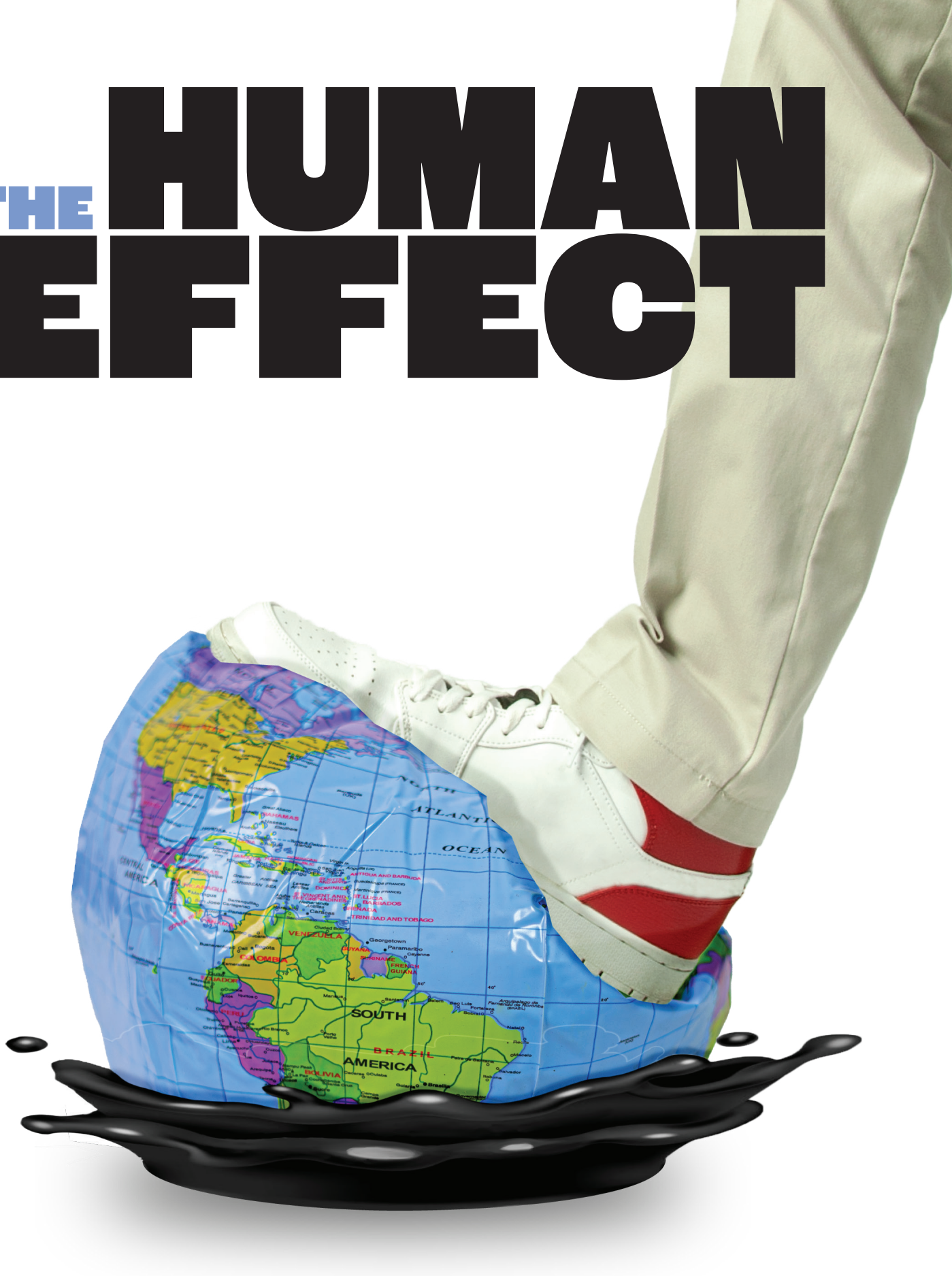
THE HUMAN EFFECT



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Depicting the impact that humanity has had on the earth, co-editors Morgan Chow and Ian Dalrymple worked with photographer Sam Adams for the photo illustration.

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A NOTE FROM THE EDITORS

THE HUMAN EFFECT

The environment is being destroyed in so many ways it's hard to keep track.

Forests are being cut down, animals are dying, oil is spilling into the ocean. Chemicals are polluting the air, sea levels are rising, wildfires are appearing more frequently every year.

The list goes on and on and on, and the issues mentioned are just the tip of the iceberg (which, by the way, is melting due to rising global temperatures).

But, despite how innumerable these environmental problems may seem, they can all be traced back to one source. Humans.

We are cutting down forests.
We are spilling oil into the ocean.
We are harming animals, both directly and indirectly through habitat destruction.
We are pumping the air full of chemicals, both depleting the ozone layer and raising global temperatures.

The struggles that our planet faces are our fault, and they aren't going to go away on their own.

We need to do something about it.

But what?

Morgan Chow
Ian Dalrymple
Co-editors-in-Chief

SECTION ONE

THE ISSUES AT HAND

You hear about it everyday on the news. Another natural disaster, another alarming statistic, another weighty item to add to our endless list of environmental responsibilities. With so much on our plate, it's hard to know how to start. Before we even begin to address them, we first need to identify the issues at hand.

THREE BIG ISSUES

As we read the news, we see a lot of devastation surrounding climate change already. Fires, pollution and melting: here's a recap of the three biggest.

Forest fires: our future will see not only a warmer climate, but also many more forest fires

Christopher Roos, a professor of anthropology at SMU, stresses the fact that while the wildfires in California and the West Coast are well-reported in the news, there are fires all over the world very similar to those here in the United States, such as in sub-Saharan Africa and Europe.

"One that's probably unappreciated is the Mediterranean basin," Roos said. "In the last few years, we've seen big fires in Greece, Portugal and Spain, along with some in Italy. These are smaller in size than the ones that are a big problem here, but similarly damaging. In 2018, at the same time that the big fires were happening in California, you had about 120 people killed in fires in Portugal."

Looking towards the future, Roos says we can expect a lot more fire as climate change worsens.

"Most people think of our fiery future as one with more fire, uniformly, as the planet heats up and dries up," Roos said. "It's a bit more complicated than that. Partly because there are certain environments like cold and wet boreal forests in the high latitudes, but also at higher altitudes that will unquestionably become more flammable as they become hotter and drier."

However, as these fires rage on for a while, they will eventually start to taper out after all the fuel is burned up. According to Roos, the fires we've seen lately in California, the Southwest and the Rocky Mountains have been more destructive to tree populations than in the past.

"There'll be other places like parts of California, in the Southwest, and other Mediterranean climates where there may be a lot of fire for the next few decades," Roos said, "but the vegetation that is so flammable now, especially these dry forests and woodlands, are going to be replaced by other life forms. In some of those places, after a very fiery transitional period, there may actually be less fire in some places."

Roos sees the first step to reducing the frequency and severity of wildfires in the United States as making the United States Forest Service—the entity that does the majority of wildland firefighting in the country—a full-time agency and having them conduct preventative measures.

"The Forest Service basically is responsible for nearly all wildland firefighting in the US," Roos said. "But those firefighters and most other firefighters are just seasonal. We would do a lot better to hire people on a permanent basis and spend the rest of the year fitting forests and getting good fire on the ground to try to get ahead of this. Just try to get ahead of the problem really aggressively, with thinning trees, modifying fuels and burning."

Melting ice caps: how glaciers shrinking directly affects our coastal climate

Of the many negative effects that would come from ice caps melting, the imbalance between freshwater and saltwater as well as temperature changes would cause massive damage to the ocean's ability to serve as a temperature control.

"We call it thermohaline circulation," Roos said. "We haven't seen that yet, thank goodness. Thermohaline circulation is one of the reasons why some parts of northern latitudes have a much milder climate than they would have otherwise. Think especially Northwestern Europe, a latitude that's comparable to Ontario, Canada, but they have much milder weather there."

The impact a rising temperature would have on ocean life similarly cannot be ignored.

"In terms of the ecology," Roos said, "the biggest impacts on ocean ecosystems has to do with ocean warming itself, which is impacting the ranges and distributions of those populations as well as their breeding grounds and the coral reefs that are tied to breeding for a lot of species."

Roos put the dangers of flooding from rising sea levels in real terms in the United States, happening right now along the coasts.

"Miami is already experiencing nuisance flooding from elevated sea levels once a month," Roos said. "Even with normal high tides, it's forcing water up the storm drains and inundating some streets. On king tides, you've got barrier island communities in the Carolinas that are entirely inaccessible. It's flooding out bridges, and the low parts of those communities have their streets flooded. So it's not a thing of the future. It's something that's very much with us now."

Ocean pollution: our waste means more carbon dioxide in the atmosphere

According to Director of Environmental Studies Dan Northcut, the problem of ocean pollution is multifaceted, with many causes and many areas of improvement.

"There are several different kinds of pollution that are going on," Northcut said. "Some of it is trash pollution, where you have trash and especially plastics everywhere."

Along with the more familiar problem of trash pollution, Northcut asserts that chemical pollution from food production is equally as destructive.

"There's also a lot of chemical pollution from agricultural runoff causing over-fertilization of parts of the ocean," Northcut said. "That ends up causing huge dead zones."

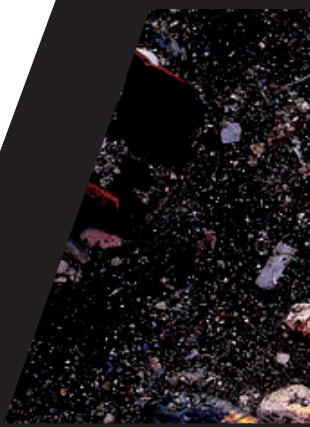
Ocean water naturally dissolves carbon dioxide in the atmosphere. This has historically been a mitigating factor in the human effect on the environment.

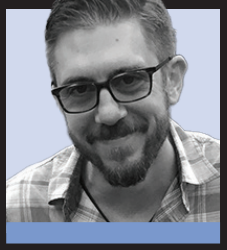
"The ocean will absorb a certain amount of the CO_2 that gets into the atmosphere," Northcut said. "Some of the CO_2 that dissolves into the water can be used, and some of it sinks out, and that's good."

When carbon dioxide dissolves in water, a chemical reaction occurs and carbonic acid is produced. This acid builds up over time, giving researchers an indication of the ocean's ability to continue absorbing carbon dioxide into the future.

"The oceans have been buffering our CO_2 output for 150 years, but they've clearly begun reaching the limit of how much they can buffer," Northcut said. "We know that it's reached its limit because the acidity of the ocean has been going up over the last few decades."

STORY Axel Icazbalceta, Will Spencer
PHOTOS Courtesy Creative Commons





Christopher Roos
Anthropology professor at SMU

Dan Northcut '81
director of environmental studies

RAGING FLAME Wildfires devastate forests worldwide, from the Rockies to the Mediterranean Basin.

MELTING ICE Ice caps and glaciers melting can have drastic effects on various world regions' climates.

PLASTIC PROBLEMS Plastic waste makes up approximately 80 percent of the ocean's pollution.

A SHARED ISSUE

From booming metropolises like New York City to rural communities in Peru, the world's rising sea levels, warming atmosphere and depleting resources are putting people at risk.

Damage to the environment takes many forms — forest fires, flooding, even overpopulation. And it can be explored through the stories of people from around the globe. From the Philippines to California to Oman to Peru, students and teachers alike have a story to tell.

Junior Matthias Canon moved to Dallas from Peru this year, and he recognizes how little emphasis countries like Peru place on solving environmental issues.

"Peru is not a very healthy country for climate change," Canon said. "The government doesn't really focus on the environment. It's more focused on poverty because that's the number one issue right there."

For History and Social Sciences Department Chair David Fisher, climate change encompasses a range of phenomena that can be analyzed through measurements.

