Geoengineering and Ecological Ethics in the Anthropocene

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One of the most relentless moral narratives in the American environmental tradition is the critique of technology and of the human desire to manipulate and control nature. This line of argument can be traced back at least to Thoreau's grousing about the Fitchburg Railroad in *Walden* (1854); the engine's whistle, he complained, "pierces" his solitude and contemplation of the pastoral beauty of the New England countryside. A century later, Aldo Leopold, the forester–conservationist and author of *A Sand County Almanac* (1949), wrote derisively of the agricultural engineers who brought their heavy-handed notions of "progress" to Wisconsin's marshes by draining them and destroying critical wildlife habitat. And at the dawn of the modern US environmental movement in the early 1960s, Rachel Carson assailed the agrotechnological system responsible for producing "biocides" such as DDT (dichlorodiphenyltrichloroethane), which she warned posed a deadly, multigenerational threat to wildlife and humans. It was a technology, moreover, that was the product of a pathological environmental ethic and culture. "The 'control of nature,'" Carson wrote in *Silent Spring* (1962), "is a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man" (Carson 2002, p. 297).

Out of these sympathetic critiques emerged a common call for ethical restraint, a keener sense of ecological limits and the argument, variously stated, that human activities should not subvert, in Leopold's words, the "integrity, stability, and beauty" of the natural environment (Leopold 1949, pp. 224–225). Modern environmental writers such as Carson and Leopold stressed the urgency of catalyzing a deeper transformation in our collective ethical sensibilities toward other species and ecosystems and of adopting an attitude of respect toward wild populations and landscapes. Trained as scientists, yet skilled at cutting to the philosophical and cultural core of environmental problems, they wrote powerfully about the need for us to assume a cooperative and life-affirming role on the planet rather than a despotic and destructive one. And they spoke of the broader societal responsibility to chasten rather than quicken the development of aggressive scientific and technological interventions that threatened to undermine the integrity of ecological systems.

> *"If all were as it seems, and men made the elements their servants for noble ends!"*
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> Henry David Thoreau

The emergence of geoengineering proposals to combat the effects of anthropogenic climate change suggests a degree and perhaps a kind of environmental manipulation and technological intervention in nature that Thoreau, Leopold, and Carson probably could not have envisioned. Whether they are focused primarily on carbon dioxide removal or solar radiation management, the more ambitious geoengineering activities will clearly result in the extensive human modification and control of global environmental systems. The heroic, planetary scale of geoengineering (e.g., ocean fertilization, cloud whitening, orbital sun shades), its potential litany of environmental impacts (e.g., increased ocean acidification, alteration of regional weather patterns, increased acid rain deposition; see, e.g., Robock 2008, Russell et al. 2012), and especially its seemingly perfect embodiment of the human-mastery-of-nature ethos put geoengineering at odds with the dominant moral narrative of environmental responsibility and nature preservation in the American tradition.

And yet, it is also the case that the environmentalist critique of the manipulation of nature and the defense of ecological integrity are today not as compelling and relevant as they once were, although this judgment has more to do with the failure of societal restraint than it does with the weakness of the underlying moral principle. It would be difficult to deny that the accumulated impact of global human activities has significantly undercut appeals to *integrity* (understood as the historical state of an environmental system) as a normative standard in decisionmaking. This is especially true given that the human footprint is now geological in scale: We are living, we are told, in the era of the *Anthropocene*, an epoch defined by the dominant human role in the modification of Earth systems (Steffen et al. 2011).

What this suggests is that climate change—and global environmental change more generally—is shaking up our traditional understanding of the ethical requirements of environmental responsibility in the twenty-first century, particularly the presumption that human intervention in and manipulation of nature is inherently wrong. This, in turn, reveals the great difficulty in staking out a consistent and defensible ethical position toward geoengineering that seeks to draw on the tradition's preservationist impulses and its deep skepticism about technological

interventions in nature. The challenge becomes not one of protecting nature's integrity from human manipulation but, rather, one of drawing a bright ethical line between acceptable and unacceptable interventions in swiftly transforming environmental systems (Hobbs et al. 2011).

Furthermore, it is increasingly clear that the ethical scrutiny of geoengineering should not be treated as an isolated activity; rather, it should be undertaken as part of a wider evaluation of our evolving responsibilities to species and ecosystems on a rapidly changing planet. In particular, geoengineering must be assessed alongside other emerging proposals in the environmental community that stir up similar—and similarly murky—ethical issues of human intervention and environmental modification and control. These include the preemptive relocation of species threatened by climate change (*managed relocation* or *assisted colonization*) and the design and management of *novel ecosystems* that provide valued ecosystem services (e.g., carbon sequestration) yet bear little resemblance to historical landscapes (Minteer and Collins 2010, Marris 2011).

What is needed in such discussions is the articulation of a new and comprehensive ethical paradigm of human solicitude for species and ecosystems that can accommodate significant, perhaps unprecedented, human interventions in nature and that will apply as well to those species and systems for which we wish to retain a degree of naturalness and wildness (to the extent that this is possible). The great challenge of environmental responsibility in the Anthropocene, in other words, is whether we can retain the sense of restraint and moral regard for nature that we think of as being the best of the environmental tradition while at the same time being pragmatic and clear eyed about the global impact of human activities—and the eclipse of venerable cultural ideals of wilderness, native species, and the autonomy of a natural world beyond our ken.

In the end, one of the most troubling consequences of geoengineering may prove to be its implications for our environmental character, especially our respect for ecological distinctiveness and our ability to hold on to a sense of humility in the Anthropocene epoch. At worst, geoengineering could play a significant role in extinguishing the final flickering of the "fierce green fire" that Leopold wrote about so movingly in "Thinking Like a Mountain," his elegiac (and personal) account of wolf eradication in the American West (Leopold 1949). Although it might no longer be tenable or desirable to argue for strict preservationism in the era of climate change, it is also not clear that we have yet developed a pragmatic, nature-affirming ecological ethic that can serve as a strong rejoinder to Thoreau's challenge about "noble ends." We might wonder what will encourage us to embrace such values—and their evocation of human limits in the face of nature—if we transform the seas, whiten the clouds, and turn back the sun.

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