, but we mention them here as they represent potentially interesting areas of scholarship. For example, one could move beyond examining humans as the only victims of environmental injustices to include other organisms, which are affected when IAS disrupt ecological communities (Neimanis et al 2012; Schlosberg 2012). One could also argue, following Larson (2005), that IAS are in some sense victims themselves, functioning as a scapegoat for human activities that led to and facilitated the invasions. Thus, scholarship could explore how an alternative perspective with IAS as victims could alter how we perceive and manage them. Lastly, there is the potential to revise the language used in invasion science to use less value-laden terminology. An ongoing debate within the field of invasion science has tackled the field's language use that some claim carries racist or xenophobic connotations (e.g. Davis et al., 2011; Larson, 2005; Simberloff et al., 2013). Indeed, the European designation of a "black" list to describe the list of the most problematic IAS could be viewed by some as problematic in itself. Language and terminology are important because, as Kueffer and Larson (2014) point out, they can drive management actions: extreme language can lead to extreme action, which can be particularly problematic for a field where impacts are likely variable and fall differently across different stakeholder groups.

CONCLUSIONS

As the scope of environmental justice expands to incorporate the integrity of ecosystems, incorporating scholarship on IAS with an environmental justice perspective represents an important area for research. IAS have been designated as such for the harm they cause or are perceived to cause to humans, economic systems, and nature, but the distribution of these effects has rarely been examined through an environmental justice lens. In particular, there is a need to identify instances where vulnerable groups are carrying a greater burden from IAS or where the impacts of the management of IAS falls more heavily on these communities. We encourage the use of a framework that allows consideration of cultural, ecological, environmental, justice, and social perspectives when deciding upon management actions for IAS.

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Confronting Collapse: Environmental Science at the End of the World

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On 1 May 1973, the biologist Barry Commoner appeared on *Firing Line*, hosted by William F. Buckley, the conservative political pundit. By 1973, Commoner was arguably the most visible and outspoken radical voice in American environmental politics. He had, in 1970, appeared on the cover of *TIME* magazine as "the Paul Revere of Ecology," and his book, *The Closing Circle* (1971), which articulated his now-famous Four Laws of Ecology, had been well received. For his part, Buckley, an erudite and articulate writer and broadcaster, presented a worthy debate foe. The subject was "Is there an Ecological Crisis?" In his preamble Buckley insinuated the question seemed less urgent in 1973 than it had a few years earlier. Commoner disagreed. The discussion veered toward environmental policy, with Commoner criticizing President Richard Nixon for backing away from much of the strong environmental policy he had signed during the first two years of the decade. Commoner wanted more: more investment in environmental remediation, more enforcement of environmental legislation, more stringent guidelines for various production processes. In effect, Commoner insisted that the economic system needed to be confined by the limits of the ecological system:

> Buckley: "I hope you, if President of the United States, would not appoint as Secretary of Defense somebody who would superordinate the problems of ecology over those of national sovereignty."
> Commoner: "Well, that is your hope; mine is the reverse."
> Buckley: "Why would you call him Secretary of Defense? Call him Secretary of Undefense, or Secretary of Surrender."
> Commoner: "Why don't we call him Secretary of Survival?"[8]

Commoner's is a good line. But set aside, for the moment, any wistfulness for a time in American politics when disagreement could be engaged through civil discourse or for a time in which such interlocutors might correctly pronounce and use the word "superordinate." Set aside, too, the fact that Commoner would indeed run for President of the United States in 1980 (this was not a long-range announcement of his candidacy, or that an oil crisis later that year would vindicate Commoner's case that the environment remained a topic of critical importance. Concentrate, instead, on Commoner's final idea of having a Secretary of Survival. For Commoner, this was not a rhetorical flourish but rather a sincere assertion that the urgency required to address the environmental crisis superseded (and, indeed, was interconnected with) geopolitical and socioeconomic imperatives. This paper, like Commoner, takes seriously the idea of survival as it relates to the science developed to confront the environmental crisis.

The post-World War II period witnessed a shift in environmentalism. Whereas before 1945 environmental protection was understood in terms of saving nature from the onslaught of civilization, after 1945 it had become an exercise in saving civilization from itself. At risk was not just the physical environment, but also people and their health. Through growing concerns over nuclear radiation and the ubiquity of synthetic chemicals in air, soil, and water—as demonstrated, for example, by Rachel Carson in 1962's *Silent Spring*—the popular consciousness came to realize that the body was an ecological landscape under threat. In 1948, Fairfield Osborn and William Vogt penned neo-Malthusian treatises that examined humanity's growing rapaciousness for natural resources, and warned that over-consumption and population growth had us hurtling towards an apocalyptic tipping point. The Cold War—with its new weaponry and its potential to turn hot at any

[8] "Is There an Ecological Crisis?" *Firing Line with William F. Buckley Jr.* First aired on PBS (1 May 1973).

moment—presented the first context in human history for the complete and utter destruction of civilization. And the view of Earth from space underlined the planet's finite nature.[9]

Against this backdrop, the prospect of ecological collapse seemed frighteningly possible. The Club of Rome's classic 1972 book, *The Limits to Growth*, showed that humanity was in grave danger of overshooting the Earth's carrying capacity in the imminent future. A year later, E. F. Schumacher's *Small is Beautiful* presented a compelling argument that countered the necessity of economic growth. Humanity needed to control its appetite for the world's finite resources and learn to work with less. In times past, doomsday prophets had emerged as a counterweight to spiritual authority. Apocalyptic warnings came from outsiders, dissenters, radicals, and their predictions were ignored in the hallways of power. After World War II, well-established science and scientists were communicating the warning and world leaders were heeding the message.[10]

On a less cosmic scale, scientists found themselves responding to myriad environmental problems the world over. Mercury pollution of water systems; synthetic fertilizer run-off from agriculture; hazardous emissions from manufacturing plants; air quality problems in major urban areas; new chemical compounds—dioxin, PCBs, etc.—appearing throughout the food chain and in human bodies. If any of these didn't seem as globally terrifying as the prospect of nuclear war, in many circles it did augur planetary death from a thousand cuts. While ecological integrity emerged in the popular consciousness as a new priority, the discovery of these assaults on the planet—and, by extension, on human health—recruited a novel or distinct scientific response.[11]

This essay proposes a lens for examining the recent history of science as it pertains to the environmental crisis. I introduce the concept of "survival science" as an organizing tool for understanding the working worlds in which various sciences functioned during a period of intense environmental disruption. Survival science as I use it here brings together a series of historical practices that worked at the social boundaries of scientific work. Many of its practitioners (some are discussed below) recognized that the work in which they engaged functioned beyond the traditional interpretations of "pure" or "proper" science. I draw on survival science as an organizing tool to bring together various labels and to stress the social significance of survival as a new environmental imperative.

