EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

Solutions

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Exposing a Climate Threat

In California, EDF's infrared images revealed the biggest known methane leak in U.S. history. How do we stop the next one?

Page 8

Ancient mariners

Sea turtles can live more than 50 years and migrate thousands of miles. To protect endangered species such as this hawksbill, EDF helped lay the groundwork for the first formal environmental agreement between the United States and Cuba in almost 60 years. Under the pact, officials from marine parks in both countries will join forces to develop science, educational and management programs to conserve their shared biological resources.

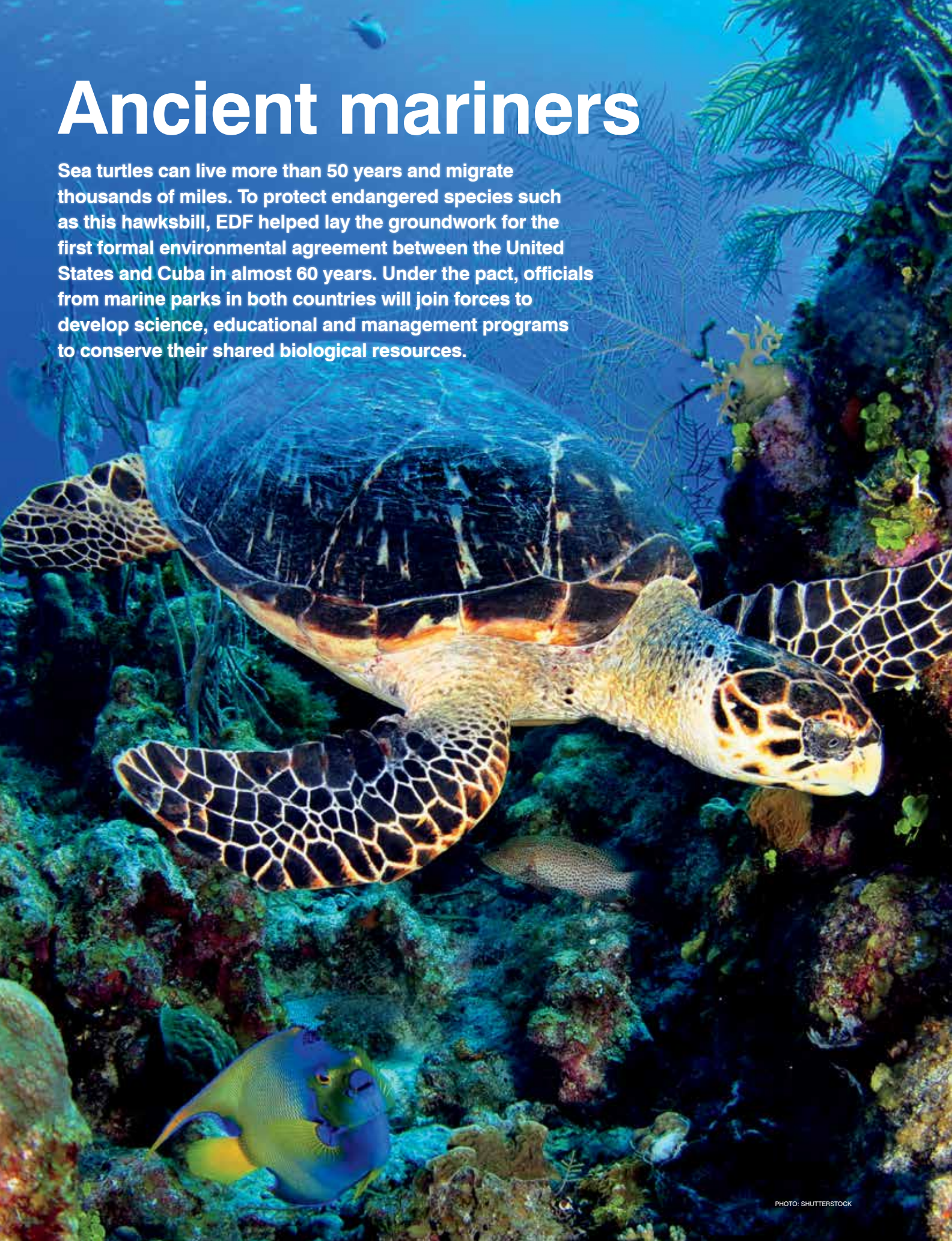

PHOTO: SHUTTERSTOCK

EDF, then and now

When he's asked how Environmental Defense Fund got its start, EDF co-founder Art Cooley likes to quote Alexis de Tocqueville: "As soon as several Americans have conceived a sentiment or an idea that they want to produce before the world, they seek each other out... thenceforth they are no longer isolated individuals, but a power conspicuous from the distance whose actions serve as an example."

It was 50 years ago that Art, then a high school biology teacher, sat down with some fellow scientists and an attorney in his living room on Long Island to talk about bringing into court the evidence against DDT, the pesticide Rachel Carson had warned about in her 1962 book *Silent Spring*.

That meeting, and the legal actions that it sparked, led to the formation of EDF in 1967 and the banning of DDT in 1972, which saved the bald eagle and other great American birds of prey. It also began the partnership of science and law that helped pave the way for the modern environmental movement.

"It all began in a living room."

The environmental issues we face today may seem more daunting than EDF's first case against a single chemical. But then, as now, everything is connected. In October, the nation's worst known natural gas leak erupted in Aliso Canyon, CA—and remained unplugged for four months—spewing methane and toxic gases into the air. It was not only a health crisis for the residents of Porter Ranch, but an extreme example of the methane leaks that are endemic to oil and gas operations around the globe. Methane accounts for about one-quarter of the global warming we are now experiencing *(see story, p. 8)*.

I'm proud of EDF's leadership in exposing and investigating the perfectly avoidable problem of methane leakage, and in fighting to change industry practices and get strong regulations in place. Research shows that nearly half of methane leaks globally could be repaired at a cost of about one-half of 1% of the price of natural gas. The benefit to the climate over 20 years would be equivalent to shutting down one-third of all coal-fired power plants.

In March, our efforts paid off. In an announcement with huge potential for the climate, Canada matched an earlier U.S. pledge to reduce methane emissions by 40–45% from 2012 levels by 2025. And both countries agreed for the first time to cut methane pollution from oil and gas facilities—which produce the vast majority of emissions.

Key to our climate efforts, and many other initiatives, are EDF economists. They have found that if you make environmental protection pay, people will invent all kinds of ways to make it happen. We'll be celebrating the role of economics in environmental protection in a new regular feature in *Solutions*, honoring the legacy of longtime EDF supporter and trustee Robert W. Wilson *(see p. 13)*.

Fred Krupp
EDF President

EDF ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

Environmental Defense Fund's mission is to preserve the natural systems on which all life depends. Guided by science and economics, we find practical and lasting solutions to the most serious environmental problems.

Our work is made possible by the support of our members.

On the cover:
When an old natural gas well above California's San Fernando Valley began spewing methane and toxic gases, no one knew how bad the leak was. EDF's Tim O'Connor helped expose the magnitude of the disaster. He shot the infrared cover image of the otherwise invisible plume. Senior writer Leslie Valentine followed the unfolding story and what it meant for nearby residents *(see page 8)*.

Cover photo: Timothy O'Connor

Solutions

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FIELD NOTES

GETTY

Penguins diving for krill, a staple of their diet.

Krill, the canary of the sea

The small, shrimp-like crustaceans called krill sustain much of the marine life in the Southern Ocean. They form schools that are miles long and serve as the primary food source for whales, penguins, sea birds and fish.

