

[Union of
Concerned Scientists

50 | YEARS of
SCIENCE
and ACTION

UCS

Catalyst

Volume 19, Spring 2019

**How Fossil Fuel
Companies Threaten
Our Oceans**

**UCS Timeline:
Charting 50 Years of
Science in Action**

**Assessing the
Green New Deal**

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EDITORIAL DIRECTOR
Seth Shulman

MANAGING EDITOR
Bryan Wadsworth

PRODUCTION MANAGER
Heather Tuttle

CONTRIBUTING EDITOR
Pamela Worth

CONTRIBUTING WRITER
Elliott Negin

DESIGN
Rigsby Hull

FRONT COVER
Michael Greenfelder/Alamy

BACK COVER
Gibson Hurst/Unsplash

The Union of Concerned Scientists puts rigorous, independent science to work to solve our planet's most pressing problems. Joining with people across the country, we combine technical analysis and effective advocacy to create innovative, practical solutions for a healthy, safe, and sustainable future.

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CHAIR
Anne Kapuscinski

PRESIDENT
Kenneth Kimmell

NATIONAL HEADQUARTERS
Two Brattle Square
Cambridge, MA
02138-3780

PHONE
(617) 547-5552

EMAIL
ucs@ucsusa.org

WEB
www.ucsusa.org

ON THE COVER:
Ocean acidification—accelerated by increased carbon dioxide emissions from fossil fuel producers—is harming coral reefs around the globe, including this one in the central Pacific. See p. 8 to learn more about why this is happening, and how we can address it.

[FIRST PRINCIPLES]

How the Green New Deal's Vision Can Unify Us



Representative Alexandria Ocasio-Cortez (center) and Senator Ed Markey (far right) announced their “Green New Deal” resolution at a press conference outside the Capitol building in Washington, DC, in February.

By Ken Kimmell

The Green New Deal has captured the attention of many of us who recognize that preventing runaway climate change is the greatest challenge of our time. Its inspiring title calls to mind an era when our country worked together to pull out of an economic depression. Its main proponents are young people—who better than the up-and-coming generation to demand that the former one leaves behind a habitable world? And, it calls for action on a scale that aligns with the best available science.

Unfortunately, many who oppose acting on climate change are using the Green New Deal as a political football, putting forth alarmist predictions of economic collapse and threats to personal freedom. What's needed right now by those of us committed to climate action is to proactively define the Green New Deal before such misguided caricatures stick, by showing that, while the plan is ambitious, it is also realistic and affordable.

We can succeed if we follow these principles:

IDENTIFY TRIED-AND-TRUE APPROACHES AND SCALE THEM UP

When it comes to climate change, states really are the laboratories of American democracy. Twenty-three have already adopted binding goals for reducing carbon emissions, most of which align well with the latest scientific evidence showing that we need to be at or close to “net zero” emissions by mid-century. Twenty-nine have adopted standards that require electric utilities to purchase increasing amounts of renewable energy and invest in energy efficiency. And a number of states have launched miniature “Green New Deals” of their own, such as Texas, which invested approximately \$7 billion in building transmission lines and is now the world's sixth-largest generator of wind energy.

Of course, the Green New Deal proposes to marshal federal resources to do much more than individual states can do on their own. But proven successes at the state level can form the backbone of the federal effort.

(continued on p. 20)



WHAT OUR MEMBERS ARE SAYING

Here's a sampling of recent feedback from the UCS Facebook page (www.facebook.com/unionofconcernedscientists) and Twitter feed (www.twitter.com/ucsusa).

ON THE UNION OF CONCERNED SCIENTISTS' 50TH ANNIVERSARY

 @ScienceMarchDC:
Happy 50th anniversary @UCSUSA! Thank you for all you do in standing up for science & justice! #ScienceNotSilence #UCS50

 Star Thomas:
Keep up the good work—we need all the creative, innovative minds we can get.

 @anjalikumar6:
I am a proud supporter & ally. Happy 50th Birthday! #UCS50

ON THE EPA NOW GETTING MORE SCIENCE ADVICE FROM INDUSTRY REPRESENTATIVES THAN UNIVERSITY OR INDEPENDENT SCIENTISTS

 Jeanette Salisbury Supple:
This should frighten all people who prefer clean air and water and believe in climate change.

 Sylvia Jane Townsend:
More foxes guarding the henhouse.

 Nancy Federman Kaplan:
EPA desperately needs to be rescued from this wrecking crew!

 @SachaSpector:
Climate denial has no place in the @EPA. Thanks @UCSUSA for speaking up for science!

ON NEW MEXICO COMMITTING TO 100 PERCENT CARBON-FREE ELECTRICITY (SEE P. 4)

 Kirsten Whetstone:
You go New Mexico! This is progressive and smart. Land of Enchantment for a reason!

 Janelle London:
Awesome! Next step: transition away from polluting gasoline vehicles to electric ones ASAP. Plenty of free NM sunshine available to fuel them.

 Marie Jackson:
Let those who say it can't be done get out of the way of those who are doing it.

ON EPA ADVISORS SIDELINING SCIENCE ON AIR POLLUTION STANDARDS

 Tanner Drummond:
What else should we use in place of science?

 Traci Barela:
Live in a high-particulate country and then tell me you think this is good.

 Sarah Oh:
It should be criminal to deface and deregulate standing health and air quality protections for profit.

 Lin Sirenas:
Sure, because we all realize it's logical to base our environmental protections on corporate profits rather than hard science.

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UCS research links industry emissions to ocean acidification

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Our successes over the past 50 years

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New Mexico Commits to 100 Percent Carbon-Free Electricity



After years of advocacy and analysis by UCS and its partners, New Mexico Governor Michelle Lujan Grisham signed a bill in March committing the state to getting 100 percent of its electricity from carbon-free resources by 2045.