By way of rough, working definition for survival science as it evolved through the post-war period, some general requisite criteria are necessary. Rather than a singular disciplinary practice, survival science constituted synthetic, multidisciplinary sciences in which the boundaries between "basic" and "applied" research were blurred or non-existent. It also demanded new approaches to environmental problems, and pitted scientists in a novel socio-political dynamic where scientific evidence ran up against economic and regulatory imperatives, local and industrial interests, and a newfound urgency provoked by fears of imminent environmental collapse on local and global scales. Survival sciences were reactionary, invariably responding to a newly-discovered but extant problem.

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[9] Rachel Carson, *Silent Spring* (Boston: Houghton-Mifflin, 1962); Fairfield Osborn, *Our Plundered Planet* (Boston: Little, Brown, 1948); & William Vogt, *Road to Survival* (New York: W. Sloane Associates, 1948).
[10] Donella H. Meadows et al., *The Limits to Growth* (New York: Universe Books, 1972); & E. F. Schumacher, *Small is Beautiful: Economics as if People Mattered* (New York: Harper & Row, 1973).
[11] This paper focuses on the scientific response. For popular ecological thinking, see Michael Egan, "Shamans of the Spring: 1960s Environmentalism and the New Jeremiad," in *New World Coming: The Sixties and the Shaping of Global Consciousness* edited by Karen Dubinsky et al. (New York: Palgrave Macmillan, 2009), 296-303.

Interest in the point at which a particular chemical exposure posed adverse health risks in humans was a line of inquiry typically inspired by the discovery of that chemical's presence in the environment. Survival sciences were also mission-oriented, which is to say that they were primarily problem-solving ventures, designed to quickly make sense of a discrete problem. In this respect, traditional scientific inquiry merged with engineering solution-based approaches. Such ventures were also invariably *adisciplinary*. In establishing his Center for the Biology of Natural Systems in 1966, Commoner argued that traditional academic disciplines were not independently equipped to tackle environmental problems. Adisciplinarity required a breaking down of traditional disciplinary jargon and vocabulary, creating a more vernacular method of communicating amongst collaborators, but also with the public and with regulators. Finally, survival science was politically engaged. Their findings, however incomplete, were designed to help shape remedial policies in the face of some environmental emergency. The conservation biologist Michael Soulé artfully used the metaphor of a "shuttle bus going back and forth, with a cargo of ideas, guidelines, and empirical results in one direction, and a cargo of issues, problems, criticism, constraints, and changed conditions in the other."[12] Historian Jerome Ravetz offers a nice comparison along this line, emphasizing the social importance of survival science. Whereas scientists in a less crisis-driven period "chose their problems and investigated them under the guidance of the criteria of value and adequacy established by a communal consensus of their peers and mentors …, that haven is no more."[13] It is hardly exaggeration to submit that survival science and the social politics it engendered constitute one of the most profound changes in the history of science since World War II.

There is often a danger that historians of science impose a presentist interest on past actors, but in coining "survival science," I am responding to a very conscious change in praxis orchestrated by numerous environmental scientists all over the world. At the end of 1985, for example, in a short essay in the journal *BioScience*, conservation biologist Michael Soulé used the term "crisis discipline" to describe his area of specialization. In "What is Conservation Biology?," Soulé argued that conservation biology was to other biological sciences as "surgery to physiology and war to political science."[14] The analogy stressed the imperative of action in conservation biology—or practice over theory—but also the nature of the problems scientists confronted. In his conclusion, he observed:

> The current frenzy of environmental degradation is unprecedented, with deforestation, desertification, and destruction of wetlands and coral reefs occurring at rates rivalling the major catastrophes in the fossil record and threatening to eliminate most tropical forests and millions of species in our lifetimes. The response must also be unprecedented. It is fortunate, therefore that conservation biology, and parallel approaches in the social sciences, provides academics and other professionals with constructive outlets for their concern.[15]

Crisis disciplines also implied an epistemological shift away from traditional scientific practice. "In crisis disciplines," Soulé wrote, "one must act before knowing all the facts; crisis disciplines are thus a mixture of science and art, and their pursuit requires intuition as well as information." Such a statement might undermine traditional scientific authority, but to Soulé this was an unavoidable reality. The nature of crisis rarely permitted sufficient time to complete exhaustive research, never

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12 Soulé, "Conservation Biology and the 'Real World,'" in *Conservation Biology: The Science of Scarcity and Diversity* edited by Soulé (Sunderland, MA: Sinauer, 1986), 3.
13 Jerome R. Ravetz, *Scientific Knowledge and its Social Problems* (New Brunswick, NJ: Transaction, 1996), xi. The quotation is from a new introduction; *Scientific Knowledge and its Social Problems* was originally published in 1971.
14 Michael E. Soulé, "What is Conservation Biology?," *BioScience* 35 (December 1985), 727-734. Quotation is on page 727.
15 Soulé, "What is Conservation Biology?," 733.

mind definitively answer scientific or policy questions posed of it. Scientists engaged in crisis disciplines "may have to make decisions or recommendations about design and management before he or she is completely comfortable with the theoretical and empirical bases of the analysis."[16] Reflecting on this period more broadly, Ravetz referred to a shift in scientific practice, which he called "post-normal science," where "facts are uncertain, values in dispute, stakes high, and decisions urgent."[17]

