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LOVE YOUR MONSTERS

POSTENVIRONMENTALISM and the ANTHROPOCENE

Edited by
MICHAEL SHELLENBERGER and TED NORDHAUS

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INTRODUCTION

Ted Nordhaus and Michael Shellenberger

Paving of road brings change in the Amazon rainforest. AP, May 28, 2005

The last few years have been demoralizing for anyone who cares about the environment. Emissions continue to rise. Ancient forests continue to disappear. And the world appears unwilling or unable to do anything about it.

The ecological thinkers assembled in *Love Your Monsters* argue that environmentalism, in its failure to evolve, has become an obstacle to addressing these challenges. A political movement founded on shrinking the human footprint is doomed to fail in a world of seven going on ten billion souls seeking to live energy-rich modern lives.

But if this collection of essays delivers tough love to greens, it also offers hope. By 2100, nearly all of us will be prosperous enough to live healthy, free, and creative lives. Despite the claims of Malthusian pessimists, that world is both economically and ecologically possible. But to realize it, and to save what remains of the Earth's ecological heritage, we must once and for all embrace human power, technology, and the larger process of modernization.

The idea that poor nations can be persuaded to choose a development path fundamentally different from the one pursued by the West is naïve. Brazil is

developing its forested interior, as Europe and the United States did before it, with dams, farms, ranches, and roads in order to sell its beef, soy, and minerals on foreign markets. Its indigenous people sell logging contracts; its rubber tappers run cattle. China, meanwhile, is now manufacturer to the world thanks to Confucian grit, industriousness, and cheap coal — not waterwheels, solar panels, and respect for nature. In the process, China has lifted roughly half a billion peasants out of grinding poverty. And, as Siddhartha Shome observes in these pages, India has instead chosen modernization and integration into the global knowledge economy over the ascetic path advocated by Mahatma Gandhi.

For traditional greens, all of this is evidence that humankind is destroying itself — but is it? Geographer Erle Ellis describes how humans have repeatedly transgressed ecological limits since we were hunter-gatherers. Human civilization rests not upon natural systems but human ones, like agriculture, cities, and industry, which have proven extraordinarily resilient to population and climatic pressures. What's at stake, Ellis and the other thinkers assembled here argue, is not the survival of human civilization, but rather the contours and qualities of our gardened planet.

Though barely audible amidst the loud claims of imminent catastrophe, ecologists have decisively moved away from the conception of nature as a fragile system in a tenuous state of balance. Over the last two decades, Mark Sagoff notes, empirically oriented ecologists rejected the 1950s cybernetic view of nature as a "system" where any disruption could result in its collapse — a theory that, Sagoff explains, was built upon the Christian doctrine that nature existed as a Great Chain of Being. In reality, esteemed conservation biologist Peter Kareiva and his colleagues observe, nature has proven extraordinarily resilient.

Rising economic optimism in poor nations has been matched, over the last two decades, by rising ecological pessimism in rich ones. As developed nations became knowledge economies, their populations enjoyed greater wealth to travel and experience the natural world, but also became increasingly alienated from material (i.e., agricultural and industrial) production. Rising anomie and disenchantment with modernity, we argue in our essay, "Evolve," have driven rising skepticism about the ability of technology to improve our lives. Daniel Sarewitz observes that green liberalism's turn away from technology and modernity beginning in the 1960s also coincided with its turn toward a scientific rationality "unmoored from appropriate moral and experiential foundations."

But if greens rejected technology and modernization in the 1960s, there is no reason they can't embrace them today. One of the founders of science and technology studies, Bruno Latour, points the way. Through a novel reading of

Frankenstein, Latour argues that we must learn to love our technologies as we do our children — not reject them at the first sign of trouble. And given the critical role played by tool use in human evolution, the two of us conclude, we must understand technology as natural and sacred, not alien and profane. A new, postenvironmental liberalism should thus, Sarewitz argues, understand technology as a public good — a way to achieve broadly agreed upon societal goals, whether for improved health or cleaner air.

Meanwhile, Kareiva and colleagues argue, for conservation to be relevant in this new world it must move beyond the old parks and wilderness model and find ways to shape development. We will not wall off the entirety of the Amazon or the rainforests of Indonesia from all development as if we were protecting Yosemite and Yellowstone.

Ultimately, if we are to be responsible planetary stewards, we need a new view of both human agency and the planet. We must abandon the faith that humankind's powers can be abdicated in deference to higher ones, whether Nature or the Market. And we must see through the illusion that these supposedly higher powers exist in a delicate state of harmony constantly at risk of collapse from too much human interference.

All of this will require a new posture and a new paradigm. We must open our eyes to the joy and excitement experienced by the newly prosperous and increasingly free. We must create a world where every human can not only realize her material needs but also her higher needs for creativity, choice, beauty — and wilderness. In the words of the father of the modern Indian Constitution, Babasaheb Ambedkar, "The slogan of a democratic society must be machinery, and more machinery, civilization and more civilization" — the same tools needed, we might add, for planetary gardening. /

EVOLVE

The Case for Modernization as the Road to Salvation

Michael Shellenberger and Ted Nordhaus

We evolved ourselves from apes by using technologies that favored shorter hands, longer thumbs, and twisting wrists.

Sometime around 2014, Italy will complete construction of 78 mobile floodgates aimed at protecting Venice's three inlets from the rising tides of the Adriatic Sea. The massive doors — 20 meters by 30 meters, and 5 meters thick — will, most of the time, lie flat on the sandy seabed between the lagoon and the sea. But when a high tide is predicted, the doors will empty themselves of water and fill with compressed air, rising up on hinges to keep the Adriatic out of the city. Three locks will allow ships to move in and out of the lagoon while the gates are up.

Nowhere else in the world have humans so constantly had to create and re-create their infrastructure in response to a changing natural environment than in Venice. The idea for the gates dates back to the 1966 flood, which inundated 100 percent of the city. Still, it took from 1970 to 2002 for the hydrologist Robert Frassetto and others to convince their fellow Italians to build them. Not everyone

sees the oscillating and buoyant floodgates as Venice's salvation. After the project was approved, the head of World Wildlife Fund Italy said, "Today the city's destiny rests on a pretentious, costly, and environmentally harmful technological gamble."

In truth, the grandeur that is Venice has always rested — quite literally — on a series of pretentious, costly, and environmentally harmful technological gambles. Her buildings rest upon pylons made of ancient larch and oak trees ripped from inland forests a thousand years ago. Over time, the pylons were petrified by the saltwater, infill was added, and cathedrals were constructed. Little by little, technology helped transform a town of humble fisherfolk into the city we know today.

Saving Venice has meant creating Venice, not once, but many times since its founding. And that is why her rescue from the rising seas serves as an apt metaphor for solving this century's formidable environmental problems. Each new act of salvation will result in new unintended consequences, positive and negative, which will in turn require new acts of salvation. What we call "saving the Earth" will, in practice, require creating and re-creating it again and again for as long as humans inhabit it.

1.

Many environmentally concerned people today view technology as an affront to the sacredness of nature, but our technologies have always been perfectly natural. Our animal skins, our fire, our farms, our windmills, our nuclear plants, and our solar panels — all 100 percent natural, drawn, as they are, from the raw materials of the Earth.

Furthermore, over the course of human history, those technologies have not only been created by us, but have also helped to create us. Recent archeological evidence suggests that the reason for our modern hands, with their opposable thumbs and shorter fingers, is that they were better adapted for tool use. Ape hands are great for climbing trees but not, it turns out, for striking flint or making arrowheads. Those prehumans whose hands could best use tools gained an enormous advantage over those whose hands could not.

As our hands and wrists changed, we increasingly walked upright, hunted, ate meat, and evolved. Our upright posture allowed us to chase down animals we had wounded with our weapons. Our long-distance running was aided by sweat glands replacing fur. The use of fire to cook meat allowed us to consume much larger amounts of protein, which allowed our heads to grow so large that some prehumans began delivering bigger-brained babies prematurely. Those babies, in turn, were able to survive because we were able to fashion still more tools, made

from animal bladders and skins, to strap the helpless infants to their mothers' chests. Technology, in short, made us human.

Of course, as our bodies, our brains, and our tools evolved, so too did our ability to radically modify our environment. We hunted mammoths and other species to extinction. We torched whole forests and savannas in order to flush prey and clear land for agriculture. And long before human emissions began to affect the climate, we had already shifted the albedo of the Earth by replacing many of the world's forests with cultivated agriculture. While our capabilities to alter our environment have, over the last century, expanded substantially, the trend is longstanding. The Earth of 100 or 200 or 300 years ago was one that had already been profoundly shaped by human endeavor.

None of this changes the reality and risks of the ecological crises humans have created. Global warming, deforestation, overfishing, and other human activities — if they don't threaten our very existence — certainly offer the possibility of misery for many hundreds of millions, if not billions, of humans and are rapidly transforming nonhuman nature at a pace not seen for many hundreds of millions of years. But the difference between the new ecological crises and the ways in which humans and even prehumans have shaped nonhuman nature for tens of thousands of years is one of scope and scale, not kind.

Humans have long been cocreators of the environment they inhabit. Any proposal to fix environmental problems by turning away from technology risks worsening them by attempting to deny the ongoing coevolution of humans and nature.

2.

Nevertheless, elites in the West — who rely more heavily on technology than anyone else on the planet — insist that development and technology are the causes of ecological problems but not their solution. They claim that economic sacrifice is the answer while living amidst historic levels of affluence and abundance. They consume resources on a vast scale, overwhelming whatever meager conservations they may partake in through living in dense (and often fashionable) urban enclaves, driving fuel-efficient automobiles, and purchasing locally grown produce. Indeed, the most visible and common expressions of faith in ecological salvation are new forms of consumption. Green products and services — the Toyota Prius, the efficient washer/dryer, the LEED-certified office building — are consciously identified by consumers as things they do to express their higher moral status.

The same is true at the political level, as world leaders, to the cheers of the left-leaning postmaterial constituencies that increasingly hold the balance of

political power in many developed economies, offer promise after promise to address climate change, species extinction, deforestation, and global poverty, all while studiously avoiding any action that might impose real cost or sacrifice upon their constituents. While it has been convenient for many sympathetic observers to chalk up the failure of such efforts to corporate greed, corruption, and political cowardice, the reality is that the entire postmaterial project is, confoundingly, built upon a foundation of affluence and material consumption that would be considerably threatened by any serious effort to address the ecological crises through substantially downscaling economic activity.

It's not too difficult to understand how this hypocrisy has come to infiltrate such a seemingly well-meaning swath of our culture. As large populations in the developed North achieved unprecedented economic security, affluence, and freedom, the project that has centrally occupied humanity for thou-sands of years — emancipating ourselves from nature, tribalism, peonage, and poverty — has been subsumed by the need to manage the unintended consequences of modernization itself, from local pollution to nuclear proliferation to global warming.

Increasingly skeptical of capitalist meritocracy and economic criteria as the implicit standards of success at the individual level and the defining measure of progress at the societal level, the post-World War II generations have redefined normative notions of well-being and quality of life in developed societies. Humanitarianism and environmentalism have become the dominant social movements, bringing environmental protection, preservation of quality of life, and other "life-political" issues, in the words of British sociologist, Anthony Giddens, to the fore.

The rise of the knowledge economy — encompassing medicine, law, finance, media, real estate, marketing, and the nonprofit sector — has further accelerated the West's growing disenchantment with modern life, especially among the educated elite. Knowledge workers are more alienated from the products of their labor than any other class in history, unable to claim some role in producing food, shelter, or even basic consumer products. And yet they can afford to spend time in beautiful places — in their gardens, in the countryside, on beaches, and near old-growth forests. As they survey these landscapes, they tell themselves that the best things in life are free — even though they have consumed mightily to travel to places where they feel peaceful, calm, and far from the worries of the modern world.

These postmaterial values have given rise to a secular and largely inchoate ecotheology, complete with apocalyptic fears of ecological collapse, disenchanting notions of living in a fallen world, and the growing conviction that

some kind of collective sacrifice is needed to avoid the end of the world. Alongside those dark incantations shine nostalgic visions of a transcendent future in which humans might, once again, live in harmony with nature through a return to small-scale agriculture, or even to hunter-gatherer life.

The contradictions between the world as it is — filled with the unintended consequences of our actions — and the world as so many of us would like it to be, result in a pseudorejection of modernity, a kind of postmaterialist nihilism. Empty gestures are the defining sacraments of ecotheology. The belief that we must radically curtail our consumption in order to survive as a civilization is no impediment to elites paying for private university educations, frequent jet travel, and iPads.

Thus, ecotheology, like all dominant religious narratives, serves the dominant forms of social and economic organization in which it is embedded. Catholicism valorized poverty, social hierarchy, and agrarianism for the masses in feudal societies that lived and worked the land. Protestantism valorized industriousness, capital accumulation, and individuation among the rising merchant classes of early capitalist societies and would define the social norms of modernizing industrial societies. Today's secular ecotheology values creativity, imagination, and leisure over the work ethic, productivity, and efficiency in societies that increasingly prosper from their knowledge economies while outsourcing crude, industrial production of goods to developing societies. Living amid unprecedented levels of wealth and security, ecological elites reject economic growth as a measure of well-being, tell cautionary tales about modernity and technology, and warn of overpopulation abroad now that the societies in which they live are wealthy and their populations are no longer growing.

Such hypocrisy has rarely been a hindrance to religion and, indeed, contributes to its power. One of the most enduring characteristics of human civilization is the way ruling elites espouse beliefs radically at odds with their own behaviors. The ancient Greeks recited the cautionary tales of Prometheus and Icarus while using fire, dreaming of flight, and pursing technological frontiers. Early agriculturalists told the story of the fall from Eden as a cautionary tale against the very agriculture they practiced. European Christians espoused poverty and peacemaking while accumulating wealth and waging war.

In preaching antimodernity while living as moderns, ecological elites affirm their status at the top of the postindustrial knowledge hierarchy. Affluent developed-world elites offer both their less well-to-do countrymen and the global poor a laundry list of don'ts — don't develop like we developed, don't drive tacky SUVs, don't overconsume — that engender resentment, not emulation, from fellow citizens at home and abroad. That the ecological elite

hold themselves to a different standard while insisting that all are equal is yet another demonstration of their higher status, for they are thus unaccountable even to reality.

Though it poses as a solution, today's nihilistic ecotheology is actually a significant obstacle to dealing with ecological problems created by modernization — one that must be replaced by a new, creative, and life-affirming worldview. After all, human development, wealth, and technology liberated us from hunger, deprivation, and insecurity; now they must be considered essential to overcoming ecological risks.

3.

There's no question that humans are radically remaking the Earth, but fears of ecological apocalypse — of condemning this world to fiery destruction — are unsupported by the sciences. Global warming may bring worsening disasters and disruptions to rainfall, snowmelts, and agriculture, but there is little evidence to suggest it will deliver the end of modernization. Even the most catastrophic United Nations scenarios predict rising economic growth. While wealthy environmentalists claim to be especially worried about the impact of global warming on the poor, it is rapid, not retarded, development that is most likely to protect the poor against natural disasters and agricultural losses.

What modernization may threaten most is not human civilization, but the survival of those nonhuman species and environments we care about. While global warming dominates ecological discourse, the greatest threats to nonhumans remain our direct changes to the land and the seas. The world's great, diverse, and ancient forests are being converted to tree plantations, farms, and ranches. Humans are causing massive, unprecedented extinctions on Earth due to habitat destruction. We are on the verge of losing primates in the wild. We have so overfished the oceans that most of the big fish are gone.

The apocalyptic vision of ecotheology warns that degrading nonhuman natures will undermine the basis for human civilization, but history has shown the opposite: the degradation of nonhuman environments has made us rich. We have become rather adept at transferring the wealth and diversity of nonhuman environments into human ones. The solution to the unintended consequences of modernity is, and has always been, more modernity — just as the solution to the unintended consequences of our technologies has always been more technology. The Y2K computer bug was fixed by better computer programming, not by going back to typewriters. The ozone-hole crisis was averted, not by an end to air-conditioning, but rather by more advanced, less environmentally harmful technologies.

The question for humanity, then, is not whether humans and our civilizations will survive but rather what kind of a planet we will inhabit. Would we like a planet with wild primates, old-growth forests, a living ocean, and modest rather than extreme temperature increases? Of course we would — virtually everybody would. Only continued modernization and technological innovation can make such a world possible.

Putting faith in modernization will require a new secular theology consistent with the reality of human creation and life on Earth, not with some imagined dystopia or utopia. It will require a worldview that sees technology as humane and sacred, rather than inhumane and profane. It will require replacing the antiquated notion that human development is antithetical to the preservation of nature with the view that modernization is the key to saving it. Let's call this "modernization theology."

Where ecotheology imagines that our ecological problems are the consequence of human violations of a separate "nature," modernization theology views environmental problems as an inevitable part of life on Earth. Where the last generation of ecologists saw a natural harmony in Creation, the new ecologists see constant change. Where ecotheologians suggest that unintended consequences of human development might be avoidable, proponents of modernization view them as inevitable, and positive as often as negative. And where the ecological elites see the powers of humankind as the enemy of Creation, the modernists acknowledge them as central to its salvation.