New Mexico Governor Michelle Lujan Grisham recently signed into law a landmark bill that puts the state's energy sector on an ambitious path and establishes New Mexico as a clean energy leader.

The state's Energy Transition Act takes New Mexico's current renewable electricity standard of 20 percent by 2020 and accelerates it—jumping to 50 percent by 2030, and 80 percent by 2040. Then, by 2045, the bill commits the state to a power sector that's 100 percent carbon-free. With this farsighted move, New Mexico becomes only the third state (after Hawaii

and California) to explicitly set itself on a path to zero-carbon electricity.

The move comes after years of advocacy and analysis by UCS and its partners, including the influential 2017 UCS report *Committing to Renewables in New Mexico: Boosting the State's Economy, Generating Dividends for All*, which demonstrated the cost-effectiveness of moving to a high level of renewable energy to power the state's electric grid, especially given the relatively high cost of coal. "Transitioning away from coal-fired power plants presents an incredible opportunity for New Mexico to slash carbon emissions, clean

the air, and create a vibrant, clean energy economy," says UCS Senior Energy Analyst Julie McNamara. Equally important, she notes, by working toward a carbon-free electric grid, the bill ensures the state will not simply replace coal with natural gas, which also produces carbon emissions.

SUPPORTING COAL WORKERS

Notably, the Energy Transition Act acknowledges that coal plant and coal mine workers and communities need a transition plan of their own. While striving to keep the economics of the transition cost-effective, the bill ensures that some of the

money saved will be used to support the workers and communities affected by the shift—through work-force retraining, economic development, severance pay, and reclamation.

"Instead of ducking hard truths, New Mexico's state legislators confronted the challenges of coal plant retirements head-on to make sure coal workers and coal communities won't be left behind," McNamara says. "The time is right for other states to follow New Mexico's lead and balance the particular challenges and opportunities they face to make a swift transition to a carbon-free future."

UCS Exposes Air Quality Inequities in California



A recent UCS analysis, *Inequitable Exposure to Air Pollution from Vehicles in California*, published in both Spanish and English, demonstrates that Latinos, African Americans, Asian Americans, and low-income communities are exposed to substantially more air pollution from cars, trucks, and buses than other demographic groups in the state.

Our analysis (online at www.ucsusa.org/ca-air-quality-equity) focused on fine particulate air pollution (smaller than 2.5 micrometers in diameter), which can be directly produced by the burning of gasoline or diesel in an engine and indirectly produced in the atmosphere from tailpipe exhaust and fuel evaporation. These particles, some 20 times smaller than the width of a human hair, can penetrate deeply into the lungs and even enter the bloodstream, posing a serious threat to human health from heart and lung diseases.

Previous public health studies have shown anecdotally

that communities of color and low-income communities have experienced elevated incidence of air pollution-related illnesses such as asthma and lung and heart ailments, and even premature death. But,

in a new line of analysis, our team overlaid data about the amounts of fine particulate air pollution from cars, trucks, and buses with demographic data to determine which communities were hardest hit.

Among the key findings are that African Americans in the state are exposed to fine particulate pollution at a level 43 percent higher than that for white residents of the state; this pollution exposure is 39 percent higher for Latinos in the state than for white residents. In addition, low-income households in California are exposed to fine particulate pollution at a level 10 percent higher than the state average; by comparison, for the state's highest-income

households, the level is 13 percent below the state average.

What to do? The analysis makes a number of recommendations for targeted actions state and local governments should take, including: electrifying passenger and freight vehicles as swiftly as possible; requiring, as California currently does, that a percentage of revenue generated from the state's cap-and-trade program be specifically earmarked for low-income communities; and offering clean vehicle incentive programs that provide greater financial incentives for low-income households and for accelerating the retirement of the oldest, most high-polluting vehicles.

A Trip to the Supermarket with UCS

Consumers in the United States today are becoming more interested and invested in how our food is produced, packaged, and distributed. And now, UCS has a new interactive tool to help shoppers learn more about how our food system actually

works, and what it will take to make real change.

At our virtual supermarket, you can shop for knowledge on the hidden costs of items you might buy regularly at your local store such as coffee, eggs, meat, and vegetables. You can also find recommen-

dations to help make our food system work better for all of us, not just through supermarket trips but also with policy shifts.

"We understand that making choices about food can be overwhelming," says Karen Perry Stillerman, senior strategist and analyst for the UCS Food and Environment program. "By revealing hidden stories behind some of the products on the shelves, we're giving shoppers information to make more informed decisions—and an understanding of how to advocate for a better food system."

Try it out and fill your cart at www.ucsusa.org/supermarket.



UCS Spotlight on PFAS Spurs Progress



A sign in Millford, Michigan, warns of the dangers of eating fish from a local river that has been found to be contaminated with a group of chemicals known as PFAS.

Over the past year, UCS has sounded the alarm about the health risks of unregulated exposure to per- and polyfluoroalkyl substances, or PFAS. These chemicals are used in firefighting foam, food packaging, and nonstick pans, and are linked to health problems including asthma, multiple types of cancers, and thyroid disease. And sadly, these chemicals may be found at unsafe levels in the drinking water of many people in the United States.

For example, a 2018 UCS report flagged the prevalence of high concentrations of

PFAS in the drinking water at military bases around the country, with some groundwater concentrations as high as 1,000 times the levels scientifically considered safe. UCS also drew attention to an attempt by the Trump administration to cover up the results of a study suggesting these chemicals are unsafe at lower amounts than previously believed.

“We’re starting to see movement on this issue now,” says Genna Reed, lead science and policy analyst with the Center for Science and Democracy at UCS.

“Congress and individual states are launching oversight and accountability measures, which is good news for public health.” Notable among the state efforts, the New Jersey Department of Environmental Protection recently set science-based limits for PFAS in the state’s drinking water and ordered five major chemical companies that produce PFAS to pay for the cleanup of contaminated sites. Additionally, New Jersey’s attorney general is suing two of those companies for the

damage they’ve caused. Meanwhile, members of Congress have created a task force on PFAS contamination and introduced bipartisan bills in the House and Senate that would classify PFAS as hazardous substances under the Superfund toxics law.

