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# De-extinction and the Community of Being

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BY CURT MEINE

Extinction deeply colors the way we think about conservation and the role of humans in nature. It is easy to overlook how recently, in fact, it has entered our consciousness. Only in the last two centuries has science sought to critically study life's origins, development, and diversification.<sup>1</sup> Only in the last several generations have we identified and calibrated life's five major extinction events and speculated on their causes and effects.<sup>2</sup> And only in recent decades have we come to appreciate the still-unfolding fate of life's diversity under the increasing influence of humanity.<sup>3</sup>

The story of extinction has continually changed as this monumental process of interdisciplinary synthesis and imagination has unfolded. Geology, paleontology, taxonomy, biogeography, and evolutionary biology have allowed us to comprehend the deep temporal and broad spatial dynamics of the extinction story. Archaeology, cultural anthropology, and environmental and economic history have illuminated the role of humans in altering the trajectory of species, landscapes, and ecosystems over the millennia. Ecology, genetics, population biology, and conservation biology have revealed the more recent patterns in life's vulnerability and resilience. As a *phenomenon*, extinction is as old as life itself. As a *story* shaping our consciousness, values, and intentions, it is still new.

And it is uncomfortable. We humans have had a hard time coming to terms with our awareness of extinction. To listen to the story of our own complicity in life's con-

temporary diminishment is not a task for the timid or the proud. It is so much easier to avert one's eyes and skip the soul-searching or, alternatively, to see our human dominance as the inevitable and welcome end result of the long story.

For those who do accept the ethical challenge, the task is unforgiving. The loss of biodiversity does not lend itself to agreeable dinner conversation or commencement oratory. For conservation scientists and educators trying to communicate their concern, it makes for hard storytelling. People grow weary of the hard news, especially alongside other, concurrent narratives of global, postmodern gloom. We prefer the comfort of positive tales, hopeful examples, and affirmative acts. In fact, we yearn for them, mightily.

The prospect of overcoming extinction—of reversing what has until now been irreversible—answers to and expresses that yearning. Under the banner of de-extinction, the new techniques of genomic reconstitution provide a possible counternarrative. Instead of lamenting incessantly, we can thrill to the possibility of reclaiming lost life. Instead of dwelling on a tragic past of human-induced ecological wounds, we can anticipate a future of bioengineered recovery. De-extinction technologies can disrupt the dour old conservation movement as easily as Uber and Lyft have disrupted the taxi industry. It can dispel the very fact of extinction. It can change the story and turn the narrative around.

Even the dowdiest conservationists can understand the appeal. They may even share in it. The prospect of de-extinction taps into deep layers of human myth and meaning, involving ancient themes of life and death, light and dark, creation and chaos, loss and resurrec-

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tion, free will and fate, guilt and redemption. The optimism behind it has, after all, served our species well. And so the great irony: the prospect of de-extinction appeals to our pragmatic, Promethean cleverness, that part of our humanity that has allowed us to rise (or fall) to ecological dominance and given us the power to drive other species to extinction in the first place.<sup>4</sup> How we process that irony reveals what lessons we humans have gleaned in becoming not just the *subject*, but a self-conscious *agent*, of evolution.

### The Historical Response to Anthropogenic Extinction: A Brief Review

Once paleontologists established the fact of past extinction events, and once naturalists focused on the human role in recent and contemporary extinctions, a moral response followed. In 1863, Alfred Russel Wallace lamented “the extinction of the numerous forms of life which the progress of cultivation invariably entails” and instructed his fellow naturalists to amplify their efforts to document life’s diversity:

If this is not done, future ages will certainly look back upon us as a people so immersed in the pursuit of wealth as to be blind to higher considerations. They will charge us with having culpably allowed the destruction of some of those records of Creation which we had it in our power to preserve; and while professing to regard every living thing as the direct handiwork and best evidence of a Creator, yet, with a strange inconsistency, seeing many of them perish irrecoverably from the face of the earth, uncared for and unknown.<sup>5</sup>