Modernization theology should thus be grounded in a sense of profound gratitude to Creation — human and nonhuman. It should celebrate, not desecrate, the technologies that led our prehuman ancestors to evolve. Our experience of transcendence in the outdoors should translate into the desire for all humans to benefit from the fruits of modernization and be able to experience similar transcendence. Our valorization of creativity should lead us to care for our cocreation of the planet.

4.

The risks now faced by humanity are increasingly ones of our own making and ones over which we have only partial, tentative, and temporary control. Various kinds of liberation — from hard agricultural labor and high infant mortality rates to tuberculosis and oppressive traditional values — bring all kinds of new problems, from global warming and obesity to alienation and depression. These new problems will largely be better than the old ones, in the way that obesity is a better problem than hunger, and living in a hotter world is a better problem to have than living in one without electricity. But they are serious problems

nonetheless.

The good news is that we already have many nascent, promising technologies to overcome ecological problems. Stabilizing greenhouse emissions will require a new generation of nuclear power plants to cheaply replace coal plants as well as, perhaps, to pull carbon dioxide out of the atmosphere, and power desalination plants to irrigate and grow forests in today's deserts. Pulling frontier agriculture back from forests will require massively increasing agricultural yields through genetic engineering. Replacing environmentally degrading cattle ranching may require growing meat in laboratories, which will gradually be viewed as less repulsive than today's cruel and deadly methods of meat production. And the solution to the species extinction problem will involve creating new habitats and new organisms, perhaps from the DNA of previously extinct ones.

In attempting to solve these problems, we will inevitably create new ones. One common objection to technology and development is that it will bring unintended consequences, but life on Earth has always been a story of unintended consequences. The Venice floodgates offer a pointed illustration. Concerns raised by the environmental community that the floodgates would impact marine life have been borne out — only not in the way they had feared. Though the gates are still under construction, marine biologists have announced that they have already become host to many coral and fish species, some of which used to be found only in the southern Mediterranean or Red Sea.

Other critics of the gates have questioned what will happen if global warming should raise sea levels higher than the tops of the gates. If this should become inevitable, it is unlikely that Venetians would abandon their city. Instead they may attempt to raise it. One sweetly ironic proposal would levitate the city by blowing carbon dioxide emissions 2,000 feet below the lagoon floor. Some may call such strong faith in the technological fix an instance of hubris, but others will simply call it compassion.

The French anthropologist Bruno Latour has some interesting thoughts on the matter. According to Latour, Mary Shelley's *Frankenstein* is not a cautionary tale against hubris, but rather a cautionary tale against irrational fears of imperfection. Dr. Frankenstein is an antihero not because he created life, but rather because he fled in horror when he mistook his creation for a monster — a self-fulfilling prophecy. The moral of the story, where saving the planet is concerned, is that we should treat our technological creations as we would treat our children, with care and love, lest our abandonment of them turn them into monsters.

"The sin is not to wish to have dominion over nature," Latour writes, "but to believe that this dominion means emancipation and not attachment." In other

words, the term “ecological hubris” should not be used to describe the human desire to remake the world, but rather the faith that we can end the cycle of creation and destruction. /

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LOVE YOUR MONSTERS

Why we must care for our technologies as we do our children

Bruno Latour

The moral of Frankenstein is that we must love, care for, and improve our technologies as we do our children.

In the summer of 1816, a young British woman by the name of Mary Godwin and her boyfriend Percy Shelley went to visit Lord Byron in Lake Geneva, Switzerland. They had planned to spend much of the summer outdoors, but the eruption of Mount Tambora in Indonesia the previous year had changed the climate of Europe. The weather was so bad that they spent most of their time indoors, discussing the latest popular writings on science and the supernatural.

After reading a book of German ghost stories, somebody suggested they each write their own. Byron's physician, John Polidori, came up with the idea for *The Vampyre*, published in 1819,[1] which was the first of the "vampire-as-seducer" novels. Godwin's story came to her in a dream, during which she saw "the pale student of unhallowed arts kneeling beside the thing he had put together."[2] Soon after that fateful summer, Godwin and Shelley married, and in 1818, Mary Shelley's horror story was published under the title, *Frankenstein, Or, the*

Modern Prometheus.[3]

Frankenstein lives on in the popular imagination as a cautionary tale against technology. We use the monster as an all-purpose modifier to denote technological crimes against nature. When we fear genetically modified foods we call them "frankenfoods" and "frankenfish." It is telling that even as we warn against such hybrids, we confuse the monster with its creator. We now mostly refer to Dr. Frankenstein's monster as Frankenstein. And just as we have forgotten that Frankenstein was the man, not the monster, we have also forgotten Frankenstein's real sin.

Dr. Frankenstein's crime was not that he invented a creature through some combination of hubris and high technology, but rather that he *abandoned the creature to itself*. When Dr. Frankenstein meets his creation on a glacier in the Alps, the monster claims that it was not *born* a monster, but that it became a criminal only *after* being left alone by his horrified creator, who fled the laboratory once the horrible thing twitched to life. "Remember, I am thy creature," the monster protests, "I ought to be thy Adam; but I am rather the fallen angel, whom thou drivest from joy for no misdeed… I was benevolent and good; misery made me a fiend. Make me happy, and I shall again be virtuous."

Written at the dawn of the great technological revolutions that would define the 19th and 20th centuries, *Frankenstein* foresees that the gigantic sins that were to be committed would hide a much greater sin. It is not the case that we have failed to care for Creation, but that we have failed to care for our technological creations. We confuse the monster for its creator and blame our sins against Nature upon our creations. But our sin is not that we created technologies but that we failed to love and care for them. It is as if we decided that we were unable to follow through with the education of our children.[4]

Let Dr. Frankenstein's sin serve as a parable for political ecology. At a time when science, technology, and demography make clear that we can never separate ourselves from the nonhuman world — that we, our technologies, and nature can no more be disentangled than we can remember the distinction between Dr. Frankenstein and his monster — this is the moment chosen by millions of well-meaning souls to flagellate themselves for their earlier aspiration to dominion, to repent for their past hubris, to look for ways of diminishing the numbers of their fellow humans, and to swear to make their footprints invisible?

The goal of political ecology must not be to stop innovating, inventing, creating, and intervening. The real goal must be to have the same type of patience and commitment to our creations as God the Creator, Himself. And the comparison is not blasphemous: we have taken the whole of Creation on our

shoulders and have become coextensive with the Earth.

What, then, should be the work of political ecology? It is, I believe, to *modernize modernization*, to borrow an expression proposed by Ulrich Beck.[5] This challenge demands more of us than simply embracing technology and innovation. It requires exchanging the modernist notion of modernity for what I have called a "compositionist" one that sees the process of human development as neither liberation from Nature nor as a fall from it, but rather as a process of becoming ever-more attached to, and intimate with, a panoply of nonhuman natures.

1.

At the time of the plough we could only scratch the surface of the soil. Three centuries back, we could only dream, like Cyrano de Bergerac, of traveling to the moon. In the past, my Gallic ancestors were afraid of nothing except that the "sky will fall on their heads."

Today we can fold ourselves into the molecular machinery of soil bacteria through our sciences and technologies. We run robots on Mars. We photograph and dream of further galaxies. And yet we fear that the climate could destroy us.

Everyday in our newspapers we read about more entanglements of all those things that were once imagined to be separable — science, morality, religion, law, technology, finance, and politics. But these things are tangled up together everywhere: in the Intergovernmental Panel on Climate Change, in the space shuttle, and in the Fukushima nuclear power plant.

If you envision a future in which there will be less and less of these entanglements thanks to Science, capital *S*, you are a modernist. But if you brace yourself for a future in which there will always be more of these imbroglios, mixing many more heterogeneous actors, at a greater and greater scale and at an ever-tinier level of intimacy requiring even more detailed care, then you are… what? A compositionist!

The dominant, peculiar story of modernity is of humankind's *emancipation* from Nature. Modernity is the thrusting-forward arrow of time — Progress — characterized by its juvenile enthusiasm, risk taking, frontier spirit, optimism, and indifference to the past. The spirit can be summarized in a single sentence: "Tomorrow, we will be able to separate more accurately what the world is really like from the subjective illusions we used to entertain about it."

The very forward movement of the arrow of time and the frontier spirit associated with it (the modernizing front) is due to a certain conception of knowledge: "Tomorrow, we will be able to differentiate clearly what in the past was still mixed up, namely facts and values, thanks to Science."

Science is the shibboleth that defines the right direction of the arrow of time because it, and only it, is able to cut into two well-separated parts what had, in the past, remained hopelessly confused: a morass of ideology, emotions, and values on the one hand, and, on the other, stark and naked matters of fact.

The notion of the past as an archaic and dangerous confusion arises directly from giving Science this role. A modernist, in this great narrative, is the one who expects from Science the revelation that Nature will finally be visible through the veils of subjectivity — and subjection — that hid it fromour ancestors.

And here has been the great failure of political ecology. Just when all of the human and nonhuman associations are finally coming to the center of our consciousness, when science and nature and technology and politics become so confused and mixed up as to be impossible to untangle, just as these associations are beginning to be shaped in our political arenas and are triggering our most personal and deepest emotions, this is when a new apartheid is declared: leave Nature alone and let the humans *retreat* — as the English did on the beaches of Dunkirk in the 1940s.

Just at the moment when this fabulous dissonance inherent in the modernist project between what modernists say (*emancipation from all attachments!*) and what they do (*create ever-more attachments!*) is becoming apparent to all, along come those alleging to speak for Nature to say the problem lies in the violations and imbroglios — *the attachments!*

Instead of deciding that the great narrative of modernism (Emancipation) has always resulted in another history altogether (Attachments), the spirit of the age has interpreted the dissonance in quasi-apocalyptic terms: “We were wrong all along, let’s turn our back to progress, limit ourselves, and return to our narrow human confines, leaving the nonhumans alone in as pristine a Nature as possible, *mea culpa, mea maxima culpa*…”

Nature, this great shortcut of due political process, is now used to forbid humans to encroach. Instead of realizing at last that the emancipation narrative is bunk, and that modernism was always about attachments, modernist greens have suddenly shifted gears and have begun to oppose the promises of modernization.

Why do we feel so frightened at the moment that our dreams of modernization finally come true? Why do we suddenly turn pale and wish to fall back on the other side of Hercules’s columns, thinking we are being punished for having transgressed the sign: “Thou shall not transgress?” Was not our slogan until now, as Nordhaus and Shellenberger note in *Break Through*, “We shall overcome!”?[6]

In the name of indisputable facts portraying a bleak future for the human race, green politics has succeeded in leaving citizens nothing but a gloomy asceticism,

a terror of trespassing Nature, and a diffidence toward industry, innovation, technology, and science. No wonder that, while political ecology claims to embody the political power of the future, it is reduced everywhere to a tiny portion of electoral strap-hangers. Even in countries where political ecology is a little more powerful, it contributes only a supporting force.

Political ecology has remained marginal because it has not grasped either its own politics or its own ecology. It thinks it is speaking of Nature, System, a hierarchical totality, a world without man, an assured Science, but it is precisely these overly ordered pronouncements that marginalize it.

Set in contrast to the modernist narrative, this idea of political ecology could not possibly succeed. There is beauty and strength in the modernist story of emancipation. Its picture of the future is so attractive, especially when put against such a repellent past, that it makes one wish to run forward to break all the shackles of ancient existence.

To succeed, an ecological politics must manage to be at least as powerful as the modernizing story of emancipation without imagining that we are emancipating ourselves from Nature. What the emancipation narrative points to as proof of increasing human mastery *over* and freedom *from* Nature — agriculture, fossil energy, technology — can be redescribed as the increasing *attachments* between things and people at an ever-expanding scale. If the older narratives imagined humans either fell from Nature or freed themselves from it, the compositionist narrative describes our ever-increasing degree of *intimacy* with the new natures we are constantly creating. Only “out of Nature” may ecological politics start again and anew.

2.

The paradox of “the environment” is that it emerged in public parlance just when it was starting to disappear. During the heyday of modernism, no one seemed to care about “the environment” because there existed a huge unknown reserve on which to discharge all bad consequences of collective modernizing actions. The environment is what appeared when unwanted consequences came back to haunt the originators of such actions.

But if the originators are true modernists, they will see the return of “the environment” as incomprehensible since they believed they were finally free of it. The return of consequences, like global warming, is taken as a contradiction, or even as a monstrosity, which it is, of course, but *only according* to the modernist’s narrative of emancipation. In the compositionist’s narrative of attachments, unintended consequences are quite *normal* — indeed, the most expected things on earth!

Environmentalists, in the American sense of the word, never managed to extract themselves from the contradiction that the environment is precisely *not* "what lies beyond and should be left alone" — this was the contrary, the view of their worst enemies! The environment is exactly what should be even more managed, taken up, cared for, stewarded, in brief, integrated and internalized in the very fabric of the polity.

France, for its part, has never believed in the notion of a pristine Nature that has so confused the "defense of the environment" in other countries. What we call a "national park" is a rural ecosystem complete with post offices, well-tended roads, highly subsidized cows, and handsome villages.

Those who wish to protect natural ecosystems learn, to their stupefaction, that they have to work harder and harder — that is, to intervene even more, at always greater levels of detail, with ever more subtle care — to keep them "natural enough" for Nature-intoxicated tourists to remain happy.

Like France's parks, all of Nature needs our constant care, our undivided attention, our costly instruments, our hundreds of thousands of scientists, our huge institutions, our careful funding. But though we have Nature, and we have nurture, we don't know what it would mean for Nature itself to be nurtured.[7]

The word "environmentalism" thus designates this turning point in history when the unwanted consequences are suddenly considered to be such a monstrosity that the only logical step appears to be to abstain and repent: "We should not have committed so many crimes; now we should be good and limit ourselves." Or at least this is what people felt and thought *before the breakthrough*, at the time when there was still an "environment."

But what is *the breakthrough* itself then? If I am right, the breakthrough involves no longer seeing a contradiction between the spirit of emancipation and its catastrophic outcomes, but accepting it as the normal duty of *continuing* to care for unwanted consequences, even if this means going further and further down into the imbroglios. Environmentalists say: "From now on we should limit ourselves." Postenvironmentalists exclaim: "From now on, we should stop flagellating ourselves and take up explicitly and seriously what we have been doing all along at an ever-increasing scale, namely, intervening, acting, wanting, caring." For environmentalists, the return of unexpected consequences appears as a scandal (which it is for the modernist myth of mastery). For postenvironmentalists, the other, unintended consequences are part and parcel of any action.

3.

One way to seize upon the breakthrough from environmentalism to

postenvironmentalism is to reshape the very definition of the "precautionary principle." This strange moral, legal, epistemological monster has appeared in European and especially French politics after many scandals due to the misplaced belief by state authority in the certainties provided by Science.[8]

When action is supposed to be nothing but the logical consequence of reason and facts (which the French, of all people, still believe), it is quite normal to wait for the certainty of science before administrators and politicians spring to action. The problem begins when experts *fail to agree* on the reasons and facts that have been taken as the necessary premises of any action. Then the machinery of decision is stuck until experts come to an agreement. It was in such a situation that the great tainted blood catastrophe of the 1980s ensued: before agreement was produced, hundreds of patients were transfused with blood contaminated by the AIDS virus.[9]

The precautionary principle was introduced to break this odd connection between scientific certainty and political action, stating that even in the absence of certainty, decisions could be made. But of course, as soon as it was introduced, fierce debates began on its meaning. Is it an environmentalist notion that precludes action or a postenvironmentalist notion that finally follows action through to its consequences?

Not surprisingly, the enemies of the precautionary principle — which President Chirac enshrined in the French Constitution as if the French, having indulged so much in rationalism, had to be protected against it by the highest legal pronouncements — took it as proof that no action was possible any more. As good modernists, they claimed that if you had to take so many precautions in advance, to anticipate so many risks, to include the unexpected consequences even before they arrived, and worse, to be responsible for them, then it was a plea for impotence, despondency, and despair. The only way to innovate, they claimed, is to bounce forward, blissfully ignorant of the consequences or at least unconcerned by what lies outside your range of action. Their opponents largely agreed. Modernist environmentalists argued that the principle of precaution dictated no action, no new technology, no intervention unless it could be proven with certainty that no harm would result. Modernists we were, modernists we shall be!

But for its postenvironmental supporters (of which I am one) the principle of precaution, properly understood, is exactly the change of *zeitgeist* needed: not a principle of abstention — as many have come to see it — but a change in the way *any action* is considered, a deep tidal change in the linkage modernism established between science and politics. From now on, thanks to this principle, unexpected consequences are *attached* to their initiators and have to be followed

through all the way.

4.

The link between technology and theology hinges on the notion of *mastery*. Descartes exclaimed that we should be "*maîtres et possesseurs de la nature.*"[10] But what does it mean to be a master? In the modernist narrative, mastery was supposed to require such total dominance by the master that he was emancipated entirely from any care and worry. This is the myth about mastery that was used to describe the technical, scientific, and economic dominion of Man over Nature.

But if you think about it according to the compositionist narrative, this myth is quite odd: where have we ever seen a master freed from any dependence on his dependents? The Christian God, at least, is not a master who is freed from dependents, but who, on the contrary, gets folded into, involved with, implicated with, and incarnated into His Creation. God is so attached and dependent upon His Creation that he is continually forced (convinced? willing?) to save it. Once again, the sin is not to wish to have dominion over Nature, but to believe that this dominion means emancipation and not attachment.