But there's a problem: krill are at risk from global warming.

Higher levels of carbon dioxide in the water mean greater levels of ocean acidification, which interrupts the physiology of krill. It stops the eggs from hatching and the larvae from developing.

As the ocean takes up more carbon dioxide, it becomes difficult for crustaceans such as krill to build shells and exoskeletons.

If oceans continue to acidify, new research predicts there could be a 20% to 70% reduction in Antarctic krill by 2100. That would be a tragedy.

"All of us—fishermen, fishery managers, NGOs and concerned citizens—need to push for reductions in the carbon emissions that are causing acidification," says Dr. Rod Fujita, EDF's director of oceans research and development. "We also need to adjust harvests to account for these changes so that krill and the magnificent marine species that depend on them can stay healthy."

EDF—one of the nation's best

EDF was rated one of the most effective environmental groups in an annual ranking of best and worst charities.

See how we did in *Consumer Reports*!

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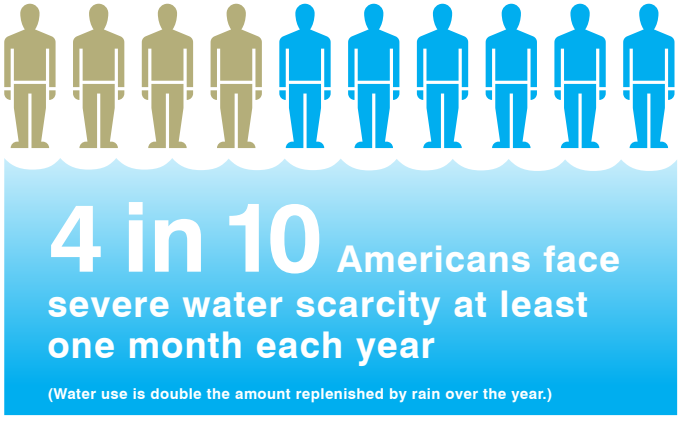
"The existing coal leasing program amounted to an unfair federal subsidy for coal."

—EDF President Fred Krupp, commenting on the decision by the U.S. to block coal leasing on public land.



SOURCE: SCIENCE ADVANCES 12 FEB 2016

WIKIPEDIA

Shuttered: three units at the Allen coal plant in North Carolina.

EDF court win closes plants

EDF and three other environmental groups have settled a lawsuit against Duke Energy after the company rebuilt a dozen coal-fired power plants without the required pollution controls. The settlement requires Duke Energy, the nation's second biggest utility, to close three polluting coal units near Charlotte, NC, that in 2014 emitted thousands of tons of sulfur and nitrogen pollutants into the air, and more than a million tons of carbon dioxide. The lawsuit was initially filed by EPA, but it was EDF who took the case to the Supreme Court and won a unanimous decision, paving the way for the historic settlement.

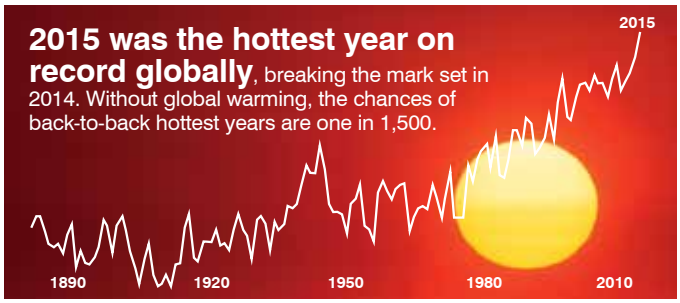
"Millions of people in North Carolina will be better off when these dirty coal plants are shuttered," said Michael Regan, associate vice president at EDF.

U.S. bans microbeads, aiding oceans

FREE IMAGES

Sailing through Congress with rare bipartisan support last year was a bill to ban microbeads nationwide by 2017. President Obama signed the bill into law in December. Found in consumer products such as toothpaste and cosmetics, microbeads are minute plastic particles that wash into waterways and oceans. Toxic chemicals like PCBs stick to the microbeads. The contaminated particles are then consumed by fish and pass up the food chain to people. An estimated 11 billion microbeads are released every day in American waterways. Moms Clean Air Force, an EDF-backed group, mounted strong pressure on Congress to take action.

FOR THE RECORD BOOKS



SOURCES: NASA, U.S. FOREST SERVICE PHOTOS: CORBIS

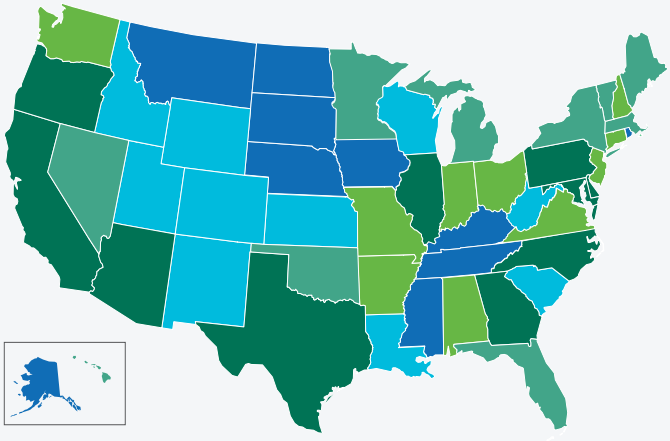
IN THE COURTS

In a win for public health, the U.S. Supreme Court upheld a federal rule allowing customers to get paid for using less power at times of peak demand. On hot days when demand skyrockets, utilities fire up polluting "peaker" plants. With "demand response," customers are paid for using less power at times of peak demand, reducing the need for peaker plants. Power companies originally challenged the policy, and EDF defended it as a friend of the court. "This is a crucial tool against global warming," says EDF attorney Michael Panfil.

Where EDF founders first met, 50 years ago...

Fifty years ago this May, a group of scientists met with a lawyer in the living room of science teacher Art Cooley's house on Long Island. Was it possible, they wondered, to sue the county mosquito commission for dumping the pesticide DDT into Yaphank Lake, causing a fish kill? The scientists agreed to testify, and the lawyer, Victor Yannacone, won an injunction ending the local spraying of DDT. To continue this promising partnership, they launched EDF 17 months later. Watch for more 50th anniversary coverage in upcoming issues of *Solutions*.

The energy report card: How does your state rank?



A new report ranks states according to their investments in renewable energy and how well their policies increase efficiency and reduce pollution. More details at edf.org/statereport.

NORTH CAROLINA

Has more solar capacity than all the other Southeast states combined.

TEXAS

Generates so much wind energy that some utilities offer free electricity overnight.

HAWAII

Is the first state in the nation to commit to 100% renewable energy, by 2045.

NEW JERSEY

Has more solar businesses than tanning salons. Solar employs more than 7,000 people.

SOURCES: GRIDWISE ALLIANCE, SEIA, SOLAR JOBS CENSUS 2015, NY TIMES

Making the Gulf Coast whole again

MINDEN PICTURES

Tens of millions of birds, including these roseate spoonbills, depend on a healthy Mississippi River Delta.

When BP reached a settlement to pay $20.8 billion to mitigate damage from the 2010 Deepwater Horizon oil disaster, all parties agreed that most of the money would go to restore the battered Gulf ecosystem. But today there's intense pressure to divert funds for other purposes. EDF is fighting for the environment and local communities.

BOONDOGGLES ARE PART OF THE American political landscape. But even jaded pundits raised eyebrows this winter when Alabama Gov. Robert Bentley decided to use up to $1.8 million in BP funds to restore the dilapidated governor's mansion on the Gulf Coast. This old house has been falling apart since 1997, well before the BP disaster.

