In These Times

A Humanities Program for
Today
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There will be no session on February 24. We invite you to join us at 7 p.m. that evening for the Martin Luther King, Jr. commemorative address given by best-selling author, professor, and antiracist activist Ibram X. Kendi. Learn more & register here.

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In These Times: A Humanities Program for Today

Climates of Opinion: Nature and Human Society
At a moment when climate change compels us to address the impacts of human behavior on our environment, this segment of “In These Times: A Humanities Program for Today” explores various ways that people throughout history have envisioned their relationships to the natural world. On what basis did a drought seem a sign of God’s displeasure? Did unpopulated land offer an opportunity for spiritual renewal or a resource for the benefit of civilization? In what contexts were the poet, artist, and musician regarded as especially attuned to the sounds and sights of woods and water? Join University of Rochester faculty members to discuss these and other questions, including whether the categories of the human and the natural stand up to philosophical scrutiny altogether. Sessions will also be devoted to the dilemmas of the 21st century.

“In These Times” is a humanities-based discussion program for University of Rochester alumni, community members, faculty, staff, students, and friends. Participants may attend as few or as many sessions as they choose. Brief readings and Zoom links are included in this document.

“In These Times” will be held on February 16, 17, 23 and March 2, 3, 9, 10, 16, and 17 from 7 to 8:30 p.m. on Zoom: link here.

Schedule of topics, readings, and discussion leaders:

February 16
Thinking about Value in Nature and Our Place in the Natural World
Ross Andersen, “Nature Has Lost Its Meaning”
Prof. William FitzPatrick

February 17
Providential Encounters
Selection of environmental sutras
Christopher Ives, “Debates about Buddhism and Ecology”
Prof. Jack Lee Downey

February 23
Natural/Supernaturalism in British Romanticism
Introduction and selection of readings from William Blake and others
Prof. Morris Eaves

There will be no session on February 24.

March 2
Romantic Renderings: Sound and Song
Introduction and selection of songs compiled by Professor Watkins
Franz Schubert, Winterreise
Charles Rosen, The Romantic Generation (excerpt)
Prof. Holly Watkins

March 3
Challenges of the Arctic
Olaus One 23
This and other images will be discussed during the session.

Prof. Christopher Heuer
March 9

The Utilitarian Calculus and its Critics
Albert J. Beveridge, "For the Greater Republic, Not for Imperialism"

Prof. Ruben Flores

March 10

The Natural and the Human in Recent Short Fiction
Diane Cook, The Way the End of Days Should Be

Prof. Stephen Schottenfeld

March 16

Gender, Politics, and Natural Spaces
No advance readings for this session.

Prof. Tanya Bakhmetyeva
Prof. Stewart Weaver

March 17

Climate Change Now: A Panel Discussion
Beth Gardiner, “Unequal Impact: Deep Links Between Racism and Climate Change”
IPCC, “Special Report: Global Warming of 1.5°C: Summary for Policymakers”

Prof. Karen Berger
Prof. Randall Curren
Prof. Lee T. Murray

Faculty bios:

Tanya Bakhmetyeva, associate professor of gender, sexuality, and women’s studies, is an award-winning teacher and historian of Russia and Eastern Europe. Her research combines her expertise on gender with her interest in national identities and the natural environment. Her book Mother of the Church (2016) received the 2018 Harry C. Koenig Book Prize for the best Catholic biography that year.

Karen Berger, associate professor of instruction, earth, and environmental sciences, is the coordinator of college sustainability studies and previously served as co-chair of the University Council on Sustainability. She brings to her teaching and research her passionate interest in sustaining energy and water resources and her commitment to community-engaged learning.

Randall Curren, chair of the Department of Philosophy, is an ethicist who draws on thinkers from Aristotle to present-day psychologists to explore concepts of the good life in society. A prolific writer, he is the author of Living Well Now and In The Future: Why Sustainability Matters (2017).

Jack Lee Downey, the John Henry Newman Chair in Roman Catholic Studies, joined the University of Rochester faculty in 2020. His wide-ranging scholarly interests include liberation theologies, North American religious history, Christianity, Buddhism, and protest movements.

Morris Eaves, professor of English and the Richard L. Turner Professor of Humanities, has focused his research on literature and the visual art, and the cultural contexts of British Romanticism. A Guggenheim Fellow, he is an authority on William Blake and a pioneering editor of the online Blake Archive. He is also the director of the University’s Mellon Graduate Program in the Digital Humanities.

William FitzPatrick, the Gideon Webster Burbank Professor of Intellectual and Moral Philosophy, studies both theoretical and applied dimensions of ethics. He is a prize-winning teacher, and his research interests include philosophical questions about the significance of evolutionary biology for ethics, the kinds of value to be found in nature, and our environmental obligations to future generations.
Ruben Flores, associate professor of history, is an intellectual and cultural historian of the United States and Mexico. He has written the prize-winning book Backroads Pragmatists: Mexico’s Melting Pot and Civil Rights in the United States (2014). Flores is also co-principal investigator for the Mellon-funded Sawyer Seminar “Unbordering Migration in the Americas: Causes, Experiences, Identities,” to be held in the 2021-22 academic year.

Christopher Heuer, associate professor of art history, is the author of Into the White: The Renaissance Arctic and the End of the Image (2019) and many other writings on art history. His research, currently focused on Albrecht Durer and catastrophe as well as subterranean art-making in the early modern world, has earned him international recognition.

Lee Murray, assistant professor of earth and environmental sciences, leads the University’s Atmospheric Chemistry and Climate Modeling Group. His current research, which concerns the atmosphere’s ability to cleanse itself of air pollutants and greenhouse gasses, is motivated in part by a desire to reduce future environmental problems.

Stephen Schottenfeld, associate professor of English, is a novelist and short story writer who teaches literature, fiction writing, and screenwriting. His fiction often chronicles the work lives of his characters, who include pawnbrokers (Bluff City Pawn (2014)), postal carriers, telephone repairmen, handymen, and video game designers, and explores how these professions bring an individual into a unique set of experiences.

Holly Watkins, chair of the Department of Musicology at the Eastman School of Music, has published widely on such topics as German musical thought, ecocriticism, and modernist aesthetics. Her most recent book is Musical Vitalities: Ventures in a Biotic Aesthetics of Music (2018). Her work has been supported by several competitive grants and awards, including an American Council of Learned Societies fellowship in 2014-15.

Stewart Weaver, professor of history, is currently investigating the cultural history of nature, land, and landscapes. He is the author of Fallen Giants (2008), a prize-winning book on Himalayan exploration and mountaineering. Weaver was named a Carnegie Fellow in 2019 to support his work on climate change in the Ladakh region of India.

Facilitator:

Joan Shelley Rubin is the Dexter Perkins Professor in the Department of History and the Ani and Mark Gabrellian Director of the Humanities Center at the University of Rochester. A Guggenheim Fellow, she is an American historian specializing in the popularization of the humanities; the history of reading practices; and the intersection of classical music and print culture in the twentieth century United States. She is delighted to welcome participants to “In These Times: A Humanities Program for Today.”
Nature Has Lost Its Meaning
To solve climate change, we need to reimagine our entire relationship to the nonhuman world.

ROSS ANDERSEN  NOVEMBER 30, 2015
Humans were once a fairly average species of large mammals, living off the land with little effect on it. But in recent millennia, our relationship with the natural world has changed as dramatically as our perception of it.

There are now more than 7 billion people on this planet, drinking its water, eating its plants and animals, and mining its raw materials to build and power our tools. These everyday activities might seem trivial from the perspective of any one individual, but aggregated together they promise to leave lasting imprints on the Earth. Human power is now geological in scope—and if we are to avoid making a mess of this, our only home, our politics must catch up.

Making this shift will require a radical change in how we think about our relationship to the natural world. That may sound like cause for despair. After all, many people refuse to admit that environmental crises like climate change exist at all. But as Jedediah Purdy reminds us in his dazzling new book, *After Nature*, our relationship with the nonhuman world has proved flexible over time. People have imagined nature in a great many ways across history.

Purdy is a law professor at Duke, and as such, he feels most at home in American history. His book is, among other things, a panoramic tour of what he calls the “American environmental imagination.” In Purdy’s telling, European settlers initially took a providential view of North America, seeing it as a wild land set apart by god for human cultivation. The Romantics that followed saw America’s landscapes as “secular cathedrals,” meant to inspire awe and reflection. In the late 19th century, a new utilitarian cast of mind took hold, and America’s wild lands—especially its forests—became resources to be managed.
In more recent times, Americans have taken an ecological view of the natural world, seeing it as a connected, interdependent whole. “The main premise here is that nothing is isolated,” says Purdy. “The world is a network of inter-permeable systems, so that what comes out of a smokestack can travel through wind, rain, groundwater, and soil, and end up in flesh.” The “Anthropocene” or “age of humans” is, in some ways, a logical extension of this view.

Purdy hopes that climate change might spur yet another change in how we think about the natural world, but he insists that such a shift will be inescapably political. There is no other way to “build the movements and institutions that could match the scale of
Ross Andersen: For a relatively slim volume, this book distills an incredible amount of scholarship—about Americans’ changing attitudes toward the natural world, and about how those attitudes might change in the future. How long have you been thinking about this?

Jedediah Purdy: I started thinking about this project seven or eight years ago, when I was co-teaching a course at Duke on the law, science, and politics of climate change. What struck me then was how much of the scholarship involved very sophisticated analyses of futility. There were all these studies about why we should expect to do nothing: because climate change overruns our national borders, the timelines of our political decision-making, the scope of our moral concern, and even our cognition.

So I began thinking: This sounds familiar. Many of the ideas we take for granted now, at least as widely shared goals—democracy, gender equality, diversity, economic life without any form of slavery, overcoming the legacy of racism and even overcoming the myth of race itself—would have seemed impossible at many earlier times. In fact, they would have seemed unnatural. Not so long ago, the best minds believed they had seen the limits of human possibility, and those limits did not extend very far. And in a sense they were right. In fighting out these questions, humans became different kinds of people. They came to care about new and different things. The scope and shape of their moral communities changed.

So, I thought, maybe climate change—and, really, the whole global environmental crisis—is like that. Maybe it’s one of these deep problems that, if we engage it in a serious way, changes us. Maybe we need to become different people in relation to the natural world. And maybe that isn’t such a wildly utopian thought: that becoming different people is something that humans do, in wrestling with deep problems.
So I went back and started digging around in the history of environmental politics and lawmaking. I looked at all the different ways that people talked about the natural world when something was at stake, when they were trying to move, persuade, inspire, shame, other people into acting with them.

I looked at all of these key moments in American political and cultural history—the definition of equality and freedom, the creation of a national state, the confrontation with the limits of technological mastery in the later twentieth century, the search for secular meaning, and so forth. The non-human world figured in many of these moments. It was this neglected thread running through political life, and its meaning had changed profoundly along the way.

Seeing those changes play out over the course of history gave me hope. It suggests that how we are going to live in relation to the world is a question that we have the power to answer in many different ways. That power is not just technological, but also cultural and imaginative. And in the Anthropocene, the pivot that turns its future, for better or worse, is politics.

**Andersen:** It feels like there is currently a backlash against that idea—the Anthropocene idea—especially on the left. Why do you think that is?

**Purdy:** Yes, there’s a whole clutch of objections to it. For some critics, the Anthropocene is too focused on humanity as a species, and as a result, it ignores the systematic forms of inequality, such as imperialism and racism, which have shaped the world.

From this camp, you hear calls to name what we’re living through the “Capitalocene,” or the “Eurocene.” After all, the “humanity” that put most of the greenhouse gases into
Nature Has Lost Its Meaning - The Atlantic

plastics that line the world—in other words, the anthropos of the Anthropocene—is good old *homo europaeus*. So let's not talk about human responsibility when this world order was made by and for some people, and others were drawn into it without much choice in its design, and often enough against their will and violently.

For others, talking about the Anthropocene smacks of anthropocentrism and arrogance: To their ears, the terms seems to celebrate human control and putting selfish human interests first. This is a more or less traditionally environmentalist objection to human selfishness and hubris. E.O. Wilson, for instance, takes many swipes at “Anthropocene enthusiasts” in his forthcoming book, *Half-Earth*, as does Elizabeth Kolbert in her work for *The New Yorker*. Wilson and Kolbert are identifying “Anthropocene” with anthropocentrism, meaning some mix of (1) the idea that people decide what matters, and what is worth saving, according to our own lights; and (2) the idea that we're in charge, that technological mastery is just going to keep on rolling, even deepen. Geo-engineering! Robots! Martian colonies! To hell with nature, anyway! That sort of thing.

I agree with Kolbert and Wilson that this version of the Anthropocene is worth rejecting. I also think they're associating the term with Peter Kareiva, a senior scientist with the Nature Conservancy who has tried to brand (I hate this word, but it's exactly what he's doing, so he deserves it) his frankly anthropocentric, business-friendly, wilderness-bashing agenda, “conservation for the Anthropocene.” But recognizing that Kareiva's agenda is narrow and opportunistic doesn't mean we can get out of the Anthropocene. The idea, and the reasons to take it seriously, are much more substantial and encompassing than the Kareiva version.

Finally, there are those for whom the Anthropocene perspective deepens the philosophical mistake of humanism, which is to emphasize what makes us special, what
and explore what we have in common with the rest of the living world, including, obviously, animals, but also perhaps mushrooms, forests, supercomputers, etc.

These “post-humanist” thinkers want to talk about incorporating other species into democratic life, extending citizenship to them, developing extensive social and ethical relations with them. They want to think of the world in animistic terms, as full of consciousness, full of points of views—from other animals, but maybe also the wind, the storms, a tree.

I'm all for this as a matter of experiments in consciousness: Expanding aesthetics and moral imagination has always been an important part of moving environmental politics, and it should be central in Anthropocene politics, too. But I think this radical group is really confused, maybe willfully so, in their conception of politics.

What is distinctive about a politics that can organize a common world, and create an architecture for interdependence, is that it requires language. It is an artificial order whose materials are linguistic. People will object to this on sentimental or confused grounds, but I think it is irrefutable. You can’t have politics without having linguistic access to others.

A political community can create rights in those who can’t participate—you might think of the Endangered Species Act and animal-welfare legislation as doing this—and of course people's interactions with non-human animals will feed into human politics, and quite appropriately. But there is a limit. The idea of something like multi-species democracy shows a failure to understand what is at stake in democracy: joint participation in creating a common world, culminating in an authoritative decision about its shape (which of course can be revisited and contested). I wonder whether the idea that we could share a democracy with animals doesn’t show the depth of our
As I see it, a call for an Anthropocene politics, and specifically a democratic Anthropocene, is a call to move toward building movements and institutions that could match the scale of decisions that now have to be made, which affect everyone in interdependent (though unequal) ways.

**Andersen:** In your book, you argue, persuasively, that we should never look to nature itself for our values. Where do you see that happening today, in American culture?

**Purdy:** You see it in paleo diets, in the anti-vaccination movement, in arguments against gender diversity and marriage equality. You see it in “natural capitalism” types who see an ecologically complex, interdependent world as a template for a fully marketized society, where everything has a price, all “waste” is accounted for within the system, etc. I don’t mean that there aren’t engineering and design lessons to learn from the workings of natural systems, but this is just reading a certain ideological version of our economy back into the natural world.

There’s also a subtler way that evolutionary psychology encourages people to treat, say, politics as just a side-effect of our animal nature. You see this at work in this idea that being a liberal or a conservative is about the strength of your disgust response. These stories tend to conceal how very much “human nature” has changed over centuries (a time much too short to involve biological change) because of politics, consciousness, and imagination.

Let’s say there really is a left-right spectrum connected with various aspects of disgust, fear, openness, respect for authority or parental figures, etc. None of this is the interesting thing. The interesting thing is that the person at the rightward end of that spectrum today would have been falling off the leftward end of the spectrum two hundred years ago by admitting basic equality among people, the possibility of living a
fringe, the right today is, in many respects, the revolutionary left of the eighteenth century. How that changed is not a question that “nature” can answer for us.

Valuing and relating to the non-human world is one of the richest among our cultural, aesthetic, and spiritual resources. My book is partly a loving, if critical, history of how some people—mainly Americans—have done this. But it is a human project, ultimately, an experiment in interpretation and living. No part of the natural world tells us how to value it, let alone how to live and relate to one another.

**Andersen:** Most people instinctively shrink from nature as a teacher of values when it comes to ideas like the divine right of kings, which was a kind of argument from nature. But what about John Muir telling us to, “keep close to nature’s heart,” or Wordsworth telling us to “come into the light, and let nature be [our] teacher.” What makes that kind of thinking objectionable?

**Purdy:** Wordsworth, Thoreau, Muir, the Hudson River School of painters, all developed this idea: By appreciating nature, we become better people and learn how to live. This has been part of the rationale for the national parks and wilderness areas, part of the recruiting pitch for the Sierra Club, and so forth.

This way of moralizing nature, saying that it has things to teach us, remains very prominent in environmentalist, agrarian, and other sub-cultures. At the same time, we have—or at least readers of *The Atlantic* have —mostly thrown aside the idea that nature teaches us how to live in more traditional ways: that the hierarchical structure of lions’ society teaches us that God wants us to obey kings, or that the design of our reproductive organs shows that we should confine marriage to one man and one woman, or that the biological differences between the sexes justifies keeping women out of politics and the professions. All of these were very respectable arguments about the
into the twentieth century—and I am not even talking about the nature-based theories that were used to justify slavery and expropriation Native American lands.

These rather terrible examples are not, by themselves, the philosophical argument against treating nature as a teacher. Any idea, stated at a certain level of generality, can be used for pretty awful purposes. The Belgians described their entry into the Congo on humanitarian grounds, for example. The Khmer Rouge were supposedly pursuing equality.

The larger argument against nature as teacher moves in two steps. First, for nearly any example of an argument about how nature wants us to live—equally or unequally, under kings or in feminist communes, eating fruit or burning coal—you can find the opposite. Second, this cacophony of uses of “nature” reflects a deeper point, which is that nothing in the natural world teaches us how to relate to it, how to value it, or how to relate to one another.

You can pick out instances of species, ecosystems, natural processes, or whatever, doing something you like—cooperating, conserving waste—and try to make a general lesson out of it. But what about the massacre of high-birth-rate species every spring? What about ants that enslave the pupae of the colonies they raid? What about parasites, like ticks weighing down Rocky Mountain moose that can't pick them off, or a cat playing with its prey?

Picking out and interpreting these examples is always a human activity. It always involves smuggling in the human idea that, because we see something happening in the non-human world, we should emulate it. And to become effective, it always involves persuading other people, by reference to existing human values. So it's not necessarily terrible to say, “I'm just following nature.” It may be innocent. But it’s not necessarily innocuous.
**Andersen:** Has the word nature itself outlived its philosophical usefulness?

**Purdy:** This is a good question. I find myself saying “the natural world” or “people and nature” all the time, and I basically think that’s fine, at the level of usage. We don’t need more neologisms. My sense is that we can use these old words in new ways.

But that’s not really your question. You’re asking something else. You’re asking about the idea of “nature,” a coherent system of principles that somehow adds up to a whole and orders all the material activity of the universe, at all scales, living and nonliving—and to which we can have a relationship of respect, or admiration, or reverence, or defiance. Let’s call it capital-N Nature.

I think Nature, used this way, is a religious holdover. It’s a monotheistic idea, as if the universe had a single meaning because it’s the work of a single mind. Now, I should say that I am not a monotheist, not really a theistic believer at all. But I think that, even if you are, this is a very difficult position to sustain. It’s difficult for all the reasons I was just setting out—from the human perspective, the world is both appealing and terrible, familiar and alien, cruel and generous, and it’s not at all clear how to know what we should take from it, what its meaning is. And I would say that’s because it isn’t the sort of thing that has a meaning. It just is, in all its variety.

I wonder whether—to stay with the religious imagery for a moment—a polytheist or animist image wouldn’t fit better today and going forward. It’s just not true that Nature has a meaning, or that we have relations with it, as a whole. But that doesn’t mean we are disconnected from the living world. Quite the contrary. We have bonds and relations with particular places, species, seasons in a place. All of these are fragments of what I think we should keep calling the natural world.
nor do they see it as just a set of resources and logistical problems. They have relations to it, rather like the relations you might have with your partner’s family, or the neighbors, or your co-workers: a bit opaque, touchy, a mix of affection, obligation, and prudence. And these relations are specific—not with Nature, but with the salmon, or a river, or a tree. They are on many scales, again, much like our relations with individuals, institutions, countries, cultures, in our human-on-human lives.

We can’t decide to be Athabascan, of course, but this strikes me as a promising direction for a realistic, open-minded ethical practice. It takes very seriously that we live with the rest of the world, and it can be a big pain in the ass, or even hurt or kill us, but it is also the only possible site and source of all the joys we can have.

**Andersen:** In the book, you identify four main ways that Americans have imagined nature. The first is *providential*, where nature is a wild place set apart by God, for human cultivation. The second is *romantic*, where nature is a place of aesthetic and spiritual inspiration, a “secular cathedral.” The third is *utilitarian*, where nature is a storehouse of resources, requiring expert management. And the fourth is *ecological*, where nature is the totality of many interdependent systems. You say that we can find these four kinds of imaginations in our law books, but also in our landscapes. Are there particular American landscapes where the imprints of these ideas can be seen most obviously?

**Purdy:** The farmland of the Midwest has that checkerboard pattern that everyone has seen from airplanes. (I don’t mean any disrespect to so-called flyover country: You can see it best from the sky!) That’s a transcription, in the form of land deeds, of a picture of an agrarian republic spreading west; it’s Jefferson’s grid, each farm plot with enough land, notionally, to support a family, each one nestled into a larger pattern, with checker
There is nothing innocent about this providential theory, by the way. This was the same theory that provided justification for the expropriation of Native American lands, because they were “failing” to put it to its proper use. Nature wanted Europeans to have it, on the condition that they filled it up with settlement and development. That was the theory, and the whole web of nineteenth-century law that granted private property in return for settlement and development was the mechanism. You could get land for cash, but also by settling it. You could establish ownership by clearing forest, planting trees in grassland, draining wetlands, irrigating drylands, mining valuable minerals—in other words, by making it bloom with something you could take to market.

In North Carolina, where I live now, for a time a settler could get 50 acres for each enslaved person he brought into the territory, on the theory that their labor increased his productivity. And of course this slavery was defended by another appeal to nature—the false nature of racial hierarchy.

Now take the romantic form of environmental imagination. If you visit a national park or wilderness area, especially one of the parks from the late nineteenth and early twentieth centuries, like Yosemite or Glacier, you will find a landscape picked out for its approximation to an aesthetic ideal: the principle of sublimity, wild and inspiring nature, as theorized by Immanuel Kant and Edmund Burke, and popularized for an American setting by Frederic Church, Asher Durand, and other painters from the Hudson River School. These parks were created by acts of Congress to approximate a painterly ideal. Of course the landscapes were already there; but now they are managed as secular cathedrals, our answer to the Sistine Chapel, the place where a person of a certain turn of mind goes to see the hand of God.

And of course the romantic landscape also has a history of deep inequality written into
white, upper-middle class constituency, people who—in groups like the early Sierra Club, which Muir founded in 1892—set themselves up as Nature’s spokespersons. And some, like Madison Grant, who founded the first groups devoted to saving the redwoods and the bison, were outright white supremacists. (Grant wrote a book about race that Hitler once called “my bible;” Teddy Roosevelt liked it well enough to blurb it.)

It’s key that both the providential and romantic landscapes were produced by law. That was one thing that emerged for me in working on the book: that law is the tendon that connects imagination and materiality when it comes to landscapes. The way we live is a kind of collective landscape architecture. We make the world by moving around, getting food and shelter, staying warm in the winter and cool in the summer. Law orchestrates that activity, produces its shape, and in turn, shapes the world.

We can see this in the landscapes shaped by the utilitarian imagination, like the national forests managed by the Bureau of Land Management, and the Western regions irrigated by the vast irrigation projects built and administered by the Bureau of Reclamation (a telling name, by the way!). These are administered lands, built up coextensively with the branches of the federal government that oversee them. Teddy Roosevelt, who was a pioneer in creating them, once said that his whole domestic program—antitrust, public health, labor law—was just the principle of conservation writ large: expert management of natural and artificial systems for the public good. These planned, deliberately exploited landscapes, are the record of the utilitarian sensibility that built much of modern government.

And here, too, the history has some terrible aspects. Roosevelt’s chief conservation theorist and the head of his Forest Service, Gifford Pinchot, was a leader in the eugenics
who were inclined to treat disfavored or excluded populations as not really mattering much anyway.

The ecological imagination is more multifarious. It shaped modern environmental law—the Clean Air Act, the Clean Water Act, Superfund, etc—and it’s a part of how we think, increasingly, about all sorts of questions. Its premise is that nothing is isolated: The world is a network of inter-permeable systems, so that what comes out of a smokestack can travel through wind, rain, groundwater, and soil, and end up in flesh.

We’re still figuring out what it means to see ecologically. What does the food economy look like if we think hard about the kinds of landscapes we want it to form, the ways we want it to interact with waterways, long-term soil health, and the chemistry of the global atmosphere? What does it look like if we think also about the kind of work that we want people to be able to do in making food?

All of this is the next generation of ecological thinking: about all the systems at once, and seeing the links everywhere between their human and natural aspects. In some respects, Anthropocene thinking is ecological thinking turned up to eleven, with a keen awareness not just of the practical relations among human and natural systems, but also of the values at stake in those.

What I call a democratic Anthropocene is a way of naming the politics that could possibly be up to this situation. It’s about building movements and institutions that move toward an equal voice in shaping the planet. And it’s about building up the capacity to begin engaging in real collective self-constraint.

That may require building social systems where people have less to fear from the future and from one another, where they have room to breathe, and can relax their grip on
resource-intensive, such as friendship, reflection, and just learning to feel wonder at the world. Unfortunately, to state the obvious, a lot in our fractious politics and unequal economies is running in the opposite direction now.

**Andersen:** This week, the most important climate-change talks in a decade are taking place in Paris. Do you see a new way of imagining the natural world—and perhaps even a new anthropocene politics—emerging there?

**Purdy:** I wish I did. A lot of hope has been invested in these climate talks in the decades since Kyoto. And we have to wish for their success. But so far, the pessimistic analyses (of futility) that I was reacting against when I started this book are still more true than false. International efforts are still epiphenomena of national politics that are themselves, on the whole, pretty selfish and short-sighted.

The worst compromise would be a sugary layer of noble talk about global responsibility slathered on a world whose economies are still driving up greenhouse-gas emissions, toxicity, soil degradation, ocean acidification, species extinction, deforestation. It's nice that there is much, much more of a climate movement now than there was even five years ago, and it's nice that Canadians are back on the side of the angels. But the scary possibility is that we may know the right thing to do for decades, talk about it on the international stage, and keep living in a way that deepens the problem. A politics that can pivot how we live, freely and democratically, is a tall order, but it's the only way forward.
**Maharatnakuta Sutra, “Dwelling in the Forest”**

“Kashyapa, after a forest-dwelling monk arrives at a secluded place, he should follow the Dharma of a forest-dweller and perform eight deeds to show kindness for all sentient beings. What are the eight?

To benefit sentient beings;

to gladden sentient beings;

not to hate sentient beings;

to be straightforward;

not to discriminate among sentient beings;

to be compliant with sentient beings;

to contemplate all dharmas; and

to be as pure as space.

Kashyapa, a forest-dwelling monk should perform these eight deeds to show kindness for all sentient beings...

“Kashyapa, if a forest-dwelling monk sees men, women, boys, girls, or animals when begging for food, he should have kindness and compassion toward them and think, ‘I strive with vigor so that I can make the vow that sentient beings who see me and those who give me food will all be reborn in heaven.’ ...”

“Kashyapa, if a forest-dwelling monk is given much food, he should gladly put a handful of it on a clean rock, thinking, ‘I give this to the birds and beasts that can eat it. I am the donor and they are the recipients.’ ...”

**Metta Sutta, “Loving-kindness”**

This is what should be done
By those who are skilled in goodness,
And who know the path of peace:
Let them be able and upright,
Straightforward and gentle in speech,
Humble and not conceited,
Contented and easily satisfied,
Unburdened with duties and frugal in their ways,
Peaceful and calm, wise and skillful,
Not proud and demanding in nature.
Let them not do the slightest thing
That the wise would later reprove.
Wishing: in gladness and in safety,  
May all beings be at ease.  
Whatever living beings there may be,  
Whether they are weak or strong, omitting none,  
The great or the mighty, medium, short or small,  
The seen and the unseen,  
Those living near and far away,  
Those born to-be-born--  
May all beings be at ease!  
Let none deceive another,  
Or despise any being in any state.  
Let none through anger or ill-will  
Wish harm upon another.  
Even as a mother protects with her life  
Her child, her only child,  
So with a boundless heart  
Should one cherish all living beings,  
Radiating kindness over the entire world,  
Spreading upward to the skies,  
And downward to the depths,  
Outward and unbounded.  
Freed from hatred and ill-will,  
Whether standing or walking, seated or lying down,  
Free from drowsiness,  
One should sustain this recollection.  
This is said to be the sublime abiding.  
By not holding to fixed views,  
The pure-hearted one, having clarity of vision,  
Being freed from all sense desires,  
Is not born again into this world.

Lotus Sutra, “Dharma Rain”

The Thus Come One, worthy of honor and reverence,  
is profound and far-reaching in wisdom.  
For long he remained silent regarding the essential,  
in no hurry to speak of it at once.  
If those who are wise hear of it  
they can believe and understand it,  
but those without wisdom will have doubts and regrets  
and for all time will remain in error.  
For this reason,  
he adjusts to the person’s power when preaching,  
taking advantage of various causes
and enabling the person to gain a correct view.
You should understand
that it is like a great cloud
that rises up in the world
and covers it all over.
This beneficent cloud is laden with moisture;
the lightning gleams and flashes,
and the sound of thunder reverberates afar,
causing the multitude to rejoice.
The sun’s rays are veiled and hidden,
a clear coolness comes over the land;
masses of darkness descend and spread—
you can almost touch them.
The rain falls everywhere,
coming down on all four sides.
Its flow and saturation are measureless,
reaching to every area of the earth,
to the ravines and valleys of the mountains and streams,
to the remote and secluded places where grow
plants, bushes, medicinal herbs,
trees large and small,
a hundred grains, rice seedlings,
sugar cane, grape vines.
The rain moistens them all,
none fails to receive its full share.
The parched ground is everywhere watered,
herbs and trees alike grow lush.
What falls from the cloud
is water of a single flavor,
but the plants and trees, thickets and groves,
each accept the moisture that is appropriate to its portion.
All the various trees,
whether superior, middling, or inferior,
take what is fitting for large or small,
and each is enabled to sprout and grow.
Root, stem, limb, leaf,
the glow and hue of flower and fruit—
one rain extends to them
and all are able to become fresh and glossy.
Whether their allotment
of substance, form, and nature is large or small,
the moistening they receive is one,
but each grows and flourishes in its own way.
The Buddha is like this
when he appears in the world,
comparable to a great cloud
that covers all things everywhere.
Having appeared in the world,  
or the sake of living beings  
he makes distinctions in expounding  
the truth regarding phenomena.  
The great sage, the World-Honored One,  
to heavenly and human beings,  
in the midst of all beings,  
pronounces these words:  
I am the Thus Come One,  
most honored of two-legged beings.  
I appear in the world  
like a great cloud  
that showers moisture upon  
all the dry and withered living beings,  
so that all are able to escape suffering,  
gain the joy of peace and security,  
the joys of this world  
and the joy of nirvana.  
All you heavenly and human beings of this assembly,  
listen carefully and with one mind! ...  
I bring fullness and satisfaction to the world,  
like a rain that spreads its moisture everywhere.  
Eminent and lowly, superior and inferior,  
observers of precepts, violators of precepts,  
those fully endowed with proper demeanor,  
those not fully endowed,  
those of correct views, of erroneous views,  
of keen capacity, of dull capacity—  
I cause the Dharma rain to rain on all equally,  
ever lax or neglectful.  
When all the various living beings  
hear my Law,  
they receive it according to their power,  
dwelling in their different environments.  
Some inhabit the realm of human and heavenly beings,  
of wheel-turning sage kings,  
Shakra, Brahma and the other kings—  
these are the inferior medicinal herbs.  
Some understand the Law of no outflows,  
are able to attain nirvana,  
to acquire the six transcendent powers  
and gain in particular the three understandings,  
or live alone in mountain forests,  
constantly practicing meditation  
and gaining the enlightenment of pratyekabuddhas—  
these are the middling medicinal herbs.  
Still others seek the place of the World-Honored One,
convinced that they can become Buddhas, putting forth diligent effort and practicing meditation—these are the superior medicinal herbs.

