# Documenting Disappearance

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climate modification, the technologies being considered, and the problems that they might pose.

David W. Orr, with *Down to the Wire: Confronting Climate Collapse*, and Bill McKibben, with *Eaarth: Making a Life on a Tough New Planet*, have written eloquent, thoughtful books that are valuable resources for living meaningfully in the 21st century. In his 1989 book, *The End of Nature,* McKibben helped bring climate change to popular attention, and his work with *Step It Up* and *350.org* has inspired people all over the world. McKibben and Orr agree that in some sense the game is over and climate change has won. Forget about saving the Earth and instead think about what it is to be human in this world of our own making. Rather than putting their hopes in superheroes, these authors are concerned with how we can live with hope, grace, and dignity in the world that we are bringing about.

Although both authors have wise and interesting things to say, it is something of a disappointment that their prescriptions for the future are so like the advice that they have given in the past. In *Down to the Wire,* Orr does suggest a range of structural reforms. Some are attractive (e.g., revoking corporate personhood), others are romantic (e.g., a council of elders to advise the president), some are downright scary (e.g., calling a constitutional convention), and all are underdeveloped. While recognizing the ambiguous importance of globalization, both writers primarily celebrate the value and importance of localism. Their enthusiasm jumps off the page when they describe small farms in a proposed greenbelt around Oberlin, Ohio, or eating at the Farmers Diner in Quechee, Vermont. They know as well as I do that whatever the virtues of life in a small Ohio or Vermont town, this is not the whole story. In 1800, only 3 percent of the world's population was urban; by 2050 the proportion will be 70 percent, and most of them will be in the developing world.

Climate change is, among other things, a global and intergenerational collective action problem. Our prevailing ethical norms and political institutions are not adequate for addressing such problems. What we need is all the thinking that these authors have brought to us, and more besides. We need an ethics and politics as rigorous as the science that has revealed our predicament. This requires serious work, some of which is already going on in comparative obscurity. Such work does not lead naturally to coffee table books or riveting descriptions of "the smartest guys in the room." Yet it is the kind of work that is required if we are to reason together about the most serious problem that humanity has ever faced.

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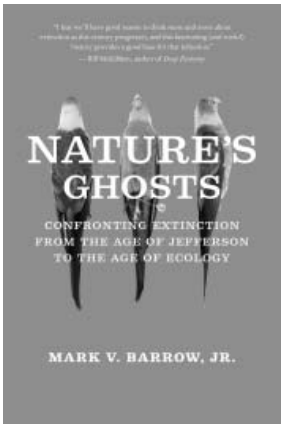
## DOCUMENTING DISAPPEARANCE

A reader will draw two inescapable conclusions from these two well-researched volumes about extinction: We know an impressive amount about human-caused extinctions, and we have done little to stop them. Both of these books, *Holocene Extinctions* and *Nature's Ghosts: Confronting Extinction from the Age of Jefferson to the Age of Ecology*, examine the toll taken by extinctions in removing innumerable species, many of them beautiful, extraordinary, and large. For all who admire diversity, these books document and illuminate the tragedy—and




the history of species extinction is, in fact, a tragedy. Merriam Webster's definition is apt: "a serious drama typically describing a conflict between the protagonist and a superior force (as destiny) and having a sorrowful or disastrous conclusion that excites pity or terror." Here, Earth is the protagonist and the superior force is humanity, whose devastating impact was already clear in 1864 to George Perkins Marsh when he wrote in *Man and Nature*: "Man is everywhere a disturbing agent. Wherever he plants his foot, the harmonies of nature are turned to discords."

To put extinctions into perspective, it is important to remember that even before the evolution of humans,

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species were disappearing. It has been estimated that roughly 99 percent of the species that have appeared on Earth have become extinct, some of them due to catastrophic events that took place long before the appearance of humans. However, since the arrival of humans, extinction rates have soared—and as the recording of the loss has improved, we have learned more and more about what is gone and what is on the brink. Naturalists, historians, artists, statesmen, and a panoply of scientists in the fields of biology, ecology, evolution, and paleontology have recorded the losses, sometimes eloquently, often methodically, and in intricate detail. Still, the decimation has continued from the early "noble savages" and frontiersmen who slaughtered millions of American bison, to early clergymen-naturalists who collected tons of colorful shells and rare birds' eggs, to hunters and sportsmen who shot flocks of passenger pigeons in the heartland of America and rare oryx in remote deserts of the Arabian peninsula.

