EDF ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

Solutions

Vol. 49, No. 3/ Summer 2018

Meet the Fourth Wave

A new era of environmental innovation gives us powerful new ways to protect nature

Page 8

EDF's MethaneSAT, expected to launch within three years, will measure pollution from space.

Partners in preservation

Ending tropical forest loss would reduce global greenhouse gas emissions by about 15%. In Brazil, where two football fields of rainforest are destroyed every minute, beef ranching is the main source of deforestation. EDF is sending a powerful signal to Brazil's producers and governments that their biggest buyers, including McDonald's and Unilever, prefer sustainably grown beef and soy. With our corporate partners and local communities, we are working to eliminate illegal deforestation in the state of Mato Grosso by 2020, even as we expand agricultural production.

The Fourth Wave of environmentalism

Recently, at a TED Talk in Vancouver, British Columbia, I announced a plan for EDF to develop and launch, within three years, a new satellite—MethaneSAT—to identify and measure methane emissions from human-made sources worldwide, starting with the oil and gas industry *(see p. 10)*.

Methane is a powerful greenhouse gas; emissions from human activities are responsible for a quarter of the warming our planet is experiencing. Cutting methane emissions from the global oil and gas industry is the single fastest thing we can do to help put the brakes on climate change right now. With data from MethaneSAT, both countries and companies will be able to spot problem areas, identify savings opportunities and measure their progress over time.

MethaneSat is a prime example of Fourth Wave environmentalism, a megatrend fueled by technological innovation that is transforming how we solve environmental problems by putting powerful new tools into the hands of people around the world.

The Fourth Wave is the latest advance in a century of environmental evolution. First there was the land conservation movement led by President Teddy Roosevelt; second came the anti-pollution laws of the 1960s and 1970s; and finally, there was the rise of powerful market-based solutions and corporate partnerships in the 1990s, widely known as the Third Wave.

EDF is applying Fourth Wave innovation in a variety of ways—from using passive sonar to track sardine fish stocks in the Philippines, to developing precision agricultural tools to reduce fertilizer waste in the Midwest *(see p. 12)*. And we aren't alone. EDF is just one of many groups doing Fourth Wave work.

Of course, even as we launch into space, EDF continues to fight back against the anti-environmental policies of the current administration here on Earth. For example, our legal team is battling EPA's plan to roll back the clean car standards established by the Obama administration *(see p. 7)*, and we continue to expose EPA Administrator Scott Pruitt's cosy ties with polluters.

In any era, those doing the hard work of solving environmental problems take advantage of the best available tools. Technology can obviously be used for good or ill. But when satellites, sensors and data analytics are used to advance transparency, responsibility and low-cost solutions, the result will be smart policies that help people and nature prosper.

Fred Krupp
EDF President

PHOTO: GETTY

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. Donate online at edf.org/newsletter or by mail: EDF, attn.: Member Services, 1875 Connecticut Ave NW, Ste. 600, Washington DC 20009.

On the cover: Environmental progress doesn't just happen. It has been propelled by successive waves of ingenuity, each wave unleashing a powerful new set of tools. In this issue, we explore how EDF is tapping advances in technology to scale an array of environmental solutions. Foremost among them is our plan to launch a satellite to track methane emissions and help curb climate change.

Solutions

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FIELD NOTES

PHIL COLLA

A vast ocean wilderness protected

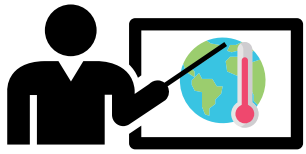
A treasure trove of deep sea habitats are now protected thanks to a historic accord between EDF and partners, fishermen and policy makers. The plan, approved by the Pacific Fishery Management Council in April, will permanently protect 140,000 square miles of ocean, mostly off the California coast. With an area larger than the state of New Mexico, it is home to coral reefs, sponges and pinnacles. Parts of these delicate ecosystems were at risk from the nets of bottom trawlers searching for rockfish. Simultaneously, 2,000 square miles of previously closed grounds, where sandy seabeds make trawling less invasive, were re-opened for fishing.

"This is now one of the best-managed fisheries in the world," said Shems Jud, the west coast director of EDF's Oceans program.

The plan came to fruition after EDF and other NGOs convened more than 30 meetings with fishermen along the coast—a process that built understanding between stakeholders more used to legal wrangling: conservation groups, lawmakers and those who earn a living from the sea.

"This was an amazing team effort," said Ralph Brown, a fisherman from Brookings, OR. "Both fishermen and environmentalists focused on the goal of opening up closed fishing grounds and carving out the areas that really need protection."

Keeping score



78%

of Americans believe schools should teach children about global warming.

SOURCE: YALE PROGRAM ON CLIMATE CHANGE COMMUNICATION.

GETTY

Silt repairs a storied Delta

Louisiana is embarking on massive sediment diversions to help solve its land-loss crisis—the worst in the nation. The diversions will send sediment-rich Mississippi water into wetlands, reinforcing them against sea level rise. EDF convened a group of leading experts to advise the state on the diversions, which have never been tried before. Louisiana is evaluating our group's recommendations, such as operating diversions in wintertime to minimize harm to fish and wildlife. Other regions wrestling with the consequences of sea level rise are monitoring the projects.

Victory on a killer chemical

American families scored a bittersweet victory when EPA decided not to block a rule to ban a toxic chemical that has claimed dozens of lives.

Last year, EPA's Scott Pruitt bowed to industry pressure and indefinitely delayed banning methylene chloride in paint strippers. But in May he made a dramatic about-face after EDF arranged for families of victims to meet Pruitt and key members of Congress.

Home Depot, Lowe's and Sherman Williams also pledged to remove products containing the chemical from their shelves.

"The credit belongs to the brave families who are fighting to ban this deadly chemical," said Dr. Sarah Vogel, EDF's vice president of Health.

JULIE DERMANSKY

Wendy Hartley *(pictured)*, whose son Kevin, 21, died last year while stripping paint from a bathtub, said: "I want to use Kevin's story to try to save more lives." EPA announced it will now finalize the rule as EDF requested. "We're watching closely to make sure the administration delivers on its promise to ban this chemical," said Dr. Vogel.