Conservation biology, environmental toxicology, cancer biology, the science of the total environment, as well as much more direct responses to such environmental problems such as mercury pollution, acid rain, and chlorine-based contamination functioned in just such a context. Scientific investigations into environmental problems took on an urgency that required the rapid delivery of new kinds of knowledge, not always complete. For example, when scientists in Sweden deliberated on what constituted an acceptable level of mercury in fish for human consumption, the toxicological values were altered after discovery that their preliminary evaluations threatened to close an entire fishery in Lake Vänern. Their data was sufficiently incomplete that policymakers and representatives from the fishing industry could claim that since no cases of mercury poisoning had yet emerged in Sweden, the numbers were far too conservative.[18]

Soulé's essay was written in the middle-1980s, but he was introducing conservation biology into an older development in scientific discourse. In 1972, the nuclear physicist Alvin Weinberg lamented that responses to social problems "hang on answers to questions which can be asked of science and yet *which cannot be answered by science*."[19] For example, seeking an answer to what constituted an acceptable exposure to low-level nuclear radiation was impossible in terms of receiving a specific, individual accounting. There was no magic number after which exposure should be taken more seriously. The best scientists could do was extrapolate averages at which they felt confident that minimal hazard might occur. To some degree, this was educated guesswork. But evaluating risk was steeped as much in qualitative moral values and fears as it was in quantifiable scientific empiricism. Scientists, Weinberg contended, were at home with quantifiable empiricism and technically sweet problems, but they had no special expertise when it came to moral questions. And yet, these questions—which science could not answer—were being asked of it with increasing concern and regularity. To Weinberg, this was a "trans-scientific" question, because its answer transcended, or demanded, more than just science.

And science was facing its own inner crisis. Weinberg was consciously responding to the transformation that had occurred in American science in the previous decade (in 1971, Weinberg famously referred to nuclear energy as a "Faustian bargain"). Whereas in 1960 *TIME* magazine had heralded American scientists as "statesmen and savants, builders and even priests"—they were the "true 20th century adventurers, the real intellectuals of the day"—whose work had touched the "life

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16 Soulé, "What is Conservation Biology?," 727.
17 S. O. Funtowicz & J. R. Ravetz, "Three Types of Risk Assessment and the Emergence of Post-Normal Science," in *Social Theories of Risk* edited by S. Krimsky & D. Golding (Westport, CT: Prager, 1992), 251-273. Quotation is on 254.
18 Egan, "Communicating Knowledge: The Swedish Mercury Group and Vernacular Science, 1965-1972," in *New Natures: Joining Environmental History with Science and Technology Studies* edited by Dolly Jørgensen, Finn Arne Jørgensen, and Sara B. Pritchard (Pittsburgh: University of Pittsburgh Press, 2013), 103-117. See 112-113.
19 Alvin M. Weinberg, "Science and Trans-Science," *Minerva* 10 (April 1972), 209-222. Quotation is from page 209.

of every human on the planet," by 1970, a popular hostility towards science had emerged.[20] Science was an integral part of the "war/space machine," according to *The Nation*. Suspicion towards science had grown, as Americans identified in the apparently merged science and technology the source of "war, pollution, and every manner of evil."[21] Confidence had waned in science, but science was also seen as responsible for the period's disillusionment. For Weinberg, some of this disenchantment with science stemmed from asking trans-scientific questions, which "science" could not answer. Science seemed fallible, unable to explain or understand the brave new world it had created or the health and environmental hazards that the new world presented. While survival science represented a recognition that the threat of environmental catastrophe required new approaches, it was also situated in time. By the beginning of the 1970s, distrust in traditional science—which occurred in technical language and was conducted behind closed doors—demanded a new approach to science communication. That became a central tenet of politically engaged crisis disciplines.

As a scientific counterpoint to the decline of scientific authority, *TIME*'s 2 February 1970 cover showed the biologist Barry Commoner, an irreverent and anti-authoritarian scientific voice. Commoner was "the Paul Revere of Ecology," and championed the "emerging science of survival" against the backdrop of the plundered planet wrought by science and technology. Commoner was an apt choice for the *TIME* cover on the eve of the first Earth Day (22 April 1970). After raising public awareness of the radiation hazards posed by aboveground nuclear fallout in the late 1950s, he spent the 1960s shifting his focus to a number of different issues that rested at the heart of the new environmentalism. In addition to fallout, Commoner expressed concerns about the increasing use of synthetic pesticides and fertilizers and their contamination of groundwater. He communicated his fears about the abundance of plastics being produced and the petrochemical industry's turn to materials that did not break down in nature; he campaigned for stiffer controls over such hazardous heavy metals such as mercury and lead, which were omnipresent in production methods and spreading into the food chain and into humans at alarming rates. His writing, teaching, and activism during this period featured waste, pollution, and the need for measures to restore clean air, soil, and water. In addition, Commoner articulated explicit links between conflict, poverty, and environmental deterioration. If any single environmentalist effectively captured the complex panoply of new environmental issues confronting Americans and the world during the 1960s, it was Barry Commoner.[22]

Commoner also acted as an important contributor to the rise of survival science. His emphasis that the new approach to environmental problems must necessarily be adisciplinary stemmed from his growing appreciation that the environment must be analyzed in its entirety. This is not ecology, but rather a more systems-oriented approach to the environment's interrelations and interconnections. As he noted in 1965: "The scale and intensity of the biological and technological activities of man which affect the environment has now begun to approach the scale of the environment itself."[23] Whereas the environment had typically been regarded as an infinite sink for the hazardous products

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[20] "Men of the Year," *TIME* (2 January 1961), 40.
[21] "The Scientists' Dilemma," *The Nation* (18 January 1971), 69. *TIME* and *The Nation* are quoted in Kelly Moore, *Disrupting Science: Social Movements, American Scientists, and the Politics of the Military, 1945-1975* (Princeton: Princeton University Press, 2008), 1.
[22] For more on Commoner, see Michael Egan, *Barry Commoner and the Science of Survival: The Remaking of American Environmentalism* (Cambridge, MA: MIT Press, 2007).
[23] CBNS Grant Proposal (1965). Document held in the Barry Commoner Center for Health and Environment offices, CUNY-Queens, NY.

of human activity, the intensity of technological activity after World War II put into question the total environment's capacity as a reservoir. Nuclear weapons, the massive expansion of chlorinated hydrocarbons, the widespread adoption of synthetic biocides and fertilizers combined with discoveries that the Earth's biological systems did not function as previously imagined. New, synthetic materials did not break down. Many accumulated, detrimentally, within biological organisms, most concerningly within humans. Commoner's Four Laws of Ecology—that everything was connected to everything else; that everything must go somewhere; that nature knew best; and that there was no such thing as a free lunch—highlighted these facts. They were the product of research into a much broader examination of the physical environment than had previously been undertaken. His adisciplinary approach resisted the boundaries established by singular disciplines such as biology, ecology, or plant physiology (in which he had originally been trained).