> "Natural climate change ... usually occurs over long periods of time. The fact that I can remember that things used to be different in my own lifetime is the issue."
>
> **David Fisher**
> History and Social Sciences Department Chair

"One of the ways you can measure climate change is by increasing sea levels," Fisher said. "I lived in Bangladesh. The capital, Dhaka, is sinking. The population of Bangladesh is somewhere just south of 200 million people, and an enormous number of those people live in areas that are prone to flooding because Bangladesh has a flat river delta."

Beyond Dhaka sinking, the consequences of flooding extend to water damage and can be attributed to partially causing staggering overpopulation and Bangladesh's slow development.

"It affects the entire coastal area of Bangladesh," Fisher said, "which means that people have to move inland, and areas that were already overcrowded become more crowded still."

Fisher also lived in Oman, where rising sea levels threaten the freshwater aquifers the desert nation desperately needs to support its population, and in the Philippines, where rapidly rising global temperatures combine with the metropolitan density of his hometown Manila to create average summer temperatures he never saw as a child.

Having spent a substantial part of his life in both locations, Fisher believes this worrying change within such a short span of time encapsulates the true problem at hand.

"Of course, there is such a thing as natural climate change, but it usually occurs over long periods of time," Fisher said. "The fact that I can remember that things used to be different in my own lifetime is the issue."

Former chemistry teacher Christina Macaraeg also witnessed the dangers of rising sea levels in the span of months.

"Climate change is a huge issue [in New York City] since we are at sea level. Any significant sea level rise will lead to catastrophic flooding of heavily populated areas," Macaraeg said. "In the few months I've been here, I've seen rainstorms so bad that people's basement apartments flooded, and the entire subway system had to shut down for hours while they pumped out water. The storms were back-to-back, so the already soaked ground was hit again by Hurricane Ida."

She noticed how already existing infrastructure, however strong it may be, can also succumb to the eventual forces of rising sea levels.

"The aging infrastructure, like the subways, can't keep up with the frequency and severity of the storms," Macaraeg said. "The whole public transportation system will have to be reworked, and lower-lying areas will have to be abandoned, like parts of lower Manhattan and Brooklyn."

Much like Fisher's experience in Bangladesh, Macaraeg says the dense population and forces driving people inland create a dangerous combination that has yet to be addressed.

"I was surprised to find how often there are tornado watches and warnings in and around the city," Macaraeg said. "Since it's a vertical city, there's nowhere to really go when there's a warning. Hopefully, your high-rise has a basement. I think a challenge with recovery here is that since it's already so densely populated, if there's a disaster and people need to find temporary shelter, there's not really space to do that."

And, in the short term, Macaraeg says these issues are the most important to address.

"This city absolutely needs to focus on climate change," Macaraeg said. "To me, the most immediate need is addressing the flooding, whether that's rehousing people, upgrading drainage and runoff systems or something like that. It comes back to infrastructure."

STORY Toby Barrett, Nikhil Dattatreya
GRAPHIC Jonathan Yin

WHEN THE WATER RUNS OUT

Water is essential to human life. As climates continue to change, weather patterns shift, as does water availability. What do we do when we run out of water?

Open the tap and brush your teeth. Twist open a bottle and take a sip. Turn on the sprinkler and water the lawn. Water — it's everywhere.

But not for everyone. A combination of decreasing annual rainfall and increasing population has led to water shortages around the world and widespread restrictions on usage. Now, women have to walk miles just to bring it to their families. Wars are fought over this base necessity.

An extreme example is Cape Town, South Africa, which between 2017 and 2018 became the first major city in the world to be at risk of running out of water. The idea of a "Day Zero" was even tossed around: the day when the majority of the city's water supply would be turned off except for certain major access points.

That's right, a city with over 4 million residents just about ran out of water.

Rob Petersen '68, a resident of Cape Town, saw the crisis unfold firsthand. Despite the many contributing factors, Petersen specifically attributes the lack of water to a shift in rain patterns.

"The weather systems which bring rain to the southern part of South Africa come off the Atlantic Ocean and move from the west to the east," Petersen said. "Going back decades, I can remember when there was good rainfall in Cape Town where it would eventually make its way to the Eastern Cape. Rain systems now tend to move further south than before, so they just brush along the southern coast. By the time they get to the Eastern Cape, they're moving out to sea. The good rain is falling on the sea rather than in the catchment areas."

The government honed in on excessive consumption as one of the primary causes of the water crisis, a course of action Petersen felt was somewhat misguided.

"Even reasonable consumption becomes a problem as the population grows in urban areas and as more people are getting running water to their homes," Petersen said. "The consumption will naturally increase."

Rob Petersen '68
Cape Town resident

To curb consumption, a graduated water price was introduced, where additional use over a certain threshold was penalized.

"If you're rolling in money that doesn't make much difference," Petersen said. "Overall, though, I think it was good because water consumption is metered, so it's possible to identify and target reckless consumers."

Some wealthy residents did have the ability to buy rainwater-collection tanks to supply them with water for personal use.

"I, like thousands of better-off South Africans, bought rainwater tanks, known here as JoJo tanks," Petersen said, "and those are not affected by the water restrictions, so you can water to your heart's content from rainwater tanks."

In South Africa and other developing nations, that economic inequality goes further, with some struggling to find clean water even without a shortage.

"For many hundreds of thousands of people, getting water at all is a major undertaking that involves taking buckets to stand pipes," Petersen said. "There's no way that their consumption is measured, but they are restricted by the fact that they have to take buckets to pipes. In Cape Town, it's not necessary to worry about drinking polluted water, but in the rural areas, that is an additional problem."

The pandemic has only increased the importance of water.

"One of the important measures to take is the regular washing of hands," Petersen said. "How do you do that if you haven't got water? The effects are cumulative."

Although the situation has since improved, Petersen notes that the water crisis has led to lasting change.

"Since the water crisis of 2018, we've been having quite good rains in the Western Cape and the region's major dams are currently nearly full," Petersen said. "There's more rain now in the summer months, previously almost completely dry, than I can remember. In any event, some water restrictions are sensibly being maintained in the Western Cape, and our behavior as privileged water consumers has certainly improved."

STORY Keshav Krishna, Grayson Redmond
PHOTO Courtesy Creative Commons

PROTECTED TOO LATE

Roughly 1000 documented species have gone extinct over the last 400 years. Unfortunately, a majority of these extinctions have been caused by humans. Director of environmental studies Dan Northcut explores the different ways in which we have contributed to animal extinction and vulnerability, and how we can do better to prevent extinctions in the future.

Native to North America, the passenger pigeon aided regeneration cycles in forests for hundreds of thousands of years. But because of human violence, these birds rapidly went extinct.

Dan Northcut: The passenger pigeon went extinct because we shot them all. The last one died in a zoo in the early 20th century — the last one of a species that used to darken the sky with its flocks during migrations. Because there were so many of them, people decided to shoot them. Over a couple of decades, we killed them all.

The dodo bird was a flightless bird which was native to Mauritius in the 16th and 17th century before human indulgence ended the species in 1681.

DN: The dodos went extinct because we just ate them all. There weren't many of them because they were on a small set of islands in the Indian Ocean, but when sailors began to show up on those islands, dodos became easy meals.

While not extinct, whales used to be a major target for sailors because of the valuable oils they produced.

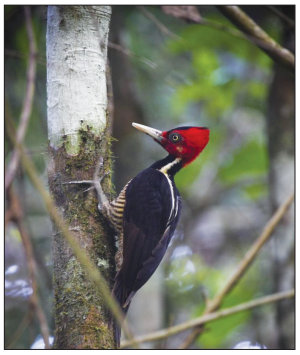
DN: There are a lot of species we killed off for food just because we could. We would have killed off a lot more species if we hadn't started paying attention. People realized in the mid-20th century that we were just about to cause a lot of whale species to go extinct. It took governments to come together and put a ban on whaling so that the whales wouldn't go the same route as the passenger pigeons and the dodos.

Polar bears are currently considered vulnerable as they struggle to survive in the Arctic.

DN: Polar bears are marine mammals. They've evolved to live most of their lives on the ice caps in the Arctic. As the Arctic ice caps disappear slowly year after year, it gets smaller and the ice gets thinner. It's predicted that we won't have an ice cap in the next 30 years. What that means for the polar bears is that they may end up becoming extinct because of the way they hunt. That is, by waiting over air holes for seals to come up and get air. If there's no ice, then seals can get air anywhere, and there will be nowhere for the polar bears to ambush them.

> "We need to do a better job of living with our neighbors. A big part of that is education. We have to get the word out so that everybody understands that we are all part of a whole life system on Earth. We are not above or separate from the ecosystems that maintain life on Earth."
>
> **Dan Northcut**
> Director of environmental studies

The ivory-billed woodpecker used to reside in the southern United States and Cuba.



DN: The ivory-billed woodpecker went extinct around 40-50 years ago. The woodpecker lived in a swampy environment and was able to thrive in it until we cleared it out. We drained it and destroyed their ecosystems. We took so much of it away that they didn't have a habitat to survive in.

STORY Dillon Wyatt, Arjun Khatti
PHOTOS Creative Commons

THE CORPORATE DILEMMA

DRILLING DEEP The oil and gas industry is often the center of discourse about corporations' impact on the planet

For years, humanity has struck a delicate balance between corporations and the planet. Now, as the state of the planet continues to worsen, it has become clear that the two clash. Something needs to change.

—Personal commentary by **Axel Icazbalceta**, *ReMarker* opinions editor

The struggle to make a green world is just that—a struggle. In a world and economy dependent on overproduction, waste and efficiency that sacrifices sustainability, changing our habits to always be mindful of the effects our purchases and behaviors have on the planet is inherently difficult.

Nonetheless, leave it up to corporate America to give us the easy way out.

We are bombarded with advertisements from all types of companies telling us what great things they're doing for our planet: how they're emitting less, how they use recycled materials, how their products are "sustainable," et cetera. When they're telling the truth (yeah, sometimes they just lie to your face about it. Thanks H&M.), they're either guilting us into buying their product or putting up a smoke screen for a company that likes to roleplay being environmentally conscious but couldn't care less about greenhouse gas emissions or ocean pollution — in fact, they'd rather emit and pollute than see their profit margins go down.

I don't buy the green facade. The fundamental tenet they want us to believe is this: the path to fixing the environment is more consumption from their companies.

If you don't mind, don't spit in my face and tell me it's raining.

COLUMN CONTINUED ON NEXT PAGE

COLUMN CONTINUED FROM PREVIOUS PAGE

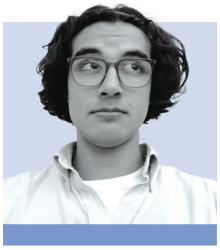
And it's not just us consuming more. It's everyday people putting in all the hard work in sustainability efforts and taking all pressure off of them.

It goes like this.

Someone says, "we need fundamental change in our efforts to go green," and suggests policy that would make corporations emit less, waste less and holds them accountable through vigorous enforcement and heavy fines.

Then someone else says, "that's all well and good, but we also need action on the individual scale. Have you recycled your aluminum and cardboard?"

See the issue?



Axel Icazbalceta
Opinions Editor,
ReMarker

Industrial waste absolutely dwarfs municipal waste. An oft-cited statistic says that 97 percent of waste in this country is industrial, with municipal waste making up the remaining three percent. While these numbers came from a 1987 EPA study, and we have not had any recent similar studies, other estimates since then—such as a 2011 study in Canada—indicate that disparity still exists. Not a good sign.

It's the same thing with greenhouse gas emissions. According to an EPA study on the source of greenhouse gas emissions in 2016, 24.2% of emissions come from energy used in industry, and an additional 5.2% come from industry. Fugitive emissions—methane accidentally leaked during oil and gas extraction and coal mining—make another 5.8%, with an additional 4.8% from road freight vehicles. Nearly half of all emissions come from industrial sources, not counting the agricultural sector.

In comparison, emissions from energy for homes, passenger road transportation and commercial flights collectively account for less than 20% of emissions. While we obviously still need to find cleaner, greener alternatives for our day-to-day activities, to focus on the individual impact on the environment irresponsibly places the onus of sustainability on the wrong group.