This sort of diversion of funds is regrettable. But the good news is that most of the BP money is being spent properly, as Gulf states realize the urgent need to restore their shared coastline.

GETTY

Gulf bounty: Louisiana's $1.3 billion shrimp industry requires a healthy Gulf.

Neighboring Louisiana—itself no stranger to political scandal—has remained committed to using oil spill settlement money for coastal restoration. Wetlands help protect New Orleans from hurricanes, provide habitat for wildlife and tens of millions of migrating birds, and nurture the Gulf region's $5.5 billion fishing industry.

After the BP blowout, which spilled 3.2 million barrels of oil into the Gulf of Mexico, EDF and partners helped win bipartisan support for the RESTORE Act, which dedicates 80% of BP civil penalties to the Gulf economy and restoration. Without this legislation, penalties might have gone to unrelated federal projects.

Prior to the election of Louisiana Gov. John Bel Edwards in November, we led a campaign to ensure that any candidate elected would support restoration and pledge not to divert funds for other uses.

The world's largest coastal restoration effort is now moving forward, with two sediment diversion projects—mid-Barataria and mid-Breton—in the works. The diversion projects will reintroduce fresh water and sediment from the Mississippi River into its surrounding wetlands to support and rebuild land over time.

Since the 1930s, the Louisiana coast has lost 1.2 million acres. Wetlands that had grown from Mississippi River sediment for centuries have been chopped and channelized for oil and gas operations and cut off from the river that built and nourished them. Today more than an acre of land slips away every hour. The BP spill made things worse. A recent study found that oiled marshes erode at twice the rate of healthy ones.

"Diversions are the backbone of coastal restoration," said Governor Edwards. EDF is helping ensure that local communities and businesses can manage during the transition. For example, we're helping the area's shrimp and oyster industries, on which thousands of jobs depend, adapt to a changing coastline.

EDF has long worked with state leaders and the Army Corps of Engineers to restore the delta. Our scientists, attorneys and policy staff have focused on making sure that sediment diversions are built soon and managed well.

"Nature's power can be more effective than bricks and mortar," says Steve Cochran, director of EDF's Mississippi River Delta program. "If we let it do what it naturally does, the river can help heal this ecosystem."

High court throws a curveball

By Vickie Patton, EDF general counsel

FEBRUARY BROUGHT ONE OF THE most radical legal decisions I've witnessed in my 25 years as an environmental attorney. The Supreme Court voted 5-4 to grant a "stay" of the Clean Power Plan, the centerpiece of our nation's effort to reduce climate pollution from power plants. Never before in our nation's history has the Supreme Court imposed a stay on an administrative action before a lower court had ruled on the merits.

We are determined, with our allies, to fight for these safeguards. Millions of Americans have worked together to put these protections in place for the climate security of our communities.

The Supreme Court did not explain its reasoning. Its damaging order is set out in just a few sentences. The decision puts the Clean Power Plan on pause while the U.S. Court of Appeals in Washington, DC, reviews the case, but we remain confident we will prevail. The Supreme Court itself has repeatedly upheld EPA's authority and responsibility to limit climate pollution under the Clean Air Act.

Vickie Patton

CORBIS

Supreme disappointment: The high court's decision was unprecedented.

The stakes in the legal battle couldn't be higher. Fossil fuel power plants are America's single largest source of climate pollution. The Clean Power Plan will, for the first time, limit that pollution, by setting state targets for emissions reductions and giving each state the flexibility to develop its own compliance measures. The plan catapulted the United States from laggard to leader on climate change and, together with action by China and others, helped convince 195 countries to join the Paris climate agreement.

Because of the court decision, EPA cannot enforce these protections. But fortunately, many states and power companies are pressing ahead with plans to cut carbon emissions from high-emitting power plants and investing in clean energy. The Court's "stay" decision does not stop the climate progress under way in communities across America.

The case is in court because powerful coal interests and their allies are litigating to obstruct progress. But a broad coalition is fighting to defend the Clean Power Plan, including 18 states, the U.S. Conference of Mayors, numerous cities, power companies, leading medical and public health associations and environmental groups.

Next, the Court of Appeals will hear oral arguments on June 2 and is expected to reach a decision by this fall. Then the case will likely move back to the Supreme Court.

At EDF, our focus is on defending the merits of the Clean Power Plan—and we will fight through the full arc of this litigation. We need your support.

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Remember when you first realized we have to protect our environment?

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Direct: 212-616-1201

Getting serious about methane

By Leslie Valentine

An October blowout at a natural gas storage field outside Los Angeles poisoned the air for months, sickening families and polluting the climate. It's time for strong rules to control methane—and EDF is leading the charge.

LAST DECEMBER, TIM O'CONNOR, director of EDF's oil and gas program in California, found himself flying sideways through turbulence in a single-engine Cessna manned by a 25-year-old amateur stunt pilot. Along with a colleague from Earthworks, they were above California's Aliso Canyon, just 28 miles from downtown Los Angeles, circling a giant natural gas storage field. Fighting air sickness and the rotten-egg smell of leaking gas, O'Connor looked down at the field through an infrared video camera and saw a huge black plume of methane, invisible to the naked eye, pouring from a ruptured well. "It looked like a volcano," says O'Connor.

The resulting footage—the first aerial view of the gusher—went viral, with widespread broadcast coverage and more than 1.3 million YouTube views (you can watch it at edf.org/aliso). Soon the entire nation was aware that a climate and public health disaster was occurring in Southern California. On January 6, California Governor Jerry Brown declared a state of emergency. Within a month, California regulators proposed rules to reduce methane pollution across the state's oil and gas industry and took steps to better regulate the 14 gas storage facilities operating in the state. After the faulty well was finally plugged 112 days later, the disaster would turn out to be the largest known methane leak in U.S. history.

The human cost

For O'Connor, the infrared footage was the culmination of weeks of persistent work to document the scope of the disaster, which began on Oct. 23, 2015, when a 62-year-old, 7-inch-diameter steel pipe failed in a well deep underground.

Early on, O'Connor suspected that the leak was serious. Just days after it started, he got wind that senior engineers and natural gas experts were being flown in from across the nation by Southern California Gas (SoCalGas), owner of the Aliso Canyon storage facility, to check out the situation. Then he spotted an article in the *Los Angeles Daily News* that reported nearly 200 complaints from families living in the nearby community of Porter Ranch. They reported a putrid smell and mysterious illnesses—especially in children and the elderly. While methane itself is odorless and harmless to health in low concentrations, other chemicals in the leak were suspect *(see p. 10)*.

At first, SoCalGas downplayed the situation. When Jacki Swift, a Porter Ranch resident and mother of four, called the utility to report that her children were suffering unusual headaches and rashes, the customer representative assured her that the foul-smelling fumes came from mercaptans, chemical additives used to make the otherwise odorless methane detectable, and posed no long-term health risks. "They promised the leak would be fixed quickly, but they weren't telling the truth," Swift says. "It's scary, and I want the truth."

At a community meeting shortly after the leak began, O'Connor listened as frightened and angry parents recounted how their young children were vomiting and suffering from coughs and nosebleeds. "I have two young boys of my own, and I felt the same fear and anger they did," says O'Connor.

That night, O'Connor and his EDF team decided they needed to get a special plane in the air to measure the leak. They attempted the first overflight on November 5, but SoCalGas demanded they call back the plane, citing the risk of explosion. EDF contacted state officials about the urgency of the situation, and the plane went up two days later. When pilot Steve Conley, a UC Davis atmospheric scientist, saw what the numbers were, he was flabbergasted: "I thought my instruments were broken."

