From the editors...

We did it, everyone! Congratulations on yet another semester done, with all of the studying, grading, writing, and bustling that this time of year so often entails.

Just like the students who are preparing to leave campus for a restful winter break, The Trail, too, will be taking a winter recess. But never fear—our staff will be back in February with our next issue, for what will mark the second semester of our 10th year in operation! As always, we’d like to extend a heartfelt thanks to the Department of Human Ecology’s Dr. Clark and Kristen Goodrich for their support of The Trail this semester. We hope all of our readership has a relaxing break with plenty of downtime to peruse our latest holiday edition!

Happy Trails,
James & Mackenzie

Happy holidays, and see you all in January!
The world’s forests serve a vital role in regulating carbon dioxide levels in the atmosphere and providing habitat for countless plant and animal species. Research by the World Resources Institute has found that “30 percent of global forest cover has been cleared, while another 20 percent has been degraded.” Only about 15% of our forests are still ‘intact’, meaning they have maintained natural levels of biodiversity and have not been fragmented or impacted substantially by human activity.

While deforestation has left species that live in trees and on the forest floor without a home, the impacts reach far beyond into the biodiverse ecosystems that depend on forests. With less trees, fish and other water dwellers experience food shortages and pollution in their natural habitats. Deforestation has and continues to decrease the average size of individual fish, while decreasing overall biodiversity of fish stocks around the world.

Leaves, fruits, and other falling plant material serve as an important supplement in the diet of fish. Dr. Tanentzap of the University of Cambridge explains that while small fish often rely on zooplankton and other microorganisms for nutrients, the organic carbon in plant material increase body size and strength. In a study of Daisy Lake in Canada, researchers “found fish that had almost 70% of their biomass made from carbon that came from trees and leaves instead of aquatic food chain sources.” In areas that have been clear-cut or degraded, less food leads to smaller fish with lower survival rates.

Deforestation also leads to the pollution of watersheds and fish habitats. When logging operations enter a new area, roads, trucks, and other developments are introduced. While these man-made interventions pollute the local watershed in their own right, the removal of trees for these activities leads to soil erosion. Soil that had previously been held in place by complex root systems erodes into flowing water, “clogging these waterways and causing declines in fish and other species.” Smothering fish and their eggs, soil erosion further threatens biodiversity in fish stocks.

Projects to repopulate forests constantly battle the increasing rate of deforestation. Despite the opinion that deforestation must face heavier regulations, others see
forests destroyed for human inhabitants, mining, logging, hydropower, and agriculture as an opportunity for economic growth. Many argue that forests are an extractable resource similar to fossil fuels or minerals.

Meanwhile, replanting initiatives around the world fight hard to put a dent in the alarming rate of global tree loss. Earlier this year, Conservation International began a “project to add 73 million native trees to Brazil’s Amazon by 2023.” The largest reforestation initiative in world history, this project may indicate that the trend for destruction may bend towards one of restoration in coming years. Non-governmental organizations and government agencies alike must now push for greater protection of these vital forest areas.

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Slimy, Yet Satisfying

By Ella Grande

Entomophagy is a fancy word for something, well, not so fancy: eating bugs. As bizarre as this may sound, just about every country besides the US and Europe nations has insects on their menu. From grasshopper bacon bits, to deep fried tarantula, all the way to mezcal worm tacos, insects are a delicacy in a lot of places around the world. An article in Medical News Today states “Beetles are the most commonly consumed insect, followed by caterpillars, bees, wasps, ants, grasshoppers, locusts, and crickets. All in all, more than 1,900 insect species are considered edible.” Once you can get past the “ick factor”, we see how sustainable this actually is and how beneficial it is in terms of our health, our economy, and most importantly, our environment.

You may be saying to yourself, “I will never eat bugs!” But believe it or not, you already have. We consume up to 500 grams of insects per year, unknowingly of course. The Food and Drug Administration allows a certain amount of insect components in food. Chocolate, for example, is allowed 60 insect components per 100 grams, and peanut butter is allowed 30 insect components per 100 grams. Another surprising fact, most of the red dye you see in food is bug based! Popular food items such as ketchup, candies, fruit drinks, soft drinks, ice cream, yogurt will most likely contain cochineal if it is red or pink. Cochineal are scale insects that live on cacti and from these little guys, red dye can be extracted. So whether we like it or not, bugs already secretly find their way into our diet.