Raleigh office shows the way forward

EDF's North Carolina office is celebrating its 30th anniversary. Over the years we have compiled a series of environmental victories in this Southern purple state that serve as a guide for defending the environment in states across the country.

The 2010 elections swept into power a cadre of state lawmakers with an anti-regulatory agenda. North Carolina's legislature began shredding environmental laws and weakening public health and environmental agencies. EDF's Raleigh team, working closely with state and regional allies, battled back.

We successfully defended the state's clean energy policies, which have made North Carolina a national leader on solar energy. And we're fighting to restore funding for clean water and conservation programs.

> **"The EPA administrator's legal arguments are fatally flawed and reflect an egregious misreading of the text, structure, history and purpose of the Clean Air Act."**
>
> —Excerpt from EDF's comments defending the Clean Power Plan, now under siege by the Trump administration

Fighting a dirty bailout for coal

President Trump is dead set on propping up the coal industry. His latest scheme? To keep coal plants running by linking them to national security, under an obscure Korean War–era legal provision. The plan comes after pleas from Ohio-based FirstEnergy to bail out 80 uneconomic coal and nuclear plants, at a cost of $8 billion—to be paid for by utility customers. In June, Trump directed Energy Secretary Rick Perry to proceed, despite the absence of any threat to national security. EDF is fighting to stop the maneuver.

Executives see increasing alignment between business and environmental goals

SOURCE: BUSINESS AND THE FOURTH WAVE OF ENVIRONMENTALISM, EDF REPORT, 2018

ISTOCK

This beautiful manatee is one of 300 species protected under a section of the Endangered Species Act now itself under threat. The White House is reviewing the "blanket 4(d) rule," which provides protection to species in decline but not yet listed as endangered. EDF is monitoring the review closely.

"This flies in the face of years-long collaborative conservation efforts," says EDF associate vice president Eric Holst.

NOTEWORTHY

EDF and Maryland prevailed in a legal battle with EPA after a federal judge ordered the agency to stop delaying a rule requiring neighboring states to limit power plant emissions. 70% of Maryland's smog comes from upwind states.

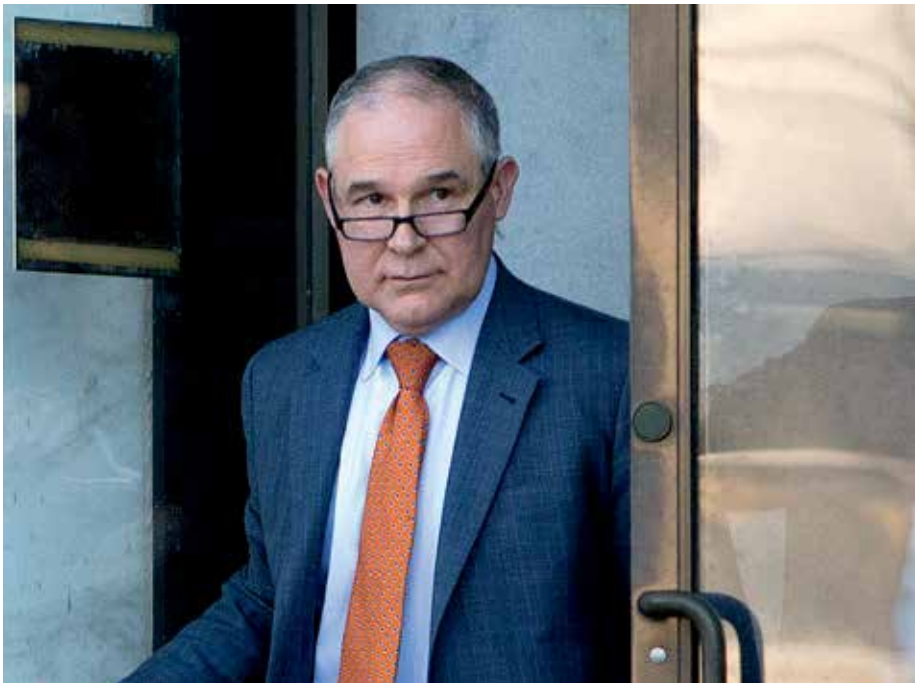
With EDF support, New Jersey passed a bill requiring the state to source 50% of its electricity from renewables by 2030. Governor Phil Murphy (D) has pledged to increase that to 100% by 2050.

EDF has 22 EDF Climate Corps fellows in China this summer—a record year and more evidence of China's growing climate agenda. In total, this summer sees 115 fellows helping 97 companies and institutions move toward cleaner, greener operations.

A 1.5 million acre oil and gas project in eastern Wyoming threatens core sage grouse habitat, even as the Bureau of Land Management is weakening key protections for the imperilled bird. EDF is working to keep the protections in place.

Lifting the curtain on Scott Pruitt's misdeeds

EDF finds weak spots in the administration's environmental onslaught



TOM BRENNER/REDUX PICTURES

EPA's Scott Pruitt

THIS SPRING, SCOTT PRUITT outdid himself. Without notice or public input, the head of the Environmental Protection Agency (EPA) created a new loophole in the Clean Air Act that allows many industrial polluters to turn off pollution control equipment and pump additional benzene, lead, chromium and other air toxics into neighborhoods around the country.

It was one of his most brazen moves. Fortunately EDF and our allies were prepared. We moved swiftly to file suit in federal appeals court, asking the court to strike down the new policy as a violation of the Clean Air Act.

Like so many of Pruitt's initiatives, this gift to polluters was created in secrecy, with no opportunity for public comment. We learned about the new policy only after seeing an unheralded memo to EPA's regional air directors.

To expose Pruitt's evasions and ensure transparency at federal agencies, EDF is using another tool: the Freedom of Information Act (FOIA). EDF has filed 50 FOIA requests since the advent of the Trump administration.

EDF's Erin Murphy digs up the truth.

Our first FOIA request was filed on Inauguration Day. Anticipating that Pruitt would hide information about climate change, we asked for files that might reveal whether EPA had made changes to the agency's website.

Last August, we got our answer: Under Pruitt EPA had removed or modified 1,900 pages and documents on the site. The URL that previously led visitors to the Clean Power Plan now redirects them to a webpage touting President Trump's plans to revive the coal industry.