Again there are sons of the Buddha who devote their minds solely to the Buddha way, constantly practicing mercy and compassion, knowing that they themselves will attain Buddhahood, certain of it and never doubting—these I call the small trees. Those who abide in peace in their transcendental powers, turning the wheel of non-regression, saving innumerable millions of hundreds of thousands of living beings—bodhisattvas such as these I call the large trees.

The equality of the Buddha’s preaching is like a rain of a single flavor, but depending upon the nature of the living being, the way in which it is received is not uniform, just as the various plants and trees each receive the moisture in a different manner. The Buddha employs this parable as an expedient means to open up and reveal the matter, using various kinds of words and phrases and expounding the single Law; but in terms of the Buddha wisdom this is no more than one drop of the ocean. I rain down the Dharma rain, filling the whole world, and this single-flavored Dharma is practiced by each according to the individual’s power. It is like those thickets and groves, medicinal herbs and trees which, according to whether they are large or small, bit by bit grow lush and beautiful. The Law of the Buddhas is constantly of a single flavor, causing the many worlds to attain full satisfaction everywhere; by practicing gradually and stage by stage, all beings can gain the fruits of the way.
In recent decades Buddhists have started formulating responses to the climate crisis and other environmental problems. In the months leading up to the 2015 climate conference in Paris, for example, the Dalai Lama, Thich Nhat Hanh, and other Buddhist leaders signed the “Buddhist Climate Change Statement to World Leaders.” In 2009 several eco-Buddhists published an edited volume, *A Buddhist Response to the Climate Emergency*, which lead to the formulation of an organization, Ecological Buddhism, and a declaration, “The Time to Act is Now: A Buddhist Declaration on Climate Change.” Another group of Buddhists, many of whom are connected to Spirit Rock Meditation Center, founded in 2013 the Dharma Teachers International Collaborative on Climate Change and issued a declaration of their own: “The Earth is My Witness.” A third recently formed organization, One Earth Sangha, takes as its mission “expressing a Buddhist response to climate change and other threats to our home.” A range of other Buddhist organizations and institutions have been offering additional responses to the eco-crisis, including the International Network of Engaged Buddhists (led by Thai Buddhist Sulak Sivaraksa), the Buddhist Peace Fellowship, Ordinary Dharma, Green Sangha, the Green Gulch Zen Center north of San Francisco, and the Zen Environmental Studies Institute at Zen Mountain Monastery in New York State, as well as the Boston Research Center for the twenty-first century, Wonderwell Mountain Refuge in New Hampshire, the Sarvodaya Movement in Sri Lanka, the Tesi Environmental Awareness Movement in Tibet (also known as Eco-Tibet), and the headquarters of Sōtō Zen Buddhism in Japan. Parallel to the praxis of these groups, eco-Buddhists have published monographs, anthologies, and articles in journals and popular Buddhist publications. What we are seeing in these writings is the emergence of a new theoretical dimension of the Buddhist tradition: environmental ethics.

In this “greening” of Buddhism, eco-Buddhists have tapped an array of sources: texts, doctrines, ethical values, and ritual practices. The arguments and activism of these Buddhists, however, are not without controversy. Critics have claimed, for example, that Buddhism has not been as ecological as some have made it out to be, and that eco-Buddhists are engaging in acts of eisegesis by looking selectively in Buddhist sources to support the environmental ethic they brought to their practice of Buddhism in the first place.

It is important to note that eco-Buddhists are generally focused more on continuing their activism than on responding to the skeptics. In this respect, there is no ongoing debate per se, though several eco-Buddhists have responded to the main criticisms, which concern
“interdependence,” identification with nature, Buddhist views of nature, the status of animals, Buddhism in relation to core constructs in Environmental Ethics, and adapted ritual practices.

Interdependence and identification

Much of the debate about Buddhism and ecology has centered on interpretations of *patiça-samuppañḍ̄a* (Skt. *pratītya-samutpāda*), which eco-Buddhists often translate as interdependence but can be more accurately translated as “dependent origination.” The Buddha reportedly expressed this doctrine as a broad principle: “When this exists, that comes to be; with the arising of this, that arises. When this does not exist that does not come to be; with the cessation of this, that ceases.” Eco-Buddhists frequently lift up this doctrine in support of their arguments that Buddhism, based on this notion of radical interconnectedness, is ecological and that Buddhist practice fosters a strong awareness of this interconnection as well as intimacy if not identity with nature. According to leading eco-Buddhist Joanna Macy, the egotistical self is “replaced by wider constructs of identity and self-interest—by what you might call the ecological self or the eco-self, co-extensive with other beings and the life of our planet” (Macy 1990, 53); and this shift “puts one into the world with a livelier, more caring sense of social engagement” (Macy 1991, 190).

Critics have questioned whether recent discourse on interdependence accurately represents the Buddhist tradition. According to David McMahan, “The monks and ascetics who developed the concept of dependent origination and its implications saw the phenomenal world as a binding chain, a web of entanglement, not a web of wonderment” (2008, 153), and early Buddhist texts advocate not engagement but “disengagement from all entanglement in this web” (154). Mark Blum writes that early Buddhists were motivated not “to embrace, revere, or ordain nature, but to remove any and all personal craving for and attachment to nature within themselves so as to become aloof or indifferent (*upekṣa*)” (2009, 215). Critics also question claims that awakening to *patiça-samuppañḍ̄a* leads us automatically to value and care for the world. Christopher Gowans writes, “Why should the realization that we human beings are interdependent parts of the natural world give us reason to value other parts of that world? That all things are interdependent would not seem to establish, all by itself, that these things have some kind of value that we should care about, appreciate or respect” (2015, 287).

The debate about early Buddhist views of the world, however, is not settled. Some have argued that the main thing that early Buddhists were rejecting was not the world or nature per se but certain ways of viewing it, responding to it, and living in it. Gowans writes, “It may be said...that in early Buddhism suffering is not an essential feature of the natural world as such, but of our unenlightened way of experiencing the world. Moreover, enlightenment is not an escape from the natural world, but a non-attached way of living in it (as exemplified by the life of the Buddha)” (2015, 284). From this perspective, nirvana is less a separate, unconditioned realm realized after one steps back from the conditioned world of samsara than a mental state attained when one frees oneself from the “three poisons” of greed, ill-will, and ignorance. This facet of Buddhist thought becomes more pronounced in the emergence of Mahāyāna Buddhism, in which philosophers like Nagārjuna, with their critique of the distinction between nirvana and samsara, shift the focus from “transcending samsara” to living an “awakened life in the midst of the world” (McMahan 2008, 158). (As we will see, Mahāyāna Buddhists view the conditioned world (of nature) described by the doctrine of *patiça-samuppañḍ̄a* more positively than early Buddhists did, and it is generally out of this Mahāyāna perspective that eco-Buddhists marshal their arguments.) In short, although the monks who formulated the
doctrine of paticca-samuppāda may have seen the world as a trap, this does not mean that the doctrine constitutes a negative view of the world.

Rendering paticca-samuppāda as interdependence has generated derivative statements that have prompted other criticisms. As I have outlined elsewhere (Ives 2009), eco-Buddhist discourse includes claims like “everything, including us, is dependent on everything else” (Loy 2003, 85); “in an undivided world everything miraculously supports everything else” (Batchelor 1992, 35); and “We are born into a world in which all things nurture us” (Aitken 2000, 426). Some eco-Buddhists have also derived from paticca-samuppāda a notion of responsibility, making claims like “in being aware of interdependence we also assume responsibility for all that occurs” (Deicke 1990, 166).

We can criticize such claims as these by noting that although things may affect each other, it is not necessarily the case that I depend on everything else or that all things support and nurture me: while I am affected by the destroyed nuclear reactors in Fukushima, they do not support or nurture me and my well-being does not depend on them but depends on my becoming physically independent of them. Nor in any intelligible ethical sense do we all have to assume responsibility for everything that happens: Jewish children in the Warsaw ghetto did not bear any responsibility for the Holocaust.

**Buddhist views of nature**

Some eco-Buddhists lift up passages from suttas to claim that from the start Buddhism has valued nature. For example, they point out that early canonical sources celebrate wild places—with their solitude, silence, and abundant examples of impermanence—as good locations for meditative practice. Critics have pointed out, however, that the Pali canon also portrays them as dangerous, for it is there that one encounters large predators like tigers, poisonous snakes and insects, bandits, and others who would do one harm. The preferred nature is a garden or groomed park, and the Cākkavatti-sīhanāda-sutta portrays a future utopia that is more urban than wild, as noted by Ian Harris: “In Jambudvīpa cities and towns are so close to one another that a cock can comfortably fly from one to the next. In this perfect world only urban and suburban environments are left” (Harris 1991, 108). This celebration of groomed gardens and urban utopias amounts to what Lawrence Schmithausen terms the “pro-civilization strand” of early Buddhism (1991, 14–17).

At the very least, however, early Buddhists did not see nature in stark instrumentalist terms as something to be exploited for the sake of building human cities and civilization. David Eckel writes, “one does not attempt to dominate or destroy nature (in the form of either animals or plants) in order to seek a human good” (1997, 337). “But,” Eckel continues, “neither is the wild and untamed aspect of nature to be encouraged or cultivated. The natural world functions as a locus and an example of the impermanence and unsatisfactoriness of death and rebirth. The goal to be cultivated is not wildness in its own right but a state of awareness in which the practitioner can let go of the ‘natural’—of all that is impermanent and unsatisfactory—and achieve the sense of peace and freedom that is represented by the state of nīrūṇa. One might say that nature is not to be dominated but to be relinquished in order to become free” (337).

This view of nature, however, is found mainly in early Buddhism rather than in the frameworks from which many eco-Buddhists are operating: Mahāyāna texts and East Asian Buddhism. These strands of Buddhism offer a view of nature that differs from what we have sketched thus far. The Avatamsaka-sūtra, for example, formulates a notion of interconnection through the metaphor of Indra’s Net and lifts up the seeker Sudhana, who has “a vision of the entire cosmos within the body of the Buddha Mahāvairocana,” becomes one with that cosmic
buddha, and thereby stands as the prime example of “the identification of a person with a being who is the universe itself or with the underlying reality of things” (McMahan 2008, 158). This interpretation of dependent origination, more positive view of the world, and advocacy of identification with the world helped shape Zen Buddhism and, by extension, Thich Nhat Hanh’s argumentation about “interbeing” as the foundation for ecological awareness and compassionate responsiveness to suffering.

Eco-Buddhists also draw upon such East Asian resources as hermitage traditions, the celebration of nature in arts influenced by Buddhism, and discourse on the Zen-inspired love of nature ostensibly felt by the Japanese. Also, as is the case with early Buddhism, many East Asian Buddhists value natural settings as good places for contemplative practice and as a bountiful source of symbols for Buddhist teachings like impermanence. Granted, this is, strictly speaking, a kind of instrumental value rather than intrinsic value, but nature is indeed being valued and the view of the natural world as dangerous, ensnaring, or unsatisfactory has dropped largely out of the picture.

The status of animals

Eco-Buddhists have lifted up the Jātaka Tales, with an array of virtuous animals, as granting value and dignity to non-human species. They have also cited Buddhist texts that establish a kinship between humans and animals; the Laṅkāvatāra-sūtra, for example, in admonishing Buddhists not to eat meat, includes the passage, “In the long course of rebirth there is not one among living beings with form who has not been mother, father, brother, sister, son, or daughter, or some other relative. Being connected with the process of taking birth, one is kin to all wild and domestic animals, birds, and beings born from the womb” (Swearer 2001, 227). Eco-Buddhists have argued that this intimate karmic connection between humans and animals provides a basis for valuing animals.

Scholars have pointed out, however, that in most Buddhist texts animals are portrayed as intellectually and morally inferior to humans and exist as one of the three “unfortunate” types of rebirth: they do not restrain their desires, they can be malevolent when they prey on other animals, and they lead an unhappy existence (Schmithausen 1991, 16). As such, Ian Harris writes, “beyond the fact that they appear to be beings destined for final enlightenment, they have no intrinsic value in their present form” (1995, 107). In response, Donald Swearer has argued that Harris’s “position is founded on too narrow a construction of the Buddhist view of nature and animals based on a selective reading of particular texts and traditions” and that Harris needs to take into account the Jātaka Tales, which do value animals (1997, 39). Gowans and Harris point out, however, that the animals in these stories are anthropomorphized and function to motivate humans to cultivate virtues like compassion. Gowans comments that these tales use the device of “depicting various living beings as proxies for human beings,” and “These are mainly morality tales about human beings…” (2015, 282). Harris claims that “the often highly anthropomorphic character of the essentially pre-Buddhist folk-tradition of the Jātakas may be said to empty the stories of any ‘naturalistic’ content, thus defeating the intention of those who bring them forward as evidence in support of an authentic Buddhist environmental ethic” (2000, 121). Moreover, “in the Jātaka context the animals are not animals at all in any accepted sense of the term, for at the end of each story the Buddha reveals that the central character was none other than himself, the bodhisattva, in a former life” (Harris 2000, 121).

Even so, one might respond, animals are viewed there not as mere objects but as sentient beings with at least some value, even if the tradition did not—until recently—build on this to argue in a systematic way for the protection, moral standing, or rights of animals.
Buddhism in relation to Environmental Ethics

Overlapping with the debate about the proper connotation and denotation of core Buddhist doctrines like *paṭicca-samuppāda* has been a debate about Buddhism and Environmental Ethics in the formal sense. Some critics have argued that Buddhism is ill-equipped to argue for the sorts of things that typically appear as cornerstones of philosophical and religious formulations of environmental ethics, whether rights, intrinsic value, or the sanctity of nature.

Some Buddhist writers have made claims about animal rights. Philip Kapleau, for example, has written, about the rights animals “undeniably have” (1986, 13). Critics have raised the matter of what might be a legitimate Buddhist basis for claims about the possession of rights, given the Buddhist rejection of the soul and any other sort of separate, atomistic existence apart from the web of changing relationships that constitute things. In response, eco-Buddhists have argued that intrinsic value and moral standing derive from sentience, especially the ability to feel pain and suffer in a significant sense. Others have looked to buddha-nature, but Buddhists do not agree on the connotation and scope of this construct. Some think of it as the potential to become awakened while others see it as an inherent awakening. Early Buddhists ascribed it only to (sentient) animals, not to (insentient) plants, while some in East Asia extended the scope to plants and even to inorganic things like rocks and waters. Some eco-Buddhists have celebrated this broad attribution of buddha-nature as a powerful ethical resource, but in terms of the doctrine’s usefulness for environmental ethics, we must address the subject of what “the view of the presence of Buddha-Nature even in plants, mountains, and rivers entails for practical behavior” (Schmithausen 1991, 24).

Entering this debate, one can argue that rather than forcing Buddhism to fit into received categories and frameworks in environmental ethics (or Western philosophical ethics more broadly), eco-Buddhists might remain true to their tradition and still construct a viable environmental ethic by taking as their primary focus the alleviation of suffering of humans and other sentient beings, or in positive terms, the promotion of their sustained well-being, which is contingent upon certain types of ecosystems.

Of course, focusing on humans and other sentient beings lands us in the arena of the debate about the respective values of individuals and the wholes of which they are part, that is to say, the ongoing debate in Environmental Ethics between individualism and holism. In large part Buddhist ethical concern—expressed through such doctrines as non-harming, loving-kindness, compassion, and the bodhisattva ideal—is directed toward individual suffering beings, not groups, species, or wholes like ecosystems.

In general, however, while they may not agree on whether the main Buddhist ethic is a virtue ethic or a form of utilitarianism, scholars and Buddhists tend to agree that central Buddhist virtues—or to put it in a way that is more faithful to Buddhism, wholesome mental states—do offer resources for environmental ethics in several senses, especially the informal sense of “sets of beliefs, values, and guidelines that get put into practice in attempts to live in an ecological manner” (Ives 2013, 544). As I have outlined elsewhere (2013), Buddhism offers a view of flourishing that is based on the cultivation of an array of “wholesome” mental states and values with clear environmental ramifications: generosity, non-acquisitiveness, simplicity, frugality, restraint, contentment, loving-kindness, non-harming, and mindfulness.

Simply put, as humanity faces the eco-crisis, Buddhism offers a value system and way of living that not only lead to greater fulfillment than materialist and consumerist living does but also prove useful for mitigating such problems as global warming and adapting to a new world in which we will all be forced to live more simply. That being said, Stephanie Kaza has laid the groundwork for an important debate with a remark about one of the Buddhist values often
lifted up in eco-Buddhist discourse: “The practice of detachment to hobble the power of desire could actually work against such environmental values as ‘sense of place’ and ‘ecological identity’” (2006, 201).

While the de facto virtue ethic of Buddhism does offer resources for ecological living, the discipline of Ethics features an ongoing debate about the limitations of virtue ethics—Buddhist or otherwise—in responding to urgent problems like the climate crisis. Though the cultivation of a virtuous character over the course of a lifetime may very well lead to a more sustainable way of being, it does not readily prompt the kind of immediate response that the climate crisis calls for, nor does it offer much help in making decisions about what might be effective responses to the climate crisis and other environmental problems.

**Adapted ritual practices**

In addition to tapping Buddhist metaphysical constructs, texts, and values, eco-Buddhists have reformulated ritual practices, invented new practices, or simply engaged in activism in response to environmental problems, and these efforts have spawned debates as well. Buddhists in Thailand have been debating the practice of ordaining trees as a way to protect them from logging and protect rural farming communities that depend on forests. This practice, originating in the 1980s, immediately caused a backlash from developers and government officials whose profits, power, and agendas were threatened by the practice. Critics among the laity and the sangha administration have claimed that the environmentalist monks performing the rituals cannot ordain trees, for ordination rituals can be done only for humans (Darlington 2012), and that political and economic activism is inappropriate for monks and reduces their purity. In particular, as Sue Darlington points out, the ordinations “challenge what people consider sacred—placing trees on the same level as monks goes against the sacred and social hierarchy in place” (2012, 23).

This debate in Thailand is part of a larger debate about the appropriateness of Buddhist activism. Over the years this author has heard Zen masters and other Buddhist teachers advocate that their students devote their efforts to intensive meditative practice and defer social activism until after they have woken up or at least reach advanced stages on the Buddhist path. Some have even said that if one tries to save the world before extricating oneself from the self-centered ego, one will only end up making things worse. As part of a critique of broader “Engaged Buddhism,” some have also argued that eco-Buddhism is a watering down of Buddhism insofar as it draws attention away from sustained wrestling with existential suffering and directs it to political agitation.

An eco-Buddhist might respond to this criticism by noting that existential suffering is not the only form of suffering that the Buddha took seriously, and working to reduce social, economic, and other forms of suffering through activism falls within the scope of the foundational Buddhist commitment to reduce suffering in all of its forms.

**Concluding remarks**

Perhaps the harshest criticism to date in the debate about Buddhism and ecology has come from Ian Harris, who once wrote that eco-Buddhism consists primarily of “exogenous elements somehow tacked on to a traditional Buddhist core which is incapable, without modification, of responding to the present environmental crisis” (1995, 206). Granted, some eco-Buddhists may be misconstruing doctrines, but most are simply interpreting them in response to the eco-crisis, and this hermeneutic should not be dismissed out of hand. In some respects they are doing the “modification” that Harris mentions, and in most cases what we are
seeing are reinterpretations of doctrines and practices in ways that at the very least do not contravene the overall Buddhist worldview and may actually be drawing out its ecological ramifications in a legitimate exegetical manner. In this respect eco-Buddhists are engaging in the sort of intellectual labor that, for example, biblical theologians have been doing for centuries as they look selectively in the Bible for passages that support the constructive argument they are making (and defending as consistent with what they take to be the core principles of Judaism or Christianity) in response to challenges they have faced in their particular historical situations. For example, many sections of the Bible accept—or at least do not reject—slavery, but this does not mean that anti-slavery arguments that have tapped other parts of the Bible are illegitimate. Likewise, the presence of negative views of wild nature and animals in early Buddhist texts does not in and of itself delegitimize theorizing that draws from other resources in those—or other—Buddhist texts (though it does undermine broad claims like “Buddhism is an ecological religion” or “Buddhists have always revered nature”).

Like other religious traditions, then, Buddhism has continuously changed as its beliefs and practices have been reinterpreted in different cultural contexts and historical moments. So as David McMahan points out,

Simply to dismiss the current environmental and ethical discourse of Buddhist interdependence as an inadequate representation of traditional Buddhism…would fail to take seriously the process of modernity as it manifests itself on the ground…. Like virtually all normative religious reflection, this discourse is practitioners’ constructive response to an unprecedented situation, not a historiographical endeavor. Pointing out the incongruities between ancient and modern cosmologies, while crucial, is not more historically important than showing how the often radical reconstitution of doctrine in terms of present circumstances has attempted to bridge these incongruities. The history of religions is precisely the history of such reconstitutions of doctrine and practice, which are themselves reconstitutions of prior versions.

(2008, 180)

It is also important to note that some of the most important eco-Buddhists doing this modification and reinterpretation are not convert Buddhists who might be bringing exogenous elements from their Christian, Jewish, or leftist roots to bear on Buddhism but rather renowned Asian Buddhists who were brought up in the Buddhist tradition, such as the Dalai Lama, Thich Nhat Hanh, BuddhaDāsā, and Sulak Sivaraksa. Harris seems to assume that eco-Buddhists are all Western converts or simply people approaching Buddhism from typically Western perspectives, but this is clearly not the case (even allowing for some degree of Western influence on Asian eco-Buddhists). For this reason, the argument that “much that masquerades under the label of eco-Buddhism…on analysis, turns out to be an uneasy partnership between Spinozism, New Age religiosity and highly selective Buddhism” (2000, 132) does not do justice to the full scope of eco-Buddhism.

At the same time, eco-Buddhists, or at least those focused on theory more than praxis, have much intellectual labor to do. For example, work needs to be done to clarify the exact resources that the doctrine of dependent origination offers. As a metaphysical construct, it does highlight how we are all embedded in nature and our actions affect everything around us and everything affects us, but, this process of interrelating or interbeing pertains to all configurations of reality, whether a relatively pristine wilderness area or a nuclear reactor that is melting down. For this reason, if we are to avoid the naturalistic fallacy of conflating the “is” and the “ought,” and if we are to make wise decisions, we need to make distinctions between various
configurations (such as the pristine wilderness area, the lethal reactor, this or that economic system, this or that way of living) by considering which are desirable or optimal and which are to be mitigated or eliminated. Some eco-Buddhists have begun addressing this question (Jones 1993, 2003; Loy 2003; Kaza 2008; Ives 1992, 2011, 2013), and as their formulations become more systematic we can expect further debates.

Notes
1 This appears, for example, in the eleventh section of the Bahudhâtuka Sutta in the Majjhima Nikâkaya. Bhikkhu Nâgamoli and Bhikkhu Bodhi, trs. (2001), The Middle Length Discourses of the Buddha: A Translation of the Majjhima Nikâya (Boston: Wisdom Publications), 927.
2 Technically, as several of us have pointed out, in Japan the nature that is valued and loved most is a tamed, distilled, miniaturized, and stylized nature, not wild creatures, ecosystems, or the wilderness (Ives 2005, 900).
3 For examples of this, see Kaza 2000 and Swearer 1997 and 2001.

References
Buddhism


In These Times: A Humanities Program for Today
Winter Segment: Climates of Opinion: Nature and Human Society
Tuesday Feb. 23

Readings

Natural/Supernaturalism in British Romanticism: Mr. Wordsworth, Meet Mr. Blake

Morris Eaves

Romanticism and nature are more than married—and yet they don’t by any means always get along. And each has its own unruly life. Put the two together and problems multiply like crazy. We certainly can’t pretend to possess the key that will unlock the secrets of their true selves.

Our best hope is to spend just a few minutes with some fundamentals of each one separately and of the two in combination. To do this we’ll concentrate on British romanticism—two romantics in particular, William Wordsworth (1770-1850) and William Blake (1757-1827). We’ll look at a tiny number of strong comparisons and contrasts—and even then there will be some confusing noise in the intellectual attic. If you feel rattled, that’s normal.

Warning: These are often, especially after the beginning bits, in rough, or maybe no, rational order.

A typical definition of romanticism:

An artistic and intellectual movement originating in Europe in the late 1700s and characterized by a heightened interest in nature, emphasis on the individual's expression of emotion and imagination, departure from the attitudes and forms of classicism, and rebellion against established social rules and conventions. (https://www.yourdictionary.com/romanticism)

British romanticism in particular is a posthumous romanticism, not conscious of itself as romantic--a big, baggy, self-contradictory romanticism, not at all uniform, with no manifestoes, no romantic costumes or poses that signal romantic. There is no manifesto, no program, no clubs, no handshakes or tattoos.

Nature before Romanticism: Mountains

The contention that romanticism, whatever it is, has at its heart a fundamentally altered view of nature, has often been demonstrated by changes in how we look at the outside world, using mountains as the test case.

Check out this short video on the web: https://aislinnthomas.ca/index.php/portfolio/a-peoples-history-of-the-sublime-mountains-used-to-be-ugly/

“In England, from the middle ages up until the 18th century, mountains were dismissed with ‘violent disparagement’ as the ugliest of natural objects. But once the Romantic period begins, language regarding mountains becomes exalting, ecstatic, lyrical.”

The preface to a later reprinting of Nicholson’s book explains further that “between the middle of the seventeenth century and the end of the eighteenth, English attitudes toward mountain landscapes underwent nearly a 180-degree reversal. At the beginning of this period, and for centuries previous, the dominant tendency in England and many other parts of Europe was to regard mountains as inconvenient, aesthetically repellent, and dangerous not just to one’s body but to one’s soul. They were, in a word, ugly, and people of good taste generally sought to avoid them. A century and a half later, such attitudes had very nearly reversed themselves. Mountains like the Alps were now among the prime tourist attractions . . .” (paperback edition introduced by William Cronon, U of Washington Press, 1997)

Compare Katy Kelleher, [https://hazlitt.net/longreads/when-mountains-were-ugly](https://hazlitt.net/longreads/when-mountains-were-ugly):

“Between the 1700s to the 1900s, the cultural messaging around mountains underwent a series of transformations. Slowly but surely, mountains went from being viewed as ‘ugly and fearsome’ to ‘terrible but godly’ to ‘beautiful and vital’ (to, finally, with the late 20th century embrace of ski culture, ‘fun and fancy’). Once modernity took hold, many previously negative (and previously dangerous) things began to seem less threatening. Fears changed, and aesthetics naturally followed. In *Winter: Five Windows on the Season*, Adam Gopnik classifies the ‘mind for winter’ (named after a line in Wallace Stevens’ poem, ‘The Snow Man’) as a thoroughly ‘modern taste.’ ‘A taste for winter, a love for winter vistas—a belief that they are as beautiful and seductive in their own way, and as essential to the human spirit and the human souls as any summer sense—is part of the modern condition,’ Gopnik writes. Likewise, he identifies the cultural appreciation for the ‘mysterious, the strange, the sublime’ as a modern taste. Although Gopnik is writing about a season, he could also be talking about the landscape itself. Having a mind for mountains is a modern construction, like being able to enjoy abstract art or ride through the landscape at 70 miles per hour without fainting from dizziness. Just as the word ‘awesome’ changed meanings over the centuries, shifting from fearsome and terrible to radical and excellent, so too have the mountains moved. Our inner landscapes have shifted to accommodate new forms of beauty, old forms of worship.”

Excerpt, Samuel Taylor Coleridge, “Frost at Midnight” (1798)

My babe so beautiful! it thrills my heart
With tender gladness, thus to look at thee,
And think that thou shalt learn far other lore,
And in far other scenes! For I was reared
In the great city, pent 'mid cloisters dim,
And saw nought lovely but the sky and stars.
But thou, my babe! shalt wander like a breeze
By lakes and sandy shores, beneath the crags
Of ancient mountain, and beneath the clouds,
Which image in their bulk both lakes and shores
And mountain crags: so shalt thou see and hear
The lovely shapes and sounds intelligible
Of that eternal language, which thy God
Utters, who from eternity doth teach
Himself in all, and all things in himself.
Great universal Teacher! he shall mould
Thy spirit, and by giving make it ask.

Excerpt, Wordsworth, Preface to *Lyrical Ballads* (1802) (my emphases)

The principal object, then, which I proposed to myself in these Poems was to chuse incidents and situations from common life, and to relate or describe them, throughout, as far as was possible, in a selection of language really used by men; and, at the same time, to throw over them a certain colouring of imagination, whereby ordinary things should be presented to the mind in an unusual way; and, further, and above all, to make these incidents and situations interesting by tracing in them, truly though not ostentatiously, the primary laws of our nature: chiefly, as far as regards the manner in which we associate ideas in a state of excitement. Low and rustic life was generally chosen, because in that condition, the essential passions of the heart find a better soil in which they can attain their maturity, are less under restraint, and speak a plainer and more emphatic language; because in that condition of life our elementary feelings co-exist in a state of greater simplicity, and, consequently, may be more accurately contemplated, and more forcibly communicated; because the manners of rural life germinate from those elementary feelings; and, from the necessary character of rural occupations, are more easily comprehended, and are more durable; and lastly, because in that condition the passions of men are incorporated with the beautiful and permanent forms of nature. The language, too, of these men is adopted (purified indeed from what appear to be its real defects, from all lasting and rational causes of dislike or disgust) because such men hourly communicate with the best objects from which the best part of language is originally derived; and because, from their rank in society and the sameness and narrow circle of their intercourse, being less under the influence of social vanity they convey their feelings and notions in simple and unelaborated expressions. Accordingly, such a language, arising out of repeated experience and regular feelings, is a more permanent, and a far more philosophical language, than that which is frequently substituted for it by Poets, who think that they are conferring honour upon themselves and their art, in proportion as they separate themselves from the sympathies of men, and indulge in arbitrary and capricious habits of expression, in order to furnish food for fickle tastes, and fickle appetites, of their own creation.

Wordsworth’s attitudes toward nature are embedded in his theories of art but also in his poetry. His long autobiographical poem, *The Prelude*, published by his wife only after his death in 1850, is organized around “spots of time”—revelatory lifechanging experiences—like this one:


Now look over the text in Blake’s famous single print of the *Laocoon*. (I am sending you to the Blake Archive here and elsewhere. The Archive is very convenient but it may take a minute to get used to. Click on the image itself and then on the R (for Reading Mode) at the top right of the window to get easy-to-read transcriptions of Blake’s words. Look for “nature.”

http://www.blakearchive.org/copy/laocoon.b?descId=laocoon.b.illbk.01

Blake read some Wordsworth and wrote his reactions in the margins. So we can see a few instances in which they come head to head on the page. Blake’s Wordsworth marginalia aren’t, unfortunately, in the Blake Archive proper, so I’ll have to provide a link to another source (this is a digital version of the standard scholarly printed edition of Blake’s work):

Start here:
http://erdman.blakearchive.org
In the Table of Contents, click on XII. *The Marginalia*. Then click on the two volumes of Wordsworth that Blake seems to have encountered. Again—how does “nature” figure into Blake’s reactions?

On the other hand, Blake wrote out some poems in a manuscript that is now in the Morgan Library in NYC. One of those is “Auguries of Innocence.” Compare the “nature” here with the “nature” in the works by Blake above:
https://www.poetryfoundation.org/poems/43650/auguries-of-innocence

One of Blake’s late works was an answer to a closet drama (to be read, not produced on stage) by Lord Byron, far and away the most famous poet, and one of the most famous people, in Europe—so notorious for his formidable naughtiness (“mad, bad, and dangerous to know,” according to his lover Lady Caroline Lamb) that he had to move to Italy to get away from English overattentiveness.

Byron’s poem–play was entitled *Cain, A Mystery*. Blake countered with *The Ghost of Abel / A Revelation in the Visions of Jehovah / Seen by William Blake*. Read the first 8 lines:

http://blakearchive.org/copy/abel.a?descId=abel.a.illbk.01 [don’t forget to click R, for reading mode, at the top right of the window]

Blake always had intriguing, compelling ideas about the human body. (These are the ideas that made Aldous Huxley name his book about experiments with psychedelic drugs *The Doors of Perception*, quoting from Blake’s *Marriage of Heaven and Hell* (Huxley 1954; also the essay “Heaven and Hell,” 1956); Jim Morrison and his bandmates named their band The Doors for related reasons.

Read *The Marriage of Heaven and Hell* plates 6-7 and 14 (these are short but tricky). Think about the human body and “nature.” Here’s the Blake Archive link (don’t forget to click on R at the top right of the screen):
And then jump to the rousing apocalyptic ending of Blake’s 100-plate epic *Jerusalem, The Emanation of the Giant Albion*. Again, think about the human body, the human being, and “nature” in this intense vision of life as it should be—in Paradise. Begin reading at line 13 and continue to the end:

http://blakearchive.org/copy/jerusalem.e?descId=jerusalem.e.illbk.98

A lot of intellectual effort was expended in the 20th century trying to define romanticism. For the last 2 or 3 decades that effort has faded considerably as gender, colonialism, and ecocriticism have taken its place. But let’s end by returning for a moment to that last energetic phase of attempts to give always-elusive romanticism some kind of definition.