We can do better, but our companies need to do much better. No excuses.

•••

And when the solution is presented on a silver platter, it is swatted away in the name of "not enough profit."

Over the summer, MIT Technology Review wrote an article on the "lurking threat to solar power." From what I gained from the article, it seems the major problem is that solar panels produce more energy than we can store. This leads to the price of solar energy going down drastically, so much that investors are being disincentivized from investing in solar energy.

The need for better battery technology to store the excess energy for darker days is obvious, but this problem cannot stop us from investing in solar. If solar energy can really be so abundant as to drive prices into negative territory, we should be all over it, and particularly in investing in better batteries.

This is an instance where we can't rely on the market to move us in a green direction, and we must demand our elected officials invest in these renewable energies and technologies, no matter how deep they may be in the pocket of the oil and gas industry.

•••

The fact of the matter is that private individuals have a responsibility to change their habits for the sake of humanity and the world, but we cannot use this as a distraction from the changes our corporations must make that would have a much greater impact on climate change.

Yes, we will see a rise in prices and other negative effects from the consumer's perspective. But this is part of the struggle of holding corporations accountable for what they must do to reduce their pollution and waste. It is a sacrifice we must accept to get companies on the right environmental track.

Corporate America hasn't done its part in fighting climate change not only because they didn't want to, but also because we didn't make them. It's about time we do.

STORY Axel Icazbalceta
PHOTO Courtesy Creative Commons

Business leaders and climate activists have long been at odds. Here's a look at their opposing perspectives.

Our public statements about climate change have been truthful, fact-based, transparent, and consistent with the views of the broader, mainstream scientific community.

Casey Norton
spokesman at ExxonMobil

Climate change is a huge challenge, but it can be brought in line if governments, businesses and individuals work together.

Richard Branson
founder of Virgin Group

You can have a healthy fossil-fuel balance sheet or a relatively healthy planet – but now that we know the numbers, it looks like you can't have both.

Bill McKibben
co-founder of 350.org

Climate change is real. And yes, renewables are an indispensable part of the future energy mix. But provoking a sudden death of fossil fuels isn't a plausible plan.

Ben Van Beurden
CEO of Royal Dutch Shell

Fashion is on par to become a quarter of the global footprint of carbon. That's astounding. The industry isn't headed in the right direction.

Michael Stanley-Jones
co-secretary of the UN Alliance for Sustainable Fashion

People of conscience need to break their ties with corporations financing the injustices of climate change.

the late **Desmond Tutu**
archbishop, human rights activist

SOURCES: AXIOS, CNBC, SHELL

THE OZONE HOLE

This is the first of a three-part series about one of the biggest environmental crises the human race has ever faced –the Antarctic Ozone hole.

In the mid-1980s, meteorologist Jonathan Shanklin made a discovery that would rock the world of environmental science, one that would serve as a call to action for governments across the world to take human impact on the atmosphere seriously. And he did it almost by accident.

Shanklin was just sifting through data, preparing for visitors of The Antarctic Survey at the University of Cambridge, when he made the discovery. Other meteriologists had been worried about the effects of chlorofluorocarbons (CFCs) on the ozone layer before Shanklin, so he wanted to put the guests' worries at ease.

"Because of the concern about chlorofluorocarbons, I thought I'd show the public the latest data that I was working on," Shanklin said. "Then I'd compare it to 20 years earlier, and it would be the same."

It wasn't. Before 1979, the atmospheric ozone concentrations were above 220 Dobson Units.* But when Shanklin took the data from 1982, the concentration was below 175.

His boss told him not to worry.

"His thesis was that the amount of ozone that was trapped within the polar vortex, the strong circulation around Antarctica, was highly variable," Shanklin said. "One year, it might be low; the next year, it might be high. He wanted more convincing evidence."

But when ozone levels didn't return to normal, Shanklin's digging began.

"That gave me the incentive to work back through all the missing data," Shanklin said. "We had about 10 years where it was all still on the sheets of paper."

It was then that Shanklin knew that the low ozone wasn't just a two-year fluke. Given the assumption of CFCs at the time, areas surrounding the Equator would be particular points of interest. However, there was a definitive ozone hole over Antarctica, a breakthrough that changed current assumptions about CFCs.

"The prevailing theory at that time was that if CFCs were going to affect the ozone layer, they would do so at a high altitude above the tropics," Shanklin said. "That was the area where solar energy was greatest. It was therefore expected that oxygen atoms would be in a particularly excited state that would allow them to react with chlorine. So when we found something in Antarctica, that really shook the scientific theory."

The hole was large, too. Ozone levels continued to drop from 173 Dobson Units to 124 in 1985 alone. By 1991, levels were below 100 units. This drop, Shanklin says, causes extreme side-effects.

"There's one directly on people and living organisms, and that's when more ultraviolet light gets through to the surface," Shanklin said. "For us, that can cause skin cancers and cataracts. And, although the ozone hole is mostly over the Antarctic, in December, it can become quite elongated and stretch northwards over the tip of South America and the Falkland Islands. There, you have significant populations that are exposed to the effects."

Another result of the ozone hole is how solar energy affects the earth's weather.

"The other side-effect is that ozone itself is a greenhouse gas," Shanklin said. "Where there's less ozone, there's more solar energy coming through to the surface. You get a climatic effect that can spread beyond Antarctica itself, because you're changing the atmospheric dynamics. There's considerable evidence for changes in rainfall in the Southern Hemisphere and changes in the winds of the Antarctic continent. There are clear effects from the ozone hole."

The ozone hole demanded action. And it was up to the United Nations to find a solution.

CONTINUED ON PAGE 29

STORY Ian Dalrymple
PHOTO Courtesy Jonathan Shanklin

ON ICE Shanklin looks out across the icy plains on his most recent visit to Antarctica.

Jonathan Shanklin
meteorologist

*One Dobson Unit measures a layer of ozone 10 micrometers thick.

SOURCE: https://earthobservatory.nasa.gov/world-of-change/Ozone.

SECTION TWO

RIGHT HERE, RIGHT NOW

On April 22, 1970, Wisconsin senator Gaylord Nelson created Earth Day, a holiday meant to increase awareness about the world's environmental crises. While we've come a long way since then, old issues persist and new ones arise. Here are just a few ways we are tackling these problems right here, right now.

SMALL STEPS

Two local companies, Hivessence and Ruibal's Plants, detail what they are doing to help improve the environment.

All it takes is one person. One person to start a business. One person to help the environment. One person to make a difference.

When faced with failure, Businessmen David Burrows and Michael Ruibal both found redemption working on projects that can improve the world around them.

Though their companies may be small, the impact they are having on the community has allowed them to make profit while also educating others on the importance of taking care of the planet we live on.

After losing his job during the pandemic, David Burrows needed to find a way to pay his bills. However, since the country was shut down, finding a job was near impossible. Burrows's desire to help save the bees motivated him to create his fifth startup, with a goal of raising awareness for the endangered species.

David Burrows
founder of Hivessence

"My wife and I talked, and we came up with Hivessence," Burrows said. "Hivessence is an upcoming niche for skincare and supplements, and we can put honey into some of those formulations. We can then raise money to help save bees."

While also working on a project to help bee research and save them from hive collapse, Burrows learned just how valuable the species is.

FIFTH TIME'S THE CHARM David Burows's fifth startup company supports the conservation of bees and other pollinating animals.

"I really became fascinated with it because of a meme. It was Albert Einstein, and he said that if bees disappeared from the planet today, there would be a total collapse of life as we know it within five to 10 years. After seeing that, I knew I needed to continue focusing on bees, so I thought to myself, 'What else could I do?'"

Burrows's creation of Hivessence became a life mission after seeing the positive impact working with bees had. It allowed him to make a 501c called Arkearth, which helps gardens and farms continue what Hivessence has sought to do.

"We're doing a host of things with one simple action," Burrows said. "We are doing a whole phase of building community gardens everywhere from Dallas to Los Angeles while incorporating kids, teaching them and also raising money for scholarships. It gives kids in these disadvantaged neighborhoods the ability to get scholarships, so they can go on to universities, while also learning about beekeeping, biology and botany to help solve bigger, global issues."

GARDEN INNOVATION Ruibal's Plants uses new technology such as biodegradable paper pots, which prevent plastic from mixing in with the soil.

Thirty-five years ago, a nearly broke Michael Ruibal bought a ten foot by ten foot piece of cement near the Dallas Farmer's Market.

Now, Ruibal's Plants of Texas has four shops in the Dallas area.

When he was just starting, Ruibal's business capital came from simply going to the pawn shop.

"I used to take this ring to the pawn shop, and the guy would give me $350," Ruibal said, "so I can buy more plants and pay my rent. And then when I got enough money to pay him back, I would go pick it back up. So this was my finance right here. That's how I got started."

In the last couple of years, Ruibal has started a few projects to help the environment.

His biggest project is the use and production of ellepots, which are biodegradable paper flower pots.

"We own all these machines. That's how we make the ellepots," Ruibal said. "When a landscaper plants in little plastic pots, they have to pick up these pots and throw them in the landfill. Now, since the pots are biodegradable, the landscapers can just leave them. Besides helping the environment, it will also save 18% of time in planting."

In addition to using ellepots, Ruibal's is trying to use as few chemical companies as possible, rather than buying bugs that will kill other bugs in their greenhouses.

"We're just very aware of the environment here," Ruibal said. "We try to do everything that we can to participate in projects like these, and I think going into the future, the ellepots especially will become more common."

STORY Dillon Wyatt, Ben Adams
PHOTO Courtesy David Burrows, Michael Ruibal

FLIPPING THE SCRIPT: FROM LANDFILL TO NATURAL BEAUTY

The story of how the largest illegal landfill in Texas became a conservation center: The Trinity River Audubon Center.

The Trinity River Audubon Center, located 10 miles south of downtown Dallas, is a gateway to the 6000 acre Great Trinity Forest. And for many, it is a place for peaceful hikes, bird watching and environmental education.

But before the extensive nature trails, diverse wildlife and educational opportunities, the 120 acres the center sits on had a very different purpose.

Prior to 2008, in place of the renowned nature center was the largest illegal landfill in Texas, known as Deepwood. Not only did the dumping ground leak toxic chemicals, it caught fire on multiple instances, covering the surrounding South Dallas neighborhood in its smog.

Ironic, isn't it?

We spoke with Marcus Cole, educator and live animal coordinator at the center, to see how the National Audubon Society transformed this part of Dallas into a place that supports the environment and the neighboring community.

For over 30 years, the South Dallas Community suffered as a result of the landfill. Trucks filled to the brim with garbage would come in and out of that area throughout the day and night. Fires would last for months at a time, destroying infrastructure and nature. Finally, the surrounding community, called Pleasant Grove, decided they had to take a stand.

"They sued the city of Dallas through a long process, and they won the case," Cole said. "The gentleman who owned the landfill didn't have the means to remove the trash, so the city seized the land. The city was liable, and took over that process of removing the trash. It took almost three years to remove most of it."

However, a good portion of the waste accumulated in the Trinity River, and the city wasn't able to resolve this problem.

"There's a history of pollutants in the river long before the Deepwood landfill site," Cole said. "It's been a problem, and having this landfill in such close proximity to the river wasn't helping. Even today, if you were to come out here, there are sections of the river where the bend is, and water and trash collects in little pockets. I always show students when they come down here that there's still trash in the river."

Nevertheless, after the majority of the trash was removed, the National Audubon Society took on a contract to oversee the 120 acres of Dallas property. Ultimately, they built the nature center that is seen today for a variety of reasons.

"They had to decide how they could change it into an environmental asset towards the community that was directly affected," Cole said. "So, they made it a green space, one of the few available in South Dallas. It's a really beautiful building. It's in the shape of a bird, and made to complement the surrounding nature, because we're tucked into 6000 acres of forest and the largest bottomland hardwood forest in North America."