Shining a light on the industry

Ultimately, more than 4,000 households in Porter Ranch were relocated. By the time the well was plugged in February, it had released about 100,000 tons of methane. Over the next 20 years, the methane that leaked from Aliso Canyon will cause as much global warming as burning more than 900 million gallons of gasoline.

As a climate problem, the Aliso Canyon leak was exceptional only in its scale. Methane pollution is all too common throughout the oil and gas industry.

"There are tens of thousands of mini-Aliso Canyons across the country and they add up to a big climate problem," says O'Connor. Methane is leaked or vented at every stage of the oil and gas supply chain, from wellheads to pipelines to the gas utility lines under our streets. EPA's estimate of the annual total of those emissions is nearly 100 times the amount of the Aliso Canyon leak.

EDF has taken a lead role in investigating the problem of methane leakage within this vast system and is fighting to change lax industry practices and get strong regulations in place.

Cheap, plentiful natural gas, which is mostly methane, is marketed as a cleaner

PETE DRONKERS, EARTHWORKS

The right stuff: EDF's Tim O'Connor with the infrared video camera he used to reveal the cloud of methane leaking from the Aliso Canyon gas field.

AP IMAGES

LISA WHITEMAN

An activist's story

Living downwind from Aliso Canyon, Vanessa Bulkacz worries about her five-year-old twin boys, Franklin (right) and Cassidy. Even eight miles away, her neighborhood had a strong natural gas smell, and Franklin, who has asthma, began having severe coughing fits. Bulkacz, a climate activist, suspected the gas was causing his flare-ups. "My kids asked me what 'the stinky smell' was," she recalls. "It was frightening." At her job closer to the leak, she suffered continuously from headaches and nausea.

She was appalled to learn that companies are allowed to scrimp on inspections and maintenance of massive storage facilities such as Aliso Canyon. So Bulkacz, a blogger for the EDF-backed Moms Clean Air Force, traveled to Washington, DC, to join other moms meeting with EPA administrator Gina McCarthy to push for strong federal regulations. "We need infrared cameras putting out live web streams at these facilities," she says. "Moms across the country should be outraged that the oil and gas industry puts profits before our children's health."

Why people are getting sick

Besides methane, which is generally nontoxic, numerous pollutants leak from oil and gas operations. These include:

BENZENE Linked to leukemia and kidney cancer

NITROGEN OXIDES Contribute to the formation of smog, which can trigger asthma and damage lungs

MERCAPTANS (chemicals added to natural gas for odor) Cause symptoms such as headaches, nausea and rashes

Health officials attribute the symptoms reported by residents near Aliso Canyon to odorants, but exposure to toxic pollutants pose health risks as well. Says EDF toxicologist Elena Craft: "There are so many unknowns. We need detailed monitoring data for all communities near oil and gas operations."

alternative to coal to generate electricity for our homes, and lately as a cleaner fuel than diesel—but is it? When burned, natural gas emits half the carbon dioxide and far less air pollution than coal. But every ton of *unburned* methane released into the atmosphere creates a large and immediate problem for the climate. That's because methane is 84 times more potent than carbon dioxide over a 20-year period. Methane is responsible for about a quarter of today's global warming.

In 2012, EDF scientists Ramón Alvarez and Steven Hamburg published a paper in the *Proceedings of the National Academy of Sciences* warning that the potential benefits of natural gas as a substitute for coal or oil could be lost entirely if too much was leaking. It caused a sensation. Because data on the actual amount of leakage was sorely lacking, EDF then launched the biggest research project in its history, a series of 16 field studies of the entire natural gas system, with more than 100 academic and industry partners. We wanted answers to some fundamental questions: How much methane is leaking from oil and gas infrastructure? What are the biggest sources of this problem? What steps can be taken to reduce it?

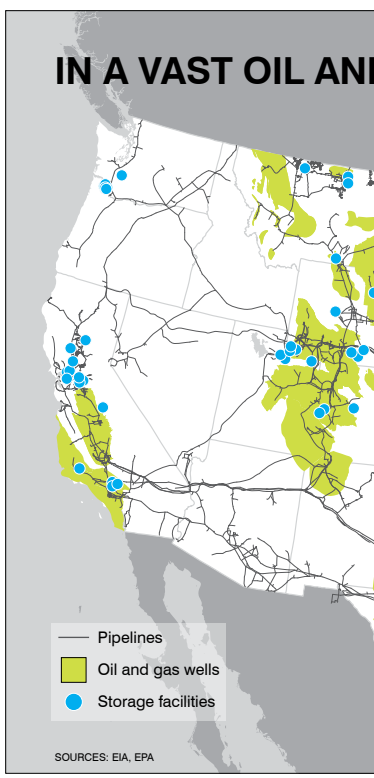
"The scale and speed of EDF's research is unprecedented," says Dr. Stephen Pacala, a professor of ecology at Princeton and an EDF trustee.

To date, more than two dozen papers have been published in peer-reviewed journals, the most recent on the Barnett Shale gas fields in North Texas. The conclusions from that study are startling—and disturbing. The researchers looked at all phases of oil and gas development in the region and found that methane emissions in this huge field are 90% higher than EPA estimates. A major cause of the problem, it turns out, are leaks due to equipment malfunctions and failures, and inattention to operations.

Fixing the system

The Aliso Canyon disaster is a grim reminder of the human costs of poorly regulated oil and gas activities. In Porter Ranch, thousands of families have seen their lives disrupted, their children sickened and their home values at risk.

Porter Ranch could be Anytown, USA. There are 413 underground storage facilities across the United States that hold supplies of natural gas. The Aliso Canyon facility is the fifth largest. Many, like Aliso, are old facilities in populated areas, and the problems they encounter are both predictable and preventable. States have primary responsibility for regulating well integrity at gas storage facilities, but most states, including California, have weak standards and lax enforcement. The federal government, under the jurisdiction of the Department of Transportation, has some



responsibility for the safe and environmentally sound operation of gas storage facilities as well, but is only now beginning to act. "The regulation of these facilities is essentially an afterthought until catastrophe strikes," says O'Connor.

State and federal agencies must improve oversight of gas storage facilities and ensure proper design and construction of wells. If a well is built badly, it's not a question of whether, but *when* it will leak. And when things go wrong, communities must be compensated and climate damages fully mitigated. To make the climate whole, SoCalGas should finance at least an equal amount of methane reductions from oil and gas operations.

A teachable moment

To truly tackle the problem of oil and gas methane pollution, we need to reduce emissions across the entire oil and gas system by at least 45%. The good news is that methane leaks can be fixed at reasonable cost. Recent studies by the consulting firm ICF International show that existing technology can cut leaks up to 45% at an average cost of a penny per thousand cubic feet of gas produced—about one-half of 1% of today's market price.

"It's not rocket science," says Mark Brownstein, director of EDF's oil and gas program. "It's simple plumbing."

To fix leaks quickly, companies need to locate them. To make continuous monitoring in the field cost-effective and commonplace, EDF challenged inventors around the world to design inexpensive real-time methane detectors—like carbon monoxide alarms. Four technologies are being tested; the next step will be bringing the best to market.

AP IMAGES

In a historic pact, Canadian Prime Minister Trudeau and President Obama pledged to reduce methane emissions from existing oil and gas facilties, which account for the lion's share of the problem.

Yet many in the industry are fighting regulations. Industry trade groups call for a voluntary approach, which can never be a substitute for strong rules.