So why eat bugs? What’s the big deal? First of all, insects contain so much protein. In just a 3.5 ounce serving of grasshoppers, there is between 14 and 28 grams of protein. Most insects also contain large amounts of unsaturated fats, iron, calcium, and zinc. 100 grams of crickets, which is about 200 crickets, contains more protein, energy, calcium and vitamins than a 100-gram serving of chicken, steak, or other meat. You can get all this without the negative effects you would generally see with our main protein sources now, like red meat. With the livestock industry causing huge environmental strains, bugs are more sustainable in every way. While livestock need enormous amounts of land and water for grazing, production and feed, insects use only a fraction. In a Ted Talk by Wendy Lu McGill, she refers to this as micro-livestock. Bugs need drastically less resources and are giving us the same amount of nutrients. It makes sense, especially since the world population is continuously growing. We need to feed more and more people and we are running out of space.

Lastly, when I say “eat bugs,” I don’t mean go outside and cook up the first thing you find. There are plenty of gourmet restaurants around the world with innovative and appetizing ways to incorporate bugs into our meals. A pre-Hispanic snackeria in San Francisco called Don Bugito sells chocolate covered worms and granola bites with a cricket flour base. El Catrin, located in Canada, serves a famous cricket guacamole. In the Australian restaurant Archipelago, they have a Love Bug Salad consisting of deep fried locusts and crickets. There are many ways we can make this not-so-appetizing idea more appetizing. With all the positive benefits, why not give it a shot?
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Humna: What is the Rutgers Students for Environment and Energy Development (SEED), and what does your organization do?

Evan: SEED is an organization devoted to learning and applying the science and engineering that is helping the way society interacts with our environment. We accomplish this through field trips, lectures from professors, as well as professionals, competitions, hands on projects, and involvement around Rutgers. We have travelled to Duke Farms where we learned about how glycol can be used to tap into the stable temperature of the Earth and moderate the temperatures of a home. We also travelled to the Middlesex County landfill where we learned about biogas recapturing and the use of solar panels. Next semester, we plan on travelling to the Atlantic City Utility Authority where we will get to go inside of a wind turbine as well as the Rutgers Eco-Complex where we will learn about hydroponics. We are currently competing in the 2018 AWWA Student Filtration competition where teams build wastewater treatment plants out of buckets, and we are also competing in the 2018 Rutgers Innovation Competition (I can’t disclose what we are working on—it’s pretty cool and I do not want others to know about it quite yet). We have built a wind turbine and recently 3D printed blades. We have also put together a solar panel and a microbial fuel cell that can turn dirt into a little bit of electricity with the help of microbes. In the past we have had Dr. Birnie talk to us about how solar panels work, and we have had Dr. Reinfelder talk to us about the chemistry of water pollution. In the future we will be having an expert talk to us about smart grids, and we will also be...
having representatives from the company NORESCO come and talk to us. In terms of what we do at Rutgers, in the future we are looking to build a new Rutgers bus stop equipped with a green roof and other eco-friendly additions. Oh, one more thing—we have a pizza party and watch Planet Earth once a semester.

**Humna: What do you do in your club meetings?**

Evan: Our meetings start with updates, new and old business. After this, we allow people to talk about any ideas they have had. Then, we usually pick a topic to learn about and discuss the problems/solutions. One week we looked at the problem of road salt, we watched a video, then we talked about the economic, political, scientific, and societal solutions that can be used to solve these problems. As a club we try to always discuss all parties that are affected, something we feel many environmentalists do not always consider. For us, many problems do not get solved because one or more of the four categories we talk about (economic, political, scientific, and societal) are ignored. After this we break up into project and competition groups.