Reed is determined to keep PFAS top-of-mind among lawmakers and regulators. “UCS is going to keep working on PFAS until it’s evident that contaminated sites are cleaned up, enforceable standards are set, and our drinking water is safe,” she says. “Our health is at stake.”

Sidelining Science on Air Pollution Standards: UCS Fights Back

The Environmental Protection Agency (EPA) has a long-established process for ensuring that national air pollution standards are based on science, as required

under the Clean Air Act. But to an unprecedented extent, the Trump administration has been trying to chip away at the science that underpins these protections.

In October of last year, the EPA disbanded a scientific review panel that had served as a key resource for ensuring the agency sets air pollution standards that will protect public health. At the same time, the EPA kicked independent scientists off its Clean Air Scientific Advisory Committee (CASAC). Together, these changes mean the EPA is getting far less qualified science advice for the decisions it needs to make about air pollution policy.

In the latest effort to sideline science, Dr. Tony Cox, the current chair of CASAC, has called on the EPA to upend its time-tested and scientifically sound process for setting air pollution standards. Gretchen Goldman, an air pollution expert and research director

for the Center for Science and Democracy at UCS, is pushing back.

Goldman co-authored a prominent piece in *Science* charging that Cox and the current administration are undermining a process that, even in the face of enormous political and financial pressures, “has worked remarkably well across both Republican and Democratic administrations and has been upheld in the courts.” As *Catalyst* goes to press, early indications are that the pressure we are exerting has helped forestall Cox’s current efforts to do an end run around EPA requirements. UCS is monitoring developments closely and will continue to fight hard for air pollution protections based on science.



Dr. Tony Cox, the current chair of the EPA’s Clean Air Scientific Advisory Committee, is calling for changes that will undermine the scientific process that shapes the nation’s clean air policies.

GET YOUR SCIENCE ON WITH THE UCS GOT SCIENCE PODCAST!

Our hosts take on technology, attacks on science, climate change, and more, as they channel the power of science to make the world a better place. On iTunes and at gotsciencepodcast.org.



ARE FOSSIL FUEL DESTROYING MARINE ECOSYSTEMS?



Ocean acidification, driven by absorption of carbon dioxide from the burning of fossil fuels, is responsible for production declines in oyster farms, such as this one in Washington State, and other marine industries that generate billions in revenue for coastal economies.

COMPANIES INE

New research links carbon emissions from the major oil and gas producers to dangerous changes in the oceans' chemistry.

BY PAMELA WORTH

Growing up in Pittsburgh, Pennsylvania, where coal-fueled fires powered the steel industry, Brenda Ekwurzel received an early education in air and water pollution.

“We’d see barges of coal being sent down the river for the mills to burn. When my brother and I went canoeing on that river with our parents,” she says, “they’d tell us to try not to touch the water or even let it splash on us. Back then, it was so polluted, there weren’t any fish.”

Today, as director of climate science at the Union of Concerned Scientists, Ekwurzel is focusing on the consequences of burning fossil fuels on a much larger scale: the impact on the world’s oceans.

“So far, people are not paying nearly enough attention to one of the most significant and direct effects of carbon emissions in our atmosphere,” she says. “Globally, our oceans aren’t just warming. They’re also acidifying. And this has serious consequences for marine life and food chains worldwide.”





We're fast approaching the threshold where organisms can't form shells and deep-water corals can't bounce back, within the next decades.

While some emissions from burning fossil fuels are taken up by plants and animals on land, some linger in the atmosphere, contributing to the blanketing “greenhouse” effect that warms the earth. The world’s oceans absorb the rest, which nudges its chemistry along the pH scale from basic toward acidic. Surface waters are now nearly 30 percent more acidic than they were in 1850. And ocean acidification is happening at a faster rate today than at any point in the last 66 million years. Projections show that if we do not reduce our carbon emissions, ocean surface waters could be more than twice as acidic in 2100 as they were in 2000.

Ekwrzel isn’t just studying the process of acidification, however. She and her team are examining who is responsible, and to what extent.

In the decades since she left Pittsburgh, one of its major steel companies has been repeatedly held liable for air and water pollution, paying out large settlements for cleanup and to affected residents. The company’s fingerprints on the damage were clear.

As it turns out, it’s also possible to prove who is responsible for the destructive effects of climate change, including ocean acidification. Ekwrzel is in the forefront of scientific research showing that such effects are, to a large extent, the result of the practices and policies of the fossil fuel industry.

ATTRIBUTION AND ACCOUNTABILITY

Ekwrzel and her team have been working for several years to attribute specific effects of climate change to the largest industrial producers of carbon emissions, including ExxonMobil and Chevron. With Ekwrzel as lead author, the team published a paper in the peer-reviewed journal *Climatic Change* debuting a scientific formula that assigns responsibility for hotter temperatures and rising seas to 90 private, majority state-owned and national companies.

The team concluded that emissions traced to those producers from 1854 to 2010 were responsible for 42 to 50 percent of the rise in global average surface temperatures, and 26 to 32 percent of global sea level rise. That paper was the journal's most widely read article in 2018, with nearly 1,000 shares and 70,000 downloads.

"We calculated the increase of carbon dioxide in the atmosphere that can be traced back to the extraction, production, and sale of oil, gas, and coal, as well as cement production," Ekwurzel says, noting that the work relied on these companies' own detailed records.

Now the team, led by Ekwurzel and UCS Senior Climate Scientist Rachel Licker, has applied the same formula to attribute documented changes in ocean pH to specific

companies. As *Catalyst* went to press, the new analysis was under consideration for publication in a peer-reviewed scientific journal.