Over the next half century, the incidence of documented extinctions accelerated. The great auk disappeared in 1852, the Labrador duck in 1878, and the quagga in 1883, while prominent species such as the American bison and passenger pigeon faced extraordinary exploitation and rapid collapse. Early conservationists began to make the case for valuing other life-forms and for taking action to prevent human-caused extinction. “All nature,” wrote George Perkins Marsh in 1864, “is linked together by invisible bonds, and every organic creature, however low, however feeble, however dependent, is necessary to the well-being of some other among the myriad forms of life with which the Creator has peopled the earth.”<sup>6</sup> Theodore Roosevelt regarded it as “vandalism wantonly to destroy or to permit the destruction of what is beautiful in nature, whether it be a cliff, a forest, or a species of mammal or bird.”<sup>7</sup> The zealous zoologist and activist William Temple Hornaday (in one of his more restrained moments) held that “[t]he wild things of this earth are not ours to do with as we please. They have been given to us *in trust*, and we must account

for them to the generation which will come after us and audit our accounts.”<sup>8</sup> The decline and loss of wild species became an important force behind the American conservation movement as it arose in the Progressive Era of the early twentieth century. Scientific concern, policy actions, and moral fervor intensified further with the passing of Martha, the last passenger pigeon, in the Cincinnati Zoo on September 1, 1914. The pigeon’s well-publicized extinction stirred the campaign for wildlife protection, leading to adoption of the U.S.-Canadian Migratory Bird Treaty in 1916.<sup>9</sup>

For all the growing fervor for conservation reforms, there was as yet no generally developed science or technique for sustaining or restoring viable populations of wild animals *in situ*. Wildlife conservation and management, such as they were, involved the passage of more restrictive game laws and regulations, persecution of predatory species, artificial rearing of some hunted species on game farms, and establishment of occasional game refuges (with the assumption that national parks and other protected areas would suffice to maintain wildlife). In a 1930 address, conservationist Aldo Leopold noted that these steps, “which served to string out the remnants of the virgin game supply . . . seem to have reached the limit of their effectiveness. Something new must be done.”<sup>10</sup>

That “something new” required nothing less than a paradigm shift in conservation and the creation of a new professional field. Wildlife management emerged in the 1930s, based on the fundamental insight that the status of any species, in any place, at any time, is a function and expression of its ecological relationships. In an early formulation of this novel approach, Leopold stated, “[T]he one and only thing we can do to raise a crop of game is to make the environment more favorable. This . . . is the fundamental truth which the conservation movement must learn if it is to attain its objective.”<sup>11</sup>

Over the next decade, as Leopold and his contemporaries labored to apply emerging ecological principles and concepts to the conservation cause, the scope of the new field embraced a broader array of wild species, including rare and threatened ones. Leopold wrote in 1936, “No species can persist whose environment is no longer habitable. The next move is to examine each threatened species, to analyze its requirements for reproduction and survival, to build out of this knowledge a technique of conservation, and to bring this technique to the attention of landowners who can apply it.”<sup>12</sup> As the paradigm shifted, conservation began to redefine itself, to lift its eyes beyond the value and fate of particular species to the functional health of entire biotic communities, landscapes, and ecosystems. By 1939, Leopold was making the case for valuing the full spectrum of biological diversity. “The emergence of ecology has placed the economic biologist in a peculiar dilemma,” he

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observed. “With one hand he points out the accumulated findings of his search for utility, or lack of utility, in this or that species; with the other he lifts the veil from a biota so complex, so conditioned by interwoven cooperations and competitions, that no man can say where utility begins or ends.”<sup>13</sup>

A generation of conservationists, tempered by the experience of widespread deforestation, depleted wildlife populations, and epic-scale soil erosion, came to realize that the aim of conservation had to be as complex as the community of life itself—and that the biotic community included people. Let us call this the *relational* concept of species extinction and conservation. As ethicist Ronald Sandler has emphasized, “What is important about species is not just that they exist but that *their existence is in context*, as part of relationships, performing specific functions” (emphasis added).<sup>14</sup>

