

Should We Lead Them Two by Two?
The search for authority in assisted migration

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Abstract

Anthropogenic climate change has started to cause shifts in the geographic ranges of plants, animals, and biomes around the world. These shifts will continue to get more drastic as warming does, driving species farther and farther from their native ranges.¹ Populations of species that cannot migrate in time will likely dwindle and it is estimated that as many as one-third of all species could potentially go extinct.² Clearly, there is a need to deviate from traditional, baseline-dependent conservation strategies in order to mitigate the biodiversity loss that is predicted to accompany global climate change.³ Scholars in the conservation field are engaged in a heated debate how to set up a practice like assisted migration, which cannot be judged with the traditional baseline criteria. In this thesis I explore articles written by these scholars', searching for common recommendations among them. I found that among the most common prescriptions scholars have for assisted migration is an imbedded tension that pits extreme caution, trumpeting a lack of certainty and risk aversion, against a strong sense of urgency. These prescriptions reflect a profound unease with human beings as ultimate managers of ecosystems. In their common fixation on the development of a highly systematized, risk-averse, science-focused infrastructure to oversee assisted migration, these scholars reveal in themselves a recurrent desire to establish a non-human authority. However instead of yielding to the idea of the "pristine," "pre-human" ecosystem as has been done in the past, now human authority is being relinquished to another "higher" institution: science.

¹ Schwartz et al., "Managed Relocation: Integrating the Scientific, Regulator, and Ethical Challenges," 734.

² Camacho, "Reassessing Conservation Goals in a Changing Climate," 22.

³ IPCC, *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, (New York: Cambridge University Press, 2007) Chapter 4.

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The fire, the flood, and building an ark without instruction

Assisted migration, or the intentional translocation of species outside of their historic ranges in order to mitigate actual or anticipated biodiversity losses caused by anthropogenic climate change, lends itself incredibly well to metaphor.⁴ This is perhaps because assisted migration has just barely left the realm of the theoretical, especially in the U.S., with fewer than a half dozen instances of this type of action. When I first encountered this topic I was partial to likening it to carrying one's possessions out of a burning house. I, like many people, consider Earth and the physical environments it provides to be the home, at least on the most basic level, to every human on the planet. However, we have entered a period of time in which the environments we recognize as our homes, though not likely to literally burn, are going to change dramatically. The average global temperature shows a warming trend proceeding at a rate that is unprecedented in the past 1,300 years.⁵ Other major geologic phenomena have, in turn, become increasingly rapid, including sea level rise, shrinking ice sheets, glacial retreat, ocean acidification, as well as increased instance of extreme weather events.⁶ This list, though not complete, includes some of the most significant forces that shape the environment as we know it and as they continue to become more and more extreme, we can only expect ecosystems, and the species they support, to do as they have done in

⁴ N. Hewitt et al., "Taking stock of the assisted migration debate," *Biological Conservation* 144 (2011): 2561.

⁵ IPCC, *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change: Summary for Policymakers*, by Susan Solomon, et al., New York, NY: Cambridge University Press, 2007.

⁶ "Global Climate Change," National Aeronautics and Space Administration, February 20, 2013, <http://climate.nasa.gov/evidence>.

every previous major climate shift: adapt, migrate, or go extinct.⁷ With the unusually rapid warming caused by anthropogenic climate change of this particular shift, there is a concern that the extinction rates are likely to be disproportionately high this time around.⁸ If we are continuing to follow the metaphor: our planet is on fire, and if we want to lessen the biodiversity loss that comes with it, it is time to choose what species we would like to put our time, energy, and resources into carrying out of the fire.

However, as I got deeper and deeper into the subject of assisted migration I realized that the people thinking about this problem are nowhere near ready to approach the question of choosing which species they want to assist in migrating. Rather, the ecologists, biologists, conservationists, and environmentalists who are writing on assisted migration are still largely caught up in *how* to choose which species to move, not to mention how exactly they want to go about doing the moving, or if we should even be pursuing this course of action at all. These decisions, and others like them, loom in the minds of many in the field of conservation and have become the center of a major debate that has divided many ecologists and conservationists around the world, but especially here in the United States.⁹ I found that even as scholars discussed what assisted migration should look like, they were incredibly nervous about the possible negative impacts, pointing to examples of past, human-facilitated species translocations that have had catastrophic ecological consequences.¹⁰

⁷ Fred T Mackenzie, *Our Changing Planet: An Introduction to Earth System Science and Global Environmental Change*, 4th edition, (New Jersey: Prentice Hall, 2010), 500.

⁸ S. T. Jackson and D.F. Sax, "Balancing biodiversity in a changing environment: Extinction debt, immigration credit and species turnover," *Trends in Ecology and Evolution*, 25 (2010): 153-160.

⁹ Ben A. Minter and James P. Collins, "Move it or lost it?" The ecological ethics of relocating species under climate change," *Ecological Applications*, 20(7) (2010): 1801.

¹⁰ Mark W. Schwartz et al., "Managed Relocation: Integrating the Scientific, Regulator, and Ethical Challenges," *BioScience*, 62(8) (2012): 734.

These catastrophic ecological consequences almost always come in the form of the creation of invasive species. In one study, conducted to identify the barriers to consensus over assisted migration, Hewitt et al. found that “the most commonly identified risk of AM [assisted migration] was that the introduced species would become invasive.”¹¹ It is undeniable that in the past certain invasives have wreaked havoc on ecosystems – kudzu, zebra mussels, cheatgrass, and feral cats to name a few – invading, driving out native species, and replacing complex and diverse systems with homogenous, weedy landscapes.¹² However, the problem of creating invasive species in this instance does not just lie in the possibility of negative impacts but that, in the eyes of the current conservation system, all forms of assisted migration technically represent the intentional creation of invasive species. This gets at one of the root difficulties with adopting assisted migration into present day conservation systems – that the practice is contradictory to the very core principle that dominates conservation strategy: historical baselines.

In the United States, historical baselines were adopted as the target for management of national parks and similar conservation entities in the 1960s, when, in his much quoted “Leopold Report,” A. Starker Leopold stated that:

As a primary goal, we would recommend that the biotic associations within each park be maintained, or where necessary recreated, as nearly as possible in the condition that prevailed when the area was first visited by the white man. A national park should represent a vignette of primitive America.¹³

This preference for “primitive,” pre-Columbian landscapes is still incredibly pervasive in the U.S. conservation system today, dictating anything from how individual parks are managed to federal laws surrounding ecosystem and species protection. By intentionally

¹¹ Hewitt et al., “Taking stock of the assisted migration debate,” 2566.