In *Nature's Ghosts*, Mark V. Barrow Jr., an associate professor of history at Virginia Tech, carefully traces the steamroller of human-caused extinctions over the past 200 years, presenting an engaging and in-depth look at the individuals who registered what was happening. He quotes extensively from naturalists, politicians, scientists, and activists, putting a human face on the events that framed the disappearance of species. His narrative continues through the rise of conservation biology to the present-day regulations intended to slow extinctions. Samuel T. Turvey, the editor of *Holocene Extinctions*, looks deeper in time and presents abundant evidence of extinctions of species on land, in the sea, and in the air during the past 11,500 years. Although the approaches of these two books differ, one coming from a historian and the other from a conservation biologist, the conclusions are often the same: The loss of species from this planet has steadily increased and shows little sign of abating as entire ecosystems are threatened.

Barrow's narrative is insightful and often eloquent, probing human impact on the natural world, the influence of key individuals, and the public's concern. He provides the crucial context of the culture, politics, and popular opinions that shaped the development of ecology and the environmentalist movement. *Nature's Ghosts* reflects 18 years of research and writing; Barrow's efforts to create a rounded and thoughtful history are evident. Well documented, with 82 pages of endnotes, the book has an extensive bibliography, 62 figures, and some poignant historical photos of people and endangered or extinct birds and animals.

*Nature's Ghosts* begins in 1780, when Thomas Jefferson, then-governor of Virginia, catalogued the natural resources of his state, including its fossils. Barrow describes Jefferson's fascination with the bones and teeth of an American mammoth, which Jefferson called *incognitum.* He desperately wanted to find the animal they belonged to, and later alerted Meriwether Lewis and William Clark to keep a look out for rare species as they traveled west on their expedition. Although Jefferson was interested in natural history, Barrows attributes his drive to find a live *incognitum* to national pride: a desire to show that his young country could produce an animal estimated to be six times larger than an elephant, a rival to any species ever seen. Jefferson aimed to refute the claims of Georges-Louis Leclerc, Comte de Buffon, who had argued in his *Histoire naturelle, générale et particuliére* that the New World lacked the environment to produce vigorous and magnificent species equal to those of the Old World. Slowly, the idea that the North American mammoth might no longer exist began to enter the consciousness of both the Old and New Worlds. By the time of Jefferson's death in 1826, the reality of not only *incognitum*'s extinction but also that of other species had been accepted on both sides of the Atlantic. Thus, there was a time not so long ago when the very idea that a species could go extinct was questioned. This seems almost unfathomable today, but we need look no further than the debate on climate change to see similar doubts about major events of our own era.

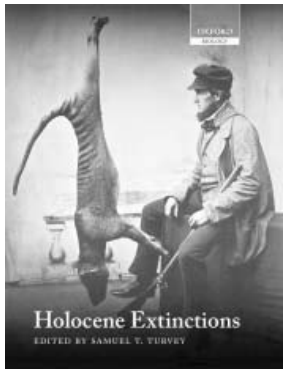
Barrow describes the notion developing in the 18th century of a great chain of being, espoused both by Buffon and by Swedish naturalist Carl Linnaeus who, in addition to his careful binomial naming of species, expressed confidence in "the economy of nature." The reports arriving from North America in the 17th and 18th centuries had great impact. They extolled the bounty of native flora and fauna, a sharp contrast to the depleted landscapes of densely settled Europe. The "myth of inexhaustibility" that arose was soon met by what Barrows calls "nearly inexhaustible demands." He relates the reports of the astonishing spring migrations of alewives up shallow waters, vast herds of bison flowing across the plains, and skies darkened with immense flocks of birds, including passenger pigeons—images that by any measure of evolutionary time occurred only yesterday.

Barrow also reminds us that there were early warning signs and a recognition that parts of the natural world were being lost. For example, in 1698 the Connecticut Assembly prohibited deer hunting between 1 January and 25 July in response to the sharp decrease in wildlife. But it was not until the 19th century that naturalists seriously considered human predation as a hypothesis for species disappearance. Barrow describes the rush to collect, preserve, and catalog species as they became rare.