Even after the completion of the construction of the center, the job wasn't finished. The city still had to find a way to give back to the community that was so greatly afflicted by the uninvited pollution in its area.

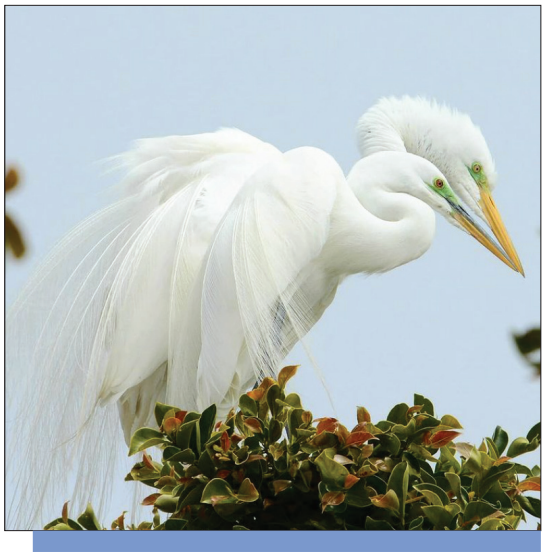
"When the National Audubon Society went to Dallas, they first worked to open this Nature Center, and then their goal was to give back to the community with the large number of educational programs that go on here," Cole said. "In addition, they offer free admission for life to anyone that lives in the same zip code as the center."

Currently, the center is still trying to give back to the South Dallas community. That is one of their biggest initiatives.

"It should be our job to go out to the community and make ourselves established and known," Cole said. "We want to invite them to our facility, and give them a place to enjoy nature and the environment. It's a very different place than it used to be, and we want people to take advantage of that."

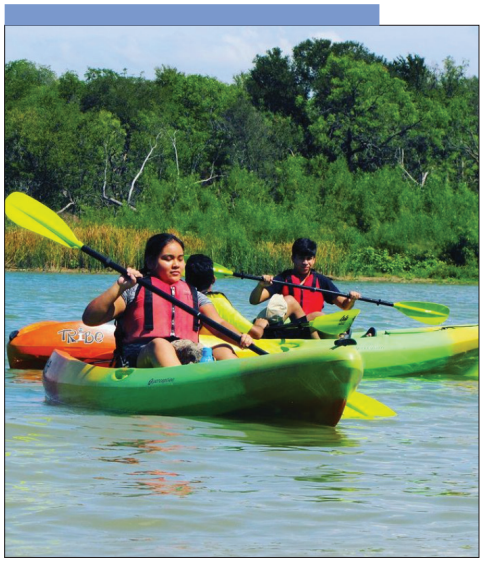
STORY Shreyan Daulat, Myles Lowenberg
PHOTO Courtesy Marcus Cole

BIRD'S EYE VIEW The new Audobon center has been constructed in the shape of a bird, symbolizing the center's primary mission of conservation for the various birds and other species around the Dallas area.



VIRAL Groundwork Dallas, through the use of their instagram @groundworkdallas, promotes the conservation of endangered species such as the Great Egret (above).

ON BOARD Volunteers at Groundwork Dallas' Green Team get the chance to kayak as they help clean rivers.



THE SOCIAL BENEFIT

To promote the conservation of nature, one organization looks to the power of the internet.

With the transition to online accelerating in recent years, environmental organizations can now reach out to millions with the click of a button. For Groundwork Dallas, a nonprofit organization focused on preserving and restoring nature in Dallas, this involves leveraging tools like social media to spread its mission while sharing work opportunities to those who are interested.

"A lot of the students I work with are looking for a job opportunity in the environmental field, so sometimes I post about job openings they can apply to," Groundwork Dallas Education Director Katherina Kang said. "For example, the National Park Service out in Montana had some openings for Youth Conservation Corps leaders, and I was more than happy to recommend students for it."

In addition to job opportunities, Groundwork Dallas uses social media to spread awareness about community development and education and to share outreach events.

"We often post about things people should know about our surroundings, and we're trying to start up a weekly 'Did you know?' bulletin sometime soon about the Trinity River and the local Dallas ecosystem," Kang said. "Other than that, it's mostly just events, flyers, conservation trips and educational segment days that anyone can join as long as they sign up."

Sharing these opportunities is critical for Groundwork Dallas's goal of educating interested individuals through real-world restoration projects.

"We focus a lot on providing conservation experiences for people interested in the environmental science field," Kang said. "We train them in things like water quality testing, environmental assessments and trail building, depending on whatever career goals they have for their future education."

By utilizing social media along with other traditional outreach methods, the organization has been able to organize large restoration projects, like the Frasier Dam Recreation Area, a five-year project which just opened up to the public a few months ago.

"The area around the dam was originally an illegal dumping site and was filled to the brim with trash," Kang said. "For the past five years, we've gone in with our staff and volunteers to renovate, put in new trails, create picnic sites and get rid of all the trash that we possibly could. Now, it's 110 acres of preserved urban forest right here in Dallas."

Above all, Kang's favorite part about her job and about tools like social media is being able to share more opportunities.

"My favorite thing working with Groundwork Dallas has got to be the opportunity that we provide," Kang said. "A lot of students don't seem to understand that there are resources available for them to join very easily. Through outreach, we're able to share these opportunities with them."

STORY Aaron Liu, Dawson Yao
PHOTO Courtsey Groundwork Dallas

CARBON EMISSION TRADING

Carbon emission trading has occured for over 20 years, yet many people don't fully understand it. What are carbon credits? Is this a viable solution to climate change? Can it also help nations economically? Here's both sides.

Carbon emissions trading is an approach to limit climate change by creating a market with limited allowances for emissions — carbon credits. One carbon credit is equivalent to one ton of carbon dioxide. The 1997 Kyoto Protocol was the first major international agreement to lower greenhouse gases. At this meeting, 38 countries committed to emission targets assigned by the United Nations and timetables to enact their respective plans. If a country exceeds their emission limit, they can purchase more carbon credits. On the other hand, a country that is under their limit has the ability to sell their remaining carbon credits.

PRO

- **It lowers competitiveness** of fossil fuel production and increases investments into low carbon energy sources such as windmills or solar panels.
- **It decreases the number** of deaths related to air pollution. A 2017 study found 1.23 million air pollution related deaths in 2010 China. Another study found that premature deaths as a result of air pollution will increase drastically by 2060. Executing various emission plans of respective countries will result in less deaths and less pressure on healthcare systems.
- **Carbon taxes** can be used to bolster the economy while still prioritising the reduction of emissions. In addition, the tax can lower the reliance on foreign fossil fuels and government spending.
- **It incentivices countries** to stay under their carbon emission limit, so that they can sell remaining carbon credits. If countries can put successful systems into place to lower their carbon footprint, they will benefit economically.

CON

- **It puts a disproportionate** emphasis on individual lifestyles and carbon footprints, distracting from systematic and political changes that can be instituted to fight climate change.
- **It allows countries** to put systems into place that produce emissions without consequences, depending on the EU Emissions Trading Scheme to take care of the problem. For example, under the proposed 2009 Waxman-Markey bill in the United States, 43 new coal plants were to be engineered, resulting in 150 million tons of carbon dioxide each year for the following five years.
- **Corporate profitability** should not be a part of the equation to solve climate change. Polluting corporations and governments have gained massive profits because of the money-making trading of carbon credits. In addition, some industrialized countries invest a relatively marginal amount of money into a third world region to establish eco-friendly systems. In return, they recieve carbon credits, and the exploiting continues.
- **It has too much reliance** on the carbon market. Important decisions, opportunities and discussions regarding climate change are disregarded in favor of "leaving it to the market." This is corrupt, because a significant part of the carbon market's paramaters were determined by some of the biggest polluters.

STORY Shreyan Daulat
PHOTO Courtesy Creative Commons

WEIGHT OF THE WORLD

SAVING ENERGY Inside of the physical plant rooms by Nearburg sit two Trane chillers with condenser and chill water pumps and motors that supply cooling water to campus buildings. These chillers have control panels and variable frequency drives for greater energy efficiency.

As each new generation is born, the impact on the environment from the previous one carries over. What weight does the school have on its shoulders to be green?

Whether it's updating the Christmas lights to LEDs or implementing a new irrigation system, the school is constantly evolving across departments.

With changes happening almost every day, the potential for new and improved technology exists as an option in advancing the school.

When having a say in what features are added, does the school take environmental impact into account? Does it even have a responsibility to do so?

Headmaster David Dini sees maintaining green policies as being one of the school's duties and one that requires community-wide commitment.

"[Being environmentally friendly] is something we consider as part of the school's general responsibility in terms of operations," Dini said. "Whether it's building new buildings, overseeing them, food services or recycling, there's a wide array of areas that we consider general responsibility. It's just expectation that we operate in a responsible way, acknowledging the importance of sustainability."

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Keeping the school's systems up to date with a focus on being environmentally friendly is a task that Director of the Maintenance and Physical Plant Department Mark Webb takes leadership in.

"My responsibilities are to maintain and run the physical plant with the forethought of energy conservation, sustainability and being mindful of the capital and operating budget that the school Board has approved from year to year," Webb said. "I make sure we're upgrading systems that not only are getting older, but also upgrading systems to make them more energy efficient."

One of the central systems of the school, water and irrigation stand out as an area on Webb's list where he would like to see improvement.

"I'd like to see us use a catch basin system that would capture water from all of our gutters," Webb said. "Then we could either have an above ground or underground tank that would capture that water, where we'd use it for Porvair irrigation. We're using millions of gallons to keep the grass green, trees and shrubs watered and flowers blooming, so it'd be nice to be able to get some free water."

Recently, solar power has grown in popularity as a renewable energy source and holds value in its environmental benefits, and Webb has considered the system for the school.

"You need to put it on a building that has a roof that is south facing, and it's got to be aesthetically pleasing," Webb said, "so we've got some hurdles to overcome there, but that's something else that we're continuing to look at and see if it's cost effective."

LED LIGHTING ALSO HOLDS environmental advantages in its increase in energy efficiency compared to traditional forms of lighting. On campus, Spencer Gym, the Ralph B. Rogers Natatorium, the Mullen Fitness Center, part of the Cecil and Ida Green Library and the parking lot are among areas that have LED lighting installed, according to Webb.

"When the Winn Science Center was built, it was completely installed with LED lighting," Webb said. "The Hoffman building and Centennial Hall building, when they were built back in 2008, did not have as much LED lighting in them, but we're converting all that to LED. The school is probably at about 75 percent, so we're getting real close."

Science Department Chair Fletcher Carron also plays a role in the school's effort towards being green. For the Winn Science Center, Carron was part of the Architecture and Construction Planning Committee, where he communicated needs of the science program.

LEED (Leadership in Energy and Environmental Design) Certification is a rating system that evaluates building specifications to encourage environmentally friendly systems. The Winn Science Center reached the Silver LEED Certification level in its construction, an achievement Carron believes is consistent with their values as a department.

"For institutions that have the money to be certified, that ought to be a new baseline minimum," Carron said. "You can earn most of those points just by using the right thickness of insulation, having good indoor air filtration or little things like automated light sensors. If you add that up for hundreds or thousands or millions of buildings worldwide, that's when it begins to have an impact."

Dini was on board with the decision to pursue the certification during the planning process of the building.

"It came up a few times in meetings like, 'So we're going to do that, aren't we?,'" Dini said. "That was a quick, 'yes,' more like an expectation. It had been established that we have to do that.'"

In constructing the building, new features were added that weren't a part of the old building, a change Carron believes could impact the community's commitment to being green. One of these features is a count of water bottles saved at the fill-up station.

"I think every little bit of awareness helps and has an impact on people that's hard to predict over time," Carron said. "Ten years from now, who knows which of our students will ultimately have an impact in combating climate change, but I hope some will if we plant the seed early."

In planning for the new athletic center, Dini hopes to continue the dedication to having environmentally friendly buildings by earning LEED certification once again.