¹² Emma Marris, *Rambunctious Garden*, (New York: Bloomsbury, 2011), 97-99.

¹³ A. Leopold et al., “Wildlife Management in the National Parks,” *Transactions of the North American Wildlife and Natural Resources Conference* 28 (1963): 28 – 45.

moving species outside the ranges they would have occupied historically, assisted migration represents a complete break from historical baselines, leaving the conservation world with “no target [and] without a target, every kind of management, including those that result in lost native species, is arguably a success.”¹⁴ Given this heavy reliance on baselines as the touchstone for essentially all judgments made in the conservation system, it makes perfect sense that the suggestion of its abandonment is so concerning to the conservation community.

However, there are fundamental flaws with the historical baseline system, flaws that become fatal when climate change gets added to the mix. The most glaring of these flaws is that historical baselines are only really useful for ecosystems that are stable.¹⁵ This is not compatible with what we know about how ecosystems behave over time, which is that they are constantly changing. To attempt to hold them as they are at a single point in time is to ignore their dynamic nature and is ultimately unachievable. Global climate change makes this glaringly obvious as models show that warming trends will cause species to shift their ranges to meet their habitat requirements.¹⁶ It will become increasingly impossible to try to maintain a historical baseline as the climate begins to vary so much from historical conditions that species start to migrate out of the protected swathes of their native ranges or, for those species unable to make the move in time, too disappear altogether.

Clearly, there is a need to deviate from traditional, baseline-dependent conservation strategies in order to mitigate the biodiversity loss that is predicted to

¹⁴ Mark Schwartz, “Conservationists Should Not Move *Torreya Taxifolia*,” *Wild Earth*, (2005): 78.

¹⁵ Marris, *Rambunctious Garden*, 27.

¹⁶ Alejandro E. Camacho et al., “Reassessing Conservation Goals in a Changing Climate,” *Issues in Science and Technology*, Summer (2010): 21.

accompany global climate change.¹⁷ As I mentioned, earlier there is quite a lively debate surrounding this subject in which many scholars in the conservation field try to grapple with how to set up a practice like assisted migration, which they realize, cannot be judged with the traditional baseline criteria. It is this debate over the new criteria assisted migration ought to meet that fascinates me most about this topic. To me assisted migration represents a precipice, a jumping off point for the conservation system in the United States to change its ways, maybe not completely, but at least in such a way that seeks to preserve biodiversity and manage species in a manner dynamic enough to meet the changes that are about to occur to the ecosystems it oversees.

In this thesis I explored scholarly articles, searching for common recommendations among them regarding the shape that assisted migration should take. In finding their top recommendations for this strategy I hoped to find out where this new chapter in conservation is headed, what new goals they wish to work toward and which aspects of the process they find most important. I coded these articles for prescriptive language and ultimately came up with the top thirteen “prescriptions” promoted by the academic conservation community. I then used these scholars’ prescriptions to evaluate current, real-world, assisted migration projects to see if they were reflective of the opinions of the conservation community, both to determine how much influence the academic world has on real-life application and to see if any of these case studies could serve as a model off which to base the future actions of the conservation system.

I found that ultimately for most scholars and scientists, that this transition away from historic touchstones is really difficult. The anthropocentrism that comes along with

¹⁷ IPCC, *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, (New York: Cambridge University Press, 2007) Chapter 4.

a strategy that makes humans such blatant “planetary managers” makes these authors deeply uncomfortable. Among the top most common prescriptions scholars have for assisted migration is an imbedded tension that pits extreme caution, trumpeting a lack of certainty and risk aversion, against a strong sense of urgency. These prescriptions reflect a profound unease with the notion of human beings as the ultimate managers of ecosystems and a desire to give deference to some higher, non-human entity, be it the idea of the “pristine,” pre-human ecosystem, or even the institution of science.

Whereas I used to think of assisted migration as the arduous decision of choosing what to carry out of a burning building, I have come to adopt an entirely new metaphor more reflective of a task even more immense. Conservationists are not just carrying species out of a burning building; they are trying to build the ark that could ensure the survival of species from a much more long-term disaster. However, unlike Noah, conservationists do not have the luxury of an almighty authority to direct them in this endeavor. Instead, these scholars have the difficult task of trying to overcome narratives embedded in conservation history that remove people from what is “natural” and give deference to “pristine wilderness.”

Background

Why do we care about conservation?

Before we delve straight into assisted migration there are several assumptions and trends that we must first unpack. The biggest of these is the assumption of conservationism in general – i.e., why worry about conservation biology in the first

place? Conservation biology is the discipline that concerns itself with ecosystem degradation, diminishing genetic diversity, species endangerment and extinction.¹⁸

Simply put, it seeks to protect biodiversity. The definition of biodiversity provided by the United States Office of Technology Assessment is:

Biological diversity refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the chemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, genes, and their relative abundance.¹⁹

These days it is easy to take for granted that biodiversity has always been thought of as worth protecting, nor will one be able to find any studies that prove that biodiversity loss is wholly negative - trust me, I've looked. Rather, just as ecosystems are ever changing, turning over from one state to the next, over time species go extinct and others move into or evolve to fill their niches. Nevertheless, conservationism in the United States is wholly predicated on the notion that biodiversity loss is negative. It is important to understand the history behind how this came to be the dominant way that Americans interact and manage our "natural" spaces, as well as explore the variety of different possible explanations of why we conserve both past and present.

In America the conservation movement began in the mid 1800s just as the pioneers had separated themselves enough from wilderness to start missing it again.²⁰

First to start championing the great outdoors were thinkers and authors like Ralph Waldo

¹⁸ Glenn Adelson et al., introduction to the chapter "Biodiversity and Conservation Biology," from *Environment: an interdisciplinary anthology* (New Haven: Yale University Press, 2008): 362.

¹⁹ Adelson et al., introduction to the chapter "Biodiversity and Conservation Biology," from *Environment*, 362.

²⁰ Roderick Frazier Nash, *Wilderness and the American Mind*, (New Haven: Yale University Press, 2001): 24.