If God has not abandoned His Creation and has sent His Son to redeem it, why do you, a human, a creature, believe that you can invent, innovate, and proliferate — and then flee away in horror from what you have committed? Oh, you the hypocrite who confesses of one sin to hide a much graver, mortal one! Has God fled in horror after what humans made of His Creation? Then have at least the same forbearance that He has.

The dream of emancipation has not turned into a nightmare. It was simply too limited: it excluded nonhumans. It did not care about unexpected consequences; it was unable to follow through with its responsibilities; it entertained a wholly unrealistic notion of what science and technology had to offer; it relied on a rather impious definition of God, and a totally absurd notion of what creation, innovation, and mastery could provide.

Which God and which Creation should we be for, knowing that, contrary to Dr. Frankenstein, we cannot suddenly stop being involved and "go home?" Incarnated we are, incarnated we will be. In spite of a centuries-old misdirected metaphor, we should, without any blasphemy, reverse the Scripture and exclaim: "What good is it for a man to gain his soul yet forfeit the whole world?" /

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CONSERVATION IN THE ANTHROPOCENE

Beyond Solitude and Fragility

Peter Kareiva, Robert Lalasz, and Michelle Marvier

For conservation to be relevant in the 21st century, it must broaden its focus from parks and protected areas to a rapidly illuminating planet. Photo credit: NASA.

By its own measures, conservation is failing. Biodiversity on Earth continues its rapid decline.[1] We continue to lose forests in Africa, Asia, and Latin America.[2] There are so few wild tigers and apes that they will be lost forever if current trends continue.[3] Simply put, we are losing many more special places and species than we're saving.

Ironically, conservation is losing the war to protect nature despite winning one of its hardest fought battles — the fight to create parks, game preserves, and wilderness areas. Even as we are losing species and wild places at an accelerating rate, the worldwide number of protected areas has risen dramatically, from under 10,000 in 1950 to over 100,000 by 2009.[4] Around the world, nations have set aside beautiful, biodiverse areas where human development is restricted. By some estimates, 13 percent of the world's land mass is protected, an area larger than all of South America.[5]

But while conservation has historically been locally driven — focused on saving specific places such as Yosemite National Park and the Grand Canyon, or on managing very limited ecological systems like watersheds and forests — its more recent ambitions have become almost fantastical. For example, is halting deforestation in the Amazon, an area nearly the size of the continental United States, feasible? Is it even necessary? Putting a boundary around Yosemite

Valley is not the same as attempting to do so around the Amazon. Just as the United States was dammed, logged, and crisscrossed by roads, it is likely that much of the Amazon will be as well.

Only with the rapid transformation of the developing world — from rural or pastoral cultures to urban and industrial nations — and the unmistakable domestication of our planet that has resulted has the paradox at the heart of contemporary conservation become apparent. We may protect places of particular beauty or those places with large numbers of species, but even as we do, the pace of destruction will likely continue to accelerate. Whether or not the developing world sets aside a large percentage of its landscapes as parks or wilderness over the next hundred years, what is clear is that those protected areas will remain islands of "pristine nature" in a sea of profound human transformations to the landscape through logging, agriculture, mining, damming, and urbanization.

In the face of these realities, 21st century conservation is changing. Conservationists have taken steps to become more "people friendly" and to attend more seriously to working landscapes. Conservation will likely continue to create parks and wilderness areas, but that will be just one part of the field's larger goals. The bigger questions for 21st century conservation regard what we will do with the rest of it — the working landscapes, the urban ecosystems, the fisheries and tree plantations, the vast swaths of agricultural monocultures, and the growing expanses of marginal agricultural lands and second growth forests that, as agriculture and forestry become more productive and intensive, are already returning to something that may not be wilderness, but is of conservation value, nonetheless.

In answering these questions, conservation cannot promise a return to pristine, prehuman landscapes. Humankind has already profoundly transformed the planet and will continue to do so.[6] What conservation could promise instead is a new vision of a planet in which nature — forests, wetlands, diverse species, and other ancient ecosystems — exists amid a wide variety of modern, human landscapes. For this to happen, conservationists will have to jettison their idealized notions of nature, parks, and wilderness — ideas that have never been supported by good conservation science — and forge a more optimistic, human-friendly vision.

1.

Since the early 19th century, a number of thinkers have argued that the greatest use of nature is as a source of solitary spiritual renewal, describing nature as a

place to escape modern life, enjoy solitude, and experience God. “To go into solitude, a man needs to retire as much from his chamber as from society,” wrote Ralph Waldo Emerson in his seminal essay, “Nature.”[7] Cities and human development were portrayed as threats to these transcendence-enabling idylls, even though the writers were mostly urban intellectuals. Nathaniel Hawthorne complained bitterly of hearing the railroad whistle from his country home despite depending on modern transport to arrive at his own private Eden.[8] Henry David Thoreau famously extolled his self-sufficiency, living in a small cabin in harmony with nature; in fact, Thoreau lived close enough to town that he could frequently receive guests and have his mother wash his clothes.[9] More recently, Edward Abbey pined for companionship in his private journal even as he publicly exulted in his ascetic life in *Desert Solitaire*.[10]

The conservation movement’s original justification for parks devoid of all people (unless those people were naturalists or tourists) was born from the 19th century spiritual view of nature as God. John Muir — who, at age 11, could recite the Bible from memory — read Emerson religiously while living in Yosemite. “No temple made with hands,” Muir wrote, “can compare with Yosemite.”[11] But if Yosemite was a temple, it was one full of commerce. Though Yosemite was a state park when Muir arrived, it was occupied by Miwok Indians growing crops, white settlers raising sheep, and miners seeking gold and other minerals. Not long after he built himself a cabin and a water-powered mill, Muir, as head of the Sierra Club, decided the other occupants had to go. Muir had sympathized with the oppression of the Winnebago Indians in his home state, but when it came time to empty Yosemite of all except the naturalists and tourists, Muir vigorously backed the expulsion of the Miwok.[12] The Yosemite model spread to other national parks, including Yellowstone, where the forced evictions killed 300 Shoshone in one day.[13]

Beneath the invocations of the spiritual and transcendental value of untrammeled nature is an argument for using landscapes for some things and not others: hiking trails rather than roads, science stations rather than logging operations, and hotels for ecotourists instead of homes. By removing long-established human communities, erecting hotels in their stead, removing unwanted species while supporting more desirable species, drilling wells to water wildlife, and imposing fire management that mixes control with prescribed burns, we create parks that are no less human constructions than Disneyland.

Conservation is widely viewed as the innocent and uncontroversial practice of purchasing special places threatened by development. In truth, for 30 years, the global conservation movement has been racked with controversy arising from its role in expelling indigenous people from their lands in order to create parks and

reserves.[14] The modern protection of supposed wilderness often involves resettling large numbers of people, too often without fair compensation for their lost homes, hunting grounds, and agricultural lands.

In 2009, the investigative journalist Mark Dowie, now professor of journalism at University of California, Berkeley, published *Conservation Refugees*, which estimated, "About half the land selected for protection by the global conservation establishment over the past century was either occupied or regularly used by indigenous peoples. In the Americas that number is over 80 percent."[15] Estimates vary from five million people displaced over the last century by conservation to tens of millions, with one Cornell University professor estimating that 14 million individuals have been displaced by conservation in Africa alone.[16]

In the early 1990s, indigenous groups spoke out against these evictions at various forums, including at the United Nations Earth Summit in Rio. As a result, conservation groups pledged to respect and work with the communities living in or around protected areas. Over the next few years, conservation organizations prioritized working with local organizations including indigenous people in "stakeholder" meetings, "community-based conservation," and "sustainable development." Gorgeous photos of indigenous people started gracing the glossy annual reports and fundraising brochures of conservation groups. But by 2004, the conflicts had only increased. That spring, the International Forum on Indigenous Mapping resulted in a declaration signed by all 200 delegates that the "activities of conservation organizations now represent the single biggest threat to the integrity of indigenous lands."[17]

In many parts of the world, parks have become anathema to conservation. Consider the 1982 effort to create a national park in Mburo, Uganda.[18] In the name of preserving the wildlife, the government violently expelled thousands of men, women, and children from the surrounding region, without compensation. This expulsion proved self-defeating. In 1986, a new government encouraged these conservation refugees to resettle their former homelands, where they promptly slaughtered wildlife and vandalized the park facilities in retribution.[19]

In Indonesia, every major international conservation NGO has invested heavily to stem the tide of deforestation and the decline of iconic species, such as the orangutan. As a result, the country now has many protected areas. But you would never know it if you were to visit them because these areas are so heavily logged. Quantitative analyses of deforestation rates using satellite imagery reveal that forest loss is much greater inside protected Indonesian forests than in forests managed by local communities for sustainable logging.[20]

Conservation organizations counter these examples by saying that the

displacements of people are old news. They point out that they have learned from past mistakes. Today, most conservation NGOs have policies of best practice intended to protect the rights of local communities, and conservation NGOs are increasingly hiring social scientists and anthropologists who incorporate indigenous people into their conservation strategies.

But conservation will be controversial as long as it remains so narrowly focused on the creation of parks and protected areas, and insists, often unfairly, that local people cannot be trusted to care for their land. In his 2005 book, *Collapse,* the geographer Jared Diamond famously claimed that Easter Island's inhabitants devolved into cannibalism after they mindlessly cut down the last trees — a parable for humankind's shortsighted overuse of natural resources.[21] But Diamond got the history wrong. It was the combined effect of a nonnative species — the Polynesian rat, which ate tree seeds — and European slavery raids that destroyed Easter Island's people, not their shortsighted management of nature.[22]

2.

As conservation became a global enterprise in the 1970s and 1980s, the movement's justification for saving nature shifted from spiritual and aesthetic values to focus on biodiversity. Nature was described as primeval, fragile, and at risk of collapse from too much human use and abuse. And indeed, there are consequences when humans convert landscapes for mining, logging, intensive agriculture, and urban development and when key species or ecosystems are lost.

But ecologists and conservationists have grossly overstated the fragility of nature, frequently arguing that once an ecosystem is altered, it is gone forever. Some ecologists suggest that if a single species is lost, a whole ecosystem will be in danger of collapse, and that if too much biodiversity is lost, spaceship Earth will start to come apart. Everything, from the expansion of agriculture to rainforest destruction to changing waterways, has been painted as a threat to the delicate inner-workings of our planetary ecosystem.

The fragility trope dates back, at least, to Rachel Carson, who wrote plaintively in *Silent Spring* of the delicate web of life and warned that perturbing the intricate balance of nature could have disastrous consequences.[23] Al Gore made a similar argument in his 1992 book, *Earth in the Balance*.[24] And the 2005 Millennium Ecosystem Assessment warned darkly that, while the expansion of agriculture and other forms of development have been overwhelmingly positive for the world's poor, ecosystem degradation was simultaneously putting systems in jeopardy of collapse.[25]

The trouble for conservation is that the data simply do not support the idea of

a fragile nature at risk of collapse. Ecologists now know that the disappearance of one species does not necessarily lead to the extinction of any others, much less all others in the same ecosystem. In many circumstances, the demise of formerly abundant species can be inconsequential to ecosystem function. The American chestnut, once a dominant tree in eastern North America, has been extinguished by a foreign disease, yet the forest ecosystem is surprisingly unaffected. The passenger pigeon, once so abundant that its flocks darkened the sky, went extinct, along with countless other species from the Steller's sea cow to the dodo, with no catastrophic or even measurable effects.

These stories of resilience are not isolated examples — a thorough review of the scientific literature identified 240 studies of ecosystems following major disturbances such as deforestation, mining, oil spills, and other types of pollution. The abundance of plant and animal species as well as other measures of ecosystem function recovered, at least partially, in 173 (72 percent) of these studies.[26]

While global forest cover is continuing to decline, it is rising in the Northern Hemisphere, where "nature" is returning to former agricultural lands.[27] Something similar is likely to occur in the Southern Hemisphere, after poor countries achieve a similar level of economic development. A 2010 report concluded that rainforests that have grown back over abandoned agricultural land had 40 to 70 percent of the species of the original forests.[28] Even Indonesian orangutans, which were widely thought to be able to survive only in pristine forests, have been found in surprising numbers in oil palm plantations and degraded lands.[29]

Nature is so resilient that it can recover rapidly from even the most powerful human disturbances. Around the Chernobyl nuclear facility, which melted down in 1986, wildlife is thriving, despite the high levels of radiation.[30] In the Bikini Atoll, the site of multiple nuclear bomb tests, including the 1954 hydrogen bomb test that boiled the water in the area, the number of coral species has actually increased relative to before the explosions.[31] More recently, the massive 2010 oil spill in the Gulf of Mexico was degraded and consumed by bacteria at a remarkably fast rate.[32]

Today, coyotes roam downtown Chicago, and peregrine falcons astonish San Franciscans as they sweep down skyscraper canyons to pick off pigeons for their next meal. As we destroy habitats, we create new ones: in the southwestern United States a rare and federally listed salamander species seems specialized to live in cattle tanks — to date, it has been found in no other habitat.[33] Books have been written about the collapse of cod in the Georges Bank, yet recent trawl data show the biomass of cod has recovered to precollapse levels.[34] It's doubtful that

books will be written about this cod recovery since it does not play well to an audience somehow addicted to stories of collapse and environmental apocalypse.

Even that classic symbol of fragility — the polar bear, seemingly stranded on a melting ice block — may have a good chance of surviving global warming if the changing environment continues to increase the populations and northern ranges of harbor seals and harp seals. Polar bears evolved from brown bears 200,000 years ago during a cooling period in Earth's history, developing a highly specialized carnivorous diet focused on seals. Thus, the fate of polar bears depends on two opposing trends — the decline of sea ice and the potential increase of energy-rich prey. The history of life on Earth is of species evolving to take advantage of new environments only to be at risk when the environment changes again.

The wilderness ideal presupposes that there are parts of the world untouched by humankind, but today it is impossible to find a place on Earth that is unmarked by human activity. The truth is humans have been impacting their natural environment for centuries. The wilderness so beloved by conservationists — places "untrammeled by man"[35] — never existed, at least not in the last thousand years, and arguably even longer.

The effects of human activity are found in every corner of the Earth. Fish and whales in remote Arctic oceans are contaminated with chemical pesticides. The nitrogen cycle and hydrological cycle are now dominated by people — human activities produce 60 percent of all the fixed nitrogen deposited on land each year, and people appropriate more than half of the annual accessible freshwater runoff.[36] There are now more tigers in captivity than in their native habitats. Instead of sourcing wood from natural forests, by 2050 we are expected to get over three-quarters of our wood from intensively managed tree farms. Erosion, weathering, and landslides used to be the prime movers of rock and soil; today humans rival these geological processes with road building and massive construction projects.[37] All around the world, a mix of climate change and nonnative species has created a wealth of novel ecosystems catalyzed by human activities.

3.

Scientists have coined a name for our era — the Anthropocene — to emphasize that we have entered a new geological era in which humans dominate every flux and cycle of the planet's ecology and geochemistry. Most people worldwide (regardless of culture) welcome the opportunities that development provides to improve lives of grinding rural poverty. At the same time, the global scale of this transformation has reinforced conservation's intense nostalgia for wilderness and

a past of pristine nature. But conservation's continuing focus upon preserving islands of Holocene ecosystems in the age of the Anthropocene is both anachronistic and counterproductive.

Consider the decline of the orangutan, which has been largely attributed to the logging of their forest habitats. Recent field studies suggest that humans are killing the orangutans for bush meat and bounty at rates far greater than anyone suspected, and it is this practice, not deforestation, that places orangutans at the greatest peril.[38] In order to save the orangutan, conservationists will also have to address the problem of food and income deprivation in Indonesia. That means conservationists will have to embrace human development and the "exploitation of nature" for human uses, like agriculture, even while they seek to "protect" nature inside of parks.

Conservation's binaries — growth *or* nature, prosperity *or* biodiversity — have marginalized it in a world that will soon add at least two billion more people. In the developing world, efforts to constrain growth and protect forests from agriculture are unfair, if not unethical, when directed at the 2.5 billion people who live on less than two dollars a day and the one billion who are chronically hungry. By pitting people against nature, conservationists actually create an atmosphere in which people see nature as the enemy. If people don't believe conservation is in their own best interests, then it will never be a societal priority. Conservation must demonstrate how the fates of nature and of people are deeply intertwined — and then offer new strategies for promoting the health and prosperity of both.

One need not be a postmodernist to understand that the concept of Nature, as opposed to the physical and chemical workings of natural systems, has always been a human construction, shaped and designed for human ends. The notion that nature without people is more valuable than nature with people and the portrayal of nature as fragile or feminine reflect not timeless truths, but mental schema that change to fit the time.

If there is no wilderness, if nature is resilient rather than fragile, and if people are actually part of nature and not the original sinners who caused our banishment from Eden, what should be the new vision for conservation? It would start by appreciating the strength and resilience of nature while also recognizing the many ways in which we depend upon it. Conservation should seek to support and inform the right kind of development — development by design, done with the importance of nature to thriving economies foremost in mind. And it will utilize the right kinds of technology to enhance the health and well-being of both human and nonhuman natures. Instead of scolding capitalism, conservationists should partner with corporations in a science-based effort to

integrate the value of nature's benefits into their operations and cultures. Instead of pursuing the protection of biodiversity for biodiversity's sake, a new conservation should seek to enhance those natural systems that benefit the widest number of people, especially the poor. Instead of trying to restore remote iconic landscapes to pre-European conditions, conservation will measure its achievement in large part by its relevance to people, including city dwellers. Nature could be a garden — not a carefully manicured and rigid one, but a tangle of species and wildness amidst lands used for food production, mineral extraction, and urban life.