"Our expectation would be that we deliver the highest level of sustainability that we think is meaningful and appropriate," Dini said. "Recognition is not the goal, but rather driving towards a model and approach that provides the highest degree of sustainability that we can."

STORY Will Pechersky, Aaron Augustine
PHOTOS Will Pechersky
ILLUSTRATION Morgan Chow

HOT WATER A pair of Patterson Kelly package boilers supplies domestic hot water to the kitchen and four of the campus' buildings. The boilers can be staged to run from 20 to 100 percent depending on demand.

CULTIVATION & EDUCATION

Without big budgets, large teams, or extensive training, clubs on campus seem to have it rough when it comes to dealing with environmental damage. So, how do they address this issue?

Juniors Akash Munshi and Sam Adams both lead clubs that focus on education and mitigation of climate change and environmental damage. While their clubs differ in the details, they share common ground when it comes to overarching goals. Their clubs are responsible for discussing climate change and addressing an array of environmental issues from biodiversity to energy savings.

Munshi says the Cultivation Nation has three main objectives, the first of which involves educating students about the importance of native plants in the ecosystem.

"We've done an event with the fourth-graders this year," Munshi said. "We did one last year, and we hope to do a few more this year. We also became a nonprofit, and through that, we're hoping to do some education with other schools."

The second branch of the club involves food donations, which can make a significant impact despite the limited space in the greenhouse.

"[We] grow our own food in the raised beds here," Munshi said. "We're hoping to get more raised beds, and our goal is to grow and donate more produce."

The final directive of the club are its gardens in public areas meant to protect species around the Dallas area at risk of extinction.

"We have a partnership with the Northaven trail," Munshi said. "We've done our first pollinator garden on Northaven Trail and Hillcrest, so that's a public garden."

Because of the location, Munshi can plant a wider range of species that better target species and habitat endangerment.

Akash Munshi
Cultivation Nation
student leader

"They're all native plants with a strong emphasis on milkweed to help the native Blackland Prairie insects and plants, which are critically endangered," Munshi said.

The work extends beyond visible education programs or public planting efforts. To allow for further native planting in the future, Munshi started to store the seeds, helping to preserve biodiversity one step at a time.

EXPERIMENTATION Munshi and his club members learn the intricacies of sowing seeds.

"We started creating a seed bank [because] we have a lot of native seeds," Munshi said. "We're pretty much planting all the native plants from seeds now, but during the winter, I want to collect native plant seeds, so we could build up our native seed reservoir."

Adams says that the goal of the Green Mark's Club is to bring awareness about the issue of climate change to the community at 10600 Preston Road.

"Our main mission is to help educate St. Mark's students and those in the community about the environment," Adams said. "It's about what the problems that exist are and what they can do to help fix them."

The club has focused on educating Lower School Marksmen on the importance of the environment through projects and presentations.

"For the last three years, we have gone down to the Lower School and given presentations to the first and fourth graders about different environmental topics," Adams said. "We also helped educate them on certain things like recycling, pollution, and what they can do to help. It's something as easy as just putting their plastic bottles in recycling, taking a shorter shower, or trying to carpool with a friend."

To Adams, getting the community involved in events is important.

"As leaders, we help set up community service events," Adams said. "We help facilitate the planning for Lower School teaching. There's nothing too terribly crazy that we do as leaders, but it's a lot of making sure that people get to where they need to be, whether it's for a service project or for a Lower School class like we did earlier this year."

Adams recognizes the impact climate change has had on the environment.

"As an organization, we're doing our job to help fight climate change by starting with the younger kids and helping educate them," Adams said. "There's a lot of damage that's been done, and we're going to need kind of bright minds going forward to come up with ideas about how we can fix some of the problems that we have like pollution in the atmosphere and greenhouse gases."

Sam Adams
Green Mark's Club
student leader

Some of the more surprising ideas come from the younger students, and for Adams, that is the most important part of the experience.

"I've seen the most clever solutions come from somebody that you wouldn't expect it to come from," Adams said. "By educating we can help set up a better future."

STORY Nikhil Dattatreya, Grant Jackson
PHOTO Nikhil Dattatreya

ON KNIFE'S EDGE

The modern industrial way of life has brought the environment to the brink of collapse. In a world of must-haves, should polluting foods be the first to go?

Practice just ended.
You're sweaty. Tired. Exhausted.
And hungry. Oh, so hungry.
You swear nothing other than a large, tender steak would make you the happiest person on earth.

But you're in a pinch, caught up in the commotion of everyday life, and need something quick. So, you stop at your favorite fast-food place, and order that delicious burger you've been craving — the one with a sesame seed bun, some delicious variety of cheese, that secret sauce you can't seem to find the recipe for, and the star of the show, that juicy all-beef patty.

But chowing down on that mouth-watering burger can have consequences that go way beyond the bathroom scale. Our diets can affect the planet in more ways than one, according to the University of Texas at Dallas's Director of Sustainability Gary Cocke.

"Our palettes are often very meat heavy, especially in the United States," Cocke said. "The problem with that is, as you raise cattle, you often take grain, which requires resources to grow. As you feed that grain to the cattle, it takes a lot more of those resources to produce one pound of meat."

These resource drains are just a small portion of what goes on behind the scenes of meat production.

"There's just a whole bunch of water, carbon and assets that go into a meat-intensive diet," Cocke said. "All of that has a carbon footprint that affects our atmosphere."

Meat, however, isn't the sole culprit in food's overall environmental impact. The vast occupation of land by food production infrastructure also comes with its own problems.

"We remove natural areas and convert them to cropland," Cocke said. "To begin with, those natural areas are better off sequestering carbon. Then, we use fossil-fuel-based fertilizers and put them onto the crops."

Gary Cocke
Director of Sustainability at UT Dallas

Additional problems arise when consumers don't clean their plates. According to the United Nations Environment Programme, approximately one third of food produced around the world — about 1.3 billion tons — is wasted.

"When we waste food, much of it goes to landfills," Cocke said, "it creates methane as it decomposes, which contributes to climate change. There are many parts of the lifecycles of our food that can contribute to climate change."

Aadi Khasgiwala
Junior Class president

In order to soften the effects our diets have on the environment, Cocke suggests that people consume food lower on the trophic ladder, meaning food that is closer to the bottom of the food chain.

"The lower your diet is on the trophic ladder and the more plant-based your diet is," Cocke said, "the less impact you're going to have on the environment."

Maintaining such a diet is something life-long vegetarian junior Aadi Khasgiwala believes is fairly simple.

"Everyone is generally pretty accommodating to vegetarians," Khasgiwala said. "Even when I traveled abroad, it was possible to find vegetarian food, which I feel is even easier in the United States."

Khasgiwala reassures those worried about the healthiness of switching to a plant-based diet.

"Some of the top athletes in the world compete on a vegan diet," Khasgiwala said, "so why should we be concerned?"

Other than reducing the amount of meat we consume, there are certainly other pertinent ways to approach the climate crisis from a food standpoint, some of which involve government strategy.

"On a production level," Cocke said, "I think it's important that we try to prevent the tillage of wild lands as much as possible, and I believe policy should be pursued to accomplish that, as well as a policy to make our growing as sustainable as possible. We could reduce the amount of fertilizers and pesticides we use, as well."

Junior Akash Munshi believes that reducing the amount of space used to grow crops and becoming more self-sufficient is another key step to solving harm created by food production.

"During World War Two, due to a shortage of farmers," Munshi said, "people tended to grow much of their produce in their yard. People don't realize how, in a ridiculously small area, you can grow a ton of produce. I think it would be extremely beneficial to the environment if we got rid of a large part of this farming system, which is going to struggle to feed everyone due to pure land area. If people learned to grow [produce], they could transform their yard into a garden, which saves water."

Furthermore, Cocke believes that poor leadership can lead to disastrous consequences for the planet.

"Wildfires such as the [2019] Amazon rainforest fires," Cocke said, "are oftentimes

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By the **numbers:**

70 percent of total human freshwater consumption used by agriculture

1.7 billion acres — nearly half of all cultivatable land — devoted to growing corn, wheat, rice, and other staples.

600 percent increase of reactive nitrogen levels in the environment as a result of fertilizer pollution

SOURCE: NATIONAL GEOGRAPHIC

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intentionally set by rural, impoverished farmers that were given a wink and a nod from their government that they would not get in trouble if they were to set fire to the rainforest, with the goal of converting it to farmable land. This is all conducive to environmental harm."

As the global climate crises worsens, Khasgiwala carries a message to those who think their impact may not be felt.

"You may think you're only one person," Khasgiwala said, "something as simple as changes in your diet can add up if you have hundreds of thousands of other people doing the same thing as you."

Similarly, Cocke believes big changes begin with small steps.

"As the next generation inherits these issues going forward, they will be tasked with the challenges of sustainability," Cocke said. "I hope that, once people graduate and find their niches, they will assert their values and inspire positive change. None of these issues are solved through individual action alone, but they don't get solved without individuals taking action."

STORY Will Spencer, Zack Goforth
PHOTOILLUSTRATION Will Spencer

RIPE AND READY Oranges are just one of many fruits and vegetables that Munshi (below) helps grow in the greenhouse.

Being vegetarian– How much does it really help?

—Personal commentary by
Myles Lowenberg, *ReMarker* issues editor

The short, unsatisfying answer to so many questions about being vegetarian is "it depends." Is vegetarianism helpful to the environment? Is it healthier than eating meat? Overall, should you be vegetarian?

The first question might seem like it has an easy answer: animals have to be fed and given large amounts of water before they are killed for meat, so that would naturally be worse for the environment, right?

All of those things are true, but there are also plants that have high methane emissions like rice and vegetarian foods like avocados and almonds, which take up a massive amount of water. They also often have to ship long distances, further polluting the Earth. Getting rid of meat in one's diet still reduces emissions, but sustainable methods can be developed for all foods.

Myles Lowenberg
Issues Editor,
ReMarker

One of the most important eating adjustments to make has nothing to do with meat. The consumption of palm oil contributes heavily to deforestation in tropical regions, increasing air pollution and climate change, as well as destroying habitats for endangered species. It's in many packaged foods, but just checking the ingredients and buying an alternative is one example of being able to eat more sustainably without sacrificing any sort of taste. Not wasting food is another obvious way to help.

Ultimately, better policy and innovation has to factor into making food more sustainable, and simply switching from meat would help, but not be sufficient to solve food's problems.

Being vegetarian also does not mean being healthy. At its core, losing weight is just based on burning more calories than one consumes, and while avoiding red meats especially can help with eating less calories, it is certainly no guarantee of good health.

I don't have a set reason for being vegetarian, but there are certainly benefits. However, someone can be a vegetarian and still be unhealthy or have high emissions, even if the diet does help prevent those things.

THE MONTREAL PROTOCOL

Shortly after Shanklin discovered the ozone hole, the United Nations responded by creating the Montreal Protocol. In order to keep the hole from growing, the protocol regulated chemicals that destroy the ozone layer. It worked, but it wasn't easy to implement.

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In 1989, roughly four years after Shanklin's discovery of the ozone hole, the Montreal Protocol went into effect. The protocol, created and ratified by all 198 members of the United Nations, regulated nearly 100 ozone-depleting substances. And, according to Dr. Maria Ivanova, Associate Professor of Global Governance at the University of Massachusetts Boston, it was a success.

"The Montreal Protocol succeeded in pretty much everything that it set out to do," Ivanova said. "It took the scientific evidence, the discovery of an ozone hole, and it figured out what we needed to do to address it. That was collective action."

Ivanova says one of the reasons it succeeded was the help it gave to countries that needed it.

"Even though it was a global commitment with a global goal and a common timeline of phasing out CFCs, the leadership realized that we cannot make developing countries commit to exactly the same thing and not support them," Ivanova said. "Their timeline was extended. There were financial supports for the transition, there were sanctions for those who did not implement the commitment, and there were various types of institutional support that allowed countries to do what they had committed to do."

