NOVEMBER 2021

CURRENT HISTORY

A Journal of Contemporary World Affairs

CLIMATE TRANSFORMATIONS

Systemic Shifts

Biodiversity and Climate: Two Sides of the Same Coin
Pamela McElwee

Ready for Carbon Removal?
Simon Nicholson

Restructuring Business
Peter Newell

Voice and Vulnerability

Disability and Disaster Response
Emma Calgaro

History and Climate Justice
Prakash Kashwan and Jesse Ribot

Plus:

Sustainable Sustenance
Jessica Fanzo

A Monkeywrenching Manifesto
Keith Makoto Woodhouse

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NOVEMBER 2021 VOL. 120, NO. 829

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COMING IN DECEMBER
The Middle East

A DECADE SINCE THE ARAB SPRING, it seems as though authoritarian counterrevolutions have prevailed over the uprisings demanding freedom and jobs. Monarchs and military strongmen are firmly entrenched in power; Islamist parties have lost the gains they made, most recently in Tunisia and Morocco. But change may be happening nonetheless, even in unexpected places. *Current History*'s December issue will cover these developments and more across the region. Topics scheduled to appear include:

- **Civilian Targets in the New Way of War**
  Jeannie Sowers, University of New Hampshire
  Erika Weinthal, Duke University

- **Contested Memories in Kuwait**
  Farah Al-Nakib, California Polytechnic State University

- **Disability Rights in Difficult Environments**
  Christine Sargent, University of Colorado, Denver
  Fourth in a series

- **The Druze Across the Region, and Beyond**
  William F. S. Miles, Northeastern University

- **A Sultan's Legacy of Nationalism in Oman**
  Amal Sachedina, American University

- **Tales of Turkey's Urban Wilderness**
  Pelin Başçı, Portland State University

- **The Scramble for Post-Oil Advantage**
  Michele Dunne, Carnegie Endowment for International Peace

Current History (ISSN 0011-3530) (Online: ISSN 1944-785X) is published monthly (except June, July, and August) by University of California Press, 155 Grand Avenue, Suite 400, Oakland, CA 94612. See online.ucpress.edu/currenthistory/pages/subscriptions for single issue and subscription orders, and claims information. Postmaster: send address changes to University of California Press, 155 Grand Avenue, Suite 400, Oakland, CA 94612.

Printed in the United States by The Sheridan Press.

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"If we want to fix climate change, we cannot ignore its links to biodiversity."

Climate Change and Biodiversity Loss: Two Sides of the Same Coin

PAMELA MCELWEE

Upon hearing that climate change will have serious impacts on our planet's rich storehouses of biodiversity, many people likely conjure up an image of a polar bear trapped on shrinking ice, or perhaps of rescuers saving soot-blackened koalas from Australia's 2019 bushfires. But the impact of rapidly increasing global temperatures is hardly confined to dangers to iconic animal species. We are altering the globe in far more complex ways, involving unprecedented changes in how ecosystems function, the accelerated spread of alien invasive species, and even extraordinary disruptions to the process of evolution itself. This poses a danger not only to the abundance of nonhuman life all around us, but ultimately to ourselves.

Scientists with the Intergovernmental Panel on Climate Change (IPCC)—the international body that provides regular assessments of the state of climate science, present and future impacts, and possible pathways for mitigation—have long warned that biodiversity, which includes species, ecosystems, and their functions and productivity, is at risk from climate change. Two degrees Celsius of warming above pre-industrial temperatures would risk "shifts of species to higher latitudes, damage to ecosystems (e.g., coral reefs, and mangroves, seagrass and other wetland ecosystems), loss of fisheries productivity (at low latitudes), and changes to ocean chemistry (e.g., acidification, hypoxia and dead zones)," the IPCC warned in 2018.

If we reach the 2°C threshold, it is projected that 18 percent of insects, 16 percent of plants, and 8 percent of vertebrate species will lose over half of their geographic range, and localized extinctions are a near certainty. Beyond this threshold, total extinction of thousands of vulnerable species is a real risk later in the twenty-first century.

The alterations to ecosystems occurring over recent decades as the planet has warmed are increasingly visible not just to scientists but also to average citizens who see their garden plants blooming earlier, or fewer lightning bugs on summer evenings, or the spread of invasive species, like the spotted lanternfly that is currently spreading ominously across my home state of New Jersey, threatening the state's agricultural economy. As many of our landscapes and ecosystems become less diverse, they are rendered even more vulnerable to temperature changes. This puts at risk the many benefits these systems provide to us, like clean freshwater from vegetated lands or pollination of many of our most valuable crops by bees, birds, and other creatures. Changes in ecosystems and higher temperatures also increase our vulnerability to emergent diseases, at a time when the COVID-19 pandemic has revealed the fragility of our preparedness and our inability to coherently respond.

Recent disasters and extreme events have made it even clearer that biodiversity loss and climate change are two sides of the same coin. One of the most vulnerable and threatened ecosystems, tropical coral reefs, are bleaching regularly, and many species within them are dying off. This occurs not only because of warming ocean temperatures. These reefs were overfished, overharvested, or overtouristed in the first place, creating more fragile reef complexes that cannot survive the added stressor of warming water.

When wildfires rage out of control due to extended dry seasons, we lose more than just the

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many animals and plants that cannot move away from the blazes. The combustion of millions of acres of trees releases more carbon into the atmosphere, which is normally counterbalanced by revegetation—but if it is not, it can accelerate the greenhouse process in what scientists dispassionately call a "positive feedback cycle." It could instead be described as a terrible circular Catch-22.

If we want to fix climate change, we cannot ignore its links to biodiversity. Climate change is not just a technical problem requiring shifts in energy systems, as billionaires like Bill Gates and Elon Musk would have us believe. Tackling climate will require a holistic approach and transformations not only in what we drive or how we heat our homes, but also in how we produce food, how we procure water and timber as well as energy, and even where we live.

Given that we have already locked in further warming even if our greenhouse gas emissions drop to zero tomorrow, we need to think of ways to help species and ecosystems adapt to the temperature changes that are already under way. This may involve assisted species relocations, extensive restoration work to remove invasives and restore native biodiversity, genetic manipulation of species like corals and fish to increase their chances of survival, and even reanimating species that have already been extirpated. These adaptation measures can help buy time and prevent some extinctions and ecosystem collapses, though scientists warn that we have very little wiggle room and much to do.

Multiple interventions will be needed to help species and ecosystems adapt.

There is a further catch: while most policies that we put in place to protect biodiversity are either neutral or positive for climate change—like expanding protected areas around the globe, or helping species recover through restoration efforts—we cannot say the same about climate policies, many of which will require considerable trade-offs. Imagine the expansion of solar panels into ever-larger areas, disturbing some species' habitats or disrupting fragile ecosystems like deserts. Or deep-seabed mining for metals required in renewable energy technologies or electric car batteries. Or large-scale afforestation with fast-growing trees that may maximize carbon sequestration but often may displace local vegetation. In other words, failing to consider climate and biodiversity together risks making an already bad situation worse.

LINKED FATES

Climate and biodiversity are linked in multiple ways. Rising global temperatures caused by emissions of greenhouse gases have a number of important and related effects. The average changes in temperature we have experienced thus far (around 1.1°C of warming above the pre-industrial era) are felt unevenly across the globe and across ecosystems. The average warming on land has already exceeded 1.5°C globally, while in some polar regions, average temperature anomalies are now closer to 4°C and rising.

An unprecedented "heat dome" that blasted the North American West Coast with temperatures as high as 115°F in July 2021 was quickly attributed by climate modelers to global warming; such extremes simply could not have happened in the absence of anthropogenic emissions. The ecosystem impacts of the heat dome event are only beginning to be accounted for and will take years of study to understand. But biologists have initially estimated that billions of sea creatures, ranging from mussels to sea stars and barnacles, were literally cooked to death in the scorching temperatures.

Oceans are storehouses of incredible biodiversity in coastal, offshore, and deep-sea ecosystems, as well as an important buffer for atmospheric carbon concentrations. They now face multiple threats: warming waters and rising oxygen depletion that affect sea creatures' ability to survive, along with increased acidification. The latter occurs because of the exchange of carbon in the atmosphere with the sea surface, which enables the ocean to act as a sponge and draw down nearly a third of all anthropogenic CO_2 emissions. Without this ocean exchange, atmospheric carbon concentrations would likely be much higher than they are now. However, there is increasing evidence that the oceans' ability to absorb our CO_2 emissions may be slowing.

Although it is beneficial to us, the absorption of CO_2 reduces the pH of the oceans. This acidification is increasing at a rate that is "unprecedented for at least the last 65 million years," according to the IPCC. Marine organisms that rely on carbonates in seawater to make their shells are less able to do so in more acidic waters. Other species' physiologies are also sensitive to changes in pH: for example, some crabs and sea urchins respond to rising acidity inside their bodies by dissolving their exoskeletons, literally melting into the seawater.

Global temperature changes also alter precipitation regimes, bringing more unseasonable rains and risk of floods to some areas, as we saw in Germany and China in July 2021, while drying up other regions, like California and the US Southwest. Extreme weather events like wildfires, hurricanes (including unusual appearances in the Southern Hemisphere), and drought all adversely affect biodiversity in different ways. Too frequent and hotter-burning wildfires can inhibit ecosystem recovery, favoring colonization by invasive species and causing permanent loss of habitat for some species. Hurricanes can inflict structural damage on forest canopies, while rising sea levels and increased salinity in root systems have given rise to the phenomenon of "ghost forests," where decaying trees poisoned by brackish water serve as sentinels warning of the damage we are doing.

At the same time, changes in biodiversity also affect the climate system: what we do with ecosystems can alter carbon cycles, water exchange, and nitrogen circulation. When forests are converted to agriculture, for example, the natural sink capacity of trees, roots, and soil to absorb anthropogenic CO_2 is altered. There is increasing evidence that deforestation and degradation in the Amazon Basin, once considered the largest and richest storehouse of biodiversity on the planet, have led to a tipping point whereby the system now releases more carbon than it stores.

All these impacts associated with climate change alter the "distribution, functioning and interactions of organisms," according to the first-ever joint report by the IPCC and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), released in June 2021, for which I was one of fifty expert scientists. The report noted that the most vulnerable species and ecosystems are ones that have limited distribution (such as those found only in specific or small areas); those that have limited ability to move into new habitats (organisms that are immobile, like corals, or that move slowly, like most plants); and those that are already close to their physiological tolerance limits (species like fish that already live in waters as warm as they are able to survive in).

Certain ecosystems were singled out by the report as being most at risk of irreversible losses: mountains, islands, high-latitude ecosystems, Mediterranean climate systems (including California and South Africa as well as the Mediterranean proper), and coral reefs, along with ecosystems already fragmented by land-use change and overexploitation. It is entirely possible that my six-year-old daughter will live in a world facing the complete extirpation of the majority of tropical coral reefs before she turns thirty, if warming trends continue.

With the loss of these vulnerable ecosystems, we lose not only the species complexes that inhabit them, but also direct benefits to humans. IPBES has called the services that ecosystems provide to us "nature's contributions to people." The collapse of rich sources of food, fiber, and other important economic assets threatens human well-being, especially among vulnerable and poor populations. As the IPCC/IPBES report noted, "Biodiversity loss disproportionately impacts those communities and societal groups that are most directly dependent on nature."

Coastal ecosystems, for example, support food and water provisioning for many island populations and form the backbone of their economic systems, particularly through tourism and fishing. One estimate has suggested that loss of coral reefs alone would cause $1 trillion in economic damage globally. The uneven impacts of climate change and biodiversity loss will be felt far more acutely in some areas than others. Often the communities and nations most at risk are the ones that have emitted the least carbon emissions: poorer countries, small island states, Indigenous peoples, and polar regions.

Damage Drivers

The drivers of biodiversity loss and climate change are related, but are not exactly the same. For biodiversity loss, a 2019 report by IPBES identified five primary drivers, ranked in order: land use change, direct exploitation of wild species, climate change, invasive alien species, and pollution. These trends are all shaped by other indirect drivers, such as demographic and social changes and economic pressures.

For climate change, the primary drivers of rising CO_2 emissions are increasing fossil fuel use in transportation, industry, and other sectors, alongside land use change and agriculture. These in turn are driven by rising affluence and the increasing number of people on the planet.

Each of these sources and drivers is difficult to tackle on its own, but designing policies that reach across both problems has posed particular challenges. Currently, the primary international agreements that govern global climate policy, the UN Framework Convention on Climate Change

(UNFCCC) and the associated Paris Agreement, and the pact that covers biodiversity, the Convention on Biological Diversity (CBD), operate mostly separately from one other. While some nations have explicitly addressed the need for including ecosystem management and restoration within the climate pledges required by the Paris Agreement, most countries have tended to focus their promised climate policies on the energy sector.

The CBD is working to finalize a post-2020 global biodiversity framework (delayed since last year due to COVID-19), and currently only one of its twenty goals (Target 8) is linked to climate. The UN's Sustainable Development Goals, adopted in 2015, address both climate (in goal 13) and biodiversity (in goals 14 and 15), but these targets are poorly integrated, with few identified actions that might tackle both problems. Overall, as the recent IPCC/IPBES report noted, "mainstreaming of biodiversity into climate policy and vice versa, and of both into initiatives to advance human development and good quality of life, remains limited at many scales and in many sectors."

It is also clear that what has worked in the past is unlikely to work in the future. For example, species conservation in a warming world cannot follow the tried-and-true strategy of designating protected areas, given the ways that species are rapidly shifting across landscapes: some protected areas may someday enclose zones in which few original species are able to live. Multiple interventions will be needed to help species and ecosystems adapt to present and future changes. Such interventions may include integrating conservation throughout landscapes and corridors to enable species movement; more aggressive management of invasive species threats; and even technological interventions to help nonhuman species survive extreme events—as Australia has done by installing sprinklers in one protected area to help flying foxes cool off in severe heat.

Overall, the healthier an ecosystem is, the more resilient it is to climate change. This argues for precautionary and active approaches to managing our lands and oceans. As the IPBES/IPCC report notes, "Higher genetic, species, and ecosystem diversities help to reduce risk in the face of uncertain changes in climate and keep adaptation options open."

Billions of sea creatures were cooked to death in the heat dome's scorching temperatures.

DUBIOUS SOLUTIONS

Beyond helping species and ecosystems adapt, we also need to avoid the costly trade-offs and negative consequences of some policy "solutions." Certain proposed actions to mitigate climate change are likely to have very detrimental impacts on biodiversity if not managed properly.

These include large-scale tree planting proposals, which might displace native vegetation or local food production, and extensive reliance on bioenergy crops, which often harbor little biodiversity. Such proposals have become increasingly popular, since they make use of plants' incredible ability to turn CO_2 into food through photosynthesis. One report in 2017 suggested that "natural climate solutions" like conserving and expanding forests, restoring wetlands, and protecting peatlands could provide up to 30 percent of the carbon sequestration needed by 2030 to hold the global temperature increase to 2°C.

While these are all promising approaches that recognize the links between climate and biodiversity, ecosystems alone cannot save us. All too often, nature is being seen as a "get out of jail free" card to make up for our failure to reduce fossil fuel use. Witness the many countries and companies rushing to issue "net-zero" pledges, primarily by using tree planting or other measures to offset their carbon emissions, rather than by fully decarbonizing their production and supply chains or national economies. For example, Shell Oil recently announced a plan to make its petroleum products "carbon-neutral" by offsetting some greenhouse gas emissions with tree planting, an absurd proposition worthy of Dr. Seuss.

Numerous initiatives have focused on the miraculous benefits of forests, from the Trillion Tree worldwide reforestation program to a proposal for a Great Green Wall of new trees in the Sahara, but their claims are often overstated. Although trees are enormously important assistants in sequestering carbon, they are not equally helpful everywhere. Trees planted in the northern latitudes can affect albedo (reflectivity of the land surface to solar radiation), increasing warming potential. Trees also affect processes like evapotranspiration and aerosol exchange with the atmosphere, which in turn have both regional and global climate effects. These multiplier effects can

diminish the effectiveness of trees' role in carbon removal, given the complexities of the biosphere.

Trees also compete with other land uses, whether for food, fiber, or other benefits. If trees replace food production in one area, agriculture may be displaced to another area, leading to rising deforestation overall. Food production will need to continue to increase to feed a growing global population. Overly optimistic projections of the amount of land available for tree planting usually underestimate how much will be needed for agriculture. And as the 2021 IPBES/IPCC report noted, "Afforestation in particular may even reduce existing ecosystem carbon storage, cause further biodiversity loss, and displace local people or curtail their access to land and its use." In other words, tree planting can be extremely counterproductive if not done correctly.

Particularly problematic are plans for rapid and extensive expansion of bioenergy with carbon capture and storage (BECCS) initiatives. In these projects, large-scale bioenergy sources—either crops like corn for ethanol, or trees like willow and grasses such as Miscanthus—are planted (so they absorb CO_2 while growing) and then used for power generation. The CO_2 emitted by the latter is captured and stored, resulting in net "negative" emissions. Although there is little evidence for the current feasibility of BECCS, it has become increasingly of interest to modelers and policymakers as a way to avoid the worst outcomes of warming.