**Humna: I know your club was previously called Rutgers Environmental Science and Engineering. Why did you change to Students for Environment and Energy Development? What effect does this change in name have on your clubs and activities?**

Evan: Awesome research. First of all, this club was at one point discontinued and was not recognized by the University, so we had free will to make whatever we wanted. A big focus of SEED was to incorporate energy, something that was not mentioned in the name Rutgers Environmental Science and Engineering. Also, we wanted to imply that our work was to further the future of the Earth (a bit serious but you get the idea) so we also wanted use the word development. We wanted Students for Environmental & Energy Solutions, but SEES is weird and too much like SEA.

**Humna: Currently, how many club members do you have?**

Evan: This past Tuesday we had a big meeting and actually worked with Dr. Reinfelder in the environmental chemistry lab, and I would say we had 18 people there.

**Humna: I heard that you are doing some very interesting things with testing water turbidity. Tell us more about it?**

Evan: Who’s your inside scoop!? Yes we did some awesome stuff. For the student filter competition we wanted to know what materials reduced turbidity the most. After much research we got the list
of materials down to orange/lemon peels, coconut fiber, sand, diatomaceous earth, activated carbon, and cotton. We then weighed these materials and put them into funnels. After this, we created some muddy water, measured the turbidity, and then ran this muddy water through each of the funnels. It was really fun and now our club has a great idea of what we want to put in our bucket.

**Humna: How do you think it will have an impact on the Rutgers community or in the community of New Brunswick in general?**

Evan: This is a great question. Due to the nuance of the club, we have been more dedicated to being stable and not reaching out too much. Next semester we want to take part in at least two volunteer cleanups. In regards to something that is more advanced, as I have said our club has intentions of talking to facilities about implementing bus stops with green roofs. We are also considering working with local schools to teach and help out, but this is a big-time commitment.

**Humna: What is one interesting thing you learned from your experiment?**

Evan: One fascinating thing I learned from my experiment was that diatomaceous earth, the remnants of unicellular microalgae, are so fine that in order to clean water with it you have to make a sludge out of it. Even at this point, they are better at taking out chemicals than physical pollutants because of how fine they are.

“By bringing together the environmentally concerned yet hard working, SEED strives to go beyond awareness and inspire our members into designing for a more sustainable future. Through competitions as well as local projects SEED looks to improve the communication, critical thinking, and problem solving skills of each member. SEED ultimately wants each of its members to become better leaders of tomorrow, leaders that understand how to solve issues creatively and sustainably. The supervision and guidance of professors ensures that with every attempt to solve a problem, SEED will design with practicality and ingenuity. “

(https://rutgers.campuslabs.com/engage/organization/SEED)
Fight or Flight? For Narwhals More Like Freeze and Flee

By Olivia Le Warn

Many of us are familiar with the old adage about fight or flight, or the two common ways species physiologically respond to fear. Yet “fight or flight” often overshadows another common response: freeze. While the first two responses yield an increase in metabolic activity that provides the organism the energy needed to attack or run, freezing decreases metabolic activities in order to preserve energy and stay still until the threat moves on. A fleeing mammal will show responses similar to exercising, such as tachycardia (increased heart beat) or elevated respiration rates. On the other hand, a freezing mammal will experience the opposite effects, namely bradycardia (decreased heart beat) and a reduced respiratory rate. The central nervous system is divided into separate regions of the brain and motor pathways in order to keep the two types of reactions distinguished. Curiously, the narwhal (*Monodon monoceros*) displays both a freezing behavior and a fleeing behavior simultaneously when threatened, as seen in a study published in *Science*.

Researchers worked with the Ittoqqortoormiit people of Greenland in order to track the elusive narwhals and record the mammals’ heart rates and swimming movements, along with other data. This study is the first of its kind that would have a long-term record of an electrocardiogram (EKG) for a wild cetacean. Remarkably, once researchers released the caught narwhals after securing monitors onto the animals, they witnessed a simultaneous freeze and flee response.