Maria Ivanova
professor

Ivanova says this is a major roadblock in implementing environmental policy.

"There are different countries with different capabilities, and they need to take different steps at different timescales with different amounts of support," Ivanova said. "The current narrative that is repeated again and again of a level playing field actually diminishes the differences in both the capability to address the problem and the responsibility for the problem. Historically, we in the developed world bear a much larger responsibility for the problem of climate change, and therefore have to take a much more significant action towards solving it."

But, although Ivanova believes that accommodating developing countries is critical to saving the planet, it is not the only way humanity's approach needs to change. The biggest issues lie in how people see the Earth.

CONTINUED ON PAGE 40

STORY Ian Dalrymple
PHOTOS Courtesy Maria Ivanova, Creative Commons

SOURCE: www.unep.org/ozonaction/who-we-are/about-montreal-protocol.

FIGHTING TOGETHER Ivanova stands with former United Nations Secretary-General Ban Ki-moon

SECTION THREE

MOVING FORWARD

So now what? We understand the weight, the consequences of inaction. Some of us are already working toward a better future, but that's not enough. If we want to realize this future, we all have to do our part. What will we do moving forward?

ALTERNATIVE GLOBAL WARMING SOLUTIONS

Artificial trees? White paint? Tin foil? Here's a look at a few eccentric remedies to the changing climate.

Man-made trees

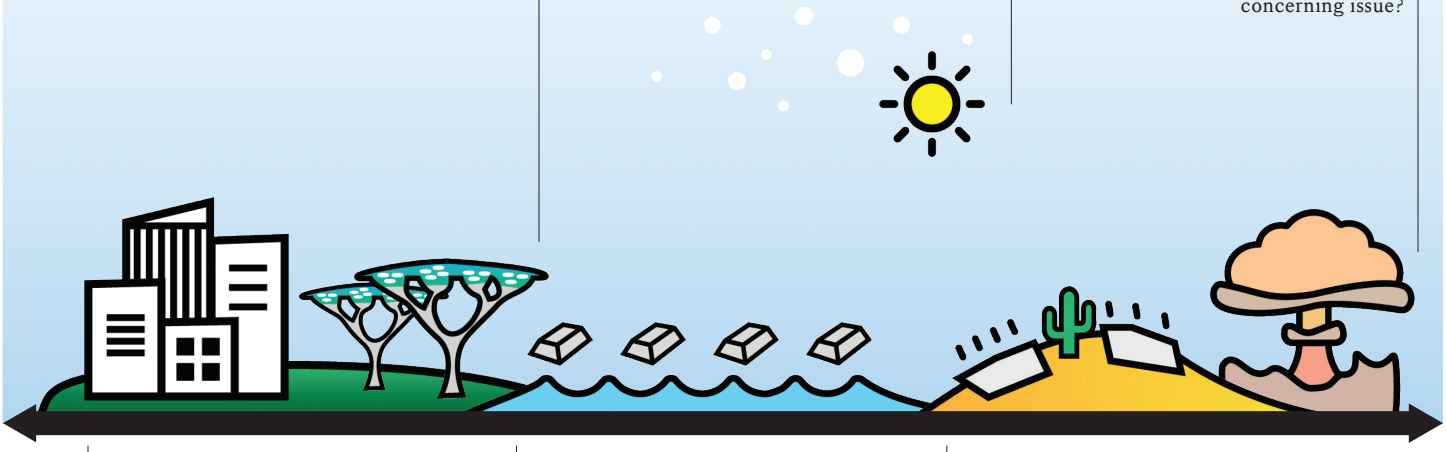
This artificial foliage would filter and take pure carbon dioxide out of the atmopshere, then trap the gas underground.

Sulfur skies

Sulfur is known to contribute to many compounds with not so great odors, but its property to be an aerosol, or be suspended in air, can aid in combating a warming earth by reflecting sunlight.

Nuclear wastelands

All-out nuclear warfare would certainly curb the warming climate, as the immense volume of soot in the air would drop temperatures dramatically, but would global warming be the most concerning issue?



Color it white

A white color on roofs means that less energy is needed to cool down houses because it reflects the sun's scorching heat (at the cost of a bland color scheme).

Iron oceans

Dumping iron into the ocean doesn't seem like it would help more than it would hurt, but because of tiny iron-loving plankton in the ocean that absorb carbon dioxide, this solution is quite effective.

Tin foil deserts

Reflecting sunlight is a goal that many of these solutions aim to acheive, but covering all unused lands with tin foil is certainly an unconventional way to do it.

ILLUSTRATION Morgan Chow

SOURCE: ROYAL SOCIETY, 'GEOENGINEERING THE CLIMATE' (2009)

SPACE ESCAPE?

As 'The Human Effect' takes place on planet earth, 40 billion escape plans watch from far beyond the atmosphere. But even if only one planet existed within human reach — would it be worth a try?

Former SpaceX rocket engineer Michael Gilliland '13 certainly thinks so.

"We're right on the precipice of seeing humans on another planet," Gilliland said. "I think we will see humans on Mars within our lifetime — and that's pretty exciting."

Gilliland, who found his way to SpaceX after taking a fascinating fluid mechanics course, sees transportation as our most significant limiting factor.

"The key enabler will be having rockets that are large enough to carry meaningful payloads," Gilliland said. "And having these rockets be reusable so we can avoid huge resource strains on Earth, as well as having them use propellers that are semi-sustainable."

Gilliland believes a day-to-day living difference will develop between Martians and Earthlings, and finds it kind of terrifying to think about.

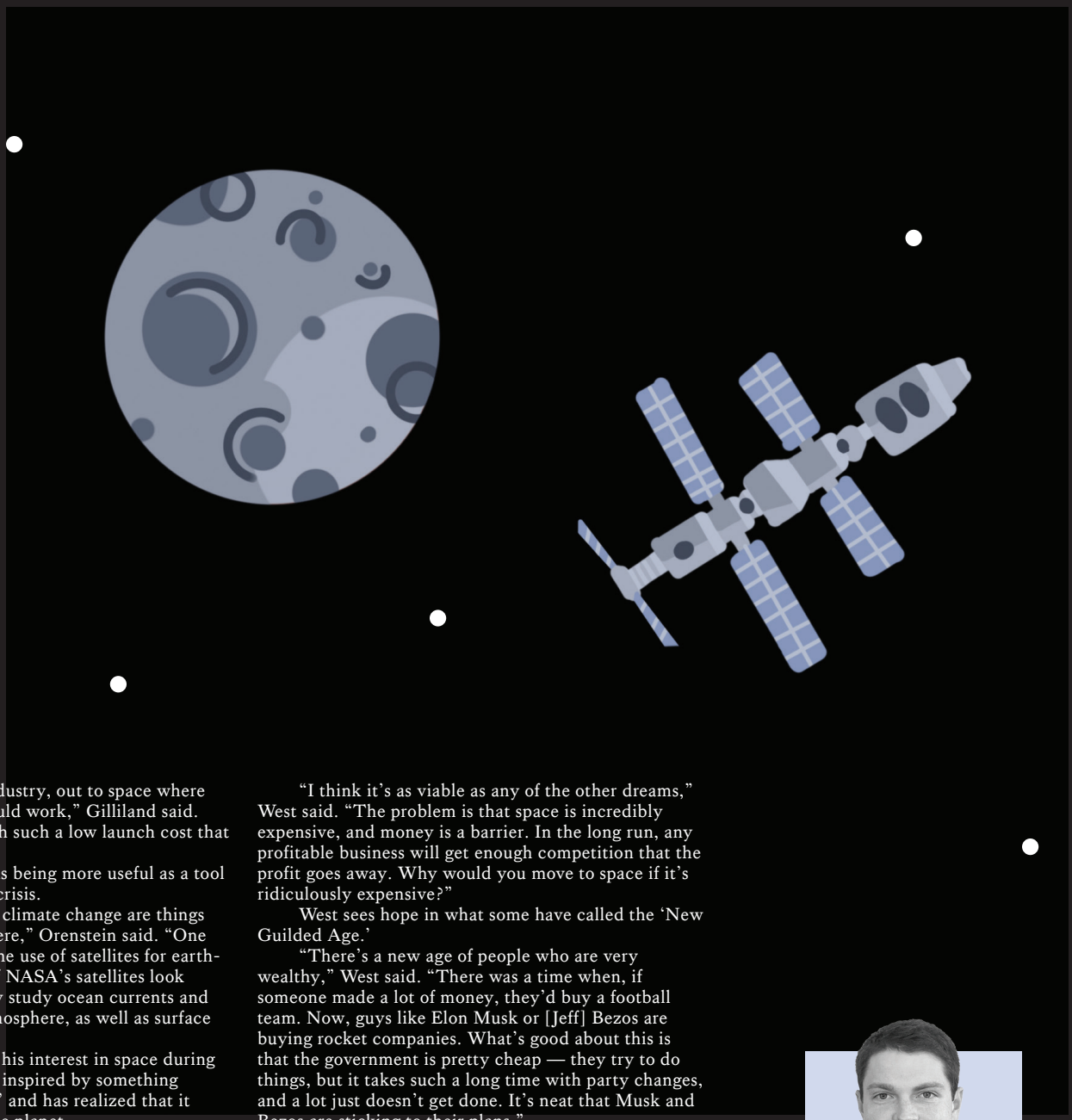
"The human body starts to develop in slightly different ways when it's in a third of the gravity it's used to," Gilliland said. "Your heart doesn't need to work as hard, and your eyes can start to change shape."

Nick Orenstein '01, former SpaceX crew equipment engineer, sees underdeveloped life-support systems as another barrier to interplanetary survival.

"Specifically, closed-loop life support systems would be a huge improvement we don't have fully fleshed out yet," Orenstein said. "That means all waste byproducts of the habitat — the air we breathe, food waste and body waste — wouldn't leave the full system. It would need to be recycled and reused so that they wouldn't need to resupply. The International Space Station, for example, still needs breathing air and water brought up to it. It's not a fully closed loop."

Beyond relocating entire populations, Gilliland believes another possible solution could be to isolate waste in parts of space like the moon.

"Moving things that are detrimental to the



environment, like heavy industry, out to space where they don't really matter could work," Gilliland said. "But we really have to reach such a low launch cost that it makes economic sense."

Orenstein sees space as being more useful as a tool in fighting Earth's climate crisis.

"I think the drivers of climate change are things that are happening down here," Orenstein said. "One solution space provides is the use of satellites for earth-based observation. Some of NASA's satellites look down instead of out — they study ocean currents and gas compositions in the atmosphere, as well as surface temperature and weather."

Orenstein, who found his interest in space during his childhood, was initially inspired by something called the 'overview effect,' and has realized that it plays a role in protecting the planet.

"It means seeing the planet's fragility from orbit," Orenstein said. "Seeing the interconnectedness of everyone who lives here, along with the planet itself as a living being. Those who have been lucky enough to do so on a frequent basis are observing noticeable climate change. The ice in the sea is decreasing; the clouds are different; the storms are bigger. All the things we read about in the news, astronauts are able to see at scale with their own eyes."

One space-related potentiality in the global warming conversation is building an enormous sunshade, with the essential goal of mitigating some of the sun's radiation.

"I think shading the planet is pretty infeasible for a number of reasons," Orenstein said. "One simply being the size it would have to be. Beyond that, the sun isn't any hotter than it used to be — we just have cities with so much concrete and so few trees that the average temperature has risen. We have deforestation and increased aridity in areas. There's just more absorption of heat on the planet."

John West '79, former manager of space studies at Draper Laboratory, approves of building a sunshade but thinks we have a long way to go before any space-related solution is successful.

"I think it's as viable as any of the other dreams," West said. "The problem is that space is incredibly expensive, and money is a barrier. In the long run, any profitable business will get enough competition that the profit goes away. Why would you move to space if it's ridiculously expensive?"

West sees hope in what some have called the 'New Guilded Age.'