Conservation is slowly turning toward these directions but far too slowly and with insufficient commitment to make them *the* conservation work of the 21st century. The problem lies in our reluctance, and the reluctance of many of conservation's wealthy supporters, to shed the old paradigms.

This move requires conservation to embrace marginalized and demonized groups and to embrace a priority that has been anathema to us for more than a hundred years: economic development for all. The conservation we will get by embracing development and advancing human well-being will almost certainly not be the conservation that was imagined in its early days. But it will be more effective and far more broadly supported, in boardrooms and political chambers, as well as at kitchen tables.

None of this is to argue for eliminating nature reserves or no longer investing in their stewardship. But we need to acknowledge that a conservation that is only about fences, limits, and far away places only a few can actually experience is a losing proposition. Protecting biodiversity for its own sake has not worked. Protecting nature that is dynamic and resilient, that is in our midst rather than far away, and that sustains human communities — these are the ways forward now. Otherwise, conservation will fail, clinging to its old myths. /

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THE PLANET OF NO RETURN

Human resilience on an artificial earth

Erle Ellis

Being responsible stewards of the Anthropocene will require embracing the ecological benefits of increasing agricultural productivity and livable cities.

Over the last several decades, a consensus has grown among scientists that humans have become the dominant ecological force on the planet. According to these scientists, we are now living in the Anthropocene, a new geological epoch shaped by humans[1]. While some have hailed this forward-looking vision of the planet, others have linked this view with the perennial concern that human civilization has exceeded the carrying capacity of Earth's natural systems and may thus be fundamentally unsustainable.[2] In this article, I argue that this latter notion rests upon a series of assumptions that are inconsistent with contemporary science on how humans interact with ecosystems, as well as with most historical and archeological evidence.

Ever since early humans discovered fire and the benefits of collaborative systems such as collective hunting and social learning, human systems, not the classic biophysical limits that still constrain other species, have set the wider envelope for human population growth and prosperity. It was not planetary

boundaries, but human system boundaries that constrained human development in the Holocene, the geological epoch that we have just left. We should expect no less in the Anthropocene.

Humans have dramatically altered natural systems — converting forests to farmlands, damming rivers, driving some species to extinction and domesticating others, altering the nitrogen and carbon cycles, and warming the globe — and yet the Earth has become more productive and more capable of supporting the human population.[3] This process has dramatically intensified in recent centuries at a rate unprecedented in Earth's (and human) history,[4] but there is little evidence to date that this dynamic has been fundamentally altered. While the onset of the Anthropocene carries new ecological and social risks, human systems such as agriculture have proven extraordinarily resilient to environmental and social challenges, responding robustly to population pressures, soil exhaustion, and climate fluctuations over millennia, from a global perspective.

Though the sustainability of human civilization may not be at stake, we must still take our responsibilities as planetary stewards more seriously than ever. As the scale and power of human systems continue to increase at accelerating rates, we are awakening to a new world of possibilities — some of them frightening. And yet our unprecedented and growing powers also allow us the opportunity to create a planet that is better for both its human and nonhuman inhabitants. It is an opportunity that we should embrace.

1.

Long before the Holocene, Paleolithic human systems had already evolved powers beyond those of any other species, managing to engineer ecosystems using fire, to innovate collective strategies for hunting, and to develop other tools and techniques that revolutionized human livelihoods from hunting and foraging.[5] The extinction of megafauna across most of the terrestrial biosphere demonstrates the unprecedented success of early human engineering of ecosystems.[6] Those extinctions had cascading effects (trophic downscaling) caused by the loss of dominant species, leading to forest loss in some regions and forest regrowth in others.[7] Paleolithic humans, with a population of just a few million, dramatically transformed ecosystems across most of the terrestrial biosphere and most coastal ecosystems,[8] demonstrating that population size is not the main source of the transformative power of human systems.

The onset of the Holocene, which began with the end of the last ice age, roughly corresponds with the start of the Neolithic Age of human development.

During this period, agricultural human systems began to displace earlier Paleolithic human systems,[9] and human systems became dependent upon the entirely novel, unambiguously anthropogenic process of clearing native vegetation and herbivores and replacing them with engineered ecosystems populated by domesticated plant and animal species.[10] This process allowed available land and resources to support many more people and set the stage for massive and sustained human population growth way beyond what was possible by Paleolithic systems. In ten millennia, the human population surged from just a few million to billions today.[11]

While the warm and stable climate of the Holocene is widely credited with enabling the rise of agriculture, more complex forms of human social organization, and the general thriving of human populations to a degree far exceeding that of the prior epoch, it was not these new climatic and biophysical conditions themselves that brought the Paleolithic era to an end. Rather, Paleolithic human systems failed to compete with a new human system built upon a series of profound technological innovations in ecosystem engineering.[12]

The dramatic, sustained rise of agricultural populations, along with their eventual success in dominating Earth's most productive lands, demonstrates that the main constraints on these populations were not environmental.[13] The Malthusian model holds that populations are ultimately limited by their environmental resources — primarily the ability of a given area of land to provide adequate food.[14] But this model makes little sense when engineered ecosystems have long been the basis for sustaining human populations.

Throughout the world, food production has risen in tandem with the density of agricultural populations. Populations work harder and employ more productive technologies to increase the productivity of land only after it becomes a limiting resource. This results in a complex interplay of population growth, labor inputs, technology adoption, and increased productivity — a process of agricultural intensification that still continues in many developing agricultural regions today.[15]

Until the widespread commodification of agricultural production over the last century or so, agriculturalists — and likely their Paleolithic hunting and foraging predecessors — used the minimal amount of labor, technologies, and other resources necessary to support their livelihoods on the lands available to them.[16] In most regions, yield-boosting technologies, like the plow and manuring, had already been developed or introduced long before they became necessary to overcome constraints on local food availability for subsistence populations.[17] Improving agricultural productivity facilitated rising population growth and

density and placed greater pressure on food production, which, in turn, induced the adoption of more productive agricultural technologies.

While this steady increase in the productivity of land use in tandem with population seems to conflict with the environmental degradation classically ascribed to human use of land,[18] the theoretical explanations for this are simple and robust. The low-density populations of early farmers tended to adopt long-fallow shifting cultivation systems (rotations of 20 years and longer), progressing through short-fallow shifting cultivation, annual cropping, multiple cropping, and the increasing use of irrigation and fertilizers as populations grew and land became scarce.[19]

Cultivation of agricultural land has resulted in all manner of environmental degradation at local scales. Although agricultural productivity inevitably declines after land is first cleared for agriculture and in agricultural systems without intensive management, there is little evidence of declining long-term productivity in agricultural lands that have been managed intensively for millennia.[20] Indeed, the overwhelming trend is quite the opposite.[21] Increasing demands upon the productivity of agricultural lands have resulted in an increasing demand for technological inputs (and labor, in the preindustrial era) in order to maintain and increase productivity, which continues to rise in most agricultural regions.

2.

The long trends toward both the intensification of agricultural cultivation and the engineering of ecosystems at increasing scope and scale have accelerated as more and more of the world transitions from rural and agricultural societies to urban and industrial ones. The exponential growth in population, resource use, technologies, and social systems over the past half-century marks the most rapid and powerful transformation of both Earth and human systems ever.[22]

In the past two centuries, fossil energy has mostly replaced biomass for fuel and substituted for most human and animal labor,[23] revolutionizing the human capacity for ecosystem engineering, transport, and other activities. Large-scale industrial synthesis has introduced artificial compounds almost too numerous to count,[24] including a wide variety used to control undesired species.[25] Synthetic nitrogen fertilizers have helped to both double the amount of biologically reactive nitrogen in the Earth system and have largely replaced the use of native soil fertility in sustaining human populations.[26] Genetic engineering has accelerated gene transfer across species.[27] The waste products of human systems are felt almost everywhere on land, water, and air, including emissions of carbon

dioxide rapid enough to acidify the oceans and change the climate system at rates likely unprecedented in Earth's history.[28] Wild fish and forests have almost disappeared,[29] receding into the depths of our ancestral memory.

At the same time, advances in hygiene and medicine have dramatically increased human health and life expectancy.[30] Industrial human systems are far more connected globally and evolve more rapidly than prior social systems, accelerating the pace of social change and interaction, technological innovation, material exchange, as well as the entire tempo of human interactions with the Earth system.[31] Over the last two centuries (and especially the past fifty years) most humans have enjoyed longer, healthier, and freer lives than we ever did during the Holocene.

There is no sign that these processes or their dynamics are slowing down in any way — an indication of their resilience in the face of change.[32] As far as food and other basic resources are concerned, we remain far from any physically determined limits to the growth and sustenance of our populations.[33] For better or for worse, humans appear fully capable of continuing to support a burgeoning population by engineering and transforming the planet.

3.

While human societies are likely to continue to thrive and expand, largely unconstrained by any hard biophysical boundaries to growth, this trend need not be inconsistent with conserving and even restoring a solid measure of our ecological inheritance. As populations, consumption, and technological power advance at an exponential pace, industrial systems appear to be evolving in new directions that tend to reverse many of the environmental impacts caused by agriculture and prior human systems.

Urbanization, perhaps the most powerful global change process of the industrial age, is rapidly concentrating human populations across the world into the market-based economies of cities, decoupling most of humanity from agricultural livelihoods and direct interactions with rural lands.[34] And while urbanization is nothing new, its current scale and rate are unprecedented.[35]

Urban economies of scale, particularly in human interactions and infrastructure, accrue as a result of population density and lead to improvements and additional advantages in nearly all aspects of human systems, including better health care, incomes, housing, access to markets, transportation, and waste treatment among many others.[36] Urban populations also tend to experience much lower and declining birth rates.[37]

Yet the greatest global effects of urbanization may be realized outside of

cities, which occupy less than one percent of Earth's ice-free land. Rural-to-urban migration leads to the depopulation of rural landscapes, and massive urban demand for food and resources leads to the upscaling of agricultural systems.[38] The process is complex, but such trends tend to concentrate production in Earth's most productive agricultural lands, boosting agricultural yields in these areas through intensive use of inputs and technology by large-scale farming operations.[39] Depending on whether governance systems are in place to take advantage of these transformative powers of urbanization, large-scale forest recoveries can and have taken place in response to the widespread abandonment of marginal agricultural lands.[40]

As a result, massive urbanization may ultimately prove yet another stage in the process of agricultural intensification. In this case, increasing human population densities in urban areas drive ever increasing productivity per unit area of land, while at the same time allowing less productive lands to recover. Multifunctional landscape management may then support both intensive food production and habitat recovery for native and other desirable species.[41]

4.

With urbanization shaping the Industrial Age, and as we move rapidly into the most artificial environments we have ever created, the decisions we must make are ever clearer. Indeed, even as urbanization drives advances in some forms of agricultural productivity, the trend is rapidly spelling an end to some of the most ancient and productive agricultural human systems the world has ever seen — the ancient rice paddies of Asia are being transformed into factory floors. As we did at the end of the Paleolithic, most of humanity is defecting from the older ways, which will soon become hobbies for the elite and nostalgic memories for the rest of humanity. Just as wild forests, wild game, and soon, wild fish disappear, so do the human systems associated with them.

While there is nothing particularly good about a planet hotter than our ancestors ever experienced — not to mention one free of wild forests or wild fish — it seems all too evident that human systems are prepared to adapt to and prosper in the hotter, less biodiverse planet that we are busily creating. The "planetary boundaries" hypothesis asserts that biophysical limits are the ultimate constraints on the human enterprise.[42] Yet the evidence shows clearly that the human enterprise has continued to expand beyond natural limits for millennia. Indeed, the history of human civilization might be characterized as a history of transgressing natural limits and thriving. While the Holocene's relatively stable conditions certainly helped support the rise and expansion of agricultural

systems, we should not assume that agriculture can only thrive under those particular conditions. Indeed, agriculture already thrives across climatic extremes whose variance goes far beyond anything likely to result from human-caused climate change.

The Earth we have inherited from our ancestors is now our responsibility. It is not natural limits that will determine whether this planet will sustain a robust measure of its evolutionary inheritance into the future. Our powers may yet exceed our ability to manage them, but there is no alternative except to shoulder the mantle of planetary stewardship. A good, or at least a better, Anthropocene is within our grasp. Creating that future will mean going beyond fears of transgressing natural limits and nostalgic hopes of returning to some pastoral or pristine era. Most of all, we must not see the Anthropocene as a crisis, but as the beginning of a new geological epoch ripe with human-directed opportunity. /

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THE RISE AND FALL OF ECOLOGICAL ECONOMICS

A Cautionary Tale

Mark Sagoff

Marginalized by more empirical studies of natural and economic behavior, ecological economics devolved into pricing nature.

In September of 1982, a group of scholars met in Stockholm intending to reform — even to revolutionize — the study of economics. The new *ecological economists* saw the economy as embedded in, and supported by, natural systems; nature was not simply a factor in, but the foundation of, economic activity. By integrating models from ecology and economics, ecological economists sought to provide scientific arguments for preserving the natural world.[1]

The Stockholm meeting came at a critical time. During the 1970s, prominent environmentalists, encouraged by what they saw as a public awakening to environmental concerns, issued best-selling books and reports that predicted that if population, consumption, and with them the global economy continued to grow, the world would soon run out of food and other resources. By the early

1980s, however, these predictions had been discredited. The public worried more about unemployment and recession. They feared that the regulations environmentalists proposed would derail the economy or slow it down. Environmentalists faced a populist backlash.

President Ronald Reagan swept into office in 1980 promising to get the economy moving again. Reagan had campaigned against "environmental extremists" who he said favored "rabbits' holes" and "birds' nests" over jobs and economic growth.[2]He arrived in Washington determined to roll back environmental and other social regulations. He named anti-environmentalists to fill top spots at the Environmental Protection Agency, the Department of the Interior, and the Forest Service. The president promptly issued an executive order that subjected every major regulation to an economic cost-benefit test.

The Reagan administration and other advocates of growth invoked mainstream economic science to justify pulling back regulations. Ecological economists responded by attacking mainstream economic science and contended that mainstream economists failed to properly acknowledge the value of the natural world and the services it provides.

The environmental movement quickly embraced ecological economics because it promised to reconcile ecology with economics in a new science that would be reliably on the side of environmental protection. The MacArthur Foundation, the Pew Charitable Trusts, and other large foundations invested heavily in ecological economics. Leading environmental figures such as Amory Lovins, Paul Hawken, Bill McKibben, and Al Gore, and popular writers like Thomas Friedman picked up its language and its concepts, as did the United Nations, European governments, and nongovernmental organizations.[3]

Ecological economics set out 30 years ago to be a redemptive science — to "right size" the human economy for its natural infrastructure.[4] But today, ecological economics finds itself at a political and academic dead end. Trapped in the amber of its mathematical models and conceptual constructs, ecological economics presents an object lesson for those who would appeal to scientific theories, rather than to popular concerns, to provide an intellectual and political basis for an effective green politics.

1.

Ecologists and economists made unlikely partners — indeed, these disciplines have often appeared at odds with, and determined to ignore, each other. As Robert Costanza, the founding president of the International Society for Ecological Economics, acknowledged in the inaugural issue of *Ecological Economics*, "Ecology, as it is currently practiced, sometimes deals with human

impacts on ecosystems, but the more common tendency is to stick to ‘natural’ systems.”[5] The modeling of ecological communities or systems seemed purposely to leave out the human economy.[6] At the same time, economists either took for granted or ignored the principles, powers, or forces that ecologists believed governed the world’s natural communities. The market mechanism, or competitive equilibrium, that mainstream economists studied assigned no role to the natural ecosystem.[7] Ecological economics sought to embed the study of economics within a larger understanding of how ecosystems work.

Ecological economists also wanted to distinguish their scientific professionalism from the neo-Malthusian alarmism of the previous decade. The Club of Rome’s 1972 best seller, *The Limits to Growth*, was associated in many reviews with dire projections: for example, that the world would run out of minerals, such as silver, tungsten, and mercury, within 40 years.[8] In 1970, Paul Ehrlich, the neo-Malthusian author of *The Population Bomb*, predicted that global food shortages would cause four billion people to starve to death between 1980 and 1989 — 65 million of them in the United States.[9] Further warnings poured forth in the *Global 2000 Report* (1980) and in annual State of the World reports by Lester Brown and the Worldwatch Institute.