Ekwurzel says the process for attributing ocean acidification to the fossil fuel industry is more straightforward than her team's previous research. One reason: the world's oceans absorb carbon dioxide swiftly compared with the lengthier processes that lead to rising temperatures and seas.

"Based on the amount of carbon we've emitted, we haven't yet felt the full expression of sea level rise or warming," says Ekwurzel. "It takes time to melt huge ice sheets. It takes time to warm large bodies of water. But the atmosphere is in direct contact with the ocean's surface, and we can measure that absorption happening every day."

(continued on p. 21)

ACIDIC OCEANS ERODE COASTAL ECONOMIES



Dr. Brenda Ekwurzel (left) talks to an attendee of the Maine Fisherman's Forum about UCS and our work.

As Northeast regional advocacy director for UCS, Roger Stephenson works with scientists such as Brenda Ekwurzel to connect their research with people who can use it. In March, Stephenson brought Ekwurzel's new work on ocean acidification to the Maine Fishermen's Forum, a three-day trade show for fishermen, academics, government agencies, and other people interested in the Gulf of Maine's fishing industry.

"We wanted to build awareness and share the science attributing ocean acidification to specific fossil fuel companies," says Stephenson. "This research dovetails very closely with the 'polluters pay' principle: namely, that those who cause the pollution should pay the costs of dealing with it."

From large-scale fishing operations to individual subsistence fishers, ocean warming and acidification pose

an existential threat to the millions of people worldwide who depend on healthy oceans for their survival. The science of attribution can help many of the people facing the most immediate impacts take steps toward economic restoration. This is especially true in acidification "hot spots" including the South Pacific's Coral Triangle, the Gulf of Alaska, the Arctic, the California current (which spans the coastal Pacific Northwest), and the Peru current (which runs along the western coast of South America) that are all acidifying more rapidly than other regions. In the Coral Triangle alone, where the region's marine biodiversity supports more than 100 million people, \$6 billion in annual fisheries exports and tourism are at risk.

Ekwurzel and her team's research includes some quantification of the risk to lives and livelihoods for each of these hot spots—such as the number of jobs that could be lost—along with specific changes to oceanwater pH.

"If people at risk use our work in conjunction with regional studies dedicated to acidification, we have confidence that they could tie the harmful changes occurring in their specific location back to the fossil fuel producers," she says.

Changing the Idea of What a Scientist Looks Like

INTERVIEW WITH MARYAM ZARINGHALAM

As a molecular biologist, science communicator, and leader within 500 Women Scientists, you wear a lot of hats! Was science your first calling?

MARYAM ZARINGHALAM: Yes, absolutely. From an early age, I had a lot of interest in how small parts come together to make a functional whole. When I was a kid, I was dissecting TV remotes and trying to reverse engineer them to work again. That translated into biology when in ninth grade we dissected a fetal pig. I had this moment where I was looking inside the pig and realizing, “If this creature weren’t being dissected right now, these parts would be coming together to make an oinking, rolling-around-in-the-mud pig.” That got me hooked on biology right then and there. I continued to learn about biology until that translated into a love of genetics—ultimately, the most basic functional unit of complex beings like ourselves is DNA.

What inspired you to become equally as passionate about science communications and policy?

MARYAM ZARINGHALAM: When I was in graduate school, I started to notice that what I was doing in the lab felt isolated from conversations I was having with my friends, who would claim they didn’t understand science or they weren’t smart enough. But then we would have the most engaging, interesting conversations about it. I got interested in communication then, and I started a project—a conversation series—called ArtLab, where I was trying to use art as a lens to think about science. Doing ArtLab, then later doing the podcast *Science Soapbox*, I found that people were connecting their expertise in science with the public at large in many different ways. And I started to wonder if there was a place for me to combine my skills in communication, my background as a

scientist, and my interest in social justice. That led me to leave academia and pursue a science policy fellowship through AAAS [the American Association for the Advancement of Science].

How did you get involved with 500 Women Scientists?

MARYAM ZARINGHALAM: After the 2016 election, 500 Women Scientists began as a pledge: to stand up for the responsible use of science and, more importantly, to stand up for the people who should benefit from science. By that, I mean that what we’re allowed to do in research is constrained by things like funding. Of the billions and billions of questions we could be asking about the world, we’re only given the support to ask a small subset. And we should really be making sure those questions we’re asking are ones whose answers can benefit as many people as possible.

I signed the pledge back then and kind of forgot about it. But later, in January 2017, I flew out to Iran, which is where my family is from. I’m a US citizen, but I thought I should visit while I could because I was sure this administration would not have a great relationship with the country. And while I was in Iran, the first iteration of the travel ban happened. I emailed 500 Women Scientists and asked if there was any way I could get involved because I wanted to do something. And I haven’t looked back.

You’ve been vocal about the need for scientists to bring their whole selves—including marginalized identities—including their work. Why is this important for scientists, and for science as a whole?



Maryam Zaringhalam is a molecular biologist, a member of the UCS Science Network, and a AAAS Science and Technology Policy Fellow. She received her PhD from The Rockefeller University, where she focused on how genetic building blocks affect how we look and function. She serves on the leadership board of 500 Women Scientists—a grassroots, women-founded, women-run science advocacy organization. She also co-hosts the science policy podcast *Science Soapbox*, and her writing has appeared in *Quartz*, *Scientific American*, and *Slate*. UCS named her one of our 2018 Science Defenders; hear more about why she became a scientist defending science on our podcast, www.ucsusa.org/ep49-zaringhalam.

“Of the billions of questions we could be asking about the world, we’re only given the support to ask a small subset. . . . Those questions [should be] ones whose answers can benefit as many people as possible.”

MARYAM ZARINGHALAM: I have a hard time seeing the point of only being a scientist, because I think no one is ever only just a scientist, especially if you’re somebody who comes from an underrepresented background. Being able to forget about your identity when you’re at work is a privilege afforded to a select few.