We can ground this line of thought in Blake’s little fable in *The Marriage of Heaven and Hell*, plate 11. Notice what happens to the Ancient Poets and their poetic acts at the beginning by the time the story reaches its end.

http://blakearchive.org/copy/mhh.c?descId=mhh.c.illbk.11

Compare Blake’s story of the petrification and especially the *outering* of poetry into priestly religion in *MHH* 11 to Percy Shelley’s similar little story in his fierce and formidable romantic manifesto, *A Defence of Poetry* (1821): “At a certain period after the prevalence of a system of opinions founded upon those promulgated by him, the three forms into which Plato had distributed the faculties of mind underwent a sort of apotheosis, and became the object of the worship of the civilized world” (*Shelley’s Critical Prose*, ed. McElderry, 23). As far as we know, Blake and Shelley were unaware of each other—and yet they are telling the same kind of story—clearly a symptom of something rumbling under the surface of the culture.

So that’s up (“underwent a sort of apotheosis”: God is up, angels are up, Heaven is up).

Now, for romanticism, flip these: up tends to get turned inside out and upside down, producing an intellectual transformation:

“We have found then, that the metaphorical structure of romantic poetry tends to move inside and downward instead of outside and upward, hence the creative world is deep within, and so is heaven or the place of the presence of God” (*The Drunken Boat: The Revolutionary Element in Romanticism*). Frye termed this revolutionary inversion *the recovery of projection* (in “The Drunken Boat” and “An Essay on Romanticism”).

Frye usefully said later that “Romanticism is a new mythology” (*A Study of English Romanticism* 16)—which coincides with “the beginning of an open attitude toward mythology . . . a structure out of which beliefs come, rather than directly one of compulsory belief” (16).

*Where man is not, nature is barren.*  
*Truth can never be told so as to be understood, and not be believ’d.*  
**Enough! or Too much**

--Blake, Proverbs of Hell, *The Marriage of Heaven and Hell* pl. 10
In These Times: Climates of Opinion  
University of Rochester Humanities Center

Romantic Renderings: Sound and Song  
Holly Watkins, Professor of Musicology, Eastman School of Music  
March 2, 2021

Our session will focus on the Romantic imagery of nature and encounters between humans and nonhumans in early nineteenth-century music and poetry. Our main musical example will be Franz Schubert’s song cycle Die Winterreise (A Winter’s Journey), composed in 1827 to poems by Wilhelm Müller. Of the twenty-four songs, I would like you to listen to four (see below if you’d like to follow along in the score):

1. “Gute Nacht” (“Good Night”). https://www.youtube.com/watch?v=YJXM6C1biPM (Ian Bostridge, tenor and Thomas Adès, piano)  
5. “Der Lindenbaum” (“The Lime Tree”). https://www.youtube.com/watch?v=M0WTnYJKc6E (Bostridge and Adès)  

Translations of the songs can be found here:  

To help you begin thinking about the poetic protagonist’s engagement with nature in the songs, as well as about how the music depicts that engagement, please read the following excerpts from Charles Rosen’s book The Romantic Generation (Harvard, 1995): 116-25 and 194-204.

For a “classical” contrast to the Romantic approach to nature in Müller’s cycle, you may wish to read a short excerpt from Friedrich Schiller’s essay “On Naïve and Sentimental Poetry” (1795-96), translated here by William F. Wertz, Jr. (the full essay can be found at https://archive.schillerinstitute.com/transl/Schiller_essays/naive_sentimental-1.html):

“There are moments in our life, when we dedicate a kind of love and touching respect to nature in its plants, minerals, animals, landscapes, just as to human nature in its children, in the morals of country folk and of the primeval world, not because it is pleasing to our senses, not even because it satisfies our understanding or taste (the opposite can often occur in respect to both), but rather merely because it is nature. Every fine man, who does not altogether lack feeling, experiences this, when he walks in the open, when he lives upon the land or tarries beside monuments of ancient times, in short, when he is surprised in artificial relations and situations with the sight of simple nature. It is interest, not seldom elevated to need, which lies at the foundation of many of our fancies for flowers and animals, for simple gardens, for walks, for the country and its inhabitants, for many products of remote antiquity, etc.; provided, that neither affectation nor an accidental interest in it be in play. This kind of interest in nature takes place, however, only under two conditions. First, it is entirely necessary, that the object which infuses
us with the same, be *nature* or certainly be held by us therefor; second, that it (in the broadest meaning of the word) be *naive*, i.e., that nature stand in contrast with art and shame her. So soon as the last is added to the first, and not before, nature is changed into the naive. Nature in this mode of contemplation is for us nothing other than voluntary existence, subsistence of things through themselves, existence according to its own unalterable laws.

“This conception is absolutely necessary, if we should take interest in such phenomena. If one could give to an artificial flower by means of the most perfect deception, the appearance of nature, if one could carry the imitation of the naive in morals up to the highest illusion, so would the discovery, that it be imitation, completely destroy the feeling of which we are speaking. From this it is clear, that this kind of pleasure in regard to nature is not aesthetical, but rather moral; for it is produced by means of an idea, not immediately through contemplation; also, it by no means depends upon the beauty of forms. What would even a plain flower, a spring, a mossy stone, the chirping of birds, the buzzing of bees, etc., have in itself so charming for us? What could give it any claim upon our love? It is not these objects, it is an idea represented through them, which we love in them. We love in them the quietly working life, the calm effects from out itself, existence under its own laws, the inner necessity, the eternal unity with itself.

“They *are* what we *were*; they are what we *ought to become* once more. We were nature as they, and our culture should lead us back to nature, upon the path of reason and freedom. They are therefore at the same time a representation of our lost childhood, which remains eternally most dear to us; hence, they fill us with a certain melancholy. At the same time, they are representations of our highest perfection in the ideal, hence, they transpose us into a sublime emotion.

“But their perfection is not their merit, because it is not the work of its choice. They afford us, therefore, the entirely peculiar pleasure, that they, without shaming us, are our model. A constant divine appearance, they surround us, but more refreshingly than dazzlingly. What constitutes their character is precisely that which is lacking in ours to be complete; what distinguishes us from them is precisely that which is missing in them to be divine. We are free, and they are necessary; we change, they remain the same. But only when both are united with one another—when the will freely obeys the law of necessity, and with all change of the imagination reason maintains its rule, does the divine or the ideal issue forth. We therefore perceive *in them* eternally that which is missing from us, but after which we are required to strive, and which, although we never attain it, we nevertheless may hope to approach in an infinite progress. We perceive *in ourselves* an advantage, which is wanting in them, but of which they can partake either never at all, such as those lacking in reason, or not other than if they go *our* way, such as in childhood. They provide us accordingly with the sweetest enjoyment of our human nature as idea, although they must necessarily humble us in regard to every *determined state* of our human nature. Since this interest in nature is grounded upon an idea, so can it appear only in souls, which are susceptible to ideas, i.e., in moral ones. By far the majority of men merely affect it, and the universality of this sentimental taste to our times, which is expressed, especially since the appearance of certain writings, in sentimental journeys, such gardens, walks, and other fancies of this kind, is yet by no means proof of the universality of this manner of perception.
“The poets are everywhere, according to their concept, the guardian of nature. Where they can no longer entirely be the latter and already experience in themselves the destructive influence of capricious and artificial forms, or indeed have had to struggle with the same, then will they appear as the witnesses and the avengers of nature. They will either be nature, or they will seek the lost nature. Therefrom arise two entirely different kinds of poetry, through which the entire province of poetry is exhausted and measured out. All poets, who are really such, will, according to the time in which they flourish, or as accidental circumstances have influence upon their general education and upon their passing dispositions of mind, belong either to the naive or to the sentimental.”
Winterreise.
Ein Cyclos von Liedern von Wilhelm Müller.
Für eine Singstimme mit Begleitung des Pianoforte
componirt von
FRANZ SCHUBERT.
Op. 89.

ERSTE ABTHEILUNG.

I.
Gute Nacht.

Mässig, in gehender Bewegung.

Fremd bin ich einge - zo - gen, fremd zieht ich wie der aus. Der Mai war mir ge -
Ich kam zu meiner Reis - en nicht wählen mit der Zeit, muss selbst den Weg mir

wo - gen mit manchem Blumenstrauß. Das Mädchen sprach von Lie - be, die Mut - ter gar von
wei - sen in die - ser Dunkel - heit. Es zicht ein Mon - den - schat - ten als mein Ge - fahr, te...
Ei, das Mädchen sprach von Liebe, die Mutter gar von Ehre,
mit, es zieht ein Mond, schatt'en als mein Ge'fäh'te mit,
nun und

ist die Welt so trüb, der Weg gehüllt in Schnee, nun ist die Welt so trüb, der
auf den weissen Mat' ten sucht ich des Will des Tritt, und auf den weissen Mat' ten such

Weg gehüllt in Schnee.
ich des Will des Tritt.

Was soll ich länger weilen, dass man mich trieb hin aus? Lass ird'he Hunde

leuen vor ih' res Herren Haus! Die Liebe liest das Wander, Gott hüt sie so ge-

F S. 87s.
macht, von Einem zu dem An dern, Gott hat sie so gemacht.

Die Liebe liebt das Wandern, fein Liebchen, gute Nacht! von

Einem zu dem An dern, fein Liebchen, gute Nacht!

Will dich im Traum nicht stören, wär Schad' um deine Ruh, sollst meinen Tritt nicht hö ren, Nacht.
sacht die Thü re zu! Schreib im Vor über ge hen aus! Thor dir: gute Nacht, damit du mögest se hen, an dich hab' ich gedacht, an dich hab' ich gedacht.
V.

Der Lindenbaum.

Singstimme.

Mässig*)

Pianoforte.

Am Brunnen vor dem Thore
da steht ein Lindenbaum; ich

träumt in seinem Schatten
so manchen süßen Traum. Ich

schnitt in seine Rinde, so

manches liebe Wort; es zog in
Freude und Leid zu ihm, mich immer fort.

*) Urspr.: Mässig langsam.
Ich musst' auch heute wandern vorbei in tiefer Nacht, da
hab ich noch im Dun. kel die Augen zugemacht. Und seine Zweige
rauschen, als riefen sie mir zu: komm her zu mir, Ge. sel. le, hier
findst du deine Ruh!

Die
kal-ten Win-de bie-sen mir grad’ ins An-ge-

sicht, der Hut flog mir vom Kop-te, ich
cresc.

wen-de-te mich nicht.
decresc.

Nun bin ich manche Stun-de ent-fernt von je-nem Ort, und

P.S. 882.
VII.

Auf dem Flusse.

Langsam

Singstimme.

Pianoforte.

Der du so lustig

rauschest, du hel ler, wil der Fluss, wie still bist du ge wor den, gie bist

keinen Scheide gruss!

Mit har ter, star rer Rin de hast

sehr leise

du dich ü ber deckt, liegst kalt und un be weg lich im San de aus ge

*) Urspr. Mösle.

F.S. 334.
Mein Herz, in diesem Bach.

Kennst du nun dein Bild? Ob's unter seiner Rin.de wohl

Auch so reissend schwimmt, ob's wohl

Auch so reissend schwimmt? Mein Herz, in diesem Bach.

F. S. 884.
erkennt du nun dein Bild?
Ob's unter seiner

Binde wohl auch so reißend schwillt,
ob's wohl

auch so reißend schwillt, ob's wohl auch so reißend

schwillt?

F. S. 884.
XV.

Die Krähe.

Etwas langsam.

Singstimme.

Pianoforte.

Eine Krähe war mit mir aus der Stadt gezogen.

ist bis heute für und für um mein Haupt ge...
Krähe, wunderliches Thier, willst mich nicht lassen?
Meinst wohl bald als Beute hier meinen Leib zu lassen?
Nun es wird nicht weit mehr gehn an dem Wunder.
Stabat. Krähe, lass' mich endlich sein.

Treu e bis zum Grab e!

Krähe, lass' mich endlich sein. Treue bis zum Grab e!

F. S. n°1.
Nicht zu geschwind.

Hie und da ist an den Bäumen manches bunte Blatt zu sehn,

und ich bleibe vor den Bäumen oft mals in Gedanken stehen.

Schaue nach dem eignen Blatte, hänge
meine Hoffnung dran; spielt der Wind mit meinem Blatte, zitter ich,
cresc.
was ich zittern kann.
Ach, und fällt das Blatt zu Boden,
cresc.
Etwas langsamer.
fällt mit ihm die Hoffnung ab,

decresc.  \(p\) un poco ritard.  \(pp\)

F. S. 895.
(33) 3

a tempo

fall' ich sel' ber mit zu Boden,

cresc.

wein', weil auf meiner Hoffnung

decresc.

Grab, wein', weil auf meiner Hoffnung.

PP

Grab.
CHAPTER THREE

Mountains and Song Cycles

Horn calls

Horn calls and the sound of wind through leaves open "Der Lindenbaum" (The Lime Tree), the fifth song of Schubert's song cycle Winterreise (Winter's Journey):

[Musical notation image]
The horn calls may at first appear curious: there are no horns in Wilhelm Müller's poem. These are traditional hunting-horn formulas, associated, certainly, with forests, but there are no forests in Müller's poem: the lime tree is an urban tree at the city gate.

The rustling of the leaves has a certain ambiguity as well. It is now winter, and there are no leaves; the poem speaks only of the rustling of the twigs. It is clear, however, that the triplets of the opening do not represent the sound of twigs. Our identification of the triplets with wind is indeed confirmed later in the song, but that will be the present wind of winter which blows off the traveller's hat. The wind of the introduction is not a winter wind but the wind of summer, the rustling is a symbol of memory.

The horn calls, too, are symbols of memory—or, more exactly, of distance, absence and regret. A similar horn call opens Beethoven's Les Adieux (The Farewell):

\[ \text{[Staff notation image]} \]

and it continues to resound throughout the rest of his first movement, with a wonderful series of blurred echoes on the last page:
“Le son du cor au fond des bois,” the sound of the horn in the depths of the woods is one of the few pieces of romantic iconography to find a firm foothold in music.

Horn calls and the wind are combined elsewhere by Schubert, in “Suleika 1,” for example (Brahms thought this the greatest of his songs):

This is the East wind which stirs up the dust and the leaves, but it later brings news of the distant beloved, and with the words of absence and separation appear the horn sonorities in the inner voices:
The motion that we associated with the wind at the opening of the song never stops, and the horn calls steal in with unsurpassed subtlety as if from afar.

“The Lime Tree” goes further: it is saturated in horn sounds. The opening stanza is scored as if for a quartet of horns:
At the spring before the city gate
There stands a lime tree
I dreamt in its shade
So many sweet dreams

The traditional sign for absence is essential: the lime tree is, in fact, not visually present in the song. The traveller wishes it to remain invisible, to keep only the memory:

I had even today to go
By it in the deepest night
There have I, still in darkness,
Closed my eyes.

Ich musst auch heute wandern
Vorbei in tiefer Nacht,
Da hab ich noch im Dunkel
Die Augen zugemacht.

The tree, in whose bark the traveller had carved his words of love, is not seen, only heard, as the scraping of the twigs calls the lover to his death:

And its twigs rustled
As if they called to me:
Come here to me, companion
Here will you find your peace.

Und seine Zweige rauschten
Als riefen sie mir zu:
Komm her zu mir, Geselle,
Hier findest du deine Ruh.

This is the first song in Winter's Journey to speak of the longing for death, which will become the main burden of the cycle. Winter's Journey moves towards death, and the peace that the rustling twigs promise the young man
is the peace of death. “The Lime Tree” is also the first song in a low register after four in a relatively high one. (When the cycle is performed, as it so often is, by a baritone, this relation is missed; the first four songs are then transposed downward, but “Der Lindenbaum” is generally left in the original key, as it sits well for baritones, and indeed lies too low to be transposed like the others. The cycle makes its proper effect only when sung by a tenor.) The preceding songs all end a fourth to a ninth higher than “The Lime Tree,” and the graver, more somber register of this song introduces a new sound; in context, the simple lyric resignation is even more serious than the despair, ironic and passionate, of the opening songs.

The wind unites past and present in “The Lime Tree,” and it determines the structure of the song. Three times the melody is sung, the first two preceded by the introduction with its rustling leaves and distant horn calls (on its second appearance the introduction is shortened to four bars). Before the melody comes for the third and last time, however, voice and piano unite to describe the winter wind:
The cold wind blew
Straight into my face.
The hat flew off my head.
I did not turn.

The poet does not turn because he does not wish to see what must remain a memory: he tries to imprison the tree in the past. The wind forces the present on him, as it changes without warning from summer breeze to the blast of winter. In this stanza the motif of the wind is transformed from a remembrance into an evocation of what is actually happening, a phenomenological description of the experience of remembering and of being attacked by reality at the same time.

We may say that the introduction actually appears three times, twice instrumentally to represent the past, and the third time integrated with the vocal line, to bring the present before us—or, in fact, to confound memory and immediate perception. This third appearance, transformed, is the only place in the song where the motif of the wind is combined with the vocal part, where, in fact, the introduction invades the song proper. It is the dramatic climax, and it breaks the symmetry of the music. It also breaks the symmetry of the verse: there are six stanzas in Müller’s poem, and Schubert’s melody spans two
stanzas. He uses one stanza, however, for the winter wind—for the fusion of remembered time with actual time—and the third appearance of the melody has the words of only one stanza left and must repeat them in order to reach its full length.

Memory is the central theme of early nineteenth-century lyric poetry. It was Schubert's genius to find a way to represent both past and present with the same motif. The opening song of Winter's Journey is a walking song, as are many of the successive ones. From the first bars of "Good Night," the sense of walking combines with the anguish of memory:
A stranger I came
A stranger once more I depart.

_Fremd bin ich eingezogen,
Fremd zieh' ich wieder aus._

The opening of the vocal line is at once painful and casual: the first note is an awkwardly difficult high F, but it is there unaccented, almost in passing. The steady walking rhythm takes precedence. The sense of grief and regret is in the harmonies, in the way the melody opens by expressively outlining a ninth, and above all in the accents that break up the even surface, disturb the regular movement without impeding it.

_Landscape and music_

The double time scale, the representation of the past through the immediate sensation of the present, made possible one of the greatest achievements of Romantic style: the elevation of the song from a minor genre to the vehicle of the sublime. The great polyphonic song writing of the Renaissance was a long-dead tradition: only the accompanied song lived on. Throughout the eighteenth century, however, the accompanied song was a despised form, unfit for truly serious consideration. No important composer of the period wasted much of his time on writing songs; those of Bach, Handel, the two Scarlattis, Rameau, Hasse, Jomelli, Gluck, Mozart, and Haydn are a negligible part of their output, although some of them, Gluck in particular, wrote interesting ones. Mozart, for example, occasionally produced a modest song in his spare time, as a relief from more important matters. The most imposing of these, "Abendempfindung" (Evening Sentiment), has been called a precursor of the
Romantic *Lied*, but it is nothing of the kind: in *arioso* style—half aria, half accompanied recitative—it is a miniature operatic *scena*, and has little in common with later developments. As a setting of landscape poetry it is, however, significant. It was the lyric poetry of landscape that was the chief inspiration in the development of the *Lied*, and gave vocal music the grandeur that had until then been reserved for opera and oratorio. The first great successes of Schubert may somewhat obscure this: two songs from Goethe, “The Erl-King,” a ballad; and “Gretchen at the Spinning Wheel,” a scene from *Faust*. Unlike Mozart’s “Abendempfindung,” “Gretchen” has nothing operatic about its style, and owes little to theatrical tradition. “The Erl-King” derives to some extent from operatic formulas: the ballad, however, remained a separate enclave in the domain of the *Lied*, and had little influence on the concurrent developments that were to lead to *Winterreise*. The direction that Schubert’s genius was to take was not revealed in the setting of dramatic texts or of narratives but in his engagement with short lyric poems, most often sentimental descriptions of nature—his early settings of Ludwig Höltz give the truest indications of his later power: brief exquisite evocations of nightingales, harvest time, and mournfully frustrated passion.

It is above all through landscape that music joins Romantic art and literature. The first song cycle is a series of landscapes, Beethoven’s *An die ferne Geliebte* (To the Distant Beloved). Other candidates are sometime brought forward for this path-breaking role (including a set of songs by Carl Maria von Weber), but none of them has the unity, cohesion, or power of Beethoven’s and, later, of Schubert’s cycles: they are only loosely related groups of songs that do not even pretend to a more impressive status. It is, in fact, the pretensions of the song cycle that make it such an extraordinary phenomenon. With it, a modest genre, intended largely for the unambitious amateur, becomes a major endeavor that in weight and seriousness rivals grand opera, the Baroque oratorio, or the Classical symphony. The triumph of these pretensions is doubly remarkable: first, in that the basis is still the simple lyric song; and second, that the triumph remained unchallenged—the song cycles of Beethoven, Schubert, and Schumann have never needed apology or resuscitation, unlike the operas of Schubert, the chamber music of Schumann, and the oratorios of Liszt. The prestige of the great song cycles is a testimony to the central role they played in the history of Romantic art. They realized one of the ideals of the period: to give the lyrical expression of Nature an epic status, a genuine monumentality, without losing the apparent simplicity of a personal expression.

The creation of the song cycle is a parallel to the replacement of epic poetry by landscape poetry and the elevation of landscape poetry to the commanding position in Romantic nature poetry. The *Lied* is more than a
centers: it moves with great suppleness of line, and the length of each of these sets is defined by the event.

The comparison of these sets I made above to the movements of a symphony is deeply misleading in one respect. Songs 5 to 10, for example, are clearly centered on the key of A, but we do not understand this fully until we reach the last of these songs. The tonality of a movement from a classical symphony, however, is perceptible at once: its definition may be postponed for a few seconds at most. The perception of the large-scale tonal structure of the song cycle is like our experience of reading a novel or moving through a landscape: it is realized and defined progressively.

The song cycle is the most original musical form created in the first half of the nineteenth century. It most clearly embodies the Romantic conception of experience as a gradual unfolding and illumination of reality in place of the Classical insistence on an initial clarity. The form of Schubert's song cycle is not less precise than that of a Classical sonata, but its precision is only gradually comprehended as it unfolds. The significance of many of the elements can be realized only retrospectively in a way that is fundamentally different from the realization in time of an eighteenth-century musical form. The contrapuntal possibilities of the theme of a Bach fugue are displayed one by one, but they are already present in the initial bars, and an experienced musician would be able to predict the most important musical developments. The famous dissonant C in bar 7 of Beethoven's Eroica Symphony may not find its implications fully realized until 397 bars later, but its harmonic significance and its importance in the harmonic framework are immediately felt. In Die schöne Müllerin, however, the harmonic structure of the last five songs is defined by the final one, the stream's requiem and lullaby, and consequently the harmonic function of the opening of this set can be perceived only after the fact. Just as the travelers of the last decades of the eighteenth century looked back and saw a landscape almost unrecognizable, astonishingly different from the one they believed themselves to have passed through, so the listener must listen back in his memory to the earlier songs, and only then can he perceive how the cycle is taking shape. The movement towards death that begins with a suggestion in the tenth song becomes fully intelligible in the last pages.

In the second of Schubert's cycles, Winterreise, all the events take place before the cycle begins, and we are not even sure what they were. There are only allusions to a girl who spoke of love, and a mother who had schemes of marriage. Twenty-four landscapes awaken memories and lead the poet to an acceptance of death. In this cycle not even death is an event. It is an image in the last song, the organ-grinder who mechanically and monotonously turns the handle of his instrument in the frozen winter landscape. Melody and accompaniment turn in steady, inexpressive circles, like the arm of the musician. All the phrases revolve: they mimic the gestures of the organ-grinder. The
harmony is as frozen as the landscape, reduced almost to numbing alternation of tonic and dominant:

With this song the poet welcomes his death.

As the last song of a long cycle, this one is a magnificent, laconic, tragic hymn. If it were performed on its own, its repetitive monotony would seem unmotivated. The songs of Winterreise are only apparently separate and even those which are effective outside the cycle lose in character and meaning on repetition. Within the context of the cycle, "The Lime
Tree" is the first intimation that death is a grave, as a separate song, it is merely sentimental and even pathetic. The Schubert song cycle embodies a paradox: each song is a completely independent form, well rounded and finished, which nevertheless makes imperfect sense on its own.

The reduction of narrative almost to zero brings a greater lyric intensity to Winterreise than to Die schöne Müllerin. Indeed, in its first version, the first twelve songs alone, it had a more striking concentration, although lacking the tragic power of the second part. This first version was tonally closed, beginning and ending in D minor (and songs number 2 and 11 were both in the related key of A, making the closure more emphatic: DA–AD). It is difficult to speak of the larger tonal plan, however, as several songs of Winterreise were transposed down a whole step or a minor third, and we cannot know whether this was done to make the music easier to sing or for harmonic reasons; whether these were spontaneous decisions on Schubert's part or a response to demands from the publisher or singers—or even if the transpositions were made after Schubert conceived the second part, and this made the symmetrical closure of the first part less important.

The history of the composition of Winterreise is complex. In February 1827 Schubert saw the twelve poems published as Winterreise by Müller early in 1823 and set them to music. Müller, however, had added another twelve poems and integrated them in 1824 into the first set. When Schubert came upon the enlarged version of twenty-four poems in October 1827, he set to music all those he had not previously composed. He did not, however, follow Müller's new grouping but picked out the twelve new poems one by one in the order that he found them; he made only one change, inverting the order of the tenth and eleventh poems, "Die Nebensonnen" and "Muth." He conceived the new songs as a second part after the first twelve. Schubert's new arrangement, in fact, reduces the narrative sense of Müller's, who had placed "Die Post" (The Mail) as the sixth song after "The Lime Tree." "Die Post" opens Schubert's second book, but it would be more reasonable for the poet to hope for a letter (which never comes) from his beloved soon after he has left the city than some time later, after the intervention of several songs which have testified to his hopeless acceptance of isolation. Schubert, however, had other and more important considerations than narrative coherency. What these were may be suggested by his inversion of the order of "Die Nebensonnen" and "Muth" just before the final song. This order gives him a more intensely lyric finale. "Muth" (Courage) is a blasphemy, full of false cheer and bravado:

If there be no God on earth  
We ourselves are gods.

Will kein Gott auf Erde sein  
Sind wir selber Götter.
“Die Nebensonnen” (The Lesser Suns), on the other hand, is a cryptic lament that all light has set, gone out of the poet’s life; as the penultimate song, it gives a more purely meditative introduction to the ultimate despair of “The Organ-Grinder.”

Musical images of walking dominate the first half of the cycle: songs 1, 3, 7, 10, and 12 all have the easygoing rhythm of a walk through the countryside. The country walk, and its ideology of a direct contact with Nature through physical activity often pushed to the point of exhaustion, dominated German and, less powerfully, English culture from the mid-eighteenth century until the Second World War. Over this movement of walking Schubert imposes the musical images of landscape—in the seventh song, for example, the ice of the frozen stream, under which passion still flows. This is a symbol of the poet’s heart:
The pianissimo of bar 45 recalls the apparent stillness of the frozen stream, for which it was explicitly used in the first stanza:

The later appearance refers back and prepares the sense of the violent swell under the surface that follows. The complex images of walking, stillness, and repressed passion are already almost completely intelligible in the music without the words:
My heart, in this stream
Do you recognize your image?
As if under its crust
It also swells so violently.

The last two of these walking songs, numbers 10 and 12, have a more tired, even exhausted pace. Other textures intrude, above all the hurried walk over snow and ice of songs 4 and 8. The movement of the latter begins with a certain brutality:
but with the return of memories, there is a change and the presence of the familiar horn calls that symbolize the once again the horn sonorities depend on a tenor voice that lies between the left and right hands of the pianist):

How differently did you once receive me
You town of infidelity.

Images of death dominate the second part of the cycle. In the second song, "The Raven" ("Die Krahe"), the opening accompaniment hovers above the voice, and remains in this register almost throughout:
At the end, however, it descends into the tomb:

Raven, let me finally see
Fidelity unto the grave!

Winterreise is unsurpassed in the art of musical representation. Perhaps most remarkable is the picture of the single leaves that remain isolated on the trees, and in the end fall to the ground. This is the beginning of "Last Hope" ("Letzte Hoffnung"), where the two-note motif is isolated, tentative,
The vocal line is built over the motifs in the piano, and constructed out of them as well:

Here and there on the trees
Is many an isolated leaf to be seen.

The fall of the leaf is the death of hope:

And I myself fall with it to the ground
Weep, weep, on the grave of my hope.

Fall ich selber mit zu Boden,
Wein', wein' auf meiner Hoffnung Grab.

"The Signpost" ("Der Wegweiser") of song 20 is the formal announcement of death. The last stanza presents the final immobility, as in "Die liebe Farbe" from Die schöne Müllerin, by the obstinate repetition of one note:
This is a parallel to the monotonous repetition of the last song, and induces by its rigidity a sense of the terror of imminent death. The repeated notes are already present at the opening of the song, but only in the last stanza do they reach their full insistent power. This kind of musical imagery does not so much represent or even express emotion as provoke it. It does not work upon the listener's imagination but upon his nerves.

Throughout *Winterreise*, the dynamic processes of Nature are represented by musical landscape painting of extraordinary suggestion and even precision: the pivoting of the weathervane, the flowing water under the ice, the rustling of leaves, the winter wind, the will-o'-the-wisp, the slowly moving clouds, the quiet village street, a stormy morning—all these receive a remarkable musical contour. As in the great landscape tradition, present sensation and memory are superimposed and confounded. Above all, it is the sense of future time that Müller and Schubert have added to the physical sense of the present and the past.

The oncoming presence of death fills the last five songs: the signpost that points to the road from which there is no return; the cemetery that appears as an inn; the blasphemy and the false cheer in the face of despair; the mysterious subsidiary suns from which the light goes out on life as they set; and finally the organ-grinder as Death himself. The succession of these apparently unrelated images all moving to the same point has a cumulative power. It is, in fact, an advantage here for Schubert that the cycle lacks the strict large-scale harmonic scheme or the subtle motivic relations we find in Beethoven and Schumann—they would have drawn attention away from the disparity of poetic images, each represented by an almost exaggerated contrast of musical texture. The disparity is essential to the emotional power, too tight a web, too formal...
a scheme would have been irrelevant, out of place. Death does not close except with a question of the poet. Schubert asks the composer:

"Wonderful old man, should I go with you? Will you play for me?"

Schubert singles out this question with striking emphasis: it identifies death with the music itself, and it forces the autobiographical interpretation to the surface. This was, by his time, already a tradition: even the poet Wilhelm Müller insists on it in the earlier cycle by making the poet a miller. By the end of Winterreise, the subject is the composer's own imminent death, its approach already visible.

**The unfinished workings of the past**

In Schumann's song cycles of 1839-40, set to poems by Heine, Eichendorff, and Kerner, the immediate experience of landscape has almost disappeared. For Heine, the elements of Nature—nightingales, roses, lilies—have become a kind of emotional bric-a-brac, and they work simply as part of a psychological system of signs: nightingales are only a symbol of the lover's sorrow; lilies make present the whiteness of the beloved's skin. The banality of his poetic paraphernalia does not disturb Heine—quite the contrary: he uses it expertly to reflect a bitter irony onto a genuine passion, a passion that is forced to use such commonplace modes of expression in order to reveal itself. In Eichendorff and Kerner the general presence of Nature has still a great power, but the details have become obscured: trees, moonlight, wind all have only an ideal form—they do not exist except as they rise from the depths of the poet's mind. Müller's lime tree by the city gate is far too specific for Schumann's poets:
De castellis niualibus iuuenum.

CAP. XXIII.

MOS est Septentrionalium popullorum, prouida quadam sagacitate adolescentes diversis bellandi exercitiiis, & artibus castella impugnandi exercere, & excitare, quibus presertim tyrocinia fine cede, & fanguine, ac quouis vitae periculo hæc aggregi putant voluptionem; & ob id quotannis hyeme durantibus niujbus, loco ariquo eminenti turmatim a maioribus excitati congruentiuntur adolescentes, conformi labore immensas nium moles comportantes: & quibus propugnacula ad formam castrensiwm moeniorum feriatis.
FAMOUS AMERICAN STATESMEN & ORATORS

PAST AND PRESENT

WITH

BIOGRAPHICAL SKETCHES

AND

THEIR FAMOUS ORATIONS

IN SIX VOLUMES

VOLUME VI

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NEW YORK
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Beveridge, Albert J., an American politician and orator, born in Highland Co., Ohio, October 6, 1862. His parents removed to Indiana soon after his birth, and his boyhood was one of hard work. Securing an education with difficulty he presently became a law clerk in Indianapolis, and subsequently established a practice of his own. He entered politics in 1884 by speaking in behalf of Blaine and was prominent in later campaigns, particularly in that of 1896, when his speeches attracted general attention. In 1899, he was chosen to the United States Senate as a Republican. He is intensely partisan in his sympathies, devoting more time to party, it has been said, than any other man in his State. He is an able debater and a fluent, ready, political speaker.