Emerson, Henry David Thoreau, and John Muir. Thoreau and Emerson believed that “wildness” was good for the soul, though to them this could be achieved in retreat to places like Walden Pond, which is only about a mile and half outside Concord, Massachusetts.²¹ Muir, on the other hand, though heavily influenced by Thoreau, advocated for “wildernness” which he saw as areas that had not been changed to suit man, or “untrammeled” landscapes. Muir was one of the first Americans to write about wilderness as a sacred space, an idea that authors like Emma Marris hold partially responsible for “an American conservation movement that often focused on protecting pristine wilderness rather than on achieving coexistence between humans and other species.”²²

The responsibility for conservationism in the U.S., however, does not at all rest entirely on Muir’s shoulders. Historian Roderick Frazier Nash talks about a national fad he calls the “wilderness cult” that emerged in the 1890s, which appreciated nature as an escape from rapidly urbanizing and industrialization occurring at the time.²³ Author Emma Marris identifies the king of this “wilderness cult” as none other than 26th President of the United States, Teddy Roosevelt. To Roosevelt, the key role of wilderness was as “a many-faceted opponent against which to test oneself,” especially by way of hunting game as a form of landscape domination.²⁴ However, as Marris also points out, one can only dominate the wilderness if there is wilderness around to dominate, which

²¹ Marris, *Rambunctious Garden*, 19.

²² *Ibid*, 21.

²³ Nash, *Wilderness and the American Mind*, 143.

²⁴ Marris, *Rambunctious Garden*, 23.

ultimately led to the creation of the first national parks in the very end of the 19th century.²⁵

Ironically enough, this is the first concern we see in the United States about biodiversity in the context of conservation. There was a desire from human beings to preserve the abundant variety of species, specifically fauna, so that the full array of different species would be available to us to hunt and kill. However, just because this is where American conservationism originated, it does not make it the only or best reason to do so, and it is certainly not the reason we do so today. I have already mentioned some of the other, older ideas behind conserving either wildness or wilderness through biodiversity: There was the idea that spending time in such environments was good for one's soul and important in the development of healthy, productive citizens; Muir's idea of wilderness as having a holy quality; and of course as a place to test oneself. In the years since the first official conservation institutions were established, a whole slew of newer ideas surrounding conservation have arisen. There was the establishment of the Wilderness Act of 1964, which protected wilderness for "higher," leisure purposes.²⁶ There is an instrumental argument for wilderness conservation that we ought to conserve biodiversity because the ecosystem services that they provide are beneficial to humans and the absence of those services harmful.²⁷ There is a purely aesthetic argument to be made as well as one for the inherent value of plant and animal species.

Many, both past and present, have argued that the best reason for conserving biodiversity through wilderness protection is on ethical grounds. In the past this was most famously expressed by Aldo Leopold's Land Ethic. Finally, only in the past 30 years are

²⁵ Ibid, 23.

²⁶ Marris, *Rambunctious Garden*, 25.

²⁷ Camacho, "Reassessing Conservation Goals in a Changing Climate," 22.

so, has an idea emerged that humans are morally responsible for treating the landscape a certain way, not in order to “change the role of Homo sapiens from conqueror of the land-community to plain member and citizen of it ... impl[ying] respect for his fellow-members, and also respect for the community as such,” but as an extension of their role as conquerors.²⁸ In their piece titled “Human Domination of Earth’s Ecosystems,” Vitousek et al., expressed the idea that “humanity’s dominance of Earth means that we cannot escape responsibility for managing the planet.”²⁹ This idea suggests that we must conserve as a way to make up for anthropogenic biodiversity loss.

The take away message here is that conservation is a constructed idea and that to fully understand the concept you have to understand its context in space and time. For the purposes of this thesis, understanding how the American conservation system developed and changed is crucial to understanding the trajectory that led up to assisted migration.

The “holy baseline” and its self-exiled stewards

The second idea that needs to be explored before assisted migration can fully be understood is that of ecological restoration. Restoration shares similarities to assisted migration in that it is a conservation strategy that is also very hands on, requiring human beings to insert themselves into ecosystems, sometimes aggressively manipulating the landscape in order to restore it to an assigned historic baseline. Why then has restoration been adopted and widely used by the conservation system since the 1980s, while assisted migration is treated as a radical and dangerous idea? The difference between these two strategies lies in the fact that though restoration allows human manipulation that can be

²⁸ Aldo Leopold, *A Sand County Almanac* (Ballantine Books, 1986).

²⁹ Peter Vitousek et al., “Human Domination of Earth’s Ecosystems,” in *Environment: an interdisciplinary anthology* (New Haven: Yale University Press, 2008): 372.

considered a breach of an area's "wilderness" status, it still adheres to historical baselines. In her book critiquing what she refers to as our romantic notions of untrammeled wilderness, Emma Marris discusses this phenomenon she calls the "paradox of pristine wilderness." This is the paradox that exists between the fact that "if we define *wild* as 'unmanaged,' then the ecosystems that look the most pristine are perhaps the least likely to be truly wild."³⁰ This reveals a preference, so deeply seeded as to almost be religious, in the conservation world for landscapes that appear historically accurate, or "wild" even if people had to construct them to look this way. Marris notes that:

The faith that native ecosystems are better than changed ecosystems is so pervasive in fields like ecology that it has become an unquestioned assumption. One often finds it built into experiments, which sometimes automatically classify any human change to nature as "degradation."³¹

The only time when human change is acceptable in conservation seems to be when humans are making up for past degradation by setting an ecosystem back to its "native" conditions. American conservationism is obsessed with erasing ourselves from wilderness, not just by keeping people off protected land except for low impact visiting, but also by physically manipulating the landscape so that any trace of our impact is gone.

It is worth noting that this is a very human enterprise, not only in that no other species worries about the changes it makes to its environment (as much as they can worry) but that people also do not worry about the changes other species make to their environment, only those made by our own species. So long as a species is native, according to a historic baseline, conservationists are not worried about the impact they have on an ecosystem, whatever change they make is considered natural. By removing our impact from the environment, by setting them back to a "pre-human" state, we are

³⁰ Marris, *Rambunctious Garden*, 12.

³¹ Marris, 14.

perpetually reinforcing our removal from what is natural. As long as human-touched is synonymous with degraded, there is little chance for hands on strategies like assisted migration, even if the change that is being proposed upholds conservation goals better than those reliant on historic baselines.