Much of this work had been conducted at the Center for the Biology of Natural Systems, which he had founded at Washington University in 1966. In September 1965, Commoner submitted a proposal to the U.S. Public Health Service for funding for the creation of a scientific research centre that would tackle the growing number of environmental threats to human health. Commoner was the principal investigator of a team of St. Louis-based collaborators, who included members of the departments of botany, zoology, physics, and chemistry, as well as colleagues from the Medical School at Washington University, the St. Louis Zoo, and the Missouri Botanical Garden. As Commoner wrote in the grant proposal:

> At the present time, the interactions between man and his environment are undergoing quantitative and qualitative changes of such a magnitude as to create wholly new problems. The present problems of environmental health have rapidly begun to outrun our understanding of the complex processes that mediate the interaction between organisms and the environment. There is, therefore, an urgent need to reorganize our scientific approach to environmental health problems, so that we can find new ways to bring the growing power of modern science to bear on them.[24]

The application is a remarkable document. It articulated the state of the environmental crisis and how the new center could serve as intermediary between knowledge production, policy-makers, and the public. The Center became a clearinghouse for all manner of environmental investigations. Their work on synthetic fertilizer use and run-off in the farm area around Decator, IL, in the late 1960s reinforced the manner in which new technologies did not always behave the way people wanted them to. During the same period, the Center's researchers were among the first to raise awareness of mercury pollution in the United States. They also tackled the question of photochemical smog in cities. In each instance, their efforts consisted of raising public awareness, translating technical information into accessible language for the public, and working collaboratively across a number of scientific disciplines.[25]

If the crisis disciplines that made up survival science changed the nature of science and how it approached the environmental crisis, it is important to stress that the environmental crisis provoked new ways of looking at the physical environment. The potential harm of rising mercury levels in fish for human consumption, for example, demanded quantitative and qualitative evaluations (Weinberg's trans-science) of newly gathered data, drawn from very specific and urgent questions. The environmental crisis also dictated that the physical environment was bereft with human-induced

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[24] CBNS Grant Proposal.

[25] For more on Commoner and the Center for the Biology of Natural Systems, see Egan, *Barry Commoner and the Science of Survival: The Remaking of American Environmentalism* (Cambridge, MA: MIT Press, 2007).

problems that threatened to strike back at human health. Indeed, much of the new work was reactionary in nature—trespasses into nature had already occurred, and scientists scrambled to resolve the environmental problem while simultaneously trying to understand the nature of the hazard.

By way of conclusion, a few caveats and thoughts for further analysis. This paper deliberately skirts the subject of expertise. Survival science radically transformed what expertise meant in modern science and how expertise was used to advance knowledge and justify policy decisions. Practitioners of crisis disciplines were still regarded as experts and often as public intellectuals, even if many of them were disinclined to claim definitive knowledge. Tellingly, Soulé pointed out, in crisis disciplines, "tolerating uncertainty is often necessary."[26] Uncertainty is a critical component of crisis disciplines—and of survival science more broadly. Further work needs to illuminate the place of uncertainty in science, especially as it pertains to ideas about expertise and authority.

On some level, survival science merely constituted tacit acknowledgment that science and society were inextricably linked. Asking trans-scientific questions demanded that science come into conversation with economics, politics, values, and forms of local knowledge. While such a dynamic arguably weakened the authority of scientific expertise, it was hailed in some corners as a democratization of science. This is an important shift. Writing in the mid-1980s, Steve Shapin and Simon Schaffer concluded *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, their brilliant study of early modern science with a critique of mainstream scientific practice from their vantage point. "Now we live in a less certain age," they wrote:

> We are no longer so sure that traditional characterizations of how science proceeds adequately describe its reality. ... Our present-day problems of defining our knowledge, our society, and the relationships between them centre on … dichotomies between the public and the private, [and] between authority and expertise. ... We regard our scientific knowledge as open and accessible in principle, but the public does not understand it. Scientific journals are in our public libraries, but they are written in a language alien to the citizenry. We say that our laboratories constitute some of our most open professional spaces, yet the public does not enter them. Our society is said to be democratic, but the public cannot call to account what they cannot comprehend. A form of knowledge that is the most open in principle has become the most closed in practice.[27]

In many ways—explicitly and implicitly—survival science was a conscious break from this paradox. The democratization of science evidenced in much of the survival science practice was meant to be inclusive and designed to redirect science more squarely back towards producing knowledge for the public good (however urgently that knowledge was needed).

At the same time, crisis disciplines typically lacked the social and political standing of the more traditional scientific disciplines. This meant less funding. But it also meant—absent short-term responses to newfound problems—less policy influence. And, here, let me submit that climate science has become a crisis discipline with its myriad cooperations between meteorologists,

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[26] Soulé, "What is Conservation Biology," 727.