Post-release, the narwhals would have a brief moment of disorientation followed by bradycardia concurrent with fleeing. The bradycardia is so extreme it is referred to as a “cardiac freeze”; the narwhals had, on average, only three to four heartbeats per minute, and this could last for up to ten minutes. This is greater than a 94% reduction in heart rate when compared to resting on the surface. In semi-aquatic mammals that have been studied, freeze responses have been known to result in 34-50% decreases in heart rates relative to resting levels.
The drastic cardiac freeze that is experienced by the narwhals is incredible on its own. But even more shocking is that it is combined with stroke frequencies that were as fast or faster than routine dives. Normally, a bradycardia this severe would leave an animal immobile. It was expected that specialized diving mammals could only react by freezing during bradycardia, in order to conserve oxygen and prevent hypoxic tissue damage. However, the fleeing phenomenon seen by narwhals contradicts this hypothesis. This mixed response was found to require 97% of the narwhal’s onboard oxygen store, which counteracts the evolutionary function of having a freeze response. Researchers on the study are baffled as to how narwhal tissues are able to function under these conditions.

As ice in the Arctic melts, there are a host of new anthropogenic threats that could instigate the narwhal’s dual fear response, such as human hunting, shipping, and seismic exploration. The narwhals’ previous method of relying on covert movements in order to sink down or move to shallows is no longer as effective in the face of these hazards. It is theorized that the lack of oxygen in the narwhal’s brains due to this mixed fear response could lead to whale beaching, where the hypoxic brain becomes disoriented or damaged and leads the creatures ashore. If true, we may expect to see more narwhal strandings as anthropogenic menaces in the arctic rise.

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Changing How We Portray and Discuss Climate Change

By Mackenzie Pitt

Photographers Cristina Mittermeier and Paul Nicklen and other filmmakers recently released a heart-wrenching video of a starving polar bear scavenging for food on Baffin Island at the site of an abandoned fishing camp in Northern Canada. The video went viral in a matter of days and elicited strong emotional reactions from the public. In the video, the bear is visibly skinny, its patchy white fur and loose skin sags around its skeletal frame, and can barely walk due to muscle atrophy. In its hunger, the bear attempts to eat a piece of foam from an old snowmobile seat cushion out of a trashcan. It’s almost guaranteed to make you cry. "We stood there crying—filming with tears rolling down our cheeks," said Nicklen. Mittermeier and Nicklen are contributing wildlife photographers to National Geographic and represent the non-profit organization Sea Legacy.

In response to the video, many viewers questioned why the film crew did not intervene to help the dying bear. But there was little the crew to do to help, as they were neither equipped nor trained to handle such a situation. It is also illegal to feed wild bears in Canada. Instead, Nicklen decided the most powerful use of this footage would be to shed new light on the severity and seriousness of climate change. Nicklen hopes that by capturing the suffering of a single polar bear, they might draw attention to the fate that may await polar bears as a species as a result of climate change.

According to the National Snow and Ice Data Center, sea ice cover continues to reach record lows year after year, drastically reducing polar bear habitats. Yet, despite 97 percent of climate scientists agreeing that climate change is caused by human
activity, 3 out of 10 adult Americans deny it. While devastating images or videos of animals at the brink of extinction are powerful in bringing national attention to climate change, it is more important than ever to follow up with conversations about the global risks it implies to all types of ecosystems.

Nonetheless, discussing such issues with climate change deniers is easier said than done. The main reason it is so difficult is because of several rhetorical and logical fallacies that are often inherent in denier language. But as with most debates, the best way to dismantle your opponent’s argument is by being knowledgeable of their approach.

The most common defense used by climate change deniers, or more specifically anthropogenic global warming (AGW) deniers, is referencing fake experts. The Global Warming Petition is a petition that features 31,000 signatures from “scientists” claiming that climate change is not caused by humans and is often referenced by deniers as cause for doubt. However, a large majority of the signatures are not from climate scientists but from computer scientists, medical scientists, and mechanical engineers. Deniers also commonly reference false scientific studies that “cherry pick” data and falsely equivocate them to sound peer-reviewed, and duplicated climate studies.