In the decades since, conservation has struggled to reorient itself according to this concept, even while warding off the traditional exploitative threats and addressing intensified global environmental dilemmas. The Endangered Species Act and other legal mechanisms absorbed the science and codified the protocols for meeting the biological needs of species. Landscape ecology, conservation biology, agroecology, ecosystem management, community-based conservation, ecosystem services, traditional ecological knowledge, and other fields and approaches have emerged to cut across disciplines, jurisdictional boundaries, and value systems.<sup>15</sup> The “land ethic” that Leopold drew out of his life experience has, by one reading, been overwhelmed by the postwar “great acceleration” into the Anthropocene.<sup>16</sup> Under an alternative interpretation, however, the land ethic has continually evolved to address new concerns, providing rootstock for an increasingly urgent and unifying earth ethic.<sup>17</sup> More than ever, conservation is all about relationships that promote social and ecological resilience at varied scales of time and space.

### **The Complexity of Modern Extinction**

**W**hat does all this mean in terms of the prospects for de-extinction?

Whatever else it entails, it may lead us to appreciate the complexity of modern extinction as a phenomenon. The stark reality of extinction leads us to consider it in simple terms, as the end of a biological line. But in the modern age, extinction—and, in general, the status or fate of any species—is hardly simple. Conservation biologists, summarizing the primary threats to biodiversity, recognize several “horsemen of the ecological apocalypse”: overexploitation, habitat destruction (including pollution), introduced species, disease, and other interspecific impacts. In recent years, they have tended to add a fifth—climate change—and to emphasize the ominous synergies among them.<sup>18</sup> Extinction is not so much the line at the end of a straight downward path as the culminating moment of a complicated vortex.

Moreover, conservation biologists have increasingly come to recognize and emphasize the obvious fact that each of these threats has a social and cultural dimension.<sup>19</sup> The status of a species at risk of extinction reflects not only a suite of biological vulnerabilities but also a set of ever-shifting, ever-evolving ecological and social relationships. The persistence, demise, or recovery of a species is a manifestation of a human community’s collective knowledge, ethic, economy, policies, practices, and ecological condition.

Extinction, then, does not merely mark the end of a genetic line and the blinking out of a population or a last individual. It is the final stage in the dimming and fraying of a socioecological reality. Global extinctions and local extirpations are therefore also biological barometers. Like abnormal soil erosion or water pollution or anthropogenic climate change, species extinctions and extirpations are outward indicators of trends in our ways of living with each other and with other species, within entire ecosystems.

The first five great episodes of extinction occurred in the absence of humans. We are now complicit. Henceforth, because of our now pervasive influence on global conditions, any extinction will involve some degree of human implication (and hence ethical consideration). Extinction is a natural phenomenon that human agency has exacerbated and accelerated over the millennia. As the human role within natural communities has intensified in recent

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centuries, and especially in the last few decades, extinction has become more and more a *social* process.

Extinction is, however, just one (albeit ultimate) expression of any given species' status. Species *survival* is a function of continuity and connection within human and natural communities. Species *evolution* occurs as a result of genetic change and natural selection and, increasingly, in response to human behavior and ecosystem modification.<sup>20</sup> Species *abundance* is an expression of biological opportunity and socioecological context. Species *loss* is the result of links that have inadvertently eroded—or that have been purposefully broken—in the land (and Earth) community. Species *recovery* is the result of links reestablished, space reclaimed, human values and priorities shifting, and potentials realized in a changed and ever-changing environment. The passenger pigeon provides a classic historical example. It was lost because, due to its life history, behavior, and ecological requirements, it could not adapt in the face of colonization, relentless market demand, new technologies (especially the railroad, telegraph, and firearms), and the lack of any effective ethical restraint among its exploiters.<sup>21</sup>