Then, in January, we obtained emails indicating that Pruitt himself was personally involved in scrubbing information on the website.

"Pruitt's pattern of ruling EPA under a cloak of secrecy is no way to run an agency entrusted with protecting public health and environment," says EDF attorney Ben Levitan.

To push back, we and our allies need to know who is influencing Pruitt's EPA. Through another FOIA request, we received 1,800 pages of correspondence between EPA and the Heartland Institute, a hub of climate denial supported in the past by the Koch brothers and billionaire Trump supporter Robert Mercer. The emails showed EPA political appointees collaborating with Heartland, soliciting the group's assistance on everything from climate policy to media coverage.

EDF is expanding its use of FOIA as new threats emerge. In April, we learned of Pruitt's efforts to censor the science used in EPA rule making, which could have calamitous consequences for clean air and public health protections.

Legal fellows on EDF's Clean Air team are on the front lines of our FOIA efforts, filing FOIA requests and sifting through thousands of documents.

One fellow is Erin Murphy, a 27-year-old graduate of Georgetown Law School.

"It's an honor to be part of this team," says Murphy. She traces her commitment to the environment to a family vacation at Montana's Glacier National Park. It was there that the 14-year-old saw a dramatically receding glacier.

"I knew then what I had to do with my life," says Murphy. "Nothing is more important."

Charlie Miller

SUPPORT EDF'S LEGAL CHALLENGE FUND!

From day one of the Trump administration, EDF has taken legal action to block assaults on the environment. We win because we arrive in court fully prepared. Help EDF's ace legal team defeat the Trump agenda and we'll double your donation $1-for-$1. Here's how: edf.org/LCFMatch

ISTOCK

Clean car showdown in California

PEOPLE LIKE CLEANER CARS because they save money, pollute less and are good for public health.

So why are President Trump and EPA Administrator Scott Pruitt rolling back clean car standards? New standards would spur improvements that would nearly double the average fuel economy of new cars to 54.5 miles per gallon by 2025 and cut oil consumption by about 12 billion barrels. The standards would also reduce carbon pollution by about six billion tons over the lifetime of all cars affected by the rules.

"The whole world is moving toward cleaner cars, but not the United States, which is stuck in reverse," says EDF general counsel Vickie Patton. "Trump seems to enjoy swinging a wrecking ball at environmental standards out of spite, regardless of merit."

The rollback would increase carbon emissions at a time when vehicles are eclipsing power plants as the nation's top source. Even some major car companies are raising concerns. Honda said plainly, "We do not support their rollback," while Ford said, "We support increasing clean car standards through 2025 and are not asking for a rollback."

In May, California and 16 other states sued to challenge the drive to weaken existing standards. EDF also asked a federal appeals court to review the administration's action. "We stand on solid legal ground," says Patton.

More lawsuits will undoubtedly follow if the new, weaker rules are finalized. California already has the authority to set its own, stronger clean car standards under the Clean Air Act. Pruitt is expected to attack this authority, setting up a major legal confrontation with California and the other states that have adopted that state's standards.

EDF has a long history of championing clean cars. California's landmark Clean Cars law, enacted in 2002 with vigorous support from EDF, mandated ambitious emissions reductions. Twelve states, representing a third of the national market, followed suit. EDF successfully defended the California law in court against a challenge by automakers.

With equal resolve, we'll defend today's clean car standards and states' authority to lead on clean air. "With the help of our members, we believe we will prevail," says Patton.

Charlie Miller

BY THE NUMBERS

SCOTT PRUITT'S DIRTY CARS PLAY

Zero
Number of times Pruitt mentioned the words "children," "health," "air pollution" or "climate" when announcing rollback plans

63
Number of times Pruitt cited the auto industry

Zero
Number of cited EPA analyses that support rollbacks

The new frontier of environmentalism

By Rod Griffin, Tasha Kosviner and Leslie Valentine

Fifty years ago, NASA astronauts sent photos of the Earth from space. The riveting images helped inspire the modern environmental movement. Today, cell phones have as much power as the computers that guided the Apollo flight, and EDF is launching a satellite to help put the brakes on climate change.

The mission is just one example of how technological innovation is transforming environmental protection. We think history will remember this as the Fourth Wave of environmentalism; the first being the Teddy Roosevelt-era land conservation movement; the second, the 1970s use of the law to combat pollution; and the third, the 1990s emergence of market-based solutions. The Fourth Wave builds on that progress with technological advances that are making the invisible visible. This is giving local groups powerful tools to help the environment: remote sensing that tracks deforestation; data analytics that reveal pollution patterns; artificial intelligence that curbs overfishing.

These tools are solving long-standing problems, changing behavior, reining in polluters and rewarding corporate responsibility. Like the Apollo mission of 1968, Fourth Wave environmentalism is opening new frontiers that could change the course of history.

PHOTO: GETTY

EDF fights climate change from space

COURTESY OF TED TALK

EDF president Fred Krupp announces the methane satellite project at a TED Talk in Vancouver, British Columbia

TOM INGERSOLL, A HIGHLY successful satellite entrepreneur, was surprised last year when he got a call from EDF's chief scientist, Dr. Steven Hamburg.

Hamburg said EDF wanted to build and launch a satellite to help fight climate change—and wondered whether Ingersoll would consider leading the effort. "I thought, 'Wow, that's kind of crazy for a nonprofit,'" recalls Ingersoll, the former CEO of Skybox, a satellite imaging company that sold to Google for $500 million.

After examining the technologies carefully, Ingersoll signed on as project manager in February. "It will be difficult," he says, "but the potential benefits for society are huge and worth the risk."

Two months later, EDF president Fred Krupp unveiled the plan during a TED Talk in Vancouver, British Columbia.

The new satellite, called MethaneSAT, will initially track methane emissions from oil and gas fields, but will also be capable of measuring emissions from feedlots, landfills and agriculture. Methane is an extremely potent greenhouse gas, responsible for about a quarter of today's global warming. Cutting these emissions is the fastest, cheapest thing we can do to slow the rate of warming today, even as we attack carbon dioxide emissions.

Refineries, pipelines and remote oil and gas fields can be hard to monitor, but an orbiting satellite traveling over four miles per second can measure a facility's emissions more cheaply, more accurately and more often than other monitoring methods. Some government satellites already track methane, but they lack adequate resolution to monitor emissions at the source.