Because we’re more likely to trust people we can identify with, increasing representation so that people from many different backgrounds participate in the scientific enterprise helps the public understand that scientists are people just like them. The more we can attract people from communities that haven’t traditionally been represented in science—such as evangelical Christians, or people who have been historically marginalized or even dehumanized in the name of science—the more we can build trust within those communities. From there, we can build a firmer ground for science in communities that might be traditionally skeptical. What we advocate for with 500 Women Scientists is that we need to change our idea of what a scientist looks like and where a scientist has business inserting her expertise.

Does scientific objectivity suffer when people’s identities become part of the work?

MARYAM ZARINGHALAM: I’d say objectivity actually improves. Scientists are people. And people have biases. We need to do a better job of recognizing that what’s currently coded as “objective” in science is based on a white, cisgender, male perspective that has historically dominated science, because science has actively excluded diverse perspectives. If we don’t acknowledge that, we can’t work to correct those biases.

Thankfully, we can be trained to recognize our biases and the ways they manifest in our research, and then course-correct. But that can only happen when we welcome and include as many perspectives as possible to challenge our default ways of thinking. By including people’s identities and lived experiences, we get closer to a more representative experience of the world, which is essential when we’re working to understand the world around us.

Do you have any advice for early-career scientists, or scientists who are considering federal work but might be disheartened by the diminishing role of facts and evidence within the Trump administration?

MARYAM ZARINGHALAM: Something I’ve realized as I’ve gotten into organizing is that optimism is a muscle

you have to strengthen and exercise. It can be difficult to look at the world around you and immediately feel hope. You have to search for it. I’m constantly looking at examples where organizing paid off.

It’s also helpful to look at the greater scope of history beyond just these one or two years. Something I’ve learned during my fellowship is that bureaucracies are big and unwieldy and multilayered. That’s why things are hard to change quickly—but it’s also why there is a lot of stability in the work that is being done in the government.

Don’t lose hope. You’re among loads of people I have met through organizations like the Union of Concerned Scientists or 500 Women Scientists who are dedicated to making sure science is working for everybody. It’s a big, wide tent, and I hope you’ll join me there. {C}

WE’RE TURNING 50. TIME TO PLAN FOR THE FUTURE

Charitable gift annuities offer significant tax benefits and reliable income.

By establishing a charitable gift annuity with UCS, you can receive significant tax benefits and income for life. Payment rates are based on your age (minimum age 60) and can be as high as 9%. Gift annuities can also help reduce capital gains taxes on gifts of stock.

CONTACT US FOR MORE INFORMATION

Please contact Eric St. Jacques at (617) 301-8095 or email plannedgiving@ucsusa.org.

A HISTORY OF UCS ACCOMPLISHMENTS

For 50 years, the Union of Concerned Scientists has worked, along with our many supporters, allies, and partners, to develop practical solutions to some of the world's most pressing problems. Here's a sampling of our impact so far—with more examples available at www.ucsusa.org/history. And check out our podcast at www.ucsusa.org/got-science-podcast/ep53-wright to learn how a small group of scientists making their voices heard led to the founding of UCS.

1969

1972

Report on the US-Soviet antiballistic missile treaty helped slow the nuclear arms race

1981

Rallied 100,000 students for teach-ins on nuclear war threats

1984

Convened top scientists for televised conference to provide facts on US missile defense



1969

At the height of the Vietnam War, UCS is founded when faculty at MIT and other universities call for scientists to serve the public good.



1979

UCS calls for the Three Mile Island nuclear plant to be shut down—two months before the accident there.

“I was a student at MIT when UCS was founded. I’ve supported UCS for almost 50 years because of its unique approach to arms reduction: rigorous technical analysis translated to public policy that can make us all safer.”

—JOEL WEISBERG, PROFESSOR OF PHYSICS AND ASTRONOMY, CARLETON COLLEGE, 2017

“I appreciate the time and energy UCS invested to educate [us] on the need to address the overuse of antibiotics in animal agriculture and to help turn those concerns into legislation that will make a very real difference.”

—SENATOR OLYMPIA J. SNOWE
(R-ME), 2003



1987

UCS sues the government to strengthen safety standards at nuclear power plants across the country.



2001

UCS shows how overuse of antibiotics in animal agriculture harms their effectiveness in human medicine.

1990

Called for increased fuel efficiency and exploration into alternative fuels

1997

Led US nonprofit organizations to negotiations resulting in the Kyoto Protocol climate treaty

2000

Released a report demonstrating the vulnerability of US missile defense plans

2008

Won international protections to preserve the world's rain forests



1992

UCS issues a “World Scientists’ Warning to Humanity” on climate change and sustainability, signed by most of the world’s Nobel Prize winners.

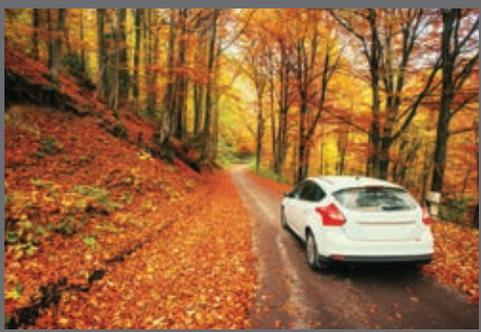
“UCS is out there making sure the public—and especially our lawmakers—understand the work being done in science today and why it’s important. . . . No other such organization is as thorough and trusted.”

—BILL NYE (“THE SCIENCE GUY”),
SCIENCE EDUCATOR, 2017



1993

UCS outlines how state renewable electricity standards—now used by 29 states—can speed the transition to clean energy.



2009

Informed by UCS analyses, a regional initiative to cut global warming emissions in the Northeast is established.

“UCS provides a bridge that can help scientists connect with real folks in a way that is authentic and has mutual value. That’s extremely important, because science and environmental justice go hand in hand.”