Only very recently, since the 20th century, has it been clear that it is important to study endangered species in the wild to learn about their behavior and life cycles. After millions of passenger pigeons were shot or captured in the mid-1800s, a law was passed in 1897 to protect them, but it came too late. They had been the most abundant bird in America but were, by then, past the point of recovery. The last passenger pigeon died in a Cincinnati zoo in 1914. A similar story played out in the destruction of the

American bison, 20 million to 30 million of which ranged across the Great Plains in the early 1800s. Before the end of the 1880s, commercial hunters and Native Americans had reduced bison numbers to only a few hundred. The heath hen may have been the first endangered species to be studied in the wild, but it nevertheless disappeared in 1932. The last individual, "Booming Ben," was pathetically depicted as wandering off to die on Martha's Vineyard. Hopes for better luck with the ivory-billed woodpecker rose then fell on what Barrow calls "the hard rocks of political and economic reality." The California condor has fared better, with ups and downs, but its survival is still precarious.

Vignettes about people and endangered animals are used effectively throughout *Nature's Ghosts* to enliven the historical facts and dates. They also show the contradictions of human behavior. John James Audubon lamented the slaughter of seabirds in Labrador and the disappearance of the great auk—but continued to collect dozens of samples from other species to produce his drawings. While witnessing the wholesale shooting of the passenger pigeons, Audubon mistakenly prided himself with enough knowledge of the bird to assure others that the species would be safe and only "diminution of our forests" could result in their decline. William Temple Hornaday, chief taxidermist of the US National Museum, was convinced in 1886 that the American bison was near obliteration—and scrambled to collect 100 specimens for museums from the remaining 300, saying he had no alternative because their days were clearly numbered. Later, in 1913, Hornaday converted from collector to protector of the remaining bison and succeeded in repopulating several sites with their progeny, and establishing a national zoo to "atone for the national disgrace that attaches to the heartless and senseless extermination of the species in the wild state." He was not successful, however, in projects to reestablish the passenger pigeon or the strikingly beautiful Carolina parakeet, the last of which died in 1917. Three Carolina parakeet museum specimens are featured on the cover of *Nature's Ghosts*; the cover of *Holocene Extinctions* depicts the hanging body of a Tasmanian tiger, alongside the hunter who shot it in 1869.




*Nature's Ghosts* presents interesting historical background about the development of conservation movements, primarily from the US perspective, and the regulatory restrictions put in place beginning in the early 20th century. In retrospect, we also see some of the ironies. President Theodore Roosevelt created more than 50 wildlife reservations in the United States, but the first thing he did after leaving office in 1909 was embark on an African safari during which he and his son killed 17 lions, 11 elephants, 14 rhinos, 8 buffalo, and various other species—a total of 512 mammals. (The specimens were donated to the Smithsonian Institution.) Barrow describes the founding of the Audubon Society in 1886, the American Committee for International Wild Life Protection in 1930, and many other environmentalist groups, as well as the gradual shift from preserving specimens to preserving living animals. As well as tracing the development of the conservationist movement, Barrow presents a view of changing cultural perspectives; for example, a rising interest in bird watching is countered by strong concern about predators, from bald eagles to wolves.

Where *Nature's Ghosts* provides the narrative, *Holocene Extinctions* presents the evidence: a collection of scientific papers, several written or cowritten by Turvey, a conservation biologist and research fellow at the Institute of Zoology, the research division of the Zoological Society of London. In the preface, Turvey expresses the hope that the volume will draw attention not only to human impacts on major taxonomic groups but also to how ecosystems have changed and species have been lost throughout the entire Holocene. This broad view begins with a chapter on Late Glacial–Holocene environments by Anson W. Mackay, which explains external climate-forcing mechanisms, including changes in Earth's orbit, solar irradiance, and volcanic eruptions. Arguing that these provide the essential background against which extinctions can be assessed, Mackay concludes: "Climate has undoubtedly been the major forcing factor for ecosystem change through much of the Late Glacial and Holocene intervals. However, anthropogenic influence on the Earth's ecosystem has increased steadily since the Late Glacial, culminating in the interval now known as the Anthropocene, during which time few if any analogues for past environments exist" (p. 15).

Turvey's chapters on megafauna extinctions probe the reasons for the loss of 523 bird species and 255 mammal species recorded from subfossil or historical records in the Holocene. He breaks down the Pleistocene-Holocene extinctions of continental mammals and birds into areas: Europe and northern Asia; North America and Australia; South America, Africa and southeast Asia; and the island extinctions in the Mediterranean, the West Indies, Madagascar, and in the Pacific. His verdict: "Only an extremely small proportion of Holocene species or population losses can even questionably be interpreted as non-anthropogenic events" (p. 37).