A little-known fact is that all integrated assessment models that show the world limiting warming to well below 2°C require the inclusion of substantial land-based mitigation, with different combinations of reforestation, afforestation, reduced deforestation, and BECCS. But BECCS would greatly increase demand for land conversion if applied at the scale necessary to make a difference—several million square kilometers, up to 1.5 times the size of India. That would mean adverse consequences in the form of water scarcity, land degradation, food insecurity, and biodiversity losses.

Instead, a much more realistic approach would be to focus on supporting and protecting ecosystems that already aid in climate mitigation, namely natural systems that store large amounts of carbon. These include forests (especially tropical ones and coastal mangroves), peatlands, coastal wetlands, and "blue carbon" stocks like kelp forests and seagrass meadows. Ecosystem restoration can improve the resilience of biodiversity to climate change, as well as provide additional benefits to people in the form of soil erosion control, reduced flood risks, and buffers against coastal storms.

Restoration also provides jobs and income, a fact recognized by the Biden administration in its proposal for a new Civilian Conservation Corps to help restore the health of federal lands. Such investments have been proven to work. Marine restoration projects funded as part of the 2009 US stimulus bill in the wake of the global financial crisis generated more jobs per million dollars invested than most other sectors.

A POST-PANDEMIC PATH

Many voices have been making the case for a low-carbon recovery from the COVID-19 pandemic, but much less attention has been paid to biodiversity. Only a few countries have identified nature-based investments or policies in their economic recovery proposals, and even then, green funding has been well under 10 percent of the total. Several countries, the United States and China among them, have allocated essentially zero stimulus funds to biodiversity or ecosystems. In other countries, post-pandemic recovery packages include steps backward on climate, such as subsidies for national airlines or bailouts of fossil fuel producers.

Yet there are a number of policies that would aid in post-COVID reconstruction while addressing many of the root causes of climate change and biodiversity loss. At a minimum, recovery packages should do no harm to ecosystems and climate. At their most ambitious, longer-term efforts could be transformative in addressing the interlocked biodiversity, climate, and well-being challenges.

One area that could be prioritized encompasses nature-based solutions—the use of natural systems to aid in both climate mitigation and adaptation. For example, parks and gardens, trees, and green roofs in cities have multiple positive impacts: they reduce the urban heat-island effect (inner cities are hotter than surrounding areas), and they can help prevent flooding, control stormwater runoff, enhance local biodiversity, and improve residents' quality of life. Numerous studies have shown that urban green spaces contribute to healthier populations through recreation opportunities and psychological benefits, as well as increased property values and even reduced crime rates. These green spaces in turn help store carbon and can encourage reduced automobile use, lowering emissions even further.

Other types of nature-based solutions can involve using nature, rather than concrete, to protect coastal zones. Such projects include restoring wetlands and protective mangroves instead of dredging and building seawalls to keep out rising seas and storms. Many experts have noted that green infrastructure is more effective than hard structures and cheaper to boot.

Some novel policies and projects combine nature and technology. Pilot projects have shown that grazing cattle and goats under solar panels increases soil carbon storage by encouraging turnover and growth of vegetation. Some solar array operators are experimenting with restoration of native grasses to improve pollinator habitat. Solar photovoltaic cells can also be floated on water, which not only reduces the need for land but also provides shade that helps address the increasing evaporation from water surfaces, an inevitable result of climate change. While some offshore wind installations have run into conflicts with fishing communities and conservationists, well-designed systems can imitate reefs and provide habitat for marine biodiversity.

The need for more funding for nature-based solutions and conservation actions for threatened ecosystems has been made more urgent by the COVID-19 pandemic. Rising unemployment and food insecurity in the global South have added to the pressure on local landscapes, leading to expansion of agriculture or the illegal wildlife trade, which in turn can increase the risk of future epidemics. There is already evidence that falling ecotourism income and reduced ranger activity as a result of COVID-19 have had negative consequences in many conservation areas around the world. This calls for a more concerted effort to address these problems in pandemic recovery packages.

Fixing our food system is another priority. Overall, producing, transporting, and consuming food generates between 21 and 37 percent of total anthropogenic greenhouse gas emissions. Improving how we produce food, with steps such as soil conservation measures and better fertility management in croplands and pastures, can yield substantial reductions in greenhouse gas emissions from this sector. Using agroforestry and agroecology to diversify food systems would also help, while providing more adaptive capacity to handle extreme events like heat waves, droughts, fires, and pest and disease outbreaks. Demand-side policies are needed as well—such as reducing food loss and waste and encouraging dietary shifts away from excessive meat consumption, especially in richer countries.

Ecosystem restoration can improve the resilience of biodiversity to climate change.

ANTHROPOCENE REALITIES

The dual effects of climate change and biodiversity loss have irrevocably altered the composition of life on our planet. From changing weather patterns and increasingly frequent extreme events to melting polar and glacial ice and rising sea levels, shifting geographic distribution of plants and animals, and the loss of rich storehouses of both carbon and species in peatlands and tropical forests, the Anthropocene is upon us. Human activity has had a heavy impact on the planet.

Recent scientific assessments have laid out the choice starkly. We must make rapid reductions in emissions from fossil fuel use, across energy, transport, agriculture, and other sectors, to keep from exceeding 2°C of global warming, the red line established by the Paris Agreement. If we fail to meet this goal, we will make things much riskier for both nature and ourselves.

Policymakers and scientists increasingly discuss the need for "transformative change" in the way we relate to nature to address these dual crises. While there is not yet consensus on what this would look like, a diverse range of bodies, from the European Union to the World Economic Forum to major Fortune 500 corporations, all recognize that the current approach is unsustainable and risks the long-term welfare of nature and humanity. Achieving the long-term targets of the Sustainable Development Goals, the Paris Agreement, and a post-2020 global biodiversity framework will require us to address the problems of climate change and biodiversity simultaneously and in an integrated manner. As the Convention on Biological Diversity puts it, the goal must be "living in harmony with nature."

Whether the COVID-19 pandemic has provided a reset button to put us on this better pathway remains to be seen. Nonetheless, the urgency and scale of the problems we face demand that our relationship with nature be placed at the forefront of all our economic, social, and political agendas moving forward. ■

"Each carbon removal option needs to be looked at not just in terms of its technical potential to help draw carbon dioxide out of the atmosphere, but also in terms of social and environmental co-benefits and risks."

Carbon Removal to the Rescue?

SIMON NICHOLSON

Every year, the global atmospheric concentration of greenhouse gases is rising. Human activities annually expel a combined 40 billion metric tonnes (40 gigatonnes) of carbon dioxide. The figure grows to around 50 gigatonnes of carbon dioxide equivalent when other greenhouse gases like methane and nitrous oxides are taken into account. This emitting of greenhouse gases is one component of the inexorable math of climate change: we humans, collectively, have been building up year after year the stock of greenhouse gases blanketing the planet, and as that stock grows, global warming and associated climate-related risks intensify.

Temperatures will continue to creep upward until, a few scientific provisos aside, the annual human contribution to the atmospheric load of greenhouse gases is reduced to zero. This insight runs up against a second component of climate change math: there is a slim and narrowing window to slash the overall net flow of greenhouse gases in order to keep average atmospheric temperatures from rising above critical thresholds.

The international negotiations that led to the Paris Agreement in 2015 have set the upper acceptable warming threshold at 2 degrees Celsius above pre-industrial averages, with the countries of the world further agreeing to do everything possible to limit warming to no more than 1.5°C. Already, the world has warmed by around 1°C. The first portion of the most recent report from the Intergovernmental Panel on Climate Change (IPCC), released in August 2021, suggests that the Earth is on track, across a range of near-future scenarios, to cross the 1.5°C mark sometime between 2030 and 2035.

Every year, then, in which human-caused greenhouse gas emissions are more than zero, the remaining "carbon budgets" associated with 1.5 or 2 degrees of warming shrink and the negative impacts associated with global heating grow. What does reaching zero emissions entail? The first order of business has to be what some call deep decarbonization. This is the work of transforming the built environment and energy, transportation, and agricultural systems in order to halt, as much as possible, the use of fossil fuels, and curtail land use practices and changes that contribute to emissions of greenhouse gases.

Now, though, as carbon budgets tighten and climate impacts worsen, the mitigation component of climate action must mean more than limiting the outpouring of greenhouse gases. In recent years, a slew of scientific assessments has made it clear that slashing emissions will need to be supplemented with other actions. Even as work is undertaken to halt flows into the atmosphere of human-caused greenhouse gases, excess carbon dioxide must also be *removed* from the atmosphere.

This is the starting point for any conversation about carbon removal. Sometimes also called carbon dioxide removal, greenhouse gas removal, or negative emissions technology, this process involves pulling carbon dioxide out of the atmosphere and directing it to long-term storage or to beneficial use. There is a wide variety of currently available or imagined land and ocean management practices and technologies that could support this carbon removal function.

Such practices and technologies, described in more detail below, could play at least three roles in climate policy. First, carbon removal could act to essentially expand the existing carbon budget, by removing carbon dioxide at the same time as

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deep decarbonization actions are being implemented and scaled up. Expanding the carbon budget creates more time for other climate change response options to take hold and more breathing room before critical temperature thresholds are crossed, with less likelihood of drastic ecological or societal disruptions or of a need for draconian reactions.

Second, carbon removal could play a kind of clean-up role, offsetting continued emissions that will be hard to abate in some sectors of the global economy. Think, for instance, of the potential deployment of carbon removal options to account for the possibility that certain kinds of heavy industry or transportation might continue to rely on fossil fuel use for the foreseeable future.

Third, carbon removal could play a restorative role, turning back the dial on decades and centuries of atmospheric concentrations of carbon dioxide. Ultimately, carbon removal could take the planet back closer to the climatic conditions that facilitated the rise of human civilization, or reverse an "overshoot" in which climate change responses are not sweeping or rapid enough to avoid the crossing of temperature thresholds.

The goal is to pull carbon dioxide directly from the open air.

The possibility of such roles for carbon removal approaches is signaled by the Paris Agreement. The Agreement calls, in Article 4, for balancing greenhouse gas emissions and removals by mid-century. This language has given rise to a spate of "net zero" pledges from many countries and companies, charting a pathway to reaching zero emissions not only by reducing greenhouse gas outflows but also by depending to some extent on carbon removal options. It has also led to rising levels of public and private spending on carbon removal research and purchases of carbon removal services.

Recent IPCC reports further suggest that over the latter half of the century, there will likely be a need to go beyond net zero to "net negative"—a scenario in which more carbon dioxide is being pulled each year from the atmosphere than is being emitted from human sources. Many of the scenarios examined in IPCC reports that would keep warming beneath 1.5 or 2°C posit carbon removal of 10 gigatonnes or more per year by the time the 2050s roll around. For a sense of scale, remember that annual human emissions today equal around 50 gigatonnes of carbon dioxide equivalent.

Still, even as the need for some role for carbon removal in climate action has come more clearly into focus, and as carbon removal options are moving from chalkboards to the real world, such schemes are subject to a range of persistent questions and challenges. In some civil society and academic circles, in particular, carbon removal remains a controversial notion. The possibility that it might grow to play a larger role in humanity's response to climate change is derided by some as a "false solution," a distraction from the real work that needs to be done on deep decarbonization and the building of more equitable societies, or a potential boon for fossil fuel interests intent on keeping their core business models intact. Carbon removal options also raise a host of technical, political, and justice-related issues that may limit the scale at which any or all of these approaches can ever be utilized.

Here's the bottom line: carbon removal must now be considered an essential component of climate action, but not all forms of carbon removal are created equal. Carbon removal done well—meaning options developed and deployed at appropriate scales, with strong environmental and social protections, and linked to actions aimed at keeping deep decarbonization as the overriding priority for climate action—could be an important component of the transition to a climate-safe world. Carbon removal done poorly, however, could lead to a lock-in of the very social, political, and economic processes that have given rise to the climate crisis.

There is a pressing need to research the technical and engineering aspects of carbon removal in order to better understand what might be possible, and at the same time to work to set in place the rules of the road that can guide carbon removal in the best possible directions. This is the work needed to ensure that carbon removal programs are effective as well as attentive to both environmental sustainability and social justice.

WHAT IS CARBON REMOVAL?

There are many different potential approaches to carbon removal. In developing a taxonomy, it helps to think about carbon removal as a two-step process. Step one has to do with drawing down carbon dioxide from the atmosphere. Step two involves doing something with that captured carbon.

The potential pathways involved in the capturing step can be placed, broadly speaking, into two buckets. In one of the capture buckets are biological options, like planting trees and managing soils. In the other bucket is a set of mechanical or engineered options for carbon dioxide drawdown, including direct air capture and what is known as enhanced mineralization or enhanced weathering.

When it comes to step two—doing something with the carbon—most biological drawdown options operate to hold captured carbon dioxide in biological systems. (There are a couple of major exceptions to this, outlined below.) Engineered and mechanical drawdown, by contrast, may direct the captured carbon dioxide into long-lived products or into long-term sequestration, either deep underground or in rock formations.

Before proceeding, there is one important aside to make. The carbon removal options discussed here are not to be confused with the carbon capture and storage (CCS) systems used at fossil-fueled power plants or industrial facilities. This kind of traditional CCS technology can help, when it works, to *reduce the flow of carbon dioxide* into the atmosphere. Traditional CCS acts, in other words, as a way to slow down the rate at which greenhouse gas concentrations are rising.

Carbon removal is different. When it works, carbon removal actually *reduces atmospheric concentrations of carbon dioxide*. The goal is to pull carbon dioxide directly from the open air, where it contributes to climate change, and render it benign in climate terms.

This is why I just referred to long-lived products and long-term biological or underground storage, or holding carbon dioxide in rock formations. By contrast, if captured carbon dioxide is directed into a short-lived product like a fuel, it will quickly find its way back into the atmosphere, resulting in a kind of carbon recycling but not true carbon removal. These distinctions may seem a little arcane, but they matter for the crafting of policy and for nuanced consideration of different climate response options and their social consequences.

BIOLOGICAL POSSIBILITIES

So what are some of the major carbon removal options that are either in development or in discussion? The terrestrial (that is, land-based) biological options are most familiar. Planting trees and working to protect and expand existing forests are tried and true means of pulling carbon dioxide from the atmosphere and storing it. Likewise, restorative farming practices can operate to drive carbon dioxide into storage in soils. A related approach involves the introduction into soils of biochar, a substance created by heating organic matter in the absence of oxygen. The biochar can act as a production-boosting soil augmentation, while adding to the stock of carbon dioxide that soils hold in storage (unlike traditional nitrate fertilizers, which are a contributor to climate change).

The oceans also offer opportunities for drawing down and storing carbon dioxide via biological pathways. So-called blue carbon options include the restoration and maintenance of coastal wetlands and seagrass beds. A more exotic option is known as ocean iron fertilization, which involves depositing iron filings into relatively iron-scarce regions of the open ocean. There, the iron can act as a kind of fertilizer, causing blooms of microscopic phytoplankton that absorb atmospheric carbon dioxide as they grow. The phytoplankton potentially can hold some of that carbon in storage as they die and sink to the ocean floor.

The open ocean is of interest to carbon removal startup companies like Running Tide, which is investigating the potential for capturing carbon dioxide by growing kelp tethered to buoys out at sea, with the aim of then sinking the kelp for the purpose of carbon dioxide storage in the deep ocean. (Such commercial undertakings may ultimately be money-making enterprises should a price ever be put on carbon dioxide pollution by governments. At the moment, though, carbon removal companies either are relying on funding from venture capitalists or the relatively small group of companies and other entities willing to pay voluntarily for carbon removal services, or are exploring carbon removal in an effort simply to do something good for the environment.)

A further ocean-based biological approach is offered by artificial upwelling and downwelling, which involve pulling up nutrients from lower ocean boundaries to make them available to life toward the ocean surface. The sinking of some of the resulting increase in biological matter could, as with ocean iron fertilization and kelp farming, help store carbon dioxide away from the atmosphere.

Some call these kinds of biological pathways to carbon dioxide removal and sequestration "nature-based solutions," though options like

ocean iron fertilization and artificial upwelling stretch such categories due to their engineered character. Exactly what does and does not count as "nature-based" matters for the ways in which nongovernmental organizations, policymakers, and society at large understand carbon removal options. Those options that appear (or can be made to appear) "natural" tend to be easier for the civil society actors and the broader public to support.

Biological approaches to carbon dioxide drawdown and storage offer great potential to contribute to an effective climate change response. One challenge, though, is keeping carbon dioxide in storage in biological systems once the gas has been captured. Soils can be plowed, restored coastal ecosystems disturbed, forests burned or cut down. This means that biological carbon sequestration must be coupled with careful, robust, long-term management in order to have positive climatic effects.

The world's forests, for instance, currently operate each year as a vast and expanding carbon dioxide sink. Recent analysis from Global Forest Watch indicates that forests sequestered twice as much carbon as they emitted between 2001 and 2020, for a net absorption of around 7.6 gigatonnes of drawdown and storage per year. But many of the forest ecosystems are under severe threat from cutting, forest fires, and the introduction of pests by humans. The latter two issues are made worse by climate change.