—MUSTAFA ALI, FORMER SENIOR VICE PRESIDENT OF THE HIP HOP CAUCUS AND FORMER EPA CHIEF ENVIRONMENTAL JUSTICE OFFICIAL, 2017



2010

UCS expertise helps persuade the US Senate to approve the New START treaty, dramatically reducing US and Russian nuclear weapons.

“UCS’s independent analysis of missile defense programs has consistently provided me and my Senate colleagues with the sort of relevant technical information we need to oversee these programs.”

—SENATOR CARL LEVIN (D-MI), 2003

2009

2011

Provided critical, independent expertise on the Fukushima nuclear disaster

2013

Spotlighted how restructuring US food policy could save trillions

2016

Secured fuel efficiency standards for big trucks



2009

UCS wins standards designed to cut global warming emissions from new cars and light trucks in half by 2025.

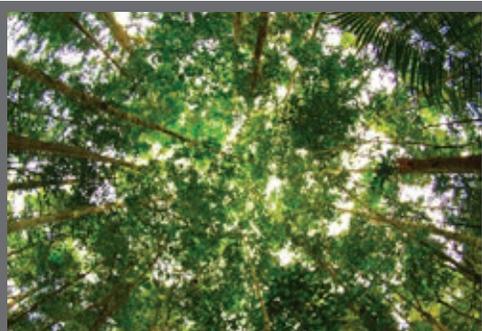
“When lawmakers in Washington and their staffs want solid, scientific analysis of policies designed to encourage clean vehicles, [UCS] is one of the first places we turn.”

—SENATOR DICK DURBIN (D-IL), 2003



2012

UCS wins a landmark victory in Congress with the passage of a bill granting whistleblower protection to scientists.



2014

UCS convinces 12 global companies to use only deforestation-free and peat-free palm oil in their products.



2018

UCS estimates more than \$117 billion of coastal real estate is at risk of chronic flooding from sea level rise by 2045.

“Science tells us the planet is warming, the impacts we’re seeing today are already serious, and our future is in our hands. [UCS] is the most effective organization I know for addressing those truths head-on.”

—KATHARINE HAYHOE,
ATMOSPHERIC SCIENTIST AND
LEAD AUTHOR OF THE
US NATIONAL CLIMATE ASSESSMENT, 2016

2017

Forced ExxonMobil to acknowledge climate change in its business plans

2017

Provided crucial analysis of the North Korean missile program

2018

Blocked anti-science nominees from being appointed to the Trump administration

2018

Provided technical analysis for a program to reduce transportation emissions in the Northeast and Mid-Atlantic



2015

UCS documents that fossil fuel companies knew about their products’ climate hazards—and misinformed the public—for decades.



2018

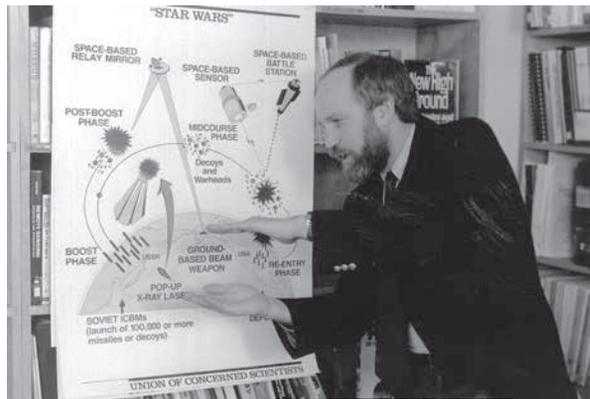
After UCS proved it was possible, California passes a bill requiring 100 percent clean, renewable electricity by 2045.

“What I really like about UCS is that they tell it like it is, and we need to hear that.”

—SECRETARY OF THE INTERIOR
SALLY JEWELL, 2014

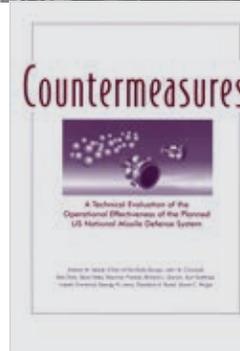
An Indispensable Voice of Science and Sanity on Global Security

BY ELLIOTT NEGIN



The Global Security Program has deep roots at the Union of Concerned Scientists. From the start, our experts have focused on promoting arms control treaties, encouraging steep nuclear arsenal reductions, and blocking the development and deployment of new nuclear weapons. The work continues as vigorously as ever today, and we can point to some significant progress since we entered the fray.

Perhaps the most notable indicator is the current size of the world's nuclear arsenals. Back in 1969, nuclear-armed states had more than 38,000 warheads in their stockpiles. The total peaked in 1986, when the world's arsenals had more than 69,000 warheads—98 percent of which were retained by the United States and the Soviet Union. Thanks to a succession



**WORLDWIDE NUCLEAR ARSENALS
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IN 1986. US-RUSSIAN TREATIES HAVE BROUGHT THIS
TOTAL DOWN TO FEWER THAN
10,000 TODAY.**

of US-Russian treaties, the world's stockpile of nuclear warheads now stands at fewer than 10,000.

UCS helped push the most recent US-Russian arms control treaty across the finish line by spearheading a campaign that convinced several key senators to vote for its ratification. The New Strategic Arms Reduction Treaty (New START), signed in 2010, capped deployed strategic nuclear weapons at 1,550 for each country. Unfortunately, there has been a serious

deterioration in US-Russian relations since then, including threats to pull out of bedrock bilateral security treaties.

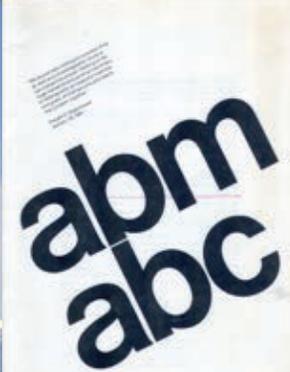
The program also has helped make the world safer by playing a key role in stopping dangerous and unnecessary weapons systems, including the now-retired Tomahawk cruise missile and the cancelled “bunker-busting” Robust Nuclear Earth Penetrator.