Once launched by 2021, MethaneSAT should provide a new level of precision in monitoring about 50 major oil and gas regions, covering 80% of global production. Ingersoll says some of the technologies to be incorporated in the satellite were developed for military purposes, so "it's rewarding to see this technology benefit society in other ways."

Our goal: a 45% reduction in oil and gas methane emissions by 2025. That

> **"EDF will be a trailblazer for the concept of using the power of space and remote sensing to address a wide range of problems on a not-for-profit basis."**
>
> — Tom Ingersoll, MethaneSAT project director

would deliver the same 20-year climate benefit as closing one-third of the world's coal-fired power plants.

In the United States, the oil and gas industry is the single-largest industrial source of methane pollution, but 42% of oil and gas companies don't report any information on methane emissions. How much is actually leaking was unknown until EDF brought together 140 scientists from 40 institutions to publish 35 peer-reviewed papers on the subject. The studies revealed leakage approximately 60% higher than EPA had estimated and led to the first national methane standards.

Data on global emissions are even more uncertain. The International Energy Agency (IEA) estimates half of the gas leaks could be stopped at no net cost, because energy companies could sell the extra gas captured. But currently public information about leak rates is scarce and near-absent in regions where scrutiny is unwelcome.

"An effective response to the problem of methane emissions requires good data," said IEA executive director Fatih Birol. "This [project] is a major step forward, and continues EDF's pioneering work in seeking to tackle these emissions worldwide."

MethaneSAT, which is being developed in collaboration with Harvard and the Smithsonian Astrophysical Observatory, will help fill important data gaps, but action will require other measurements as well *(see Drones story, right)*.

EDF will make the data publicly available so that companies, policy makers and regulators can take action. This is all the more significant at a time when the Trump administration has undercut support for science.

With more detailed information at the level of individual fields, Hamburg says, companies will have the data to help identify and plug leaks. And governments around the world will have more information to develop policies to drive real reductions.

"EDF will be a trailblazer for the concept of using the power of space and remote sensing to address a wide range of problems on a not-for-profit basis," says Ingersoll.

"We're the first," says Hamburg, "but I think we're going to see this approach used by others as well."

The sky, it turns out, is *not* the limit.

SEAN BOGGS

Drones join campaign against emissions

EDF'S METHANESAT WILL BE critical for spotting methane emissions across large regions. But how will oil and gas companies pinpoint the precise size and location of leaks on the ground so they can be stopped?

That was the question occupying the minds of the inventors guiding drone-mounted sensors across a methane leak testing facility in Colorado this summer.

"Mobile methane detection is the next frontier for the oil and gas industry," said James Scherer of Aeris Technologies.

Aeris Technologies was one of ten teams invited to participate in the 2017/8 Stanford/EDF Mobile Monitoring Challenge. Using sensors mounted on drones, trucks and planes, the teams spent a week navigating increasingly challenging blind, controlled leaks. They then used their own algorithms to overlay information from sensors with other data, such as GPS and wind conditions, to determine the presence, location and size of leaks.

The findings are now being analyzed by Stanford scientists. By 2019, the aim is to have oil and gas industry leaders piloting the most promising technologies, leading to broad commercial use.

"We can localize and quantify emissions in a third of the time of traditional methods," says Andrew Aubrey, co-founder of challenge participants, SeekOps Inc.

It's in the wristband

OUR GENES HELP DETERMINE our health. But air pollution and industrial chemicals in consumer products also play a role. EDF is exploring technologies capable of detecting an individual's exposure to a broad spectrum of chemicals. We launched a project in which volunteers wore a silicone wristband capable of detecting over 1,400 chemicals in the environment. We found 57 chemicals, including carcinogens and endocrine disruptors. Now, with the price of precision information going down, we're supporting innovation in technologies that enable people to detect when and where unhealthy exposure occurred.

In the heartland, tech-savvy farmers rewrite the rules

NUTRIENT RUNOFF from farmland causes widespread algae blooms in waterways across the U.S. In 2014, an outbreak in Lake Erie contaminated the drinking water of more than 500,000 Ohio residents. Meanwhile in the Midwest, runoff from farmland in 12 states enters the Gulf of Mexico via the Mississippi River. There, it stimulates massive algal growth, which consumes the oxygen needed to support ocean life and causes a vast "dead zone."

Fertilizer is critical to agriculture but knowing precisely how much to use has been a challenge.

Now, a new generation of tech savvy, data-hungry young farmers are using precision agriculture tools to improve nutrient management and protect waterways and air.

"We invested in technologies and software to help us understand every detail about how our grain is grown," says Scott Henry, a 28-year-old farmer in central Iowa.

Henry is an EDF farmer adviser and participant in Land O'Lakes SUSTAIN, a program developed in collaboration with EDF to improve sustainability on 20 million acres of land by 2025.

One of the tools he uses analyses soil, topography and farming practices to recommend the best location for buffer zones—unfarmed areas that help prevent fertilizer runoff into streams. Another recommends the optimal quantity and timing of fertilizer application.

"Today," says Henry, "we can write prescriptions at a granular level for an individual field."

EDF partner Scott Henry

LESLIE VON PLESS

JONATHAN ALCORN

In cities, an early warning system for toxic pollution

THERE ARE MORE THAN 3,500 active oil and gas wells in Los Angeles County, many of them located near schools, hospitals and homes. Roughly 110,000 people live within 500 feet of these wells.

People living that close to an oil well have a cancer rate eight times higher than the national average, and more frequent respiratory illnesses, studies show. This concerns Compton-Gardena residents like Lloyd Duvernay, a retired cop who lives just 40 feet from the Breitburn oil field.

"The air quality isn't monitored at all," says Duvernay, whose son has asthma. "It'd be a relief to know kids here can grow up being safe—and their parents don't have to worry about toxic fumes affecting their health."

The good news is that recent breakthroughs in technology have increased the affordability and precision of air monitors, removing cost as a barrier for companies to install this equipment and enabling communities to launch their own monitoring networks.

"This gives communities power they didn't have before to become advocates and track pollution at hazardous oil and gas sites," says EDF project manager Irene Burga.