[27] Steven Shapin & Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985), 343.

oceanographers, geophysicists, biologists, physicists, mathematicians, geologists, and other specialists.[28]

But what of historical significance? Survival science persists. Health risks and hazards are still measured not objectively but in the context of a murkier algorithm that acknowledges myriad cultural and socio-economic priorities. I submit three lasting outcomes of crisis disciplines and their activities during the latter half of the twentieth century. Survival science helped give voice—and empirical evidence—to the environmental crisis as a crisis of civilization. In the manner in which groups of scientists were teamed in unorthodox ways to explain and resolve discrete environmental problems, survival science irrevocably altered scientific praxis. Finally, inasmuch as survival science engaged multiple audiences of local and industrial interests, policymakers, media, and other scientists, it authored a new, vernacular science, which transformed the public understanding of science as well as the public participation in science and politics. Lest this sound too triumphal, this third point requires further analysis and complication. In spite of the explicit attempts to create a more vernacular language for science information and practice in order to better encourage public participation, a growing science illiteracy has been the dominant trend in North America and in much of Europe. Science (traditional and survival) remains walled off from many aspects of public life, sequestered from people confronted with environmental hazards where they live, work, and play. But survival science has also opened avenues of dialogue through which citizen science and greater public participation might more effectively contribute to social efforts to realize a more resilient future.

BIOGRAPHY

Michael Egan is associate professor of History and University Teaching Fellow at McMaster University. His research examines the interstices between science, environment, and policy. He is the author of *Barry Commoner and the Science of Survival: The Remaking of American Environmentalism* (MIT Press, 2007), and the series editor for *History for a Sustainable Future* (MIT Press).

[28] "Until the 1980s, discussions of anthropogenic climate change had been confined largely to the scientific community. There had been some political awareness and media coverage during the 1970s, but the issue was too new and abstract to receive much of a hearing. Moreover, the scientific consensus about warming was relatively weak. But the 1980s were a watershed decade, as scientific agreement about anthropogenic warming strengthened and the issue became political for the first time." J. R. McNeill & Peter Engelke, "Into the Anthropocene: People and their Planet," *Global Interdependence: The World After 1945* edited by Akira Iriye (Cambridge, MA: Harvard University Press, 2014), 429.

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Biophilia on Purpose: A Declaration to Become an Ecosocial Citizen

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KEY WORDS
African-Americans, biophilia, ecological citizenship; environmental justice; global citizens

> Despite the interventions designed to restrict, subvert, and deny black life, on the American landscape African Americans utilize agency, identity, and civic engagement as a means to expand this narrative of disenfranchisement. Adaptiveness, resilience, fearlessness, and courage wasn't the anomaly, but was the reality.
>
> —Carolyn Finney, *Black Faces, White Spaces: Reimagining the Relationship of African-Americans to the Great Outdoors*

> Our inborn affinity for the natural world is, in effect, a birthright that must be cultivated and earned. For a creature of learning and free will, this is not a hard-wired outcome, but one that requires conscious and sustained engagement. To become adaptive and beneficial, our biophilic tendencies must be learned through experience and be supported by others.
>
> —Steven Kellert, *Birthright: People and Nature in the Modern World*

Inspired by the conceptual capital of my ancestors and intrigued by the social influence of global elites' monetary capital, I am in search of a new, broader concept of citizenship. I am in agreement with Stephen Kellert who suggests, in the epigraph above, that we need greater biophilic fitness to adapt to the demands of our times. As Kellert points out, our "birthright" is something that must be cultivated and supported. My study of African-American ecological traditions has given me firm examples of how a dehumanized population is able to cultivate and support its biophilia. Carolyn Finney rightly identifies that "adaptiveness" has been a long part of African-American tradition; it has been a hallmark of our ecological outlook. This tradition and reflection on the "alternative citizenship" of global elites has sparked in me the desire to begin adapting to what I consider to be the age of the ecosocial citizen.

"Ecosocial citizenship" requires civic participation informed by the interconnectedness of ecological and social worlds. It is not because the relevance of the nation-state or nation-state citizenship has expired (although globalization is challenging the nation-state as the dominant form of social organization). Instead, we are in an era in which our ability to meet our fundamental needs is not only driven by the health of nation-states but also the endangered health of interconnected global ecosystems which support the world's web of social systems.

It might seem odd that super-rich global elites in the 21st century inquiring about citizenship-by-investment and the 20th century's last generation of racialized, unpaid, enslaved labor in the U.S. were the catalyst for my newfound identity as an ecosocial citizen. Yet, Franklin University Switzerland's "Environmental Justice, Collapse, and the Question of Evidence" conference brought discussion of these groups together and sparked this development in my thinking. My presentation's focus on the lives of people enslaved in early U.S. history ("Averting Collapse? Challenges to African-American Ecological Citizenship") and Phillippe Forêt's presentation, "In Anticipation of Collapse: Citizenship, Mobility, and Evidence" encouraged me to think about more than the stark differences between these groups. In fact, it was the groups' similarities that led me to see a familiar topic with new eyes.

Both yesterday's enslaved African-Americans and today's global elites have different kinds of capital that affirms their humanity and propels them to try to secure their future. Either implicitly or

explicitly inspired by biophilia, "the innate tendency to focus on life and lifelike processes" (Wilson, 1984, p. 1), they direct this capital to gain greater association with nurturing human and non-human affiliations.

In my book *Black on Earth: African-American Ecoliterary Traditions*, I found that conceptual capital enabled Blacks to self-certify as biophilic actors in the face of persistent dehumanization. Particularly during enslavement, circumscribed social participation meant they were challenged in using human systems to secure their own bodies and their connections to non-human nature. The simultaneous misperceptions that they were less than human and less intellectually capable supported their exclusion from human systems. Enslavement and subsequent institutional and individual racism were firmly supported by the message that people of African descent were sub-human, ape-like beings incapable of "human" behavior. This pernicious history and present could have meant the full collapse of African-American attempts to support their biophilia. However, African-Americans have a triumphant record of self-certified biophilia that enriched their connections to non-human nature and emboldened them to change human systems built to exclude them.