“There’s no doubt that we’ve come a long way, but we still have a long way to go,” says physicist Lisbeth Gronlund, co-director of the Global Security Program. “As history shows, treaties are essential not only to controlling these weapons, but also to improving relationships between adversaries.”

PRESENTING THE FACTS ABOUT MISSILE DEFENSE

Perhaps no issue has been more enduring for UCS than missile defense.

Our very first report, released in April 1969, criticized the Nixon administration’s plan to build an antiballistic missile system and helped build support for the landmark 1972 US-Soviet Antiballistic Missile (ABM) Treaty, a critical arms control agreement that lasted nearly 30 years. Since then, a



citing its vulnerability to countermeasures as a major reason. Skepticism grew in Congress as well, and in 2001, it appeared ready to cut the system's funding significantly.

A CRITICALLY FLAWED SYSTEM

The September 11, 2001, terrorist attack changed everything. Three months after 9/11, President George W. Bush announced the United States would withdraw from the ABM Treaty, and later announced plans to deploy a missile defense system in Alaska and California by 2004.

In its haste to get the system up and running, however, the administration exempted it from the Pentagon's standard "fly before you buy" oversight protocol that would have required it to pass realistic tests before being deployed. A 2016 UCS analysis explained the consequences of that ill-advised decision: \$67 billion spent to date on a faulty system with an extremely limited capability to defend against even a small-scale attack.

Regardless, Pentagon officials, members of Congress, and even presidents have falsely claimed that the system works. If it were not for UCS providing the facts, policymakers and the general public would likely take their specious claims as gospel.

**MORE THAN
\$67 BILLION
HAS BEEN SPENT TO DATE ON
US MISSILE DEFENSE SYSTEMS THAT
FAIL TO PROTECT US
FROM A LARGE-SCALE
NUCLEAR ATTACK.**

series of high-profile UCS analyses have consistently warned that building such a system is not a reliable way to defend against nuclear-armed missiles and could hinder future arms control agreements.

In the early 1980s, for instance, UCS helped lead the scientific community and the general public to oppose President Reagan's chimerical Strategic Defense Initiative, widely known as "Star Wars." Since then, instead of trying to establish a shield that would protect the United States from an all-out attack, as Reagan imagined, successive administrations focused on developing defenses that could intercept and destroy a limited, rudimentary attack by a country such as North Korea.

However, even that goal is impractical. In April 2000, a joint UCS-MIT report showed that any nation capable of firing a nuclear-tipped intercontinental ballistic missile at the United States would also be able to use decoys and other countermeasures to foil a defensive system. The analysis showed that tests of the proposed system failed to demonstrate that it would work in a real-world scenario.

In September of that year, President Clinton announced he would not deploy the system because it was "not yet proven,"

Coming full circle, President Trump channeled Ronald Reagan when he released his administration's Missile Defense Review at the Pentagon last January. "Our goal is simple," he said, "to ensure that we can detect and destroy any missile launched against the United States anywhere, anytime, anyplace." Trump's aspirations for the system—along with congressional interest in putting interceptors in space—are certain to increase international tensions and complicate arms control efforts in exactly the way the now-defunct ABM Treaty was intended to prevent.

In other words, UCS will continue to have a vital role to play. "We've been educating the public and sounding the alarm about this reckless missile defense program for more than two decades, and the stakes today are as high as ever," says physicist David Wright, fellow co-director of the Global Security Program. "Unwarranted confidence in this system could lull policymakers into a false sense of security and embolden military and political leaders to start a war. We're working to make sure that doesn't happen." {C}

How the Green New Deal's Vision Can Unify Us

(continued from p.2)

DEPLOY ALL EFFECTIVE SOLUTIONS, NOT JUST ONES FAVORED BY ONE GROUP OR ANOTHER

For example, while some climate activists are skeptical of market-based programs such as a tax or fee on carbon emissions, there should be room for this approach. A relatively modest price on carbon would shift our electricity generating mix toward low-carbon sources, but in other sectors such as transportation, a carbon price alone will not get the job done. We will need other measures such as incentives for electric vehicles and public investment in mass transit and EV charging networks.

Similarly, while renewable energy is vitally important, the Green New Deal would benefit from setting a goal of 100 percent *carbon-free* energy rather than 100 percent *renewable* energy. The former can include energy efficiency and fossil-fueled plants that can capture, store, or reuse carbon dioxide, and leaves the door open to temporarily extend licenses of existing nuclear plants that meet stringent safety standards to buy us time as we ramp up renewable resources.

What's clear is the science tells us we must act to dramatically cut emissions now—not later.

FOCUS ON AREAS OF AGREEMENT

There is widespread agreement that storing energy is a linchpin solution for both clean transportation and clean electricity, but the batteries we have today are still too expensive and not adequate for all our storage needs. The Green New Deal can broaden its appeal by promoting public and private mobilization of research, development, and deployment of innovative technologies including large-scale energy storage.

THE ORIGINAL NEW DEAL WASN'T BUILT IN A DAY

Franklin Roosevelt's New Deal was not accomplished with one piece of legislation. It took hold through many different laws and regulations, enacted at different times as the political system allowed. Similarly, the Green New Deal is unlikely to be established through one comprehensive bill. The current resolution focuses primarily on limiting the emissions causing climate change, but it also promotes improvements in health care, housing, and jobs, which are critical to building a more just society. Our history and congressional dynamics suggest multiple bills over time will be needed to address these issues and even to tackle the climate issue alone.

What's clear is the science that unequivocally tells us we must act to dramatically cut emissions of heat-trapping gases *now*—not later. The Green New Deal offers a fresh frame for the bold, ambitious action we need. Its success depends on defining it in a way that draws us together, rather than setting us apart. {C}

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Are Fossil Fuel Companies Destroying Marine Ecosystems?