Data alone aren't enough. That's why EDF helped pass state regulations in 2017 that include provisions for real-time monitoring of some components of oil and gas operations near underserved communities—and for the rapid development of pollution-reduction plans.

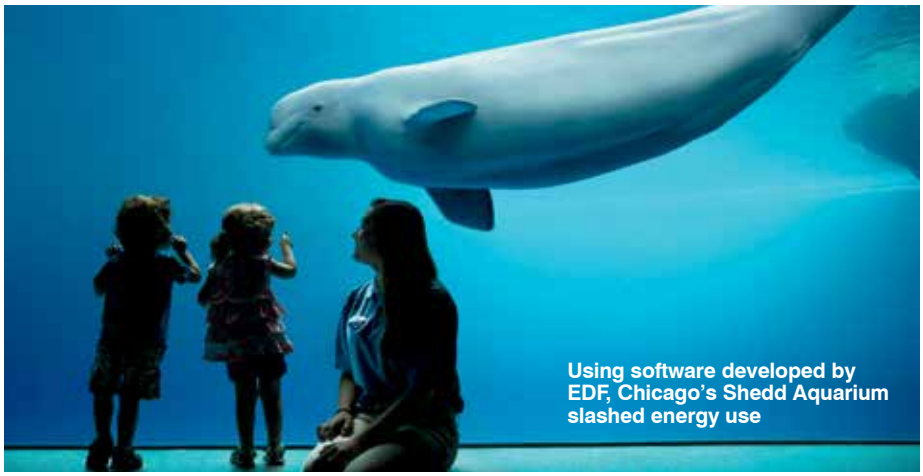
Says Burga: "Now companies and safety regulators no longer have excuses for dragging their feet implementing solutions."

An emerging megatrend

Until recently, environmentalists, policy makers and regulators often operated from partial data and guesswork when it came to addressing environmental problems. But today, thanks to rapid technological advances, new tools for defining and fixing those problems are being introduced, offering benefits that were unimaginable only a few years ago. And it isn't only EDF that's riding this wave.

The Nature Conservancy is applying **human facial-recognition technology** to fish to help identify and track catches. The FishFace project could offer a low-cost way to help manage fisheries and monitor declining species.

Putting big buildings on an energy-efficient diet



COURTESY OF SHEDD AQUARIUM

Using software developed by EDF, Chicago's Shedd Aquarium slashed energy use

FROM ARCTIC BELUGA WHALES TO tropical fish, the animals at Shedd Aquarium in Chicago need the right water conditions to thrive. Balancing their care with a commitment to energy conservation, the famous aquarium has joined a program EDF is implementing with ComEd, Illinois's largest utility.

The aquarium is one of ten buildings in the pilot, which helps managers of large buildings save energy. Buildings use about 40% of all energy consumed in the United States and hold great promise for reducing global warming pollution.

In our project, smart meters feed data to software developed by EDF and the Accelerate Group that provides building operators with a picture of real-time energy use. The program rewards building owners financially for reducing energy.

Our first-of-its-kind program is already making Illinois into a clean energy leader among states. It brings together efficiency experts, building engineers and the utility, and provides building operators with real-time information to find savings beyond simple mechanical efficiency.

We're now bringing the model to other Midwestern cities. Today, the Shedd Aquarium saves at least $150,000 a year in energy costs. Says Dick Munson, EDF Midwest clean energy director: "This is clearly a win for the environment and for utilities and customers alike."

Eavesdropping to help a Philippine fishery

PABLO SANCHEZ QUIZA

EDF scientist Dr. Rod Fujita tests advanced sonar

OFF CEBU ISLAND IN THE Philippines, millions of sardines swirl on Moalboal reef. Dr. Rod Fujita, director of research and development for EDF's Oceans program, joins colleagues from the Atkinson Center at Cornell University and other partners in the water to deploy sounding devices. The research team is testing sophisticated acoustic technology to estimate sardine abundance, which would help authorities better assess how many can be caught sustainably.

Sardines are a vital source of protein for Filipinos—and a critical link in the marine food chain. But they're in steep decline due to overfishing. The Philippine government recently reformed its fisheries law, adding provisions for science-based management, but there's currently no reliable way to assess the sardine population.

Fujita believes new acoustic technologies could help. "Active sonar," such as that used by submarines, emits sound waves that are reflected back from fish schools. "Passive sonar," in contrast, uses ultra-sensitive microphones to detect unique acoustic signatures associated with different species.

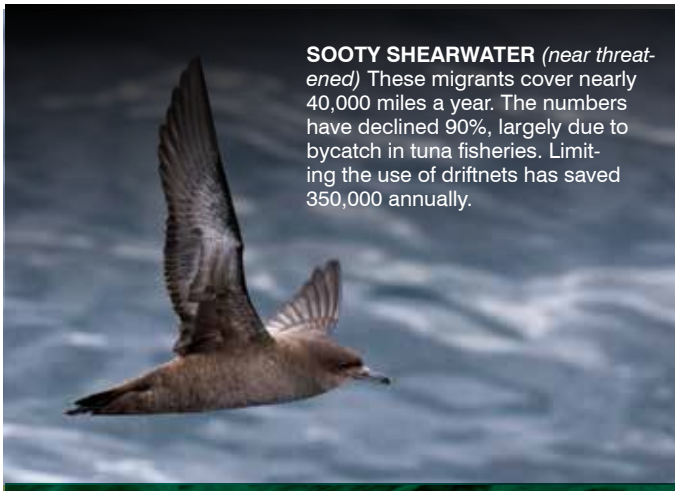
The use of these technologies to assess sardine populations is still experimental, but initial results are promising. If successful, they could be used to rapidly and cost-effectively assess the health of fish stocks, under pressure due to climate change as well as overfishing. And that would protect an important source of food and jobs for hundreds of millions of people.

In the Great Lakes, **robotic instruments** detect pathogens in drinking water and email data to resource managers to avert the sort of health crisis that affected 400,000 people in Toledo, OH, in 2014.

Off Cape Cod, the Woods Hole Oceanographic Institution and Cornell have deployed **acoustic sensors on buoys** to alert commercial vessels when they are on a collision course with endangered North Atlantic right whales.