Global warming, the game changer

Global climate change, or global warming, as it is colloquially called, is drastically upsetting the balance in the conservation world. This is true not only in that it is causing widespread changes to literally every ecosystem on the planet, but also in that these changes are going to start making long-held conservation strategies obsolete.

In William Auddiman's textbook, *Earth's Climate Past and Future* the drastic effects of anthropogenic climate change are spelled out quite clearly:

Global temperature changes produced by all natural causes combined are unlikely to reach 1°C over the next 1000 years. As we shall see, the projected global warming resulting from human additions of greenhouse gases within this same interval is between 2 ° and 8 °C, with a likely value of 4 ° to 5 °C. As a result, natural climate changes will gradually become irrelevant to future projections of climate.³²

Though the earth has experienced shifts in climate before, the anthropogenic forcing behind this particular shift is being predicted to cause changes of a higher magnitude in a shorter period of time than shifts caused by natural forcing.³³ These climatic changes, which are already being felt, have started to cause shifts in the geographic ranges of plants, animals, and biomes around the world. These shifts in range, also known as poleward migration, will continue to get more drastic as warming does, driving species

³² William F. Ruddiman, *Earth's Climate: Past and Future*, 2nd ed. (W. H. Freeman, 2007): 424.

³³ IPCC, *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change: Summary for Policymakers*, by Susan Solomon, et al., New York, NY: Cambridge University Press, 2007.

farther and farther from the ranges considered by conservation standards to be native.³⁴

Populations of species that cannot migrate in time, are tied to fragmented or highly specialized habitat conditions, or are unable to cross the man-made barriers between current habitat and ideal future habitat, will likely start to dwindle and it is estimated that as many as one-third of all species (including plants, vertebrates, invertebrates, fungi and microbes) could potentially go extinct.³⁵

Traditional conservation methods that look to historical baselines are going to be totally useless in the face of anthropogenic climate change. As Marris aptly puts:

Climate change pits two common assumptions against each other: the pristineness myth and the myth of a correct baseline for each area. If humans are outside nature and humans caused climate change, then it follows that humans should make good – should make sure that species that would have survived without climate change survive, no matter what ... But if ecosystems have a correct baseline to which we must return – the second assumption – then we absolutely cannot move species from one area to another. To do so would violate the baseline and be tantamount to willfully creating invasive species.³⁶

As I said before, we are on a precipice here. With many scholars recognizing that in order to circumvent climate-driven extinction, assisted migration must be considered a management option and some part of the traditional conservation paradigm is going to have to change. The way the conservation world is talking about this proposed change could reveal the shape of future conservation in the U.S.

³⁴ Schwartz et al., “Managed Relocation: Integrating the Scientific, Regulator, and Ethical Challenges,” 734.

³⁵ Camacho, “Reassessing Conservation Goals in a Changing Climate,” 22.

³⁶ Marris, *Rambunctious Garden*, 77.

Methodology & Results

First Tier Analysis: Disagreement and Agreement between Academic Articles

One of the largest obstacles to the real world application of assisted migration is the disagreement between members of the institutions that are most likely to take responsibility for designing and carrying out these types of projects. In any article written on the subject of assisted migration by conservation biologists, ecologists, and other experts, each author has a different idea of what assisted migration should ideally look like. Often times, these ideas have some overlap, however, many also directly contradict each other. Until these disagreements are resolved it seems impossible to create a cohesive set of guidelines to govern assisted migration. Without a set of rules or some sort of systematic procedure it will be impossible to measure the success or failure of assisted migration efforts in a way that satisfies the scientific community. Since the conservation system is built around the scientific method, without this sort of validity, assisted migration will continue to be debated instead of put into action.

In hopes of exploring where this new chapter in conservation is headed toward, what new goals they wish to work towards and which aspects of the process they find most important, I have looked for commonalities between expert opinions on assisted migration that underlie the chaos of disagreement. My source of expert opinion comes from academic articles whose main focus is the debate or consideration of assisted migration. I used the search engine Academic Search Complete to find such articles by searching for the phrases “assisted migration,” “assisted colonization,” “managed relocation,” and “debate.” This search generated many articles, which I narrowed down to those written in the past five years. I selected articles from this list of results in order,

ignoring those articles that were only marginally relevant to my topic, which I determined by the title. I then recorded in a spreadsheet the author, title, year it was written, and from reading the abstract whether or not they were for or against assisted migration.

Content Analysis

Content analysis allowed me to systematically identify the intentions and opinions of biologists, ecologists and conservationists on the subject of assisted migration as presented in their published work. I used emergent coding meaning the categories I coded for were created after I did a preliminary examination of the data. More specifically, I read the first five articles to get a feel for the setup and how and where in articles opinions were presented. I found that in any given article authors presented a number of what I have come to call “prescriptions” for assisted migration. Prescriptions are simply components that the author, or group of authors, suggests are necessary in the assisted migration process. For example an author might prescribe “thorough risk assessment” or “the prioritization of endemic species.” The prescriptions are reflective of different authors concerns and priorities and more or less add up to what these authors imagine assisted migration should look like.

To identify prescriptions within articles it was necessary to use relational analysis on account of language variations, wherein authors may be prescribing the same thing but use different language to describe the prescription. It would be near impossible to code for every possible wording of the concepts I was looking for, not to mention it would also require anticipating every prescription an author would present. Instead I decided to code for the language used to present prescriptions, more specifically modal verbs used to make suggestions, such as “should” among others. I used several thesauruses to generate

the following list of words: “ought” “have to” “should” “advocate” “need[ed]” “necessary” “call[s] for” and “must.” I searched articles for these words using the “find” mechanism on Adobe Reader. For each word I would read the sentence to determine if this was the right use of the word for my purposes and if the authors were giving this opinion for themselves and not referencing another paper. If both of these criteria were met I would then scan the entire paragraph it was contained in, in order to ascertain the context and from there derive what this particular prescription was calling for in terms of assisted migration. I then recorded this prescription, paraphrasing the wording used in the article, on the same spreadsheet mentioned above in a column labeled “Prescription 1.” I continued doing this for all the words on the list, writing new prescriptions in their own columns and keeping a count of repeated prescriptions in a column directly next to the corresponding prescription labeled “Number of Times Mentioned.” While doing so I was careful not to double count prescriptions in places where two or more modal verbs were present.