FOR THE GREATER REPUBLIC, NOT FOR IMPERIALISM

ADDRESS DELIVERED AT THE UNION LEAGUE OF PHILADELPHIA, FEBRUARY 15, 1899.

GENTLEMEN OF THE UNION LEAGUE,—The Republic never retreats. Why should it retreat? The Republic is the highest form of civilization, and civilization must advance. The Republic's young men are the most virile and unwasted of the world, and they pant for enterprise worthy of their power. The Republic's preparation has been the self-discipline of a century, and that preparedness has found its task. The Republic's opportunity is as noble as its strength, and that opportunity is here. The Republic's duty is as sacred as its opportunity is real, and Americans never desert their duty.
The Republic could not retreat if it would; whatever its destiny, it must proceed. For the American Republic is a part of the movement of a race,—the most masterful race of history,—and race movements are not to be stayed by the hand of man. They are mighty answers to Divine commands. Their leaders are not only statesmen of peoples—they are prophets of God. The inherent tendencies of a race are its highest law. They precede and survive all statutes, all constitutions. The first question real statesmanship asks is: What are the abiding characteristics of my people? From that basis all reasoning may be natural and true. From any other basis all reasoning must be artificial and false.

The sovereign tendencies of our race are organization and government. We govern so well that we govern ourselves. We organize by instinct. Under the flag of England our race builds an empire out of the ends of earth. In Australia it is to-day erecting a nation out of fragments. In America it wove out of segregated settlements that complex and wonderful organization called the American Republic. Everywhere it builds. Everywhere it governs. Everywhere it administers order and law. Everywhere it is the spirit of regulated liberty. Everywhere it obeys that Voice not to be denied which bids us strive and rest not, makes of us our brothers' keeper, and appoints us steward under God of the civilization of the world.

Organization means growth. Government means administration. When Washington pleaded with the States to organize into a consolidated people, he was
the advocate of perpetual growth. When Abraham Lincoln argued for the indivisibility of the Republic, he became the prophet of the Greater Republic. And when they did both, they were but the interpreters of the tendencies of the race. That is what made them Washington and Lincoln. Had they been separatists and contractionists they would not have been Washington and Lincoln—they would have been Davis and Calhoun. They are the great Americans because they were the supreme constructors and conservers of organized government among the American people, and to-day William McKinley, as divinely guided as they, is carrying to its conclusion the tremendous syllogism of which the works of Washington and Lincoln are the premises.

God did not make the American people the mightiest human force of all time simply to feed and die. He did not give our race the brain of organization and heart of domination to no purpose and no end. No; he has given us a task equal to our talents. He has appointed for us a destiny equal to our endowments. He has made us the lords of civilization that we may administer civilization. Such administration is needed in Cuba. Such administration is needed in the Philippines. And Cuba and the Philippines are in our hands.

If it be said that, at home, tasks as large as our strength await us,—that politics are to be purified, want relieved, municipal government perfected, the relations of capital and labor better adjusted,—I answer: Has England’s discharge of her duty to the world corrupted her politics? Are not her cities, like
Birmingham, the municipal models upon which we build our reforms? Is her labor problem more perplexed than ours? Considering the newness of our country, is it as bad as ours? And is not the like true of Holland—even of Germany.

And what of England? England’s immortal glory is not Agincourt or Waterloo. It is not her merchandise or commerce. It is Australia, New Zealand, and Africa reclaimed. It is India redeemed. It is Egypt, mummy of the nations, touched into modern life. England’s imperishable renown is in English science throttling the plague in Calcutta; English law administering order in Bombay; English energy planting an industrial civilization from Cairo to the Cape; and English discipline creating soldiers, men, and finally citizens, perhaps, even out of the fellaheen of the dead land of the Pharaohs. And yet the liberties of Englishmen were never so secure as now. And that which is England’s undying fame has also been her infinite profit, so sure is duty golden in the end.

And what of America? With the twentieth century the real task and true life of the Republic begins. And we are prepared. We have learned restraint from a hundred years of self-control. We are instructed by the experience of others. We are advised and inspired by present example. And our work awaits us.

The dominant notes in American history have thus far been self-government and internal improvement. But these were not ends only; they were means also. They were modes of preparation. The dominant notes in American life heretofore have been self-government
and internal development. The dominant notes in American life henceforth will be not only self-government and internal development, but also administration and world improvement. It is the arduous but splendid mission of our race. It is ours to govern in the name of civilized liberty. It is ours to administer order and law in the name of human progress. It is ours to chasen, that we may be kind. It is ours to cleanse, that we may save. It is ours to build, that free institutions may finally enter and abide. It is ours to bear the torch of Christianity where midnight has reigned a thousand years. It is ours to reinforce that thin red line which constitutes the outposts of civilization all around the world.

If it be said that this is vague talk of an indefinite future, we answer that it is the specific program of the present hour. Civil government is to be perfected in Porto Rico. The future of Cuba is to be worked out by the wisdom of events. Ultimately, annexation is as certain as the island’s existence. Even if Cubans are capable of self-government, every interest points to union. We and they may blunder forward and timidly try the devices of doubt; but in the end Jefferson’s desire will be fulfilled and Cuba will be a part of the great Republic. And, whatever befalls, definite and immediate work awaits us. Harbors are to be dredged, sanitation established, highways built, railroads constructed, postal service organized, common schools opened—all by or under the government of the American Republic.

The Philippines are ours forever. Let faint hearts anoint their fears with the thought that some day
American administration and American duty there may end. But they never will end. England's occupation of Egypt was to be temporary; but events, which are the commands of God, are making it permanent. And now God has given us this Pacific empire for civilized administration. The first office of administration is order. Orders must be established throughout the archipelago. The spoiled child, Aguinaldo, may not stay the march of civilization. Rebellion against the authority of the flag must be crushed without delay, for hesitation encourages revolt; and without anger, for the turbulent children know not what they do. And then civilization must be organized, administered, and maintained. Law and justice must rule where savagery, tyranny, and caprice have rioted. The people must be taught the art of orderly and continuous industry. A hundred wildernesses are to be subdued. Unpenetrated regions must be explored. Unviolated valleys must be tilled. Unmastered forests must be felled. Unriven mountains must be torn asunder, and their riches of iron and gold and ores of price must be delivered to the world. We are to do in the Philippines what Holland does in Java, or England in New Zealand or the Cape, or else work out new methods and new results of our own nobler than any the world has seen. All this is not indefinite; it is the very specification of duty.

The frail of faith declare that these peoples are not fitted for citizenship. It is not proposed to make them citizens. Those who see disaster in every forward step of the Republic prophesy that Philippine labor will overrun our country and starve our workingmen.
But the Javanese have not so overrun Holland; New Zealand's Malays, Australia's bushmen, Africa's Kaffirs, Zulus, and Hottentots, and India's millions of surplus labor have not so overrun England. Whips of scorpions could not lash the Filipinos to this land of fervid enterprise, sleepless industry, and rigid order.

Those who measure duty by dollars cry out at the expense. When did America ever count the cost of righteousness? And, besides, this Republic must have a mighty navy in any event. And new markets secured, new enterprises opened, new resources in timber, mines, and products of the tropics acquired, and the vitalization of all our industries which will follow will pay back a thousandfold all the Government spends in discharging the highest duty to which the Republic can be called.

Those who mutter words and call it wisdom deny the constitutional power of the Republic to govern Porto Rico, Cuba, the Philippines; for if we have the power in Porto Rico, we have the power in the Philippines. The Constitution is not interpreted by degrees of latitude or longitude. It is a hoary objection. There have always been those who have proclaimed the unconstitutionality of progress. The first to deny the power of the Republic's government were those who opposed the adoption of the Constitution itself, and they and their successors have denied its vitality and intelligence to this day. They denied the Republic's government the power to create a national bank; to make internal improvements; to issue greenbacks; to make gold the standard of value; to preserve prop-
erty and life in States where treasonable Governors refused to call for aid.

Let them read Hamilton, and understand the meaning of implied powers. Let them read Marshall, and learn that the Constitution is the people's ordinance of national life, capable of growth as great as the people's growth. Let them learn the golden rule of constitutional interpretation. The Constitution was made for the American people; not the American people for the Constitution. Let them study the history, purposes, and instincts of our race, and then read again the Constitution, which is but an expression of the development of that race. Power to govern territory acquired! What else does the Constitution mean when it says, "Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or other property of the United States?"

But aside from these express words of the American Constitution, the Republic has power to govern in the Pacific, the Caribbean, or in any other portion of the globe where Providence commands. Aside from the example of Alaska, all our territories, and the experience of a century, the Republic has the power to administer civilization wherever interest and duty call. It is the power which inheres in and is a part of the Government itself. And the Constitution does not deny the Government this inherent power residing in the very nature of all government. Who, then, can deny it? Those who do, write a new Constitution of their own, and interpret that. Those who do, dispute history. Those who do, are alien to the instincts of our race.
All protests against the Greater Republic are tolerable except this constitutional objection. But they who resist the Republic's career in the name of the Constitution are not to be endured. They are jugglers of words. Their counsel is the wisdom of verbiage. They deal not with realities, neither give heed to vital things. The most magnificent fact in history is the mighty movement and mission of our race, and the most splendid phase of that world-redeeming movement is the entrance of the American people as the greatest force in all the earth to do their part in administering civilization among mankind, and they are not to be halted by a ruck of words called constitutional arguments. Pretenders to legal learning have always denounced all virile interpretations of the Constitution. The so-called constitutional lawyers in Marshall's day said that he did not understand the Constitution, because he looked, not at its syllables, but surveyed the whole instrument, and behold in its profound meaning and infinite scope the sublime human processes of which it is an expression. The Constitution is not a prohibition of our progress. It is not an interdict to our destiny. It is not a treatise on geography. Let the flag advance; the word "retreat" is not in the Constitution. Let the Republic govern as conditions demand; the Constitution does not blemish its brain nor palsy its hand.

The Declaration of Independence applies only to peoples capable of self-government. Otherwise, how dared we administer the affairs of the Indians? How dare we continue to govern them to-day? Precedent does not impair natural and inalienable rights. And
how is the world to be prepared for self-government? Savagery can not prepare itself. Barbarism must be assisted toward the light. Assuming that these people can be made capable of self-government, shall we have no part in this sacred and glorious cause?

And if self-government is not possible for them, shall we leave them to themselves? Shall tribal wars scourge them, disease waste them, savagery brutalize them more and more? Shall their fields lie fallow, their forests rot, their mines remain sealed, and all the purposes and possibilities of nature be nullified? If not, who shall govern them rather than the kindest and most merciful of the world's great race of administrators, the people of the American Republic? Who lifted from us the judgment which makes men of our blood our brothers' keepers?

We do not deny them liberty. The administration of orderly government is not denial of liberty. The administration of equal justice is not denial of liberty. Teaching the habits of industry is not denial of liberty. Development of the wealth of the land is not denial of liberty. If they are, then civilization itself is denial of liberty. Denial of liberty to whom? There are 12,000,000 of people in the Philippines, divided into thirty tribes. Aguinaldo is of the Tagal tribe of 2,000,000 souls, and he has an intermittent authority over less than 50,000 of these.

To deliver these islands to him and his crew would be to establish an autocracy of barbarism. It would be to license spoliation. It would be to plant the republic of piracy, for such a government could not prevent that crime in piracy's natural home. It would
be to make war certain among the powers of earth, who would dispute with arms each other's possession of a Pacific empire from which that ocean can be ruled. The blood already shed is but a drop to that which would flow if America should desert its post in the Pacific. And the blood already spilled was poured out upon the altar of the world's regeneration. Manila is as noble as Omdurman, and both are holier than Jericho.

Retreat from the Philippines on any pretext would be the master cowardice of history. It would be the betrayal of a trust as sacred as humanity. It would be a crime against Christian civilization, and would mark the beginning of the decadence of our race. And so, thank God, the Republic never retreats.

The fervent moral resolve throughout the Republic is not "a fever of expansion." It is a tremendous awakening of the people, like that of Elizabethan England. It is no fever, but the hot blood of the most magnificent young manhood of all time; a manhood begotten while yet the splendid moral passion of the war for national life filled the thought of all the land with ideals worth dying for, and charged its very atmosphere with noble purposes and a courage which dared put destiny to the touch—a manhood which contains a million Roosevelts, Woods, Hobsons, and Duboces, who grieve that they, too, may not so conspicuously serve their country, civilization, and mankind.

Indeed, these heroes are great because they are typical. American manhood to-day contains the master administrators of the world, and they go forth for the healing of the nations. They go forth in the cause
of civilization. They go forth for the betterment of man; they go forth, and the word on their lips is Christ and his peace—not conquest and its pillage. They go forth to prepare the peoples, through decades, and may be centuries, of patient effort, for the great gift of American institutions. They go forth, not for imperialism, but for the Greater Republic.

Imperialism is not the word for our vast work. Imperialism, as used by the opposers of national greatness, means oppression, and we oppress not. Imperialism, as used by the opposers of national destiny, means monarchy, and the days of monarchy are spent. Imperialism, as used by the opposers of national progress, is a word to frighten the faint of heart, and so is powerless with the fearless American people.

Who honestly believes that the liberties of 80,000,000 Americans will be destroyed because the Republic administers civilization in the Philippines? Who honestly believes that free institutions are stricken unto death because the Republic, under God, takes its place as the first power of the world? Who honestly believes that we plunge to our doom when we march forward in a path of duty prepared by a higher wisdom than our own? Those who so believe have lost their faith in the immortality of liberty. Those who so believe deny the vitality of the American people. Those who so believe are infidels to the providence of God. Those who so believe have lost the reckoning of events, and think it sunset when it is, in truth, only the breaking of another day—the day of the Greater Republic, dawning as dawns the twentieth century.

The Republic never retreats. Its flag is the only
flag that has never known defeat. Where the flag leads we follow, for we know that the hand that bears it onward is the unseen hand of God. We follow the flag and independence is ours. We follow the flag and nationality is ours. We follow the flag and oceans are ruled. We follow the flag and, in Occident and Orient, tyranny falls and barbarism is subdued. We follow the flag at Trenton and Valley Forge; at Saratoga and upon the crimson seas; at Buena Vista and Chapultepec; at Gettysburg and Missionary Ridge; at Santiago and Manila; and everywhere and always it means larger liberty, nobler opportunity, and greater human happiness, for everywhere and always it means the blessings of the Greater Republic. And so God leads, we follow the flag, and the Republic never retreats.
THE WAY THE END OF DAYS SHOULD BE
Now those colonies are underwater, most of the inhabitants drowned. Any survivors are desperate.

The other day a man in what looked to have once been a pretty fine suit knocked on my door. The suit was now in ruins, the arms shredded like party streamers from his shoulders. Sea salt ghosted his face. Some sand, or maybe a barnacle, clung to his neck. A blue crab scuttled under his hand-stitched lapel. But I mostly noticed his loosened tie because it was definitely designer—it was a kind of damask pattern, but nontraditional. Of course, only designers change designs. It’s why we used to pay so much for them. We paid for innovation.

This man in the nice suit asked for food and water, then tried to strangle me, choked back tears, apologized, asked to be let in, and when I refused, tried to strangle me again. When I managed to close the door on him, he sat on my veranda and cried.

I’ve gotten used to these interruptions, of course. Though the strangling is new.

I don’t blame them. If I’d been one of the unprepared, I’d be desperate too. They come to my door, see that I am clean, are dazzled by the generator-fed lights. They sense I have rooms full of provisions, that my maid’s quarters are filled with bottled water, cords of wood in the exercise annex, and gas in the garage. They ogle my well-fed gut. I am dry. They are embarrassed, filthy, smell of fish. They get back on their driftwood, or whatever they use to keep their heads above water, and paddle next door to my neighbor’s. If I were them, I would overtake someone standing dry in the doorway of a fine home. I wouldn’t give up so easily. But
these men are not me. For starters, they’re awfully weak due to not eating. But still. I don’t like the change. I miss the old days when, though they happened to be begging, they were still gentlemen who understood that hard work was their ticket to success. I’ll need to carry a knife to the door next time.

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It was happening just like they said it would. Things never happen like they say they will. That I was living to see it felt kind of special, truth be told. Like a headline. HISTORY IN THE MAKING!

My neighbor’s house still stands, and across a new tiny sea roiling from trapped fish and unprepared people, one additional cluster of houses remains, perhaps four in all. Day and night, people hang out the windows waving flags of white bedsheets and shouting. What kind of message is that? Surrender? To whom? I’ll bet they have no food and water. My neighbor’s house shakes from the extra people crammed inside. Each of the ten bedrooms probably holds a small village of newly homeless vagrants he’s rescued. I told him to prepare. “I know this sounds crazy,” I said. We haven’t always gotten along, but I thought it the neighborly thing to do. You’d think he’d be grateful. But instead he just crowds our last parcel of heavenly land with bums. If I open the windows I will smell the house, its burdened toilets and piss-soaked corners. The shallow but rising sea moat between our homes is rank with sewage. The tide takes it away, but more always comes.

In the old days, I would have left a letter in his mail-
box about this or that neighborly issue. One time, the mail carrier warned me that it was illegal for non-mail carriers to put things into mailboxes. “It’s just a note,” I reasoned when she tried to give it back to me. “See how overgrown his hedges are?” She stared unbudgeably hard, held the letter steady between us. “Why can’t you just leave it there for him?” I snarled. I slammed the door in her face, and the next morning I found it stuffed in with my own mail, in my own mailbox. On it she had scrawled petulantly, Only I can put this in the mailbox and I won’t do it!

Through my great-room window, I can see that his grand staircase, with its audacious pineapple-carved finials, is littered with men, women, and children. The way they lie about, it looks as though there’s one whole family to a stair. A boy dangles from a dusty crystal chandelier. I watch an old woman topple over a railing while maneuvering through the immense spiral shantytown. What a shame. But you can’t let everyone in. There would be no end to it.

I run a finger over the great-room mantel. Dead skin, infiltrated ash. Too bad the housekeeper has most likely perished.

Someone knocks on my door—insistent and angry rather than timid and begging. I grab that kitchen knife.

On my veranda stands a man holding himself up by the door knocker, his wiry muscles about to tense themselves off his bones. His face is unshaven, neglected. He has the skinny corpse and fat face of a drunk, and when I pull the door open he attempts to keep hold of the knocker and falls in, face-plants on my entryway Oriental.
“Whiskey,” he moans, reaching for some imaginary rumbler.

I think about swiping his open palm with my blade, but there is something about him that I like. His request is original. At least he’s trying.

Where my driveway used to curve into a grand circular turnaround, the waves are mincing: they hiss, churn up crud and fish parts. But the ones in the distance are large and smooth; they conceal the city I used to look out at. They roll long like bedsheets drying in the wind, and I can feel their break.

I didn’t think I could tire of the sound of crashing waves, but it never ends. It holds your attention like someone who can’t stop coughing. It grates. It might be nice to listen to something else for a change. Plus, I’m tired of my music.

I know I probably shouldn’t, but I kick his feet toward an ornamental umbrella stand, get him full-bodied into the house, and close and lock the door. He wants whiskey? I don’t care for it, and I have too much as it is. Besides, I’ve always liked having drinkers around. They often surprise.

The man—he grumbles that his name is Gary—doesn’t even take the stack of crackers I offer him. He flings them like dice and messily pours another glass.

“Ice,” he slurs.

I shake my head. The fridge is dormant. My food is canned. And the kind of whiskey I keep should be enjoyed sans ice.

He’s so at ease in his stupor. Though he arrived sopping,
if he asked me what's with all this water, I wouldn't be the least surprised.

Now he wears one of my bespoke suits, bespoken on a trip abroad, in fact. He wears it like he's a metal hanger, but it's a bit tight on me. I'm not ashamed. I live a good life.

I make a list of chores for him, written out like a contract.

"If you're going to live here, you're going to work," I say, and slide it over for him to sign. He does so without reading. Irresponsible.

So I read it to him. "The contract states that in exchange for room and board, Gary will guard the house and take care of any beggars or intruders. He will refill the flush buckets with seawater so we can flush our toilets like civilized people. He will throw our empty cans, bottles, and uneaten food out the back door each night to avoid smells. He will help the owner with weekly cleanings of the house. He will perform all other duties the owner asks."

There are plenty of extra bedrooms for him to stay in, but it's my house. So for the first night, I set him up on the study love seat with some fine sheets and a goose down pillow. He scrunches into it, keeping one eye open as he sleeps, one foot up on the coffee table and the other leg bent, perfectly right-angled, foot flat on the floor, ready. For what? To run? Though the water is creeping closer to the house, I'm not sure that's it.

The far stand of houses is gone. Where there should be rickety multifamilies, I see water flat like a prairie, occasional
whale spouts blurring the horizon line. The glare off all that water is like looking right at the sun.

I see my neighbor padding around the sleeping bodies in his halfway home for derelicts. He is dressed in a tattered robe, his beard long and unkempt. I can practically smell him.

I catch his eye across the moat and mime a drowned body, limbs, head, and tongue hung and bobbing, and then point to where the houses had stood. He looks, rubs his eyes, and drops to his knees. Some of the criminals he’s invited into his home take this opportunity to rob him. Their hands work him over, dig in his bathrobe pockets, his hair, while he shudders with grief. Something is yanked from under his arm, and they disperse so quickly it’s like they were never there. I shiver. My neighbor is taller than I am, and stronger. What would become of me if I had hundreds of people crammed into my house? I’d have no food left. I’d be bullied out of my master suite. I might even lose my life. I am once again grateful for Gary. He wants nothing from me except my whiskey, and has the build of a welterweight or a thief: small and wiry, someone who can put you in a headlock before you feel his touch.

As my neighbor wipes his tears, I shrug in commiseration. But he just shakes his head at me with disappointment, like I’m the one who just robbed him; I’m the water that tore those houses down.

And here I thought I was being neighborly.

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Unless he’s sneaking into the pantry late at night, I doubt Gary has eaten a morsel since his arrival. I notice no dent in
my supplies, except the whiskey, which is already half gone. I’ve always known liquor to be the stuff of preservation, so I’m only a little surprised. The other night, I crumbled some crackers into a half-full bottle to see if he would take to the sustenance, and he roared, smashed the bottle against the marble table where we dine. The noise was exhilarating. Normally the only sound is the constant murmur of the sea around us. Some nights I hear displaced loons call out to find their mates, or human calls from the boats of survivors looking for land, shelter. Their voices travel low across the water and get trapped within the walls of my bedroom. Sometimes I hear music from my neighbor’s house. Not often. Usually it’s dreary, but on occasion a piano is tuned, accompanied by some squeaky string instrument. People stomp feet and call out. It’s rustic. One night I heard a wavering wedding march and imagined a bride, in a dress of pinned white towels, making her way through the mob to stand with her groom. Two people desperate to have what they think is love before the big end—it was hard not to feel something.

Gary doesn’t always hear noise, or even conversation. He sleeps undisturbed at strange intervals, like a pet. It’s pleasant enough. When I need him, he is a great bodyguard. When a knock echoes through the house, I send him to the door with instructions to gut-punch the supplicant men. And he does it. They fall backward from shock and he slams the door. Once a woman came to the door, bent like a hook, and Gary paused and then turned to me miserably. I shrugged. Most bands of vagrants send the men out of respect, but clearly they were desperate. They hoped we
might treat a woman differently. I saw two tense shapes in a rowboat just beyond the south wing of the house. What could Gary do? Some people hang on to old ideals. I do not. But I couldn't make a man like Gary do something he didn't feel good about. He has integrity. I pointed to my knee. He gave hers a halfhearted kick and she crumbled. He shut the door gently. I hope he feels like this is his home too.

* * *

Gary has allowed me to shave him. He sits on the edge of my tub and snoozes while I hot-towel him, lather his face and neck. I wag the razor clean in a silver bowl of Evian. He looks more and more like a business partner; his graying temples lend him an executive air. He wears my suits—navy, charcoal, funeral black—and sometimes I put him in a tie. The ties are specks of color on his landscape. The world outside is all dark water, cloud, and night, dotted with faded plastic garbage, the clothing of the dead, the red brick of my neighbor's house. A bit of color brings out Gary's eyes.

I leave him to clean up, and a while later he tumbles through the bathroom door and knocks into the armoire. He is dangerously intoxicated and half dressed.

He crouches before me in my reading chair, sticks a soiled finger into my mouth, claws my lower jaw open. He strokes the caverns of my back teeth. I taste sour salt.

"Where's your gold?" he asks, like a child who thinks everything is his mirror.

I lean back from his brackish finger. "I have porcelain fillings."

He is blank.
“You can’t see them. They blend in with my teeth. They’re better.”

His face threatens a smile, which would be a first, but instead his mouth gapes wide; it’s like a California riverbed, shallow gold in every hole.

He taps one. “My bank,” he says, and howls irresistibly. I’m transported to another time when men brawled and kept their money in a sock. I slouch luxuriously into my Queen Anne. Gary gulps from the bottle and falls into my bed. He’s wearing a pair of my paisley silk boxers, his legs knobby and bowed like a baby bird’s, and a woven dress shirt, the French cuffs gutted. I’m sure he has no idea how to fasten them with cufflinks, or why he would.

“Gary.”

He murmurs from just below sleep.

“Did you ever think you’d be sleeping under down, in a well-appointed room, clean-shaven, in French tailored shirts and silk underwear?”

He strains an eye open, seems to ponder it, like maybe he can see where I’m going with all this.

“I’m just saying, I think we have a pretty good thing here. We are at the height of land. We have a very handsome house. It doesn’t smell, doesn’t leak, isn’t crowded. Think of the wind. It sweeps over the entire sea, gathers all that fresh air just to deposit it at our doorstep. We have loads of food. More than we could ever eat, really. We drink imported water.”

I suck at a bottle to demonstrate.

“The whiskey won’t last, but I’m sure we can think of something. There’s other liquor. I have port. Several vintages. All told, Gary, we have a pretty nice life.”
He yawns. Perhaps he'll take this moment to drain another bottle. He gazes toward my neighbor's house.

I'm wondering if he's heard me when he mumbles, "We're homeless."

I don't know what he means. "Don't be absurd," I say. I'm certainly not homeless. And neither, now, is he.

But then I think maybe I do understand his meaning, looking at the lapping endless sea, which for once stretches beyond metaphor and actually is endless.

Homeless is a term of destitution. We're not hanging out of windows, waving blankets; we're not trod upon by soggy feet like my neighbor. But undeniably we are experiencing a lack. I respond, "Friend, we are worldless." I let my new word linger.

Gary sniffs and paws at his face, and then I see a glinting on his cheek.

"Gary, are you crying?" I mock tenderly.

He scowls and pulls the blanket right up under his nose, clutches the whiskey close to his heart, and pretends to sleep.

I hear murmuring outside the house.

A boat creaks offshore. A sail of ragged cloth, multicolored swatches crudely stitched together, barely registers the wind. I can make out the figures of two men swim-walking their way to our door while others wait in the boat. They gaze admiringly at the house. As they should.

"Gary," I hiss.

A minute later he shuffles into the entryway, bringing with him a scent of something savory. Not whiskey, I notice, and think it odd.
"Men are coming. See what they want."

Gary peeks out from behind the drapes, allows his eyes to adjust, and nods. I hand him a knife and he slips out the front door to meet the men.

He returns with a note in a bottle.

"They’re from next door," he says, slurring slightly.

"They have a boat next door?" Should we have a boat? I hadn’t thought about surviving outside my home. Would I even want to? It seems so awful out there. But maybe it’s something I should get Gary on, just in case. Boatbuilding. How turn-of-the-century.

The note is scrawled on the back of a soup label:

Dear Neighbor, might you have some food and water to spare? My men will ferry it over. We are running dangerously low. Might you have some room to spare? I’ll send clean women and children. We’re greatly overcrowded. The walls seem to be buckling. I am concerned.

Respectfully.

I crumple the letter. The nerve. "No way."

Gary looks surprised, which surprises me.

"But we have spare food."

"What do you know about food?" I yell.

"You said we had more than enough."

"I did not!"

"You did." He sulks.

"That was before. We’re running very low. You eat too much."
“We have a lot of food,” he mumbles again.

“I suppose you know best. I suppose you’re the decision maker now. I guess you’ll be telling me we should invite them over.”

“Would it be so terrible to let some in?”

“Yes!”

Gary looks up at the grand staircase, considers each wing. “There’s room.”

I throw my hands up. “You’re unbelievable! He’s scamming you!” I’m ashamed of the squeal in my voice, but I can’t control it. “His house was always a wreck. Cracked windows. Bricks crumbling. His vines on my side of the fence. His portico has always looked like that. His house is buckling? Well, his upkeep is for shit.”

Gary gazes longingly at the upstairs hallways, as if fantasizing that they are crowded with laughing children and pretty women.

“They’ll ruin everything. Our life. They’ll eat more than their share. They’ll waste water. They’ll drink your whiskey, you know they will.”

Gary blushes and looks down at a smudge on the golden maple floors, licks a finger and squats to rub it out. “I don’t care,” he mutters into the smudge.

“I’ll make it simple for you, simple guy. If you want to be with them, then leave.” Even as the words come out, I want to take them back. The rest of this life feels impossible without Gary. But I shouldn’t have to give up a life I enjoy to harbor the foolish masses. What’s the point of living if you can’t have the life you want?

Gary turns his gaze to me, and I don’t like the look. It’s
like we don't even know each other. He slips the knife from his pocket and strides out the door.

They are having words. I can't tell if Gary's is one of the voices. Maybe the men are begging to be let in, and Gary is merely listening, hearing them out. That would be so like Gary.

But maybe the men are begging to be let in and Gary is saying yes. That would be a different Gary, I think.

Then I hear yelling and the grunts of a struggle. The sound escapes across the sea; there is nothing to stop it. I hide in the closet. A lone trench coat hangs there. I wrap myself in it.

A cry of pain leads to the sound of men splashing in retreat.

The front door is opened, then gently clicked shut, as though I am a child and Gary is taking care not to wake me. Feet shuffle away. I crack the door and see the knife lying in the center of the rug. It is smeared with blood and sea scum. I would like to dress his wounds if he has any, but I don't move.

From the study comes the clinking of bottle to glass. A glass this time. What civility. I'm ashamed for doubting him. He knows what is at stake. He is a loyal friend. All is well.

The new ocean is changing the weather in awful ways, and it's been cold for days. The sky dumps fluffy fist-sized snowflakes, and then in a blink we are pelted with hail the size of clams. Clumps of sea ice are forming in eddies. The chimney
clogs with ice and snow, and smoke billows in from the fireplace. We cough. Gary opens a window. In comes the smell of the fecal moat. We gag. He closes the window.

It occurs to me that if it weren’t for the neighbor’s overrun house, we might be a little freer in our own. Wouldn’t it be nice to stand in the doorway and enjoy the cold breeze and the view? I never used to have much of a view, just all the rooftops below me. But now I have an ocean view.

I’m angry with my neighbor for opening his doors while I closed mine. We should have more control over the end of days. It should be more pleasant somehow. It’s the end of days, after all.

I sleep under the pall of my resentment, but then I become vaguely aware of Gary’s hand stroking my hair, his sour breath whispering in my ear, Colleen. A lesser man might feel threatened by a drunk fondling him in his bed. But I am not a lesser man. I think it’s soothing. Another’s need is a funny thing. It’s so often cloying. But sometimes, with the right person, it can be the most comforting thing in a day. I find that despite everything, in this moment I feel quietly happy.

A terrible crash wakes me. I reach across the bed, but Gary is not there.

I see nothing through the window, but hear the sea lashing at the side of the house, frantic and high. The clouds are thick like insulation and hide any evidence of a moon. Is it large and full and pulling the tides higher, or is this some kind of grand, irreversible shift in things?
I sink into the cold middle of the bed. Then comes another crash, and yelling, and the unforgettable cracking of heavy beams of wood, of walls collapsing. Screams, splashes, cries for help. If I had to guess, I'd say my neighbor's house has just fallen to pieces. I don't want to look, in case I'm right. The surrounding sea would clog with the lifeless, facedown, a simple burial for those who had survived longest. A passing thought: Must I shoulder some blame for this tragedy? I'd believed our stories were separate. I'd begun to think of this earth as my own private sanctuary. Shared with Gary. We could climb higher and higher as the water rose and live out our days in that quaint, functionless widow's walk, until it too was swallowed. I'd always thought it such a romantic scenario. But with our neighbors washed away, I'm suddenly curious what other story we all might have told together. We're each of us survivors, after all. What a pathetic end. How desperate. I fall asleep in a surprising state of grief.