The history of modern wildlife conservation may be read as the effort to recognize and respond to this ecological and social complexity—to take into account the scales of time and space, rapidly changing environmental conditions, and diverse social and economic circumstances that define the context of any species. Meanwhile, let us remember that *wildlife* conservation is but one part of conservation's much broader portfolio. While we often focus on the fauna (and usually threatened and charismatic fauna), conservation is also concerned with the status and resilience of soils, fresh waters, watersheds, plant communities, whole landscapes, and the oceans; with the stewardship of farms, forests, rangelands, and fisheries; with the restoration of ecosystems and cultural connections to lands and waters; with food systems and human health, vibrant cities and local economies, justice and climate and the claims of future generations. The status of a given species, and the efficacy of any human intervention in the trajectory of that species, is embedded within a wide field of conservation needs.

### De-extinction, Complexity, and Reductionism

The viability and utility of de-extinction as a conservation technique should be considered within this complex context. The effort to resurrect extinct species now provides a new and unprecedented twist in the great narrative of life on Earth and of conservation's efforts to sustain biodiversity and resilient ecosystems while meeting human needs. As Stanley Temple has noted, "If extinction is not forever, a lot changes."<sup>22</sup> We might add that de-extinction potentially changes things in terms not only of biological

organisms and systems but also of conservation's aims and ethical frames and its practical priorities and approaches.

Others have defined the pros and cons of de-extinction as a possible innovation. Debates have ensued over an array of issues and concerns that come with the technical advances: that the revival and release of "de-extincted" species could interfere ecologically in unpredictable ways with existing wildlife populations; that they may pose other potential biological risks (as pests, disease vectors, or invasive species); that de-extinction efforts could divert attention and resources from efforts to conserve extant biodiversity; that individual animals produced through unproven techniques may experience undue suffering; that the legal status of such potential creatures (especially as intellectual property) is unclear and problematic; that extinct species in fact have a critical continuing role to play as conveyors of the value of "collective self-restraint . . . human limits . . . [and] earthly modesty."<sup>23</sup>

Of all de-extinction's potential implications, the one I find most revealing involves the implicit species concept that defines much of the current interest. In contrast to the embedded, relational species concept toward which conservation has fitfully advanced over its history, the supposedly cutting-edge de-extinction technologies are ironically prone to regard species the old-fashioned way. They treat a biological part—in this case, a now more easily malleable genome—as isolated in time and space, detached from its ecological milieu and its ethological expression, with little consideration given to its evolutionary or human social context. Whereas the relational view of species has required an ethical response to conservation challenges, this reductionist concept of species, with its emphasis on the genome, focuses on providing a technological fix for the modern problem of anthropogenic extinction.<sup>24</sup>

This is problematic on several levels. The supposition is that resurrecting (or perpetuating) a species is first and foremost a matter of manipulating gene sequences and engineering individual organisms, not of reconstituting and sustaining community relationships—among humans, within ecosystems, and between humans and nature—that can support healthy populations capable of perpetuating themselves within their changing places. However fascinated we may be by the technological achievement, it raises this question: What is the conservation value of a de-extincted species if the landscape is unable to receive or support the revived organisms and populations?<sup>25</sup>

At least at this early point in its career, de-extinction has displayed a narrowly reductionist, mechanistic, and technocratic approach to the fate of species. Decades of hands-on experience in diverse species reintroductions have taught conservationists a basic lesson: reintroduction does not and cannot take place in a social or ecological vacuum. No species exists, or can thrive, or can be restored, apart

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from the intricate reality of its behavior patterns, population dynamics, ecological relationships, and human social contexts (not to mention its project budget). Swedish environmental historian Dolly Jørgensen has elaborated on this point, noting, “If you look at cases [where we have tried to reintroduce predators] following periods of local extinction—like the lynx in Scotland and wolves in Europe—what you see is that it’s a very contested space.”<sup>26</sup>