"There's a new age of people who are very wealthy," West said. "There was a time when, if someone made a lot of money, they'd buy a football team. Now, guys like Elon Musk or [Jeff] Bezos are buying rocket companies. What's good about this is that the government is pretty cheap — they try to do things, but it takes such a long time with party changes, and a lot just doesn't get done. It's neat that Musk and Bezos are sticking to their plans."

Outside of more expensive space-related escape plans, West referred to one, more short-term, possibility — mining 'helium-3' on the moon.

"This isotope of helium, believed to exist in sufficient quantities on the moon for mining, could be used as fuel," West said. "Most current nuclear reactors use nuclear fission. The theoretical dream reactor is a fusion reactor, and helium-3 would be one of the fuels. We could see something like a gold rush on the moon."

Ultimately, even beyond climate change, Orenstein thinks space provides a way that the whole planet can work as a collective on grand projects that bring us together.

"The International Space Station is the best example of international cooperation," Orenstein said. "We have people up there from America to Russia — countries that haven't always had the closest political relationship. Up in space, astronauts are team members, share meals and work together on a daily basis. They're international partners doing things for the good of all humanity."

STORY Austin Williams, Ben Adams
ILLUSTRATION Morgan Chow

Michael Gilliland '13
former SpaceX rocket development engineer

Nick Orenstein '01
former SpaceX crew equipment engineer

THE NEXT STEP

Every year, more and more Marksmen walk across the stage at Commencement. Every year, humanity's impact on the planet continues to grow. So, as we leave our homes and move on to the wider world, it begs the question:

What kind of an impact will we make?

What do you think is the general attitude towards climate change with the younger generation, specifically with Marksmen?

Sophomore Baxter Perry-Miller: Obviously, nobody wants climate change, but I think not many people know how to actively fight and stop climate change. People are interested in stopping climate change, but they may not know where to start or how to contribute to stopping it.

6th-grader Parker Oskoui: It's definitely a pressing issue because when we get older, I think it'll become more of a problem. It will affect our generation more than older generations.

What do you know about the climate crisis?

3rd-grader William Medland: I know that when people litter it kind of changes the air and goes up into the ozone layer and breaks it so that more sun rays can come in.

William Medland
third-grader

How do you help the planet, both on a daily basis and in general?

Senior Henry Piccagli: To be honest, I don't do nearly as much as I could be doing. I recycle as much as I can, I pick up any loose trash I see, I try to use reusable items over plastic, but that's about it. I don't feel the effects of climate change enough to drastically shift my daily habits such as eating meat, using electric over gas, or in the future, shifting my career path to work for a more 'sustainable company.

Baxter Perry-Miller
sophomore

WM: When things say that you can recycle, I don't normally put it in the trash can. But if there's nowhere else to put it, I would probably put it in the garbage.

Do you think we should prioritize helping the environment over something like bettering the economy?

Senior Blake Molthan: Climate change has become such a political issue, but in theory, it should be prioritized at the expense of the economy in certain cases. But we're trying to do that right now, and a lot of countries are still emitting huge amounts of carbon dioxide into the atmosphere. We can't make as much significant change as we want to with the money we're putting into it when there's not a global unification behind the cause.

Junior Will Grable: I think there's actually a very strong business case to be made for sustainable practices. I'm not an expert on that, but, from what I've heard, companies who seek to not harm the environment can actually improve their performance. That's an avenue where you could see a coupling of sustainability and economic performance.

Do you think that we're going to be the generation to solve the climate crisis?

WM: I think we might need a bigger community. But I think we can make a pretty big impact.

Is it too late for our planet?

Blake Molthan
senior

WG: I think there's already been a lot of efforts to kind of help the environment around Dallas. We've already got what knowledge we need, and we know what needs to be done. It's just a matter of whether we actually take those steps.

BM: I want to say no, but maybe I'll bite my words one day. I think doing something is better than doing nothing. Getting in on that as early as possible should be our priority. Rather than adopting this mentality of 'There's nothing we can do, so we might as well do nothing,' having that optimism and thinking, 'Hey, we can still make significant change' and making sure that we can help maintain our planet, that's the only way that we'll move forward.

STORY Ian Dalrymple, Peter Orsak
PHOTO Courtesy Creative Commons

STUDENTSSPEAK

We sent out a poll to Marksmen with three questions. Here's what they said:

'Humans are significantly hurting the environment.'	**51.1%** Strongly Agree (117)	**41.9%** Agree (96) **5.2%** Disagree (12) **1.7%** Strongly Disagree (4)
'Addressing environmental issues should be one of humanity's first priorities.'	**46.7%** Strongly Agree (107)	**40.2%** Agree (92) **10.5%** Disagree (24) **2.6%** Strongly Disagree (6)
'We should do whatever it takes to stop climate change, even if it i mpacts the economy.'	**21.0%** Strongly Agree (48)	**40.6%** Agree (93) **29.7%** Disagree (68) **8.7%** Strongly Disagree (20)

Poll reflects responses from 229 students

LOOKING BACK

Growing up in the late 20th century, Science Department Chair Fletcher Carron saw the emergence of many environmental movements. Now, he gives his take on how the climate crisis has evolved.

PO: Was climate change an issue people talked about when you were a kid?

FC: No. Environmental issues were talked about, but for us, environmental issues meant things like clean air, clean water, species degradation and habitat loss — not so much global warming. For example, the Amazon rainforest was a big thing in the early 90s. Earth Day was all about saving the rainforest. And I still feel like those other issues are very important, though they now receive less attention because everybody's so focused on climate change, which is a huge environmental issue but not the only environmental issue.

Fletcher Carron
Science Department Chair

PO: Do you think we've done permanent damage to the environment?

FC: Permanent for our lifetimes? Sure. My kids' lifetimes? Definitely. This cannot be reversed quickly. The wheels have begun turning, and there's a lot of inertia behind this process. The carbon is in the atmosphere. If we don't put in a shred more, the globe's going to still keep warming.

PO: Is it too late for our planet?

FC: Global warming is not going to hurt the earth — the earth will be just fine. The Earth may do better without us. Global warming will impact humans and the species currently living on Earth. Whether this is a good environment for humans to live in or not is definitely in doubt.

PO: What do you think are some of the biggest environmental issues that we are facing today?

FC: Up until now, the ocean has been big enough to swallow up and cover for most of our messes. We're reaching a point where it's not really able to do that. Maybe we'll hit a tipping point soon on the suitability of oceans to support life. I also think habitat loss on land, due to human population growth and resource extraction, and the loss of biodiversity that occurs as a result are very significant. We're losing species, or at least most of the individual specimens of each species. A self-interested human might say we don't need those species, but I think it should instead be a question of what we want.

Are you optimistic that, during our lifetimes, we'll make significant strides in the right direction or address climate change as a whole?

FC: I'm not optimistic in the short run, which I would say is the lifespan of people alive today. I think that these people are going to see things get a lot worse, and that might motivate some progress that will affect people 200 years from now. But I think there will be a lot of strain on the environment first, a lot of changes in terms of climate that we will have to face: a shortage of water supply or natural disasters, all the various consequences of global warming. Very long term, more optimism. Not a lot of it in the short term. I think people are too self-interested.

PO: What changes do you expect to see over our lifetimes?

FC: I don't expect cataclysmic events. I expect continual slow degradation of the environment as seen through human eyes. Years are a long time for us, but on a geologic scale, it's a rapid mass extinction event for other species. I don't think humans will go extinct anytime soon. We will, for a long time, find a way to claw out an existence on earth, whether it's a pretty place to live or not.

STORY Ian Dalrymple, Peter Orsak

CLEAN POWER

There's no question that the earth is heating up, and fossil fuels make up over 89% of global CO2 emissions. What does the future of sustainable energy look like?

The Paris Agreement established a goal in 2015: to keep global average temperatures 1.5 degrees celsius below pre-industrial levels. Now, six years later, we are running out of time. 84.3 percent of the world's energy consumption relies on fossil fuels, pumping greenhouse gases into the atmosphere, causing temperatures to rise.

"The planet is heating up, primarily because of carbon emissions," SELF executive director Bob Freling '77 said. "If we don't start taking climate change more seriously, whole ecosystems will start to break down, wreaking havoc on the health and well being of humanity."

And according to former liquefied natural gas consultant Jon Gross '77, the solution is one that the world has been working towards for the past 50 years — transitioning from fossil fuels to natural gas, and then eventually to renewable energy sources.

"It's hard to imagine, but if you look at parts of the country, as regulations have become more and more prevalent, there's no question that our environment has cleaned up a lot," Gross said. "Air quality has improved even as consumption of energy and petrochemical products have increased. Without regulations, companies would be allowed to pollute the environment in an unconstrained manner. I don't think anybody would want to go back to an unregulated system."

Because natural gas produces far fewer greenhouse gases than coal or oil, it has been

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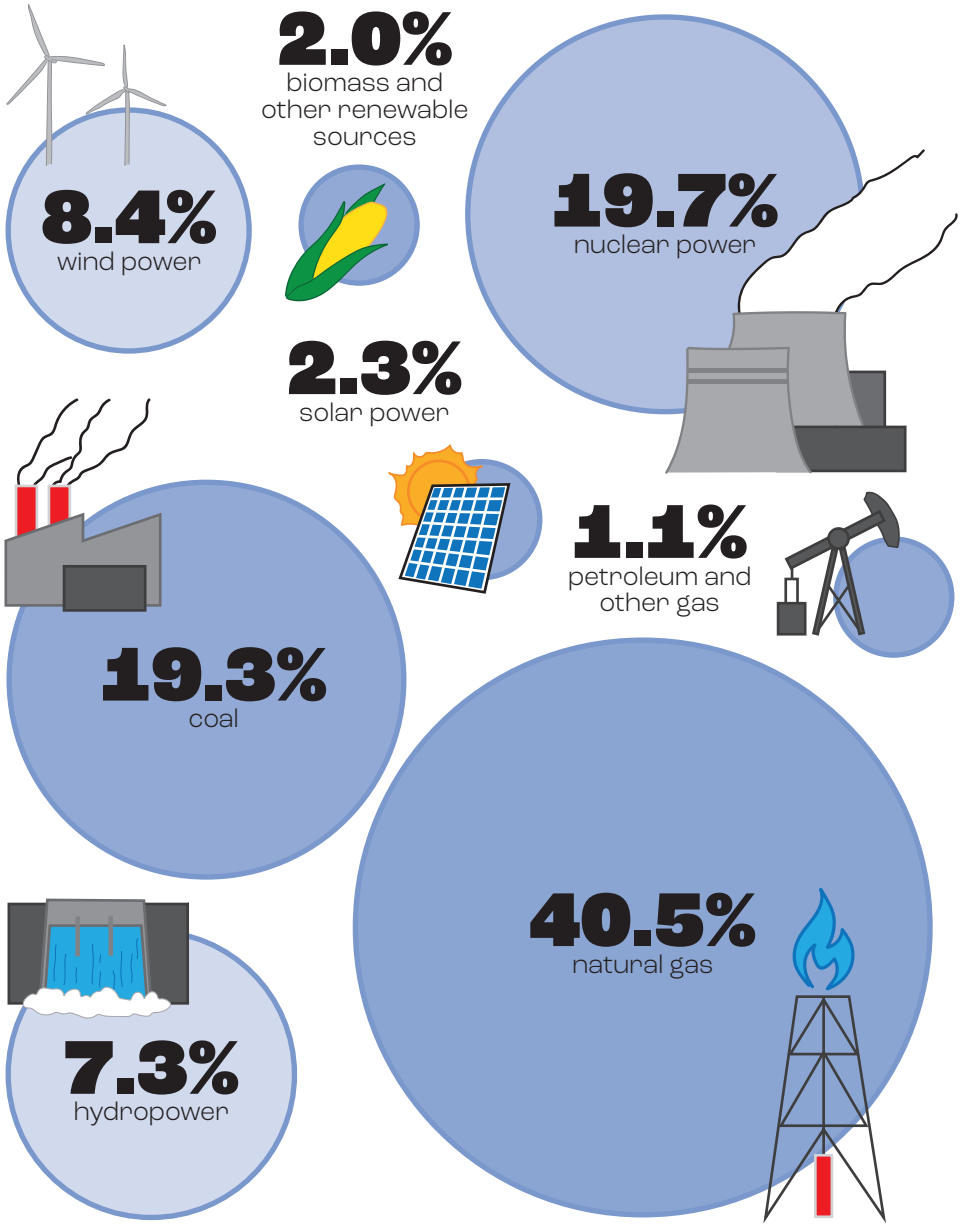


Breaking it down: energy consumption in the United States, visualized

SOURCE U.S. ENERGY INFORMATION ADMINISTRATION

used as a stepping stone energy source. However, natural gas plants regularly release methane, another greenhouse gas, into the atmosphere.