The oceans also offer opportunities for drawing down and storing carbon dioxide.

Biological approaches, like engineered alternatives, pose social and political challenges. These have to do, for instance, with whether and how carbon removal options can be managed for social as well as environmental benefit, whether carbon removal efforts might divert resources and attention away from other efforts to tackle climate change, and how to manage other related social and environmental risks.

Two additional carbon storage options for plant matter grown on land are worthy of attention. The first is what has become known as "mass timber construction." This involves using specialized wood products, which have sequestered carbon dioxide from the atmosphere, in construction—including for high-rise buildings. The materials lock the carbon dioxide away for the life of the structure. This approach is gaining ground particularly in Scandinavia.

A second storage option is known as bioenergy with carbon capture and storage (BECCS). This process, in small-scale testing in a few places, involves growing some kind of biomass—say, an oil plant like palm oil or a starch-filled plant like corn—that pulls down carbon dioxide from the atmosphere as it grows. The plant matter can then be burned directly for energy or turned into a liquid fuel, with the carbon dioxide emitted during combustion captured for underground storage. The stream of carbon dioxide produced during the operation of a BECCS facility could also conceivably be directed toward the manufacturing of certain products. If utilized in a long-lived product like cement, this could make for long-term carbon removal, locking carbon dioxide away for decades or centuries.

ENGINEERED OPTIONS

This extraction of carbon dioxide that can be directed to long-term storage or to some kind of industrial use is something that BECCS has in common with one of the engineered carbon drawdown options, direct air capture (DAC). A handful of DAC facilities are operating worldwide at pilot scale. One of these, the Orca plant run by Climeworks in Iceland, is now up and running as a commercial carbon removal enterprise, with the potential to move 4,000 tonnes of carbon dioxide into long-term storage each year. Although that would be an impressive feat, 4,000 tonnes is nowhere near the scale in gigatonnes that would make a difference in climate terms, so even this commercial endeavor can best be viewed as a test or proof of concept.

DAC facilities operate by varied means, but all of them involve directing streams of open air over a chemical membrane or electrode. Chemical reactions then separate the carbon dioxide from the other gases in the stream, and further reactions or manipulations can transform the gas into a form suitable for storage or use.

There is growing corporate and governmental interest in DAC. The US government, for instance, in one version of infrastructure legislation under negotiation in the House and Senate has proposed to devote $3.5 billion to the establishment of what are being described as four DAC "hubs."

Another potential engineered approach to carbon removal is "enhanced weathering" or

"enhanced mineralization." This process would artificially speed up Earth's carbon cycle, accelerating by many times the rate at which carbon dioxide in the atmosphere makes its way into rock formations. The most straightforward form of enhanced weathering involves the mining, grinding, and dispersal of reactive rocks such as olivine or basalt. Grinding the rocks increases the surface area available to the open atmosphere, speeding naturally occurring chemical reactions.

A start-up company called Future Forest is conducting a field test in Scotland, spreading finely ground basalt on a forest floor. The aim is not only to sequester carbon dioxide directly through the basalt's reactions with the atmosphere, but also to encourage greater tree and plant growth. Another company, Project Vesta, is investigating the potential of spreading olivine on beaches. The idea is that wave action could further grind the rock, encouraging speedier drawdown of carbon dioxide.

DAC and enhanced weathering both offer the benefit that the carbon dioxide captured using those methods could conceivably be put into safe storage for long time periods. DAC is currently expensive, though, and enhanced weathering is relatively untested, raising questions about the extent to which these options can be scaled up.

Ultimately, what's clear is that we have a wide and growing array of potential options that could facilitate the large-scale removal and storage of carbon dioxide. Some of the "nature-based" options are quite well understood in their technical facets and have broad support, but may be able to hold only limited quantities of carbon dioxide in storage over climate-relevant timelines, meaning decades or centuries. Some of the more speculative options, like DAC and enhanced weathering, offer vast potential but come with a set of environmental risks and technical and cost hurdles that may ultimately limit the scales at which they can be utilized.

What all of the carbon removal options currently being discussed have in common is the fact that they would require a great deal of time in operation to bring down atmospheric levels of carbon dioxide to such an extent that climate benefits could accrue. This observation has at least two implications. First, if carbon removal is to play any kind of role later this century in helping to address climate change, large-scale investigation into the various options must begin now. Second, no single carbon removal option can be considered all alone as a way to tackle climate change. Instead, a whole portfolio of carbon removal options will likely be needed at various scales in various places, and carbon removal itself must be viewed as an addition to—not a replacement for—efforts to reduce greenhouse gas emissions.

SOCIAL CONCERNS

These different possible approaches to carbon removal offer real potential as one component of a multipronged response to climate change, even if there are many technical hurdles that would need to be surmounted for carbon removal to operate at climate-relevant scales. In addition, there are some thorny political and social challenges associated collectively with all carbon removal options, as well as specific challenges attached to individual approaches.

At the level of collective challenges, first and foremost is the concern expressed by some academics and civil society actors that carbon removal options represent a "false solution." Some attach that label just to engineered approaches like DAC, enhanced weathering, and ocean iron fertilization, expressing a sense that the technologies and interventions represented by such approaches are part and parcel of the hubristic orientation toward nature that has given rise to climate change.

Others are skeptical even of nature-based solutions, citing the ways in which the planting of trees and the like have been used by some corporations as carbon offsets (involving the purchase of, say, the carbon removal services provided by a portion of a growing forest, to "offset" the emissions that a company itself is producing). These critics say such practices relieve businesses of pressure to pursue the transformational deep decarbonization actions that are necessary, instead allowing them to claim absolution through hard-to-verify third-party actions.

The false solution idea has also cropped up in debates over environmental justice. A report released in May 2021 by the Biden administration's new White House Environmental Justice Advisory Council made the claim that DAC cannot be developed in ways that benefit communities and, for that reason, deemed it a form of climate response that is incompatible with environmental justice principles. Yet others have argued that, based on climate math and scientific assessments, DAC must at least be investigated—and that there

are many pathways to community engagement with, and benefit from, such projects.

Sorting through the thicket of environmental justice claims, particularly about engineered carbon removal but also regarding nature-based responses, is vitally important. Incorporating thorough consideration of these concerns into decision-making can help ensure the best possible outcomes for those with the most to lose, both from carbon removal done poorly and from worsening climate change impacts.

Critics have also pointed out that it is not clear how receptive people might be to the land use changes that, say, massive BECCS operations would entail, or the pipelines needed to move captured carbon dioxide to storage locations that would accompany development of DAC facilities, or the potential negative implications for human and environmental health entailed by grinding up and spreading minerals for enhanced weathering. Each carbon removal option needs to be looked at not just in terms of its technical potential to help draw carbon dioxide out of the atmosphere, but also in terms of social and environmental co-benefits and risks. This suggests a need for both disaggregation of carbon removal options into particular projects and granular assessment of those projects.

Carbon removal raises a host of technical, political, and justice-related issues.

To take one example, an activity like tree planting sounds positive on its face. But there is a whole host of questions that need to be asked about any given tree planting project. The answers will determine the degree to which the project is beneficial in technical, environmental, and social terms. What mix of tree species is being planted, in what geography, over what area of land? To what extent are local people and livelihoods being taken into account in planning and implementation processes? To whom are the benefits associated with the project flowing, and how are potential risks and costs being apportioned? What about the environmental co-benefits and downside risks? And so on.

It is one thing for scientific assessments based on computer modeling to call for massive amounts of carbon removal. It is another thing entirely for particular projects to be developed in particular places, with all of the many forms of social engagement that such enterprises entail. What we learn from a look at these political and social challenges is that projects like tree planting and management or the building of DAC facilities are far more than just technical or technological undertakings. They are also social projects, in at least a few senses.

First, any technical enterprise requires mustering and directing social resources like money, labor, and support. Second, there will be ongoing contestation over carbon removal options from the very largest scale (Is carbon removal needed? Is it desirable?) to the smallest (Why is that DAC plant being built in my neighborhood?). Third, there are very different ways to take the idea of something like enhanced weathering or soil augmentation with biochar into the real world, with differing levels of attention to broader social and environmental needs and conditions, producing different sets of winners and losers.

Climate models tend to suggest that there is still some time left for bringing large-scale carbon removal online. The currently accepted wisdom is that carbon removal will have to be scaled up over the second half of this century. But there is more urgency associated with the investigation of the emerging technologies, to see whether any of the contemplated options can pan out and to make sure that plans for implementation proceed along socially and environmentally desirable paths. Most of the analyses of carbon removal options to date have focused on absolute or relative cost and technical potential, paying too little attention to the social dimensions.

As interest in carbon removal grows, so, too, does the need to create the rules of the road that will help guide the process. Already, even before we know the extent to which various options may prove viable, the dual facts of the need for and promise of carbon removal are shaping flows of money and policymaking. Carbon removal that is done well promises to be an important and useful part of humanity's climate change response. Carbon removal done poorly, however, could simply entrench the same social dynamics and power structures that got the world into the climate change mess in the first place. ■

"[C]urrent efforts are largely focused on incremental transitions through the narrow pursuit of decarbonization, rather than on the deeper transformations in the economy that befit a crisis of this nature."

The Business of Climate Transformation

PETER NEWELL

Scientists often talk about tipping points in the climate system. These can be points of no return, most drastically when a safe climate system for humanity disappears. But tipping points may also occur when confusingly named "positive feedbacks" reinforce one another—as when melting ice releases methane, which further warms the atmosphere, leading to more melted ice, and so on. All the indications are that in the absence of dramatic change, we are on course for further climate chaos with devastating implications: what has been described as a "hothouse earth" scenario.

Is it possible that recognition of the scale and severity of the climate emergency might also trigger a series of political, economic, and social tipping points? Will an existential threat of this nature drive technological breakthroughs, mobilize unprecedented amounts of funding, and kick-start political action? The picture, at best, is mixed.

There is some evidence that such changes might be happening here and there as the world comes to terms with the scale of the threat. Shifts are now under way in four arenas: finance, business, civil society, and the state. These shifts provide at least some grounding for evidence-based hope. But it should be recognized that current efforts are largely focused on incremental transitions through the narrow pursuit of decarbonization, rather than on the deeper transformations in the economy that befit a crisis of this nature. An adequate response would require shifts in power.

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RESTLESS CAPITAL

Start with money. Historically, finance has been the lubricant of the fossil fuel economy, beginning with the oil barons who drove the oil exploration rush in the United States. The early financiers of energy entrepreneurs such as Thomas Edison included J. P. Morgan and other moguls of that era: the Vanderbilts, the Astors, and the Rockefellers. Today, the fossil fuel economy continues to be kept afloat by vast flows of private finance, lending from regional and multilateral development banks, and state subsidies that amount to some $10 million a minute, according to the International Monetary Fund.

Current debates are about mobilizing, scaling up, and "de-risking" finance so that investments in lower-carbon alternatives match the enormity of the challenge and become more attractive to private investors anxious about returns. The most urgent challenge, however, is not finding new outlets for finance; it is redirecting finance and divesting from the businesses driving us down the destructive pathway we are on. Because of perverse incentives, business as usual continues to be highly profitable.

Yet financial actors are now under unprecedented scrutiny, facing demands to pull the plug on the fossil fuel economy. There is growing pressure on pension funds, endowments, and sovereign wealth funds to divest from fossil fuels. The divestment movement has had some success in this regard, thanks largely to the climate advocacy group 350.org and its alliance with student activists.

To date, 688 institutions and nearly 60,000 individuals across 76 countries have committed to divest from fossil fuel companies. By 2018, the movement marked its one-thousandth divestment. The approximate value of divestments by institutions (1,327 to date) is now estimated to be $14.58 trillion.

The language of "stranded assets" has gone mainstream, highlighting the fact that investments in fossil fuel reserves and infrastructure could be lost because their extraction and use are incompatible with ambitious climate targets. In other words, fossil fuel assets are at risk of becoming what the think tank Carbon Tracker calls "unburnable carbon." The degree to which companies are exposed is also becoming clearer. Pressure is mounting on them to divulge their fossil fuel assets through initiatives such as the Carbon Disclosure Project, which over 200 major buyers, with a combined purchasing power of $5.5 trillion, have asked their suppliers to join.

Shareholders are getting worried. There has been an upturn in shareholder activism in recent years. Even ExxonMobil, long one of the most stalwart opponents of climate action, was defeated in a May 2021 shareholder vote in which Engine No. 1, an activist investment firm demanding that Exxon accelerate a transition to clean energy, succeeded in electing three nominees to the company's board of directors.

Even more proactively, there are a number of joint investor initiatives aimed at the world's largest greenhouse gas emitters. The Climate Action 100+ initiative, for example, enlists fund management firms to work with the 100 most important emitters, which together account for two-thirds of annual global industrial emissions, to implement decarbonization plans.

Emergent transitions have yet to bend the emissions curve.

Different tools and strategies are required to move different types of finance out of the carbon economy. An increasing number of campaigns target public financial bodies, seeking to persuade them to withdraw their lending from fossil fuel projects. These campaigns have met with some success at the European Investment Bank, the World Bank, and the export finance agencies of individual governments, including those of the United States and the United Kingdom.

The latter, after a sustained civil society campaign, agreed to end export financing for most fossil fuels. The World Bank and the French development agency have agreed to full exclusions of finance for the exploration and extraction of oil and gas. Sweden's development finance agency, Ireland's national investment fund, and the European Investment Bank are among those that exclude financing for all fossil fuel projects from their portfolios.

These are the grounds for hope that restless capital will once again drive technological revolutions through the process Joseph Schumpeter described as "creative destruction," whereby obsolete industries are replaced by more profitable ones. That is a role it played in previous technological paradigm shifts, from the Industrial Revolution to mass production and the information technology revolution.

There is optimism, for example, about green bonds: bonds specifically intended to be used for climate and environmental projects. These are issued by organizations like the International Finance Corporation and NGOs such as the Climate Bonds Initiative, which have their eyes on a $1 trillion market. "Green" is said to be the new "black," supplanting oil company bonds.

Meanwhile, the drive for net zero emissions is expected to reignite markets for carbon trading through the United Nations' offset mechanisms, which issue carbon credits to projects that reduce greenhouse gas emissions, and in voluntary markets for carbon offsets. Both function on the principle that these projects allow countries, companies, and consumers to pay for emissions reductions elsewhere, where it is cheaper to do so than to reduce them at the source.

The trading of emission rights also continues apace, not only in the flagship European Union Emissions Trading scheme, but in dozens of other national and subnational jurisdictions as well. China and Mexico are expected to have schemes operational in the next few years.

But amid the undoubted progress being made, we need to recognize the limits of finance as a transformational force. Finance searches for new outlets for investment and seeks to create new demand for products and services. This drives higher levels of production and consumption—at the very time that wealthier parts of the world need to be living not just differently but with less.

There is also a darker side to financialization—the process of extending the trading of financial instruments to new areas, including those where money can be made speculating and capitalizing on encroaching climate chaos. Indicative of this trend is the rise of catastrophe bonds, weather derivatives, and crop insurance marketed to poorer farmers to protect their yields from a problem they played no part in causing.

Placing too much faith in carbon trading as a market fix is also misplaced. It has failed so far to produce the depth and speed of change required, and it is riddled with technical problems of double-counting and exaggerating emissions savings to boost the value of traded carbon. Offsets in particular bring few social benefits, and in some cases cause damaging impacts to communities expected to host the projects funded through these offset mechanisms, leading to allegations of greenwashing.

This raises serious issues about the differential effects of these investments, with some places and people bearing disproportionately greater costs than others. For an equitable climate transformation to occur, we need stronger forms of governance and steering to guide investment to where it is needed—but we also need to set limits and cut the supply of finance to activities, infrastructures, and investments that would lock in further climate chaos.

INDUSTRY ENDGAME

The history of business engagement with the climate issue has often centered on intense lobbying to discredit the science of climate change through misinformation, to exaggerate the costs of climate action in order to protect incumbents' market share, and to thwart targets and regulations that pose a threat to the fossil fuel economy. Although most corporations have now conceded that climate change is a threat and that there is a case for taking action, they continue to spend spectacular sums of money to gain access to policymakers and influence the ways in which governments respond to the crisis.

Political giving by the fossil fuel industry exceeds donations from the renewables sector by a ratio of 13 to 1. During the latest midterm elections cycle in the United States, the industry spent at least $359 million on federal campaign donations and lobbying. As of December 2019, 134 members of Congress and their spouses owned as much as $92.7 million worth of stock in fossil fuel companies and mutual funds.

This has global implications, given the influence of the United States in global climate politics. The world's five largest publicly owned oil and gas companies spend approximately $200 million every year on lobbying designed to control, delay, or block binding climate-motivated policy.