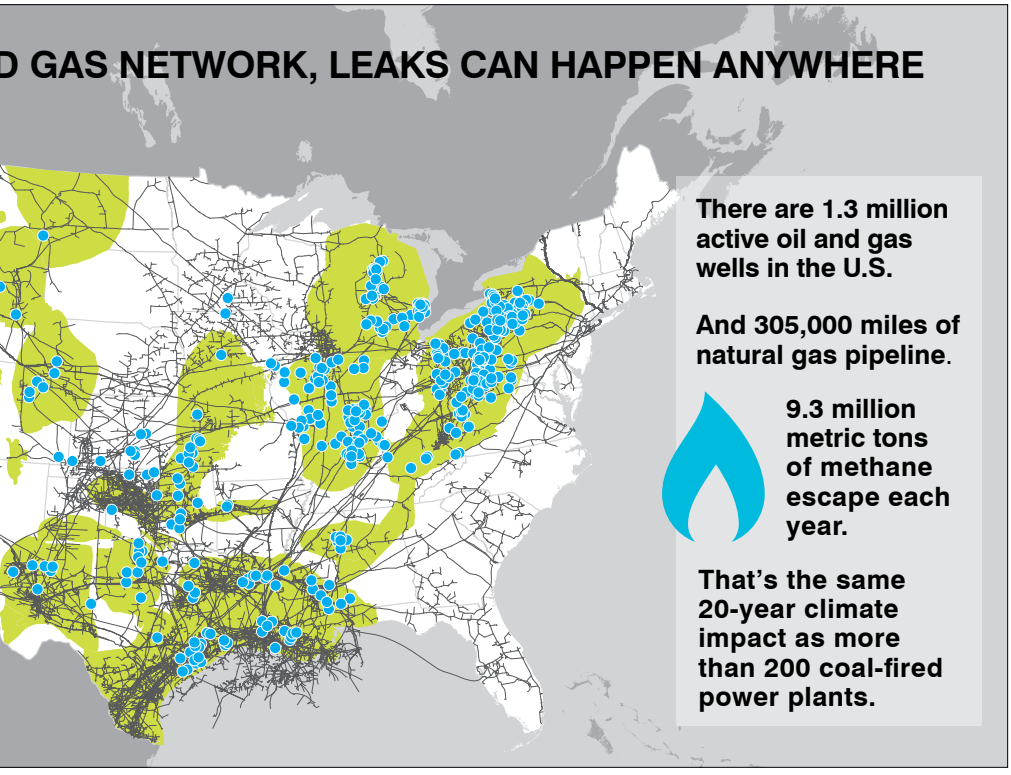
"Industry's track record with voluntary efforts is not impressive," says Brownstein. Less than one in a hundred oil and gas companies participate in EPA's voluntary program.

Working with big energy producers, EDF has shown that regulatory safeguards can deliver climate benefits at low cost. In Colorado, for example, we helped develop new standards that require companies to detect and fix leaks. This will prevent the release of more than 100,000 tons of methane annually. Operating under the new rules, one producer, Noble Energy, spent about $3 million on compliance in 2015, out of total capital expenditures that year of about $1 billion. Fixing those leaks also cut 90,000 tons of smog-forming and toxic pollutants every year, as much as are emitted by all of Colorado's cars and trucks. Ohio and Wyoming also took steps to rein in methane pollution, and in January, with Colorado's rules as a model, Pennsylvania governor Tom Wolf announced plans for strong rules.

But a national problem needs a national solution. Last year, the Obama administration pledged to reduce methane emissions 40% to 45% from 2012 levels by 2025, and EPA proposed rules for new or modified facilities.

And recently, in a landmark pact with Canada, President Obama pledged to close a huge loophole—by controlling the methane pollution from the millions of existing wells and infrastructure in the United States. This will mean addressing the biggest part of the methane problem from oil and gas, since new facilities will represent only a small fraction of emissions in the years ahead. For EDF, it was a hard-fought victory. We've long pressed the goverment to require systematic leak-detection and repair for existing facilities. But more needs to be done. We need strong rules to regulate natural gas storage facilities like Aliso Canyon.

Says Brownstein: "Cutting emissions of methane is the most effective action we can take today to slow warming over the next several decades."



CAROL ZUBER-MALLISON

Overdue repairs for the chemical safety net

SHUTTERSTOCK

Congress is near agreement on a new law that, for the first time, will require the testing of chemicals before they go on the market.

A RECENT ARTICLE IN *THE NEW YORK TIMES MAGAZINE* EXPOSED A "BRAzen, decades-long" secret held by DuPont. For years, according to the article, the chemical company withheld evidence of health problems caused by one of its signature chemicals, PFOA.

Today, PFOA—used to manufacture DuPont's popular Teflon line—is everywhere. "If you are a sentient being reading this article in 2016," author Nathaniel Rich wrote in the *Times*, "you already have PFOA in your blood."

This disturbing story shows the importance of EDF's efforts to reform the nation's weak chemical safety law, the 40-year-old Toxic Substances Control Act (TSCA). In 1976, when TSCA was passed, PFOA was one of about 60,000 chemicals already on the market. These chemicals were "grandfathered"—presumed safe without any review. In the years since, the chemical industry has introduced more than 20,000 new chemicals. Yet because of TSCA, EPA has been able to require testing of only about 3% of chemicals available for use today. Just nine have been banned.

CORBIS

A home should not be a haven for unsafe chemicals.

"After 40 years, we still have thousands of untested and, in some cases, unsafe chemicals that surround us, in the furniture we're sitting on, the carpet beneath our feet, the paint on the walls around us, and the cleaning products under our sinks," says EDF biochemist Dr. Richard Denison. "And the great majority of these chemicals have never been reviewed to determine if they are safe for human health and the environment. This law hasn't worked since day one."

A long road to reform

For decades, EDF has been drawing the public's attention to the issue of unregulated chemicals. In 1986 we helped write California's Proposition 65, which requires manufacturers to label products sold in the state that contain known carcinogens or reproductive hazards. In 1997 we published *Toxic Ignorance*, a seminal report that detailed the shortcomings of TSCA and advocated its reform.

EDF's experts advised Congress on the first TSCA reform bill introduced in 2005. Working with the late Senator Frank Lautenberg (D-NJ), we continued to bring forward new bills each session. These failed for lack of bipartisan support. Unfazed, EDF continued to work with EPA, states, and health, labor and business groups to push for chemical safety.

Gradually, the reform movement gained traction. In 2013, Senator Lautenberg reached across the aisle to work with Senator David Vitter (R-LA), a staunch ally of the chemical industry, leading to the first bipartisan TSCA reform bill. Similar efforts were launched in the House, and, in 2015, both bodies finally passed TSCA reform bills.

At a Capitol press conference, Tom Udall (D-NM), the lead sponsor of the Senate bill, said, "I attribute a lot of our progress to Environmental Defense Fund. This is an organization that likes results."

EDF's bipartisan stance means that we'll be actively involved as House and Senate staff work to reconcile the bills. As EDF vice president for health Dr. Sarah Vogel puts it: "We'll be there every step of the way to ensure the process yields a strong final bill that protects our health."

EDF ONLINE

SHUTTERSTOCK

Protecting the monarch's special places

Eric Holst, associate vice president of EDF's working lands program, develops strategies for environmental management of working forests, farms and ranches.

Growing up in California, I found myself migrating each summer to the beaches of Santa Cruz to escape the sweltering inland heat. Now, as an adult, I've learned that the monarch butterfly is drawn to the same place, but only during winter.