Even uncontested, relatively successful reintroduction efforts involve years of detailed research, planning, and preparation; careful attention to communication and social realities; and a deliberative process of adaptive management. When a herd of twenty bison returned to the Nachusa grasslands in Illinois in the fall of 2014—the first to roam the area since the 1830s—they did not do so by swimming themselves across the Mississippi River. They came by trailer from Iowa and, as a *Chicago Tribune* editorial explained, “settled into prairies that Nachusa’s volunteers had spent 450,000 hours preparing.”<sup>27</sup> Seventy years of devoted work have brought the whooping crane back from the brink of extinction, but it has taken a great conservation village to do it. Generations of devoted field biologists, aviculturists, ethologists, geneticists, educators, policy-makers, administrators, volunteers, law enforcement officers, funders, and citizen scientists have contributed to the effort. And still, between 2011 and 2016, one in five whooping cranes in the reintroduced population whose cause of death could be determined—more than twenty of these rare individuals—were illegally shot.<sup>28</sup>

In short, reconstituting a genome and putting the resulting organism outside is not the same as conserving a species or a place. Undoubtedly, recovering the pieces of an extinct genetic line and fashioning a viable organism from them are daunting technical tasks. Yet, however difficult, those tasks are so much easier than the careful, demanding, day-to-day, person-to-person, person-to-place, life-long practice of conservation—not merely the weaving together of bits of genetic material in a laboratory, but of encouraging healthy relationships in the landscape.

An argument can be made that de-extincting a species is in some sense a human effort, and a community effort, to right a human-caused wrong. In the case, for example, of the passenger pigeon, it certainly draws upon the his-

toric efforts of nineteenth-century naturalists who devoted themselves to collecting specimens of the doomed bird and techniques developed by cadres of modern synthetic biologists. But this points to a more fundamental flaw in the reductionist concept and definition of a species. As conservation biologist (and pigeon specialist) David Blockstein has pointed out, “[T]he ecological niche of the passenger pigeon is as gone as the bird. . . . Certainly nobody knows what the behavior of such birds [that is, the products of de-extinction] would be—but it would not exhibit the unique behaviors of the Passenger Pigeon and it would not be a Passenger Pigeon.”<sup>29</sup>

This is the difficult, final truth of extinction that we have such a hard time accepting. Technology cannot, and can never, recreate a lost species, because a species is more than its genome; it is the unique expression and evolution of the genome, through a vital population, interacting with and within a unique physical, biological, and social environment, over a unique period of time. We may be able to fabricate a chimeric organism, and there may be value and fascination in that work, but we cannot “bring back” a species. In the report *Guiding Principles on Creating Proxies of Extinct Species for Conservation Benefit*, the Species Survival Commission of the International Union for Conservation of Nature (IUCN) makes this point more precisely: “Epigenetic effects, the influence of the rearing environment, the absence of appropriate conspecific learning opportunities, and other factors . . . will result in the creation of proxies that differ in unknown and unpredictable ways from the extinct form, even as clones of the original.”<sup>30</sup>

Extinction, in other words, *is* indeed forever. De-extinction, it follows, is a literal impossibility. The products of de-extinction can never be more than artificial proxies. The *thing* that we are purporting to de-extinct has ceased to exist and can never exist again. The spatial and temporal context of that *thing*, and the set of relationships that created and defined it, no longer exist. In reality, de-extinction techniques would create new life-forms, albeit out of extant bits and scraps of older genetic material. Should they come into being, we may certainly wonder at them as products of our human genius for invention. We may value them as providers of lost ecosystem services; as expressions, after a fashion, of our regret and longing; and even as objects of

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beauty and rarity in their own right. But in regarding them as somehow overcoming extinction, we demonstrate the difficulty we have in facing the finality of extinction.<sup>31</sup> We are still seeking to come to terms with it.