In the light of day, my neighbor's house is still standing. The top of the building has caved in on itself. Some bodies float in the surrounding waters, but not many. The bobbing corpses lack the gravitas I imagined. I leave bed to fix myself a plate of crackers and peanut butter.

As I approach the landing, I hear hushed voices and I see my neighbor in the entryway with Gary. They lean in to one another, whispering. It all looks quite friendly, which is surprising.

"Howdy, neighbor." I try for blitheness.
They look up, caught. I scan Gary's face for clues, then my neighbor's.

My neighbor has tried to clean himself up a bit. His clothes look pressed in spots, like he has laid them between stacks of books to mimic the effect of steamers. But they are pieces from different suits, clashing directions of stripes on the jacket and pants, and a checkerboard shirt. His beard is roughly trimmed; big chunks of hair are shorter than other chunks, like he cut it with children's scissors. He looks to be wearing some kind of makeup, a powder or rouge for color.


"I know, we heard," I say, mustering horror. Gary looks distraught. Then I say, "We heard it fall, I mean," so my neighbor doesn't think we'd heard from someone else, as though it was gossip.

"I saw the bodies in the moat," I say.

My neighbor looks ashamed and sputters, "We had to. The disease. All the others."

I notice that Gary's suit is rough and wrinkled. I reach out, fondle the fabric. It's damp.

"Gary, have you been swimming?"

My neighbor coughs. "Neighbor," he says, beginning a plea.

"What do you want?" I ask, trying to sound friendly, but I can tell by their faces that my tone is pure stone.

"We have to hold up the ceiling."

Gary clears his throat. "There are big posts in the basement."

I snort. "There are not." I'm looking right into his eyes,
and they are mossy green and clean like he is fully awake. We are so close; his breath in my face smells sweet, like warm milk. Then I remember: there are posts in the basement, from the renovation on my Doric columns. Why does Gary know my house better than I?

I glare at him, preparing to accuse them of something, but then my neighbor begins to cry. Gary clamps a hand on my neighbor’s shoulder to comfort him. I’m alarmed. Those are my hands.

Sea-foam curls around my neighbor’s galoshes, and I suddenly feel woozy. I step back, hug my cardigan close, and realize I’ve become pointy, emaciated. I’m swimming in this sweater; the cuffs hang off me like I’m wearing my father’s clothes. Is this even mine? Haven’t I been taking care of myself? I look at Gary. He’s lean. But I don’t think he’s leaner than usual. What is going on here?

“He’s going to take the posts,” Gary says, making it sound utterly ordinary to give something away. He tightens his grip and guides my shell-of-a-neighbor inside. “Watch the rug,” he says, and instinctively I’m grateful. He’s thought of me. Of us. Of our things. I try to offer him my most thankful smile, but he is already leading my neighbor through the basement door. “I’ll help him,” he calls back over his shoulder.

Of course my neighbor will need help. The posts are big and long and were almost too much for the builders to get down there in the first place. And my neighbor is clearly starving. But again, I’m surprised by Gary. When they come out of the basement, I notice that Gary’s feet aren’t stumbling. He appears strong, almost. He is speaking in full sen-
rences, not slurs. He’s concerned and not angry. He directs my neighbor, who is bent and shaky, barely able to hold the post up, toward the door. Gary stands tall, the post balanced easily on his shoulder, like he doesn’t feel the weight. I want to check my food supply, but I know that would be wrong. It's his house too.

I watch them float the posts over and disappear into my neighbor’s house. I bolt the door. When they come back, let them knock. But then I think, no, it’s Gary. I draw the bolt back.

I stoke the fire all night and wait for the splashing sound of Gary crossing the moat and returning home. I deserve an explanation. I can’t sleep without him.

In my neighbor’s house, lit by candlelight, I see a crowd gathered around Gary. He appears to be giving a speech. His head is bowed and his hands cover his chest like they are protecting a wound. He is not throwing bottles and sulking. And when he begins to weep, the masses gently reach to comfort him; they place hands on him. My neighbor steps through, the people breaking apart for him, and he and Gary embrace. Gary sobs into his neck.

I crawl to the liquor cabinet. One bottle of whiskey remains. I cough down half and then hurl the bottle at the great window.

I check my food supplies. They don’t appear diminished beyond reason, but I suppose there is more food gone than there should be. Didn’t there used to be one more pallet by the bed? But that’s easily explained by Gary starting to eat.
Had he? I couldn’t remember him ever sharing a meal with me, though he always kept me company while I dined. I could live off this food for a while longer, definitely till the end, which feels closer than ever before. But that’s not the point, I think as I urinate into the fireplace. Dense smoke erupts and smothers me. I double over, breathless. I wrench the window wide and gasp in that putrid moat. Dawn is breaking. A bloated and sun-bleached cow drifts by, its hide rippling with bugs, its tail end chewed off by some animal, its methaned stomach still intact and about to burst. That will be me. Pale, bloated, and raped in some feeding frenzy by what still lives.

Why did he leave?
Who said he could leave?

The water in the moat has an eerie heft, like it is about to become slush. I find firm ground near the corner of my neighbor’s house, and soon I emerge. Water sloshes out from under my clothes and from my pockets; salt and sand grit my mouth.

I hear the noise of much life inside, hundreds and hundreds of people, but as I pass in front of a window, the commotion stops. When I knock on the front door, it’s like the whole world holds its breath. I press my ear to it. Nothing.

“I know you’re in there,” I yell. “I can see you all from my house.”

I hear a cough from inside, and a quick rush to stifle it.
“You stole my food.”

Silence.

I pull a note card from my pocket, kept dry in a plastic
baggie. It’s an eloquent reminder for Gary of our comfortable life at home, of how I saved him, of our friendship, and of the contract he signed. I find a crack at the top of the door and try to push the note through. Something stops it midslide and pushes it back out.

Gary.

I know it’s him on the other side. I palm the door and press my cheek against it. It is slimy with algae. I feel painted onto it.

“Gary!” I yell. “Let me in! I’m cold and wet.”

The moon is full. The tide will be high. The water is waiting for orders. I think it wants this house as much as I do.

I could still make it home. I might still touch the bottom of the moat if I head there now. But for what? People begin moving around again inside my neighbor’s house. I hear the march of many feet up and down the staircase. A piano is tuned. They are carrying on. I notice for the first time that my neighbor’s house sits slightly lower on the hill than mine. We truly were at the height of land. It was not my imagination, or merely a boast. I’m awash with sadness.

“Gary. We had it all.”

I sit down on the stoop, and the water rises to my knees. Small fish circle my legs like they are playing a game.

Hawks soar high in the pinking sky. I don’t know much about birds, but I imagine they need land somewhere nearby. If they are gulls, they can float on the water. I don’t think hawks can do that. Or buzzards circling a kill. If they were albatross, they could fly the length of one giant ocean and never get tired. I’ve heard they keep ships company on an entire journey and then keep going. There is something in the name that makes me believe this. Albatross. It feels never-ending.
I hadn’t considered that somewhere beyond my sight the world might be continuing as normal. If those are hawks, they’ll have to return to their treetops, high above houses full of sleeping families, husbands and wives, children lucky enough to be born. Just beyond the curve of the earth, out of my view, skyscrapers could be creaking slightly in the newly blistering wind. Newscasts could be reporting about us, the ones who perished. But I’m still here.

I’m surprised how easy it was for me to believe I was one of the lucky few left. If people are watching this sunset all over the world, then I’m not so lucky after all, sitting up to my chest in cold ocean water that’s cluttered with debris and oily with human waste. What makes me so special? I had a house. I had Gary. It felt like enough for the end of days.

Soon someone will need to open the door. They have flush buckets to fill. Cans, bottles, batteries, to toss. Don’t they? I could wait.

I try to imagine it: me in there. Pressing palms, talking about the lives we’d lived. Being nostalgic, but for what? Eating crumbs together? Of course, if they let me in, I’d be expected to give over my house and supplies. They’d paw my antiques. They’d mess up all the beds’ bedding. I’d never again enjoy that morning echo of solitary me padding across the floors of my house.

If I go home, I’ll live longer. It is indisputable. I don’t know what more I could ask for.

“Okay, Gary. Last chance. I’m leaving,” I call out. I wait a beat, listening for the door to creak, for curiosity or need to win out.

Instead, I hear laughter behind my neighbor’s door.
I know that soon they will come. Gary will lead them. It could be any minute now. They’ll wade, swim, or selectively drown their way across the moat and savagely break through my great window and splinter open the locked front door. It’s a quality door. It won’t be easy.

Then the water and weather will get in and eat the house from the inside. They’ll be left with nothing yet again. I could warn them, but do I have to think of everything?

I wait in the widow’s walk, surrounded by soft down pillows, a tower of blankets. I have with me water, crackers, tinned meat, and my two biggest knives, but I hope it won’t come to that. I don’t think Gary will let it. True, I feel betrayed. He knows all my secrets, what I’m most afraid of, all the combinations, and where anything of worth is hidden. But I will still be his friend. If he’ll have me.

The moon rises, dips, rises, dips. The tide rolls in and out. I wait for the end. Frigid air pries itself inside. Even shrouded in blankets, I’m folded over from shivering. I wait for them. Pieces of my neighbor’s house are letting go, dropping into the sea. Some break windows as they fall. Is that a piano I hear tinkling, or glass shattering? Is that the sound of singing or of wood creaking to its breaking point? The whole house leans. The wind keens something awful. The sea is knocking, but his door remains shut.
INTERVIEW

Unequal Impact: The Deep Links Between Racism and Climate Change

Activist Elizabeth Yeampierre has long focused on the connections between racial injustice and the environment and climate change. In the wake of George Floyd’s killing and the outsized impact of Covid-19 on communities of color, she hopes people may finally be ready to listen.

BY BETH GARDINER • JUNE 9, 2020

The killing of George Floyd by Minneapolis police and the disproportionate impact of Covid-19 on African Americans, Latinos, and Native Americans have cast stark new light on the racism that remains deeply embedded in U.S. society. It is as present in matters of the environment as in other aspects of life: Both historical and present-day injustices have left people of color exposed to far greater environmental health hazards than whites.

Elizabeth Yeampierre has been an important voice on these issues for more than two decades. As co-chair of the Climate Justice Alliance, she leads a coalition of more than 70 organizations focused on addressing racial and economic inequities together with climate change. In an interview with Yale Environment 360, Yeampierre draws a direct line from slavery and the rapacious exploitation of natural resources to current issues of environmental justice. “I think about people who got the worst food, the worst
health care, the worst treatment, and then when freed, were given lands that were eventually surrounded by things like petrochemical industries,” says Yeampierre.

Yeampierre sees the fights against climate change and racial injustice as deeply intertwined, noting that the transition to a low-carbon future is connected to “workers’ rights, land use, [and] how people are treated,” and she criticizes the mainstream environmental movement, which she says was “built by people who cared about conservation, who cared about wildlife, who cared about trees and open space... but didn’t care about black people.”

Yale Environment 360: You’ve spoken about the big-picture idea that climate change and racial injustice share the same roots and have to be addressed together, and that there is no climate action that is not also about racial justice. Can you describe the links you see connecting these two issues?

Elizabeth Yeampierre: Climate change is the result of a legacy of extraction, of colonialism, of slavery. A lot of times when people talk about environmental justice they go back to the 1970s or ‘60s. But I think about the slave quarters. I think about people who got the worst food, the worst health care, the worst treatment, and then
when freed, were given lands that were eventually surrounded by things like petrochemical industries. The idea of killing black people or indigenous people, all of that has a long, long history that is centered on capitalism and the extraction of our land and our labor in this country.

For us, as part of the climate justice movement, to separate those things is impossible. The truth is that the climate justice movement, people of color, indigenous people, have always worked multi-dimensionally because we have to be able to fight on so many different planes.

When I first came into this work, I was fighting police brutality at the Puerto Rican Legal Defense Fund. We were fighting for racial justice. We were in our 20s and this is how we started. It was only a few years after that I realized that if we couldn't breathe, we couldn't fight for justice and that's how I got into the environmental justice movement. For us, there is no distinction between one and the other.

In our communities, people are suffering from asthma and upper respiratory disease, and we've been fighting for the right to breathe for generations. It's ironic that those are the signs you're seeing in these protests — “I can’t breathe.” When the police are using chokeholds, literally people who suffer from a history of asthma and respiratory disease, their breath is taken away. When Eric Garner died [in 2014 from a New York City police officer’s chokehold], and we heard he had asthma, the first thing we said in my house was, “This is an environmental justice issue.”

The communities that are most impacted by Covid, or by pollution, it's not surprising that they're the ones that are going to be most impacted by extreme weather events. And it's not surprising that they're the ones that are targeted for racial violence. It’s all the same communities, all over the United States. And you can’t treat one part of the problem without the other, because it's so systemic.

With Hurricanes Maria and Katrina, the loss of lives came “out of a legacy of neglect and racism.”

**e360:** Can you more explicitly draw the connection between climate change and the history of slavery and colonialism?

**Yeampierre:** With the arrival of slavery comes a repurposing of the land, chopping down of trees, disrupting water systems and other ecological systems that comes with supporting the effort to build a capitalist society and to provide resources for the privileged, using the bodies of black people to facilitate that.

The same thing in terms of the disruption and the stealing of indigenous land. There was a taking of land, not just for expansion, but to search for gold, to take down mountains and extract fossil fuels out of mountains. All of that is connected, and I
don’t know how people don’t see the connection between the extraction and how black and indigenous people suffered as a result of that and continue to suffer, because all of those decisions were made along that historical continuum, all those decisions also came with Jim Crow. They came with literally doing everything necessary to control and squash black people from having any kind of power.

You need to understand the economics. If you understand that, then you know that climate change is the child of all that destruction, of all of that extraction, of all of those decisions that were made and how those ended up, not just in terms of our freedom and taking away freedom from black people, but hurting us along the way.

It’s all related. You can’t say that with Hurricane Maria in Puerto Rico and Hurricane Katrina in New Orleans the loss of lives was simply because there was an extreme weather event. The loss of life comes out of a legacy of neglect and racism. And that’s evident even in the rebuilding. It’s really interesting to see what happens to the land after people have been displaced, how land speculation and land grabs and investments are made in communities that, when there were black people living there, had endured not having the things people need to have livable good lives.

These things, to me, are connected. It’s comfortable for people to separate them, because remember that the environmental movement, the conservation movement, a lot of those institutions were built by people who cared about conservation, who cared about wildlife, who cared about trees and open space and wanted those privileges while also living in the city, but didn’t care about black people. There is a long history of racism in those movements.

e360: So how do you have a fight for climate action that is intertwined with a fight for racial justice? What are the steps, the policies, that we should be thinking about
looking forward?

**Yeampierre:** With the Green New Deal, for example, we said that it wasn’t a Green New Deal unless it was centered on frontline solutions and on ensuring that frontline leadership would be able to move resources to their communities to deal with things like infrastructure and food security. When that happens, we’ll be able to move the dial much more efficiently. In New York, for example, we passed the Climate Leadership and Community Protection Act, which is aggressive legislation that looks at how you move resources to frontline communities and how you invest in those communities.

Nationally, we need to be looking at stopping pipelines – reducing carbon but also reducing other pollutants. We need to start focusing on regenerative economies, creating community cooperatives and different kinds of economic systems that make it possible for people to thrive economically while at the same time taking us off the grid.

In every community there are different things people are doing, everything from putting solar in public housing to community-owned solar cooperatives. This is not the ‘60s or the ‘70s or the ‘80s where we follow one iconic leader. This is a time where we need to have numerous people really taking on the charge of directing something that’s big and complex.

**e360:** Can you talk a little bit about the idea of a just transition to a low-carbon future and how that dovetails with anti-racism efforts?

**Yeampierre:** A just transition is a process that moves us away from a fossil fuel economy to local livable economies, to regenerative economies. Those are different economies of scale that include not just renewable energy but healthy food and all of the things that people need in order to thrive. The word justice here is important because for a long time people would talk about sustainability, that you could have sustainability without justice, and the climate movement focused on reducing carbon but didn’t really care about other pollutants.

“Climate activists talk about moving at a big, grand scale, and we talk about moving at a local scale.”

A just transition looks at the process of how we get there, and so it looks at not just the outcomes, which is something that the environmentalists look at, but it looks at the process – workers’ rights, land use, how people are treated, whether the process of creating materials that take us to a carbon-neutral environment is toxic and whether it affects the host community where it’s being built. It looks at all those different kinds of things.

I can give you one example in New York City. We have been advocates of bringing in offshore wind. One of the things that we learned is that in order for that to happen, the
The climate solution is we reduce carbon, but the environmental justice problem is we dump tons of nitrogen oxides and sulfur oxides and PM2.5 [particles] into the lungs of the host community.

We need the climate solution, but then we need to talk about how we electrify the industrial waterfront and how these ships can plug in so they’re not burning diesel. While we’re doing that, we also need to look at how we create the market instead of following the market – wind turbines that are built in the United States so we don’t have to bring the parts in from Europe.

These are the kinds of things that we think about when we’re thinking about a just transition. A climate activist will be like, “Okay, we need offshore wind” – right, that’s it. But a climate justice activist will be like, “Okay, let’s look at it a little closer and let’s figure out what the process looks like and how we can engage in remediation to make sure we are not only reducing carbon but we’re also reducing co-pollutants, and let’s make sure that the people that are hired are hired locally.” So there are all of these other pieces that are involved in a just transition. Climate activists talk about moving at a big, grand scale, and we talk about moving at a local scale, and then replicating those efforts.

*e360*: Racial justice would presumably have to be at the heart of that.

**Yeampierre**: It has to be at the center. For example, in Sunset Park [Brooklyn, where Yeampierre runs the Latino community group UPROSE], we just launched the first community-owned solar cooperative in the state. Okay, we want renewable energy. We need to be able to prioritize the people that are going to be most impacted. Low-income communities. People of color. It has to matter to white folks because when our communities succeed and get what they need, everyone benefits from that.

“*These [environmental groups] have to get out of their silos and out of their dated thinking.*”

With the cooperative, the community actually owns the utility, owns the energy source. People will be able to access renewable energy, at a reduced cost, be hired locally to build it – and have ownership. So it’s really exciting. We’re hoping this model will birth more projects like this.

Now, we’re is reaching out to small businesses. They’re struggling because of how Covid-19 has affected the economy. When we started this project, we were thinking it would provide resilience to disruptions of the grid and other systems from extreme
weather events. We hadn’t anticipated the disruption would be something like Covid. But these models become a real benefit in moments like this where you don’t know where your next paycheck is coming from. You have access to energy that is both renewable – which means it has a health benefit – and also benefits your pocketbook.

**e360:** With the pandemic and its racially disparate impact, and then the killing of George Floyd and the protests that have followed, we’re at this moment where these longstanding racial disparities and racism are on vivid display. What would you hope the climate movement and the environmental justice movement take away from this moment and apply going forward?

**Yeampierre:** I think that this is a moment for them to start thinking internally and thinking about some of the challenges that they’re having. I think it’s a moment for introspection and a moment to start thinking about how they contribute to a system that makes a police officer think it’s okay to put his knee on somebody’s neck and kill them, or a woman to call the police on an African-American man who was bird-watching in the park.

These institutions [environmental groups] have to get out of their silos and out of their dated thinking, and really need to look to organizations like the Climate Justice Alliance and Movement Generation and all of the organizations that we work with. There are so many people who have been working with each other now for years and have literally put out tons of information that there’s no need to reinvent the wheel. It’s all there.

There has to be a fundamental change in the culture of these institutions. If they were thinking strategically, they would be saying, “Hey, let me see. I’m in New York. Who’s doing this and how can we support them?” We’ve had groups of white young people who have contacted us and have said to us, “How can we support you? How can we best use our resources and our skills to support the work that you’re doing?” And, we’ve been like, “You know what? That is the right question. Let’s do this together.”

*This interview has been edited for length and clarity.*

Beth Gardiner is a journalist and the author of *Choked: Life and Breath in the Age of Air Pollution* (University of Chicago Press). Her work has appeared in publications including the *New York Times*, *The Guardian*, *National Geographic* and *Smithsonian*, and she is a former longtime Associated Press reporter. [More →](https://e360.yale.edu/features/unequal-impact-the-deep-links-between-inequality-and-climate-change)
Our nation faces multiple challenges, including the ongoing climate emergency, poor health for many Americans along with enormous medical spending, unprecedented job losses and systemic inequality. Though seemingly disparate issues, these problems are all connected in many ways. In particular, the burning of fossil fuels that is the primary driver of climate change is also responsible for the majority of deadly air pollution in the US. Transitioning to alternative energy sources not only improves the environment but would create jobs and reduce the disproportionate suffering from climate change and air pollution that falls upon the most vulnerable and exacerbates inequalities.

In this testimony, I present the results of new research by my group at Duke University in cooperation with NASA colleagues on the health and economic benefits to Americans if the United States and the rest of the world mitigate climate change to meet the objectives of the Paris Climate Agreement and keep global warming below 2°C. This new work is the first to incorporate advances in understanding of public health that have taken place up through this year in a consistent evaluation of the impacts of both the climate and air quality changes resulting from aggressive policies to mitigate climate change. These results show that the health benefits are much larger than those in prior studies. I can provide the Committee with results for all the contiguous 48 states and major metropolitan areas throughout the country. Here I focus on national totals. I will then present our findings on how the health and economic benefits develop over time and how much of the benefits come from US actions. Finally, I will discuss policies to achieve these benefits and briefly touch on how those affect jobs and other societal concerns.

We find that there would be enormous benefits to the health of Americans from adopting policies consistent with the world’s 2°C pledge. **Over the next 50 years, keeping to the 2°C pathway would prevent roughly 4.5 million premature deaths, about 3.5 million hospitalizations and emergency room visits, and approximately 300 million lost workdays in the US.** These large impacts reflect our updated understanding of the severe toxicity of air pollution and the dangers of heat exposure. Although it does not appear on death certificates it is indirectly responsible for a substantial fraction of heart diseases, including strokes, and respiratory diseases, including lower respiratory infections and chronic obstructive pulmonary disease.

The economic value of these health and labor benefits is enormous. The avoided deaths are valued at more than $37 trillion. The avoided health care spending due to reduced hospitalizations and emergency room visits exceeds $37 billion, and the increased labor
productivity is valued at more than $75 billion. On average, this amounts to over $700 billion per year in benefits to the US from improved health and labor alone, far more than the cost of the energy transition.

A key finding is that roughly 1.4 million lives could be saved from improved air quality during the next 20 years. As we’ve seen with the coronavirus lockdowns in many places, air pollution responds immediately to emissions reductions. A rapid shift to a 2°C pathway could reduce the toll of air pollution, which leads to nearly 250,000 premature deaths per year in the US, by 40% in just a decade. Our work shows that action now means benefits now.

Context

Climate change is a planetary emergency, with global average temperatures at the Earth’s surface already having risen by more than 1°C since the industrial revolution. Thousands of scientific studies have provided compelling evidence of the enormous damages that will occur with further warming, prompting the nations of the world to agree to strive to keep the global temperature rise “well below 2°C” (in the Paris Climate Agreement). Failure to meet this goal will lead to disastrous consequences, including crop failures, ever stronger storms, both severe flooding and exacerbated drought in different places, large rises in sea-level, shortages of fresh water in many parts of the world, and worsening heat waves.

Moving to a 2°C pathway would therefore bring tremendous benefits from the reduction in climate change but importantly, would also provide many benefits from reductions in air pollution. This is because the same activities that drive carbon emissions, primarily burning fossil fuels, are also the main sources of the emissions that cause air pollution. Our research project is one of the few to include both these factors in a single set of analyses, with most prior work looking at either the effects of climate change or air quality alone and thus providing a valuable but partial picture of the overall economic and health impacts.

How We Do Our Research

We used NASA’s model for long-term climate projections developed over many decades at the Goddard Institute for Space Studies. Projections of climate change made with this model more than 30 years ago, and presented to Congress in 1988, have been shown to have been highly accurate in capturing observed global warming. A few years ago, my research group at Duke augmented the capabilities of this model to represent air pollution at relatively high resolution, making this model suitable for simultaneous studying the impact of climate and air quality. The model has been extensively evaluated against the fleet of Earth orbiting satellites launched by NASA and NOAA, as well as ground-based air pollution monitors, and is capable of providing reasonable estimates of future heat and pollution levels associated with different socio-economic scenarios.

We focus on a comparison over 2020 to 2070 between a baseline emission scenario including current policies alone and a scenario in which the world institutes ambitious policies starting next
year that have a high likelihood of keeping global warming below 2°C in accord with international commitments. Such policies include rapid and deep decarbonization of the energy sector, end-use electrification including of most vehicles, heating and industrial processes, improving the energy efficiency of buildings, appliances, and industry, and managing land-use to reduce carbon and methane emissions.

The health impacts of fine particles (small bits of smoke, soot, dust and other liquid and solid particles that are tiny enough to penetrate deeply into the lungs when inhaled), of ozone (a toxic molecule that is one of the primary components of smog), and of heat are then calculated from the projected changes in each quantity based on extensive medical studies that have characterized the increased risk of disease and death associated with changes in exposure to each of these environmental factors. These include studies tracking hundreds of thousands of patients over many years, or in some cases even millions of patients. We include several recent updates that use expanded datasets and reveal that air pollution is even more damaging to human health than previously believed. Indeed, a recent report put out by both the National Academy of Sciences and the National Academy of Medicine (as well as foreign academies) reported that air pollution affects nearly every major organ in the body, damaging them from before birth through to old ages. The report states: “The scientific evidence is unequivocal: air pollution can harm health across the entire lifespan. It causes disease, disability and death, and impairs everyone’s quality of life. It damages lungs, hearts, brains, skin and other organs … affecting virtually all systems in the human body.” Many of these effects are clearly present but cannot yet be reliably quantified. Hence our study includes only the well-characterized effects. Among the health impacts of climate change we focus on deaths due to heat exposure as extreme heat kills more Americans each year than are killed by floods, storms, and wildfires combined. These results are based upon a nationwide analysis technique newly developed by my group. By using the latest evidence for the impacts of both air pollution and heat to evaluate premature deaths we find impacts roughly double those that would have been obtained using older evidence. Nevertheless, by not including all health impacts of either air pollution or climate change, our estimates might be considered lower bounds. Uncertainties in our values stem primarily from those in the underlying epidemiological data, but also incorporate those in modeling air pollution and climate change. Uncertainties in impacts are roughly 25-35%, with values equally likely to be higher or lower than the best estimates provided here.

**What We Found**

Meeting the 2°C target through reductions of fossil fuel use would produce a broad range of health benefits. In addition to those reported above, these include about 50,000 fewer hospital admissions for children due to asthma and about 2 million fewer cases of childhood bronchitis in the US. Older people are particularly vulnerable to both air pollution and heat exposure, as are the poor, and so the adverse impacts fall disproportionately on the most vulnerable within society. These non-fatal health effects all stem from improved air quality, and hence all are important during the next two decades as well as in the second half of the century.

Mitigating climate change requires action now, but the health benefits from lower temperatures than would otherwise have been seen take longer to appear because of the inertia of the climate
system to response to emissions changes. During the 50-year period we study, keeping warming below 2°C could prevent over 200,000 premature deaths of Americans from heat exposure. All of these occur during the latter half of the century, adding to the benefits from cleaner air that occur both before and during those years.

The impacts on lost workdays illustrate why it is so important to reduce both air pollution and climate change. Exposure to air pollution and heat not only sends people to the hospital or to their graves, but it keeps people from working productively or going to work at all. People cannot work if they are directly affected by exposure to heat or dirty air, but also when they are caregivers for children or elderly made sick by their environment. Our analysis finds that following a 2°C pathway leads to 235 million addition workdays that would have otherwise been lost due to air pollution, valued at $51 billion. Additional benefits from reduced labor losses due to extreme heat become apparent in the 2060s, with the cooler temperatures of a 2°C pathway leading to about 80 million addition workdays that would have otherwise been lost, valued at $20 billion. Hence there would be direct benefits via labor productivity to American businesses averaging about $1.5 billion per year from the cleaner air and cooler temperatures resulting from decarbonization.

Our Duke/NASA research also allows us to differentiate between the health benefits the US will realize if the world acts together to keep warming below 2°C and those that the US will realize if we act alone. An apt analogy might be that climate change is like the coronavirus – we cannot close our borders and keep out this catastrophe. Air pollution is different, however. While concerted global action will reduce air pollution in the United States more than domestic action alone – and hence save more lives and produce more health benefits – the United States can realize a large proportion of the benefits from reducing air pollution even if it acts alone. We found that US action alone would bring us more than two-thirds of the health benefits of worldwide action over the next 15 years, with roughly half the total over the entire 50-year period analyzed. Hence while it is unquestionably true that tackling climate change requires the nations of the world to work together, it is also true that the bulk of the near-term benefits we stand to receive from taking action will come from our own policies.

**What’s Good for the Environment is Good for the Economy**

Though our study attempted to be comprehensive in health and economic impacts we could reliably quantify, climate change causes many additional profound damages. I live in North Carolina, and we’ve been hit by multiple hurricanes in the last couple years, with terrible flooding and damage. Our beautiful barrier islands are being drowned by the rising seas. We might not be able to stop these things, but we can slow down the losses and reduce the severity of hurricanes, wildfires, and heatwaves. The toll of billion-dollar disasters has been rising rapidly, with costs of more than $100 billion per year over the last 5 years and will continue to do so if we don’t take prompt action. All of these add to the economic case for action, which is clearly less expensive than failing to act.

It is sometimes claimed that we face a choice between the environment and the economy. This is false. Ask a delivery truck driver how easy is it to get their job done when it’s 108 degrees Fahrenheit. Find a construction worker hammering down a roof in the blazing sun in Texas and
ask them how well they work when it’s 110 and humid. Ask a worker on a farm or on a giant factory floor too large to be air conditioned how many breaks they’ll need when temperatures rise even more in the summertime. Adding in the impacts of breathing dirty air, these productivity losses cost American businesses billions each year. The environmental costs of climate change and air pollution are also passed on to all businesses who pay in their higher health and damage insurance costs. Hence it’s not a question of choosing the environment or the economy – it’s choosing a healthy environment and a strong economy or a polluted environment and a weaker economy.

Furthermore, renewable electricity sources such as solar and wind power and energy efficiency programs create far more jobs per unit of energy produced or saved than fossil fuels, making the transition better for workers too (though obviously compensation and training for current fossil fuel sector employees would be a necessary part of a clean energy transition). In fact, clean energy employment has grown far more rapidly than coal jobs have been lost, and 2020 data show that it now accounts for more than 40 percent of America’s entire energy workforce. New clean energy jobs are especially important now when new jobs are so desperately needed due to the economic slowdown caused the coronavirus pandemic.

Our research quantifies how when heat waves reduce labor productivity in construction, agriculture and other outdoor jobs, there are real costs paid by businesses. It evaluated how, when increased asthma keeps kids home from school, and therefore their parents stay home from work, that too leads to large costs. These indirect economic effects are analogous to those caused by the coronavirus pandemic, in which the effect of that change in our environment extends far beyond the direct impacts on individuals who need healthcare themselves. Similarly, when everyone’s insurance and health care premiums rise due to climate change and air pollution, we all pay these costs. Recognizing the magnitude of these costs is critical to making the best decisions for all. By picking up the tab for the costs of environmental and health damages from fossil fuel use, we are effectively subsidizing an extremely profitable industry, and in doing so, are paying for our own ill-health. Overall, we find that the health and labor benefits of reaching a 2°C pathway far outweigh the associated costs, especially given the newer, larger benefits reported here.

**What We Can Do**

We have solutions and can reap the enormous gains in health, jobs, productivity, and agricultural yield while in many cases saving consumers and businesses money. Solar or wind energy are now cheaper electricity sources than fossil fuels in most of the country, often cheaper even when including battery storage which is going some way to solving the intermittency challenge of wind and solar that are otherwise not always available when desired. This applies not only to new generation capacity, but even to existing infrastructure. For example, most coal-fired power plants in the US could be shut down and replaced with renewables at a net cost savings. And unlike fossil fuel systems, the cost of renewable power is continuing to decline, prompting widespread worry about stranded assets associated with any further spending on fossil fuels along with widespread optimism that future energy-intensive businesses will be more competitive in those parts of America powered by clean energy. The immediate pivot away from
fossil fuels required to meet aggressive climate change mitigation targets would thus provide
great benefits for both the health of Americans and their pocketbooks, whereas any new
construction of fossil fuel infrastructure is now viewed as both an economically risky and
ethically dubious investment by many.