But even the oil majors are feeling the heat, and not just from activists. They are under pressure from their own shareholders, who are justifiably anxious that fossil fuel investments once seen as valuable assets are increasingly recognized as liabilities in a world of more ambitious climate targets, rising carbon taxes, and the like. Yet many companies are still set on expansion, while managing pressure to reduce their emissions with fanciful proposals to reach the goal of net zero. As is the case with Shell's net zero strategy, announced in 2021, these proposals often imply the massive acquisition of forest cover to absorb planned growth in emissions from further extraction. But the oil majors know that their sector is in its endgame, and many are seeking to reposition and rebrand themselves as energy companies rather than fossil fuel giants.

This brings us to the business of rapid transition. Although the strategy adopted by many companies amounts to managing decline and buying time, there is scattered evidence of businesses adopting new models. Some have accepted responsibility for emissions produced throughout their supply chains and by the users of their products, or for the emissions they have generated throughout their existence. Microsoft, for example, has pledged that it will remove its historical emissions from the atmosphere by 2050. Some companies have adopted science-based targets that seek to align their corporate strategies with the goals of the Paris Agreement.

There are some interesting shifts taking place, but the devil is always in the details, and inconsistency is rife. Big brands may adopt impressive pledges, but then continue to support fossil fuel industries. As part of its climate pledge, Amazon announced in late 2019 that it would shift its energy consumption to 80 percent renewables by 2024 and 100 percent by 2030. Yet it still funds climate action–delaying policies and climate change–denying think tanks such as the Competitive Enterprise Institute. It also provides artificial intelligence technologies to help advance oil and gas exploration.

True corporate leaders will make climate action part of their core business models rather than engage in tokenism. There is currently scant evidence of more transformational models that go beyond niche moves and are aimed at enabling reduced production and consumption. One example of a more transformative approach, however, is B Corporation certification, which is awarded by the nonprofit organization B Lab to businesses in countries around the world that meet the highest

standards of verified social and environmental performance, public transparency, and legal accountability to balance profit and purpose.

BLOCKADES AND LAWSUITS

A growth-based economy that has no notion of boundaries or sufficiency is running up against planetary limits. History suggests that a transformation at the depth and scale that is now required to address climate change will not come about without extensive and active engagement from civil society. That is certainly the case if past struggles against apartheid, colonialism, and patriarchy are anything to go by. Encouragingly, the level and breadth of engagement with climate change by social movements including labor, human rights, gender equality, and indigenous groups is already awe-inspiring.

The state is often the target of social demands. But businesses and investors, because of the everyday power they wield through their investment decisions and ability to shape consumer preferences, are increasingly targeted. I have described this as *civil regulation*: civil society–based regulation of the private sector, aimed at filling some of the gaps caused by the reluctance or inability (or both) of governments to regulate businesses for fear of driving them away.

The strategy adopted by many companies amounts to managing decline.

Civil regulation takes a number of forms. It can involve boycotts of companies engaged in climate denialism, such as ExxonMobil, or those implicated in localized pollution or human rights violations, like Texaco and Shell, in places as diverse as Ecuador and Nigeria. It may also entail proactive negotiations to establish corporate codes of conduct, or setting up roundtables and certification schemes.

Beyond these fairly conventional forms of protest are more confrontational approaches. In her book *This Changes Everything: Capitalism vs. The Climate*, Naomi Klein coined the term "blockadia" to describe a centuries-old strategy by which people have resisted corporate and state incursions into their lands for the purpose of extraction. Recent research has documented the impact of climate mobilizations of this kind: over a quarter of fossil fuel projects that encountered social resistance have been canceled, suspended, or delayed. An environmental justice atlas produced by the EJOLT network showcases the extent of resistance to fossil fuel infrastructures across all continents. This opposition represents an additional cost and both financial and reputational risk for investors and firms engaged in the last-gasp rush for remaining fossil fuels.

Litigation forms another plank in the activist repertoire. A recent verdict in the Netherlands against Shell has sent waves of shock and alarm throughout the energy sector. Invoking the nonbinding UN Guiding Principles on Business and Human Rights, a district court in The Hague in May 2021 ordered Shell to achieve a specific emission reduction target (a 45 percent cut by 2030, compared with its 2019 levels) along its entire supply chain, effectively suggesting that the company had to cut back production. Dutch environmental group Milieudefensie had sued Shell, alleging that the company was violating Dutch law and human rights by failing to adequately reduce its emissions.

In recent years, climate lawsuits have been filed against other major companies, including Total in France and Exxon in the United States. A case was brought in the Philippines against 47 of the biggest fossil fuel companies, called the "carbon majors," by Greenpeace on behalf of Filipino communities afflicted by Typhoon Haiyan in 2013. After a four-year inquiry, the Commission on Human Rights of the Philippines in December 2019 announced that the carbon majors could be found legally responsible for human rights violations through their role in causing climate change.

Litigation has also been launched against individual fossil fuel projects, from coal mines in Australia and the United Kingdom to oil and gas pipelines in the United States. These cases build on a longer history of activism, drawing on tort law and human rights traditions to contest the climate and other environmental impacts of both fossil fuel extraction and combustion.

It is important not to underestimate the legal, financial, and political barriers to using the law to hold corporate and state actors to account for inaction on climate change. But it is also clear that legal activism as a means to address the climate crisis is here to stay.

WHAT STATES CAN DO

Although in a neoliberal age it remains popular to disparage the role of the state, all businesses rely on state support through the provision of

infrastructure and a trained labor force, as well as laws and regulations to ensure fair competition. They also receive extensive fiscal and financial support through tax breaks, subsidies, and the like. Whether as nightwatchman, entrepreneurial investor, welfare state, or regulatory authority, government has a vital role in setting the terms of the transformations required to address climate change. States need to step up in all sorts of ways: supporting new forms of innovation, financing new infrastructures, disrupting and managing the decline of existing ones, and mitigating their social impacts.

There is evidence that at least some governments are doing some of these things. From bold visions for a Green New Deal in Europe and the United States, to "first movers" setting limits on the production and supply of fossil fuels, promising signs of responsible leadership have emerged. This sends a clear signal to the private sector about the direction of change and states' commitment to meeting the climate challenge.

Several countries in recent years have adopted moratoria and bans on fossil fuel extraction. France announced in December 2017 that it would phase out oil and gas exploration and production. In the same month, Belize announced a moratorium on all offshore oil activity. Denmark implemented a ban on onshore oil and gas exploration in February 2018. New Zealand banned new offshore oil exploration licenses in April 2018. Ireland enacted a ban on future oil exploration licenses in September 2019. The challenge now is to widen this circle of first movers to include some major fossil fuel producers—perhaps under the umbrella of a new agreement such as a Fossil Fuel Non-Proliferation Treaty.

Ultimately, governments are societies' stewards, with the responsibility to protect current and future generations from the worst effects of climate change. They issue businesses licenses to operate and have at their disposal a range of regulatory tools and an ability to mobilize vast sums of money to tackle major threats. That is something they have shown themselves willing and able to do in response to the COVID-19 pandemic, helping companies to convert their production lines on short notice to produce ventilators, hand sanitizer, and masks. Confronting climate change requires a similar level of rapid industrial conversion of carbon-intensive sectors to meet the need for deep decarbonization of the economy.

CONFRONTING VESTED INTERESTS

More ambitious climate action is often held back by the power of vested interests. Beneficiaries of the fossil-fueled status quo use their power to resist change and preserve their market share. In the case of state-owned enterprises, the state is effectively being asked to regulate itself and wind down what has been a profitable source of revenue for some countries, even if it has proved to be a resource curse for many others. The line between government and business becomes very blurred.

Saudi Arabia's delegation to climate negotiations is largely composed of officials with ties to the state oil company Aramco and a direct stake in its profitability. At the United Nations climate summit in Madrid (COP25) in December 2019, over 40 Gulf state delegates were current or former employees of fossil fuel companies. The conflicts of interest are clear to see, and their political implications can be fatal.

Climate policy itself must undergo a transformation. This means rolling back incumbent powers that are frustrating ambition and passing on costs to the rest of society—to say nothing of future generations. Countering them requires measures such as independent oversight of targets and budgets, stronger mechanisms for holding governments to account for their obligations, registries of interests to avoid revolving doors between fossil fuel lobbying and government positions, and an increase in the transparency and regulation of donations to political parties.

Such measures must be combined with efforts to amplify the voices of those most affected by climate inaction and the effects of climate change. The potential beneficiaries of more ambitious climate action should be heard. Concrete options include the expansion of indirect representation for future generations, following the examples set by parliaments in Wales, Hungary, and Israel. Another approach is deepening citizen participation in climate assemblies, as has been tried in Britain, Ireland, and France.

Beyond enhancing the representation and participation of citizens in climate policy, another imperative is opening up decision making on energy, industrial, trade, and agricultural policies to broader public scrutiny regarding compatibility with climate policy goals. In these fundamental ways, the conduct of our politics needs to adapt to the urgency of deepening and scaling up action to minimize further climate chaos.

FROM TRANSITION TO TRANSFORMATION

Are such proposals enough to deal with the climate crisis? The honest answer is that we cannot yet know what all these initiatives will add up to in the longer term—but it is likely that they will not suffice, given the countervailing trends in the economy that undermine and dwarf the gains seen to date. The Production Gap report issued in 2020 by the UN Environment Program and the Stockholm Environment Institute has shown that despite everything we know about the severity of climate change and its potential to deepen existing inequalities and injustices, fossil fuel production in 2030 will still be more than double what would be consistent with the Paris Agreement's goal of limiting the global temperature increase since preindustrial times to 1.5 degrees Celsius.

To follow a 1.5°C pathway, the world will need to reduce fossil fuel production by roughly 6 percent per year between 2020 and 2030. As projected by the UN Emissions Gap report, however, the inadequacies of current commitments leave us on course for an increase of 3 to 4 degrees. That would be a catastrophic level of warming.

Emergent transitions in the energy sector and the broader global economy have been promising, but they have yet to bend the emissions curve. Incremental technological shifts and adjustments to business models have largely ignored the obvious need to get to the roots of the problem—which lie in unsustainably organized systems of production, consumption, work, and income. This deeper political economy driving the current crisis has been kept off limits.

Changing it will involve a more fundamental rewiring of the economy than anything we have seen to date. It might mean working less—or at least working differently and sharing more. It will certainly require accepting limits on the production and consumption of fossil fuels.

A climate transformation entails moving beyond substitution and "plug and play" solutions, whereby new technologies or energy sources are added to the mix but little effort is made to reduce demand or to rethink the provision of necessities such as mobility, heating, and cooling. Meanwhile, the costs of the current trajectory are hidden, downplayed, and displaced onto poorer groups within societies and around the world—and onto future generations.

Rapid and just transitions require a more disruptive politics.

Rapid and just transitions are urgently required in the subsystems of energy, housing, transportation, and food. But without deeper, transformational shifts in power over finance, production, technology, and governance, we are unlikely to deliver change at the speed and scale required.

Meeting the climate challenge ultimately requires a more disruptive politics: one that deliberately rebalances systems of participation and representation toward hearing and acting on the needs of poorer groups and others with an interest in more ambitious action, while reining in the power of incumbents who have stalled action for so long, and at such a high cost to society. Most importantly, this rebalancing is needed not just in climate policy, but in related policymaking on energy, trade, and industry, where decisions that are literally life-changing are made on a daily basis, with implications for us all. ■

"In the face of climate change, it is increasingly urgent that we realign our diets to focus on health and environmental sustainability."

A Path to Sustainable Food Systems

JESSICA FANZO

Our food systems are a wonder of the modern world. They efficiently supply almost eight billion people. Annual deaths from famine fell below one million for the first time in the 2010s, and the prevalence of undernourishment has declined globally, albeit slowly, in recent decades. Many (but not all) people around the world now enjoy an unprecedented quantity, quality, and variety of food options.

However, the foods we eat also contribute to increasingly common and burdensome health problems. And although rates of hunger have been decreasing over the past 25 years, many people remain food insecure, not knowing when and from where their next meal will come. More than 690 million people still go to bed hungry every night.

More than 20 percent of children around the world are stunted—too short for their age—because of a lack of nutritious foods. Most of those children live in low- and middle-income countries. At the same time, more than 2 billion people suffer from obesity, including 40 million children under the age of 5. The increase in obesity worldwide is linked to a rise in chronic, noncommunicable, but potentially deadly diseases such as diabetes, heart disease, and cancer, which are overwhelming health systems. Without substantial dietary changes, human health will further decline.

Simultaneously, food systems are placing a growing burden on our planet's environment. Agriculture is responsible for 10 to 24 percent of global greenhouse gas emissions, which are increasing temperatures, changing precipitation patterns, and acidifying the oceans. Agricultural production, in turn, is extremely sensitive to a changing climate, which will make it increasingly difficult to produce enough food for a growing population.

People's lifestyle choices are driving disastrous planetary changes, while many are suffering from the impacts of these changes. We are victims of our own actions in a destructive feedback loop. Transforming food systems in order to benefit human and planetary health is a way to escape that loop.

CLIMATE INTERCONNECTIONS

Climate change affects every aspect of food systems. If it is not ameliorated, it is expected to cause a 2 percent decrease in food production every decade until 2050, and much more drastic declines after that. Meanwhile, practices within food systems affect essentially all environmental systems. Our diets are thoroughly intertwined with the environment.

The Anthropocene is the geological epoch now under way, in which humans have become the dominant influence on the planet, responsible for global warming, rising sea levels, animal and plant extinctions, and habitat loss. Agriculture, which now uses 37 percent of Earth's land and 70 percent of its freshwater supply, has been a major contributor to the environmental predicaments of the Anthropocene. It is the biggest source of nutrient runoff, causing algal blooms, dead zones, and acidification of the planet's freshwater and ocean ecosystems. These changes, along with the accelerated clearing of forests for agricultural use, have been factors in one of the most dire events of the Anthropocene: an ongoing mass extinction that has culled the number of species of mammals, birds, fish, reptiles, and amphibians by an average of 60 percent since 1970.

If we continue on this trajectory, the consequences for our food systems will be catastrophic.

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Continued deforestation to clear land for agriculture will cause the collapse of biogeochemical systems that affect oxygen levels for the entire planet. The biodiversity of plants, insects, and animals will be severely diminished, increasing the vulnerability of ecosystems important to food production and human life. Extreme weather events, food and water shortages, more diseases (including pandemics), and other climate-related problems are likely to skyrocket.

Changes in global temperature and precipitation levels caused by climate change are expected to reduce agricultural productivity and the nutritional content of certain crops. Crop diseases will increase in some parts of the world, as will losses due to pathogens infecting stockpiles of harvested grains. Combating these outbreaks will require more and better cold storage of food, which in turn will use more energy, fueling climate change, unless we shift rapidly to renewable energy resources. In any case, food will likely be in shorter supply, higher priced, and less affordable, especially for the poor, causing social unrest.

In the face of climate change, it is increasingly urgent that we realign our diets to focus on health and environmental sustainability. Purchasing and eating patterns at the individual and societal level must change. People will need to buy less food, and they will have to exercise greater food consciousness to reduce spoilage and waste. This may seem difficult, but we should not fear having to make these adjustments. To the contrary, adapting in these ways would improve health and well-being for everyone, as well as the odds that Earth will remain habitable for generations to come.

Food systems are placing a growing burden on our planet's environment.

DIMINISHING DIVERSITY

More intense focus on agricultural production in recent decades has spurred economic growth while also increasing food security in many regions of the world. Yet this shift has also compromised both nutritional and environmental health. Many of these negative effects stem from the model's uniformity.

Industrial agriculture typically causes a dramatic loss of genetic diversity in crops and farm animals. The food supply increases, but a select number of globally important staple foods (wheat, rice, maize, and sugar) make up the majority of the supply, supplemented by a few newer global commodity crops, particularly soy, palm, sunflower, and rapeseed used for oils.

As these crops become more prevalent around the world, traditional staples such as sorghum, millet, rye, cassava, sweet potatoes, and yams have been marginalized. They have not disappeared—at least not yet—but in many places they are no longer eaten every day. Traditional diets formerly based on a single staple (for instance, rice in Southeast Asia) have changed over time to include other staples such as wheat and potatoes. The same is true for maize-based diets in Latin America, sorghum- and millet-based diets in sub-Saharan Africa, and so on around the globe.

Food supplies worldwide are much more uniform, and among crop species there are fewer varieties available today than a century ago. Colin Khoury, a crop diversity specialist at the International Center for Tropical Agriculture in Colombia, has argued: "If we are what we eat, then it seems that over the last half-century people around the world have become much more the same type of human being—globalized people eating globalized foods."

Industrial agriculture is resource-intensive and a major contributor to the world's greenhouse gas emissions. It exacerbates land degradation and relies on high inputs of energy, fertilizer, pesticides, and water. Even though the common practice of monocropping can increase yields, it can also, in certain contexts, damage biodiversity and upset ecosystems. A more diversified form of agriculture could provide more resilience and protection against disaster, but the time and costs needed to rebuild soil health and fertility often dissuade farmers from taking this route.