The western population of monarchs winters along the California coast, protected by its temperate climate and coastal forests. Last December, I paid a visit to my old summer stomping grounds to see this iconic North American butterfly. I wanted to catch a glimpse of the monarchs before they dispersed across the West.

At Natural Bridges State Park, I discovered a half-dozen orange clusters of monarchs clinging to branches in a protected eucalyptus grove. Soon, they would head inland to mate and search for milkweed on which the females would lay eggs. Their larvae feed only on the milkweed sap, which is toxic to most organisms. Monarchs have a unique capacity to sequester the toxins, which makes the butterflies unpalatable to many predators. Unfortunately, milkweed is in decline across the United States, largely due to habitat loss and increased use of pesticides. This accounts for a significant portion of the monarchs' population decline. Climate change poses an additional threat.

Efforts are under way by organizations like the Xerces Society and the U.S. Fish and Wildlife Service to plant milkweed throughout the range. EDF recently joined the effort by applying our own market-based approach—through habitat exchanges—to bring more of these conservation efforts to private working lands owned by farmers, ranchers and forestland owners, who manage much of the habitat appropriate for milkweed.

›››READ MORE ››› edf.org/butterflies

Moms know best

Advice from a mom on how Californians can help the environment and their pocketbooks by buying cleaner electricity at lower cost. edf.org/moms

Don't blame El Niño

2015 was by far the hottest year since record-keeping began. And we can't blame it on natural climate cycles such as El Niño. edf.org/nino

THE WILSON LEGACY

Creating habitat at one-eighth the cost

By Frank Convery, Chief Economist

Dr. Gene Murph is one of my heroes. He is playing a key role in protecting the golden-cheeked warbler, a species whose existence in the United States is threatened because its sole breeding habitat is shrinking. Dr. Murph operates a 1,300-acre ranch in prime warbler habitat near Fort Hood, TX.

This is how he got involved: The Army at Fort Hood needed to expand training into habitat favored by the warbler. To do so, the Department of Defense needed to secure high-quality habitat elsewhere. How to ensure that this habitat would leave the bird better off at minimal cost to taxpayers?

EDF worked to create a habitat exchange, in which the Army would pay nearby ranchers to improve habitat. We invited landowners to bid what they wanted to get paid to provide habitat on their land.

Dr. Murph is a hero because, when others hesitated, he made the imaginative leap and signed up, committing to habitat-enhancing practices on his land. His leadership encouraged others. Quickly, a rare bird became a valuable asset to nurture, like a crop.

The result? The known population of warblers nearly doubled from 5,000 to 9,000 birds. The cost? One-eighth of what easements would have cost. The market delivered high-quality protection at low cost. And the experience provided solid evidence that habitat exchanges can benefit a variety of imperiled species, including monarch butterflies—and help landowners too.

›››READ MORE ››› edf.org/protectwildlife

This regular column honors the memory of Robert W. Wilson, a longtime EDF supporter and champion of harnessing market forces to drive environmental progress. See edf.org/wilson.

Harnessing high tech for the planet

By Charlie Miller

Citizen scientists are helping track endangered humpback whales.

A technological revolution is transforming environmentalism, offering new solutions to problems ranging from global warming to species preservation.

Until recently, environmentalists and regulators often operated in the dark. Precisely where (and when) were Amazon rainforests being cut down? Were too many fish being pulled from a particular fishery? Were the nation's farmers applying too much chemical fertilizer to their fields? In the past, answers came mostly from partial data and guesswork. But today, new tools for defining and fixing environmental problems are being introduced everywhere, offering benefits that were almost unimaginable only a few years ago.

For example, across the United States, wind power is surging. That's a good thing. But wind energy has a problem: the turbine blades kill more than 100,000 birds every year in collisions.

The solution? Radar systems originally developed for the space shuttle and Air Force jets are now being used to detect approaching birds, determine their altitude, analyze weather conditions and decide whether they're in danger of flying into the blades. If they are, the turbines can be programmed to shut down, restarting once the birds are safely on their way.

Or take Kenya, where poachers are killing hundreds of elephants every year for their ivory. There, conservationists have outfitted elephants with GPS collars that transmit data by satellite so rangers and law enforcement can track their movements on smartphones. When elephants stray into areas frequented by poachers, the rangers deploy drones to scare the elephants into safer territory.

"Drones are basically the future of conservation," says James Hardy, a manager at Mara North Conservancy, a private wilderness area. "One drone can do what 50 rangers can do."

Even deep in the Amazon rainforest, satellites are beaming information in real time to indigenous people with laptops or smartphones, allowing them to summon help when they spot illegal logging.

Making the "big picture" real

Satellites, inexpensive sensors and wireless technologies have become our new eyes and ears.

"Humans react to what we can sense," says EDF chief scientist Steven Hamburg.

"We're not so good at responding to threats we can't see, hear or touch. So it's exciting that much of what was once invisible is now becoming visible."

New technology and improved data analysis can also help stop overfishing. EDF has championed an approach called "catch shares" in the U.S., which give fishermen shares of a scientifically determined total catch. It's been remarkably successful, but fishery managers need reliable data to make good decisions.

"Good data are critical to managing a fishery," says EDF senior vice president Amanda Leland. "Without data, scientists can't set smart catch limits, or see if their management decisions are working."

In some industrialized fisheries,

FLICKR

Mobile apps can help asthma sufferers, and everyone else, decide on daily activity.

observers have been placed on boats to monitor the catch. But they are costly—around $500 a day—take up valuable space on deck and can pose a safety risk. Now, with the help of EDF and commercial fishermen, fishery managers are experimenting with electronic data collection and monitoring, a low-cost alternative. Video cameras on board the boats record fishing activity, while GPS data pinpoint where boats have been. Sensors on winches record when nets are lowered and raised. All these data are stored on a tamper-proof hard drive onboard for analysts on shore to check later.

Big data

One barrier to communicating the dangers of climate change has been scientists' inability to point to human fingerprints on a specific weather event, like the California drought or Midwest flooding. Now that's changing, thanks to more powerful computers, sophisticated algorithms and large datasets known as "big data." Climate scientists can now provide rapid analysis of global warming's role in extreme weather events such as heat waves. In the future, the science of "extreme event attribution" will become even more precise.

Advanced technology is also helping to take on agricultural pollution. About 50% of the fertilizer applied to farmland in the United States is not absorbed by crops. It often runs off the fields into streams and rivers, causing pollution, algae blooms and "dead zones."

Today, however, a farmer can analyze his soil and crops and determine more precisely how much fertilizer to apply. Such tests, along with GPS-enabled tractors and aerial or satellite imagery, are the tools of "precision agriculture," which is revolutionizing farming. Some predict that 80% of drones will be used on farms in coming years. By identifying problem areas, such as wet areas or low-producing zones, technology can give farmers the ability to fertilize and water their fields much more efficiently, minimizing costs and pollution.

IVAN KASHINSKY

With smart phones and computers, the Surui Paiter tribe in Brazil documents illegal logging on its land.

What's next

The speed with which technology has advanced is remarkable. Thirty years ago, acid rain was harming lakes and forests in the eastern United States, killing trees and aquatic life. EDF scientists helped prove that smokestack emissions traveled hundreds of miles to cause acid rain—an analysis that required all the power of EDF's entire computer system to carry out. "Today," one of the scientists says, "I could do it all on my phone."

Meanwhile, sensors keep getting smaller, processors faster and environmental technologies more exotic. The National Oceanic and Atmospheric Administration (NOAA) has been working with a private company on sailing robots that could roam the oceans, tracking endangered species, collecting information on water quality and temperature, and transmitting the data by satellite.