A more philosophical rhetorical fallacy commonly used by AGW deniers is that of “naturalness.” The language of the naturalistic fallacy can be traced as far back as the imperialistic colonizing era and has been used to justify disruptive environmental actions since. For example, the term “natural resources” implies a source of material intended by nature to be utilized for human consumption. AGW deniers often utilize this language to their favor by framing the environment as an object separate from human activity and intended for human benefit. This type of logic becomes a slippery slope for the insertion of philosophical or religion-based opinions into scientific conjecture and fuels the tragedy of the commons. One likely reason AGW deniers tend to cling to these fallacies is due to “identity protective cognition” which, similar to cognitive dissonance, means individuals selectively accept or dismiss risks in order to preserve a socio-economic structure beneficial or important to them. With this in mind, sometimes the best way to challenge AGW denier logic is to use it against them. So, next time you find yourself being told “global warming is a hoax” start by listening and remember these logical fallacies. You may find that your opponents defeat lies in their own words.

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Drones May Be Key To Ferret Conservation

By Gina Sbrilli

Biologists have found that drones may be the key to saving the black-footed ferret (*Mustela nigripes*) from extinction. The black-footed ferret — affectionately referred to as the BFF — is one of the most endangered mammals in North America, with a population currently hovering around 300, according to an interview with the World Wildlife Foundation (WWF) put out by npr.com. “The recovery of [the BFF] signifies the health of the grassland ecosystem, which they depend on to survive,” the WWF’s website states.

According to npr.com, the key to saving the BFF actually lies in saving and increasing the prairie dog population. Prairie dogs make up the majority of the BFF’s diet, according to Kristy Bly, a senior biologist with WWF. “Prairie dogs are the Chicken McNuggets of the prairie, where so many species eat them,” she said. And while this may be a humorous way to consider these animals, they are in fact vital to the balance of the grassland ecosystem in the American Midwest.

However, according to worldwildlife.org, both the prairie dog and the BFF are highly susceptible to synaptic plague. Because this is a non-native disease, neither animal possesses natural immunity against it, and, according to an article on the World Wildlife Fund’s site, “Once a prairie dog colony is infected with [the] plague, the disease can spread quickly, devastating thousands of animals within a few weeks.” It is this disease that has decimated prairie dog and BFF populations since 1999, when the first outbreak of the plague swept across the Fort Belknap Reservation in central Montana, the WWF’s website states.

Since then, researchers at the U.S. Geological Survey National Wildlife Health Center (NWHC) and the University of Wisconsin developed a vaccine to protect both the prairie dog and the BFF from the plague. The vaccine can be administered orally and so, according to npr.com, biologists are able to drop vaccine-laced pellets for the animals. The pellets are peanut butter-flavored, enticing the animals to consume the vaccine without even realizing it.

Field trials were done back in 2012 by manually distributing the pellets, but biologists have since increased the technology and distribution. By August of 2016, WWF had partnered with the U.S. Fish and Wildlife Service, the National Wildlife Health Center, Model Avionics, and Support XXL and developed three new ways to distribute the pellets. A 2016 article on the WWF’s site described the methods: the first was to use drones to drop one pellet at a time; the second, to use an all-terrain vehicle (ATV) to drop one pellet at a time; and the third, to use an ATV to drop three pellets simultaneously.

According to npr.com, the system was fine-tuned this past summer, where members of WWF worked to further improve the drone method of distribution. Bly said that drones cover a lot more ground and can therefore be used to speed up the rate at which both the prairie dog and ferret populations are saved. "Without [the ferret], do we really have a complete ecosystem?" Bly said. "You start taking those pieces apart, it's like a domino effect. When we have ferrets on the landscape, the piece of the puzzle that is the American prairie all fits together."
Works Referenced


Everyone knows that the best place to view the stars at night is somewhere far away from artificial lighting. This is because artificial lighting pollutes the sky, making it difficult to see the stars. New studies are shedding light on how this phenomenon is not only disrupting our views of the stars, but also disrupting the seasonal and circadian rhythms of certain species. The changing of the nightscape from light pollution is also having effects on humans.

Artificial lighting impacts the circadian rhythms and seasonal patterns of both plant and animal species that require a change in lighting to differentiate between day and night. Increases in light pollution may disrupt this pattern. The consequence of this can be a change in hunting patterns for animals, and some studies suggest that they impact the timing of bud formation and burst in plants. Some scientists even claim this can affect the timing of leaf emergence by days or weeks, though the same scientists caution that more research is needed to parse out the effects of light and other environmental factors.