Evidence suggests that despite increased yields, production of the world's major crops, such as maize, rice, wheat, and soy, has already begun to stagnate. It is possible that crop productivity can be increased only up to a certain point, after which new techniques are necessary for a boost. And future agricultural expansion will be curbed by urban sprawl. It is expected that urbanization will result in the loss of approximately 2 percent of global croplands by 2030. About 80 percent of that cropland loss will take place in Asia and Africa. These are all reasons to move away from industrial farming, or at least to rethink intensification efforts, in order to better support human and environmental health.

VICIOUS CYCLES

Human alterations to the climate are already producing dire consequences. Under the most optimistic scenarios, 1.2 billion people will reside outside the comfortable "climate niche" in which humans have thrived for at least 6,000 years. This, along with rising seas inundating coastal areas, will cause people to migrate to more livable places on the planet, increasing population pressure in some parts of the world.

Regions will not suffer equally from climate change. In some areas, such as the Andes and East African highlands, growing seasons may expand. The production of cassava is projected to increase with climate change because cassava plants (which produce edible roots and leaves, a staple crop for many Africans) thrive in warmer temperatures and with higher carbon dioxide levels. In most of the global South, however, particularly in equatorial regions, climate change is expected to decrease yields of various crops and make it more difficult to produce many foods.

Cyclone Idai, considered one of the worst climate-related disasters in the Southern Hemisphere to date, caused widespread food insecurity when it hit Mozambique in 2019. The number of once-rare climate-related disasters is expected to rise with every incremental increase in the global temperature level, as the Intergovernmental Panel on Climate Change warned in August 2021. The consequences for humans, their homes, and their food security and diets will be graver than ever.

Climate change is a long-term shock to food systems. Some experts argue that extreme weather events such as heat waves, droughts, flooding, and cold spells can lead to devastating failures of major crops, including wheat, maize, soy, and rice. The risk of extreme weather events occurring simultaneously in many growing regions is increasing because of climate change. Such "multiple breadbasket failures" are likely to occur in the next two decades, compromising food access for billions of people.

Most of the world's acute hunger and undernutrition occurs not due to conflicts and natural disasters, but during annual "hunger seasons"—the times of year when the previous harvest's stocks have dwindled, food prices are high, jobs are scarce, and rainfall is unpredictable. The frequency and intensity of seasonal hunger is expected to increase with climate change and to be especially severe in Africa south of the Sahara. Such effects will be most dire in areas where agriculture is rainfed and rains are highly seasonal.

Maintaining, much less expanding, agricultural production will become increasingly difficult in the face of hotter temperatures, a more limited water supply, and acidification of soils and oceans. Heat-stressed plants are more susceptible to disease, which could lead to smaller yields and greater use of agrochemicals for pest control. Some pest populations are expected to flourish in warmer temperatures and migrate to new, higher latitudes.

Agricultural production involves a feedback loop with the environment. It contributes to ever-increasing climate change, which in turn drives intensified production to meet global food demand. Fossil fuels are one component of this feedback loop. They are used to produce fertilizers, pesticides, and other synthetic agrochemicals, which drive up crop yields but also contribute to groundwater contamination, soil acidification and biodiversity loss, and buildup of chemicals in waterways and on land to levels that can be toxic to humans and animals.

The use of pesticides in agriculture compounds the downward spiral of dwindling crop diversity. Pesticides have reduced the numbers and diversity of species of pollinators such as bees, bats, and butterflies, which play vital roles in crop production. Climate change poses another huge threat to these and other insects that help keep ecosystems in balance.

Such adverse outcomes could lead to lower crop yields in the long run, which in turn will prompt even more chemical use to increase productivity. This vicious cycle will be incredibly challenging to break.

Beyond its effects on diversity, intensive agriculture also contributes to erosion and the degradation of soil quality, which has already resulted in the abandonment of roughly one-third of the world's arable land. The south-central United States experienced the dire consequences of poor soil conservation practices in the 1930s with the Dust Bowl, which deepened the Great Depression and forced 2.5 million people to migrate across the country. Increased use of techniques to reduce soil erosion, such as no-till methods and cover crops, will be necessary to avoid repeating such catastrophes and meet global food demand.

NUTRITIONAL DEFICIENCIES

Industrialized agriculture aims to meet nutritional needs by combining highly specialized and

productive farming with trading systems that allow consumers to buy a variety of foods. But the diversity of choice delivered by international trade has mainly benefited wealthy consumers in high-income countries. Meanwhile, substandard infrastructure and broken or inadequate value chains have forced poor people in low-income countries to rely on staple crops that are insufficient to meet their nutritional needs.

Climate change also threatens the nutritional quality of food. Elevated levels of atmospheric carbon dioxide can increase photosynthesis and plant growth. But it can also reduce the nutritional value of some crops, especially wheat, rice, potatoes, soy, and peas. Samuel Myers, the director of the Planetary Health Alliance at Harvard University, has shown that productivity gains may offset the yield-decreasing impact of climate change, but the harvested crops will typically contain less protein, iron, and zinc, essential nutrients for human health.

Of the more than 50,000 edible plant species on Earth, people throughout human history have used roughly 7,000 of them as food sources, along with a wide variety of animals and other organisms, including fungi, algae, yeasts, and bacteria. But over the past century, primarily by conscious choice, humans have driven the diversity out of agricultural systems. Just 15 crops now account for 90 percent of the world population's caloric demands. And only three staple crops—rice, maize, and wheat—account for two-thirds of global food-energy intake.

A quality diet not only improves human health; it also protects the environment.

A century ago, commercial seed houses offered hundreds of varieties of crops that provided nutritional diversity, risk reduction, and climate adaptability. Now, farmers face pressure to stop saving seeds, which has caused a loss in such heirloom varieties. Today, the United Nations Food and Agriculture Organization reports that the world's agricultural landscape is dominated by only 12 species of grain crops, 23 species of vegetable crops, 35 species of fruit and nut crops, and 5 animal species (not including fish). Globally, 75 percent of agricultural land is devoted to growing those 12 grains.

It is not only the diversity of crops that matters, but the variety of species of individual crops as well. In India, for example, more than 80,000 varieties of rice were once cultivated, but that number has now fallen to just several hundred. Similarly, the United States has largely shifted to monocultures of corn and soy, with the great majority of farms producing the same varieties of the same crops. This creates incredible risk not only from a nutritional perspective, but also from a climate standpoint. As with an investment portfolio, it pays to diversify—a hard-earned lesson of the Irish Potato Famine.

Many factors have contributed to the decline in diversity, including replacement of human labor with machinery and investments in the breeding and distribution of high-yielding major crops as an economic development strategy. Agriculture subsidies dedicated to a narrow range of crop commodities have further reduced diversity. This trend toward homogeneity in the global food supply also heightens interdependence among countries for access to vital food imports, which can be vulnerable to supply chain disruptions.

SMALL FARMS IN PERIL

As farm sizes increase, the nutrient content of crops typically diminishes with the loss of diversity. Smaller farms with more agrobiodiversity often introduce a broader array of nutrients (particularly micronutrients) into the food supply than large farms. As sustainable food systems expert Mario Herrero says, "Small and medium holder farmers are providing a monumental ecosystem service. They're the stewards of the nutrients and biodiversity for the world."

Despite their value to global ecosystems, smallholder farms—generally defined as less than 2 hectares (about 5 acres), but sometimes as up to 10 hectares—are the farms most vulnerable to the effects of climate change. They also are the most disenfranchised from the global financial system. Many smallholder farmers, especially women, struggle to rise above subsistence levels. They often lack access to credit, technical support, and markets while enduring the volatility of global commodity prices.

Subsistence farmers try to eke out a living by growing crops to send to market, hoping to have enough left over to feed their families. Unfortunately, they often fail because of droughts, unpredictable rains, lack of mechanization or other technology to support a small business, and lack of infrastructure (sometimes even roads) to get their crops to distant markets. Even with the odds

these farmers face, their land still accounts for 30 percent of all food commodities in their regions.

Globalization has intensified costly regulatory burdens and downward price pressures for farmers of all sizes (though during the COVID-19 pandemic, food prices have risen and were about 30 percent higher in July 2021 than they were a year earlier). But half of the hungry people in the world are dependent on small-scale farming communities. And nearly one billion people who derive their livelihoods primarily from agriculture will bear the brunt of large-scale environmental disruptions in the near future. Climate change may force smallholders to abandon their own farms to seek more secure food sources and livelihoods.

HOLISTIC POLICIES

Transforming global food systems will require changes at two broad levels: in the policymaking arena and in the realm of individuals' actions. Policies should help ensure that all people have access to safe, healthy, affordable food; that farmers and workers are supported; that animals are treated humanely; that air, water, and land are protected for future generations; and that climate change is mitigated.

These goals are not achieved by current food policies in the United States—or anywhere else. Not a single nation has a holistic food system policy designed to improve human nutrition and well-being while protecting the environment. Many countries have agriculture policies, dietary guidelines, or climate change policies, but what's lacking is an effort to bring those policies together in a coherent, all-encompassing strategy that addresses the entirety of food systems. In fact, the goals of different sets of policies are sometimes contradictory.

One of the most important steps that governments can take to improve public health and sustainability within food systems is to promote agricultural diversity. Ministries of agriculture can enhance biodiversity and nutrition by increasing access to a wider array of seed varieties and livestock breeds that are resilient to weather conditions, pests, and diseases. Governments should also support farmers' groups, community-based organizations, and social movements that encourage diversification and offer agricultural extension services. The use of cover crops, crop rotation, manure, and appropriately applied fertilizers can improve soil quality and potentially enhance the nutritional content of foods.

In food systems that are not yet highly modernized, strategies should focus on basic improvements to storage and transportation infrastructure to ensure the safety of perishable foods from farm to consumer. In more modernized food systems, innovative and sustainable technologies for storage and distribution should be developed and implemented. Satellite technologies allow shippers and carriers to monitor the quality of their cargo and shorten delivery times. Wider adoption of these practices could reduce spoilage, improve food safety, and increase profits.

The COVID-19 pandemic has sparked debates about supply chains. Disruptions during global lockdowns caused food shortages. Shorter supply chains and alternative retail infrastructures can provide accessible and affordable alternatives to mass retail outlets, which may be hard for some consumers to reach. Networks and micro-hubs of food producers could increase market access and limit food loss. Governments can support local food by repurposing infrastructure in cities to favor farmers' markets, mobile food trucks, and community food centers.

Changing food environments to promote healthier, sustainable food choices will require action in many other policy areas, including regulation of advertising and sales tactics; food provisioning in institutional settings, such as schools; and economic incentives and disincentives, such as retail subsidies and taxes. A step as simple as requiring more informative nutrition labels can help both consumers and food producers. It would encourage healthier individual choices and guide the food industry to reformulate products with more nutritious ingredients and less environmental impact.

FISCAL NUDGES

Policymakers can create strong fiscal incentives to shape the actions of those responsible for our food systems. Trade agreements, tax policies, and subsidies must all better align with policies that promote healthy and sustainable diets. Corporate goodwill and voluntary measures are not enough. While there are some exceptions in the food and beverage industry, transgressions against public health, environmental, and climate goals remain common. Only governments have the necessary legitimacy to establish a fiscal framework that puts diets on a healthier and more sustainable track.

Shifting agriculture subsidies toward crops that would contribute to healthy diets, such as fruits,

vegetables, nuts, and legumes, could be a game changer for farmers and the consumers of their harvests. Local or national governments could institute tax incentives to motivate producers and retailers to engage in healthier and more sustainable practices. They could tax fertilizer, which might encourage farmers to switch to more organic approaches.

Governments could also provide incentives to street vendors to use healthier ingredients, as the authorities in Singapore did. They could offer tax breaks or financial incentives for retailers that sell healthy foods. Or they could adjust sales tax rates to incentivize a shift toward more nutritious food products by consumers.

Efforts in some cities to encourage corner stores to stock healthy, fresh foods have increased purchases of these options while generating higher profits. New York City's Healthy Bodega program has linked stores offering healthier foods to the federal Supplemental Nutrition Assistance Program, allowing low-income consumers to use the food-purchasing aid to stock up. The local production and sale of healthy foods, as well as direct sales at farmers' markets and farms via Community Supported Agriculture programs, offer important economic and social benefits to farmers, consumers, and communities, particularly in neglected neighborhoods.

Weathering climate change will require much more sustainable approaches.

More ambitiously, a greenhouse gas emissions tax on foods, based on the amount of emissions generated by their production, could be a powerful health-promoting climate policy. The tax revenue could be used to subsidize healthier foods or to fund health care programs. Other tax policies that could be considered in order to improve health and sustainability include levies on the food and beverage industries for water use, meat, sugar, and pollution. One model for this is a proposal for a carbon tax on fossil fuel extraction, with the revenues to be distributed equally among all citizens.

CALORIE COUNTING

Responsibility for health and sustainability should not be the burden solely of individual citizens. Yet what we eat and what policies we support can shape food systems and the food supply. Individual actions can contribute to much larger social movements that collectively shift the food agenda.

Transitioning to healthy and sustainable diets is not easy. It requires knowledge, will, and persistence. But a quality diet not only improves human health; it also protects the environment.

We must determine how to meet the world's caloric and nutritional needs while minimizing further harm to the planet and ensuring that farmers have the support they need to adapt to a changing climate. Three measures in particular could go a long way toward improving both human and environmental health.

First, we need to end consumption of calories in excess of what the body expends every day. According to the US Department of Health and Human Services, this is 1,600 to 2,400 calories for adult women and 2,000 to 3,000 for adult men. Moderate consumption entails eating to satisfy but not to exceed energy and nutrient requirements for growth, physical activity, and bodily repair. Reducing excess caloric intake typically averts the health risks associated with obesity, while placing less demand on finite supplies of food.

Second, we need to avoid unhealthy, highly processed foods. That could prove to be a challenge, especially in high-income, industrialized countries, where nearly everything has been processed to some extent. The foods to avoid are those that include ingredients rarely or never used in home kitchens.

Third, individuals in middle- and high-income countries need to reduce their consumption of animal-source foods, especially beef. Cattle produce large amounts of methane, a toxic greenhouse gas that contributes significantly to global warming. Raising livestock also contributes to deforestation and biodiversity loss.

While most people in high-income countries consume far more meat than they need, most people in low-income countries do not have enough animal-source foods. In low-income countries, the aim should be to facilitate enough meat consumption to fulfill nutritional needs. That means improving supply-chain infrastructure and subsidizing prices to ensure that these foods are more accessible and affordable. Middle-income countries, for their part, should aim to prevent meat consumption from reaching excessive levels.

A growing world population will require more food. At the same time, climate change will make it increasingly difficult for farmers to feed that

population. Our current systems focus on cheap, abundant food that can be produced as quickly as possible while generating ample profit margins for industries that dominate the marketplace, leaving many smallholders behind.

Urbanization is encroaching on remaining open spaces, and the average age of farmers is hitting 60 (among those surveyed). This raises the question: *Who will feed us?* And who would want to be a farmer with climate change barreling down on us?

Weathering climate change will require much more sustainable approaches. Preventing catastrophic collapses of global food systems demands an all-hands-on-deck approach. On both individual and systemic levels, we need to be bolder. Our world is changing rapidly; there is no time to let problems fester.

Governments need to make decisions now and be less risk averse. There is much evidence already available about how to improve food systems and diets while pursuing climate adaptation and mitigation. Strategies exist to address all these challenges simultaneously. But for such approaches to be effective, governments must commit to and invest in change.

The private sector also has to participate and develop partnerships with other sectors to improve public health and environmental sustainability. Consumer awareness needs to increase. Young innovators should be encouraged to bring new ideas to the table. And citizens need to vote for leaders who will foster global cooperation and goodwill.

No single country can address climate change or steer food systems in the right direction by itself. Every country has some form of malnutrition, and each will struggle with climate change, some more than others. These are collective global issues that call for a collective response. While the challenges may seem daunting, cooperation can help food systems adapt to rescue both planetary and human health. ■

"The vulnerability of people with disabilities to climate change–related risk and other hazards is due to multiple and self-reinforcing socio-cultural, economic, political, and physical obstacles that they face in their daily lives."

Climate Disaster Risk, Disability, and Resilience

EMMA CALGARO

Disability and Equality
Third in a series

The climate crisis has already arrived. In a speech at Columbia University in December 2020, United Nations Secretary-General António Guterres bluntly observed, "The state of the planet is broken." The frequency and severity of climate change–related hydro-meteorological events (extreme temperatures, drought, wildfires) and climatological events (storms, floods, avalanches, landslides) are increasing, and they often occur as compounding events. The number of climate-related disasters has tripled in the past 30 years.

In 2020, Australians witnessed unprecedented and catastrophic firestorms following the country's hottest year on record and a prolonged drought. Next came flooding in Indonesia, super-cyclone Amphan hitting the coasts of India and Bangladesh, and more flooding in Kenya and large swaths of Central and West Africa. Then there were soaring temperatures and wildfires in the Siberian Arctic, the Brazilian Amazon, South America's Pantanal wetlands, California, and Colorado, followed by a historic hurricane season in the Atlantic, including two apocalyptic storms in Honduras and Nicaragua. Records continue to be broken in 2021 by compounding events, such as the heatwaves and wildfires that descended on northwestern North America in mid-2021, preceded by intense drought, while Germany and China experienced severe floods in July.