A wind farm in Texas is using **radar systems**, developed for NASA, to detect approaching birds. If they're in danger of flying into the blades, the turbines are programmed to shut down, restarting once the birds are safely on their way.

How healthy fisheries support ocean wildlife around the world



SOOTY SHEARWATER *(near threatened)* These migrants cover nearly 40,000 miles a year. The numbers have declined 90%, largely due to bycatch in tuna fisheries. Limiting the use of driftnets has saved 350,000 annually.

AUSTRALIAN SEA LION *(endangered)* Gillnet closures around breeding colonies and 100% observer coverage on fishing vessels are helping revive the endangered sea lion. Only 6,500 adults remain.

INDO-PACIFIC HUMPBACK DOLPHIN *(vulnerable)* The main threats to this charismatic species are entanglement in nets and vessel collisions. Bangladesh created its first marine protected area in 2014 to protect the dolphin.

SUSTAINABLE FISHING NOT ONLY HELPS FISH POPULATIONS and the people who depend on them, it's also critical for protecting other ocean wildlife. A new study co-authored by EDF Trustee Dr. Chris Costello concludes that better fishery management can reduce, and even reverse, the loss of rare species of turtles, dolphins and seabirds.

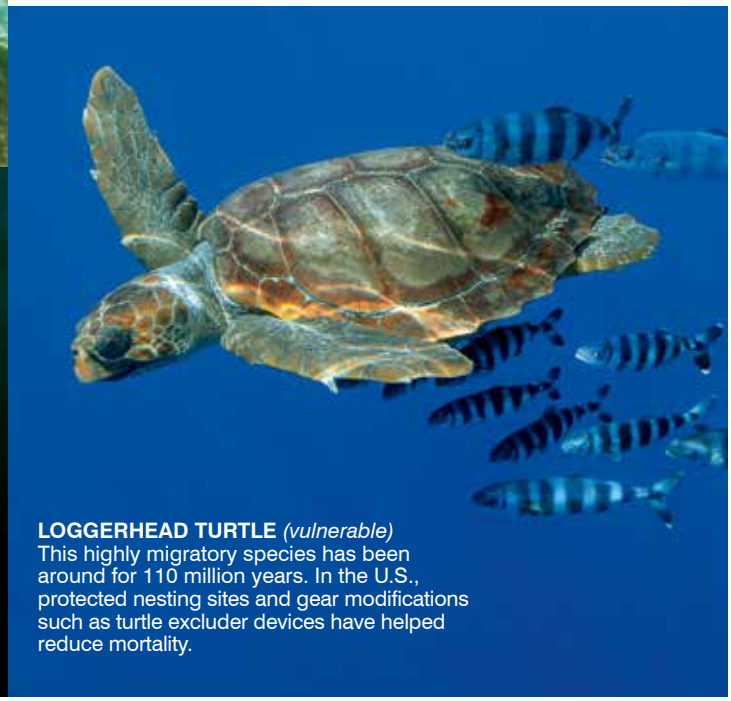
The study, the first comprehensive estimate of the benefits of sustainable fishing for the world's ocean wildlife, relies on a database of more than 4,700 global fish stocks that EDF helped compile. It focuses on the impact of sustainable fishing on 20 wildlife species threatened by accidental capture and injury through fishing.

Healthy fisheries are crucial to thriving ocean ecosystems, which include a diversity of ocean life, from microscopic plankton to colossal blue whales.

Published in *Science*, the research finds that sustainable fishing can help preserve 50% of vulnerable species, while the other half can be safeguarded through marine protected areas and other measures.

"Fishermen are often seen as a threat," says Dr. Douglas Rader, EDF's chief Oceans scientist. "But when given a secure stake in how fisheries are managed—and tasked with the challenge of avoiding vulnerable species —they develop plans that achieve better results than top-down mandates alone can."

Rod Griffin



LOGGERHEAD TURTLE *(vulnerable)* This highly migratory species has been around for 110 million years. In the U.S., protected nesting sites and gear modifications such as turtle excluder devices have helped reduce mortality.

PHOTOS: MINDEN PICTURES

JOEL SARTORE

Don't mess with the dusky gopher frog

An endangered frog gets its day in Supreme Court

When frightened, the dusky gopher frog covers its eyes with its hind legs and plays dead.

It's perhaps not the best survival strategy, but the real reason the stubby frog is critically endangered is because its longleaf pine habitat has almost disappeared. Longleaf pine forest once covered 90 million acres from Virginia to Texas, but less than 5% remains. Among the many casualties is the frog, whose range has shrunk to three remote ponds in Mississippi.

Improbably, *Lithobates sevosus* has become the vehicle for a concerted attack on the Endangered Species Act. In 2012, the Fish and Wildlife Service designated 6,477 acres of pine forest as critical habitat. The timber company Weyerhauser and others challenged the decision in Louisiana District Court and in the 5th Circuit, losing both times.

The case is now before the U.S. Supreme Court. It's the first time in a decade that the Court is addressing a core issue of the Endangered Species Act, and it comes at a time the Act is under sustained assault in Congress.

The Court will decide if the government has the authority to designate critical habitat in unoccupied lands that possess some, but not all, features necessary for endangered species survival. Opponents argue that the government can designate as critical habitat only areas where the threatened species already exists, or areas that are immediately habitable. If the Court agrees, the fallout could be devastating to many species. "Recovery today depends on creating new habitat and allowing species to migrate and adapt to a changing climate," says EDF attorney Holly Pearen. "Species are in trouble due to habitat loss. Restricting critical habitat to areas currently serving as habitat consigns many of them to almost certain extinction."

The case could also be a test of the Chevron Deference, an important judicial doctrine that holds that scientists at wildlife agencies, not judges, are best qualified to make decisions on habitat.

The attack is being led by the Pacific Legal Foundation. The Center for Biological Diversity is defending the Act, with business owners who support species protection.

In addition to crippling species' recovery, an adverse ruling would suggest that non-pristine lands aren't important. This would send the wrong message to landowners. EDF's work has shown that working lands are essential for conservation of species like sage grouse and kit fox. "The fact is we can no longer rely only on pristine ecosystems to preserve species," says Pearen.

Today, the guttural call of the dusky gopher frog is still heard in three remote ponds in Mississippi. Whether it will still be heard in the future is up to the U.S. Supreme Court. The case will be argued in November.