Technology will also amplify the power of "citizen scientists" and environmentalists to bring about real change. EDF health scientists are experimenting with wristbands that detect toxic chemicals in our environment. When EDF President Fred Krupp wore one last year, the wristband detected 14 potentially harmful chemicals, including a pesticide, plasticizers and a flame retardant. As the wristbands become less expensive, they may become more widely used in scientific research to better understand the toxic chemicals in our environment.

One company is marketing inhalers equipped with GPS sensors that transmit location data every time the inhaler is used. Put together, the data could reveal information and patterns that would allow asthma sufferers to avoid hotspots.

Citizen science is also helping save some of the world's most endangered creatures, including North Atlantic humpback whales. Whaling drastically reduced their numbers in the 19th century, and fewer than 12,000 are left. Today, scientists need to track the whales' migrations while monitoring their recovery.

Citizen scientists are helping. They photograph the whales' flukes, or tails, and submit the pictures and location data to a catalogue. Scientists can identify each individual humpback by scars and the black and white patterns on the flukes. When a new photo is submitted, scientists can compare it to pictures in the catalogue to learn more about the whale's movements.

"Nothing beats an engaged citizen observing the environment," says Hamburg.

CORBIS

EDF helped introduce technology to reduce fertilizer use by 25% in many Midwest farms.

Science says climate change is a fact.

GETTY

Political art: Olafur Eliasson transported ice from a fjord near Nuuk, Greenland, to Paris for the climate talks, putting the issue in front of the delegates' eyes.

GAVIN SCHMIDT, HEAD OF NASA'S Goddard Institute for Space Studies, had a problem. He'd give scientific presentations on climate change replete with frightening statistics, and people weren't getting it. Then, on a hunch, he put up photos of melting sea ice. "I heard audible gasps," he says.

Now, he and other scientists turn to art and music to convey data. "Art goes to a different part of the brain," says Schmidt, who harbors dreams of a climate symphony. "Adding emotion to a message makes that message more memorable." It also helps build a public movement.

"Most people don't pay attention to scientists," says playwright and climate activist Jeremy Pickard. "These are the people we try to speak to."

Art exposes people to issues they might otherwise ignore. Take Eve Mosher's HighWaterLine art project, which uses bold visuals to demarcate streets in the United States and UK that will be underwater with accelerated warming. Climate change is no longer just in remote locations like the Arctic. It hits people at home.

It's taken a long time for climate to enter the cultural mainstream, but today the floodgates are open and interesting work is cropping up all over.

The best work compels us to reflect on how human beings should act in the 21st century. It speaks for the voiceless—the poor, the embattled ecosystems and wildlife. Artists show people how to get involved.

Can climate art move us to act in time?

MUSIC

Scientists often speak of the rhythms of climate change. Musicians have picked up on that.

A Song of Our Warming Planet

Daniel Crawford based this composition on surface temperature data. The piece goes from pleasant bass notes to high-pitched heart-pumping squeals before stopping abruptly in the present. bit.ly/1mSKUvB

HOME–Heal Our Mother Earth

New voices—in this case hip-hop stars—speak out on climate change and vulnerable populations. bit.ly/1QrnENG

LITERATURE

An entire genre, "Cli-Fi," tackles climate disaster. Many works are set not in the future but in the present day. That's because climate change is already happening, and writers don't need to use their imagination to see what's already there. Other writers look into the future or take a more personal view.

Flight Behavior

A colony of migrating monarch

Merce Cunningham Dance Company's *Beach Birds*, a beautiful meditation on the vulnerability of nature. bit.ly/1T7S8dj

Alexis Rockman's painting *Mount Rushmore*: a familiar place transformed by climate change. bit.ly/1VakK5b

Daniel Crawford communicates warming by assigning low notes to cool years and high-pitched ones to warm ones.

Art takes us there.

butterflies arrives in Feathertown, TN, having flown off course due to climate change. The book by Barbara Kingsolver, an EDF National Council member, examines how climate change transforms a community.

Working the Map—Islanders and a Changing Environment
This collaborative volume looks at how climate change affects the lives of people who live in Britain's most northerly isles. In drawings and essays, farmers and fishermen tell of the changes they observe on land and sea, and their concerns for the future.

Eco Poetry
This new genre of poetry features a diverse field of practitioners addressing the Anthropocene; Kathy Jetnil-Kijiner, a Marshall Islander, addressed a video poem to the UN Climate Summit, electrifying delegates. bit.ly/1ogtymQ

TV AND FILM

Climate change has become a staple of Hollywood disaster films—call it the banalization of the Apocalypse. But high-quality, science-based documentaries are also reaching broad audiences.

Chasing Ice
Chasing Ice is a stunning documentary that used stationary cameras to produce a time-lapse movie that lets you watch Arctic glaciers disappear before your eyes. bit.ly/1TnPIrd

The Years of Living Dangerously
This Emmy-winning series on climate solutions is available on iTunes and Amazon. In one episode, producers follow EDF Climate Corps fellows on their quest to solve energy problems at corporations. bit.ly/1j3xKHS

THEATER AND DANCE

Theater and dance are being used to introduce people of all ages to the urgency of climate change.

Superhero Clubhouse
Jeremy Pickard leads a theatre company dedicated entirely to climate change. Some of his most interesting work is with children, who hear about the issue from a scientist, then write plays inspired by the talk. EDF economist Jonathan Camuzeaux helps ensure the facts are correct. bit.ly/1LxooE2

On the Nature of Things
Choreographer Karole Armitage stages a dance under the great blue whale at New York's American Museum of Natural History. bit.ly/1DRmN5c

VISUAL ARTS AND MULTIMEDIA

Climate-centered painting, photography and conceptual art is now widespread. The best work is often subtle. Meanwhile, art on the streets targets non-environmentalists—and delivers global warming's message with a jolt.

What Is Missing?
The computer screen in Maya Lin's latest project opens to colorful icons circling like birds or insects that settle on a map of the world. Click on them and you're transported to stories of creatures and places that may well disappear if we do not protect them. bit.ly/19C9yJu

Illuminating Our Common Home
Beautiful images of our shared natural world projected onto the graceful façade of St. Peter's Basilica. bit.ly/1TTnKk7

One Beat One Tree
Naziha Mestaoui's work projects virtual forests onto city spaces. Viewers connect via their phone to see digital trees grow in rhythm with their heartbeat. With each virtual tree that grows, a physical one is planted around the world. The project has already planted 13,000 trees. huff.to/21CZo5R

Submerged Motherlands
This exhibit by the street artist Swoon at the Brooklyn Museum used old sea rafts to address the loss of people's homelands due to rising sea levels. bit.ly/OU6iAh

High Arctic
This installation uses text, sound and sculpture, allowing people to interact with 3,000 Arctic glaciers that will melt entirely by the year 2100 unless we turn back climate change. bit.ly/1T7STTA

PHOTOS L TO R: MICHAEL O'NEIL AND COURTESY OF THE MERCE CUNNINGHAM TRUST; IMAGE COURTESY OF ALEXIS ROCKMAN (MOUNT RUSHMORE, 2005, OIL ON WOOD 40 X 32 INCHES); UNIVERSITY OF MINNESOTA/ENSIA; PHOTO: ADAM LEWINTER/EXTREME ICE SURVEY; GIDEON MENDEL; THEMESSENGERDOC.COM

James Balog, on location in Greenland filming *Chasing Ice*.