Neo-Malthusians argued that the world would not be able to grow enough food to keep up with population, but this assertion was simply wrong. In fact, world food production more than doubled between 1960 and 2000, and per capita food production during that period also increased.[10] In 1981, economist Amartya Sen, who later won the Nobel Prize for his research, published a book that flatly and effectively contradicted the idea that famines occur because not enough food is produced. Sen showed that oppression, injustice, and destitution — breakdowns in distribution, not shortages in production — cause famines. With such “misleading variables as food output per unit of population, the Malthusian approach profoundly misspecifies the problems facing the poor in the world,” Sen wrote, noting that as per capita food production increased, the world was lulled into a false optimism that famines would decrease. “It is often overlooked that what may be called ‘Malthusian optimism’ has actually killed millions of people.”[11]

Ecological economists distinguished themselves from neo-Malthusian catastrophists by switching the emphasis from resources to systems. The concern was no longer centered on running out of food, minerals, or energy. Instead, ecological economists drew attention to what they identified as ecological thresholds. The problem lay in overloading systems and causing them to collapse. Costanza and colleagues wrote, “There may be close substitutes for conventional natural resources, such as timber and coal, but not for natural

ecological systems."[12]

Ecological economists described ecosystems as evolutionary systems: "complex, adaptive systems… characterized by historical dependency, complex dynamics, and multiple basins of attraction."[13] These communities or systems were assumed to evolve and, as a result, achieve an "adaptive" or a "dynamic equilibrium" that could be modeled mathematically. E.P. Odum, whose *Fundamentals of Ecology* was for decades the leading textbook in the field, pictured the natural world as a great chain or a "levels-of-organization-hierarchy" ascending from smaller to larger, more inclusive systems (e.g., from genes, cells, organs, organisms, populations, communities, to ecosystems). In an influential paper published in *Science* in 1969, Odum described the natural world as "an orderly process of community development" that is "directed toward achieving as large and diverse an organic structure as is possible within the limits set by the available energy input and the prevailing physical conditions of existence."[14]

In their 1967 *Theory of Island Biogeography*, Robert MacArthur of Princeton University and E. O. Wilson of Harvard presented a similar view of evolution as an orderly progression of natural communities toward a saturation of species. According to this theory, ecosystems exist in a state of equilibrium in which the colonization by a new species is balanced by the extinction of a resident one.[15] Paul Ehrlich later updated the great chain metaphor to that of an airplane. "A dozen rivets, or a dozen species, might never be missed," he wrote with his wife Anne Ehrlich. "On the other hand, a thirteenth rivet popped from a wing flap, or the extinction of a key species involved in the cycling of nitrogen, could lead to a serious accident."[16]

Ecological economists drew from thermodynamic theory to supplement the ecological view that nature represents a constrained and constraining adaptive evolutionary system. In 1971, Nicholas Georgescu-Roegen, a Romanian economist, published *The Entropy Law and the Economic Process* which argued, "The Law of Entropy is the taproot of economic scarcity."[17] Herman Daly, an early proponent of ecological economics and the leading theoretician of what he called steady-state economics, built on the idea that a growing economy must eventually wear out the energy potential (i.e., the organization and integration) of the natural systems in which it is embedded. Optimism based on the "philosopher's stone of technology," he wrote, requires "suspensions of the laws of thermodynamics."[18] In 1992, two prominent ecological economists argued that standard models of economic growth are problematic because "they ignore the fact that the human economy is an integral part of a materially closed evolutionary system."[19]

2.

Ecological economics also drew on theoretical methods and ideas that emerged at Oak Ridge National Laboratory in Tennessee after World War II. Starting in the 1950s, the Atomic Energy Commission employed scores of ecologists — about 80 by 1970 — in dozens of projects that eventually grew into a Big Science approach to computer-based modeling of what were then known as biomes. From 1968 to 1974, various agencies funded the International Biological Program (IBP); the federal government provided nearly $60 million.[20] The IBP produced little of intellectual interest but created a large class of project managers, many of whom remain active today at governmental agencies funding big think ecosystem research.

Surrounded by physicists at Oak Ridge, ecologists adopted computer modeling and other conceptual methods that distinguish mathematical from less theoretical, and thus "softer," sciences. The most influential ecologist of the period, G. E. Hutchinson, insisted that theory was essential to science, declaring, "If we had no theory, there would be nothing to modify, and we should get nowhere."[21]

Hutchinson, along with his colleagues, posited what he called "formal analogies" to explain ecosystem structure and function in terms of equations drawn from many sciences, including statistical mechanics, logistic population growth curves, spectral analysis, circuitry, stoichiometry, thermodynamics, cybernetics, and chaos theory. This was make-work for mathematicians. Anyone with some mathematics and a metaphor — typically borrowed from some other science — could model the ecosystem.[22]

Ecologists of the period assumed "that ecosystems function in accordance to some overarching rules that control structure and/or function,"[23] without checking that assumption against evidence.[24] Princeton ecologist Simon Levin wrote, "One must recognize the powerful adaptive and self-organizing forces that shape ecosystems."[25] These forces were modeled *in silico* (on computers) rather than observed *al fresco* (in the great outdoors). As ecology became a formal science, it mistook models for empirical evidence. "In studying the logical consequences of assumptions, the theoretician is discovering, not inventing," Levin wrote. "To the theoretician, models are a part of the real world."[26]

Theory-based mathematical speculation about ecosystem structure and function appealed to the academic and scientific community of the time. The more abstract and mathematical the theory, the more respect it commanded and the higher, albeit narrower, the threshold it set for professional success.

Mathematicians enjoyed prominent academic careers without having to engage in empirical research or gain tenure in a department of mathematics.[27] In 1974, the late Leigh Van Valen, a formidable University of Chicago evolutionary biologist, concluded that mathematical ecologists had formed a "clique" and a "new orthodoxy" that considered gathering facts a "waste of time."[28]

3.

Liberated from the need to test their theories empirically, ecosystem ecologists built their mathematical models upon ideas that can be traced back to Charles Darwin's contemporary, the British philosopher and biologist Herbert Spencer. The explicit purpose of the International Biological Program — to determine "the biological basis of productivity and human welfare"[29]— was one that Spencer himself might have recognized. Spencer envisioned a theory of systems that would explain the evolution, not just of species, but of ecological communities and of human societies.

While Darwin's theory of descent with modification, for which the fossil record offered empirical evidence, explained the properties of species, Spencer's theory postulated a "universal law of evolution" which asserted that any collection of living things over time tends to self-organize in a "dynamic equilibrium" while dissipating energy.[30] This principle became a program for interpreting everything. Spencer's theory of systems provided the critical bridge from 19th century community ecology not only forward to 20th century systems ecology but also backward to 18th century natural theology. As geographer Clarence Glacken has written, "I am convinced that modern ecological theory, so important in our attitudes towards nature and man's interference with it, owes its origin to the design argument. The wisdom of the creator is self-evident… no living thing is useless, and all are related one to the other."[31]

In 19th century America, naturalists who came of age at the time of the Civil War were educated in the tradition we associate with "intelligent design," the idea that God's fullness and magnificence is demonstrated in the perfect organization and replete diversity of the natural world. The 18th century English poet Alexander Pope celebrated this idea, "Where, one step broken, the great scale's destroyed / From Nature's chain whatever link you strike."[32] The *scala natura* or Great Chain of Being served as the organizing metaphor for what would become community ecology. This approach, according to historian of ideas A.O. Lovejoy, exalted the "sufficient reason" that put every species in its place and attributed self-sufficiency, self-organization, or "quietude" to natural communities — an ability to arrange and sustain themselves as God made them if left undisturbed.[33] The commonplaces of modern ecology, such as "everything

connects" and "save all the parts," recall the neoplatonic view of nature as an integrated mechanism into which every species fits.

How were botanists, zoologists, entomologists, and other biologists able to reconcile their education in natural theology with their acceptance of evolutionary biology? Stephen Forbes, who headed the Department of Zoology at the University of Illinois, showed how this could be done. According to historian Sharon Kingsland, Forbes took from Herbert Spencer the belief that evolutionary forces will achieve and maintain adaptive dynamic equilibriums despite ever-changing relationships in ecological communities or systems.[34]

In a seminal article written in 1887, Forbes described a glacial lake in Illinois as a "system of organic interactions by which [species] influence and control each other [that] has remained substantially unchanged from a remote geological period." What could cause this system to organize and to maintain itself for thousands or millions of years? Forbes wrote:

> Out of these hard conditions, an order has been evolved which is the best conceivable… that actually accomplishes for all the parties involved the greatest good which the circumstances will at all permit…. Is there not, in this reflection, solid ground for a belief in the final beneficence of the laws of organic nature?[35]

In this paper, indeed, in this paragraph, Forbes performed intellectual feats that remain impressive to this day. First, he assumed that there was an order, a dynamic equilibrium, in the lake he visited. He had no empirical evidence to show that the organisms he observed were ancient and enduring, nor did he consider any necessary.[36] Forbes, like Spencer, relied on deductive argument based in a universal theory of natural history. The best-adapted or (as Forbes wrote) "adjusted" species will organize themselves into sustainable and resilient communities.[37]

Second, Forbes, like Spencer, called the dynamic force or universal law that organizes nature in ascending levels or scales of complexity not God, but Evolution. This substitution of nomenclature turned 18th century Great Chain of Being theodicy — with its emphasis on pattern, scale, process, mechanism, hierarchy, resilience, and plenitude — into ecology as it was studied throughout the 20th century.

Frederic Clements, the most influential plant ecologist of the early 20th century, who was also influenced by Spencer, agreed with Forbes that nature is progressive and beneficent. According to ecologist S. P. Hubbell,

> Clements believed that the community was literally a 'superorganism,' and that species were its organs and succession its ontogeny. He argued that each species had an essential role to play in preparing the way for the next serial stage in the succession toward the equilibrium or 'climax' plant

community.[38]

Because Spencer's theory of adaptation applied not just to species, but also to ecological communities, it allowed community ecology to hold on to its theological roots while it embraced a concept of evolution. By assuming that anything God could do, evolution did better, biologists leapt from 18th century natural theology to 20th century community ecology without missing a beat. But for the mantle of mathematics that ecologists had draped over it, mid-20th century community and ecosystems ecology could not be distinguished from the more openly theological framework that Forbes had adapted from Spencer and presented 80 years earlier.

4.

Ecological economists drew on the study of ecological systems — systems ecology — that developed after World War II in the context of Big Science and postulated that ecological systems or communities are unified or governed by a set of organizing principles. Nature itself, however, seems scandalously indifferent to this philosophy. Ecologists who engaged in empirical research found that the mathematical models devised by community and systems theorists were not supported by observation other than by examples cherry picked for the purpose.[39] Had theoretical ecologists been interested in empirical evidence, according to ecologist John Lawton, they would have easily falsified any principle they tested; there are "painfully few fuzzy generalisations, let alone rules or laws."[40]

As early as 1917, however, American botanist Henry Gleason (1882-1975) had challenged the assumption that the living world is organized under enduring principles or by powerful forces. He argued instead that each association of plants and animals is unique, ephemeral, spontaneous, idiosyncratic, extemporaneous, and a law unto itself.[41] The sites that ecologists study, he believed, should be seen as path-dependent histories rather than as rule-governed communities. From this point of view ecosystems do not evolve; they just change.

Gleason argued that no general law, principle, model, or theory gets any predictive traction on the comings and goings of species. In a recent article, Daniel Simberloff, a leading contemporary ecologist, refers to the "longstanding controversy stemming back to Clements, Gleason, and their contemporaries, over whether a plant community is anything other than the assemblage of populations co-occurring in a specific place at a specific time: that is, to what extent are communities integrated, discrete entities, and, if they are, what is the

nature of the integration?" Underlying this controversy is "the question of whether community ecology itself actually has generalizations beyond trivial ones like the laws of thermodynamics, and whether seeking such generalizations advances the study of ecology at the community level."[42] Simberloff concedes that there are no nontrivial laws, principles, or generalizations that predict events at the "system" or the "community" level or that explain the integration these concepts suggest. "Laws and models in community ecology are highly contingent, and their domain is usually very local."[43]

William Drury found no emergent properties, governing rules, or integration in the forests he studied.

> I feel that ecosystems are largely extemporaneous and that most species (in what we often call a community) are superfluous to the operation of those sets of species between which we can clearly identify important interactions…. Once seen, most of the interactions are simple and direct. Complexity seems to be a figment of our imaginations driven by taking the 'holistic' view."[44]

Simply put, the evidence does not support the idea that evolution applies on a system-wide scale. New ecosystems appear all the time; the species found at a place rarely coevolved there. Nearly anywhere one looks one finds species coming and going — many or most are recent arrivals. A group of 19 ecologists wrote in *Nature*, "Most human and natural communities now consist both of long-term residents and of new arrivals, and ecosystems are emerging that never existed before."[45]

If creatures just show up at sites for their own reasons, which is usually the case, the concept of evolution does not apply even as a useful metaphor at the scale of the community or the ecosystem. As Drury argued, self-organizing adaptive ecological communities or systems that achieve and sustain a dynamic equilibrium are figments of the theoretical imagination driven by taking the holistic view. Just because places change — nature is continually in flux — does not mean they evolve. There is no dynamic order, force, or principle of self-organization that makes every hodgepodge a system.

5.

If the ecological foundations of ecological economics rested upon shaky ground, the economic foundations were no less problematic. Ecological economists have argued that because they cannot guarantee that growth is sustainable — that new technologies will save the day — we should (to quote the literature) "degrow" the economy.[46] "Given our high level of uncertainty about this issue, it is irrational to bank on technology's ability to remove resource constraints,"

insisted Costanza. “This is why ecological economics assumes a prudently skeptical stance on technical progress.”[47] Ecological economists argued that what they did not know about the ecological foundations of the economy could hurt us, and that we ignored their uncertainty at our peril. In other words, they appealed to their own ignorance about ecosystem structure and function to empower their “precautionary” position.

Mainstream macroeconomists — those who deal with indicators of economic performance such as employment, inflation, trade, productivity, and national competitiveness — generally reject this precautionary stance. Robert Solow, a Nobel laureate, spoke for many economists when he opined that if the future is like the past, “there will be prolonged and substantial reductions in natural-resource requirements per unit of real output.” He asked, “Why shouldn’t the productivity of most natural resources rise more or less steadily through time, like the productivity of labor?”[48]

By shifting the content of their warnings from resource exhaustion to system overload, ecological economists convinced few but themselves. Microeconomists swatted away the precautionary principles of ecological economists as easily as they had earlier dismissed the jeremiads of neo-Malthusians like Ehrlich. The answer mainstream economics gave to system overload was the same as its response to resource exhaustion: greater resource productivity and technological innovation.

By the 1980s, in response to some of the same challenges and opportunities that had inspired the creation of ecological economics, a group of mainstream welfare economists had founded the Association of Environmental and Resource Economists. These neoclassical economists developed the field of mainstream environmental economics to provide their own analysis of and prescription for the environmental crisis. They rejected the thermodynamic theory of value ecological economists proposed — the idea that the constraint on growth is “negative entropy,” meaning “the degree of organization or order of a thing relative to its environment.”[49] Instead, environmental economists offered what they called “utility,” “welfare,” or “willingness to pay” as the central value for environmental analysis and policy.

Environmental economists defined and measured welfare or utility in terms of preferences or, practically speaking, the amounts people are 1) willing to pay (WTP) for a good or 2) willing to accept (WTA) to relinquish it. They did not describe pollution and other assaults on the environment in terms of entropic forces wearing down the resilience of holistic and integrated evolutionary systems. They diagnosed environmental problems as market externalities, that is, as uncompensated effects of economic decisions on third parties whose interests

— or whose WTP — those decisions did not take into account. Economist Robert N. Stavins wrote, “The fundamental theoretical argument for government activity in the environmental realm is that pollution is an externality.”[50]

Environmental economists had an advantage because they applied a framework that was already familiar in economic thought and therefore in policy analysis and political discourse. During the 1990s, environmental outfits and agencies staffed up with economists to attribute prices to externalities and discover market failures. Dueling cost-benefit analyses and opposing stories about WTP or WTA began to co-opt, infiltrate, and even replace moral argument and political persuasion.

In response, many ecological economists, including some who had criticized the framework of neoclassical welfare economics, adopted it. It was easy to argue that people are willing to pay a lot for nature and for the services it provides. Accordingly, ecological economists, rather than continuing to construe economic systems as embedded in ecological systems, reduced their ambitions to tweaking neoclassical cost-benefit models to assign higher existence values to nature and lower discount rates to its use.

For example, in the most cited and well-known paper written in ecological economics, Costanza and a dozen colleagues in 1997 applied what they considered to be the concepts of neoclassical utility theory to assign an economic worth of about $33 trillion — much more than the value of the product of the global economy — to what they called “The Value of the World’s Ecosystem Services and Natural Capital.”[51]

Ecological economists ended up fully embracing the slogan of mainstream welfare economics that protecting the environment is a matter of getting the prices right. A discipline that just a decade or two earlier had insisted the market was embedded in nature had learned how to embed nature into the market.

6.