In humans, extended exposure to nighttime lighting can disrupt the circadian cycle, which plays a major role in the regulation of some hormones. Melatonin production in particular appears to be tightly wound with mammals’ circadian rhythm. Longer exposures to light may disrupt this rhythm and decrease melatonin production—a phenomenon which one study has linked to increased cancer risk in overnight shift workers, whose circadian cycle is likely to be impacted by the differences in sleep patterns and light exposure.
Since light pollution remains a relatively obscure concern to many, in-depth studies on the subject are few and far between. Light pollution though, continues to increase—especially in developing countries. According to one global study, artificial light has seen an annual increase of 2 percent over the last four years. The long-term effects of growing light pollution are not known, which gives reason for new studies to be done on the potential impacts.

There are a couple of solutions to fix the problem of light pollution. Some towns and cities around the world have lighting ordinances that require lights to be turned off during certain times of the night, which can have benefits other than simply reducing light pollution. In the United States, it is estimated that $6.9 billion is spent generating electricity for lighting, which also results in the generation of about 66 million metric tons of CO2. By implementing policies that require lights to be turned off for certain periods each night, money and resources can be saved while reducing light pollution. Another solution to the problem could be the development of more efficient light bulbs that decrease the amount of light wasted.

The problem of light pollution is relatively new and understudied. In future years, light pollution is expected to increase. This problem is not unfixable, though. By coordinating policies to reduce light use at night and promoting the innovation of efficient bulbs, the problem can easily addressed.

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For many species, communication between members of a population is essential to its survival. Yet communication of some marine species could be threatened by humans’ increasing presence in the ocean.

While humans have the senses of touch and sight to aid in oral communication, the relative opacity of water and the vastness of the ocean make these senses of limited use to many marine species. Sound waves, on the other hand, travel extremely efficiently through water, allowing for reliable communication. Whales, in particular, make use of long-distance sonic communication, emitting a series of sounds at different frequencies and unique patterns. These sounds are known as songs, and may vary not only among species, but among populations within species. Essentially, you can differentiate songs based on a pattern made up of a variation of frequency, or pitch, as well as the context in which it is being used, such as males trying to attract females, grunts and groans, food location, and other uses.

One of the most fascinating things about whale songs is that the song of the humpback whale is known to travel up to 10,000 miles. These are low frequency songs that do not lose energy easily as they travel through the water. In terms of physics, sound is a mechanical wave that moves through a medium—in this case, either water or air. The speed with which sound waves move largely depends on the medium through which they are moving.

Echolocation is another sound of the deep and is used by toothed whales, or odontocetes, like dolphins and killer whales. Echolocation is different from most whale songs, as it consists of a series of clicks emitted through the water, and are produced by moving air between specialized sinuses in the head. In echolocation, sounds are emitted from the animal and travel until they reach an object—say, a fish or the sea floor—and then return to the odontocete. The whale then uses the time it took for the sound to return to deduce how far away an object is.

While toothed whales’ echolocation clicks can also be used for interacting with other animals, they are quite different from the songs of baleen whales. The major difference is what the sound is used for. While toothed whales primarily use echolocation for finding food and locating objects, baleen whales use their songs for communication, and their songs usually travel longer distances.
While each sound is used to satisfy different needs, each is crucial to the animal’s survival one way or another. Throughout the process of industrialization, humans have attained a notable ocean presence through transportation, fishing, and testing nuclear explosions. Within the last 50 years, our presence in the ocean has increased significantly, with potentially negative influences on a plethora of life below the surface. Unfortunately, this only adds to the anthropogenic influences and stresses being placed on not only our oceans, but on the nature we depend on.