The next step was to eliminate redundancy to account for prescriptions from different articles that essentially meant the same thing but were stated using different wording. For example “development of accurate models for risk,” “need to justify risk,” and “thorough risk analysis” would all fall under a category called “risk assessment/cost-benefit analysis.” I then reproduced my spreadsheet replacing the originally worded prescriptions with the new, normalized phrasing.

I could then see the rank of each prescription’s importance within each article, which I determined by the frequency with which it was mentioned. However, what I was ultimately looking for was which prescriptions were mentioned most frequently the most

important across all the articles. Simply adding the number of times they are mentioned within each article was inadequate because the fact that the most important prescription in one article was mentioned seven times, for instance, while a different article only mentioned its most important prescription, say, four times does not necessarily mean that either of these prescriptions had different levels of importance which is what addition of frequencies would reflect. Instead I chose to give each prescription a score. This score was the proportion of mentions any single prescription received in an article relative to the number of total mentions of prescriptions of any kind that occurred within that article. I then added the scores for each prescription in all the articles that mentioned them to see which prescriptions had the highest total scores.

Results

After consolidating the prescriptions from my coded articles, grouping prescriptions that had been worded differently but were similar in content, I ended up with a list of 13 prescriptions. Below I have listed these prescriptions along with an explanation of what each entails, according to the articles.

- *Preliminary risk assessment/impact study*

This prescription was mostly concerned with the presence of some sort of procedure to ensure that assisting the migration of a species would do more good than harm. Many of the articles suggested impact studies or cost-benefit analyses be done prior to any movement of species in order to justify the risk of invasives on the receiving ecosystem.

- *Further research of ecosystem dynamics*

Present in most of the articles I coded was the worry that we don't know enough about ecosystem dynamics to start interfering with them to the extent that assisted migration does. This prescription calls for an overall better understanding of ecosystems including species interactions, dispersal and abundance of species, invasion dynamics, as well as more specific data about individual species and their habitat requirements.

- *Carry out assisted migration sooner rather than later*

Though many scholars were wary of assisted migration, they were also largely adamant that it not be treated as a last resort and argued that action ought to be taken before populations of fragile species are too weak to be relocated.

- *Prioritization of “at risk” species or ecosystems*

Most scholars suggested that if assisted migration were to be put into practice certain species ought to be a prioritized above others. The criteria they suggested varied but mostly focused on species that are endangered, highly fragmented, endemic, unable to migrate on their own, or are keystone species as those they thought should be helped first.

- *Oversight of assisted migration from a higher authority*

This prescription called for some form of supervision over assisted migration projects. This ranged from governmental oversight, to an imagined scientific body by which any assisted migration endeavors would have to be sanctioned. This also included a suggestion for oversight on the smaller scale as well, including ongoing monitoring and management of projects post-migration.

- *Interdisciplinary approach*

Some scholars thought that the decisions about how assisted migration should be done in general, as well as what a specific project would look like, ought to be made not just by scientists but a group of individuals from many different disciplines.

- *Use assisted migration only as a last resort after other less extreme measures*

This prescription was expressed by scholars who disliked assisted migration because of the high amount of risk they perceived it as having as well as the fact that it is an adaptive strategy. They feel that more time and energy needs to be put into mitigating the root causes that lead to the need for assisted migration. These scholars also thought that other, less extreme forms of adaptation, such as creating corridors between wilderness areas, ought to be attempted before assisted migration.

- *System to prioritize species and ecosystem*

Rather than suggesting specific types of species to be prioritized to assist in the migration of, this prescription recommended the creation of a system by which to prioritize them. It focused on a need to systematically determine the value of individual species.

- *Better modeling and use of technological applications*

This prescription was similar to the call for further research, but focused specifically on the use of models to help find suitable future habitats for species by predicting the movement of climate patterns.

- *Systematic approach resulting in coherent and concrete policy*

This prescription was similar to the call for oversight. This one, however, focused on the need for a systematic process to follow when undertaking assisted migration, rather than the body which would oversee that process. Scholars emphasized the need for extensive planning, coherent management frameworks, and concrete policy goals.

- *Flexible assisted migration policy that can be adapted on a case-by-case basis*

Because assisted migration could potentially apply to so many different ecosystems and species, scholars recommended that the policy set up to guide this process be able to adapt on a case-by-case basis to meet a variety of goals.

- *Precautionary action*

Some articles called for precautionary action to be taken before assisted migration occurs, or while the infrastructure for this process is being set up. The most common recommendation for this was the creation of seed banks or other captive “insurance” populations, just in case native populations became too weak to move or go extinct.

- *Intergovernmental collaboration*

Because plant and animal species will likely move across national borders in their poleward migration, scholars suggested that governments start discussing how they will work together to facilitate the movement of species across jurisdictions.

Table 1:

Prescriptions	Total Combined Score
Preliminary risk assessments/impact studies	6.23
Further research of ecosystem dynamics	3.90
Carry out A.M. sooner rather than later	3.42
Prioritization of certain species or ecosystem	2.91
Oversight of A.M. process from a higher body	2.30
Interdisciplinary approach	1.80
Use A.M. as a last resort	1.64
System to prioritize species and ecosystems	1.54
Better modeling and technological applications	1.50
Systematic approach or coherent/concrete policy	1.38
Flexible A.M. process on case-by-case basis	1.29
Precautionary action	0.86
Intergovernmental collaboration	0.33

Table 1 shows the combined weighted scores of each prescription from all 30 articles. These prescriptions are the result of the categorization of the original wording of prescriptions in the article. The original wording and how they were categorized can be found in Appendix A. The total combined score represents the totaled frequency with which prescriptions of that category were mentioned within their articles, divided by the total number of mentions of any prescription in that article.

Of the thirty articles I coded, all mentioned between two and five prescriptions with varying frequency. Seven of the 13 common prescriptions I found had to do with setting up an infrastructure through which to run assisted migration: “preliminary risk assessments/impact studies; oversight of A.M. process from a higher body;” “interdisciplinary approach;” “system to prioritize species and ecosystems;” “systematic approach or coherent/concrete policy;” “flexible A.M. process on case-by-case basis;” and “intergovernmental collaboration.” Of the other six prescriptions, two were concerned with when assisted migration should be utilized, either “sooner rather than later” or “as a last resort.” Two others, “further research of ecosystem dynamics” and “better modeling and technological applications” are expressive of a lack of knowledge that needs to be filled before starting to move species. The last two are suggestions for

specific actions that scholars believe should be included in the assisted migration process: “prioritization of certain species or ecosystem” and “precautionary action.”