These events do not create disasters on their own. They act as trigger points that expose existing and often deeply rooted inequalities and injustices that influence every aspect of daily life. People who are socially, economically, culturally, politically, and institutionally marginalized in society are also disproportionately impacted by climate-related disasters.

The plight of these so-called vulnerable and marginalized groups—their heightened exposure to risk and their struggle to respond and recover effectively—often dominates disaster narratives through the emergency and recovery phases. One of these groups is people with disabilities. "Disability" is a contested term with no agreed definition. Here, I define disabilities as long-term physical, mental, intellectual, or sensory impairments that, in interaction with various attitudinal, environmental, and institutional barriers, may hinder full and effective participation in society on an equal basis with others.

The typical disaster and disability narrative goes something like this:

Disasters triggered by hydro-meteorological and climatological events disproportionately impact people who are marginalized. This includes people with disabilities, who account for 15 percent of the world's population (approximately 1 billion people), making them the world's largest minority group. The high impact of disasters on people with disabilities is reflected in disaster mortality rates. They are four times more likely to die from disasters than people without disabilities. Yet they largely remain unaccounted for in disaster risk reduction and climate change policies, practices, and planning. This increases their vulnerability to escalating risk and compounds their marginalization.

This empirically grounded narrative is important for multiple reasons. First, it shines a light on the enduring systemic inequalities in societies—the

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unequal distribution of resources underpins differential vulnerability and resilience levels found within and across communities. Second, it validates the need for a more equitable distribution of resources to enable "vulnerable" groups to respond more effectively to increasing risks that are exacerbated by climate change. Third, it justifies the need for more place-based research and funding to facilitate the design and implementation of appropriate action on the ground.

There is an unintended downside to this narrative focused on victims and their needs, however. It depicts people with disabilities as dependent on others, completely overlooking their abilities and strengths in responding to risk. This further robs them of their voice and sovereignty.

The narrative must change to recognize people with disabilities as resourceful change makers. But this alone will not change their systemic marginalization or increase their resilience to risk. Narratives grounded in equity, justice, sovereignty, and strength must be accompanied by clear examples that show how people with disabilities can be agents of change in their own communities. This will help overturn negative stereotypes and provide others with role models to follow.

There is a disconnect between disability rights–based laws and disaster risk policies.

Changes also need to be made in societal and institutional cultures that too often reinforce the narrative of victimhood and pit different "vulnerable" groups against each other in competition for limited resources. And institutional structures and processes must change to enable people with disabilities and other "vulnerable" groups to have permanent and influential seats at the tables where disaster and resilience strategies are debated and policies are made.

OLD BARRIERS

The vulnerability of people with disabilities to climate change–related risk and other hazards is due to multiple and self-reinforcing socio-cultural, economic, political, and physical obstacles that they face in their daily lives. They are "dis-abled" by normalized structural and attitudinal barriers that focus on their differences instead of their aptitudes. This dis-abling process begins with how the broader society sees and values them and their contribution to society. In most cultures, people with disabilities are robbed (consciously or not) of their human agency and a public voice by enduring religious, charity, and medical models of disability.

The moral/religious model is the oldest one, found in several faith traditions. Disability is often regarded as a divine punishment for sins that may have been committed by a person with disabilities or their parents or ancestors. Children with disabilities may be seen as karmic punishment for their or their parents' (particularly the mother's) past behavior, so they are often hidden away to avoid ridicule and maintain family reputations.

The charity model is also rooted in religious ideas, but sees people with disabilities as victims of their circumstances and objects of pity. It is used to justify a culture of care and protection.

The medical model sees disability as a deficiency in physiological functioning, which requires individualized solutions to the perceived problem. People are judged to be physiologically impaired and therefore incapable of performing tasks within a normal range or making decisions for themselves.

Despite their differences, each of these models depicts people with disabilities as being "less than" others in some way, and in need of special treatment and care for functional or compassionate reasons. Not only does this create low societal expectations of their capabilities and lead to the loss of independence, choice, and control in their lives. It also reinforces needs-based social policy that is heavily skewed toward the provision of welfare to dependent recipients.

These negative attitudes are normalized in everyday practices and laws that curtail access to education and livelihood opportunities, social support systems, and public and private spaces. The resultant social and economic disadvantages are brutally exposed when disasters occur. People with disabilities are generally poorer than the general populace because of routine exclusion from opportunities to escape cycles of poverty and disadvantage. They typically reside in areas that are more exposed to climate-related hazards and events, in low-quality housing that is more likely to be damaged. Their access to the resources needed for timely evacuation and rebuilding efforts (most notably money and insurance) is limited.

In a disaster, people with disabilities face physical and environmental barriers to accessing shelter and safe spaces. Evacuation routes, shelters, transportation, and early warning systems are often inaccessible to people with different disabilities. People with mobility disabilities have been left behind in emergency situations because they were not assisted or accommodated by building designs and emergency plans. They have also been turned away from emergency shelters due to overcrowding and inaccessibility—no ramps to accommodate wheelchairs, doorways too narrow for wheelchairs to pass through, and inappropriate washroom facilities. When people with disabilities do gain access to shelters, they often face discrimination, harassment, and harm at the hands of other survivors.

People with disabilities are also less prepared for disaster events than those without disabilities. They often have little knowledge of possible hazards and how to reduce their risk levels. They have disproportionately low literacy levels due to limited or interrupted access to education. Access to information in accessible formats (sign language, simplified language, Braille) is limited, and mediums used to deliver emergency messages (television and radio alerts, door-to-door warnings, social media) are often inappropriate and inaccessible.

Deaf people find it difficult to communicate effectively with emergency responders due to differences in languages used (sign language and/or home signs versus the dominant spoken language of the "hearing world"). They also face a shortage of sign language interpreters, who are often caught up in the same disaster.

Vulnerability to risk is also gendered. Women, including those with disabilities, are more likely to be stranded at home during a disaster and less mobile post-event due to caretaking roles and traditional divisions of labor. Strong cultural norms in highly patriarchal societies can deter women from leaving male-dominated households during disasters for fear of social and familial recriminations. Discouragement of their participation in physical activity also means women are less likely to be able to swim or climb trees or structures to escape flood waters or tsunamis.

Disasters also lead to gender-specific disadvantages in the aftermath. Men may be given better medical assistance, greater access to food relief, and longer-term monetary assistance than women and girls. Strict social rules on gender mixing can hinder women's access to medical care if female doctors are unavailable. Women and girls with disabilities are at even greater risk of violence, physical abuse, and sexual exploitation after disasters. Persistent gender disparities in labor force participation leave women with less financial independence and connectedness to power than men.

Stereotypes that have historically characterized women as weak, naïve, passive, and dependent are amplified for women with disabilities and render them socially invisible. These disempowering stigmas are often reinforced in post-event disaster accounts that normalize cultural narratives of victims left helpless by their physiological limitations.

BIASED DISASTER MANAGEMENT

International frameworks and legally binding conventions—such as the 2006 United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), the Sendai Framework for Disaster Risk Reduction 2015–30, and the Incheon Strategy 2013–22—recognize that inclusion of people with disabilities and other marginalized groups in disaster management processes is a human right and must be factored into policy and practice. Under these agreements, people with disabilities must also be afforded the same right as any other citizen to equal participation in the design and implementation of disaster risk reduction policies and practices.

Yet there are still legislative, policy, and procedural barriers to disaster justice for people with disabilities. A disconnect remains between disability rights–based laws and disaster risk policies and practices. There is a lack of robust guidelines and examples for how to bring disability-inclusive disaster risk reduction (DiDRR) into mainstream policymaking.

Current disaster management paradigms and response plans are biased toward helping the already privileged and physically abled. Disaster provisions for those with disabilities tend to be included as "add-ons" to core plans, and are often seen by disaster managers as a costly burden that requires specialist services and expertise. Such biases force different "vulnerable" and marginalized groups to compete against each other for limited resources, which deters collaboration and duplicates effort.

Disaster risk reduction actors, emergency responders, and humanitarian aid organizations

often have little knowledge or training on what people with different disabilities need before, during, and after events. Consequently, they lack the skills and capacity needed to mainstream more inclusive practices. In government agencies, there is often limited (or no) application of universal design principles to guide the making of environments, products, and communications that are accessible to everyone.

A lack of baseline data and clear legal and practical DiDRR directives undermines enforcement, accountability, and the measurement of results. Too often, no single overarching authority is tasked with ensuring adherence to inclusive policies.

But one of the biggest barriers to achieving greater disaster justice is the lack of clear pathways and platforms for people with disabilities, their representative organizations, and disability advocacy groups to be routinely included in disaster risk reduction policy, planning, and implementation processes. These processes are largely top-down and rigid, lacking adequate mechanisms (such as cross-sector policies and structures) to ensure the inclusion and active participation of people with disabilities.

There are few platforms to link disaster risk reduction managers and humanitarian organizations with those who have the skills and knowledge they lack—disability support organizations and people with disabilities themselves. As a result, disaster authorities and disability groups often act in isolation from one another, which impedes coordination and implementation of inclusive policies.

Disaster authorities and disability groups often act in isolation from one another.

RECOGNIZING SOVEREIGNTY

There is no doubt that people with disabilities are highly vulnerable to climate change risk. But the more important story is their resilience and strength. This resilience is developed over a lifetime as they navigate, cope with, and overcome multiple socially constructed barriers in a world that routinely sees them as deficient or "less than" others in some way.

Society, as well as disaster risk reduction decision-makers and actors, must recognize people with disabilities as the resourceful change makers that they are, or can be, if they are given the right support. These narratives need to be grounded in principles of equity, justice, and sovereignty. This position aligns with the social and human rights models of disability.

The social model of disability views disability as a social construct. The problem, therefore, lies with society and not the individual. Adherents of this model see disabilities as normal human variations. They blame discriminatory laws, institutions, and politicized practices for "dis-abling," discriminating against, and oppressing people with impairments that fall outside the medically determined spectrum of "normal functioning." Their focus is on anti-discrimination laws rather than welfare programs.

Anchored in the UNCRPD, the human rights model of disability similarly recognizes the disabling conditions that exclude people with disabilities from all aspects of daily life, but goes further. It focuses on both the multifaceted individual (who has multiple social identities) and the societal context that creates and perpetuates intersectional discrimination. It proffers a set of moral principles and values to underpin transformative disability policy and processes. Central to this model is recognition of the inherent dignity and self-worth of people with disabilities. It affirms that they are entitled to the same respect and civil, political, economic, social, and cultural rights as others—most notably the right to speak for oneself and be heard.

Here, the importance of individual sovereignty comes to the fore. This principle encompasses the unique authority over the jurisdiction of one's body and the right to give or withhold consent over what becomes of that body. Sovereignty also includes self-determination: the unique authority over one's actions and choices, and the right to express one's individuality in thought and feeling. Most critically, sovereignty calls for societal recognition of and compliance with both of these conditions.

TRANSFORMING DISASTER RESPONSE

People with disabilities are the experts on their own lives. They are best placed to inform and shape disaster risk reduction and response plans that are inclusionary and in compliance with both the UNCRPD and the Sendai Framework, which adopt this human rights approach to disability.

To counter negative stereotypes and provide others with role models, narratives emphasizing

sovereignty, ability, and strength must be supported with examples of people with disabilities being agents of change in their own communities. There are growing numbers of such examples in the disaster space. In a decade of collaboration with the Deaf community (defined here as those who identify as being culturally Deaf and use sign language as their preferred language), I have come across some inspirational individuals and organizations that are paving the way for greater inclusion of Deaf people in disaster risk reduction and response.

One such group is International Deaf Emergency (IDE), a disabled people's organization (DPO) that was founded and is run predominantly by Deaf people. Its mission is to bridge the language, communication, and relationship gaps between Deaf people (as well as those with any form of hearing impairment) and emergency services in order to promote greater inclusivity in disaster policy and practice. The aim is to improve pre-disaster preparedness and mitigation, disaster rescue and relief, and post-disaster rehabilitation, reconstruction, and recovery for Deaf people and those with hearing impairments.

IDE has contributed to humanitarian work in Haiti (most notably after the 2010 earthquake), China, and Nepal, becoming an internationally recognized disability advocacy group. Its success in advocating for greater inclusion of people with disabilities in disaster policy and practice is a function of its connectedness to avenues of power and influence. IDE has secured direct consultation status with the UN and the European Union, with the backing of the World Federation of the Deaf.

Another notable group is the Deaf Disaster Assistance Team–Disaster Risk Reduction (DDAT–DRR), an independent DPO in the Philippines that was established by and for Deaf and hard of hearing people. DDAT–DRR educates communities on emergency preparedness and advocates for equal access to disaster information. It also trains Deaf, hard of hearing, and Deaf–Blind people to lead workshops with local and provincial government emergency and health services to heighten awareness of their communication needs during emergencies.

In another example of promoting inclusion, the Deaf Society of the Australian state of New South Wales worked in collaboration with the state's emergency services to increase the resilience of Deaf community members to escalating climate-related hazards. A key component of this 2015 project was the training of volunteer Deaf liaison officers to form a bridge of trust, cross-cultural knowledge, and collaborative action between the Deaf community and emergency services.

The liaison officers design and lead community preparedness workshops for Deaf people and Deaf awareness training for emergency services personnel. They advise those personnel on accessibility and cultural appropriateness standards to consider when developing new resources and campaigns, and have assisted in the making of preparedness videos. They also consult on and take part in emergency services training, giving staff first-hand experience interacting with Deaf people in simulated disaster situations.

IDE, DDAT-DRR, and the Deaf liaison officers in New South Wales have been instrumental in advocating for and facilitating inclusive disaster management and greater sovereignty for people with disabilities. Their work on raising awareness of the needs and capabilities of people with disabilities and DiDRR training has increased the knowledge and capacity of disaster authorities, enabling them to work more effectively with Deaf, Deaf-Blind, and hard of hearing people in order to support them before, during, and after dangerous events.

These initiatives have also helped to bridge the cultural divide between emergency services and Deaf community members and create pathways for ongoing engagement. Most importantly, they have helped redress the enduring stigma, discrimination, and systemic marginalization faced by people with disabilities in society, specifically within institutions responsible for disaster management. Their successes can provide other DPOs with models for effective engagement with disaster risk reduction processes.

Yet such successes do not occur in a vacuum. They are constrained by existing socio-political structures and processes that award more power, freedoms, and resources to some groups, while restricting the entitlements and influence of others. Many DPOs still lack adequate information on disaster and climate risks, appropriate responses, and policy frameworks. They are largely unaware of existing programs and often lack the funding needed to advocate for greater support.

FULL PARTICIPATION

Political will is essential to transforming disaster risk reduction and climate change programs to ensure that people with disabilities are not further marginalized. People with disabilities and their

representative organizations have the right to participate in disaster policy planning, implementation, and monitoring processes. Accessible and appropriate platforms must be provided so that they can help shape equitable, just policies for disaster management and other aspects of climate adaptation.

Both the UNCRPD and the Sendai Framework affirm the right of people with disabilities to have a permanent, influential presence in forums for debating and shaping policy on disaster response and resilience. This requires the removal of the physical, informational, communication, and other barriers that prevent their full participation. Among other steps, this means ensuring that physical or virtual sites for meetings are accessible to people with a diverse range of disabilities or impairments, and delivering information in accessible formats, providing sign language interpretation and Braille materials when needed.

Such changes must also be backed up by enforceable legislation and measurable targets. But for that to happen, power must be ceded and shared. This is not yet happening at the scale needed to bring about sustained, transformative change.

The key to achieving greater equity for people with disabilities in everyday life, and particularly in disaster risk reduction and climate change responses, is learning either how to work within existing institutional processes and structures, or how to create new landscapes of power, recognition, and opportunity. Having structures and processes in place to foster greater equity in disaster policy and practice is not enough. Disability advocacy groups and disabled peoples' organizations need to know how to use them to their best advantage.

This is best done collectively, with the aid of allies that have links to power. Social actors like IDE that simultaneously exploit all the opportunities available to them—through the development of strategic partnerships with institutions such as the UN, the EU, and the World Federation of the Deaf—experience greater success in securing the resources they need and the results they desire.

Highlighting and drawing on the strengths and diverse perspectives of people with disabilities will help bring about the design of more robust and inclusive disaster risk reduction and climate adaptation processes that uphold disability sovereignty. This transformative process will require collective action by governments, risk and adaptation experts, civil society, disabled peoples' organizations, and people with disabilities themselves. We are all part of the solution. ■

Violent Silence: The Erasure of History and Justice in Global Climate Policy

PRAKASH KASHWAN AND JESSE RIBOT

Many people know the insult of being looked at and dismissed—erased on account of their color, gender, orientation, age, ethnicity, caste, class, religion, profession, or disability. They know what it means to be feared or derided and then avoided. These denials do damage, excluding people from the everyday courtesies of being recognized and affirmed. By blotting out their claims to equal recognition in the world and their histories, these erasures also perpetrate a second layer of violence, silencing explanations of the causes behind the damage they must bear.