Peter Klebnikov

THE WILSON LEGACY

The power of environmental bonds

By Frank Convery, EDF Chief Economist

Hurricane Katrina ravaged the U.S. Gulf coast in 2005, causing about $125 billion in damage. These costs would have been lower if natural protections—dunes, wetlands, barrier islands—had not been degraded, a process that continues as global warming contributes to sea level rise.

EDF is pioneering ways to make vulnerable, and valuable, coastlines more resilient. One major question is how to pay for that resiliency. For example, the cost of providing protection against the next Katrina is expected to be about $50 billion.

In the Gulf region, led by EDF economist Diego Herrera, we are exploring the feasibility of an Environmental Impact Bond (EIB)— issued by Louisiana's Coastal Protection and Restoration Authority—to raise money to protect the coast. The state will then pay back the bonds' principal with interest, using future oil spill related revenues dedicated to restoration.

By issuing EIBs, Louisiana would save money by acting more quickly to restore wetlands that reduce the extent of potential future flood damage.

The idea is to attract capital from so-called impact investors—those seeking a beneficial social or environmental impact alongside a financial return—willing to cover the upfront costs for wetland restoration.

Major players in the Gulf economy (the ports, the oil and gas industries)—all beneficiaries of coastal protection—would then complement EIB funding by providing additional finance for coastal protection.

If this funding model works, we will have a flexible, scalable way to fund coastal protection wherever it is needed.

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

This year, vote for the environment

As *POLITICO* has reported, aides to President Trump are bracing for "a possible bloodbath" in the 2018 midterm elections, which could "paralyze the president's legislative agenda."

For the environment, that would be a very good thing.

Trump is the most anti-environmental president in American history, and the current Congress is equally bad on the environment—a poor combination.

We are witnessing wholesale efforts to roll back environmental safeguards, including the Clean Power Plan, clean car rules, rules protecting Americans from toxic chemicals and much more. No fewer than 180 members of Congress deny the science behind climate change. And 46 senators received a League of Conservation Voters score of zero in 2017, voting repeatedly against the environment and public health.

"We can now see what government looks like when it's run by special interests," says Joe Bonfiglio, president of our partner advocacy group, EDF Action.

Now, however, the tide may be turning. A relatively good budget, with funding increases for EPA, passed Congress in part because more than 125,000 EDF members spoke out. Also, Moms Clean Air Force, an EDF project with more than a million members, has run dozens of actions in Washington over the past year and a half, including rallies to protest the cuts that were proposed for the EPA budget and rollbacks of critical environmental and public health protections.

In many states, anti-environmental members of Congress are sensing a growing backlash. They are facing protests at home nearly every weekend, and many admit to feeling out of touch with their constituents.

That uncertainty has created an opening for EDF and EDF Action.

With the environment emerging as a major issue in battleground House districts, EDF Action has launched Campaign Academy, a first-of-its-kind program designed to give political candidates the skills and knowledge they need to become stronger environmental advocates while building winning campaigns. The program is aimed at candidates at all levels, from city council to U.S. Senate, and trainees are learning about fund-raising strategies, how to craft an effective message and how to get out the vote. About ten training sessions are planned, featuring some of the brightest and most successful political minds in the country, including John McCain's presidential campaign manager Rick Davis and Barack Obama's battleground states director Mitch Stewart, who once worked at EDF.

"We want to make sure that this is the place to go to run a successful campaign," says Stewart.

We know that when more people are engaged in the political process and vote, we have a much better shot at pushing politicians to take pro-environment positions. That's why we are also running voter registration drives. EDF's Defend Our Future initiative, a campaign focused on mobilizing young people, has organized several dozen events in five states. And Moms Clean Air Force plans events in 20 states where organizers will also gather pledges to vote.

"Our job is keeping people politically engaged and informed," says Jeremy Symons, EDF vice president for political affairs. "We're not taking anything for granted. We're counting on EDF members in every state to help stop Trump's environmental assaults."

Charlie Miller

Maximize your voice in the midterms

Nature doesn't have a vote. But you do. Whatever your level of political engagement, here's how to step up your impact in this November's elections.

Are you registered to vote?

- **NO, not yet** → Register at defendourfuture.org/register-to-vote and sign up for election reminders at edf.turbovote.org
- **YES**
  - **but I have questions** → Learn about your candidates and current representatives at usa.gov/voting. View their stance on key environmental issues at scorecard.lcv.org
  - **I'm a voting pro!**

Are you an online activist?

- **NO, tell me how** → Be sure to vote all the way down the ballot. Environmental progress happens at every level.
- **YES**
  - **Cyberspace is my happy place**

Do you lobby your representatives?

- **NO, tell me more** →
  - Make your voice heard during office hours, town halls and other public meetings.
  - If you can't get out, write or better yet, call, using contact information on their website.
- **YES**
  - **but I'm a bit rusty** →
    - When engaging your representatives, begin by emphasizing you live in their district and mention roles that highlight your community influence.
    - Concisely detail the issue you're interested in and its effect on your community. Explain the action you wish to see. Be respectful, personal and heartfelt.
  - **I have my reps on speed dial**

Do you engage your friends and family?

- **It's complicated...** → Difficult conversations become easier by finding common ground. Discuss how environmental issues and policies affect your community, and how politicians can help. Deal courteously with alternative viewpoints.
- **YES**
  - **They know where I stand**

Do you volunteer?

- **NO, but I'd like to** → Great! A campaign depends on the commitment of its volunteers. Sign up at your candidate's office. Expect to stuff envelopes, man the phones, distribute fliers and canvass door-to-door.
- **YES**
  - **First in line, every time**

Host an Election Day party or block walk to increase awareness and voter turnout.

Remember, every action helps! Thank you for giving the environment a voice at the ballot box this November.

Knowledge center

Hone your environmental talking points with fact sheets from these EDF affiliates:

Moms Clean Air Force
edf.org/EhB

Defend Our Future
edf.org/Eh2

WIKICOMMONS

Cookstove engineer Padmavati showing how for millions, sustainability and social change go hand-in-hand

In India, climate action empowers women

A plan to install biogas cook stoves in rural India goes beyond helping the country meet its climate goals. It also elevates the role of women both inside and outside the home.