By "self-certified biophilia" I mean the ability to affirm their humanity and engage with the rest of the natural world outside of social systems that denied their humanness. "Seeds of Memory: Botanical Legacies of the African Diaspora" is just one of several studies Judith Carney has provided which document African-American botanical knowledge and application. In this study Carney notes that a focus on slavery's commodity crops yields no insight into the richness of African American ecological agency. She elucidates the way in which subsistence crops allowed them "to ward off hunger, diversify their diet, reinstate customary food preferences, and to treat illness" (Carney, 2013, p. 30). In doing so, they asserted their biophilic connection to specific plants and maintained "traditional dietary preferences across space and the dislocations of geography" despite the "property rights [of] plantation owners [who asserted] the power to claim that knowledge as their own and transmute it over time as proof of their presumed ingenuity" (Carney, 2013, p. 30). This tradition of botanical knowledge empowered African-Americans to embrace their humanity by forging non-human ecological connections while they also fought for rights within human systems. In fact, a tradition of self-certified biophilia engenders value and care which can alleviate the disappointments of social alienation. As E.O. Wilson (1984) notes, "to the degree that we come to understand other organisms, we place a greater value on them, and on ourselves" (p. 2).

We are only beginning to understand the full dimensions of the conceptual capital engendered by African-American self-certified biophilia. "Environmental justice," a most necessary cause, continues to be the default framework in which African-American ecological participation gets credit. However, as Carolyn Finney (2014) notes, "One of the biggest challenges for individuals whose work is considered 'environmental' is how quickly anything related to African-Americans gets designated as an 'environmental justice' concern" (p. 108). In my research, I came across other dimensions of this conceptual capital that suggest biophilia's power. One of the most memorable records I found was the record of Clara Davis, a formerly enslaved woman in Alabama, whose interview was recorded as part of the Federal Writers Project. She relays:

> White folks, you can have your automobiles and paved streets an' electric lights. You can have de busses an' street cars an' hot pavements an high buildin' caze I ain't got no use for 'em no way. But I'll tell you what I does want. I wants my ole cotton bed an' de moonlight nights a shinin' through de willow trees an' de cool grass under my

> feets as I runned roun' ketchin' lightin' bugs. I wants to hear de sound of de hounds in de woods atter de 'possum, an' de smell of fresh mowed hay. I wants to feel de sway of de ol' wagon a-goin' down de red, dusty road . . . I wants to see de dawn break over de black ridge an' de twilight settle . . . spreadin' a sort of orange hue over de place. I wants to walk de paths th'ew de woods an' see de rabbits an' watch de birds an' listen to frogs at night. (Born in Slavery: Slave Narratives from the Federal Writers' Project, 1936-1938)

While Davis' disinterest in modern urban development might be cast through the lens of environmental justice, her remarks also convey her deep connection to non-human nature and desire for its beauty. She does not allude to validation within human systems as her concern; instead, she stresses the importance of non-human connection. In doing so, she suggests that these connections are more than amenities of rural life, they are central to her well-being. Because she notes how desirable human-non-human relationships are, she's left behind traces of conceptual capital that enrich our understanding of biophilia in the lives of those for whom social influence is limited.

Philippe Forêt's presentation on global elites turned my attention to how monetary capital can support the biophilia of those with incredible influence in the social sphere. This kind of capital enables global elites to travel the world relatively unencumbered by a single nation-state citizenship. For instance, Henley & Partners, a residence and citizenship planning firm, provide rationale for "why you need alternative citizenship" on their website. Providing explanation of their services, they maintain that they assist global citizens with "quality of life, education, mobility, security, and tax" [which are] "tools [they] want… in an international and global world" (Our Expertise). Unlike the economically disenfranchised, these global elites can use monetary influence to ensure their place in social systems that support their humanity. Using the financial capital they have on hand, they make clear investments to obtain privilege in human systems. Despite the objections of people who do not agree with the practice, they "shop" for attractive human systems that ensure them a measure of social security. Forêt's work suggested, however, that not even super-rich global elites with multiple forms of national citizenship can buy their way out of ecological collapse.

Talking about the formerly enslaved alongside global investment citizens made me more aware of the interconnectedness of ecological and social systems and human need for both human and non-human affiliation. Both groups support their biophilia by exerting agency and influence over and outside of the systems that might otherwise limit or exclude them; both articulate their desire to live in a world that is hospitable, beautiful, and socially secure.

Going forward, human beings need both social and ecological vitality (what I will call the presence of "ecosocial security") if the planet Earth is going to continue to be the stage for their biophilia. Contemporary African-Americans cannot fully enjoy self-certified biophilia if their status in the social sphere remains compromised. And while their geographic and social mobility is enviable, investment citizens cannot shield themselves from ecological collapse through their purchased entry into human systems that confer "alternative" citizenship. Simply put, our future in our current life support system is predicated on our ability to strengthen interconnected ecosocial security.

The "Environmental Justice, 'Collapse' and the Question of Evidence" conference organizers and participants helped me sharpen my vision of what is necessary for a vital existence on Earth. The examples of the conceptual capital of African-Americans and the monetary capital of global elites demonstrate powerful examples of influence that can lead to ecological and social affiliation

respectively. These examples inspire me to employ my biophilia for the purpose of long-term ecosocial security because neither ecological nor social affiliation can be enjoyed exclusive of the other. Human beings are an intimate part of nature whose notions of rights, responsibilities, obligations, and freedoms have both a social and ecological context. Espousing this fact may assist us in defining and working toward "ecosocial security." And in gratitude for the work of my ancestors, elders, and peers, I declare myself an ecosocial citizen in-progress, knowing that my biophilia will be cultivated with the specific purpose of becoming an effective ecosocial citizen.

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BIOGRAPHY

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Of the Titanic, the Bounty, and Other Shipwrecks

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Periodically humans have to pay for their sins. Last time that a more than human entity asked them to pay the bill, it was the Deluge. Maybe everything starts from there. It might be that Noah's Ark is at the origin of the association between disasters, even the global ones, and ships. After all, the ark became the symbol of salvation, and still today the global bank of seeds located on the Svalbard Islands is called the ark. Also, in science fiction the trope of the ark has often been employed to signify the last resort of human species in the face of some apocalypse. Stephen Baxter's novel *Ark* is quite explicit proof of this, but one can also mention a popular post-apocalyptic TV series, *The 100*, where the last survivors of humanity are hosted in a space station called the Ark.