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According to the Global Carbon Project, global CO2 emissions are set to rise in 2017 for the first time in four years. Along with this, carbon output has been growing on average three per cent every year since 2006. The time to take on climate change is now, and carbon recycling is one of the answers. Throughout the past several decades, researchers have been looking into ways to lower carbon dioxide emissions. One of these approaches has been through the use of catalysts to convert this greenhouse gas into usable fuel. To quote Dr. Tomas R. Reina from the University of Surrey, "The goal we're all chasing as climate scientists is a way of reversing the impacts of harmful gases on our atmosphere - this technology, which could see those harmful gases not only removed but converted into renewable fuels for use in poorer countries is the Holy Grail of climate science".

A great concept, but efficiency has been less than optimal and has been a better concept than process. This all appears to be changing, however, thanks to ground breaking research done by the University of Surrey in England. They have developed what is being called a ‘super catalyst’ which not only increases efficiency of conversion but is also more economical. If their claims are correct, it could mean the commercialism of the technique, meaning our next fuel source could literally be pulled out of thin air.

So what is a catalyst? The most basic answer is an element or compound that is used to create a reaction. In terms of carbon dioxide recycling, these catalysts have almost always been made of copper with added elements such as tin to stabilize the reaction. The way that such a catalyst is applied to reducing carbon emissions is a remarkable process. The most common way to use a catalyst to recycle carbon dioxide is to coat an electrode and submerge it in a water bath saturated with the collected gas. The reaction will then occur and break down the water and CO2 molecules into hydrogen and the energy rich carbon monoxide. To sum it all up, test tube photosynthesis.

As of June of 2017, the best result of the use of a catalyst to convert carbon dioxide to usable fuel was done by the Swiss Federal Institute of Technology in Lausanne. Their catalyst was made of copper filaments with a layer of tin only an atom thick. With this catalyst, they were able to convert 90% of the gas. Though impressive, the process has big drawbacks. Along the carbon monoxide, hydrogen is also formed. This byproduct is a sign that the method or catalyst is not as efficient as it needs to be. Not only is efficiency an
issue, but so is the cost. The current form of the catalyst has to be very precise in order to
great the highest yield. This factor leaves catalytic conversion undesirable for
manufacturers who at the end of the day have to meet a budget.

This issue of efficiency and cost is what Surrey University has been tackling for
years, and they have finally made a breakthrough worth patenting. What has been dubbed
as the ‘super catalyst’ is nickel based and doped with both tin and seria compounds. The
innovation of the newest member of the carbon recycling movement was funded by the
Engineering and Physical Sciences Research Council's Global Research Project, which is
looking into ways to lessen the impact of global warming in Latin America. They are
currently in the process of finding a company who is willing to work with their product,
and by the looks of it they will find someone soon. The series of processes Surrey
University has conducted shows the promise of a much more affordable process while
creating a better ratio of fuel vs. waste. If this trend continues, carbon emissions will soon
be able to be tapped as an economically viable resource. The Holy Grail of climate change
reduction is within reach.

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They're everywhere— they come in all shades of the rainbow, they're sometimes adorned with stickers, and come in all shapes and sizes. What are they? They're the new fashion accessory: reusable water bottles. With the rising popularity of ditching single-use plastic water bottles in favor of becoming eco-friendly, a question comes to mind: which type of bottle is the “best”? The best bottle ideally has a low carbon footprint, but also uses sustainable materials, can be recycled, is durable, and includes other factors such as BPA-free materials and no metallic taste. The bottles we will be reviewing today are plastic (such as CamelBak bottles), aluminum (canteen-like bottles), glass (such as mason jars and Contigo products), and stainless steel (such as S’Well bottles and the Cupanion). Each bottle will be compared to a single-use plastic water bottle (plastic #1) in the several aforementioned categories.

First and foremost are plastic water bottles that are composed of longer-lasting varieties of plastic than single-use bottles. These plastic water bottles are durable and made of thick plastic. While plastic is not the most sustainable product, some bottles in this group use recycled plastic, which is greatly beneficial. Another benefit is that post-consumer plastic bottles are durable, cheap, and don’t have a metallic taste. A downside, however, is that many plastic water bottles have BPA’s in them, which can lead to concerns about chemical leakage into the water.