Electric vehicles now have long ranges and both they and more fuel-efficient vehicles save
consumers money on fuel costs over the lifetime of the car. Electric vehicles and more fuel-
efficient vehicles also save lives by reducing air pollution. Those benefits are well-known but
have been underestimated in prior analyses. The economic gains from switching to electric
vehicles are likely to grow as battery costs continue their decline and electric vehicles reach
parity with internal combustion engines in the next few years (their lifetime costs, including fuel
and maintenance, are already lower than internal combustion vehicles in many cases).
Supporting electric vehicle charging infrastructure, more fuel-efficient cars, mass transit and
active transit are all ways to reduce emissions from transportation. Another part of addressing
climate change is energy efficiency improvements, which typically pay for themselves while
putting people to work.

In addition to transitioning away from fossil fuel use, there is a compelling need to reduce
emissions of methane, the second most important driver of human-made climate change after
carbon dioxide. Fortunately, many solutions are available to reduce emissions of methane, and
even better a large fraction of them more than pay for themselves as captured methane from
landfills or fossil fuel infrastructure is a valuable product (methane is the main component of
natural gas). Since methane is one of the emissions that leads to ozone production, reductions not
only reduce climate change but also reduce air pollution, as with decarbonization. Within the
fossil fuel and waste sectors, roughly half of US methane could likely be reduced at a net cost
savings even without accounting for environmental damages. When accounting for the health
and economic benefits of the improved air quality and avoided climate change, nearly two-thirds
of our emissions could be eliminated at a net economic gain through technological changes. The
remainder are largely from agriculture. Decreasing emissions from that sector would require
reduced consumption of cattle-based foods, which for most people would be a healthy choice
that happens to also help the planet by reducing methane emissions. Hence there are many
reasons to follow a 2°C pathway in addition to environmental impacts. The Climate and Clean
Air Coalition, of which the US is a founding partner, works to achieve substantive reductions in
emissions, including methane, in order to simultaneously mitigate climate change and improve
air quality. US leadership in this area would be likely to inspire additional action elsewhere,
benefiting us all.

I would like to close by acknowledging my NASA GISS and Columbia University colleagues
and my research group at Duke, whom I note are mostly students, without whom this work
would not have been possible. Together our research has shown that we do not need to choose
between the economy or the environment, but rather that mitigating climate change helps
American businesses that would see increased worker productivity and lower health and damage
insurance premiums, improves the health of Americans suffering from heat exposure and air
pollution, increases the number of jobs, and reduces systemic inequality and injustice for the
most vulnerable who are disproportionately affected by both air pollution and climate change –
the poor, children, the elderly and people of color. We can thus gain both a stronger economy and a healthier environment by transitioning now to clean energy and a 2°C pathway.

**Research Team**

The work presented here represents the efforts of a large team of researchers, though they are not responsible for the statements expressed here. No statements should be construed to imply that NASA endorses these policy suggestions.

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**References**


Appendix: Methods

Model Setup

Our health and economic impact evaluation is based upon the results of computer simulations of the effect of future emissions of carbon dioxide and other greenhouse gases along with associated pollutants such as ozone and particulate matter under two sets of scenarios. The first set examined the effects of a transition across all sectors and all countries to a 2°C pathway.
relative to a reference scenario that leads to approximately 4°C warming by the end of the century.

The second set of scenarios compared three scenarios: (1) decarbonizing the entire world’s power sector; (2) decarbonizing only the US power sector; and (3) maintaining current policies along with projected changes in energy demand, but not taking further action to reduce burning of fossil fuels for energy production. In the decarbonization scenarios, the rate of decarbonization of the power sector was assumed to be consistent with keeping warming below 1.5°C.

These simulations were performed using the latest version of NASA’s global climate model developed at the Goddard Institute for Space Studies (version: GISS-E2.1-G4). That model includes representations of the physical and chemical processes that govern Earth’s climate and the composition of the atmosphere, has been widely used in climate research over the past several decades, and has been shown to realistically capture many of the physical quantities and trends that have been observed by the fleet of NASA and NOAA Earth-observing satellites (e.g. 10). Note that the newer E2.1 version (used for GISS submissions to phase 6 of the Coupled Model Intercomparison Project (CMIP6)) includes an improved representation of surface ozone concentrations relative to prior versions that showed a substantial positive bias.

As an example of the model’s performance, our simulations produce a 2020 population-weighted concentration of particulate matter with a diameter less than 2.5 microns (PM$_{2.5}$) across the contiguous US of 8.9 µg m$^{-3}$ (reporting the 2016-2025 average). For comparison, the comparable population-weighted concentration calculated from a widely-used dataset produced by using satellite observations of aerosol to adjust a global model’s simulated concentration is 9.3 µg m$^{-3}$ for 2014-2016, the latest years available 17, and the value estimated by US EPA scientists using a data fusion of surface monitoring and a high resolution regional model was 8.4 µg m$^{-3}$ for 2014 (the most recent year analyzed 18).

**Impacts: Introduction**

The climate and air pollution conditions derived from the modeling were then used to quantify impacts on human health (mortality and morbidity) due to pollution and heat exposure, and on worker productivity due to air pollution and heat exposure. Impacts of exposure to both pollution and climate change were calculated for each set of scenarios worldwide, but here we focus on results in the United States. Impacts were evaluated on a grid of approximately 50 x 50 km (33 x 33 miles). This relatively high-resolution simulation allows the model to capture pollutant exposures in urban areas, as documented in prior publications using similar methodology 3.

The health impacts analysis used the most up-to-date epidemiological relationships based on decades of public health data on air-pollution related deaths, heat-related deaths, and nonfatal (morbidity) impacts of exposure. In such studies, the health of hundreds of thousands or even millions of people are tracked over time, allowing a statistical relationship between exposure and health effects to be established. This is similar to research relating cigarette smoking to health impacts. Exposure to air pollution has been clearly linked to increased risk of heart disease, stroke, chronic obstructive pulmonary disease, lower respiratory infection, lung cancer,
pneumonia, and diabetes, all of which can lead to premature death. The increased risk due to exposure is combined with data on baseline public health and population distributions, along with projected changes in those factors over the coming decades, to evaluate overall health burdens on the US population.

Our analysis includes projected changes in population and baseline health conditions. Population projections are from the socio-economic modeling associated with the Shared Socio-economic Pathways (SSP), a community-wide project to provide plausible alternative projections of various futures including ‘sustainability’ (SSP1) and ‘regional rivalry’ (SSP3)19. These population projections are applied at the country-level using the year 2015 distribution of population in the US (CIESIN, https://sedac.ciesin.columbia.edu/data/collection/gpw-v3) but also accounting for the slight increase from 85% to 94% for the urban share of population from 2020 to 2070 in the projections. The projected US population varies greatly across the scenarios, even as to the direction of change relative to the current (2020) population of about 340 million. Under SSP1, the US population rises to 440 million whereas under SSP3 it decreases to 315 million. As our standard reference case is SSP3, this means that all climate policy cases (which use the other SSPs) have higher population, thereby reducing the health benefits when evaluated in terms of total numbers. In particular, the benefits of the lowest warming scenarios which are under SSP1 are realized by a population 43% larger than that projected under the reference case SSP3 in 2070, greatly reducing their apparent value when viewed in terms of total burdens. These populations projections are applied for both mortality and morbidity calculations.

The projections of future baseline mortality including cardiopulmonary disease, respiratory disease and malignant neoplasms are from the International Futures (IF;20 Hughes et al., 2011) model version 7.45 base scenario (http://pardee.du.edu/access-ifs, accessed September 23, 2019). This model projects cause- and country-specific baseline mortality rates through 2100. For each country and underlying disease, we calculate the baseline mortality rate changes between the future year (e.g. 2050) and 2015 and then we apply this relative change to the 2015 Global Burden of Disease (GBD) baseline mortality21. GBD baseline mortality rates were mapped to best match the current International Classification of Diseases (ICD) codes for respiratory (ICD-10 Codes: J00-J98; GBD Codes: B.3, A.2.3, A.2.4) and cardiovascular (ICD-10 Codes: I20-I25, I30-I51, I60-I69, I70; GBD Codes: B.2.2, B.2.3, B.2.8, B.2.9, B.2.10) related deaths for which significant impacts were found in the epidemiological study22. For ozone-related impacts, the IF cardiovascular and respiratory changes were mapped to those impacts. In the case of impacts for which the epidemiology has provided links to broader mortality rates, we apply the nearest match from the IF data: all-cause except accidents is matched to non-communicable plus communicable diseases for heat exposure and non-communicable diseases plus lower respiratory infections is used for the all-cause impacts of PM2.5 (consistent with the epidemiological study23).

**Premature Deaths**

In the case of particulate matter, these epidemiological relationships come from a comprehensive report released in 2018 by 54 of the world’s leading experts on small particle air pollution23. That analysis is based upon the results of a meta-analysis including 41 cohort studies from around the world, including the US. Among other findings, that study concluded that the all-
cause impact of PM$_{2.5}$ exposure was on the order of 30% greater than the sum of the response to the five previously established specific causes of death (ischemic heart disease (IHD), stroke, chronic obstructive pulmonary disease (COPD), lung cancer, and lower respiratory infections). Deaths are evaluated for adults older than 25 based on the response to modeled exposures obtained with the Global Exposure Mortality Model described in the meta-analysis study.

In the case of ozone, these epidemiological relationships come from a 2016 study that updates the prior analyses by the same team that is the basis of standard US and international health analyses. This analysis is based upon the responses reported in one of the largest studies to date that uses the American Cancer Society Cancer Prevention Study-II cohort. It calculated cause-specific deaths attributable to incremental changes in the maximum daily 8 h average ozone concentration using a version of this cohort that spans 22 years of follow-up and included 669,046 subjects who experienced 237,201 deaths.

The Environmental Protection Agency uses a program called BenMAP to calculate the number of air pollution-related deaths and illnesses. BenMAP, however, incorporates older versions of the epidemiological relationships between air pollution and deaths and illnesses that were developed in 2009 for ozone and 2014 for particulates. The estimates presented in this briefing use the latest epidemiological relationships developed by the researchers in 2016 for ozone and 2018 of particulates. We point out that both the exposure-response relationships in EPA’s BenMAP and those used in the estimates presented in this briefing are derived from the work of the same leading researchers. These updated epidemiological relationships show that both types of pollution are more lethal than previously understood.

For example, BenMAP estimates that exposure to particulate matter caused 121,000 premature deaths in 2014 in the United States. The more recent work by the leading small particulate experts estimates that exposure to particulate matter caused 213,000 premature deaths in 2015 in the United States and Canada. This is very similar to our 2020 value which is 191,000 annual premature deaths in the US using the latest exposure-response function, with the slightly larger value in the other study seeming to correspond well to the inclusion of Canada and the slightly earlier year for their analysis. For ozone, using observed concentrations and the older 2009 epidemiology produces estimated deaths in the United States of 17,000 per year whereas using the newer 2016 epidemiology produces estimates of 51,000 per year.

In the case of heat exposure, we use the generalized risk function covering the US for hot temperatures above the local optimum temperature derived in a prior study:

$$RR = 1 - 0.0014 \times (SMT - 30.9)T + 0.005 \times (SMT - 26.7)T$$

where RR is relative risk, SMT is the local summer mean temperature (June–August) and T is the local daily temperature in °C above the optimum temperature where the latter is represented by each location's 84th percentile temperature. For US conditions, this relationship implies a stronger increase in RR at the highest temperatures in cooler locations, consistent with the underlying epidemiological data used to derive the generalized function. This generalized risk function has been shown to capture the observed shape of the exposure-response curve in
each of the 10 US cities that were used in prior evaluation of its performance. As with other impacts, mortalities are estimated using:

\[ \Delta \text{Mort} = y_0 \times AF \times \text{Population} \]

where the attributable fraction AF is defined as \((\text{RR}-1)/1\), \(y_0\) is the all-cause baseline mortality rate and Population is the all-age local population. Potential adaptation to heat is also evaluated using a variety of plausible assumptions.

**Morbidity Outcomes**

Morbidity impacts of PM\(_{2.5}\) are based on a systematic review and meta-analysis of literature describing responses for hospital admissions (HA), asthma-related emergency room visits (ERV), and childhood bronchitis cases. Briefly, in the meta-analysis for HA, we separate impacts into those associated with cardiovascular disease and those related to respiratory disease. Cardiovascular diseases are defined as either codes 390–459 based on the International Classification of Diseases, Ninth Revision (ICD-9), or I00-I99 based on the Tenth Revision (ICD-10). For the latter revision, these include cardiovascular diseases (CVD-ICD I00-I99, except I88), arrhythmia (ICD10: I46-I49), cardiac diseases (ICD10: I00-I59, I97.1, I98.1), cardiac failure (ICD10: I50); ischemic heart disease (ICD10: I20, I21, I22, I24, I25.2), myocardial infarction (ICD10: I21, I22) and stroke (ICD10: I60-I66, I67 (except I67.0, I67.3), I68 (except I68.0), I69). Similarly, respiratory impacts are defined as hospital admissions classified with codes 460–519 in ICD-9 or codes J00-J99 in ICD-10. For ICD-10, these include the broad category diseases of the respiratory system (J00-J99), which in turn encompass acute upper respiratory infections (J00-J06), pneumonia (J12-J18), chronic obstructive pulmonary disease (J41-J44), and asthma (J45-J46), among others. We did not include studies that only focused on specific causes within the above groups. In other words, we are reviewing the increased risk in “all-cause” cardiovascular and respiratory hospital admissions.

The exposure-response function (ERF) for the relationship between PM\(_{2.5}\) exposure and cardiovascular HA is based upon 32 studies, with separate ERFs for the all-age population and for the population older than 65 years of age. Our ERF for the relationship between PM\(_{2.5}\) exposure and respiratory HA is based upon 41 studies, with a single all-age ERF as no significant differences were observed for different population subgroups. The ERF for asthma-related ERV is based upon 27 observations reported in 17 studies. Among those, 9 observations were focused on child asthma ERV but statistical tests did not indicate a significant difference between the effects on children and those on adults. We thus constructed an ERF for the all-age population based on the pooled results of all the studies.

For each morbidity endpoint, we constructed both log-linear and non-linear ERFs. The log-linear exposure-response model is described by:

\[ HR = \exp(\beta x) \]

where HR is the hazard ratio, \(\beta\) is the coefficient of the exposure-response effect, and \(x\) is the exposure to PM\(_{2.5}\). By definition, the logarithm of the HR increases at a constant rate \(\beta\) with increasing exposure. The non-linear ERF has two additional parameters, \(\mu\) and \(\tau\), to allow
curvature and location of the ERF to change across the range of exposure. This modeling approach was applied in reference 23. This ERF is expressed as:

$$HR = \exp (\theta T(x))$$

where

$$T(x) = f(x) \omega(x)$$

$$f(x) = x, \text{ or } f(x) = \log (x + 1)$$

$$\omega(x) = 1/(1 + \exp[-(x - \mu)/(\tau r)])$$

where \(\theta\) is the regression coefficient, \((\mu, \tau)\) are parameters, \(x\) is the exposure and \(r\) is the 5th-95th percentile range of exposures in the underlying studies. The two forms of \(f(x)\) allow this ERF to behave as either a log model (when \(f(x) = \log (x + 1), HR = \exp (\theta \log(x + 1) \omega(x))\)) or as a log-linear model (when \(f(x) = x, HR = \exp (\theta x \omega(x))\)). Note that when \(\omega(x) = 1\) and \(f(x) = x\), this functional form becomes identical to the log-linear model above (i.e. \(HR = \exp (\theta x)\)). The function \(\omega(x)\) is a logistic weighting function, where \(\mu\) and \(\tau\) control the shape. As such, the effect size becomes a non-linear function of \(x\), instead of being constant across the range of \(x\).

Finally, the HR calculated from the ERFs above is then used to derive AF:

$$AF = 1 - \frac{1}{HR}$$

where AF is the fraction of total morbidity burdens at a specific location attributable to the PM\(_{2.5}\) exposure, such that similar to mortality:

$$\Delta\text{Morbidity} = y_0 \times AF \times Population$$

where \(y_0\) is the baseline morbidity rate of each endpoint for the US, and population is the total population in the age groups applicable for a given morbidity endpoint.

In addition, we evaluated the effects of both air pollution and heat exposure on labor productivity. Labor losses due to exposure to extreme heat are evaluated using previously established exposure-response functions for the US\(_{29}\). In that study, nationally representative survey data from 2003 to 2006 and daily weather observations from roughly 8,000 weather stations were used to investigate how Americans allocate their work and leisure time as a function of ambient temperatures. They found a statistically significant approximately linear decrease in the time allocated to labor with increasing temperatures for high-risk sectors when value exceeded a threshold of about 29°C. This relationship has been widely used recently \(30, 31\).

In our calculations, the value of time lost is calculated using county-level annual employment (covering working ages 15-64 years old) and annual average weekly wages from the Quarterly Census of Employment and Wages, US Bureau of Labor Statistics. We use the North American Industry Classification System to determine the number of workers in high-risk industries/sectors (largely those that cannot readily be air-conditioned): agriculture, forestry, fishing and hunting, construction, manufacturing, mining, transportation, and utilities. The 2016 fraction of workers in high-risk industries is used for each county. National average wages range from $19.0 hour\(^{-1}\) for agriculture to $44.9 hour\(^{-1}\) for utilities and are spatially heterogeneous across the US. The analysis covers the contiguous US. Surface temperature changes are based upon the daily temperature values modeled in the simulations, with results reported averaging lost hours over at minimum 10 years to reduce the noise inherent in daily temperature values.

The effects of exposure to PM\(_{2.5}\) on labor are evaluated based on a study relating such exposure to work loss days in the US for 1976-1981\(_{32}\). As in similar analyses performed by the US EPA\(_{24}\), we calculate the HR as the average across years weighted by the variance of \(\beta\) each year, finding
a mean of 1.047 per 10 \( \mu g \, m^{-3} \) and a 5%-95% confidence interval of 1.04 to 1.05. These apply to the working age population defined as persons aged 15-64.

**Valuation of Impacts**

Monetized benefits associated with avoided mortality are evaluated using a willingness-to-pay (WTP) measure of the value societies place upon reduced risk of premature death. This measure is often referred to as the value of a statistical life (VSL) though it is in fact an expression of the value that people affix to small changes in mortality risks in monetary terms rather than the value of any individual’s life. Such valuations can be derived from empirical data, for example on the increased wages offered for occupations with a higher risk of death or expenditures on transportation safety measures. Health literature often uses disability adjusted life years, which are arguably more informative since they incorporate the age of the affected individuals, but for monetization VSL is a better-established metric in the economics. We base our WTP on the mean of 26 peer-reviewed studies evaluated by the United States Environmental Protection Agency and used by that agency to derive its official recommended VSL of $7.4 million in 2006$. That value is then inflated to represent the year 2018 using an economic growth rate of 2.6% yr$^{-1}$ and an elasticity for WTP with income growth of 0.4.

For morbidity, the value of avoided hospital admission is based on the Healthcare Cost and Utilization Project, a US government-run health data project with a comprehensive dataset for inpatients. Values range from $11,900 per visit for respiratory illness to $16,400 per visit for cardiovascular disease in persons over 65 and to $18,900 per visit for cardiovascular disease in persons under 65 years of age. Valuation of avoided asthma ERVs is based on ref. 35 and is $91 per visit. Valuation of work loss days due to air pollution and of childhood bronchitis is based on the Carbon Reduction Benefits on Health calculation tool produced by the World Health Organization, adjusted to US conditions, and are $216 per day and $1057 per case, respectively. Work losses due to air pollution are assumed to affect all sectors of the economy.

To estimate the value associated with labor losses from heat, which do not affect all sectors, we use 2016 county-level annual employment (working ages 15-64 years old) and annual average weekly wages from the Quarterly Census of Employment and Wages, US Bureau of Labor Statistics (https://www.bls.gov/cew/datatoc.htm, accessed Jan 10, 2019). We use the following North American Industry Classification System (NAICS) codes to determine the number of workers in high-risk industries/sectors that are affected by heat exposure: NAICS 11 for agriculture, forestry, fishing and hunting; NAICS 23 for construction; NAICS 31-33 for manufacturing; NAICS 21 for mining; NAICS 48-49 for transportation, and NAICS 22 for utilities (https://data.bls.gov/cew/doc/titles/industry/industry_titles.htm, accessed Jan 10, 2019). The 2016 fraction of workers in high-risk industries is used for each county. National average wages range from $19.0 hour$^{-1}$ for agriculture to $44.9 hour$^{-1}$ for utilities, and these are spatially heterogeneous across the US.

**Additional References Cited in the Appendix**


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Introduction

This Report responds to the invitation for IPCC ‘... to provide a Special Report in 2018 on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways’ contained in the Decision of the 21st Conference of Parties of the United Nations Framework Convention on Climate Change to adopt the Paris Agreement.1

The IPCC accepted the invitation in April 2016, deciding to prepare this Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

This Summary for Policymakers (SPM) presents the key findings of the Special Report, based on the assessment of the available scientific, technical and socio-economic literature2 relevant to global warming of 1.5°C and for the comparison between global warming of 1.5°C and 2°C above pre-industrial levels. The level of confidence associated with each key finding is reported using the IPCC calibrated language.3 The underlying scientific basis of each key finding is indicated by references provided to chapter elements. In the SPM, knowledge gaps are identified associated with the underlying chapters of the Report.

A. Understanding Global Warming of 1.5°C

A.1 Human activities are estimated to have caused approximately 1.0°C of global warming5 above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (high confidence) (Figure SPM.1) {1.2}

A.1.1 Reflecting the long-term warming trend since pre-industrial times, observed global mean surface temperature (GMST) for the decade 2006–2015 was 0.87°C (likely between 0.75°C and 0.99°C) higher than the average over the 1850–1900 period (very high confidence). Estimated anthropogenic global warming matches the level of observed warming to within ±20% (likely range). Estimated anthropogenic global warming is currently increasing at 0.2°C (likely between 0.1°C and 0.3°C) per decade due to past and ongoing emissions (high confidence). {1.2.1, Table 1.1, 1.2.4}

A.1.2 Warming greater than the global annual average is being experienced in many land regions and seasons, including two to three times higher in the Arctic. Warming is generally higher over land than over the ocean. (high confidence) {1.2.1, 1.2.2, Figure 1.1, Figure 1.3, 3.3.1, 3.3.2}

A.1.3 Trends in intensity and frequency of some climate and weather extremes have been detected over time spans during which about 0.5°C of global warming occurred (medium confidence). This assessment is based on several lines of evidence, including attribution studies for changes in extremes since 1950. (3.3.1, 3.3.2, 3.3.3)

1 Decision 1/CP.21, paragraph 21.
2 The assessment covers literature accepted for publication by 15 May 2018.
3 Each finding is grounded in an evaluation of underlying evidence and agreement. A level of confidence is expressed using five qualifiers: very low, low, medium, high and very high, and typeset in italics, for example, medium confidence. The following terms have been used to indicate the assessed likelihood of an outcome or a result: virtually certain 99–100% probability, very likely 90–100%, likely 66–100%, about as likely as not 33–66%, unlikely 0–33%, very unlikely 0–10%, exceptionally unlikely 0–1%. Additional terms (extremely likely 95–100%, more likely than not >50–100%, more unlikely than likely 0–<50%, extremely unlikely 0–5%) may also be used when appropriate. Assessed likelihood is typeset in italics, for example, very likely. This is consistent with AR5.
4 See also Box SPM.1: Core Concepts Central to this Special Report.
5 Present level of global warming is defined as the average of a 30-year period centred on 2017 assuming the recent rate of warming continues.
6 This range spans the four available peer-reviewed estimates of the observed GMST change and also accounts for additional uncertainty due to possible short-term natural variability. (1.2.1, Table 1.1)
A.2 Warming from anthropogenic emissions from the pre-industrial period to the present will persist for centuries to millennia and will continue to cause further long-term changes in the climate system, such as sea level rise, with associated impacts (high confidence), but these emissions alone are unlikely to cause global warming of 1.5°C (medium confidence). (Figure SPM.1) {1.2, 3.3, Figure 1.5}

A.2.1 Anthropogenic emissions (including greenhouse gases, aerosols and their precursors) up to the present are unlikely to cause further warming of more than 0.5°C over the next two to three decades (high confidence) or on a century time scale (medium confidence). {1.2.4, Figure 1.5}

A.2.2 Reaching and sustaining net zero global anthropogenic CO₂ emissions and declining net non-CO₂ radiative forcing would halt anthropogenic global warming on multi-decadal time scales (high confidence). The maximum temperature reached is then determined by cumulative net global anthropogenic CO₂ emissions up to the time of net zero CO₂ emissions (high confidence) and the level of non-CO₂ radiative forcing in the decades prior to the time that maximum temperatures are reached (medium confidence). On longer time scales, sustained net negative global anthropogenic CO₂ emissions and/or further reductions in non-CO₂ radiative forcing may still be required to prevent further warming due to Earth system feedbacks and to reverse ocean acidification (medium confidence) and will be required to minimize sea level rise (high confidence). (Cross-Chapter Box 2 in Chapter 1, 1.2.3, 1.2.4, Figure 1.4, 2.2.1, 2.2.2, 3.4.4.8, 3.4.5.1, 3.6.3.2)

A.3 Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present, but lower than at 2°C (high confidence). These risks depend on the magnitude and rate of warming, geographic location, levels of development and vulnerability, and on the choices and implementation of adaptation and mitigation options (high confidence). (Figure SPM.2) {1.3, 3.3, 3.4, 5.6}

A.3.1 Impacts on natural and human systems from global warming have already been observed (high confidence). Many land and ocean ecosystems and some of the services they provide have already changed due to global warming (high confidence). (Figure SPM.2) {1.4, 3.4, 3.5}

A.3.2 Future climate-related risks depend on the rate, peak and duration of warming. In the aggregate, they are larger if global warming exceeds 1.5°C before returning to that level by 2100 than if global warming gradually stabilizes at 1.5°C, especially if the peak temperature is high (e.g., about 2°C) (high confidence). Some impacts may be long-lasting or irreversible, such as the loss of some ecosystems (high confidence). {3.2, 3.4.4, 3.6.3, Cross-Chapter Box 8 in Chapter 3}

A.3.3 Adaptation and mitigation are already occurring (high confidence). Future climate-related risks would be reduced by the upscaling and acceleration of far-reaching, multilevel and cross-sectoral climate mitigation and by both incremental and transformational adaptation (high confidence). {1.2, 1.3, Table 3.5, 4.2.2, Cross-Chapter Box 9 in Chapter 4, Box 4.2, Box 4.3, Box 4.6, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.4.1, 4.4.4, 4.4.5, 4.5.3}
Cumulative emissions of CO₂ and future non-CO₂ radiative forcing determine the probability of limiting warming to 1.5°C

a) Observed global temperature change and modeled responses to stylized anthropogenic emission and forcing pathways

Global warming relative to 1850-1900 (°C)

b) Stylized net global CO₂ emission pathways
Billion tonnes CO₂ per year (GtCO₂/yr)

C0₂ emissions decline from 2020 to reach net zero in 2055 or 2040

Faster immediate CO₂ emission reductions limit cumulative CO₂ emissions shown in panel (c).

c) Cumulative net CO₂ emissions
Billion tonnes CO₂ (GtCO₂)

Cumulative CO₂ emissions in pathways reaching net zero in 2055 and 2040

Maximum temperature rise is determined by cumulative net CO₂ emissions and net non-CO₂ radiative forcing due to methane, nitrous oxide, aerosols and other anthropogenic forcing agents.

d) Non-CO₂ radiative forcing pathways
Watts per square metre (W/m²)

Non-CO₂ radiative forcing reduced after 2030 or not reduced after 2030

Figure SPM.1 | Panel a: Observed monthly global mean surface temperature (GMST, grey line up to 2017, from the HadCRUT4, GISTEMP, Cowtan–Way, and NOAA datasets) change and estimated anthropogenic global warming (solid orange line up to 2017, with orange shading indicating assessed likely range). Orange dashed arrow and horizontal orange error bar show respectively the central estimate and likely range of the time at which 1.5°C is reached if the current rate of warming continues. The grey plume on the right of panel a shows the likely range of warming responses, computed with a simple climate model, to a stylized pathway (hypothetical future) in which net CO₂ emissions (grey line in panels b and c) decline in a straight line from 2020 to reach net zero in 2055 and net non-CO₂ radiative forcing (grey line in panel d) increases to 2030 and then declines. The blue plume in panel a) shows the response to faster CO₂ emissions reductions (blue line in panel b), reaching net zero in 2040, reducing cumulative CO₂ emissions (panel c). The purple plume shows the response to net CO₂ emissions declining to zero in 2055, with net non-CO₂ forcing remaining constant after 2030. The vertical error bars on right of panel a show the likely ranges (thin lines) and central terciles (33rd – 66th percentiles, thick lines) of the estimated distribution of warming in 2100 under these three stylized pathways. Vertical dotted error bars in panels b, c and d show the likely range of historical annual and cumulative global net CO₂ emissions in 2017 (data from the Global Carbon Project) and of net non-CO₂ radiative forcing in 2011 from AR5, respectively. Vertical axes in panels c and d are scaled to represent approximately equal effects on GMST. [1.2.1, 1.2.3, 1.2.4, 2.3, Figure 1.2 and Chapter 1 Supplementary Material, Cross-Chapter Box 2 in Chapter 1]
B. Projected Climate Change, Potential Impacts and Associated Risks

B.1 Climate models project robust\textsuperscript{7} differences in regional climate characteristics between present-day and global warming of 1.5°C,\textsuperscript{8} and between 1.5°C and 2°C.\textsuperscript{8} These differences include increases in: mean temperature in most land and ocean regions (high confidence), hot extremes in most inhabited regions (high confidence), heavy precipitation in several regions (medium confidence), and the probability of drought and precipitation deficits in some regions (medium confidence). (3.3)

B.1.1 Evidence from attributed changes in some climate and weather extremes for a global warming of about 0.5°C supports the assessment that an additional 0.5°C of warming compared to present is associated with further detectable changes in these extremes (medium confidence). Several regional changes in climate are assessed to occur with global warming up to 1.5°C compared to pre-industrial levels, including warming of extreme temperatures in many regions (high confidence), increases in frequency, intensity, and/or amount of heavy precipitation in several regions (high confidence), and an increase in intensity or frequency of droughts in some regions (medium confidence). (3.2, 3.3.1, 3.3.2, 3.3.3, 3.3.4, Table 3.2)

B.1.2 Temperature extremes on land are projected to warm more than GMST (high confidence): extreme hot days in mid-latitudes warm by up to about 3°C at global warming of 1.5°C and about 4°C at 2°C, and extreme cold nights in high latitudes warm by up to about 4.5°C at 1.5°C and about 6°C at 2°C (high confidence). The number of hot days is projected to increase in most land regions, with highest increases in the tropics (high confidence). (3.3.1, 3.3.2, Cross-Chapter Box 8 in Chapter 3)

B.1.3 Risks from droughts and precipitation deficits are projected to be higher at 2°C compared to 1.5°C of global warming in some regions (medium confidence). Risks from heavy precipitation events are projected to be higher at 2°C compared to 1.5°C of global warming in several northern hemisphere high-latitude and/or high-elevation regions, eastern Asia and eastern North America (medium confidence). Heavy precipitation associated with tropical cyclones is projected to be higher at 2°C compared to 1.5°C global warming (medium confidence). There is generally low confidence in projected changes in heavy precipitation at 2°C compared to 1.5°C in other regions. Heavy precipitation when aggregated at global scale is projected to be higher at 2°C than at 1.5°C of global warming (medium confidence). As a consequence of heavy precipitation, the fraction of the global land area affected by flood hazards is projected to be larger at 2°C compared to 1.5°C of global warming (medium confidence). (3.3.1, 3.3.3, 3.3.4, 3.3.5, 3.3.6)

B.2 By 2100, global mean sea level rise is projected to be around 0.1 metre lower with global warming of 1.5°C compared to 2°C (medium confidence). Sea level will continue to rise well beyond 2100 (high confidence), and the magnitude and rate of this rise depend on future emission pathways. A slower rate of sea level rise enables greater opportunities for adaptation in the human and ecological systems of small islands, low-lying coastal areas and deltas (medium confidence). (3.3, 3.4, 3.6)

B.2.1 Model-based projections of global mean sea level rise (relative to 1986–2005) suggest an indicative range of 0.26 to 0.77 m by 2100 for 1.5°C of global warming, 0.1 m (0.04–0.16 m) less than for a global warming of 2°C (medium confidence). A reduction of 0.1 m in global sea level rise implies that up to 10 million fewer people would be exposed to related risks, based on population in the year 2010 and assuming no adaptation (medium confidence). (3.4.4, 3.4.5, 4.3.2)

B.2.2 Sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century (high confidence). Marine ice sheet instability in Antarctica and/or irreversible loss of the Greenland ice sheet could result in multi-metre rise in sea level over hundreds to thousands of years. These instabilities could be triggered at around 1.5°C to 2°C of global warming (medium confidence). (Figure SPM.2) (3.3.9, 3.4.5, 3.5.2, 3.6.3, Box 3.3)

\textsuperscript{7} Robust is here used to mean that at least two thirds of climate models show the same sign of changes at the grid point scale, and that differences in large regions are statistically significant.