Second Tier Analysis: Evaluating Case Studies

Now that I have gained insight into the common priorities held by the scientific community regarding the aspects of assisted migration they consider most important, I will compare these theoretical prescriptions to real world activities. I have found three case studies, all of which are carrying out activities that could either be, or could lead to, assisted migration. I have examined the websites of all three of the organizations responsible for these projects, and in one case a supplemental work plan, in order to judge whether their practices and goals line up with, or are at odds with, those of the conservation community. I read the websites, and supplemental material, and collected quotes that demonstrated either alignment or divergence from each of the 13 prescriptions from the first section of my analysis. I then synthesized this information into a list of which prescriptions are present in each case study and which are not.

The Case Studies

I chose these case studies because they are essentially the only assisted migration projects being carried out in the U.S. that have information about their operations available to the public. Fortunately, these three projects also represent a variety of different approaches to assisted migration and are run by groups with an array of differing interests.

Assisted Migration Adaptation Trial

The Assisted Migration Adaptation Trial or AMAT is a large, long-term study commissioned by British Columbia's Ministry of Forest and Range. The aim of the study is to develop a better understanding of the adaptation of the Ministry's breeding populations of tree species across a range of climatic environments. Ultimately they are attempting to determine which seed sources are best adapted, not to current climates, but to the warmer climates that will occur in the future. The major driving forces behind this project are the Canadian logging industry and government, who wish to mitigate potential losses from weakened populations of commercially important tree species. The study will test 48 seed sources across 48 test sites located along the west coast of North America from northern California to southern Yukon. Growth, health and wood quality of the trees on these test sites will be measured twelve times per year for four years beginning in 2009. This information will then be used to create a database of productivity for each breeding population as a function of climate and latitude.³⁷

Dixon National Tallgrass Prairie Seed Bank

The Dixon National Tallgrass Prairie Seed Bank, run through the Chicago Botanic Garden, collects seeds from states across the Midwest and northern Great Plains, including: Minnesota, Wisconsin, North Dakota, Michigan, and Iowa. They store these seeds in their seed banking facility as a form of ex situ (off site) conservation. Their mission is to conserve the native species of the tallgrass prairie ecosystems, which, due to land use changes that reduced the range of these ecosystems drastically, is one of the

³⁷ Greg O'Neill, et al. *Assisted Migration Adaptation Trial Workplan* (January 2013), 1-3.

most threatened habitats in the world.³⁸ These seeds can then be used for research as well as possibly for future restoration projects. Though not strictly restoration, these seeds could be used to establish new populations of tallgrass prairie species outside their current native range if the species are unable to migrate on their own due to rapid climate change.³⁹

Torreya Guardians

The Torreya Guardians are a self-organized group of citizen naturalists dedicated to saving the tree species *Torreya taxifolia*, or stinking cedar, by assisting its migration outside its native range in Florida to North Carolina. Torreyas have a very small present day native home range, only about a 40 mile stretch of bank along the Apalachicola River along the Georgia-Florida border. However, it is thought that torreyas used to be widespread throughout North America about 30,000 years ago, but that when climate changed and glaciers moved southward, the torreya was pushed south to a low-lying “pocket” that served as a warm climate refuge during glaciation. When the glacier retreated and the climate started warming back up, instead of moving back north again as many other species did, the trees, for unknown reasons, remained stuck in this area.⁴⁰ The population crashed in the 1950s due to a warming climate and today no adult trees remain in this native range, only saplings that die and resprout over and over again. The Torreya Guardians, concerned that rising global temperatures would mean the permanent extinction of the species, have decided to take action to save the tree. In 2008 the

³⁸ “Plant Conservation: Seed Banking,” Chicago Botanic Garden, accessed March 27, 2013, http://www.chicagobotanic.org/research/plant_conservation/seedbank.

³⁹ “The Dixon National Tallgrass Prairie Seed Bank and National Tallgrass Prairie Preparation Laboratory,” Chicago Botanic Garden, accessed March 27, 2013, http://www.chicagobotanic.org/research/seed_bank.php.

⁴⁰ “What We Are Learning About Torreya’s Habitat Preferences,” Torreya Guardians, accessed March 27, 2013, <http://www.torreyaguardians.org/learnings.html>.

Guardians moved a total of 31 seedlings 400 miles north of the Florida *torreya*'s current natural range to two sites in the North Carolina mountains, sites owned by private citizens also interested in helping the tree migrate north once more.

Results

Table 2:

Prescriptions	Case Studies		
	Assisted Migration Adaptation Trial	Dixon National Tallgrass Prairie Seed Bank	Torreyia Guardians
<i>Preliminary risk assessment/impact study</i>	No	Yes	No
<i>Further research of ecosystem dynamics</i>	No	No	No
<i>Carry out assisted migration sooner rather than later</i>	Yes	No	Yes
<i>Prioritization of endemic/fragile certain species or ecosystems</i>	No	Yes	Yes
<i>Oversight of assisted migration from a higher authority</i>	Yes	Yes	No
<i>Interdisciplinary approach</i>	No	No	No
<i>Use assisted migration only as a last resort after other less extreme measures</i>	No	Yes	No
<i>System to prioritize species and ecosystem (systematic value judgments)</i>	Yes	Yes	No
<i>Better modeling and use of technological applications</i>	Yes	Yes	No
<i>Systematic approach resulting in coherent and concrete policy</i>	Yes	Yes	No
<i>Precautionary action</i>	No	Yes	No
<i>Flexible A.M. process on case-by-case basis</i>	No	No	Yes
<i>Intergovernmental collaboration</i>	Yes	No	No
Total Prescriptions Met	6	8	3

In Table 2 I used the quotes from websites and supplemental planning documents to determine which prescriptions each case study embodied or did not embody.