(continued from p.11)

Everyone on Earth has a stake in the health of our oceans and should care about ocean acidification. We can really make a difference in reducing this threat.

Ocean acidification is such a rapid process, Ekwurzel says, that her team can track shifts in acidity in direct proportion to atmospheric carbon dioxide, just a year after its emission. And the bright side to these quick changes in our oceans' chemistry, she adds, is that we can reverse the damage much more easily than we can with warming or rising seas.

"If you think about the order of magnitude and immediacy of the impacts of climate change," she says, "ocean acidification is at the top of the list, then warming, then sea level rise. Over this century, we'll experience the biggest improvements from emissions reductions in the same order of the impacts. For ocean acidification especially, cutting our emissions now will make a noticeable difference in protecting our oceans."

But as Ekwurzel emphasizes, given the stakes involved, we don't have long to act.

THE BIOLOGICAL RISKS OF OCEAN ACIDIFICATION

The consequences of acidification are disastrous to marine life, and pose at least as much of a threat to humans as other global warming impacts such as extreme weather and sea level rise.

As carbon dioxide dissolves into the ocean, chemical reactions deprive shell-forming marine organisms (such as shellfish, corals, and foraminifera) of the carbonate ions they need to build their protective shells. Acidifying waters eat away at the bottom of the world's food chain: the marine life that depends on the current chemistry of the ocean to survive. Without them, our global food chain is at risk—to say nothing of the millions of people worldwide who make their livings from, or subsist on, seafood.

Warming and acidification are a one-two punch for marine life, says Ekwurzel, pointing to corals as an example. A coral reef bleached by warming waters will be less able to rebuild itself in acidic waters.

"It's a double whammy," she says.

Perhaps most importantly, Ekwurzel warns there is a point beyond which the consequences of acidification can be devastating. "We're fast approaching the threshold where

particular organisms can't form shells and deep-water corals can't bounce back, within the next decades," she says.

SEARCHING FOR SOLUTIONS

The solution to ocean acidification is also the solution to global warming and sea level rise: rapid, drastic, widespread cuts to carbon emissions. Ekwurzel stresses the potential for damage prevention.

"The swift reduction in carbon we need would most directly slow down the pace of ocean acidification," she says.

She also points to the possibilities of carbon sequestration (the removal and storage of atmospheric carbon) through new, undiscovered technologies, and/or the deployment of so-called blue carbon—coastal ecosystems that trap and store carbon naturally, such as seagrasses and tidal marshes.

"We could build carbon 'credits' for restoring mangroves and wetlands, and making sure seagrasses are healthy," she says. "There are other, larger-scale ideas for carbon sequestration, too, but for now they are costly and energy-intensive. I'm in favor of innovation and research into every method that's out there. There's no one silver bullet—there's silver buckshot. And we need every pellet."

The work of Ekwurzel and her team is part of that spray of buckshot. By laying the groundwork of scientific evidence for attributing increased acidity in the world's oceans to the major producers of fossil fuels, this work offers another potential legal recourse to those suffering the consequences—a way to demand restoration and an end to unchecked carbon emissions (see the sidebar). People in particular locales and with particular livelihoods will face greater impacts than others, but many of the impacts are urgent and universal.

"Everyone on Earth has a stake in the health of our oceans and should care about ocean acidification," Ekwurzel says, "especially those who eat any type of marine protein. If we act fast, we can really make a difference in reducing this threat."

To learn more about ocean acidification and the fossil fuel industry's responsibility, visit www.ucsusa.org/ocean-acidification. {C}

Will Self-Driving Cars Help or Harm Underserved Communities?

By Richard Ezike



Self-driving cars, or autonomous vehicles (AVs), are being tested in cities across the United States, and could be widely available sooner than we think. In conversations about their impacts,

one question that must be asked is: how will these vehicles help or hurt people historically underserved by the transportation system, such as those from low-income communities and communities of color? I joined the Union of Concerned Scientists to address that question.

My team and I used our home base of the Washington, DC, metro area—one of the most congested in the nation—as a stand-in for other American cities. Using projections of the future of transportation in the area, we studied the effects of AVs on traffic congestion, public transit, and job accessibility in the area by 2040, with a focus on impacts in underserved communities. Our overall finding: absent good planning and thoughtful policies, AVs are likely to exacerbate congestion and air pollution, especially in these communities.

For example, people living in underserved DC metro area communities would be subjected to large increases in congested driving in each of the five scenarios we studied, with 6 to 12 times as much congested driving as we might expect by 2040 without AVs. These findings underscore the need for electric-powered AVs. We also found that AVs provide the most benefits if they are



Traffic in the Washington, DC, metro area—and many other cities in the country—could be exacerbated by an increase in self-driving vehicles on the road.

used as shared, multi-passenger vehicles; otherwise, they will likely worsen traffic and pollution.

Ultimately, the effects of AVs will largely depend on how we regulate them. To maximize their benefits for all communities, AVs should not only be used as multi-passenger vehicles and powered by electricity, but also be integrated with an enhanced public transit system. Our analysis found that strong public transit in combination with shared AVs produced the shortest commute times. This means we need policies that encourage AVs as a complement to public transit systems, not as a replacement for them.

Policymakers setting standards for AVs must prioritize people over technology. Only then can they craft strong policies that incentivize drivers and ride-sharing companies to use these vehicles in ways that reduce congestion, cut emissions, and promote equitable access. I invite you to read our full report at www.ucsusa.org/av-equity. {C}

Richard Ezike is a Mobility and Equity Kendall Science Fellow at UCS. Read more from Richard on our blog, *The Equation*, at <http://blog.ucsusa.org>, and hear his podcast on the ethics of self-driving vehicles, online at www.ucsusa.org/got-science-podcast/ep52-ezike.

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