Having caved in to the normative framework of WTP or cost-benefit utility theory, ecological economists have been unable to confront the reasons that led Herman Daly, among others, to reject the market mechanism as an approach to understanding environmental problems. There are exceptions. A few ecological economists chided their colleagues for “commodity fetishism” and called for “conservation based on aesthetic and ethical arguments.”[52] They cited the article, “Selling Out on Nature” by Douglas McCauley in *Nature* magazine, which argued that “conservation must be framed as a moral issue,” because nature has “an intrinsic value that makes it priceless, and this is reason enough to protect it.”[53] Costanza wrote in response, “I do not agree that more progress will

be made by appealing to people's hearts rather than their wallets."[54] Gretchen Daily, a prominent ecological economist, insisted that only by attributing instrumental or economic value to nature can conservationists influence public policy. "We have to completely rethink how we deal with the environment, and we should put a price on it," she said.[55]

Ecological economics, when it embraced cost-benefit and market-based valuation, abandoned the ethos of much of the landmark environmental legislation of the 1970s, which had rejected a market failure theory of pollution. These statutes, such as the Clean Air and Clean Water Acts, were intended to protect public safety and health against toxic wastes and hazardous emissions. This legislation rests on the same principle as common law: the belief that one person should not injure or invade the person or property of others without their consent. Understood in this way, pollution represents an invasion of person and property and therefore is to be enjoined, minimized, or tolerated unwillingly until technology can do better. Environmental law is libertarian, not utilitarian, because it seeks to protect people and property against peril and trespass rather than to maximize utility. One person does not have the right to pollute and thus to trespass on another even when it is socially efficient to do so. Economists Maureen Cropper and Wallace Oates wrote in 1992 that "the cornerstones of federal environmental policy in the United States explicitly prohibited the weighing of benefits against costs in the setting of environmental standards."[56]

In response to the Reagan revolution, ecological economists had followed the cost-benefit bandwagon. But in doing so, they unwittingly played into their opponents' hands. By changing the political conversation from the question, "What is a cause of what?" to "What is a cost of what?" ecological economists substituted the technocratic framework of microeconomics for the ethical framework of responsibility.

John V. Krutilla, an influential environmental economist and strong environmentalist, demonstrated how pliable the idea of an ecological or environmental externality could become.[57] He observed that people who contribute to environmental causes must (by definition) benefit from them. Therefore, ideological, political, and moral commitments could be factored into the cost-benefit analysis (CBA) that measures social welfare and thus justifies environmental policy. Once political views, ideological principles, and spiritual beliefs were treated as consumer preferences, environmentalism could be reduced to one more interest group battling for its piece of the economic pie — for example, the aesthetic, cultural, and spiritual benefits of ecosystems.

The problem for environmentalists wasn't that they were losing the epic cost-benefit battles that raged through the 1980s and 1990s. They more than held

their own in the dark art of creating social welfare functions to justify whatever it is that one wants. But, ironically, there is ample reason to believe that CBA has never significantly affected rulemaking or regulation at all.

Robert Hahn, an advocate of CBA, conceded, "The relationship between analysis and policy decisions is tenuous."[58] He added, "There is little evidence that economic analysis of regulatory decisions has had a substantial positive impact" and argued that "the poor quality of analysis can help explain some of this ineffectiveness."[59] But the poor quality of much cost-benefit analysis is arguably a function of the fact that cost-benefit arguments are mostly invoked as a kind of "open sesame" to defend or decry any governmental intervention. Advocates and policy makers, to borrow an old saw, use CBA like a drunk uses a lamppost: for support, not illumination. After Congressional committees, administrative agencies, and the courts tear through them, the political battles that CBA is supposed to inform are settled in terms of liability, responsibility, authority, and legality — not welfare maximization.

If CBA lacks an intellectual and legal basis and has only a tenuous regulatory effect, why is it done? One reason is that so many people can do it. As law professor Duncan Kennedy has explained, CBA or the compensation test it implies is "just as open to alternating liberal and conservative ideological manipulation" as is the political deliberation it is supposed to displace. However bad or mistaken cost-benefit accounting may be, it has a centrist effect, "supportive of liberalism and conservatism together, seen as a bloc in opposition to more left and right wing positions." In other words, by engaging in CBA, experts form a scientistic "centrist bloc" that agrees on "moderation, statism, and rationalism."[60]

When partisans and opponents of environmental causes adopt the discourse of market failure and social externality, they co-opt their political fringes and tamp down the moral fervor of environmentalism, making the political conversation safe for expertise. Ecological economics has evolved into the more pro-environment wing of standard environmental economics. This has depleted the discipline of its initial energy. As long as the vocabulary of microeconomics, including cost-benefit analysis, remains the *lingua franca* of environmentalism, properly credentialed and preferably academic participants will have the policy debate to themselves. Evidently, this temptation proved to be too much for ecological economists.

7.

Ecological economics aimed to be revolutionary, but it is now ignored by the sciences it had hoped to transform. Both ecology and economics have changed,

but not because of the rise of ecological economics. The science of ecology could not draw indefinitely on its roots in 18th century theodicy. As contemporary ecologists have abandoned theory for empiricism, ecology has returned to the long-suppressed view of Gleason, as Hubbell put it, that species are "largely thrown together by chance, history, and random dispersal."[61]Species come and go. Ecological sites do not have a structure or a function. They have a history.

The science of economics has moved on as well. Just when ecological economics caved in to the normative framework of neoclassical welfarism, empirical work in behavioral and experimental economics profoundly undermined that approach. Empirically-minded economists turned to studying the behavior of institutions and individuals, rather than continuing to model abstract utility functions.

Ecological economists today try to put prices on ecosystem benefits and services. This effort by environmentalists is self-defeating. If environmental decisions are fundamentally framed as questions of economic welfare, public officials and the public itself will opt nearly every time for whatever policy promises more economic growth, more production, and more jobs. Moreover, in a world where human influence is as ancient as it is pervasive, it may be helpful to recognize that the natural environment where we live is less of an input than an output of economic activity.

Ecological economics today, its ambitions greatly diminished, has reached senescence; it provides an academic assisted-living facility for "Great Chain of Being" ecology and cost-benefit economics. A hybrid discipline, ecological economics crosses closet creationism with market fetishism. When ecological economists dispute the relative importance of intrinsic vs. instrumental value, the hybrid reverts to type.

The scientistic and self-referential controversies in which ecological economists engage drain away the moral power that once sustained environmentalism. This moral power may return if environmentalists employ science not to prescribe goals to society but to help society to achieve goals it already has. Environmentalists may then shape the natural environment of the future rather than model and monetize the environment of the past. /

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ENDNOTES

[1] For a history of the founding and early development of ecological economics, see Ropke, Inge. 2004. "The early history of modern ecological economics." *Ecological Economics.* 50: 293-314.

[2]Quoted in Kenski, Henry C., 1985. "The President, Congress, and Interest Groups. Environmental Policy in the 97th Congress", pp. 77-100 in Helen M. Ingram & R. Kenneth Godwin (eds.), *Public Policy and the Natural Environment*, Greenwich: JAI Press. 78.

[3] See, for example, Hawken, Paul, Amory Lovins, and Hunter Lovins. 1999. *Natural Capitalism: Creating the Next Industrial Revolution.* Back Bay Books; 1st edition (December 1, 2008).

[4] "The idea is to right-size the economy, to find the Goldilocks size that's not too small and not too big, but just right." CASSE, 2010. What Is a Steady State Economy?, Briefing paper. Accessed: http://steadystate.org/wp-content/uploads/2009/12/CASSE_Brief_SSE.pdf

[5] Costanza, Robert. 1989. What is ecological economics? *Ecological Economics.* 1: 1.

[6] "Traditional ecological research investigates ecosystems in terms of biophysical, ecological, and evolutionary processes unaffected by human influences. " Alberti, Marina, Marzluff, John M., Shulenberger, Eric, Bradley, Gordon, Ryan, Claire, and Craig Zumbrunnen. 2003. "Integrating Humans into Ecology: Opportunities and Challenges for Studying Urban Ecosystems." *BioScience*. 53(12):1169–1179, 1170.; R.V. O'Neill has written, "The ecosystem concept typically considers human activities as external disturbances . . . *Homo sapiens* is the only important species that is considered external from its ecosystem, deriving goods and services rather than participating in ecosystem dynamics." O'Neill, R.V. 2001. "Is It Time to Bury the Ecosystem Concept? (with full military honors, of course!)." *Ecology*. 82: 3275–3284. 3279.

[7] "If it is very easy to substitute other factors for natural resources, then there is in principle no problem. The world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe." Solow, Robert M. 1974. "The Economics of Resources or the Resources of Economics." *American Economic Review*. 64(2):1-14. 11.

[8] Meadows, Donella et al. 1972. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. Universe Books. A lengthy review of the book in *The New York Times* ascribed to it the projection that reserves of many or most crucial minerals would be exhausted within the next few decades. *The Limits to Growth* had attributed a view like this to the Bureau

of Mines. For discussion see Turner, G.M. “A Comparison of The Limits to Growth with Thirty Years of Reality.” *Global Environmental Change.* 18: 397-311.

[9] Ehrlich, P. R. 1970. “Looking backward from 2000 A.D.” *The Progressive.* 34: 23-25.

[10] Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: Synthesis*. Washington, DC: Island Press. 13. The Assessment is careful to point out that food is not distributed equitably: “Despite the growth in per capita food production in the past four decades, an estimated 852 million people were undernourished in 2000–02.”

[11] Sen, Amartya. 1984. *Resources, Values and Development*. Cambridge, MA: Harvard University Press. 524; see also, Dreze, Jean and Amartya Sen. 1989. *Hunger and Public Action.* Oxford: Clarendon Press. 26-28. For a recent elaboration of Sen’s findings, see: Keneally, Thomas. 2011. *Three Famines: Starvation and Politics* Public Affairs.

[12] Farber, S.C. et al. 2002. “Economic and Ecological Concepts for Valuing Ecosystem Services,” *Ecological Economics.* 41: 375–392. 380.

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[14] Odum, E.P. 1969. “The Strategy of Ecosystem Development.” *Science.* 164: 262-270.

[15] MacArthur, R. H. and E.O. Wilson. 1967. *The Theory of Island Biogeography*. Princeton, N.J.: Princeton University Press.

[16] Ehrlich, Paul R. and Anne H. Ehrlich. 1981. *Extinction*. New York: Random House. xii-xiii.

[17] Georgescu-Roegen, Nicholas. 1976. *Energy and Economic Myths.* 9. See also (1977) "Inequality, Limits and Growth from a Bioeconomic Viewpoint." *Review of Social Economy.* XXXV(3): 361-375.

[18] Daly, Herman E. 1995. “Reply to Mark Sagoff’s ‘Carrying Capacity and Ecological Economics.’” *Bioscience.* October 1995. 621-624.

[19] Common, Mick and Charles Perrings. 1992. “Towards an ecological economics of sustainability.” *Ecological Economics.* 6(1): 7-34.

[20] Boffey, Philip M. 1976. “International Biological Program: Was It Worth the Cost and Effort?” *Science*. 193(4256): 866-868. “Some 1800 American scientists engaged in IBP work, supported by $57 million in federal grants plus substantial contributions from other organizations.”

[21] Quoted in: Hagen, J.B. 1992. *An Entangled Bank: The Origins of Ecosystem*

Ecology. New Brunswick: Rutgers University Press. 75.; Many ecologists took this position that "without a strong theoretical core . . . we [ecologists] shall all be washed out to sea in an immense tide of unrelated information." Watt, K. E. 1971. " Dynamics of populations: A synthesis." Eds. den Boer, P.J., and G.R. Gradwell. *Dynamics of Populations: A Synthesis.* Wageningen, Netherlands: Centre for Agricultural Publishing and Documentation. 569. Ecology continues to confront a "constipating accumulation of untested models" (Schoener ,TW. 1972. "Mathematical Ecology and its Place Among the Sciences." *Science.* 178: 389–391) after indulging in "a feast of theory [that ecology] isn't quite ready to digest." Futuyma, Douglas J. 1975. Review, *50 Q. Rev. Biology*. 217.

[22] Simberloff, Daniel. 1980. "A Succession of Paradigms in Ecology: Essentialism to Materialism and Probabilism." *Synthese.* 43: 3–39. See also, McIntosh, RP. 1985. *The Background in Ecology: Concept and Theory*. United Kingdom: Cambridge University Press.; Woodwell, G. 1976. "A Confusion of Paradigms (Musings of a President-Elect)." *Bulletin of the Ecological Society of America.* 57: 8-12.

[23] Schugart, Herman. 2000. "Ecosystem Modeling." In Sala, Osvaldo E., Jackson, Robert B., Mooney, Harold A., Howarth, Robert W., Odum, E. P. 2000. *Methods in Ecosystems Science.* Springer. 384.

[24] For a discussion of the lack of testing of theory in ecology, see Belovsky, G.E., Botkin, D.B., Crowl, T.A., Cummins,K.W., Franklin, J.F., Hunter, M.L. Jr., Joern, A, Lindenmayer, D.B., MacMahon, J.A., Margules, C.R., Scott J.M. 2004. "Ten suggestions to strengthen the science of ecology." *BioScience*. 54(4): 345-351. These authors lament the development of "ecology as mathematics unimpaired by the bounds of nature."

[25] Levin, S.A. 1999. *Fragile Dominion: Complexity and the Commons.* Reading, MA: Perseus Books. 6.

[26] Levin, S.A. 1981. "The role of theoretical ecology in the description and understanding of populations in heterogeneous environments. *American Zoologist.* 21: 865-875. 866.

[27] A. O. Hirschman has explained this familiar phenomenon. "In the academy, the prestige of the theorist is towering. Further, extravagant use of language intimates that theorizing can rival sensuous delights: what used to be called an interesting or valuable theoretical point is commonly referred to today as a 'stimulating' or even 'exciting' theoretical 'insight.'" Hirschman added that in the United States, "an important role has no doubt been played by the desperate need . . . for shortcuts to the understanding of multifarious reality that must be coped with and controlled and therefore be understood at once . . . As a result of these

various factors, the quick theoretical fix has taken its place in our culture alongside the quick technical fix." Hirschman, A.O. 1987. "The Search for Paradigms as a Hindrance to Understanding." *Interpretive Social Science: A Second Look.* P. Rabinow & W. Sullivan eds. 177-178.

[28] Van Valen, L. and F.A. Pitelka. 1974. "Commentary -- Intellectual Censorship in Ecology." *Ecology*. 55: 925-926.

[29] Mitchell, Rodger, Mayer, Ramona A., and Jerry Downhower. 1976. "An Evaluation of Three Biome Programs." *Science*. 192: 859-65.; See also: Aronova, Elena, Baker, K.S., and N. Oreskes. 2010. "Big science and big data in biology: from the International Geophysical Year through the International Biological Program to the Long-Term Ecological Research, 1957–present." *Historical Studies in the Natural Sciences.* University of California. 40(2): 183-224. The current example of massive waste of public funds on Big Ecology is the NEON Project (http://www.neoninc.org/) which layers a lot of expensive infrastructure on the cybernetic-engineering-biochemical-computer-modeling effort to reach the amorphous goal that the IBP and LTER were supposed to achieve of understanding how the ecosystem works.

[30] For a discussion of Spencer's *Universal Law of Evolution*, its grounding in Great Chain of Being theodicy and its stark difference from Darwin's much more limited view, see: Corning, Peter. 1995. "Synergy and self-organization in the evolution of complex systems." *Systems Research.* 12(2): 89-121.; For a statement of Spencer's *a priori* theory of universal biological self-organization and development, see: Spencer, Herbert. 1852. "The development hypothesis." *Essays: Scientific, Political and Speculative.* Appleton, New York, 1892.

[31] Glacken, C. J. 1967. *Traces on the Rhodian Shore.* Berkeley: University of California Press. 243.

[32] Pope, Alexander. 1751. "Essay on Man."

[33] Lovejoy, Arthur O. 1936. *The Great Chain of Being*. Cambridge, MA: Harvard University Press, 1971.

[34] For discussion, see: Kingsland, Sharon. 1995. *Modeling Nature*, *Episodes in the History of Population Ecology*, *2nd edition.* Chicago: University of Chicago Press. 14.

[35] Forbes, Stephen A. 1887. "The Lake as a Microcosm." reprinted in the *Bulletin of the Illinois State Natural History Survey, 1925.* 15: 537-550.

[36] Paleoecological research has demonstrated the ephemeral nature of the kinds of places Forbes visited. According to Stephen Hubbell: "For example, the fossil pollen record from eastern North America and Europe reveals that many pre-

Holocene, full glacial, and previous interglacial plant communities are very different from modern communities." Hubbell, S. P. 2001. *The unified neutral theory of biodiversity and biogeography*. New Jersey: Princeton University Press. See also: Davis, Margaret B. 1986. "Climatic instability, time lags, and community disequilibrium." in Jared Diamond and T.J. Case, eds., *Community Ecology*. New York: Harper and Row.; Overpeck, J., Webb, R., Webb, T. III. 1992. "Mapping eastern North American vegetation change of the past 18 ka: No-analogs and the future." *Geology*. 20: 1071-1074.

[37] Forbes, Stephen A. 1887. "The Lake as a Microcosm." reprinted in the *Bulletin of the Illinois State Natural History Survey, 1925.* 15: 537-550.

[38] Hubbell, S. P. 2001. "Chapter 1." *The unified neutral theory of biodiversity and biogeography*. New Jersey: Princeton University Press.

[39] "Wherever we seek to find constancy, we discover change," ecologist Dan Botkin has observed. We find that "that nature undisturbed is not constant in form, structure, or proportion, but changes at every scale of time and space." Botkin, D.B. 1990. *Discordant Harmonies: A New Ecology for the Twenty-First Century*. New York: Oxford University Press. 62. Donald Worster summarized, "Nature should be regarded as a landscape of patches, big and little, patches of all textures and colors, a patchwork quilt of living things, changing continually through time and space, responding to an unceasing barrage of perturbations. The stitches in that quilt never hold for long." He wrote, "Many have begun to believe [that nature] is fundamentally erratic, discontinuous, and unpredictable. It is full of seemingly random events that elude our models of how things are supposed to work." Worster, Donald. 1990."The Ecology of Order and Chaos." *Environmental History Review*. Spring/Summer:13.