Drowning Worlds. Since 2007, Gideon Mendel has travelled the globe, photographing people whose lives have been devastated by floods.

The Messenger is a documentary that traces the worldwide depletion of songbirds due to climate change and the effect on humans. TheMessengerDoc.com

Eat these fish!

ARE YOU TIRED OF BEING TOLD NOT TO EAT YOUR favorite seafood because it's overfished or unsustainable? If so, you're not alone. Finally there's some good news.

Over the last 15 years, EDF has worked with fishermen, scientists and government officials to transform the way U.S. fisheries are managed. Smart management has helped fishermen stay within catch limits, avoid overfished species and stay out of sensitive areas. As a result, overfishing has dropped to an all-time low, and more than 100 species are on the path to recovery.

EDF has partnered with the National Restaurant Association, Chefs Collaborative and others on a campaign to promote underappreciated American fish that are not only sustainably caught, but also affordable and tasty. We've identified 12 species whose populations are healthy and, in some cases, are being caught well below sustainable levels.

For recipes and cooking tips from some of the nation's top chefs, go to EatTheseFish.com. Here's a sampler.

123RF

Master chefs provide cooking tips for sustainably caught fish.

Acadian redfish

Frequently shunned as "trash fish," redfish was common fare in military mess halls during the 1950s; the population plummeted during the 1990s, but has since recovered.

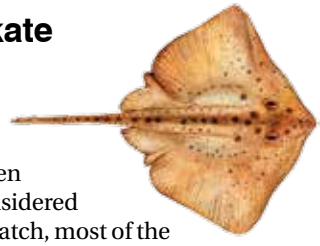
Kitchen tips: This versatile fish is lean, flaky and moist, perfect in fish tacos.

Chilipepper rockfish

One of at least 60 species of rockfish on the West Coast, this fish is sometimes called Pacific red snapper, though it is not technically a snapper.

Kitchen tips: Medium-firm fish, low in oil content, suitable for many types of preparation.

Skate



Often considered bycatch, most of the longnose skate caught off the West Coast is exported, but there is growing interest in creating a market here, too.

Kitchen tips: Skate wings have a mild flavor and tender texture, and are sometimes compared to scallops.

Red grouper

Long overfished, slow-growing red grouper are recovering, thanks to better catch management. Known as underwater architects, they dig large holes in the sea's sandy bottom, providing places for coral, sponges and other marine life to congregate.

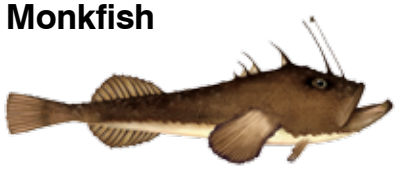
Kitchen tips: With light, flaky white meat, red grouper is a bit milder than other Gulf fish, which makes it good for just about anything from entrées to sandwiches.

Silver hake

Also known as Atlantic whiting, this fish has been historically ignored in favor of cod, a close relative. It's a great alternative because, unlike New England cod, its population is stable and prices are moderate.

Kitchen tips: This delicate, mildly flavored fish is softer and moister than cod.

Monkfish



Monkfish will never win a beauty contest, but in the 1980s, the fish became a favorite of Julia Child's. Today the fish appears on many restaurant menus around the country, though it is rarely served whole.

Kitchen tips: Called "poor man's lobster," monkfish is firm and mildly flavored.

TASTY TWELVE BY REGION

WEST COAST	EAST COAST	GULF OF MEXICO
chilipepper rockfish, lingcod, Gulf of Alaska Pacific ocean perch, Alaska snow crab, longnose skate, yellowtail rockfish	monkfish, Acadian redfish, Atlantic pollock, silver hake	red snapper, red grouper

FISH ILLUSTRATIONS: CHILIPEPPER ROCKFISH: MONTEREY BAY AQUARIUM; SKATE: BRENDA GUILD GILLESPIE/ CHARTINGNATURE.COM; ALL OTHERS: FISHWATCH.GOV

Your stories

Members pitch in to save the monarch

GETTY

The milkweed plants that monarchs lay their eggs on are vanishing across the United States—and the butterflies are paying the price. Solutions *asked EDF members to tell us how they are helping monarchs on their migration. Here are a few of the hundreds of impassioned responses we received.*

One female monarch changed my life. I was in the backyard with my dog watching a monarch fly around the milkweed I had planted when she laid an egg! I was hooked. Since that day I have raised and released between 100 and 250 monarchs every year. I am now involved with several butterfly groups and urge everyone to plant milkweed and garden organically.
—Judith J., MI

Every fall, I gather milkweed seeds and spread them to wild acres and neighboring properties, looking for fresh dug dirt and open areas. My granddaughter helps gather the seeds and tosses them to the wind.
—Vikki H., PA

Many years ago, I planted a milkweed root. Three years later my plant was covered with monarch caterpillars. I am now an official Way Station (#04296) for Kansas City University Monarch Watch. I have 62 milkweed plants plus other plants that provide food for the butterflies. **—Ronald K., CA**

I am a guitarist for a hardcore rock band and absolutely adore butterflies. One year, I found a peculiar plant near a creek. The butterflies loved it. The next year I propagated it. I found out later the white bulby flowers were milkweed. Now my small furrow in the creek provides hundreds of flowers for these delicate creatures.
—Kris P., NV

In rural southern Minnesota, monarchs are hardly seen any more, replaced by films of pesticide on our cars and in our throats. I miss the days they were plentiful and my children and I would watch them land on our flowers and flutter by on a sunny day.
—Linda T., MN

One summer in the early 1980s, a friend and I took a hike in the woods and came upon trees that seemed to be covered with orange leaves. As we crossed a clearing to get a closer view, the "leaves" exploded into the air with thousands of monarchs!
—David S., OR

I was impressed that beautiful milkweed seeds were used in life jackets in WW2 for buoyancy. Later, the herbicide sprays came on the market, and the plants could not survive this. I feel much can be done.
—Sue S., IA

This loss can't be overstated. It is a very sad commentary on mankind's lack of respect for its home and the home of something as noble as the monarch.
—Emily M., NY

Growing up in the Hudson Valley of New York, I saw thousands of monarchs in a field across the street. The orange and black sight was awe-inspiring. To think how many have been killed from herbicides is heartbreaking. **—Anonymous**

Letters

Hit them where it hurts

My husband and I just read about First Energy and its battle in the state of Ohio in the latest *Solutions* (Winter 2016). After learning that the utility is trying to avoid environmental laws, we sold our First Energy stock today. Thank you for your efforts on behalf of the environment.
— Nancy and Howard B., ME

Getting industry to listen

RE "New study finds oil and gas methane emissions almost twice what official estimates suggest" (edf.org/TXmethane). In Texas, oil and gas rules. Here in the Barnett Shale we have had zero success in getting the state to accept the facts about gas drilling and production pollution. If the industry would spend as much money on alternative power source research as they do on corrupt government, we'd have the problem of global warming drastically reduced in short order. **—Jerry L., TX**

Get out the vote

I was especially thrilled to read about your Voter Mobilization Project (Winter 2016 *Solutions*). Getting younger people involved and to show up at the ballot box is crucial to the future of our country. How about featuring a little sidebar with this information: Are you registered to vote? Visit usa.gov/register-to-vote or registertovote.org.
—Nadine S., Oceanside, CA

AP IMAGES

Young people care about the climate, but they don't always vote.

We want to hear from you!
Email us at editor@edf.org.

"The greatest wonder is that we can see these trees and not wonder more."

— Ralph Waldo Emerson

PHOTO: CORBIS