The case study that met the most prescriptions, as laid out by academic articles, was the Dixon National Tallgrass Prairie Seed Bank (DNTPSB), with eight of thirteen prescriptions met. The seed-banking project succeeded in filling most of the criteria that had to do with a systematic approach to assisted migration, which accounts for more than half of the total criteria. The case study with the least prescriptions, the Torreyia Guardians, failed to meet all but one of these “systematic” type criteria and therefore differs the most from the scholarly vision of ideal assisted migration. The Assisted Migration Adaptation Trial (AMAT) met about half of the systematic prescriptions leaving it in the middle ground between DNTPSB and the Torreyia Guardians. Of the top three prescriptions (“preliminary risk assessment/impact study,” “further research of ecosystem dynamics,” and, “carry out assisted migration sooner rather than later”) each of the three case studies only succeeded in meeting one of these prescriptions. All three case studies failed on the “interdisciplinary approach” front as well as lacking any component of “further research of ecosystem dynamics.” Further, not one of the thirteen prescriptions was met by all three case studies.

Discussion & Implications

Theory versus Practice

The take away message from the second tier of my analysis is that there is quite a divergence between the ideal version of assisted migration held by the scholars writing on the subject and the actual projects that are being done. For example, the case study that is most in line with scholarly prescriptions is the Dixon National Tallgrass Prairie

Seed Bank, which, though fulfilling eight of thirteen criteria, is not technically currently doing an assisted migrating. They are only preparing for the future possibility of needing to. The other two cases, which are actively moving species, lack some of the more central criteria. The Torreya Guardians are lacking in oversight and systematic standards, while the Assisted Migration Adaptation Trial is failing consider ecosystems as whole entities or take enough precaution to minimize negative impacts.

On one hand, the divergence between the scholars' prescriptions and the operations of these case studies shows that academic opinions, in this instance, are not very influential in shaping real world practices. On the other hand, none of these projects are being run through the Department of the Interior or any of its lesser branches, which the articles I have been coding, all seem to imagine they should be. Where these case studies fail to meet scholarly standards is largely where they differ, procedurally, from these types of government organizations. Even the AMAT, which is being run through Canada's equivalent to the Forest Service, does not quite fit the bill as it concerns itself with only commercially important species, which does not line up with the conservation goals these scholars have in mind. The case studies differ from scholarly recommendations mostly because they are following objectives laid out by their own organizations which stray from the more utilitarian conservation goals set forth by government run entities, like the National Park Service, Forest Service, and U.S. Fish and Wildlife.

In an article that explored different potential policy options for assisted migration one scholar stated that:

The only policy options we categorically reject are the two that are currently being implemented. Maverick, unsupervised translocation efforts run the risk

of undermining current conservation work and do not reflect a consensus among interested parties. We more strongly reject the far more ubiquitous ‘business as usual’ scenario that is the current de facto policy.⁴¹

There is no model within my case studies that follows a systematic enough approach toward a goal that would please the conservation community. The only model they might care to draw from is that of the Seed Banking project. This, however, would only provide them with a stopgap to ensure that species don’t go extinct while they come up with a set of procedures that reflects the top priorities of the conservation community.

Building our own ark: humans as environmental authorities

Though the gap between the conservation community and current assisted migration projects shows that the conservation system is going to have to come up with its own policy for assisted migration if it is to satisfy all its own prescriptions, an examination of the prescriptions themselves suggests that this might still be far off. Of the common criteria that scholars expressed should be present in assisted migration projects, the top three prescriptions mentioned most frequently between articles were: “Preliminary risk assessment or impact study,” “Further research of ecosystem dynamics,” and “Carry out assisted migration sooner rather than later.” As what appear to be the top priorities of the academic world, these prescriptions are incredibly telling, just by themselves, though the other ten are also note worthy.

The top two of these prescriptions are both indicative of caution, hesitancy, and self-doubt on the part of academics. In essentially every article I read, scholars wanted to mandate extensive impact studies to prove that assisted migration endeavors would do more good than harm before any action was taken. Many articles also mentioned that

⁴¹ McLachlan, Hellmann, and Schwartz, “A Framework for Debate of Assisted Migration,” 299.

until we know more about ecosystem dynamics we will be unable to assist in the migration of species without doing more harm than good. Scholars expressed that they thought ecologists lacked sufficient knowledge of complex species interactions as well as the specific habitat requirements of species to be able to pull off assisted migration that succeeds in thwarting biodiversity loss. This highly cautious attitude was also reflected in some of the lesser prescriptions that had to do with setting up infrastructure for assisted migration. Calls for oversight, systems to prioritize species, a generally systematic approach, coherent policy, and intergovernmental collaboration all show that scholars think assisted migration ought to be carried out in a highly controlled manner.

The concern scholars have about the potential harm assisted migration could cause is warranted, and their wish to curtail this harm by setting up highly structured, systematic policy makes sense. As I've already mentioned, human-facilitated movement of species has very negatively affected ecosystems in the past. However, the alarm scholars feel about assisted migration, as reflected in their obsession with setting up these precautionary measures, is very telling. I think these common priorities point to a deep unease scholars have with the idea of humans as the designers of ecosystems, at least to the extent that assisted migration requires. In his own study on the debate surrounding assisted migration, Ben Minteer came to a similar conclusion:

The role of 'planetary manager' is an uncomfortable one for many ecologists who see such a solution as little more than a cloak for the familiar human arrogance toward nature that has carved deep gashes in the landscape and defined our modern environmental history.⁴²

I completely agree with this finding, and find it incredibly revealing about the root of the conservation community's anxiety. The above statement outright identifies that what

⁴² Minteer, "Move it or lose it?" 1802.

ecologists and others are afraid of is a “familiar human arrogance... that has carved deep gashes in the landscape.” This paints a picture of humans as those who’s default setting is destroyer of environments. If one believes that to be true, then it becomes incredibly hard to enact any strategies that rely on human values, such as assisted migration.

Ultimately, I think this attitude harkens back to the obsession American conservationists have with erasing human beings from the environment. The preference for a “correct,” “native,” baseline landscape is far from dead even as it becomes nearly impossible to achieve. This idea that there is a way that an ecosystem is “supposed” to be continues to keep conservationists from imagining ways in which assisted migration could be beneficial to the environment. Years of conservation paradigms have taught conservationists to erase humans from the wilderness, so when it becomes necessary to design ecosystems without the template of a baseline, of course they find it presumptuous. Who are humans, the least natural of all species, to think that they know what an ecosystem ought to look like? In their common fixation on the development of a highly systematized, risk-averse, science focused infrastructure to oversee assisted migration, these scholars reveal in themselves a recurrent desire to establish a non-human authority. However instead of yielding to the idea of the “pristine,” “pre-human” ecosystem as has been done in the past, this time around human authority is being relinquished to another institution, that of science.