In my essay I aim to explore the tropes of the boat, the shipwreck, and the global apocalypse. I will do so by employing some actual histories as metaphors; I ask the reader to go beyond the factual stories and envision them as metaphors for my arguments. For this reason, I have selected stories to which the reader can easily relate, precisely because what matters for me is the narrative that the story conveys in the popular imaginary.

The expression: "we are all in the same boat," which is common to so many languages, is a good approximation of the mainstream discourse of the Anthropocene. This image communicates that the planet is in danger and all humans are equally responsible and affected. The boat gives the sense of the finitude of the planet and the shared destiny of humanity. As on a boat, so on Earth the crew is obliged to cooperate in order to cope with the perils of the open ocean and the intrinsic limits of the vessel. We can almost still hear Al Gore preaching that climate change is not a political issue, but a moral one in which all humanity is entangled. A planetary "we" is the obvious corollary of Al Gore's moral claim. Humanity is the crew of the global ship navigating the troubled waters of the Anthropocene. Evidently, the ship metaphor conveys also the idea that there is no way out of the Anthropocene; the vessel is finite and there is no other ship waiting for humanity if the current one should sink. Actually, the most scary development of the Anthropocene narrative is the recent Hollywood push towards a new cowboys' era of space frontiers which seems to suggest that humans can destroy the Earth and live happily ever after on some other planet (as in Interstellar). The notion of finitude must go hand in hand with the awareness that another ship will not be available.

Already in 1966 the non-conventional economist Kenneth Boulding had expressed this concept, referring to different kinds of ship metaphors. Boulding used the expression "Spaceship Earth" conflating the finitude of our planet with that of a spaceship. Both were closed environments which had to maintain their ecological balance in order to function. In this sense, the spaceship is even a better metaphor than the regular ship; not a troubled ocean, but the inhabitable space surrounds the ship known as Earth, making any idea of leaving the boat not only dangerous but just absurd.

The late 1960s and the early 70s were the perfect years to speak of the planet in those terms. The iconic Earthrise, captured by astronaut William Anders, and the oil crisis of the following years conjoined in offering a new image of the Earth: the planet was no longer an infinite land to exploit, but a fragile ship floating in the middle of a dark universe.[29] The ship worked very well as a metaphor because it implied both its finitude and its fragility navigating an almost hostile environment. For the environmentalists, Spaceship Earth provided the discourse about the limits of the planet. After all, in 1972, the Club of Rome published the well know report "The Limits to

[29] A review on this is available in Armiero and Graf von Hardenberg, 2014.

Growth" which systematized on a "scientific" basis the assumptions on the finitude of the planet that the ship metaphor was suggesting.

At more or less the same time, another ship started floating in the scientific and public debate about the ecological crisis. In 1974 Garret Hardin published the article "Lifeboat Ethics" in *Psychology Today*. Again the metaphor of the ship was used to explain the physical limits of the planet. In this case, the limits were tested vis-à-vis demographic growth rather than in relation to the continuous expansion of capitalism or, to use a more politically-neutral discourse, of consumerism. Hardin described the appalling situation of a lifeboat surrounded by a large number of castaways, arguing that saving all of them would imply the shipwrecking of that very lifeboat. Someone had to die in the ocean in order to ensure that at least the people on the lifeboat could survive. Rescuing everybody was not feasible in the lifeboat's ethics. Apart from the extremely unpleasant taste left behind by Hardin's metaphor, the lifeboat he described was deprived of any historical and social context; it just happened that some landed in the boat and others in the ocean. How this occurred seems a matter of fate rather than violence, expropriation, and power. However extreme the lifeboat ethics might seem, the obliteration of history and power remains quite common in the ship metaphors of the Anthropocene.

The parable of the lifeboat helps me introduce the topic I want to address and even leads us quite vividly to the main story I wish to employ. This is a story I am sure all readers know very well, but I hope I will be able to suggest new ways of looking at it.

On April 10, 1912, progress set sail from the harbor of Southampton in the form of a black, gigantic ship, equipped with the best technologies of that time, including a high-power radiotelegraph transmitter and remotely activated watertight doors. Nonetheless, as sometimes occurs with highly complex technological tools, the Titanic missed a much more basic piece of equipment, namely enough lifeboats. Therefore, when on the night of April 15th the ship struck an iceberg, almost 1700 people died. Of all the ship metaphors, that of the Titanic is most precisely a metaphor of the human condition in modern times. I believe that many of the typical discourses of the Anthropocene materialize in the story of the Titanic. First of all, that story speaks of the myth of the unsinkable ship; the Titanic embodied the modern western belief that our world is unbreakable. Progress cannot be stopped and human ingenuity has always overcome any obstacle. Considering the material as well as the metaphorical Titanic, everything seems too perfect, modern, and efficient to even contemplate the possibility of a complete breakdown. The warnings about the coming disaster are always seen as the ill omens of professional pessimists. The myth of the unsinkable ship—or, if you wish, of eternal progress—is connected to another discourse which is central in the story of the Titanic, namely the total faith in technology and expertise. The modern nature of the ship, which protects it from any accident, relies on the technologies employed; an old fishing boat with no up to date gadgets would never function as a metaphor for modernity. The deployment of technology implies by default the need for highly specialized experts; the Titanic as well as the Anthropocene ship work with instruments that are so complicated, that only experts can steer them. The Titanic is also a story of the apocalypse and, after all, the apocalypse is one of the main tropes in the Anthropocene. The tragic epilogue of the story suggests that in spite of all the technology and expertise, nature strikes back, oddly enough in the form of an iceberg. In the context of climate change, with the melting ice as the global icon of the coming catastrophe, the iceberg functions as the ship's perfect nemesis.