Citing several examples from studies that include geological shifts and events, Turvey specifies where more research is needed to clarify the patterns of extinctions and the processes that have driven them. He also examines intrinsic biological factors that make species vulnerable, including

size, age at reproductive maturity, length of lifespan, presence of native mammalian predators on islands, and flightlessness in birds. Among extrinsic environmental and cultural variables, he highlights the impact of humans. The rapid extinction of all species of moa, for example, was the result of both a protracted life history and eager Maori hunters. Moas disappeared within 100 years of Polynesian settlement of New Zealand. Turvey hastens to say, however, that overhunting as a major factor in megafaunal extinctions remains disputed for other island systems where early colonists were fishermen, herders, and farmers. A separate chapter by Turvey on mammal extinctions presents a table nearly 20 pages long, showing last-occurrence dates for 255 extinct mammal species that are known or suspected to have died out during the Holocene. For many, instead of an historical record of last occurrence, a radiometric date is calculated. Tommy Tyrberg contributes a similar 40-page table of the last-occurrence dates for 523 extinct bird species in the Holocene. Both tables are impressive collections of species, with geographical ranges, last-occurrence dates, archaeological or stratigraphic association, and the names of scientists who documented their disappearance. They are fascinating—and very sad—lists to read. The vast majority of species went extinct on islands.

*Holocene Extinctions* also surveys freshwater mussel extinctions in North America, as well as extinctions at sea. Wendell R. Haag, of the Center for Bottomland Hardwood Research, US Department of Agriculture Forest Service, wrote: "The world's most diverse freshwater mussel fauna is currently experiencing a massive extinction event. In the last 100 years, at least 26 but potentially more than 40 taxa have gone extinct" (p. 127). Although mussel research efforts have increased nearly tenfold since the 1970s, at least 31 surviving species are in imminent danger of extinction, and others are vulnerable. Haag expects that 25 percent or more of the North American mussel fauna will be extinct within another human generation. Again, human impact is cited as the leading cause: The first wave of extinction in the mid-20th century was due to the construction of dams, and a second, smaller wave was attributed to the earlier habitat destruction. Over time, the second extinction wave is expected to eclipse the first.

At sea, the view is murkier. A chapter on Holocene extinctions in the sea suggests that the oceans may be better off, but we just don't have enough information yet to know. Although there is evidence for loss of marine megafaunal biomass and changes in the marine ecosystems over the past several thousand years, the authors, Nicholas K. Dulvy, John K. Pinnegar, and John D. Reynolds, hold out the hope that a major loss of ocean biodiversity can still be forestalled. In a chapter on procellariiforms by R. Paul Scofield, which is documented with a table of Holocene extinctions, a whole range of ecosystem elements is implicated, along with the human impact on a taxon that has been remarkable for its resilience. "Given the antiquity of the procellariiform lineage, the extreme effects that large seabird breeding colonies have at the landscape and regional levels, and the importance of their ongoing population declines, extirpations and extinctions cannot be overestimated," (p.165) concludes Scofield, of the Canterbury Museum in Christchurch, New Zealand.

The scope of *Holocene Extinctions* extends to coextinctions, defined as the process by which one species goes extinct because of the extinction of a species on which it depends, a process for which there seem to be very few examples—although models have predicted they should be very common. The book also discusses probabilistic methods for determining extinction chronologies, Holocene deforestation, and the fate of island bird diversity. It questions whether Quaternary fossil records can be used to predict how environments might change in the future. Throughout the book, the importance and impact of climate change is raised repeatedly, for it has the potential to change entire systems and result in a game change that makes all predictions difficult or impossible.

Turvey also cowrote a chapter on the loss of "feature diversity," which raises interesting—but unresolved—questions about the loss of the unique characteristics that will disappear when a species does. He points out that taxa containing disproportionately few species have experienced elevated rates of species loss over the past 11,000 years, and continue to be disproportionately threatened with extinction. He suggests, for example, that if the sole living species of aardvark—which shares few basic characteristics with anything else—goes extinct, the loss to diversity would be greater than if one of many mouse species disappears from the spectrum of placental mammals. Turvey raises the question, Would the world be better off in an ecological or evolutionary way with more random extinctions? No answer is given.

*Holocene Extinctions* contains more than 100 pages of references as well as numerous figures and tables to make clear who is cited and how to interpret what they've said. Turvey dedicates the book to the memory of the Yangtze River dolphin, with the remark: "More should have been done." That applies to all human-caused extinctions. We owe our thanks to these authors for digging out the facts about the natural world around us, documenting the species, and reminding us of a history that we may not have known or perhaps have forgotten. Their dispassionate look at human-caused extinctions should help us think more clearly about what has already happened and take responsibility to change course.

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