### Of Melomys and Megafauna

In June 2016, Australian scientists reported that the only known population of the Bramble Cay melomys (*Melomys rubicola*), or mosaic-tailed rat, had blinked out. The melomys, an unassuming rodent found only on a tiny coral island at Australia's northernmost tip, was last seen in 2009. Multiple inundations of the low-lying island had reduced the rat's habitat and may have directly killed individuals. Analysis of sea-level rise, the increased frequency and intensity of storms, and the incidence of extreme high-water levels and storm surges in the region led the biologists to identify climate change as the root cause of the melomys's demise. Although there is hope that the species, or a closely related one, might be found across the Torres Strait in Papua New Guinea, the report's findings made headlines around the world. As the authors starkly noted, "[T]his probably represents the first recorded mammalian extinction due to anthropogenic climate change."<sup>32</sup>

It is customary in such reports to offer recommendations. In this report, the scientists call for amending the status of the species under Queensland's and Australia's statutes and on the IUCN Red List. They recommend field surveys in New Guinea and the collection of DNA data from any specimens found there. They note the need to assess the threat also to important turtle and seabird rookeries likewise found on Bramble Cay. There is among the recommendations no call to de-extinct the Bramble Cay melomys. As more and more species face continuing pressures from the old "horsemen of the ecological apocalypse," compounded by climate change, it is hard to imagine how the application of de-extinction techniques will be able to keep up—how, even with the best of intentions, they can provide a meaningful response to the rising waves of extinction.<sup>33</sup>

We thus arrive at an even less encouraging conclusion, one guaranteed, alas, to confirm the stereotype of the dour conservationist. De-extinction, however new and attention grabbing the technique, may simply perpetuate an ancient human flaw. It is liable to become just the latest example of human technological capacity intensifying while ethical expansion lags. Reflecting upon the meaning of the passenger pigeon's annihilation, Aldo Leopold observed in 1946, "[F]or one species to mourn the death of another is a new thing under the sun."<sup>34</sup> It *was* a new thing. Other species were and are blissfully unconscious of extinction. And as mentioned above, for humans with modern science at their

disposal, it presented a dawning awareness and an unprecedented moral challenge.

For Leopold and other conservationists, the loss of the pigeon and other modern extinctions elicited a profound re-examination of our values and actions. "This new knowledge should have given us, by this time, a sense of kinship with fellow-creatures; a wish to live and let live; a sense of wonder over the magnitude and duration of the biotic enterprise."<sup>35</sup> Now our era of accelerated anthropogenic threats to biological diversity prompts us to seek, not merely technological, but ethical innovation. Those are not, and cannot be, exclusive categories. But the latter is so much more difficult and complicated than the former. We find it easier to change the world around us (and the *things* within it) than to change ourselves.

Yet, guidance comes from history and from an array of cultural traditions.

I introduced this discussion with the premise that awareness of extinction is a recent phenomenon and that we have yet to come to terms with that awareness. However, the premise does not hold for all cultures in all times and places. In Native American experience, for example, we may find echoes of the loss of the Pleistocene megafauna. Kiowa poet and writer N. Scott Momaday has voiced this view, describing the emergence of Clovis culture and the effect of Paleoindian hunting on the development of Native American land ethics. The passage is worth quoting at length:

This ancient drama of the hunt is enacted again and again in the landscape. The man is preeminently a predator, the most dangerous of all. He hunts in order to survive; his very existence is simply, squarely established upon that basis. But he hunts also because he can, because he has the means; he has the ultimate weapon of his age, and his prey is plentiful. His relationship to the land has not yet become a moral equation.

But in time he will come to understand that there is an intimate, vital link between the earth and himself, a link that implies an intricate network of rights and responsibilities. In some unimagined future he will understand that he has the ability to devastate and perhaps destroy his environment. That moment will be one of extreme crisis in his evolution. . . .

Thousands of years later, about the time that Columbus begins his first voyage to the New World, another man, in the region of the Great Lakes, stands in the forest shade on the edge of a sunlit brake. In a while a deer enters into the pool of light. Silently the man fits an arrow to a bow, draws aim, and shoots. The arrow zips across the distance and strikes home. The deer leaps and falls dead.