PADMAVATI PLACES THE HEAVY black bag at her feet and settles into the auto rickshaw. As the driver navigates the muddy track to the next village, the contents of the bag rattle, pliers against wrenches and spare parts.

Padmavati is a biogas cookstove engineer, trained by EDF partners in rural India to maintain environmentally friendly stoves. The program replaces wood burning with stoves powered by methane from cow dung, or gobar.

To date, some 94,000 stoves are being installed, curbing pollution and deforestation and saving nearly 500,000 tons of carbon emissions a year. The byproduct, a rich slurry, is used as fertilizer. EDF and Fair Climate Network are now working with the states of Bihar and Uttarakhad to bring biogas to an additional 80,000 homes. Success could see it go national, helping the world's third-largest emitter of greenhouse gases meet its ambitious climate targets.

"Harnessing gobar to generate energy and fertilizer is essential to India's low carbon growth strategy," says India Member of Parliament Dr. Sanjay Jaiswal.

For many households, there are also profound social benefits, particularly for women. A 2015 report published by Frontiers in Nutrition, found the stoves save women two hours a day in cooking and collecting firewood, improve nutrition and offer relief from the risks of collecting wood—snake bites and harassment from men. There are social benefits too. Under the program, women who want stoves must first join a village administrative body, the sangha. The sangha monitors installations for compliance with the project's funding source, carbon credits from the airline IndiGo. But it also addresses other social issues and grants small loans.

"Women start to take ownership of their education, health, even reproductive rights," says EDF India director Richie Ahuja. "Many start small businesses, gaining economic autonomy for the first time."

Padmavati, 35, was among the first to adopt biogas in her village. She recalls skepticism turning to delight the day the gas first flowed. She made coffee for curious neighbors, allowing the milk to overflow—a symbolic gesture of abundance.

"From then on, my walls were no longer black with soot, and my eyes stopped constantly watering," she says. "My sons got to school on time since breakfast is ready in minutes." Her oldest son is now studying to become a doctor.

Padmavati, who left school at 11, is one of 110 engineers trained so far. The role brings an income and a measure of respect. Arriving at her appointment, she discovers and repairs a break in a pipe.

"In the beginning, people were surprised to see a woman in this job," she says. "Now they think it is normal."

Tasha Kosviner and Bharati Ramachandran

SHAMS UL HAQ QARI

EDF's Richie Ahuja (l): "Progress starts with the grassroots."

EDF MEMBER SPOTLIGHT

CHANDON S.

Doctor Kari Nadeau's research charts the effects of climate change on children's health

Doctor, scientist, environmental campaigner and EDF member

Long after the last of the 2017 California wildfires had died out, researchers at Stanford University noticed a surprising phenomenon. In Fresno, 200 miles south of the fires, emergency rooms were still admitting patients with breathing difficulties at a rate of one every six minutes.

Sophisticated rooftop sensors revealed that even at that distance, particulate matter from the fires was still thick in Fresno's air.

The data were collected by a team including EDF member and preeminent childhood asthma expert Dr. Kari Nadeau. Dr. Nadeau hopes her research on the impacts of extreme weather on children's health will do to climate change what proving the link between smoking and cancer did to tobacco.

"Our research, conducted over 12 years and involving 800 children, proved a link, at a molecular level, between air pollution and asthma," says Dr. Nadeau, who is also a scientific advisor on the California Air Resources Board. "We see similar impacts on children's health wherever climate change related events are happening in the world."

The impacts are as disparate as the extreme weather associated with them.

"Following Hurricane Harvey, we saw an increase in allergic reactions caused by waterborne toxicants; following dust storms in Saudi Arabia or extreme smog in China, we witnessed an uptick in severe cardiovascular conditions. The common denominator is air quality conditions related to climate change."

This year, Dr. Nadeau will be one of the conveners of a symposium on the effects of global climate change on children's health.

In 2017 Dr. Nadeau's research hit a roadblock when it was announced her funding, from National Institutes of Health and Environmental Protection, would be ending. She was also one of the scientists to lose a seat on EPA's Science Advisory Board following Scott Pruitt's well-documented purges.

"We are only as good as our data," Dr. Nadeau says. "When you dilute the expertise and cut the funding you lose the objectivity necessary for initiating and maintaining critical regulation."

Raised on a houseboat in New Jersey, daughter of a pediatric nurse and a marine biologist, Dr. Nadeau has public service in her DNA. She maintains her faith in the power of people—and the not-for-profit community—to drive positive change.

"When it was proven that BPA affected puberty, it was the public that demanded change," she says. "The same can happen with climate change. But we have to link elbows. EDF keeps communities engaged and informed and that empowers them to act."

To lend your voice to the drive for a healthy climate, join edfaction.org.

ASK AN EXPERT

"I live outside the monarch migratory route. Can I still help the butterfly?"

ISTOCK

Members Carolyn and Mike Durak, of Hardin County, TN, ask:

We have numerous areas of butterfly and pollinator habitat around our farm but alas, we are not quite on the monarch's spring migration route. Can our habitat still help the monarchs?

David Wolfe, EDF's conservation strategy director, responds:

While the concentration of migrating monarchs is heavier in some parts of the U.S. than others, the migratory corridors of both the eastern and western monarchs are actually very broad. With the exception of a narrow strip along the Rocky Mountains, there are few places where planting native milkweed or wildflowers doesn't help.

The U.S. needs millions of acres of restored habitat to reverse the monarch's catastrophic decline. It's fantastic you have habitat, and come spring, you should see butterflies coming in to feed. Even if there are fewer than in more densely visited areas, you're also providing critical habitat for other threatened pollinators, including bees. Take a look at Monarch Butterfly Habitat Exchange (edf.org/Eh7) to see how EDF is supporting landowner efforts.

If you want to do even more for the monarchs, check out EDF's resources (edf.org/Eh6) where you'll find links to projects that facilitate monarch tagging, counting and tracking—all crucial parts of the nationwide conservation effort for this beloved insect.

> **“Look up at the stars and not down at your feet. Try to make sense of what you see, and wonder about what makes the universe exist. Be curious.”**
>
> **— Stephen Hawking, 1942 – 2018**

PHOTO: OFFSET