"There is a lot of natural gas that just gets vented or leaked from well sites either because of poor facilities or maintenance on those facilities, or an inability to get that gas to a market for sales," former BP engineer Rob Bruant '89 said. "Natural gas has really not been all that expensive, so people would end up just allowing it to either vent or burn it as a means to just deal with it. But methane is a very powerful greenhouse gas — it has approximately 25 times the global warming potential than carbon dioxide."

The solution? Carbon capture and storage, economic incentives, and new energy sources.

"If we are going to get to a 1.5 degree celsius stabilization scenario, carbon capture and some underground storage has to be a big part of this," Bruant said. "Enhanced oil recovery is where you inject recovered carbon dioxide into oil and gas reservoirs as a means to increase the oil and gas production out of those reservoirs."

But what if there's no use for recovered carbon dioxide?

"Instead of utilizing the carbon dioxide for enhanced oil recovery, you're just injecting the CO2 into a very deep geologic formation," Bruant said. "And it stays put for hundreds to thousands of years."

Subsidies have long helped keep fossil fuel costs down, but as technology has advanced, renewable energy sources have become increasingly accessible.

"Generally, fossil fuels have been cheaper, but that is changing quickly," Bruant said. "And depending on where you are, in some states the cost of solar and wind is actually becoming competitive now. In the near future, at some point, they will be cheaper across the board, especially if you start to take away the subsidies that have often been part of the fossil fuel industry."

Jon Gross '77
director at Tellurian Incorporated

Gross believes that a reversal of economic motivation — taxing fossil fuels instead — will help facilitate this change.

"The easiest, simplest way of becoming carbon neutral is to have a tax on carbon," Gross said. "Within five years, you would see coal fired power plants shutting down. Once the tax gets high enough, there would be incentives to switch to natural gas at the beginning along with growth of renewables, and in the long term, a new generation of nuclear power could provide reliable baseload power.

But switching to renewable energy won't be easy or fast by any means: conservative estimates say 30 to 40 years will be needed to build enough renewable energy sources in order to keep up with demand.

"We use a lot of power," Gross said. "And worldwide, renewables make up maybe 10% of all the power. Even though they're increasing faster than anything else, when you're starting from a low level, it will take at least until 2060 to get over 50% of our total demand."

For example, Texas is one of the biggest wind power states, but wind only makes up 20 to 25 percent of our power demand.

"By contrast, natural gas accounts for more than 45% of our electric power in Texas," Gross said.

"So, there's still a long way to go — you can't just cut fossil fuels, or everything would go dark."

In addition, completely cutting fossil fuels would require drastic change. Countless everyday items, like plastic and even the roads we drive on are made of fossil fuel products.

"There clearly needs to be a balance," Gross said. "As technology improves, responsible companies can live side by side with the regulations — you can responsibly develop the resources and provide the power that people need, even as regulations to protect the environment become increasingly strict."

STORY Jonathan Yin, Nolan Marcus
GRAPHICS Jonathan Yin

GETTING AROUND

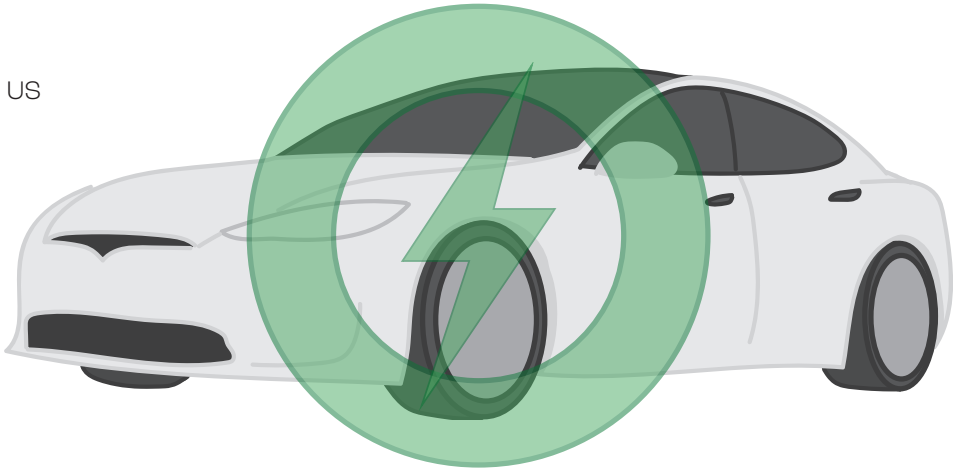
With transportation sources producing nearly 30 percent of the nation's greenhouse gases, electric cars have often marketed as the solution. But how do they stack up?

0 metric tons
average carbon emissions per year

$3,314
average annual running cost

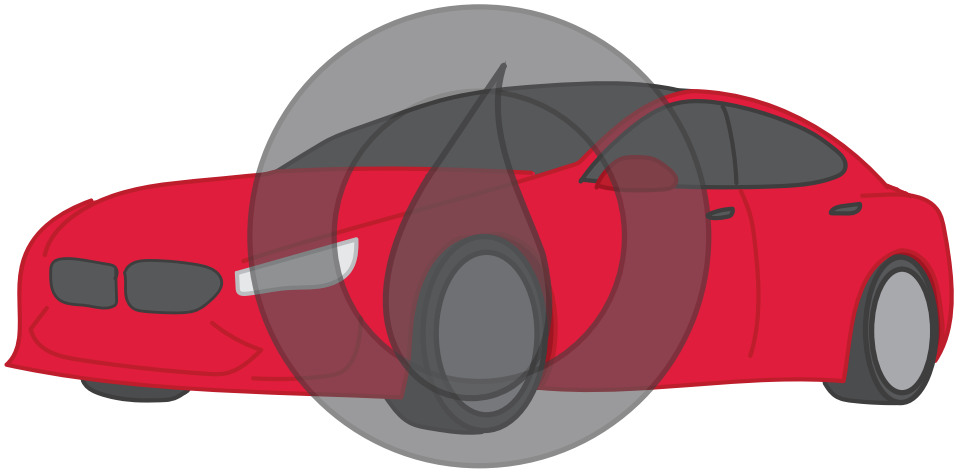
$36,600
average cost of electric cars in the US

256 miles
average single-charge range



4.6 metric tons
average annual carbon emissions per car

$42,258
average cost of gas-powered cars in the US



$3,603
average annual running cost

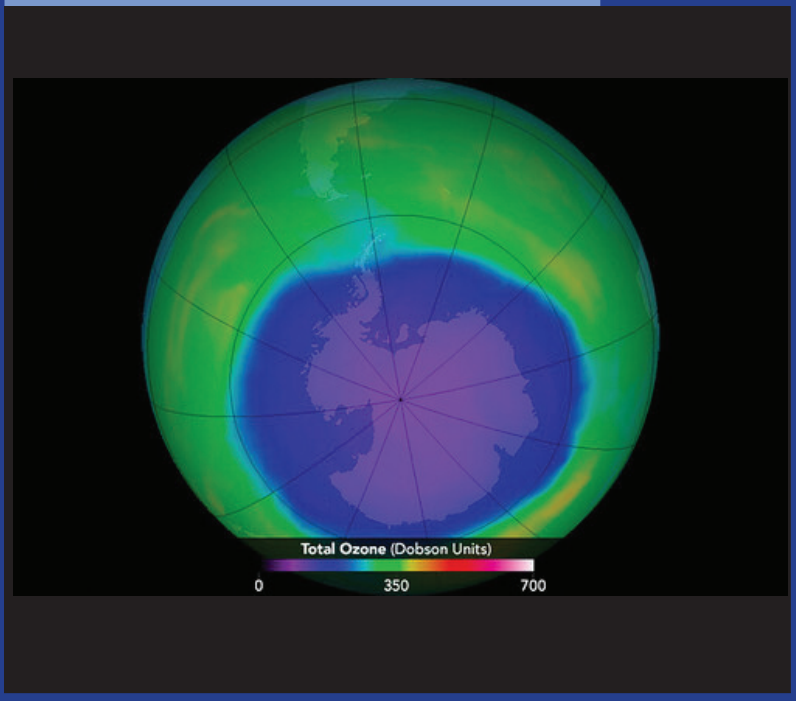
412 miles
average range on a full tank

SOURCE: TEXAS DEPARTMENT OF TRANSPORTATION

COLLECTIVE OUTLOOK

After the Montreal Protocol helped alleviate the effects of the ozone hole, the United Nations continued to develop international environmental agreements, such as the Kyoto Protocol and the Paris Agreement. Our work, however, is far from over.

STILL AROUND An image of the Antarctic ozone hole taken by NASA Earth Observatory in 2015. Despite the Montreal Protocol, the hole has remained prominent for years afterwards.



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While the Montreal Protocol may have seen success and greatly contributed to the fight for the planet, the human race still has a long way to go. The biggest problem, Ivanova says, is how humans view the planet they live on.

"Teenagers can't vote, but they have such an impact on the global narrative," Ivanova said. "You have to demand action. But you also don't know what kind of action to demand. Therefore, you have to demand the right education. You can say, 'Here are my textbooks. Here's what I'm being taught. But here's what I see is happening in the world.' Creating new educational programs will be absolutely critical. And you have the agency to not only demand that, but to also say here's what we want it to look like and here's why."

Another major problem, Ivanova says, is persuading everyone to take organized action.

"Individualism is the biggest problem that prevents collective action from happening, and it's expressed in multiple ways," Ivanova said. "One is whether we want our country to win, be first, and take the most credit. That is individualism that prevents collective action from happening."

However, Ivanova says this mindset is also prevalent on a person-to-person basis.

"Individualism also happens at the level of a person," Ivanova said. "We are all raised now in this society where we individually need to take credit, we need to be recognized, we need to be rewarded, and that's not the right attitude with which to address collective problems. Our biggest obstacle to solving environmental problems is putting the individual ego aside, whether it's at the personal level, at the institutional level or at the national level, and working together as a collective."

Shanklin also believes that humans need to change the way they think about the planet.

"The recent Glasgow meeting was really just focused on climate change, although they said they'd do something about deforestation. They weren't looking at air pollution, they weren't looking at water pollution, they weren't looking at ocean pollution, they weren't looking at soil degradation, and so on. We have many other environmental crises, and we need to look at them all together and decide what the underlying issue is that affects them all."

And, to Shanklin, it's clear what that issue is.

"It doesn't take much of a genius to see that it's us."

STORY Ian Dalrymple
PHOTO Courtesy Creative Commons

A NOTE FROM THE EDITORS

THE HUMAN EFFECT

We asked at the beginning of the magazine what we, as a species, need to do to fix our planet.

The answer? We don't know.

We can't answer that question, but, hopefully, we can give the issue some perspective. We made this magazine hoping not that you would walk away with the answer to climate change or deforestation, but that you could be a little more informed.

You should do the research.

You should do the little things.

You should be a better citizen of our planet.

And we hope that you will.

Because we are running out of time.

Better get started.

Morgan Chow
Ian Dalrymple
Co-editors-in-Chief

INSIDE BACK-COVER PHOTO

To represent humanity's mission to rectify the damage done to our planet, co-editors Ian Dalrymple and Morgan Chow worked with photographer Hayward Metcalf to create this photo illustration.