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But this latter-day man, unlike his ancient predecessor, is only incidentally a hunter; he is also a fisherman, a husbandman, even a physician. He fells trees and builds canoes; he grows corn, squash, and beans, and he gathers fruits and nuts; he uses hundreds of species of wild plants for food, medicine, teas, and dyes. Instead of one animal, or two or three, he hunts many, none to extinction as the Paleo-Indian may have done. He has fitted himself far more precisely into the patterns of the wilderness than did his ancient predecessor. He lives on the land; he takes his living from it; but he does not destroy it. This distinction supports the fundamental ethic that we call conservation today. In principle, if not yet in name, this man is a conservationist.

These two hunting sketches are far less important in themselves than is the long distance between them, the whole possibility within the dimension of time. I believe that in that interim, there grew up in the mind of man an idea of land as sacred.<sup>36</sup>

Lessons of the Pleistocene remain embedded in the varieties of Native American land ethics, which share, in all their diversity, a relational understanding of kinship within and across species boundaries. Robin Kimmerer gives voice to this understanding, drawing upon her Anishinaabe tradition: “Ecological restoration is an act of reciprocity and the Earth asks us to turn our gifts to healing the damage we have done. The Earth-shaping prowess that we thoughtlessly use to sicken the land can be used to heal it. It is not just the land that is broken, but our relationship with land. We can be medicine for the Earth, partners in renewal.”<sup>37</sup>

The prospect of de-extinction now places difficult questions before us. Given the powerful tools of synthetic biology coming into our hands, what might reciprocity entail? How can and should relations be healed or renewed when extinction has severed the living connection? How do we most appropriately honor the extinct? By pursuing their resurrection, or honoring their martyrdom? What is the appropriate form of atonement?<sup>38</sup> Does de-extinction represent an ultimate act of selflessness—the application of human ingenuity on behalf of another species—or is it in fact an ultimate act of hubristic selfishness?

In one of the most forceful passages of *Laudato Si*, Pope Francis asks that species be honored for their intrinsic value, not for what we make of them:

It is not enough . . . to think of different species merely as potential “resources” to be exploited, while overlooking the fact that they have value in themselves. Each year sees the disappearance of thousands of plant and animal species which we will never know, which our children will never see, because they have been lost forever. The great

majority become extinct for reasons related to human activity. Because of us, thousands of species will no longer give glory to God by their very existence, nor convey their message to us. We have no such right.<sup>39</sup>

In this, the pope adds the Catholic church’s voice to the ongoing elaboration of conservation ethics. In the *Guiding Principles* report, the IUCN anticipates the next question: “Humans have a moral obligation not to render species extinct, but it is unclear if this extends to a moral obligation to resurrect them.”<sup>40</sup>

Writing from Buddhist tradition, monk and scholar Tikh Naht Hahn has offered the concept of “inter-being” to highlight the realization that what we regard as our “separate” selves, and separate things, exist as manifestations of community relationships. “Nothing can exist by itself alone,” Hahn observes. “It has to depend on every other thing. That is called inter-being. To be means to inter-be. The paper inter-is with the sunshine and with the forest. The flower cannot exist by itself alone; it has to inter-be with soil, rain, weeds and insects. There is no being; there is only inter-being.”<sup>41</sup> With recent research and description of the human microbiome, we now see in even more literal terms that the boundaries of our own selfhood are, in one sense, fuzzy; but we might just as well view them as *expansive*.<sup>42</sup>

So with the boundaries of species-hood. In all these diverse cultural expressions, we are encouraged to see species, not merely as raw genetic material that can be reconstituted in new forms, but as unique manifestations that are defined by and ought to be honored through evolving relationships and ethical frames. From the ancient disappearance of the Pleistocene megafauna to the advent of accelerated extinction in the Anthropocene, humans have defined our humanity in part through our inventive genius but also through our deepening awareness of creation’s unique and ephemeral manifestations—and of that which we have needlessly lost. We are still becoming human, still coming to appreciate the creatures and places that we share with, and within, the community of being.

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