\textsuperscript{8} Projected changes in impacts between different levels of global warming are determined with respect to changes in global mean surface air temperature.
B.2.3 Increasing warming amplifies the exposure of small islands, low-lying coastal areas and deltas to the risks associated with sea level rise for many human and ecological systems, including increased saltwater intrusion, flooding and damage to infrastructure (high confidence). Risks associated with sea level rise are higher at 2°C compared to 1.5°C. The slower rate of sea level rise at global warming of 1.5°C reduces these risks, enabling greater opportunities for adaptation including managing and restoring natural coastal ecosystems and infrastructure reinforcement (medium confidence). (Figure SPM.2) (3.4.5, Box 3.5)

B.3 On land, impacts on biodiversity and ecosystems, including species loss and extinction, are projected to be lower at 1.5°C of global warming compared to 2°C. Limiting global warming to 1.5°C compared to 2°C is projected to lower the impacts on terrestrial, freshwater and coastal ecosystems and to retain more of their services to humans (high confidence). (Figure SPM.2) (3.4, 3.5, Box 3.4, Box 4.2, Cross-Chapter Box 8 in Chapter 3)

B.3.1 Of 105,000 species studied, 6% of insects, 8% of plants and 4% of vertebrates are projected to lose over half of their climatically determined geographic range for global warming of 1.5°C, compared with 18% of insects, 16% of plants and 8% of vertebrates for global warming of 2°C (medium confidence). Impacts associated with other biodiversity-related risks such as forest fires and the spread of invasive species are lower at 1.5°C compared to 2°C of global warming (high confidence). (3.4.3, 3.5.2)

B.3.2 Approximately 4% (interquartile range 2–7%) of the global terrestrial land area is projected to undergo a transformation of ecosystems from one type to another at 1°C of global warming, compared with 13% (interquartile range 8–20%) at 2°C (medium confidence). This indicates that the area at risk is projected to be approximately 50% lower at 1.5°C compared to 2°C (medium confidence). (3.4.3.1, 3.4.3.5)

B.3.3 High-latitude tundra and boreal forests are particularly at risk of climate change-induced degradation and loss, with woody shrubs already encroaching into the tundra (high confidence) and this will proceed with further warming. Limiting global warming to 1.5°C rather than 2°C is projected to prevent the thawing over centuries of a permafrost area in the range of 1.5 to 2.5 million km² (medium confidence). (3.3.2, 3.4.3, 3.5.5)

B.4 Limiting global warming to 1.5°C compared to 2°C is projected to reduce increases in ocean temperature as well as associated increases in ocean acidity and decreases in ocean oxygen levels (high confidence). Consequently, limiting global warming to 1.5°C is projected to reduce risks to marine biodiversity, fisheries, and ecosystems, and their functions and services to humans, as illustrated by recent changes to Arctic sea ice and warm-water coral reef ecosystems (high confidence). (3.3, 3.4, 3.5, Box 3.4, Box 3.5)

B.4.1 There is high confidence that the probability of a sea ice-free Arctic Ocean during summer is substantially lower at global warming of 1.5°C when compared to 2°C. With 1.5°C of global warming, one sea ice-free Arctic summer is projected per century. This likelihood is increased to at least one per decade with 2°C global warming. Effects of a temperature overshoot are reversible for Arctic sea ice cover on decadal time scales (high confidence). (3.3.8, 3.4.4.7)

B.4.2 Global warming of 1.5°C is projected to shift the ranges of many marine species to higher latitudes as well as increase the amount of damage to many ecosystems. It is also expected to drive the loss of coastal resources and reduce the productivity of fisheries and aquaculture (especially at low latitudes). The risks of climate-induced impacts are projected to be higher at 2°C than those at global warming of 1.5°C (high confidence). Coral reefs, for example, are projected to decline by a further 70–90% at 1.5°C (high confidence) with larger losses (>99%) at 2°C (very high confidence). The risk of irreversible loss of many marine and coastal ecosystems increases with global warming, especially at 2°C or more (high confidence). (3.4.4, Box 3.4)

9 Consistent with earlier studies, illustrative numbers were adopted from one recent meta-study.
B.4.3 The level of ocean acidification due to increasing CO₂ concentrations associated with global warming of 1.5°C is projected to amplify the adverse effects of warming, and even further at 2°C, impacting the growth, development, calcification, survival, and thus abundance of a broad range of species, for example, from algae to fish (high confidence). \( (3.3.10, 3.4.4) \)

B.4.4 Impacts of climate change in the ocean are increasing risks to fisheries and aquaculture via impacts on the physiology, survivorship, habitat, reproduction, disease incidence, and risk of invasive species (medium confidence) but are projected to be less at 1.5°C of global warming than at 2°C. One global fishery model, for example, projected a decrease in global annual catch for marine fisheries of about 1.5 million tonnes for 1.5°C of global warming compared to a loss of more than 3 million tonnes for 2°C of global warming (medium confidence). \( (3.4.4, 3.4) \)

B.5 Climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C and increase further with 2°C. (Figure SPM.2) \( (3.4, 3.5, 5.2, Box 3.2, Box 3.3, Box 3.5, Box 3.6, Cross-Chapter Box 6 in Chapter 3, Cross-Chapter Box 9 in Chapter 4, Cross-Chapter Box 12 in Chapter 5, 5.2) \)

B.5.1 Populations at disproportionately higher risk of adverse consequences with global warming of 1.5°C and beyond include disadvantaged and vulnerable populations, some indigenous peoples, and local communities dependent on agricultural or coastal livelihoods (high confidence). Regions at disproportionately higher risk include Arctic ecosystems, dryland regions, small island developing states, and Least Developed Countries (high confidence). Poverty and disadvantage are expected to increase in some populations as global warming increases; limiting global warming to 1.5°C, compared with 2°C, could reduce the number of people both exposed to climate-related risks and susceptible to poverty by up to several hundred million by 2050 (medium confidence). \( (3.4.10, 3.4.11, Box 3.5, Cross-Chapter Box 6 in Chapter 3, Cross-Chapter Box 9 in Chapter 4, Cross-Chapter Box 12 in Chapter 5, 4.2.2.2, 5.2.1, 5.2.2, 5.2.3, 5.6.3) \)

B.5.2 Any increase in global warming is projected to affect human health, with primarily negative consequences (high confidence). Lower risks are projected at 1.5°C than at 2°C for heat-related morbidity and mortality (very high confidence) and for ozone-related mortality if emissions needed for ozone formation remain high (high confidence). Urban heat islands often amplify the impacts of heatwaves in cities (high confidence). Risks from some vector-borne diseases, such as malaria and dengue fever, are projected to increase with warming from 1.5°C to 2°C, including potential shifts in their geographic range (high confidence). \( (3.4.7, 3.4.8, 3.5.5.8) \)

B.5.3 Limiting warming to 1.5°C compared with 2°C is projected to result in smaller net reductions in yields of maize, rice, wheat, and potentially other cereal crops, particularly in sub-Saharan Africa, Southeast Asia, and Central and South America, and in the CO₂-dependent nutritional quality of rice and wheat (high confidence). Reductions in projected food availability are larger at 2°C than at 1.5°C of global warming in the Sahel, southern Africa, the Mediterranean, central Europe, and the Amazon (medium confidence). Livestock are projected to be adversely affected with rising temperatures, depending on the extent of changes in feed quality, spread of diseases, and water resource availability (high confidence). \( (3.4.6, 3.5.4, 3.5.5, Box 3.1, Cross-Chapter Box 6 in Chapter 3, Cross-Chapter Box 9 in Chapter 4) \)

B.5.4 Depending on future socio-economic conditions, limiting global warming to 1.5°C compared to 2°C may reduce the proportion of the world population exposed to a climate change-induced increase in water stress by up to 50%, although there is considerable variability between regions (medium confidence). Many small island developing states could experience lower water stress as a result of projected changes in aridity when global warming is limited to 1.5°C, as compared to 2°C (medium confidence). \( (3.3.5, 3.4.2, 3.4.8, 3.5.5, Box 3.2, Box 3.5, Cross-Chapter Box 9 in Chapter 4) \)

B.5.5 Risks to global aggregated economic growth due to climate change impacts are projected to be lower at 1.5°C than at 2°C by the end of this century\(^\text{10}\) (medium confidence). This excludes the costs of mitigation, adaptation investments and the benefits of adaptation. Countries in the tropics and Southern Hemisphere subtropics are projected to experience the largest impacts on economic growth due to climate change should global warming increase from 1.5°C to 2°C (medium confidence). \( (3.5.2, 3.5.3) \)

\(^{10}\) Here, impacts on economic growth refer to changes in gross domestic product (GDP). Many impacts, such as loss of human lives, cultural heritage and ecosystem services, are difficult to value and monetize.
B.5.6 Exposure to multiple and compound climate-related risks increases between 1.5°C and 2°C of global warming, with greater proportions of people both so exposed and susceptible to poverty in Africa and Asia (high confidence). For global warming from 1.5°C to 2°C, risks across energy, food, and water sectors could overlap spatially and temporally, creating new and exacerbating current hazards, exposures, and vulnerabilities that could affect increasing numbers of people and regions (medium confidence). {Box 3.5, 3.3.1, 3.4.5.3, 3.4.5.6, 3.4.11, 3.5.4.9}

B.5.7 There are multiple lines of evidence that since AR5 the assessed levels of risk increased for four of the five Reasons for Concern (RFCs) for global warming to 2°C (high confidence). The risk transitions by degrees of global warming are now: from high to very high risk between 1.5°C and 2°C for RFC1 (Unique and threatened systems) (high confidence); from moderate to high risk between 1°C and 1.5°C for RFC2 (Extreme weather events) (medium confidence); from moderate to high risk between 1.5°C and 2°C for RFC3 (Distribution of impacts) (high confidence); from moderate to high risk between 1.5°C and 2.5°C for RFC4 (Global aggregate impacts) (medium confidence); and from moderate to high risk between 1°C and 2.5°C for RFC5 (Large-scale singular events) (medium confidence). (Figure SPM.2) {3.4.13; 3.5, 3.5.2}

B.6 Most adaptation needs will be lower for global warming of 1.5°C compared to 2°C (high confidence). There are a wide range of adaptation options that can reduce the risks of climate change (high confidence). There are limits to adaptation and adaptive capacity for some human and natural systems at global warming of 1.5°C, with associated losses (medium confidence). The number and availability of adaptation options vary by sector (medium confidence). {Table 3.5, 4.3, 4.5, Cross-Chapter Box 9 in Chapter 4, Cross-Chapter Box 12 in Chapter 5}

B.6.1 A wide range of adaptation options are available to reduce the risks to natural and managed ecosystems (e.g., ecosystem-based adaptation, ecosystem restoration and avoided degradation and deforestation, biodiversity management, sustainable aquaculture, and local knowledge and indigenous knowledge), the risks of sea level rise (e.g., coastal defence and hardening), and the risks to health, livelihoods, food, water, and economic growth, especially in rural landscapes (e.g., efficient irrigation, social safety nets, disaster risk management, risk spreading and sharing, and community-based adaptation) and urban areas (e.g., green infrastructure, sustainable land use and planning, and sustainable water management) (medium confidence). {4.3.1, 4.3.2, 4.3.3, 4.3.5, 4.5.3, 4.5.4, 5.3.2, Box 4.2, Box 4.3, Box 4.6, Cross-Chapter Box 9 in Chapter 4).

B.6.2 Adaptation is expected to be more challenging for ecosystems, food and health systems at 2°C of global warming than for 1.5°C (medium confidence). Some vulnerable regions, including small islands and Least Developed Countries, are projected to experience high multiple interrelated climate risks even at global warming of 1.5°C (high confidence). {3.3.1, 3.4.5, Box 3.5, Table 3.5, Cross-Chapter Box 9 in Chapter 4, 5.6, Cross-Chapter Box 12 in Chapter 5, Box 5.3}

B.6.3 Limits to adaptive capacity exist at 1.5°C of global warming, become more pronounced at higher levels of warming and vary by sector, with site-specific implications for vulnerable regions, ecosystems and human health (medium confidence). {Cross-Chapter Box 12 in Chapter 5, Box 3.5, Table 3.5}
How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

Five Reasons For Concern (RFCs) illustrate the impacts and risks of different levels of global warming for people, economies and ecosystems across sectors and regions.

Impacts and risks associated with the Reasons for Concern (RFCs)

Impacts and risks for selected natural, managed and human systems

Figure SPM.2 | Five integrative reasons for concern (RFCs) provide a framework for summarizing key impacts and risks across sectors and regions, and were introduced in the IPCC Third Assessment Report. RFCs illustrate the implications of global warming for people, economies and ecosystems. Impacts and/or risks for each RFC are based on assessment of the new literature that has appeared. As in AR5, this literature was used to make expert judgments to assess the levels of global warming at which levels of impact and/or risk are undetectable, moderate, high or very high. The selection of impacts and risks to natural, managed and human systems in the lower panel is illustrative and is not intended to be fully comprehensive. [3.4, 3.5, 3.5.2.1, 3.5.2.2, 3.5.2.3, 3.5.2.4, 3.5.2.5, 5.4.1, 5.5.3, 5.6.1, Box 3.4]

RFC1 Unique and threatened systems: ecological and human systems that have restricted geographic ranges constrained by climate-related conditions and have high endemism or other distinctive properties. Examples include coral reefs, the Arctic and its indigenous people, mountain glaciers and biodiversity hotspots.

RFC2 Extreme weather events: risks/impacts to human health, livelihoods, assets and ecosystems from extreme weather events such as heat waves, heavy rain, drought and associated wildfires, and coastal flooding.

RFC3 Distribution of impacts: risks/impacts that disproportionately affect particular groups due to uneven distribution of physical climate change hazards, exposure or vulnerability.

RFC4 Global aggregate impacts: global monetary damage, global-scale degradation and loss of ecosystems and biodiversity.

RFC5 Large-scale singular events: are relatively large, abrupt and sometimes irreversible changes in systems that are caused by global warming. Examples include disintegration of the Greenland and Antarctic ice sheets.
C. Emission Pathways and System Transitions Consistent with 1.5°C Global Warming

C.1 In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO₂ emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range). For limiting global warming to below 2°C, CO₂ emissions are projected to decline by about 25% by 2030 in most pathways (10–30% interquartile range) and reach net zero around 2070 (2065–2080 interquartile range). Non-CO₂ emissions in pathways that limit global warming to 1.5°C show deep reductions that are similar to those in pathways limiting warming to 2°C. (high confidence) (Figure SPM.3a) [2.1, 2.3, Table 2.4]

C.1.1 CO₂ emissions reductions that limit global warming to 1.5°C with no or limited overshoot can involve different portfolios of mitigation measures, striking different balances between lowering energy and resource intensity, rate of decarbonization, and the reliance on carbon dioxide removal. Different portfolios face different implementation challenges and potential synergies and trade-offs with sustainable development. (high confidence) (Figure SPM.3b) [2.3.2, 2.3.4, 2.4, 2.5.3]

C.1.2 Modelled pathways that limit global warming to 1.5°C with no or limited overshoot involve deep reductions in emissions of methane and black carbon (35% or more of both by 2050 relative to 2010). These pathways also reduce most of the cooling aerosols, which partially offsets mitigation effects for two to three decades. Non-CO₂ emissions could be reduced as a result of broad mitigation measures in the energy sector. In addition, targeted non-CO₂ mitigation measures can reduce nitrous oxide and methane from agriculture, methane from the waste sector, some sources of black carbon, and hydrofluorocarbons. High bioenergy demand can increase emissions of nitrous oxide in some 1.5°C pathways, highlighting the importance of appropriate management approaches. Improved air quality resulting from projected reductions in many non-CO₂ emissions provide direct and immediate population health benefits in all 1.5°C model pathways. (high confidence) (Figure SPM.3a) [2.2.1, 2.3.3, 2.4.4, 2.5.3, 4.3.6, 5.4.2]

C.1.3 Limiting global warming requires limiting the total cumulative global anthropogenic emissions of CO₂ since the pre-industrial period, that is, staying within a total carbon budget (high confidence).² By the end of 2017, anthropogenic CO₂ emissions since the pre-industrial period are estimated to have reduced the total carbon budget for 1.5°C by approximately 2200 ± 320 GtCO₂ (medium confidence). The associated remaining budget is being depleted by current emissions of 42 ± 3 GtCO₂ per year (high confidence). The choice of the measure of global temperature affects the estimated remaining carbon budget. Using global mean surface air temperature, as in AR5, gives an estimate of the remaining carbon budget of 580 GtCO₂ for a 50% probability of limiting warming to 1.5°C, and 420 GtCO₂ for a 66% probability (medium confidence).³ Alternatively, using GMST gives estimates of 770 and 570 GtCO₂, for 50% and 66% probabilities, respectively (medium confidence). Uncertainties in the size of these estimated remaining carbon budgets are substantial and depend on several factors. Uncertainties in the climate response to CO₂ and non-CO₂ emissions contribute ±400 GtCO₂ and the level of historic warming contributes ±250 GtCO₂ (medium confidence). Potential additional carbon release from future permafrost thawing and methane release from wetlands would reduce budgets by up to 100 GtCO₂ over the course of this century and more thereafter (medium confidence). In addition, the level of non-CO₂ mitigation in the future could alter the remaining carbon budget by 250 GtCO₂ in either direction (medium confidence). [1.2.4, 2.2.2, 2.6.1, Table 2.2, Chapter 2 Supplementary Material]

C.1.4 Solar radiation modification (SRM) measures are not included in any of the available assessed pathways. Although some SRM measures may be theoretically effective in reducing an overshoot, they face large uncertainties and knowledge gaps.

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11 References to pathways limiting global warming to 2°C are based on a 66% probability of staying below 2°C.
12 Non-CO₂ emissions included in this Report are all anthropogenic emissions other than CO₂ that result in radiative forcing. These include short-lived climate forcers, such as methane, some fluorinated gases, ozone precursors, aerosols or aerosol precursors, such as black carbon and sulphur dioxide, respectively, as well as long-lived greenhouse gases, such as nitrous oxide or some fluorinated gases. The radiative forcing associated with non-CO₂ emissions and changes in surface albedo is referred to as non-CO₂ radiative forcing. [2.2.1]
13 There is a clear scientific basis for a total carbon budget consistent with limiting global warming to 1.5°C. However, neither this total carbon budget nor the fraction of this budget taken up by past emissions were assessed in this Report.
14 Irrespective of the measure of global temperature used, updated understanding and further advances in methods have led to an increase in the estimated remaining carbon budget of about 300 GtCO₂ compared to AR5. (medium confidence) [2.2.2]
15 These estimates use observed GMST to 2006–2015 and estimate future temperature changes using near surface air temperatures.
as well as substantial risks and institutional and social constraints to deployment related to governance, ethics, and impacts on sustainable development. They also do not mitigate ocean acidification. (medium confidence) (4.3.8, Cross-Chapter Box 10 in Chapter 4)

Global emissions pathway characteristics

General characteristics of the evolution of anthropogenic net emissions of CO₂, and total emissions of methane, black carbon, and nitrous oxide in model pathways that limit global warming to 1.5°C with no or limited overshoot. Net emissions are defined as anthropogenic emissions reduced by anthropogenic removals. Reductions in net emissions can be achieved through different portfolios of mitigation measures illustrated in Figure SPM.3b.

Figure SPM.3a | Global emissions pathway characteristics. The main panel shows global net anthropogenic CO₂ emissions in pathways limiting global warming to 1.5°C with no or limited (less than 0.1°C) overshoot and pathways with higher overshoot. The shaded area shows the full range for pathways analysed in this Report. The panels on the right show non-CO₂ emissions ranges for three compounds with large historical forcing and a substantial portion of emissions coming from sources distinct from those central to CO₂ mitigation. Shaded areas in these panels show the 5–95% (light shading) and interquartile (dark shading) ranges of pathways limiting global warming to 1.5°C with no or limited overshoot. Box and whiskers at the bottom of the figure show the timing of pathways reaching global net zero CO₂ emission levels, and a comparison with pathways limiting global warming to 2°C with at least 66% probability. Four illustrative model pathways are highlighted in the main panel and are labelled P1, P2, P3 and P4, corresponding to the LED, S1, S2, and S5 pathways assessed in Chapter 2. Descriptions and characteristics of these pathways are available in Figure SPM.3b. (2.1, 2.2, 2.3, Figure 2.5, Figure 2.10, Figure 2.11)
Characteristics of four illustrative model pathways

Different mitigation strategies can achieve the net emissions reductions that would be required to follow a pathway that limits global warming to 1.5°C with no or limited overshoot. All pathways use Carbon Dioxide Removal (CDR), but the amount varies across pathways, as do the relative contributions of Bioenergy with Carbon Capture and Storage (BECCS) and removals in the Agriculture, Forestry and Other Land Use (AFOLU) sector. This has implications for emissions and several other pathway characteristics.

Breakdown of contributions to global net CO₂ emissions in four illustrative model pathways

P1: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

Global indicators

Pathway classification

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<th></th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>Interquartile range</th>
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<td>-41</td>
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<td>21</td>
<td>48</td>
<td>(56, 6)</td>
</tr>
<tr>
<td>from nuclear in 2030 (% rel to 2010)</td>
<td>59</td>
<td>83</td>
<td>98</td>
<td>106</td>
<td>(44, 102)</td>
</tr>
<tr>
<td>- in 2050 (% rel to 2010)</td>
<td>150</td>
<td>98</td>
<td>501</td>
<td>468</td>
<td>(91, 190)</td>
</tr>
<tr>
<td>from biomass in 2030 (% rel to 2010)</td>
<td>-11</td>
<td>0</td>
<td>36</td>
<td>-1</td>
<td>(29, 80)</td>
</tr>
<tr>
<td>- in 2050 (% rel to 2010)</td>
<td>-16</td>
<td>49</td>
<td>121</td>
<td>418</td>
<td>(123, 261)</td>
</tr>
<tr>
<td>from non-biomass renewables in 2030 (% rel to 2010)</td>
<td>430</td>
<td>470</td>
<td>315</td>
<td>110</td>
<td>(245, 430)</td>
</tr>
<tr>
<td>- in 2050 (% rel to 2010)</td>
<td>833</td>
<td>1327</td>
<td>878</td>
<td>1137</td>
<td>(576, 1299)</td>
</tr>
<tr>
<td>Cumulative CCS until 2100 (GtCO₂)</td>
<td>0</td>
<td>348</td>
<td>687</td>
<td>1218</td>
<td>(550, 1017)</td>
</tr>
<tr>
<td>of which BECCS (GtCO₂)</td>
<td>0</td>
<td>151</td>
<td>414</td>
<td>1191</td>
<td>(364, 662)</td>
</tr>
<tr>
<td>Land area of bioenergy crops in 2050 (million km²)</td>
<td>0.2</td>
<td>0.9</td>
<td>2.8</td>
<td>7.2</td>
<td>(1.5, 3.2)</td>
</tr>
<tr>
<td>Agricultural CO₂ emissions in 2030 (% rel to 2010)</td>
<td>-24</td>
<td>-48</td>
<td>1</td>
<td>14</td>
<td>(-30, -11)</td>
</tr>
<tr>
<td>- in 2050 (% rel to 2010)</td>
<td>-33</td>
<td>-69</td>
<td>-23</td>
<td>2</td>
<td>(-47, 24)</td>
</tr>
<tr>
<td>Agricultural N₂O emissions in 2030 (% rel to 2010)</td>
<td>5</td>
<td>-26</td>
<td>15</td>
<td>1</td>
<td>(-21, 3)</td>
</tr>
<tr>
<td>- in 2050 (% rel to 2010)</td>
<td>6</td>
<td>-26</td>
<td>0</td>
<td>39</td>
<td>(-26, 1)</td>
</tr>
</tbody>
</table>

*Kyoto gas emissions are based on IPCC Second Assessment Report GWP-100
**Changes in energy demand are associated with improvements in energy efficiency and behaviour change.

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.
Figure SPM.3b  | Characteristics of four illustrative model pathways in relation to global warming of 1.5°C introduced in Figure SPM.3a. These pathways were selected to show a range of potential mitigation approaches and vary widely in their projected energy and land use, as well as their assumptions about future socio-economic developments, including economic and population growth, equity and sustainability. A breakdown of the global net anthropogenic CO₂ emissions into the contributions in terms of CO₂ emissions from fossil fuel and industry, agriculture, forestry and other land use (AFOLU), and bioenergy with carbon capture and storage (BECCS) is shown. AFOLU estimates reported here are not necessarily comparable with countries’ estimates. Further characteristics for each of these pathways are listed below each pathway. These pathways illustrate relative global differences in mitigation strategies, but do not represent central estimates, national strategies, and do not indicate requirements. For comparison, the right-most column shows the interquartile ranges across pathways with no or limited overshoot of 1.5°C. Pathways P1, P2, P3 and P4 correspond to the LED, S1, S2 and S5 pathways assessed in Chapter 2 (Figure SPM.3a). [2.2.1, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.4.1, 2.4.2, 2.4.4, 2.5.3, Figure 2.5, Figure 2.6, Figure 2.9, Figure 2.10, Figure 2.11, Figure 2.14, Figure 2.15, Figure 2.16, Figure 2.17, Figure 2.24, Figure 2.25, Table 2.4, Table 2.6, Table 2.7, Table 2.9, Table 4.1] {2.3.3, 2.3.4, 2.4.1, 2.4.2, 2.4.4, 2.5.3, Figure 2.5, Figure 2.6, Figure 2.9, Figure 2.10, Figure 2.11, Figure 2.14, Figure 2.15, Figure 2.16, Figure 2.17, Figure 2.24, Figure 2.25, Table 2.4, Table 2.6, Table 2.7, Table 2.9, Table 4.1} 

C.2  Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). (2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5) 

C.2.1  Pathways that limit global warming to 1.5°C with no or limited overshoot show system changes that are more rapid and pronounced over the next two decades than in 2°C pathways (high confidence). The rates of system changes associated with limiting global warming to 1.5°C with no or limited overshoot have occurred in the past within specific sectors, technologies and spatial contexts, but there is no documented historic precedent for their scale (medium confidence). (2.3.3, 2.3.4, 2.4, 2.5, 4.2.1, 4.2.2, Cross-Chapter Box 11 in Chapter 4) 

C.2.2  In energy systems, modelled global pathways (considered in the literature) limiting global warming to 1.5°C with no or limited overshoot (for more details see Figure SPM.3b) generally meet energy service demand with lower energy use, including through enhanced energy efficiency, and show faster electrification of energy end use compared to 2°C (high confidence). In 1.5°C pathways with no or limited overshoot, low-emission energy sources are projected to have a higher share, compared with 2°C pathways, particularly before 2050 (high confidence). In 1.5°C pathways with no or limited overshoot, renewables are projected to supply 70–85% (interquartile range) of electricity in 2050 (high confidence). In electricity generation, shares of nuclear and fossil fuels with carbon dioxide capture and storage (CCS) are modelled to increase in most 1.5°C pathways with no or limited overshoot. In modelled 1.5°C pathways with limited or no overshoot, the use of CCS would allow the electricity generation share of gas to be approximately 8% (3–11% interquartile range) of global electricity in 2050, while the use of coal shows a steep reduction in all pathways and would be reduced to close to 0% (0–2% interquartile range) of electricity (high confidence). While acknowledging the challenges, and differences between the options and national circumstances, political, economic, social and technical feasibility of solar energy, wind energy and electricity storage technologies have substantially improved over the past few years (high confidence). These improvements signal a potential system transition in electricity generation. (Figure SPM.3b) (2.4.1, 2.4.2, Figure 2.1, Table 2.6, Table 2.7, Cross-Chapter Box 6 in Chapter 3, 4.2.1, 4.3.1, 4.3.3, 4.5.2) 

C.2.3  CO₂ emissions from industry in pathways limiting global warming to 1.5°C with no or limited overshoot are projected to be about 65–90% (interquartile range) lower in 2050 relative to 2010, as compared to 50–80% for global warming of 2°C (medium confidence). Such reductions can be achieved through combinations of new and existing technologies and practices, including electrification, hydrogen, sustainable bio-based feedstocks, product substitution, and carbon capture, utilization and storage (CCUS). These options are technically proven at various scales but their large-scale deployment may be limited by economic, financial, human capacity and institutional constraints in specific contexts, and specific characteristics of large-scale industrial installations. In industry, emissions reductions by energy and process efficiency by themselves are insufficient for limiting warming to 1.5°C with no or limited overshoot (high confidence). (2.4.3, 4.2.1, Table 4.1, Table 4.3, 4.3.3, 4.3.4, 4.5.2) 

C.2.4  The urban and infrastructure system transition consistent with limiting global warming to 1.5°C with no or limited overshoot would imply, for example, changes in land and urban planning practices, as well as deeper emissions reductions in transport and buildings compared to pathways that limit global warming below 2°C (medium confidence). Technical measures
and practices enabling deep emissions reductions include various energy efficiency options. In pathways limiting global warming to 1.5°C with no or limited overshoot, the electricity share of energy demand in buildings would be about 55–75% in 2050 compared to 50–70% in 2050 for 2°C global warming (medium confidence). In the transport sector, the share of low-emission final energy would rise from less than 5% in 2020 to about 35–65% in 2050 compared to 25–45% for 2°C of global warming (medium confidence). Economic, institutional and socio-cultural barriers may inhibit these urban and infrastructure system transitions, depending on national, regional and local circumstances, capabilities and the availability of capital (high confidence). (2.3.4, 2.4.3, 4.2.1, Table 4.1, 4.3.3, 4.5.2)

C.2.5 Transitions in global and regional land use are found in all pathways limiting global warming to 1.5°C with no or limited overshoot, but their scale depends on the pursued mitigation portfolio. Model pathways that limit global warming to 1.5°C with no or limited overshoot project a 4 million km² reduction to a 2.5 million km² increase of non-pasture agricultural land for food and feed crops and a 0.5–11 million km² reduction of pasture land, to be converted into a 0–6 million km² increase of agricultural land for energy crops and a 2 million km² reduction to 9.5 million km² increase in forests by 2050 relative to 2010 (medium confidence).¹⁶ Land-use transitions of similar magnitude can be observed in modelled 2°C pathways (medium confidence). Such large transitions pose profound challenges for sustainable management of the various demands on land for human settlements, food, livestock feed, fibre, bioenergy, carbon storage, biodiversity and other ecosystem services (high confidence). Mitigation options limiting the demand for land include sustainable intensification of land-use practices, ecosystem restoration and changes towards less resource-intensive diets (high confidence). The implementation of land-based mitigation options would require overcoming socio-economic, institutional, technological, financing and environmental barriers that differ across regions (high confidence). (2.4.4, Figure 2.24, 4.3.2, 4.3.7, 4.5.2, Cross-Chapter Box 7 in Chapter 3)

C.2.6 Additional annual average energy-related investments for the period 2016 to 2050 in pathways limiting warming to 1.5°C compared to pathways without new climate policies beyond those in place today are estimated to be around 830 billion USD2010 (range of 150 billion to 1700 billion USD2010 across six models¹⁷). This compares to total annual average energy supply investments in 1.5°C pathways of 1460 to 3510 billion USD2010 and total annual average energy demand investments of 640 to 910 billion USD2010 for the period 2016 to 2050. Total energy-related investments increase by about 12% (range of 3% to 24%) in 1.5°C pathways relative to 2°C pathways. Annual investments in low-carbon energy technologies and energy efficiency are upscaled by roughly a factor of six (range of factor of 4 to 10) by 2050 compared to 2015 (medium confidence). (2.5.2, Box 4.8, Figure 2.27)

C.2.7 Modelled pathways limiting global warming to 1.5°C with no or limited overshoot project a wide range of global average discounted marginal abatement costs over the 21st century. They are roughly 3-4 times higher than in pathways limiting global warming to below 2°C (high confidence). The economic literature distinguishes marginal abatement costs from total mitigation costs in the economy. The literature on total mitigation costs of 1.5°C mitigation pathways is limited and was not assessed in this Report. Knowledge gaps remain in the integrated assessment of the economy-wide costs and benefits of mitigation in line with pathways limiting warming to 1.5°C. (2.5.2; 2.6; Figure 2.26)

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¹⁶ The projected land-use changes presented are not deployed to their upper limits simultaneously in a single pathway.