Many individuals, communities, and nations live in a climate of injustice perpetrated by the failure to acknowledge history—the causes of, and therefore the responsibility for and solutions to, their pain and suffering. Climate change politics and status quo policies are complicit in occluding the causal histories that turn weather events into crises. Bringing causality back in, however, identifies the origins of unjust vulnerabilities, so they might be attended to—thus enabling people to adapt both to present and to changing climate stress.

A drought or storm may seem like the cause of the hunger and dislocation that follows. But the weather can only launch crises when those in its path are already exposed and precarious. Without attending to both causes and solutions for underlying precarity, climate advocacy can contribute to hiding the roots of climate-related crises, giving rise to new injustices. Unless they address the historical injustices that have generated precarity on the ground, climate action (particularly adaptation) and advocacy risk deepening the very crisis they seek to resolve.

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Justice movements can backfire by misrepresenting those affected by injustice, despite progressive intentions. Climate change discourse and advocacy is permeated by such intersecting injustices. Northern agendas and frames of discussion dominate debates and action, and the focus on climate change (despite its importance) obscures longer-term causes of exposure and precarity that enable weather events and trends to trigger crises.

US and European climate movements now seek to "integrate" a social justice perspective as part of an agenda of radical climate action, yet they do not represent those for whom they speak. As historian Jennifer Thomson has argued, an influential contingent of climate justice activists in the United States imagine themselves to be "New Abolitionists" selflessly "speaking for the masses that are unable to speak for themselves," including the poorest people in the poorest countries. This exported justice agenda focuses on climate, diverting attention from the inequalities that make people vulnerable and make climate events—whether ordinary or intensified by global change—dangerous in the first place.

WHO SHOULD PAY?

Responsibility is a key term in climate justice, as in any other arena. But over time, discussions of responsibility seem to have become less central in climate-action politics. Governments in the global North and South alike are now blaming the climate and weather for crises that stem from inequality—avoiding blame for conditions that they created and could redress. This is not to deny that they are changing the climate; they certainly are. But they also created the precarities on the ground that allow ordinary or new climate events to cause disasters.

In international climate change negotiations, countries in the global South demand that the global North pay to address the climate-related

crisis that it caused. Unfortunately, these demands for reparations are about funding only the "adaptations" required to avoid additional damage associated with increased climate hazards. Invoking the Polluter Pays Principle (PPP), they neglect to demand reparations for the vulnerabilities also produced by the long history of Northern domination and extraction—let's call it the Exploiter Pays Principle (EPP).

We know the history of extractive relations that created the marginality and poverty that makes people vulnerable in the face of climate events. Historians and social scientists find this self-evident. But many technocrats and climate scientists do not recognize that vulnerabilities have historical causes, an omission that can be seen in many "climate impact" models (as if damages that follow climate events can be assumed to be "impacts" of climate). This blind spot is what enables the technocratic climate establishment to insist on merely shielding people from climate events or paying for those "additional" damages that they associate with climate stress—damages calculated from a snapshot of precarious social arrangements that are seen as having no causes.

The precarities that climate change finds already in place are taken as a given—as "initial conditions." But these conditions have histories and causes that can be traced back to the same powers that generate carbon emissions. Thus, to avoid mere climate proofing, "adaptation" funds and ordinary "development" assistance must merge—and be considerably augmented—to redress the conditions that enable climate to cause damage. Applying the PPP, we can identify who polluted and assess who is affected. So why not also apply the principle that the colonizer or exploiter pays—our EPP?

There has been a notable recent uptick in references to climate justice in global climate debates. Climate policy analysts often acknowledge that climate change exacerbates existing vulnerabilities. For example, they have argued that climate adaptation finance should not come at the cost of international development aid, which seeks to address socioeconomic vulnerabilities in some cases. This seems to be the underlying logic in the negotiations on adaptation finance, where developing countries have demanded transparent accounting and separation of climate finance from "normal" development assistance.

By creating a fundamental distinction between development aid and climate adaptation finance, this stance reinforces the dominant understanding that vulnerability to climate change exists independent of historical injustices that international aid may address. Instead, there is a need to strengthen international aid and improve its effectiveness for addressing the historical injustices and underlying socioeconomic inequalities that make the changing climate a stratified crisis. The damages it triggers are a function of vulnerability.

The crises of rain-fed farming and other rural livelihoods in West Africa—from long ago to the present—have been wrongly attributed to the weather and climate change. Farmer suicides in India are also being attributed to climate change. Scientists, the media, and politicians tend to prefer blaming the weather to asking why people suffering hunger, famine, dislocation, or suicides are vulnerable in the first place. They fail to examine the origins of exposure and precarity.

Governments are blaming the climate and weather for crises that stem from inequality.

It is easy to blame the weather or even the climate for the precarity of farmers and pastoralists. It merely requires the erasure of history. Just assume that the problems of people who are fleeing their homelands, killing themselves, or going hungry start when the weather varies—never look back at the histories that placed these rural producers on a cliff of precarity such that even a little wiggle in the weather could push them over the edge.

FROM FAMINES TO 'CLIMATE REFUGEES' IN THE SAHEL

Past famines in the West African Sahel and recent Europe-bound migrations from the region have been widely blamed on drought. As anthropologist Jacqueline Solway wrote in 1994, "Drought is a perfect scapegoat; all social and economic dislocation and suffering can be attributed to the drought and underlying problems can be left unacknowledged and, therefore, unconfronted."

The conditions that enabled widespread hunger and famine in the Sahel, and that more recently have spurred outmigration, were established by a long history of colonial and postcolonial exploitation. Climate-change narratives allow former colonial powers, international donors, and current

governments to blame climate, rather than their own policies and actions, for the deep inequalities that make migration preferable to staying in place for most pastoralists and farmers.

Massive hunger and dislocation to the cities and neighboring regions followed severe drought in the Sahel in the 1970s and 1980s. In their 1980 book *Seeds of Famine*, anthropologist Richard Franke and sociologist Barbara Chasin describe the historical roots of this crisis. The precarity of Sahelian farmers and pastoralists was caused by colonial and postcolonial policies promoting export-oriented agricultural monocropping and the sedentarization of nomadic pastoralists to encourage adoption of commodity production systems sought by governments to boost export earnings and tax revenue. Traditional farming and pastoral practices had been diversified for risk management and adapted to local and regional weather patterns. Colonial policies made farmers dependent on drought-sensitive crops and hindered pastoralists from moving to better pastures following their normal drought response.

Geographer Michael Watts titled his 1983 book *Silent Violence* after this creeping production of widespread vulnerability that left farmers and pastoralists exposed. Living on the edge, even a localized drought could push them into crisis. Recurrent dry periods in the 1970s and 1980s sent them over that low threshold into famine. The former colonial powers and most of the newly independent Sahelian governments blamed the crisis on drought. But social scientists such as Franke, Chasin, and Watts viewed it as a product of colonial deprivations and cruel policies. From the slave trade and colonial extraction to green revolutions and neoliberal economic policies, little attention was paid to local security and well-being.

Adding insult to injury, Northern development experts and Sahelian government agents blamed the "irrational" behavior of Sahelian farmers and pastoralists for "desertification" and the drought. Yet, as climate scientists Michela Biasutti, Alessandra Giannini, Kate Marvel, and Céline Bonfils have recently established, these Sahelian droughts were actually caused by European and US industrial emissions that shifted hemispheric sea-surface temperatures. While severe, these droughts would have triggered much less damage if Sahelian farmers and pastoralists had been more secure and able to exercise traditional coping strategies. Instead, the droughts were triggers for a devastating crisis that perhaps merits retroactive evaluation of responsibility and reparations.

As is now evident, the crisis was a result of the precarity left in place by colonialism and neocolonial policies; the triggering climate events were also generated by Europe and the United States. Both precarity and drought stemmed from Northern policies.

More recently, trans-Saharan migration from the Sahel toward Europe has been attributed to global climate change. Here, too, the diagnosis is deeply flawed. A recent case study of migrants traveling toward Europe from Tambacounda in eastern Senegal (by Papa Faye, Jesse Ribot, and Matt Turner, in a 2020 issue of *Public Culture*) shows that extreme precarity due to exploitative policies explains the new wave of departures. Despite prevalent discourses of drought-driven migrations and the media's labeling of these farmers as "climate refugees," the rains have generally been improving across the region over the past 20 years, along with harvests.

When asked why they are leaving, the Senegalese farmers never talk about the weather. They talk about subsistence anxiety, the low prices of peanuts, cotton, and charcoal, and having no sense of a livable, dignified future in Tambacounda. Yet just as in the 1970s and 1980s, when drought was blamed for a crisis of vulnerability, scientists and the media now blame global climate change for migration decisions rooted in local struggles—obscuring the causes of suffering that are only tangentially related to weather.

Northern fears of "climate refugees" and "climate migrants" are now being imposed on West Africa and many other parts of the world. In an attempt to bring greater attention to climate change by highlighting the crises it will generate, climate scientists and activists project a near future when millions of poor southerners will flee over land and water from droughts, floods, or rising seas. The narrative's power comes partly from the image of masses fleeing toward Europe, which helps mobilize climate activism in Europe. But while it evokes sympathy, this narrative also stirs up xenophobia by raising the specter that some Europeans fear more than climate change—an inundation of foreigners, of dark people infiltrating their purity.

FARMER SUICIDES IN INDIA

Obfuscation of complex and multiple causes of vulnerability also has serious consequences in

India, as illustrated by the epidemic of farmer suicides. Data from India's National Crime Records Bureau (NCRB) shows that 296,438 farmers committed suicide from 1995 to 2013, averaging over 16,000 deaths a year. These suicides have continued. Although the data likely reflect an undercount amidst the COVID-19 pandemic, the NCRB reports that a total of 10,281 farmers and farm laborers died by suicide across the country in 2019.

There is little doubt that the impact of climate change on seasonal weather patterns such as the frequency, duration, and intensity of monsoon rains exacerbates the misery of India's farmers. Yet farmer suicides result from a long-festering agrarian crisis, deepened by austerity measures that led to the decimation of an already weak agriculture extension and credit system, poor physical and market infrastructures, and the failure of successive Indian governments to develop the rural nonfarm sector of the economy.

Even so, a widely circulated study by economist Tamma Carleton, published in 2017 in *Proceedings of the National Academy of Sciences*, attributed 59,300 farmer suicides to the added stress effects of global warming over the last 30 years. But Indian journalist P. Sainath, who is known for his lifelong work on India's agrarian crisis and wrote the 1996 classic *Everybody Loves a Good Drought,* argues that blaming farmer suicides on climate change avoids addressing deep-seated structural and policy failures. The ongoing farmers' movement in India has also highlighted these questions. Tens of thousands of farmers have protested for months in New Delhi against agricultural reform laws passed in September 2020.

In an extensive review of various aspects of farmers' suicides in India, published in the journal *Life Sciences, Society and Policy* in 2017, Gigesh Thomas and Johan De Tavernier found that although the Indian state has instituted various committees and inquiries to examine the problem, it has consistently ignored their recommendations for supporting small and marginal farmers. Meanwhile, successive Indian governments have implemented and institutionalized damaging pro-market reforms, which defunded agriculture extension programs, weakened state-supported rural credit provision, and allowed greater penetration of agribusiness operations.

Economist Utsa Patnaik argued (in a 2002 article in *Social Scientist*) that the root causes of the crisis in agriculture and other rural livelihoods in India—and much of the global South—date back to the emergence and subsequent dominance of highly mobile and fluid forms of global finance in the wake of the 1970s oil shocks. (We now know that this was also the juncture when Exxon and other fossil fuel companies sowed the poisonous seeds of climate denialism.) The World Bank and the International Monetary Fund imposed deflationary policies that required cutting government spending, maintaining high interest rates, and providing opportunities for global financiers to pursue unrestrained speculative gains.

Patnaik's work suggests how such deflationary fiscal policy regimes are comparable to colonial regimes, which also facilitated free flows of cheap goods and human labor, under slavery or other forms of bondage, while protecting consumers and financiers in the colonizing countries. The suicides in India are largely associated with farmers' debt and market volatility and exploitation caused by these historic and contemporary flows of transnational finance.

Many technocrats do not recognize that vulnerabilities have historical causes.

The United Nations has showcased India's crop insurance program, covering 40 million farmers, as a successful case of climate risk mitigation and adaptation. Yet instead of addressing the structural causes of farmers' vulnerability, the government seeks to privatize crop insurance. In 2017, the federal watchdog agency, the Comptroller and Auditor General of India, implicated the state-owned Agriculture Insurance Company for paying up to 36.2 billion rupees (around $500 million) in premium subsidies to 10 private insurers without due diligence between 2011 and 2016.

Meanwhile, farmer suicides continue unabated. In July 2017, the Supreme Court of India reprimanded the government for its recurring failures to protect "hapless farmers." But instead of bolstering protections for farmers, the government in January 2018 made it more difficult for states to qualify for federal aid for drought-affected populations.

India and other rapidly growing economies seek concessions in international climate negotiations by arguing that national efforts to address poverty must take priority. While hiding behind their poor in these talks, they fail to address widespread

poverty and marginalization with domestic policies. Mainstream climate narratives (including those focused on climate justice) that do not recognize either the legacies of colonialism or the domestic socioeconomic origins of inequalities help national leaders cover such failures under simplistic explanations of climate impacts. When history and context are erased, leaders are free to cynically exploit the poverty of their citizens as a bargaining chip.

MODELS OF JUSTICE?

Sidestepping of the social causes of—and responsibility for—climate-related loss and damage is explicit in the language of international agreements. Article 8.1 of the United Nations Framework Convention on Climate Change (UNFCCC)'s 2015 Paris Agreement states: "Parties recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage." Item 52 of the Paris Agreement's document of adoption, however, sets responsibility aside by affirming that "Article 8 of the Agreement does not involve or provide a basis for any liability or compensation."

This language is absurd. If we show that losses or damages follow from specific actions—those that create vulnerabilities or change the climate—then there is always the possibility of establishing liability within the law or politics. The link between cause and intention or negligence is basic to establishing culpability in tort law. Even if the language of immunity were legally binding, making this link visible would still enable public demands for accountability and compensation—via political engagement.

Obfuscating UNFCCC language perpetrates a double injustice. First, it is telling the guilty parties that they are immune to prosecution—an assertion that remains to be tested in the arenas of law and politics. Second, it steers analysis away from social causality. Even the language used in the Loss & Damage section of the Paris Agreement refers to "climate change impacts" and "loss and damage associated with the adverse effects of climate change." Note that both phrases implicitly attribute the cause of damages to the climate itself, while erasing any references to historical and existing vulnerabilities in societies.

Recent studies by the Intergovernmental Panel on Climate Change (IPCC) are bringing social and historical causes into discussions of the effects of climate change, but still underplay their effects. Their starting point for analysis remains shallow, rooted in agent-based computational models in which quantifiability often determines the factors that are counted. Not all relevant causal factors are either quantifiable or reducible to computation. Those criteria exclude the bulk of social and political-economic or structural determinants. These can involve traceable processes that may be unique or so locally contingent as to require description rather than quantification. Many such cases may ultimately be codified into quantifiable variables, but this is not always possible.

Although they acknowledge distributional inequalities, the IPCC reports frame their analysis of vulnerability by identifying, in very general terms, *who* is vulnerable—paying inadequate attention to *why* different groups are vulnerable. When the UNFCCC and others call for an assessment of vulnerability as part of their adaptation strategies, are they asking us to identify who is vulnerable, or are they aiming to understand the causal chains behind such vulnerability?

The latter would draw attention to the many causal elements that might be addressed to reduce vulnerability. Such analysis would also establish links to those responsible, helping to apportion blame and make the case for reparations. But instead of asking why people are vulnerable, vulnerability assessments rarely go beyond establishing who is vulnerable and some proximate causal variables such as poverty—as if poverty is just a terrible condition without cause. In a full analysis of vulnerability's causes, the origins of poverty would have to be included.

The Global Goal on Adaptation, included in the Paris Agreement, is forward-looking in a way that neglects analysis of past causes. Its stated objectives are "to enhance adaptive capacity and resilience" and "to reduce vulnerability, with a view to contributing to sustainable development." The UNFCCC accordingly now calls for assessments of progress in vulnerability reduction and adaptation policies. But it merely requires an understanding of how much more secure a person or community has become in the period that the assessment deems relevant. The longer history that produced the vulnerabilities in the first place is thus erased. While short-term achievements are important to understand, studying longer-term causes might help identify the basis for achieving greater justice and more durable security.

LOOKING BACK FOR WAYS FORWARD

Who is responsible for supporting—through finance and policy—climate-related adaptation? (We use the adjective "climate-related" since adaptation really entails reducing social vulnerabilities that exist independent of the weather, though they enable weather events to wreak havoc.) Without an analysis of the root causes of social vulnerabilities in the Sahel, India, and elsewhere, there can be only a superficial indication of responsibility, at best.

Effective adaptation comes with understanding the origins of the structures within which the agents of agent-based models act. It requires addressing the full range of both immediate and root causes. Those who pump excess (not basic needs–related) emissions into the atmosphere should, of course, be blamed for climate change. But the histories behind the existing fragilities that a changing climate encounters also must be examined if security is to be enhanced.