Indeed, compressed between technological optimism and natural catastrophism, the Titanic seems the ideal Anthropocene tale. It contains the technological hubris, and the inability of leadership to foresee the disaster and to take timely measures. The Titanic, though, is not only an accusation against experts and leaders; it does not leave the general public untouched, like a victim without responsibilities. The image of the passengers dancing blithely in the hall while the disaster is approaching symbolizes humanity's complete and utter disinterest for the common destiny of the planet. It does not matter whether they were actually dancing or sleeping on the Titanic; either way, they were not vigilant, but rather confident that nothing could ever touch them. In the end the Titanic can be easily used to prove that indeed in the Anthropocene we are all in the same boat. The Titanic is in fact a perfect Anthropocene tale because it occludes at least as much as it reveals. The truth is that 75% of the first class passengers survived while only 25% of the passengers in third class made it out of the disaster. Class matters in the Anthropocene. As Rob Nixon has written: "We may all be in the Anthropocene, but we're not all in it in the same way."

Thinking of ship metaphors for the Anthropocene, the Titanic seems like a perfect fit. Nonetheless, to complicate the discussion, I would like to suggest another ship story, one that does not fit so neatly into the Anthropocene narrative. Basically, I was looking for a ship metaphor which could disrupt the story-line of the Titanic and of the Anthropocene, emphasizing inequalities and power relationships instead of technologies, expertise and moral duties. Staying within the maritime environment, I clearly needed a mutiny; hence, the Bounty became my obvious ship of choice. The Bounty is the mutineers' story par excellence, etched in our imaginaries by several Hollywood reinventions of the actual facts. As I explored this story further, I discovered a rather unpleasant development of the rebellion that involved the slaughtering of natives and the kidnapping of indigenous women. Even in very recent times, the reputation of the descendants of the mutineers has not improved. Obviously, there were other mutinies, maybe less controversial, but in the end I decided to employ the Bounty merely as an archetype of the very action of mutiny; therefore, I invite the reader to join me in playing with the meanings this story mobilizes. First, the ship is never isolated, and it cannot be understood as a closed technical-management complex. This is true for both the Titanic and the Bounty. The Bounty was embedded into a network of imperial class relationships of which science was also a part. The Bounty was supposed to transport breadfruit plants from Tahiti to the British colonies in the West Indies with the idea that these plants might grow well there, providing cheap food for the slaves. The botanists working on the Bounty were instrumental in this quest for finding cheap fuel for the machine producing the wealth of the Empire, that is, black slaves.

The absence of any understanding of the wider network of power in which the material and metaphorical ship is embedded is ingrained in most of the Anthropocene narratives. In thinking of the Titanic, the weaknesses of the ship, the mistakes of captains, and the disinterest of the people on board are the recurring reasons used to explain the ultimate failure of the ship. I am employing the Bounty in order to argue that the ship must be understood within a web of social relationships: this implies that the ship cannot be saved from the disaster without understanding how that very ship is actually a function of the disaster. Sometimes I wonder whether the ship must be saved at all. For me, the Bounty is a metaphor which reminds us that despite what the Titanic narrative proposes, in reality it is not the size of the ship, the technology employed, or the capability of the leader that matters. The metaphor of the Bounty allows me to lay claim to the need for the mutiny, for taking over the ship, changing its route and leaving the network of relations in which it was embedded. Once again, I am not pointing at the Bounty story as an example—actually the mutiny of Kiel might be a much better example—but I wish to use its evocative power to reclaim the space of the mutiny

and the possibilities it opens up. The metaphor of the ship brings with it a heavy cargo of discipline, expertise, chain of command, etc. In the face of all this stands the mutiny. The Bounty metaphor challenges the naturalization of social relationships in the Anthropocene so explicitly spelled out in the lifeboat ethics of Garrett Hardin, where someone happens to be drowning in the sea while others are safe and sound on the boat. But the mutiny also challenges the de-politicization of the Anthropocene, which is so strong in the Titanic version. Poorly engineered design, shortsighted leadership, disinterested passengers, and an unfortunate combination of nature fighting back are the basic ingredients of that story. I would, however, like to shift the attention from the ship to the social relationships inscribed in that ship. 75% of the poor in the third class died, only 25% of those in the first class. The Anthropocene is thus a reification of relationships. That narrative transforms relations into a thing, claiming that the only possibility for change is to improve the thing. The mutiny, by contrast, means to change the relationships, and in the very process of changing them, the route of the ship will change as well.

When I proposed the title and the abstract for my essay the refugee crisis in Europe had not exploded so dramatically. Indeed, hundreds of ships are crossing the Mediterranean. Those are all third-class ships, all lifeboats carrying the survivors of wars, occupations, poverty, expropriation, and environmental changes. Thousands did not make it and ended their journey in the waters of the Mediterranean. The rest, the lucky ones, must face the borders of fortress Europe: confronted by our democratic police at the borders, left on the streets under the rain, they find themselves targeted by a frightening wave of xenophobic and neo-Nazis parties flourishing in a Europe in crisis. As intellectuals, academics, and environmental justice activists we must raise our voices. Welcoming the refugees is a moral imperative. We might say that there is a humanitarian argument supporting the cause of hospitality. However, there might be something else as well. There are ancient words, now completely spoiled, corrupted by the tragedies of history, which nevertheless I would like to restore. Wouldn't it be beautiful to restore words as we do with pieces of arts, buildings, even ecosystems? Proletarians from all countries unite. I know, some readers will smile, thinking that even to pronounce these words is at best inappropriate; others might even be outraged, thinking of the history connected to those same words. Instead, I think that they would serve as a great starting point for the perfect mutiny in the tempest of these current times. Plus, as environmental historians have taught us, restoring is always reinventing. Those who have seen the kids playing in the shadows of the chimneys in Flammable, a slum in Buenos Aires; or the bodies of the 1000 workers killed in the collapse of the Rana Plaza factory in Bangladesh; or those who have met, even only through the movie *Toxic Amazon*, Ze Claudio and Maria, killed for fighting against the illegal logging in the Amazon; those who have seen the slums of Durban, South Africa, and the gated communities of the rich whites with armed guards; all those among us who have seen these things, or at least who do not wish to ignore them, will understand what I mean, because they know—we all know—that we need to find the reasons and the words for a new global coalition which does not aim to make the system work, but to change the system. Unite: we are the 99%. Let's occupy the Anthropocene, before someone also places armed guards at the gate of our academic debate.

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