¹⁷ Including two pathways limiting warming to 1.5°C with no or limited overshoot and four pathways with higher overshoot.
C.3 All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of carbon dioxide removal (CDR) on the order of 100–1000 GtCO₂ over the 21st century. CDR would be used to compensate for residual emissions and, in most cases, achieve net negative emissions to return global warming to 1.5°C following a peak (high confidence). CDR deployment of several hundreds of GtCO₂ is subject to multiple feasibility and sustainability constraints (high confidence). Significant near-term emissions reductions and measures to lower energy and land demand can limit CDR deployment to a few hundred GtCO₂ without reliance on bioenergy with carbon capture and storage (BECCS) (high confidence). (2.3, 2.4, 3.6.2, 4.3, 5.4)

C.3.1 Existing and potential CDR measures include afforestation and reforestation, land restoration and soil carbon sequestration, BECCS, direct air carbon capture and storage (DACCS), enhanced weathering and ocean alkalinization. These differ widely in terms of maturity, potentials, costs, risks, co-benefits and trade-offs (high confidence). To date, only a few published pathways include CDR measures other than afforestation and BECCS. (2.3.4, 3.6.2, 4.3.2, 4.3.7)

C.3.2 In pathways limiting global warming to 1.5°C with limited or no overshoot, BECCS deployment is projected to range from 0–1, 0–8, and 0–16 GtCO₂ yr⁻¹ in 2030, 2050, and 2100, respectively, while agriculture, forestry and land-use (AFOLU) related CDR measures are projected to remove 0–5, 1–11, and 1–5 GtCO₂ yr⁻¹ in these years (medium confidence). The upper end of these deployment ranges by mid-century exceeds the BECCS potential of up to 5 GtCO₂ yr⁻¹ and afforestation potential of up to 3.6 GtCO₂ yr⁻¹ assessed based on recent literature (medium confidence). Some pathways avoid BECCS deployment completely through demand-side measures and greater reliance on AFOLU-related CDR measures (medium confidence). The use of bioenergy can be as high or even higher when BECCS is excluded compared to when it is included due to its potential for replacing fossil fuels across sectors (high confidence). (Figure SPM.3b) (2.3.3, 2.3.4, 2.4.2, 3.6.2, 4.3.1, 4.2.3, 4.3.2, 4.3.7, 4.4.3, Table 2.4)

C.3.3 Pathways that overshoot 1.5°C of global warming rely on CDR exceeding residual CO₂ emissions later in the century to return to below 1.5°C by 2100, with larger overshoots requiring greater amounts of CDR (Figure SPM.3b) (high confidence). Limitations on the speed, scale, and societal acceptability of CDR deployment hence determine the ability to return global warming to below 1.5°C following an overshoot. Carbon cycle and climate system understanding is still limited about the effectiveness of net negative emissions to reduce temperatures after they peak (high confidence). (2.2, 2.3.4, 2.3.5, 2.6, 4.3.7, 4.5.2, Table 4.11)

C.3.4 Most current and potential CDR measures could have significant impacts on land, energy, water or nutrients if deployed at large scale (high confidence). Afforestation and bioenergy may compete with other land uses and may have significant impacts on agricultural and food systems, biodiversity, and other ecosystem functions and services (high confidence). Effective governance is needed to limit such trade-offs and ensure permanence of carbon removal in terrestrial, geological and ocean reservoirs (high confidence). Feasibility and sustainability of CDR use could be enhanced by a portfolio of options deployed at substantial, but lesser scales, rather than a single option at very large scale (high confidence). (Figure SPM.3b) (2.3.4, 2.4.4, 2.5.3, 2.6, 3.6.2, 4.3.2, 4.3.7, 4.5.2, 5.4.1, 5.4.2; Cross-Chapter Boxes 7 and 8 in Chapter 3, Table 4.11, Table 5.3, Figure 5.3)

C.3.5 Some AFOLU-related CDR measures such as restoration of natural ecosystems and soil carbon sequestration could provide co-benefits such as improved biodiversity, soil quality, and local food security. If deployed at large scale, they would require governance systems enabling sustainable land management to conserve and protect land carbon stocks and other ecosystem functions and services (medium confidence). (Figure SPM.4) (2.3.3, 2.3.4, 2.4.2, 2.4.4, 3.6.2, 5.4.1, Cross-Chapter Boxes 3 in Chapter 1 and 7 in Chapter 3, 4.3.2, 4.3.7, 4.4.1, 4.5.2, Table 2.4)
D. Strengthening the Global Response in the Context of Sustainable Development and Efforts to Eradicate Poverty

D.1 Estimates of the global emissions outcome of current nationally stated mitigation ambitions as submitted under the Paris Agreement would lead to global greenhouse gas emissions\(^{18}\) in 2030 of 52–58 GtCO\(_2\)eq yr\(^{-1}\) (medium confidence). Pathways reflecting these ambitions would not limit global warming to 1.5°C, even if supplemented by very challenging increases in the scale and ambition of emissions reductions after 2030 (high confidence). Avoiding overshoot and reliance on future large-scale deployment of carbon dioxide removal (CDR) can only be achieved if global CO\(_2\) emissions start to decline well before 2030 (high confidence). {1.2, 2.3, 3.3, 3.4, 4.2, 4.4, Cross-Chapter Box 11 in Chapter 4}

D.1.1 Pathways that limit global warming to 1.5°C with no or limited overshoot show clear emission reductions by 2030 (high confidence). All but one show a decline in global greenhouse gas emissions to below 35 GtCO\(_2\)eq yr\(^{-1}\) in 2030, and half of available pathways fall within the 25–30 GtCO\(_2\)eq yr\(^{-1}\) range (interquartile range), a 40–50% reduction from 2010 levels (high confidence). Pathways reflecting current nationally stated mitigation ambition until 2030 are broadly consistent with cost-effective pathways that result in a global warming of about 3°C by 2100, with warming continuing afterwards (medium confidence). (2.3.3, 2.3.5, Cross-Chapter Box 11 in Chapter 4, 5.5.3.2)

D.1.2 Overshoot trajectories result in higher impacts and associated challenges compared to pathways that limit global warming to 1.5°C with no or limited overshoot (high confidence). Reversing warming after an overshoot of 0.2°C or larger during this century would require upscaling and deployment of CDR at rates and volumes that might not be achievable given considerable implementation challenges (medium confidence). (1.3.3, 2.3.4, 2.3.5, 2.5.1, 3.3, 4.3.7, Cross-Chapter Box 8 in Chapter 3, Cross-Chapter Box 11 in Chapter 4)

D.1.3 The lower the emissions in 2030, the lower the challenge in limiting global warming to 1.5°C after 2030 with no or limited overshoot (high confidence). The challenges from delayed actions to reduce greenhouse gas emissions include the risk of cost escalation, lock-in in carbon-emitting infrastructure, stranded assets, and reduced flexibility in future response options in the medium to long term (high confidence). These may increase uneven distributional impacts between countries at different stages of development (medium confidence). (2.3.5, 4.4.5, 5.4.2)

D.2 The avoided climate change impacts on sustainable development, eradication of poverty and reducing inequalities would be greater if global warming were limited to 1.5°C rather than 2°C, if mitigation and adaptation synergies are maximized while trade-offs are minimized (high confidence). {1.1, 1.4, 2.5, 3.3, 3.4, 5.2, Table 5.1}

D.2.1 Climate change impacts and responses are closely linked to sustainable development which balances social well-being, economic prosperity and environmental protection. The United Nations Sustainable Development Goals (SDGs), adopted in 2015, provide an established framework for assessing the links between global warming of 1.5°C or 2°C and development goals that include poverty eradication, reducing inequalities, and climate action. (high confidence) (Cross-Chapter Box 4 in Chapter 1, 1.4, 5.1)

D.2.2 The consideration of ethics and equity can help address the uneven distribution of adverse impacts associated with 1.5°C and higher levels of global warming, as well as those from mitigation and adaptation, particularly for poor and disadvantaged populations, in all societies (high confidence). (1.1.1, 1.1.2, 1.4.3, 2.5.3, 3.4.10, 5.1, 5.2, 5.3, 5.4, Cross-Chapter Box 4 in Chapter 1, Cross-Chapter Boxes 6 and 8 in Chapter 3, and Cross-Chapter Box 12 in Chapter 5)

D.2.3 Mitigation and adaptation consistent with limiting global warming to 1.5°C are underpinned by enabling conditions, assessed in this Report across the geophysical, environmental-ecological, technological, economic, socio-cultural and institutional

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\(^{18}\) GHG emissions have been aggregated with 100-year GWP values as introduced in the IPCC Second Assessment Report.
dimensions of feasibility. Strengthened multilevel governance, institutional capacity, policy instruments, technological innovation and transfer and mobilization of finance, and changes in human behaviour and lifestyles are enabling conditions that enhance the feasibility of mitigation and adaptation options for 1.5°C-consistent systems transitions. (high confidence) (1.4, Cross-Chapter Box 3 in Chapter 1, 2.5.1, 4.4, 4.5, 5.6)

D.3 Adaptation options specific to national contexts, if carefully selected together with enabling conditions, will have benefits for sustainable development and poverty reduction with global warming of 1.5°C, although trade-offs are possible (high confidence). (1.4, 4.3, 4.5)

D.3.1 Adaptation options that reduce the vulnerability of human and natural systems have many synergies with sustainable development, if well managed, such as ensuring food and water security, reducing disaster risks, improving health conditions, maintaining ecosystem services and reducing poverty and inequality (high confidence). Increasing investment in physical and social infrastructure is a key enabling condition to enhance the resilience and the adaptive capacities of societies. These benefits can occur in most regions with adaptation to 1.5°C of global warming (high confidence). (1.4.3, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.3.5, 4.4.1, 4.4.3, 4.5.3, 5.3.1, 5.3.2)

D.3.2 Adaptation to 1.5°C global warming can also result in trade-offs or maladaptations with adverse impacts for sustainable development. For example, if poorly designed or implemented, adaptation projects in a range of sectors can increase greenhouse gas emissions and water use, increase gender and social inequality, undermine health conditions, and encroach on natural ecosystems (high confidence). These trade-offs can be reduced by adaptations that include attention to poverty and sustainable development (high confidence). (4.3.2, 4.3.4, 4.5.4, 5.3.2; Cross-Chapter Boxes 6 and 7 in Chapter 3)

D.3.3 A mix of adaptation and mitigation options to limit global warming to 1.5°C, implemented in a participatory and integrated manner, can enable rapid, systemic transitions in urban and rural areas (high confidence). These are most effective when aligned with economic and sustainable development, and when local and regional governments and decision makers are supported by national governments (medium confidence). (4.3.2, 4.3.3, 4.4.1, 4.4.2)

D.3.4 Adaptation options that also mitigate emissions can provide synergies and cost savings in most sectors and system transitions, such as when land management reduces emissions and disaster risk, or when low-carbon buildings are also designed for efficient cooling. Trade-offs between mitigation and adaptation, when limiting global warming to 1.5°C, such as when bioenergy crops, reforestation or afforestation encroach on land needed for agricultural adaptation, can undermine food security, livelihoods, ecosystem functions and services and other aspects of sustainable development. (high confidence) (3.4.3, 4.3.2, 4.3.4, 4.4.1, 4.5.2, 4.5.3, 4.5.4)

D.4 Mitigation options consistent with 1.5°C pathways are associated with multiple synergies and trade-offs across the Sustainable Development Goals (SDGs). While the total number of possible synergies exceeds the number of trade-offs, their net effect will depend on the pace and magnitude of changes, the composition of the mitigation portfolio and the management of the transition. (high confidence) (Figure SPM.4) (2.5, 4.5, 5.4)

D.4.1 1.5°C pathways have robust synergies particularly for the SDGs 3 (health), 7 (clean energy), 11 (cities and communities), 12 (responsible consumption and production) and 14 (oceans) (very high confidence). Some 1.5°C pathways show potential trade-offs with mitigation for SDGs 1 (poverty), 2 (hunger), 6 (water) and 7 (energy access), if not managed carefully (high confidence). (Figure SPM.4) (5.4.2; Figure 5.4, Cross-Chapter Boxes 7 and 8 in Chapter 3)

D.4.2 1.5°C pathways that include low energy demand (e.g., see P1 in Figure SPM.3a and SPM.3b), low material consumption, and low GHG-intensive food consumption have the most pronounced synergies and the lowest number of trade-offs with respect to sustainable development and the SDGs (high confidence). Such pathways would reduce dependence on CDR. In modelled pathways, sustainable development, eradicating poverty and reducing inequality can support limiting warming to 1.5°C (high confidence). (Figure SPM.3b, Figure SPM.4) (2.4.3, 2.5.1, 2.5.3, Figure 2.4, Figure 2.28, 5.4.1, 5.4.2, Figure 5.4)
Indicative linkages between mitigation options and sustainable development using SDGs (The linkages do not show costs and benefits)

Mitigation options deployed in each sector can be associated with potential positive effects (synergies) or negative effects (trade-offs) with the Sustainable Development Goals (SDGs). The degree to which this potential is realized will depend on the selected portfolio of mitigation options, mitigation policy design, and local circumstances and context. Particularly in the energy-demand sector, the potential for synergies is larger than for trade-offs. The bars group individually assessed options by level of confidence and take into account the relative strength of the assessed mitigation-SDG connections.

<table>
<thead>
<tr>
<th>Energy Supply</th>
<th>Energy Demand</th>
<th>Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDG 1</td>
<td>No Poverty</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 2</td>
<td>Zero Hunger</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 3</td>
<td>Good Health and Well-being</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 4</td>
<td>Quality Education</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 5</td>
<td>Gender Equality</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 6</td>
<td>Clean Water and Sanitation</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 7</td>
<td>Affordable and Clean Energy</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 8</td>
<td>Decent Work and Economic Growth</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 9</td>
<td>Industry, Innovation and Infrastructure</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 10</td>
<td>Reduced Inequalities</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 11</td>
<td>Sustainable Cities and Communities</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 12</td>
<td>Responsible Consumption and Production</td>
<td>SYNERGIES</td>
</tr>
<tr>
<td>SDG 13</td>
<td>Life Below Water</td>
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<td>SDG 14</td>
<td>Life on Land</td>
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<td>Peace, Justice and Strong Institutions</td>
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<tr>
<td>SDG 16</td>
<td>Partnerships for the Goals</td>
<td>SYNERGIES</td>
</tr>
</tbody>
</table>

Length shows strength of connection

The overall size of the coloured bars depict the relative potential for synergies and trade-offs between the sectoral mitigation options and the SDGs.

Shades show level of confidence

The shades depict the level of confidence of the assessed potential for trade-offs/synergies.
Summary for Policymakers

D.5.2 Adaptation finance consistent with global warming of 1.5°C is difficult to quantify and compare with 2°C. Knowledge gaps include insufficient data to calculate specific climate resilience-enhancing investments from the provision of currently underinvested basic infrastructure. Estimates of the costs of adaptation might be lower at global warming of 1.5°C than for 2°C. Adaptation needs have typically been supported by public sector sources such as national and subnational government budgets, and in developing countries together with support from development assistance, multilateral development banks, and United Nations Framework Convention on Climate Change channels (medium confidence). More recently there is a

D.4.5 Redistributive policies across sectors and populations that shield the poor and vulnerable can resolve trade-offs for a range of SDGs, particularly hunger, poverty and energy access. Investment needs for such complementary policies are only a small fraction of the overall mitigation investments in 1.5°C pathways. (high confidence) (2.4.3, 5.4.2, Figure 5.5)

D.5 Limiting the risks from global warming of 1.5°C in the context of sustainable development and poverty eradication implies system transitions that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of technological innovation and behaviour changes (high confidence). (2.3, 2.4, 2.5, 3.2, 4.2, 4.4, 4.5, 5.2, 5.5, 5.6)

D.4.4 Mitigation consistent with 1.5°C pathways creates risks for sustainable development in regions with high dependency on fossil fuels for revenue and employment generation (high confidence). Policies that promote diversification of the economy and the energy sector can address the associated challenges (high confidence). (5.4.1.2, Box 5.2)

D.4.3 1.5°C and 2°C modelled pathways often rely on the deployment of large-scale land-related measures like afforestation and bioenergy supply, which, if poorly managed, can compete with food production and hence raise food security concerns (high confidence). The impacts of carbon dioxide removal (CDR) options on SDGs depend on the type of options and the scale of deployment (high confidence). If poorly implemented, CDR options such as BECCS and AFOLU options would lead to trade-offs. Context-relevant design and implementation requires considering people’s needs, biodiversity, and other sustainable development dimensions (very high confidence). (Figure SPM.4) (5.4.1.3, Cross-Chapter Box 7 in Chapter 3)

Information about the net impacts of mitigation on sustainable development in 1.5°C pathways is available only for a limited number of SDGs and mitigation options. Only a limited number of studies have assessed the benefits of avoided climate change impacts of 1.5°C pathways for the SDGs, and the co-effects of adaptation for mitigation and the SDGs. The assessment of the indicative mitigation potentials in Figure SPM.4 is a step further from AR5 towards a more comprehensive and integrated assessment in the future.

Figure SPM.4 | Potential synergies and trade-offs between the sectoral portfolio of climate change mitigation options and the Sustainable Development Goals (SDGs). The SDGs serve as an analytical framework for the assessment of the different sustainable development dimensions, which extend beyond the time frame of the 2030 SDG targets. The assessment is based on literature on mitigation options that are considered relevant for 1.5°C. The assessed strength of the SDG interactions is based on the qualitative and quantitative assessment of individual mitigation options listed in Table 5.2. For each mitigation option, the strength of the SDG-connection as well as the associated confidence of the underlying literature (shades of green and red) was assessed. The strength of positive connections (synergies) and negative connections (trade-offs) across all individual options within a sector (see Table 5.2) are aggregated into sectoral potentials for the whole mitigation portfolio. The (white) areas outside the bars, which indicate no interactions, have low confidence due to the uncertainty and limited number of studies exploring indirect effects. The strength of the connection considers only the effect of mitigation and does not include benefits of avoided impacts. SDG 13 (climate action) is not listed because mitigation is being considered in terms of interactions with SDGs and not vice versa. The bars denote the strength of the connection, and do not consider the strength of the impact on the SDGs. The energy demand sector comprises behavioural responses, fuel switching and efficiency options in the transport, industry and building sector as well as carbon capture options in the industry sector. Options assessed in the energy supply sector comprise biomass and non-biomass renewables, nuclear, carbon capture and storage (CCS) with bioenergy, and CCS with fossil fuels. Options in the land sector comprise agricultural and forest options, sustainable diets and reduced food waste, soil sequestration, livestock and manure management, reduced deforestation, afforestation and reforestation, and responsible sourcing. In addition to this figure, options in the ocean sector are discussed in the underlying report. (5.4, Table 5.2, Figure 5.2)
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Growing understanding of the scale and increase in non-governmental organizations and private funding in some regions (medium confidence). Barriers include the scale of adaptation financing, limited capacity and access to adaptation finance (medium confidence). (4.4.5, 4.6)

D.5.3 Global model pathways limiting global warming to 1.5°C are projected to involve the annual average investment needs in the energy system of around 2.4 trillion USD2010 between 2016 and 2035, representing about 2.5% of the world GDP (medium confidence). (4.4.5, Box 4.8)

D.5.4 Policy tools can help mobilize incremental resources, including through shifting global investments and savings and through market and non-market based instruments as well as accompanying measures to secure the equity of the transition, acknowledging the challenges related with implementation, including those of energy costs, depreciation of assets and impacts on international competition, and utilizing the opportunities to maximize co-benefits (high confidence). (1.3.3, 2.3.4, 2.3.5, 2.5.1, 2.5.2, Cross-Chapter Box 8 in Chapter 3, Cross-Chapter Box 11 in Chapter 4, 4.4.5, 5.5.2)

D.5.5 The systems transitions consistent with adapting to and limiting global warming to 1.5°C include the widespread adoption of new and possibly disruptive technologies and practices and enhanced climate-driven innovation. These imply enhanced technological innovation capabilities, including in industry and finance. Both national innovation policies and international cooperation can contribute to the development, commercialization and widespread adoption of mitigation and adaptation technologies. Innovation policies may be more effective when they combine public support for research and development with policy mixes that provide incentives for technology diffusion. (high confidence) (4.4.4, 4.4.5).

D.5.6 Education, information, and community approaches, including those that are informed by indigenous knowledge and local knowledge, can accelerate the wide-scale behaviour changes consistent with adapting to and limiting global warming to 1.5°C. These approaches are more effective when combined with other policies and tailored to the motivations, capabilities and resources of specific actors and contexts (high confidence). Public acceptability can enable or inhibit the implementation of policies and measures to limit global warming to 1.5°C and to adapt to the consequences. Public acceptability depends on the individual’s evaluation of expected policy consequences, the perceived fairness of the distribution of these consequences, and perceived fairness of decision procedures (high confidence). (1.1, 1.5, 4.3.5, 4.4.1, 4.4.3, Box 4.3, 5.5.3, 5.6.5)

D.6 Sustainable development supports, and often enables, the fundamental societal and systems transitions and transformations that help limit global warming to 1.5°C. Such changes facilitate the pursuit of climate-resilient development pathways that achieve ambitious mitigation and adaptation in conjunction with poverty eradication and efforts to reduce inequalities (high confidence). (Box 1.1, 1.4.3, Figure 5.1, 5.5.3, Box 5.3)

D.6.1 Social justice and equity are core aspects of climate-resilient development pathways that aim to limit global warming to 1.5°C as they address challenges and inevitable trade-offs, widen opportunities, and ensure that options, visions, and values are deliberated, between and within countries and communities, without making the poor and disadvantaged worse off (high confidence). (5.5.2, 5.5.3, Box 5.3, Figure 5.1, Figure 5.6, Cross-Chapter Boxes 12 and 13 in Chapter 5)

D.6.2 The potential for climate-resilient development pathways differs between and within regions and nations, due to different development contexts and systemic vulnerabilities (very high confidence). Efforts along such pathways to date have been limited (medium confidence) and enhanced efforts would involve strengthened and timely action from all countries and non-state actors (high confidence). (5.5.1, 5.5.3, Figure 5.1)

D.6.3 Pathways that are consistent with sustainable development show fewer mitigation and adaptation challenges and are associated with lower mitigation costs. The large majority of modelling studies could not construct pathways characterized by lack of international cooperation, inequality and poverty that were able to limit global warming to 1.5°C. (high confidence) (2.3.1, 2.5.1, 2.5.3, 5.5.2)
D.7  Strengthening the capacities for climate action of national and sub-national authorities, civil society, the private sector, indigenous peoples and local communities can support the implementation of ambitious actions implied by limiting global warming to 1.5°C (high confidence). International cooperation can provide an enabling environment for this to be achieved in all countries and for all people, in the context of sustainable development. International cooperation is a critical enabler for developing countries and vulnerable regions (high confidence). (1.4, 2.3, 2.5, 4.2, 4.4, 4.5, 5.3, 5.4, 5.5, 5.6, 5, Box 4.1, Box 4.2, Box 4.7, Box 5.3, Cross-Chapter Box 9 in Chapter 4, Cross-Chapter Box 13 in Chapter 5)

D.7.1  Partnerships involving non-state public and private actors, institutional investors, the banking system, civil society and scientific institutions would facilitate actions and responses consistent with limiting global warming to 1.5°C (very high confidence). (1.4, 4.4.1, 4.2.2, 4.4.3, 4.4.5, 4.5.3, 5.4.1, 5.6.2, Box 5.3).

D.7.2  Cooperation on strengthened accountable multilevel governance that includes non-state actors such as industry, civil society and scientific institutions, coordinated sectoral and cross-sectoral policies at various governance levels, gender-sensitive policies, finance including innovative financing, and cooperation on technology development and transfer can ensure participation, transparency, capacity building and learning among different players (high confidence). (2.5.1, 2.5.2, 4.2.2, 4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5, 4.5.3, Cross-Chapter Box 9 in Chapter 4, 5.3.1, 5.5.3, Cross-Chapter Box 13 in Chapter 5, 5.6.1, 5.6.3).

D.7.3  International cooperation is a critical enabler for developing countries and vulnerable regions to strengthen their action for the implementation of 1.5°C-consistent climate responses, including through enhancing access to finance and technology and enhancing domestic capacities, taking into account national and local circumstances and needs (high confidence). (2.3.1, 2.5.1, 4.4.1, 4.4.2, 4.4.4, 4.4.5, 4.5.1 5.5.3, 5.6.1, Box 4.1, Box 4.2, Box 4.7).

D.7.4  Collective efforts at all levels, in ways that reflect different circumstances and capabilities, in the pursuit of limiting global warming to 1.5°C, taking into account equity as well as effectiveness, can facilitate strengthening the global response to climate change, achieving sustainable development and eradicating poverty (high confidence). (1.4.2, 2.3.1, 2.5.1, 2.5.2, 2.5.3, 4.2.2, 4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5, 4.5.3, 5.3.1, 5.4.1, 5.5.3, 5.6.1, 5.6.2, 5.6.3).
Box SPM.1: Core Concepts Central to this Special Report

**Global mean surface temperature (GMST):** Estimated global average of near-surface air temperatures over land and sea ice, and sea surface temperatures over ice-free ocean regions, with changes normally expressed as departures from a value over a specified reference period. When estimating changes in GMST, near-surface air temperature over both land and oceans are also used.19 (1.2.1.1)

**Pre-industrial:** The multi-century period prior to the onset of large-scale industrial activity around 1750. The reference period 1850–1900 is used to approximate pre-industrial GMST. (1.2.1.2)

**Global warming:** The estimated increase in GMST averaged over a 30-year period, or the 30-year period centred on a particular year or decade, expressed relative to pre-industrial levels unless otherwise specified. For 30-year periods that span past and future years, the current multi-decadal warming trend is assumed to continue. (1.2.1)

**Net zero CO\(_2\) emissions:** Net zero carbon dioxide (CO\(_2\)) emissions are achieved when anthropogenic CO\(_2\) emissions are balanced globally by anthropogenic CO\(_2\) removals over a specified period.

**Carbon dioxide removal (CDR):** Anthropogenic activities removing CO\(_2\) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical sinks and direct air capture and storage, but excludes natural CO\(_2\) uptake not directly caused by human activities.

**Total carbon budget:** Estimated cumulative net global anthropogenic CO\(_2\) emissions from the pre-industrial period to the time that anthropogenic CO\(_2\) emissions reach net zero that would result, at some probability, in limiting global warming to a given level, accounting for the impact of other anthropogenic emissions. (2.2.2)

**Remaining carbon budget:** Estimated cumulative net global anthropogenic CO\(_2\) emissions from a given start date to the time that anthropogenic CO\(_2\) emissions reach net zero that would result, at some probability, in limiting global warming to a given level, accounting for the impact of other anthropogenic emissions. (2.2.2)

**Temperature overshoot:** The temporary exceedance of a specified level of global warming.

**Emission pathways:** In this Summary for Policymakers, the modelled trajectories of global anthropogenic emissions over the 21st century are termed emission pathways. Emission pathways are classified by their temperature trajectory over the 21st century: pathways giving at least 50% probability based on current knowledge of limiting global warming to below 1.5°C are classified as ‘no overshoot’; those limiting warming to below 1.6°C and returning to 1.5°C by 2100 are classified as ‘1.5°C limited-overshoot’; while those exceeding 1.6°C but still returning to 1.5°C by 2100 are classified as ‘higher-overshoot’.

**Impacts:** Effects of climate change on human and natural systems. Impacts can have beneficial or adverse outcomes for livelihoods, health and well-being, ecosystems and species, services, infrastructure, and economic, social and cultural assets.

**Risk:** The potential for adverse consequences from a climate-related hazard for human and natural systems, resulting from the interactions between the hazard and the vulnerability and exposure of the affected system. Risk integrates the likelihood of exposure to a hazard and the magnitude of its impact. Risk also can describe the potential for adverse consequences of adaptation or mitigation responses to climate change.

**Climate-resilient development pathways (CRDPs):** Trajectories that strengthen sustainable development at multiple scales and efforts to eradicate poverty through equitable societal and systems transitions and transformations while reducing the threat of climate change through ambitious mitigation, adaptation and climate resilience.

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19 Past IPCC reports, reflecting the literature, have used a variety of approximately equivalent metrics of GMST change.
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political philosophy, and ancient Greek philosophy. You can follow his work here.

Parenting, teaching and leading all require us to believe in the prospects for living well on this planet — and to have confidence in our capacity to equip others to live well without destroying those prospects for others.

These roles require us to both hold these beliefs and to be spokespersons for the world — ones who can make our belief in a future of opportunity credible to those we must raise, teach and lead.

Whatever forms these endeavors might take in the absence of such credible belief and confidence, they would not succeed in their proper ends. They would not enable the human beings we influence to live well together.

However, as a society we have barely begun to think about what is essential to preserving opportunity to live well.

Our policies have been dominated by the idea that a growing economy is what best enables everyone to find happiness in their own way, even as evidence has mounted that the damaging impact of human activities on planetary systems makes the explosive economic growth of recent decades unsustainable. The emergence of sustainability science, movement toward a post-carbon economy, and greater consideration of the environmental impacts of personal and institutional decisions are all signs that we are at least beginning to come to grips with the reality that we cannot persist in destabilizing the natural systems on which humanity relies without suffering severe and ultimately irreversible consequences.
The recognition that preserving opportunities to live well requires preserving the integrity of the natural systems on which we rely is a critical first step. Identifying the distinct forms of human impact and critical thresholds or planetary boundaries is an important further step that has been underway for some time. Nine such boundaries have been identified, including safe rates of biodiversity loss, nitrogen removal from the atmosphere, phosphorus flowing into the oceans, consumption of freshwater, and land cover converted to cropland. From a policy perspective, what will be required is to define and allocate budgets with respect to each of these boundaries through regional and global agreements analogous to the Paris climate accord.

Within the limits set by these boundaries and negotiated budgets, societies would then need to decide how best to preserve their members' opportunities to live well. A central argument of my book, *Living Well*, is that things will go better if the science of human well-being is taken seriously — and if policies focus on reinventing institutions to make them more efficient in providing what people actually need in order to live well, while functioning in ways that do not encourage or compel unnecessary consumption.

A central feature of Americans' understanding and promotion of opportunity to live well has been a focused on fair terms of access to employment. Promoting fair competition for employment and equal access to the education and training needed to acquire job qualifications makes sense.
However, there is no reason to expect that the dynamics of labor markets will preserve equal opportunity over time in the face of educational and economic growth and innovation. The evolution of the kinds of occupations for which individuals compete will alter the structure of opportunity in such a way that it is not even possible to conceptualize equality of opportunity to live well over time in the way we understand equal opportunity employment. Comparing the opportunities of individuals of different generations, they do not compete for the same occupations and on the same terms on which their parents or grandparents did. Nor is there any guarantee that the institutional influences on the choices individuals and institutions make would be conducive to protecting the natural systems on which all human opportunity ultimately depends.

To make comparisons of opportunity across significant expanses of time, we must directly face the question of what is inherently involved in good work and living well. And we must use what we learn to shape the institutional settings in which people live and work and not simply rely on the market incentives entailed by workers' occupational mobility. Those incentives operate synchronically (in the present) and the problem of preserving opportunity over time is diachronic (stretching over time).

So what is inherently involved in living well?

In addressing this question, my geoscientist coauthor Ellen Metzger and I have had the benefit of collaborations with psychologist colleagues, Edward Deci and Richard Ryan. Their research in self-determination theory, conducted over the course of four decades with a network of 500 collaborators in 39 countries, has found that the experience of happiness is regulated by the satisfaction of basic psychological needs to feel competent, self-determining, and positively related to other people in the activities of one's life. These are universal needs, observed across all stages of life and in every culture in which studies have been conducted, and they help explain the truth in the ancient ideal of eudaimonia, or human flourishing.

According to this ideal, living well involves fulfilling one's human potential in ways that are admirable, sustainable, and personally satisfying. My work with Ryan and Deci identifies three broad forms of potential — social, intellectual, and productive/creative — the fulfillment of which is enabled by admirable personal
qualities and is psychologically linked to the satisfaction of human beings' universal basic needs for positive relatedness, self-determination, and competence. Fulfilling all three forms of potential is the key to happiness, and shaping our lives and institutions accordingly would be much more compatible with sustainability than pursuing wealth without limit.

A related finding, which is very important for the pursuit of sustainability, is that escape from poverty is important to happiness but the pursuit of wealth, status, and image as life goals is less conducive to happiness than the pursuit of life goals that directly fulfill our basic forms of potential and satisfy our related psychological needs. Societies that have promoted the accumulation of wealth without limit have not raised their general level of happiness by doing so. It should be evident to any observer of life in the U.S. that as wealth and inequality have grown, most Americans have become more painfully focused on occupational insecurity and on status competition that has simply become more expensive and less sustainable.

As counterintuitive as it may seem, we could be happier both now and in the future if we could overcome the blind faith in wealth accumulation that shaped the socially, politically and environmentally unstable world with which we must now contend.

**Correction**

Jan. 31, 2018

A previous version of this post said 10 planetary boundaries have been identified. In fact, nine have been identified.