Effective adaptation requires addressing the full range of both immediate and root causes.

Too often, when loss or damage associated with a given climate hazard is measured, the "initial" conditions found in place are taken as given—as if the history of exploitation that produced vulnerability never happened. Europeans, as the anthropologist and historian Eric Wolf observed in a 1982 book, have long viewed the poor and the colonized as "people without history." Such erasure of history is the mother of all injustice.

Were the people most affected to have a real say in the agenda, both their precarity and its multiple causes—well beyond the singular insult of climate change—might be taken into account. Yet the Paris Agreement, while adopting an ambitious and admirable goal of limiting global warming to 1.5 degrees Celsius above pre-industrial levels, also includes Article 52, which attempts to dismiss any possibility of determining historical responsibility, whether for emissions or for vulnerabilities.

As historians Jo Guldi and David Armitage urged in their 2014 *History Manifesto*, we must acknowledge and analyze the multiple long-term causes of the concentric social, economic, and ecological crises that produce the current global crisis, and the many local crises of which it is constituted. To do so, we must also uncover the institutionalized assumptions—such as those incorporated in the models used by the IPCC, the policy instruments of the UNFCCC, and the Paris Agreement—that avoid history, spurred by the desire (or compulsion) of some parties to avoid responsibility and blame. This is violent silence.

A just response would not merely treat precarity as a climate phenomenon. It would see vulnerabilities for the colonial and neocolonial legacy they represent. It would acknowledge that responsibility arcs to the North both through the sky, in the form of climate change, and over land, through the history of extractive violence. Ungag history—its silencing perpetuates such violence. ■

A Case for Extreme Climate Action

KEITH MAKOTO WOODHOUSE

Anyone interested in learning how to blow up a pipeline will be disappointed by Andreas Malm's latest book, which offers little in the way of technical advice. For insight into setting explosives, wielding a cutting torch, and avoiding detection, such readers will continue to rely on older works like William Powell's classic *The Anarchist Cookbook*, or *Ecodefense: A Field Guide to Monkeywrenching*, a detailed how-to manual for enterprising saboteurs edited by Dave Foreman and the pseudonymous Bill Haywood.

How to Blow Up a Pipeline
Andreas Malm
Verso, 2021

Few people are actually contemplating clandestine attacks on major infrastructure, which is why Malm doesn't concern himself with matters of technique and instead thinks through the political, moral, and strategic questions raised by sabotage and property destruction. Those wrestling with the applied ethics of sabotage will be richly rewarded by this short and pointed book, but so will anyone in the larger audience at which Malm aims: people who consider climate change a rapidly unfolding catastrophe that demands an immediate response. The first group makes up only a fragment of the second, and Malm has no illusions about the transformative potential of pipeline demolition. Whatever power such isolated acts of destruction might hold lies only in catalyzing large-scale political change.

At the heart of *How to Blow Up a Pipeline* are two questions, one concerned with justification and the other with attribution. The first is whether sabotage and violence—in the form of property destruction—are useful tactics for climate activists. The second is about where to lay blame for the climate crisis.

MEANS AND ENDS

The first question is likely to divide any sizable set of environmentally minded respondents. Some will immediately say either "Definitely" or "Absolutely not," and many will equivocate. The book's answer is made fairly clear by its title and much more so by its content. Malm is not one to equivocate. His goal is less to weigh the relative merits of different arguments than to establish what strikes him as patently true, and the stridency of his writing is seductive and often convincing.

In his 2017 book *The Progress of This Storm: Nature and Society in a Warming World*, in some ways a more theoretical companion to *How to Blow Up a Pipeline*, Malm argues against the sort of scholarly fixation on hybridity that seeks to blur the lines between human society and nature. He favors drawing sharp if complex distinctions in order to "clarify the stakes and gather the forces." *The Progress of This Storm* spends many of its pages navigating abstruse academic debates, but its aim is to hack through that dense foliage in order to clear a path for decisive action so that those so inclined might "let go of everything else and physically cut off fossil fuel combustion, deflate the tyres, block the runways, lay siege to the platforms, invade the mines."

According to Malm, the current crisis makes mass action absolutely essential, and sabotage by small groups and resolute individuals increasingly necessary. *How to Blow Up a Pipeline* presents this view methodically and insistently. It quickly reminds us of the stakes: massive forest fires, searing droughts, floods and mudslides, hurricanes (and typhoons and cyclones), and much worse to come—all of these disasters engendering social strife and falling disproportionately on the most vulnerable and least culpable communities. It characterizes the political response so far as not only insufficient but counterproductive: the agreements reached at the various United Nations climate summits since 1995 have been anemic, while many nations continue to wantonly extract fossil fuels and build associated infrastructure. And it attacks the various arguments against the use of

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violence, saving particular scorn for the theory of strategic pacifism.

Malm is not only a scholar and activist but something of a protest camp philosopher of the climate movement. He doesn't speak from a lectern to an audience of moderates and skeptics; he shouts through a megaphone to an already impassioned crowd. He argues most vehemently with peaceful climate activists because they are the ones he most hopes to convert.

Extinction Rebellion, the direct-action climate group that emerged in Britain in 2018, occupying intersections and offices and blockading bridges and railroads, is one of Malm's favorite foils. The readiness of Extinction Rebellion activists to engage in civil disobedience makes them rowdy compared with, say, the Environmental Defense Fund, while their commitment to nonviolence makes them straitlaced compared with the Earth Liberation Front. This is a familiar position along the spectrum of environmental activism, traditionally occupied by groups like Greenpeace and Rainforest Action Network.

Greenpeace, which pioneered the art of attracting public attention to environmental causes through bold direct actions—most famously, steering inflatable motorboats between whales and harpoon guns—has never tolerated violence of any sort. In 1977 Greenpeace expelled Paul Watson, one of its original members, for his flexible interpretation of nonviolence, and he went on to found the Sea Shepherd Conservation Society. Watson judged Greenpeace tactics incommensurate with the acute threat posed by whaling; whereas Greenpeace vessels simply bore witness to the slaughter, Sea Shepherd's ships slammed their hulls against whalers to make clear they meant business.

Malm has a bit of Watson in him. He sees in Extinction Rebellion a group of passionate activists pursuing an outdated strategy for all the wrong reasons, most naïvely a dedication to pacifism as the most effective means of achieving political goals. Extinction Rebellion claims that violence is antidemocratic and has historically worked against progressive change by alienating the public. To refute this claim, Malm rehearses analogy after analogy, citing abolitionists, suffragettes, civil rights activists, and the fight against South African apartheid, arguing that in each instance violence was not just an acceptable but an essential tactic. Malm insists that in most cases it has been the existence of a "radical flank" ready to use confrontational and even violent methods that has cast nonviolent protesters and their demands in a comparatively favorable light.

Political change, for Malm, arises from this sort of triangulation: militants present such a bitter extreme that policymakers develop a taste for negotiating with reformers. Government action is the eventual goal—"At the end of the day," Malm writes, "it will be states that ram through the transition or no one will"—but policymakers are so beholden to propertied interests that they cannot be trusted to act on their own. It is the job of activists to prod those in power, and nonviolent demonstrations are often too blunt a tool. Even Robert Hunter, who helped found Greenpeace, began to doubt nonviolent activism by the 1980s. "So far," he admitted, "history has not shown much evidence that the strategy is inevitably going to triumph."

Historical analogies aside, is there any evidence that property destruction can advance the climate movement? That's difficult to say, given the variety of tactics activists have simultaneously employed. The politics of pipelines offers, at best, an ambiguous record. Arguably the most decisive pipeline conflict so far has been the fight over the Keystone XL extension from Alberta to Nebraska, which the Canadian company TC Energy canceled in June 2021. That fight involved little in the way of sabotage; instead, the coalition of groups that opposed Keystone XL relied on legal challenges and nonviolent civil disobedience. The ongoing struggles against other North American projects, from Dakota Access to Enbridge Inc.'s Lines 3 and 5, have been pursued with vigor and moral force by a coalition of groups and interests arguing that these pipelines violate environmental regulations, Indigenous treaty rights, and common sense.

What is the climate movement fighting against? Who is to blame?

As Malm rightly points out, the Dakota Access fight has also featured property destruction: Jessica Reznicek and Ruby Montoya of the Des Moines Catholic Worker community set fire to heavy machinery and cut through the pipeline itself in a series of attacks in 2016 and 2017. This was a daring undertaking—Reznicek has been sentenced to eight years in prison and Montoya is awaiting sentencing—but it's unclear whether it advanced broader opposition to the pipeline. The elevation of Dakota Access to an international

cause is probably due most of all to the involvement of Indigenous activists and their commitment to nonviolent protest.

It seems clear, though, that pipelines are vulnerable and that strikes against them can be consequential. Reznicek and Montoya temporarily prevented millions of barrels of oil from flowing through Dakota Access. A recent cyberattack against the Colonial Pipeline in the southeastern United States—not the work of environmentalists, as far as we know—knocked that conduit offline for nearly a week. If general disruption is the goal, pipelines are a tempting target. But should that be the goal?

CASTING BLAME

Against whom or what should sabotage and property destruction be used, and why? The question of target selection—and, by extension, of culpability—is the second conundrum Malm confronts. What is the climate movement fighting against? Who is to blame?

Malm is both explicit and cagey about finding fault. He is explicit in that he points again and again to "the ruling classes" as the primary cause of climate change and the major obstacle to its amelioration. He is less clear about who constitutes this rarefied group.

Climate activists tend to lay blame somewhere along a spectrum running from a handful of corporations to all of humanity. Sticking to either end of that spectrum is simplistic, but determining where to come down between them is confounding. Despite the title of his book, Malm spends a lot of time discussing the merits of targeting SUVs and other "CO_2-emitting property." The production of fossil fuels is not the only problem, he sensibly points out; consumption matters as well. Some consumption is clearly necessary, however, so activists should focus on "luxury emissions" from sources like private jets and superyachts—playthings of the rich.

It's hard to argue against directing a great deal of scorn and maybe some creative monkeywrenching at jets and yachts, but it's harder still to actually reach them. SUVs are closer at hand. Still, is someone who drives a Ford Explorer necessarily a member of the ruling class? Does it matter whether a vehicle is used primarily for work or pleasure? Should activists also target minivans and pickup trucks, given their relative cost and poor fuel efficiency? Consumption matters, but attacking the property of private individuals about whom activists know next to nothing seems like a recipe for misjudgment and backlash.

Another option is to assume that mere participation in industrial civilization comes with a degree of liability, an assumption that expands the range of acceptable targets considerably. Malm rejects this position. He has no truck with those who place undifferentiated blame for environmental harms on humanity as a whole, a tendency that he associates with the ideologies of deep ecology and animal liberation, and so with groups like Earth First!, the Earth Liberation Front, and the Animal Liberation Front. These groups engaged in sabotage and property destruction, but Malm judges them theoretically unsophisticated because they condemned human activity in sweeping and misanthropic terms, as well as strategically ineffective since they failed to coordinate their clandestine actions with a mass movement.

This is a common appraisal, but not at all a fair one. Some deep ecologists delved into misanthropy (Paul Watson was notable in this regard) and some did not; for most of them, the basic relationship between people and nonhuman nature remained an open question. It is true that Earth First! never limited its denunciations to the ruling classes or the fossil fuel industry, and Malm chides deep ecologists for assailing all industrial development, whether fueled by coal or by wind. But while climate change is the greatest environmental threat it is not the only one, and if the age of fossil fuels is replaced by an age of extracting lithium and paving over deserts to build massive solar arrays, we may end up trading one set of social and environmental costs for another.

Earth First! did tend to cast blame too widely, finding fault with loggers as easily as with timber industry CEOs. But its acts of sabotage were never the sort of wild volleys at a ubiquitous enemy that Malm suggests; they were instead careful and strategic gambits. Earth First! members constantly debated how they should position their own campaigns—whether overt or covert—relative to the mainstream environmental movement.

Many Earth First! activists had spent years working for established advocacy organizations or public agencies before blockading logging roads or spiking trees, and some continued to do so. Most of them recognized, as Malm does, that shaping policy was the best means of achieving long-term goals. In its early years, Earth First! maintained a secret council with representatives from major environmental groups in order to avoid working at cross purposes.

Malm's claim that Earth First! monkeywrenching achieved "no lasting gains" is a questionable assessment. The group's tactics never inspired a mass political movement, but some of the positions it advocated in defiance of mainstream environmental opinion—including dam removal, a moratorium on cutting trees in national forests, and the protection of all roadless lands—soon became mainstream talking points and even official policy.

In other words, Earth First! is a valuable study in the sort of three-pronged structure that Malm advocates, in which saboteurs, mainstream activists, and governments operate in tension with one another in a way that ends up advancing an overall agenda. In one sense, Earth First! offers a cautionary tale about the precarity of this set of relationships—in particular, how quickly and forcefully governments can crack down on illicit activism.

In the 1980s, the group's most notorious tactic was tree spiking, which involved inserting metal or ceramic spikes into trees marked for timber sales. The idea was to prevent tree cutting by threatening the safety of loggers. Congress soon made tree spiking a felony, and politicians began using terms like "environmental terrorism." In 2006, Federal Bureau of Investigation Director Robert Mueller said overt environmental and animal rights activism had become one of the FBI's "highest domestic terrorism priorities." Courts began applying "terrorism enhancements" that extended sentences for convicted environmental and especially animal rights activists.

Malm believes that the general public's tolerance for radical action will grow as the planet warms, but he also acknowledges the political consequences of being labeled a "terrorist" and advises strict avoidance of anything that might provoke that accusation. In simple terms this means never endangering any lives. In the end, though, activists have little control over how such terms are deployed. Prosecutors have accused Reznicek and Montoya of "terrorism," despite what Malm rightly describes as the absurdity of that characterization. Meanwhile, Republicans on the Senate Energy and Natural Resources Committee have accused Joe Biden's nominee to head the Bureau of Land Management of association with "an eco-terrorist cell" because of her peripheral involvement in an Earth First! tree-spiking incident in Idaho more than 30 years ago.

THE USES OF IMPATIENCE

In another sense, the example of Earth First! points toward what is most valuable about Malm's book. Earth First! treated the unrestrained transformation of the nonhuman world with the sort of exigency that few other environmental groups could muster. At a time when many organizations warned of an emerging environmental crisis and yet responded with a politics of gradualism, Earth First! acted with urgency and persistence.

A similar and useful sense of impatience and consternation animates *How to Blow Up a Pipeline*. This is a book to read for questions and incitements as much as for answers. If climate change is as great a cataclysm as climate activists insist, Malm asks, how can the movement continue to rely on conventional methods like civil disobedience? Doesn't an extraordinary crisis demand an extraordinary response? How should we understand one without the other? In climate activism, the question of proportionality is inescapable, and this lends Malm's book both strategic relevance and moral weight.

Doesn't an extraordinary crisis demand an extraordinary response?

Malm ends by castigating writers like Roy Scranton and Jonathan Franzen for their climate fatalism. To whatever degree Scranton and Franzen actually counsel resignation, their position is a difficult one to defend, and, as Malm notes, a luxury few can afford. But Malm also points out that imagination is a "pivotal faculty" when it comes to what might be done about climate change. This can work both ways—desperation may be as provocative as inspiration, and instilling a sense of foreboding as galvanizing as providing a sense of hope.

The environmental movement has long struck a tenuous balance between ringing an alarm and shining a beacon, and the climate movement must negotiate a similar tension. Malm's book operates in both registers, lamenting the tribulations that climate change will inevitably bring about while also insisting that the worst can still be avoided if the climate movement takes off its gloves. It is only that combination of destiny and possibility that might justify lighting a fuse under cover of darkness. Blowing up a pipeline is an extreme act born of an extreme situation; whatever you might think about the implications of either, Malm makes a strong case for their relatedness. His pressing questions deserve a hearing. ■

Ideas Matter: A Political History of the Twentieth-Century Environment

Excerpted from an essay by J. R. McNeill in the November 2000 issue of Current History.

Domestic politics in open societies proved mildly more responsive to environmental problems that annoyed citizens than did more authoritarian societies, especially after 1970, but there were clear limits to the ecological prudence that citizens wanted. Regardless of political system, policymakers at all levels responded more readily to clear and present dangers (and opportunities) than to more subtle and gradual worries about the environment. The prospect of economic depression or military defeat commanded attention that pollution, deforestation, or climate change could not. More jobs, higher tax revenues, and stronger militaries all appealed, with an immediate lure that cleaner air or diversified ecosystems could not match.

By 1970, however, something new was afoot. The interlocked, mutually supporting (and co-evolving) social, ideological, political, economic, and technological systems that we conveniently call industrial society spawned movements that cast doubt on the propriety and prudence of business as usual. Some of these movements demanded the antithesis of industrial society, denouncing technology, wealth, and large-scale organization. Others called for yet more and better technology and organization, and more wealth for those who had least, as solutions to environmental problems. To date these new movements exercise only modest influence over the course of events, but they are still young. ■