[40] Lawton, J. H. 1999. "Are there general laws in ecology?" *Oikos.* 84: 177-192. For an excellent discussion of the absence of general principles or rules in ecology, see: Lange, Marc. 2005. "Ecological Laws: What Would They Be and Why Would They Matter?" *Oikos.* 110(2): 394–403.

[41] The clearest statement Gleason gave to this view is found in: Gleason, Henry A. 1926. "The Individualistic Concept of the Plant Association." *Bulletin of the Torrey Botanical Club*. 53: 7-26.

[42] Simberloff, Daniel. 2010. "Invasion of plant communities: More of the same, something very different, or both?" *American Midland Naturalist.* 163(1): 220-233. 221.

[43] Simberloff, Daniel. 2004. "Community ecology: is it time to move on?" *American Naturalist.* 163: 787–799. 787.

[44] Drury, W.H. 1998. *Chance and Change: Ecology for Conservationists*.

Berkeley: University of California Press. 23. Similarly, conservation biologist Michael Soulé has written, "Certainly the idea that species live in integrated communities is a myth." He adds, "So-called biotic communities, a misleading term, are constantly changing in membership." By insisting on integrated systems, "the science of ecology has been hoist on its own petard." Soulé, Michael. 1995. "The social siege of nature." *Reinventing Nature? Responses to postmodern deconstruction.* eds. M.E. Soule and G. Lease. Washington: Island Press. 143.

[45]Davis, Mark et al. 2011. "Don't Judge Species On Their Origins." *Nature*. June (474): 153-54.

[46] For a review of this literature, see: Kallis, G. 2011. "In defence of degrowth," *Ecological Economics.* 70: 873–880.

[47] Costanza, Robert. 1991. "Ecological economics: a research agenda." *Structural Change and Economic Dynamics.* 2:335-357. 339. See also: Costanza, Robert, Cumberland, John, Daly, Herman, Goodland, Robert, and Richard Norgaard. 1997. "Chapter 3." *An Introduction to Ecological Economics.* CRC Press.

[48] Solow, Robert M. 1973. "Is the End of the World at Hand?" in Andrew Weintraub, Eli Schwartz, and J. Richard Aronson, eds. *The Economic Growth Controversy*. White Plains, NY: Institute of Arts and Sciences Press. 49.

[49] Farber, S.C., et al. 2002. "Economic and ecological concepts for valuing ecosystem services." *Ecological Economics.* 41: 375–392. 382.

[50] Stavins, Robert N. 2008. "Environmental Economics." *The New Palgrave Dictionary of Economics, Second Edition*. Eds. Steven N. Durlauf and Lawrence E. Blume.

[51] Costanza, Robert, et al. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature.* 387.

[52] Kosoy, N. and Corbera, E. 2010. "Payments for ecosystem services as commodity fetishism." *Ecological Economics.* 228:1236.

[53] McCauley, D.J. 2006. "Selling Out on Nature." *Nature.* 443: 27-28.

[54] Costanza, Robert. 2006. "Correspondence." *Nature.* October 19. 443: 749.

[55] Gretchen Daily, quoted in: Petit, Charles. 1997. "Natural Environment Gets a Price Tag – $33 Trillion." *San Francisco Chronicle.* May 15.

[56] Cropper, Maureen L. and Wallace E. Oates. 1992. "Environmental Economics: A Survey." *Journal of Economic Literature.* 30: 675-740.

[57] Krutilla, J. V. 1967. "Conservation Reconsidered." *American Economic Review*. 57: 777-86.

[58] Hahn, Robert W. 2009. “An Evaluation of Government Efforts to Improve Regulatory Decision Making.” *International Review of Environmental and Resource Economics*. 3: 245–298. 245.

[59] Hahn, Robert W. 2009. “An Evaluation of Government Efforts to Improve Regulatory Decision Making.” *International Review of Environmental and Resource Economics*. 3: 245–298. 250.

[60] Kennedy, Duncan. 1998. “Law and Economics from the Perspective of Critical Legal Studies.” *The New Palgrave Dictionary of Economics and the Law*. Edited by Peter Newman, Macmillan Reference Ltd.

[61] Hubbell, S. P. 2001. “Chapter 1.” *The unified neutral theory of biodiversity and biogeography*. New Jersey: Princeton University Press.

LIBERALISM'S MODEST PROPOSALS

Or, the Tyranny of Scientific Rationality

Daniel Sarewitz

"I have been assured by a very knowing American of my acquaintance in London, that a young healthy child well nursed, is, at a year old, a most delicious, nourishing, and wholesome food, whether stewed, roasted, baked, or boiled…"

— Jonathan Swift, "A Modest Proposal," 1729

As with eugenics and forced sterilization, the liberal proposal to make energy more expensive for the poor was grounded in scientific rationality.

Jonathan Swift's famous satirical essay remains shockingly effective nearly 300 years after its publication. What was Swift's secret? In part, it lies in the deadpan delivery of an unspeakably macabre solution to the problem of Irish poverty. But what really chills the soul is the author's analytical precision — the cold logic and hard data as the argument proceeds from problem statement to proposed solution:

> I have already computed the charge of nursing a beggar's child (in which list I reckon all

> cottagers, laborers, and four-fifths of the farmers) to be about two shillings per annum, rags included; and I believe no gentleman would repine to give ten shillings for the carcass of a good fat child, which, as I have said, will make four dishes of excellent nutritive meat, when he hath only some particular friend or his own family to dine with him.

Swift is most obviously commenting on England's predatory policies toward Ireland, but "A Modest Proposal" is also an attack on scientific rationality unchecked by experience, empathy, and moral grounding. Swift's game was to show that pretty much any position, however repulsive, could be advanced on the back of rationality.[1]

Where is Jonathan Swift when we need him? American liberalism, it turns out, has been dangerously susceptible to the political confusion sewn by an uncritical devotion to scientific rationality and the false belief that right action can be extracted from a set of scientific facts, however unmoored from appropriate moral and experiential foundations. In the 1920s, liberal scientists and progressive reformers rationalized their support of eugenic policies through the emerging science of genetics. Oliver Wendell Holmes authored a Supreme Court opinion rendering constitutional the enforced sterilization of a woman on the grounds that it was necessary to keep her from passing on her defective genes, while another liberal lion, Louis Brandeis, supported the opinion.[2] In the early 1960s, escalating US involvement in the Vietnam War was in part justified by liberal confidence in the power of scientific analysis to guide complex national policies. Later that same decade, leading liberal ecologists advocated cutting off food aid to countries like India, where population growth was outstripping agricultural productivity.

Scientific rationality is a terrible foundation for progressive politics, yet liberals seem more devoted to it than ever. As a result, the politics of rational assessment is displacing the politics of liberal values. This evolution has led liberals astray on core moral issues. It has also alienated them from one of the most powerful tools for creating a more equitable society: technology.

1.

American liberalism's one big, galvanizing idea of recent decades has been that, in order to protect the global environment, societies need to fundamentally change the way they are organized. This idea emerged gradually from the environmental movement of the 1960s and 1970s, gaining credence as scientific research began to show evidence of worrisome change in a variety of large-scale environmental systems, most notably the Earth's atmosphere.

From this big idea emerged a proposal worthy of Jonathan Swift's satirical imagination: make energy more expensive. Because fossil fuel emissions were

disturbing the planet's climate, fuel prices should be raised to force a reduction in emissions and stimulate a transition to non-fossil energy sources.

If one were seeking a policy intervention that could simply and effectively erode economic and social equity worldwide, one could hardly do better than to increase the cost of energy. Production and distribution systems for energy are an absolute foundation for material welfare in modern societies. In an interdependent world of billions of humans, there is no food, no work, no economy without energy, and one's capacity as an individual to participate fully in that world depends on access to, and thus the cost of, energy. Access to cheap energy in an industrialized world is a basic requirement for human development and dignity. This fact is so blindingly obvious that nearly every large developing country has treated the idea of a global agreement to raise energy prices as a joke of Swiftean character. The difference being, of course, that it was not a joke.

Energy equity ought naturally to be a core commitment of liberal-progressive politics, but somehow it became an inconvenience, an impertinence. Liberals from rich countries, their sense of irony (not to mention equity) apparently dulled to insensibility, defended their call for higher energy prices by saying that poor countries will suffer the most from global warming — a response that ignores the reality that poor nations already suffer the most from disenfranchisement and disasters,[3] and that any future for the poor in which they are no longer poor or disenfranchised almost certainly requires that they consume much more energy, which, of necessity, must be cheap. Indeed, access to cheap energy is a core equity issue in rich countries as well, where poor people suffer disproportionately from the impacts of rising energy prices.

My aim here, however, is not to critique climate change policy per se. What I want to try to understand is why one of the centerpieces of the progressive liberal agenda in the United States over the past decade or more presents itself as a sort of irony-free "Modest Proposal" — an effort to address a real problem in a way that is fundamentally antipathetic to the precepts of modern American political liberalism.

2.

I take for my definition of American political liberalism the somewhat inchoate family of ideas that understands government action as appropriately aimed at enhancing economic and social equity, that is skeptical the marketplace can sufficiently advance social equity and justice on its own, and is optimistic about the potential for social progress as a result of government action. In total, I would therefore take it as a fundamental premise of American liberalism that policies pursued through the erosion of economic and social equity are

repugnant and anathema.

How then did liberalism become associated with — and, to some extent, obsessed with — policies whose most obvious direct effects would be to undermine economic and social equity? Here I focus on two related causes. The first is the tyrannical role that scientific rationality has come to play in the liberal imagination and agenda. Second is the alienation of the liberal agenda from technological approaches to social problems.

The value of science as an embodiment of rational thought and action has been central to the American cultural identity since the nation's inception. Yet to the nation's founders, this value was abstract: a knowledge of science helped to cultivate general habits of rational thought that were deemed necessary for the wise governance of democratic society.[4] Today we think about science much more concretely, not simply as a habit of mind, but as a source of facts and knowledge that can bring problems to light and tell us how to go about solving them.

This more practical view of science in society did not, however, gain much relevance until the early 20th century, when the technical complexity of the world increasingly seemed to demand specialized expertise for its management, and when developments in social and biological sciences seemed to offer important insights for guiding human action. As Walter Lippmann observed in 1922, the "theory of universal competence" was no longer up to the task of providing the necessary wisdom for governing the "Great Society [that] had grown furiously and to colossal dimensions by the application of technical knowledge…. It could not be governed, men began to discover, by men who thought deductively about rights and wrongs." Now it required "experts who were trained, or had trained themselves, to make parts of this Great Society intelligible to those who manage it."[5]

For any ideological perspective that saw government as at least partly in the business of actively making society better, science in this diagnostic and advisory mode became a powerful ally. And thus science, enlisted as a tool for defining and advancing political agendas, has had a particular and natural allure for modern American liberalism dating back to its early 20th century variants.

3.

If liberals have erred — morally as well as politically — in placing too much reliance on science as a political polestar, their even greater error, again both moral and political, has been their gradual alienation since World War II from the promise of technological change to effectively addressing social problems.

These two tendencies, as we shall see, are closely related.

There are, of course, plenty of good reasons to be worried about technology and suspicious of the utopian claims of technology promoters. During the 1960s and 1970s, the threat of global self-immolation from nuclear weapons, the despoliation of the natural environment through industrialization, the gruesome unleashing of new military technologies against the Vietnamese people, and the depressing tendency of "technology transfer" to mire poor countries in economic dependence, all fed into an understandable liberal skepticism about technology as a source of human betterment.[6]

But the most politically resonant strand of technological skepticism in the post-World War II era has not focused on issues of power, equity, or distribution, but rather on questions of risk to human health and environmental quality. Such risks may be chronic (toxic chemicals in soil and water) or catastrophic (oil spills and nuclear meltdown), but what unifies them are their origins in technology and their diagnoses in science. Indeed, the emergence of health, environmental, and technological risks as galvanizing liberal issues in the late 1960s marked a thorough repudiation of the technological progressivism that sat comfortably in mainstream American politics through the first half of the 20th century.[7] This repudiation brought with it a commitment to regulatory intervention as the cure for the ills that technology visited on humans and nature.

At the same time, the foundations for risk-based liberal politics have increasingly lain with science and scientific evidence, as the political agenda for risk has moved from the obvious and palpable (smog, burning rivers, vanishing eagles) to the increasingly invisible and statistical (disappearing stratospheric ozone, small changes in cancer incidences or cognitive function in large populations of people, gradual increases in average global atmospheric temperature).

Science also documents with increasing precision the declining stocks of natural resources, from fresh water to soil to timber to fish, and thus supports a robust neo-Malthusian strand of liberalism. As with the liberal politics of risk, the politics of scarcity is also an expression of technoskepticism, because it declares (oblivious of history) that technological advance and substitution will not be able to keep up with the technology-driven resource depletion that scientists have measured.

The combination of risk- and scarcity-based liberal politics can only give rise to political incoherence, as liberals find themselves, for reasons of risk, opposing new technologies that could help resolve issues of scarcity. An obvious example is opposition to genetically modified organisms (GMOs). While one strand of liberalism has opposed GMOs because of fears about potential health and

ecological risks, another strand has insisted that the combination of soil and water depletion, pollution, and population growth is moving the world toward an agricultural productivity crisis — a crisis that GMOs can (and will) help to avert. And, while it may now seem difficult to remember, in the 1970s, the liberal politics of energy was a politics of fossil fuel scarcity. Predicted fossil fuel shortages drove liberal demands for more conservation and energy efficiency — the same technoskeptical demands that are now applied in the context of fossil fuel overabundance, as the politics of energy scarcity transitioned to a politics of climate change risk.

A central theme of contemporary liberalism thus emerges from a reverence for science that increasingly, and with ever-greater precision, documents the problems associated with a technology-dependent society. Meanwhile, the philosophical commitment to technoskepticism hampers liberals from achieving their political and social goals because it constricts their imagination about how to accomplish what's important, often leading them to focus on small risks to individuals rather than the potential for very large benefits to society that technological advance can bring.

4.

Against the claims of contemporary liberal technoskepticism is the simple reality that technology has often offered a uniquely effective path to advancing core values that liberals care about.

A rather small set of technologies has made an incalculably positive contribution to human betterment in the past couple of centuries. Cheap, widely distributed energy sources would be among these. Engineered systems for delivering clean water to, and removing dirty water from, people's living spaces is another. So is the advance of agricultural technologies, which has allowed agricultural productivity to keep up with (and of course to permit, as well) exponential population growth, in a continuing repudiation of Malthusian pessimism. So is an array of basic medical technologies, from vaccines and antibiotics to obstetric forceps and Cesarean sections.

The fact that these technologies are not perfect, may have adverse environmental impacts, are sometimes misused or overused, and are accompanied by some degree of risk, does not in any way undermine what they have helped to achieve.

Yet technologies are something of an embarrassment to postwar liberal ideological tendencies. An effective technological intervention can advance liberal social goals without requiring the sorts of social change that liberals desire. Science can guide politically progressive policies toward such goals, but

technology threatens to make the policies unnecessary.

Consider the entrenched inequities in birth outcomes that continue to be a stark symbol of injustice in the United States. Infant mortality among African Americans is roughly twice what it is among whites. The overall rates of US infant mortality have long been unconscionably high relative to other rich countries, mirroring America's greater levels of socioeconomic disparity. From this perspective, America's unaffordable, high-technology medical system ought to be an affront to liberal sensibilities.[8]

But there are, it turns out, two twists to this tale. First, over the last few decades, infant mortality rates among poor and minority babies in the United States have declined at about the same rate as among the babies of more well-to-do parents. So, while the disparities remain distressingly resistant to change, the absolute outcomes have improved more or less equally for everyone. These declines are apparently explained almost entirely by prenatal, neonatal, and obstetric technologies that benefit poor and well-off alike.

The second twist is that substantial efforts to address unequal birth outcomes through public policies have largely failed. More than forty years of science-based progressive policies aimed at increasing the quality of prenatal and maternal health care and nutrition among poor women in the United States have had little or no positive effect on birth outcomes nationwide.[9] The causes of high infant mortality rates among poor people are complex, and deeply embedded in broader problems of socioeconomic inequity that continue to resist political solutions and policy intervention.

The technological path may seem less ethically and psychologically satisfactory than the political path because it leaves unaddressed the underlying social failures that contribute to inequity. This may create some reasonable sense that the technological path provides us with an excuse for not taking the political path — that the available means distract us from the more important end, from doing what is right, which is to solve the problem by making society better, by reducing inequality, rather than by separating the problem from its social context through a technological fix.

Yet, when the essence of a problem is amenable to capture by a technological intervention, real progress can sometimes be made very rapidly, whereas political paths to solving a bigger, underlying problem will almost always be much slower, more uncertain, and less effective. This is what we are seeing in the infant mortality case.

The technological path also offers political opportunities. Technologies that solve a problem can also act as an organizing tool to bring diverse political and institutional players together. Consider, for example, how the vaccine industry,

medical practitioners, health insurers, government regulators, school systems, local governments, and individual families have all recognized a common interest that allows them to work together to ensure that almost all children in the United States get vaccinated.[10] The gravitational center of the near-miraculous degree of cooperation among these fractious institutions and interests is the technology itself — vaccines that yield reliable and desirable outcomes, and thus motivate and justify the cooperation necessary to achieve an enormous public benefit. To get a sense of how miraculous this degree of long-term cooperation really is, imagine what it would take to coordinate a similar diversity of interests on behalf of some broader political agenda like health care or education reform.