The adoption of scientific procedure as authority is far from the worst thing that could happen. However, I hope that as the conservation system moves forward with assisted migration (if they do, in fact move forward) that they embrace this as an opportunity to reintroduce humans into the environment. We need to acknowledge that

with anthropogenic forces that are now geologic in scale, there is literally no place on earth that remains untouched by human hands and therefore “hands off” policies no longer make sense. We need to own up to the fact that even when we adhered to historic baselines we were impressing human values – our historically born preference for “old,” “sublime,” “untrammelled” nature – on to conservation policy and that we need to consciously allow those values and policies to change to meet future challenges.

It is true that abandoning historical baselines means getting rid of our current ways of judging success and failure, but it does not mean we cannot build new systems for these judgments. This of course is a big risk. Changing our conservation policy and possibly the laws that govern and protect threatened species and ecosystems makes them vulnerable to being done away with forever: “Because of the political pressures that can be brought to bear against conservation, reopening discussion on those targets presents real risks for conservation advocates. It is not surprising that the conservation community has not been anxious to debate goals.”⁴³ However, I strongly believe that this is a risk worth taking. Old conservation goals, that champion pre-Columbian nature, by definition have no room for people in them and if we stick to them we are going to let negative human impacts be the ultimate decider of what ecosystems look like, instead of conscious, planned human impacts. We need to allow room for people to enact positive change; otherwise our legacy as destroyers of nature becomes a self-fulfilling prophecy.

In some ways the priorities of these conservation scholars show a lot of promise. After all, among the top three prescriptions was the recognition that assisted migration needs to be done sooner rather than later; they are well aware of the urgency behind this

⁴³ Camacho et al., “Reassessing Conservation Goals in a Changing Climate,” 24.

issue. The prescriptions that called for an interdisciplinary approach and for flexibility to be built in to the process show steps toward what Marris refers to as the “cutting edge of conservation:” layering goals and managing landscapes with an eye to the future rather than the past.⁴⁴

From what I have learned, conservationists have quite a long way to go before they are ready infrastructurally or dogmatically for assisted migration. Conservationists are going to have to stop searching for some higher authority and own up to the fact that humans must become their own authority and build an ark based on human values and human understandings of the environment. This is not going to be an easy feat, but in the end there is a possibility that people can impact the natural world in a positive way, for once. Noah had it easy, he just did what God told him.

⁴⁴ Marris, *Rambunctious Garden*, 14.

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Appendix A

Preliminary risk assessment and cost-benefit analysis

- Risk assessment
- Impact studies
- More predictive understanding of impacts
- Cost/benefit analysis
- Thorough risk analysis
- Development of accurate models for risk
- Assess risks/benefits of practice
- Need to justify risk (cost benefit)
- Need to address uncertainties
- Limit invasives
- Eliminating uncertainty through research

Better modeling and technological applications

- Use of ecological engineering
- Development of models to predict future suitable habitat
- Habitat profile database
- More modeling/understanding of ecosystem dynamics
- Development of models
- Need for better models

Better understanding through further research of ecosystem dynamics

- Better understanding of habitat requirements of species
- Better understanding of populations of species
- Better understanding of invasion
- Understanding effects of translocation on ecosystem function
- Need vast research program first
- Eliminating uncertainty through research
- Need for more specific data
- Further study/research
- Better understanding of invasion
- Need for additional research on dispersal/abundance
- Better understanding of ecosystems and species interactions
- More research needed to understand ecosystems better
- Understanding of species and population dynamics and ecosystem interactions
- Better understanding of invasion
- Need future habitat suitability research/assessment (system to choose new habitat)

Development of system to prioritize species and ecosystems

- Value of species needs to be determined
- Value of species needs to be determined
- Need to decide how much we want to shape/interfere with ecosystems
- Decide what sorts of ecosystems we want around/how to prioritize

- Need system for choosing species
- Need to assess future habitat suitability
- Need way to prioritize species;

Prioritize fragile or at risk species or ecosystem

- Attention to evolutionary lineages in deciding which species to help
- Only for species that can't move themselves
- Used for endangered species
- Focus on species that will suffer with fragmentation
- Moving species that are highly fragmented
- Must be for very high risk species
- Prioritizing fragile ecosystems
- Protection of endemics
- Focus on keystone species vital to ecological function

Flexible A.M. process that can evaluate on case-by-case basis

- Case by case assessment (in terms of species)
- Case by case evaluation
- Species by species/case by case basis
- Management strategies with flexibility to respond to emerging insights
- Flexibility in policy/management
- Flexibility in policy/management

General need for systematic approach or coherent/concrete policy to guide process

- Need for means of evaluating proposed A.M.
- Decision making framework for when to start moving
- Intensive planning
- Development of management frameworks
- Transparent, structured decision-making process/policy
- Need for concrete policy goals
- Translocation guidelines
- Coherent policy

Oversight and permission for A.M. from some higher body

- Need for scientific policy/oversight
- Scientific evaluation
- Need for oversight/pragmatic approach
- Ongoing Monitoring and Management
- Monitoring program to keep tabs on ecosystems and decide when to act
- Need for oversight
- Need for scientific oversight
- Limit unsupervised translocation

Interdisciplinary approach/consultation of experts in many fields

- Need for multidisciplinary discussion of A.M. and its implications

- Consideration of stakeholders
- Interdisciplinary experts should consult/interagency cooperation

Intergovernmental collaboration

- Intergovernmental collaboration

Carry out A.M. sooner rather than later

- A.M. Not treated as a last resort
- Do not discount A.M.
- Act before species is seriously in trouble
- Carrying out A.M. in a timely manner
- Do not dismiss A.M.
- Early action
- Cannot wait for better data
- Need to consider other options for conservation
- Broader goals than just a few species

Precautionary action through genetic storage/preservation

- Unified Seed Banking in preparation for climate change
- Seed Banking
- Captive "insurance" population (just in case)

Use A.M. as a last resort (only after less extreme adaptation strategies / along with mitigation efforts)

- Mitigation before A.M. or other adaptation
- Mitigation instead of A.M.
- A.M. minor role compared to other mitigation
- Need to question practicality/feasibility of A.M.
- A.M. with mitigation as well