The suspicion of technological approaches to social problems is self-defeating, both because it prevents liberalism from exploiting the built-in political logic of effective technological interventions, and because it actually commits liberals to political pathways of social intervention that are not very likely to succeed. When combined with the strong faith in science as a foundation for progressive policies, liberal alienation from technology results in the sort of dumbfoundingly misconceived policy prescriptions that have arisen around the problem of climate change. It was, however, not always thus.

5.

In 1944, David Lilienthal, the chairman of the Tennessee Valley Authority (TVA), published *Democracy on the March*, a passionate expression of the scientific and technological optimism that existed amidst the social and economic devastation of the Great Depression.

Lilienthal was an archetypal New Deal figure, confident that the combination of science, technology, rational planning, and democratic government could help bring the nation back to its feet. His book was an explanation and defense of the TVA, a New Deal initiative aimed at bringing electricity, flood management, river navigability, improved agricultural practices, better health and education, new jobs and economic opportunity, and restoration of the environment to an impoverished region of the United States.

While *Democracy on the March* seems quaint, if not somewhat scary in its unvarnished confidence in grand technological schemes, Lilienthal was no technological utopian. He treats technology’s power as complex and ambiguous, requiring holistic thinking and democratic oversight in order to fulfill its promise. The TVA he describes was democratically responsive and administratively decentralized. Authority lay not just with formally trained technocrats, but also with those who had local, real-world experience and expertise.

In many of its elements, *Democracy on the March* reads like a 21st century primer for sustainable development. Lilienthal articulates ideas equivalent to what today we would call systems thinking, sustainable business practices, comparative effectiveness research, devolution of governance, public-private partnerships, adaptive learning, and democratization of science and technology.[11]

If Lilienthal's technologically optimistic vision nonetheless sounds naïve to today's liberal ear, perhaps the problem is with the liberal ear, which seems to find greater political resonance in abstract scientific diagnoses of risk than technological opportunities to improve human well-being. Thus was TVA advanced on exactly the opposite political rationale that liberals adopted, half a century later, for climate change. For TVA's core idea was this: the best and most direct way to improve the quality of life in the Tennessee Valley was to make electricity — energy — cheap and universally available. What if we imported this outmoded strand of liberalism into the present, and tried to apply it to the climate change problem? The starting place for formulating a politically attractive strategy that honors core liberal values might be this particular fact: 1.4 billion people lack access to reliable energy (and billions more are economically and socially vulnerable to increasing energy costs).[12] This number needs to decline in the future, not increase, meaning that the shared human dignity of a growing global population will require more energy in the future, not less. A commitment to increasing rather than eroding energy equity is a necessary precursor to exploring new technological paths for delivering energy that is clean, reliable, and affordable. This was the argument advanced in the "Hartwell Paper," which I coauthored with a small group of scholars in Europe, the United States, and Japan. Energy equity, we concluded, is a globally unifying goal, whereas increasing energy prices is globally divisive.[13]

Action therefore begins with the quest for more, cheaper, and cleaner energy technology, not raising energy prices. And in this regard, the opportunities for making progress are actually quite expansive. Technological advance is largely a process of gradual improvement of existing technologies, and many potential options for clean energy technology already exist as platforms for further improvement. What has been lacking have been a serious, strategic commitment to the appropriate policies and necessary levels of investment that can catalyze clean energy innovation. While technology has always been a faddish, if marginal, presence in the climate policy agenda (we liberals do love hybrid cars and solar power, however expensive), innovation policy has never been taken seriously, and technological progress has generally been treated as if it would automatically and miraculously appear as necessary.[14]

Moreover, it may turn out that the world needs to reduce greenhouse gas emissions more quickly and decisively than can be achieved even with an aggressive commitment to clean energy innovation. Here liberals have another tool in their arsenal that they have forsaken as a consequence of their technoskepticism. The government has often been a primary investor and customer for new technologies that advance public well-being. The TVA was based on the belief that governments had an obligation to directly invest in public works that could level the social and economic playing field.

Treating greenhouse gas reductions as a public good, like investments in rural electrification, transportation, water and sewerage, national parks, and national defense, would exploit a historically powerful liberal rationale for directly addressing technological problems that lack marketplace solutions. This public good-public works approach has the political benefit of being relatively transparent in terms of motives and costs, unlike the ridiculously complex, too-clever-by-a-half approaches to climate policy of the past 20 years.

A public goods-public works approach could provide new political options for attacking climate and energy problems directly, for example through the capture and storage of carbon dioxide from power plants. Here our friend the TVA, a public enterprise that operates 11 coal-fired plants with nearly 60 generating units, may offer opportunities.[15] Congress could direct and fund TVA to explore carbon dioxide capture technologies and to demonstrate them at increasing scale.[16] This would be an appropriate next generation public good mission for a public works program rooted in liberal values and a commitment to the role of technology in advancing those values.

Since the decisive crash of the international and US climate policy frameworks in 2009, liberals have at last begun to more seriously embrace energy innovation in the United States, but with some palpable sense that they are regretfully adopting “Plan B,” rather than doing what they should have done from the beginning. Unfortunately, 20 years of fruitless fighting over the science and politics of reducing risk by making energy more expensive has so utterly alienated conservatives from the very idea of climate change, that a program of energy innovation that would once have been potentially appealing to many conservatives for its wealth-creating, competitiveness-enhancing potential now risks being viewed on the Right as a Trojan horse for failed climate policies.

Thus, the political debacle of climate change illustrates with excruciating clarity the price that liberals have paid as a result of their overdependence upon scientific rationality and their alienation from technology. Yes, much technology is aimed at countering the unexpected effects of past technologies. Yes, technology creates new risks and uncertainties, reinforces power asymmetries

and anomie, and continually destabilizes social arrangements and even moral frameworks. But humans are an innovating species, and we are utterly committed for our survival to an unending technological journey. In acknowledging this perhaps uncomfortable fact, liberals would do well to recover the message of pragmatic optimism in David Lilienthal's *Democracy on the March*: that technology tempered by democracy can be an incredibly powerful tool for social betterment. /

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THE NEW INDIA VERSUS THE GLOBAL GREEN BRAHMINS

The Surprising History of Tree Hugging

Siddhartha Shome

Against the Gandhian insistence on poverty and self-denial, India has embraced modernization.

On March 26, 1974, a crew of out-of-town loggers arrived near the small village of Reni in the Uttarakhand Himalayas with plans and a permit to log the nearby forest. Opposition to increased logging by outsiders had been growing. But with the men of the village away one day for some government work, the loggers took advantage of the men's absence to start cutting down trees. When word got back to the women of Reni, dozens of them ran to the forest to confront the loggers.

Shouts filled the air as the women did something that would become a landmark event in the history of environmentalism. Accounts vary as to whether the women actually hugged the trees, but regardless, they successfully prevented the loggers from chopping them down.[1]

In the years that followed, the Chipko movement — referring literally to the Hindi verb "to stick" (as in, to the trees) — would become an international media sensation. "Tree hugger" entered the lexicon as an all-purpose signifier

for environmental sympathies. Among greens in the West, the Chipko movement became a symbol of poor women standing up for nature, while for many Indian elites at home, it provoked nostalgia for ancient spiritual customs and traditional ways of village life that seemed to be fast disappearing in India's modernizing cities.

The Chipko story became iconic in rough proportion to the degree to which it became detached from the actual events that transpired in Uttarakhand. From the start, Chipko was driven by a desire among villagers for local autonomy and economic opportunity. Outside efforts to protect the Himalayan forest would spark a backlash among the very same villagers. The actual history of the Chipko is the story of rural Indians' efforts to establish local control of resources, first by fighting the outside forest contractors who wanted to log their trees, and then by fighting outside environmentalists who wanted to protect them.

Today the Himalayan region, like the rest of India, has chosen the path of economic development and modernization. Even so, the idea that the women of Uttarakhand were hugging trees to protect the environment and prevent economic development, repeated most famously by Vandana Shiva in her international best seller, *Staying Alive*, captivates the imaginations of Western environmentalists and urban Indian elites alike.[2] Sitting comfortably at the intersection of environmental suspicions of modernity and India's home-grown ascetic tradition, the Chipko fable has profoundly misinterpreted and distorted the true meaning of Chipko, and with it, the larger story of modernization in India.

1.

The notion that poverty ennobles while wealth corrupts has transfixed elites for centuries. It is repeated by those with wealth and power as both a cautionary tale about the spiritually corrupting effects of wealth and a way to rationalize their power in highly unequal societies. In India, this was manifested by the glorification of asceticism in the traditional Brahminical value system espoused by high-caste Hindus.

In the early 20th century, Mahatma Gandhi updated this Brahmin asceticism by advocating an idealized vision of a traditional village-based society with limited needs, limited ambitions, and small-scale subsistence production. "We have managed with the same kind of plough as existed thousands of years ago," he wrote in his 1910 book, *Hind Swaraj*. "We have retained the same kind of cottages that we had in former times and our indigenous education remains the same as before." Economic development, for Gandhi, was no prerequisite for

happiness. “A man is not necessarily happy because he is rich, or unhappy because he is poor,” he wrote. “Millions will always remain poor.” In *Hind Swaraj*, Gandhi defended hereditary occupations, and thus, implicitly the caste system.[3]

The Gandhian valorization of poverty and asceticism fit neatly into the emerging cosmopolitan discourse of “sustainable development” for poor nations. With the rise of environmentalism in the 1970s, many Indian elites started to justify asceticism and poverty not only as spiritually ennobling, but as environmentally virtuous as well. “Gandhi’s *Hind Swaraj* has for me been the best teaching on real freedom,” wrote Shiva, who trained as a physicist in Canada. “For Gandhi, slavery and violence were not just a consequence of imperialism: a deeper slavery and violence were intrinsic to industrialism, which Gandhi called ‘modern civilization.’”[4]

Shiva and other green elites attacked modernization and development in India as a calamitous foreign imposition on the rural poor by multinational corporations and the World Bank; some even depicted the traditional (caste) society as natural. Shiva valorized traditional village life, where women worked harder than “men and farm animals” and “invisibly with the earthworm.”[5] Environmentalists Madhav Gadgil and Ramachandra Guha argued that the caste system was an ecological adaptation to reduce competition for scarce resources. They contended that caste groups in traditional Indian society “might with profit be compared to biological species,” complete with “characteristic modes of subsistence,” “distinct habitats,” and “ecological niches.”[6]

But while the new green Brahmins naturalized poverty and invoked the interests of the rural poor as justification for their antimodern ideas, those ideas never stood a chance in a democratic India. Neither Gandhi’s vision for India in *Hind Swaraj*, nor the green Brahminism that developed in the 1970s, had any significant following among India’s lower castes, who increasingly rejected the exploitative nature of the traditional socioeconomic system. Even as early as 1945, Jawaharlal Nehru, who would become India’s first Prime Minister wrote to Gandhi, “It is many years since I read *Hind Swaraj*… but even when I read it twenty or more years ago it seemed to me completely unreal.” Nehru reminded Gandhi that, “the [Indian National] Congress has never considered that picture, [portrayed in *Hind Swaraj*] much less adopted it.”[7] It was the nationalist, nonviolent, and humanist Gandhi that poor Indians admired and respected, not the Gandhi of asceticism, deprivation, and tradition.

2.

From its earliest moments, the Chipko movement was centrally focused upon

economic demands, access to resources, and control of local forests. For Chandi Prasad Bhatt, who organized some of the first protests and efforts among local communities to develop the forests for their own benefit, Chipko meant preserving people's traditional forest rights, which, in his view, were being threatened by a distant "bureaucratic set-up." Although he was inspired by Gandhi's promotion of economic self-sufficiency, Bhatt was not against development or industrialization as long as it was controlled by local communities.[8]

But outsiders were quick to take up the cause, and they had very different ideas about what the Chipko movement was about. Sunderlal Bahuguna, a well-traveled regional politician with good English language skills, supported the Chipko demands and eventually became the charismatic face of the movement outside the region. Influenced both by Gandhi's asceticism and by a British environmentalist known as the "Man of the Trees," Bahuguna presented Chipko to his growing audience as a deeply conservative movement, interested only in preserving the ecological balance of the Himalayas and the traditional socioeconomic order of its villages.[9]

Bahuguna took his demands directly to the Central (federal) Government in New Delhi, correctly betting that his antidevelopment message would appeal more strongly to distant metropolitan elites than to local government officials. "Gandhi had foreseen the doomsday as early as 1908, when he wrote *Hind Swaraj*," wrote Bahuguna. "The objective of development is economic growth or prosperity, but to achieve this temporary economic prosperity we have lost peace and happiness."[10] Bahuguna's message met with applause from his elite audiences, who hailed him as an ecological Gandhi, fighting the evils of modern technology and commerce.

The rebranding of Chipko as an "environmentalism of the poor" worked — at least in swaying influential figures. Bahuguna and allies won the support of Prime Minister Indira Gandhi and international NGOs and succeeded in enacting a slew of laws and regulations, all aimed at better conserving the Himalayan forests. But the logging restrictions sparked a backlash in Uttarakhand. By the late 1980s, regional political groups such as the Uttarakhand Revolutionary Party and *Jungle Kato Andolan* (which literally translates as the "Log the Forest Movement") began publicly exhorting communities to start cutting down trees in defiance of what became known as the "Chipko Laws."[11] These groups offered to clear cut forest areas on behalf of any community or village wishing to initiate development projects. In the 2000 book, *Of Myths and Movements*, historian Haripriya Rangan quotes former Chipko supporter, Gayatri Devi:

> Now they tell me that because of Chipko the road cannot be built, because everything has become *paryavaran* [environment].... We cannot even get wood to build a house.... I plan to contest the *panchayat* [village council] elections and become the *pradhan* [mayor] next year.... My first fight will be for a road, let the environmentalists do what they will.[12]

When researcher Antje Linkenbach visited Reni in the 1990s, the villagers accused Bahuguna of misrepresenting the Chipko movement and even complained, perhaps apocryphally, that in some public events Bahuguna had used another woman to impersonate Gaura Devi, a prominent Chipko activist from Reni. Asked what they had gained from Chipko, the villagers interpreted the question in strictly economic, not environmental, terms and replied that they had not seen any gains at all except that "two boxes came with old clothes" and some certificates.[13]

But the most dramatic testimony came in a Press Institute of India workshop in which villagers from Reni and a neighboring village, referring to the establishment of the Nanda Devi Biosphere Reserve in their area, complained that the conservation laws and federal control had backfired. The local communities were better at managing the forests than the federal government, they asserted. "Now there is virtual plunder to supply valuable herbs to the Delhi cosmetic market," one man lamented. "So there is no protection in the protected area while the local villagers are denied their basic needs."[14]

3.

While deep greens romanticize village life and sustainable development NGOs deliver solar panels, efficient cook stoves, and other "appropriate technologies" to rural communities, Indian villagers are migrating to cities in massive numbers, drawn by the promise of economic opportunity. The popular mass movement that would ultimately define Uttarakhand's future would not be Chipko, but rather the Uttarakhand statehood movement demanding regional autonomy and development. In 2000, the new state of Uttarakhand was carved out of Uttar Pradesh and today its leaders prioritize economic development, industry, and jobs.

Ultimately India's destiny does not lie in the traditional village-based society promoted by Mahatma Gandhi in *Hind Swaraj*, but in an entirely different paradigm envisioned by Babasaheb Ambedkar, the father of India's democratic constitution, whose ideas have become increasingly prominent in modern India. During his life, Ambedkar, who was the leader of the Dalits, formerly known as the "untouchables," publicly and emphatically rejected Gandhi's idealization of India's traditional rural order. "The love of the intellectual Indians for the village community is infinite, if not pathetic," Ambedkar wrote in 1948, "What is the

village but a sink of localism, a den of ignorance, narrow mindedness, and communalism?" He observed, "In Gandhism, the common man has no hope… The ultimate goal of man's existence is not reached unless and until he has fully cultivated his mind." Ambedkar argued:

> Machinery and modern civilization are thus indispensable for emancipating man from leading the life of a brute…. The slogan of a democratic society must be machinery, and more machinery, civilization and more civilization.[15]

In contrast to the asceticism of Gandhi and the green Brahmins, Ambedkar saw that liberating India's lower castes from the exploitation of the caste system could unleash the energy and creativity that might make India a modern and prosperous nation. This is in fact what is transpiring across the subcontinent as India's enormous population embraces technological transformation, modernization, and urbanization in search of better lives and greater freedom. Rapid modernization and urbanization bring their own problems and challenges, but they present far greater opportunities for the poor than traditional technologies and the traditional village-based socioeconomic order — along with the potential for greatly reduced ecological impacts.

The modernization of India is, like that of the rest of the Global South, inevitable. While India's ascetic tradition has many admirable aspects, it is also the cause and effect of a caste system that has left much of its population living in dire poverty for hundreds of years. Thankfully, modernization and urbanization are now finally breaking that cycle. /

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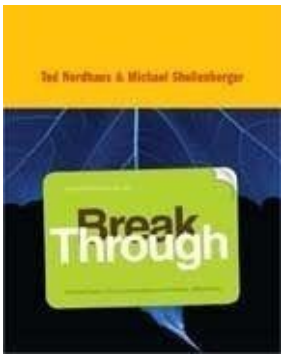

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