Second are aluminum bottles. These bottles look very similar to stainless steel, but are a much cheaper alternative. This seems to be the only advantage of aluminum, as bottles of this material have many issues associated with them. First, aluminum bottles must have a liner to protect the water. The bottles are durable, but if they are dropped and a dent occurs, this could rupture the liner within the bottle. Another issue is that aluminum is very costly to produce and due to the liners, many bottles cannot be recycled efficiently. Lastly, aluminum bottles are very difficult to clean and have a strong metallic taste to them. Due to the nature of aluminum bottles, while it is still a better alternative to single-use, it is best to instead invest in stainless steel or even a reusable plastic bottle.

Next is the glass bottle which, while not extremely practical, provides few downsides. Glass is easily recyclable, inexpensive, easily washed, and avoids any chemical leaching or metallic taste. An obvious downside is durability, as glass is extremely fragile and will break upon impact. Recently however, manufacturers have been creating glass bottles that are wrapped in a shatter-free resin, which provides stability to these bottles upon impact.

Battle of the Bottles

Marissa O’Conner
With only having one downside, glass bottles become a fabulous alternative to single-use plastic bottles.

Lastly are stainless steel bottles, which are almost as popular as reusable plastic products, but are a bit more expensive. However, these bottles are a good alternative to reusable plastic bottles if one is concerned with plastic production or chemical leaching. Cheaper steel bottles come with a plastic lining inside, so it is important when choosing such bottle to invest in one of higher quality. Another downside is that stainless steel cannot be easily recycled, and the mining of chromium to make the bottles is highly controversial. In most debates however, the stainless steel bottle wins the title of best alternative to single-use plastic bottles.

In the spring 2017 semester, Rutgers dining halls introduced the Cupanion, a stainless steel water bottle that replaced the paper cups at dining hall take-out services in order to reduce waste. However, the mining of chromium comes with its own environmental impacts, requiring large amount of fossil fuels. Furthermore, the manufacturing of stainless steel results in large amounts of pollution, and overall has a larger carbon footprint than the manufacturing of single-use plastic bottles. It has been estimated that in order to become better than plastic in all environmental aspects, the stainless steel water bottle would have to be used 500 times. This begs the question: does the Cupanion really reduce waste at Rutgers? Or is the student body another victim of greenwashing?

Greenwashing in terms of plastic bottles is not a new concept, as single-use bottles often love to flaunt the label of being eco-friendly by using less plastic. However, with reusable bottles becoming something akin to fashion accessories, many people are starting a collection. If one stainless steel water bottle must be used 500 times to become more sustainable than the average single-use plastic bottle, what happens when a person owns multiple bottles? This begs the question: are stainless steel bottles really worth it, or should

Sources


In 2010, an estimated 39% of the United States' population resided in counties adjacent to the coastal shoreline—a figure which is projected to increase by 8% by 2020. Most major US cities and numerous smaller communities were founded on or near a major river system’s shores. This pattern reflects a longstanding reality: there are major benefits to be had by settling near water. But humanity’s propensity to thrive at the water’s edge has never been without risk—especially from flooding.

Today, the frequency of natural disasters that bring flooding to shoreline communities is predicted to increase alongside changes in global weather patterns. High-profile storms such as Hurricane Irene in 2011, Hurricane Sandy in 2012, and Hurricanes Maria and Harvey this year, have thrust flood resilience and mitigation into the political spotlight in municipal and state governments across the country.

Inland communities aren’t excluded from the conversation, either; a 2013 Cornell University study estimated that the total riverine floodplain area susceptible to 100-year flood events in the United States could increase by as much as 45% due to climate change in the next 100 years.

As coastal and inland communities alike grapple with the implications of costlier floods and a lack of flood-proof infrastructure, governments at all levels have increasingly turned to purchasing and vacating flood-prone properties as a means of mitigating future flood losses. This practice holds promise for moving families and homes away from chronically flooded land—but raises questions about how shoreline communities will adapt to changing floodplain management regimes.

**Floodplain Reclamation on the Jersey Shore**

In New Jersey, the idea of government action against climate change and sea level rise is perhaps less controversial than in many parts of the country. The destruction wrought by Superstorm Sandy (downgraded from hurricane status by the time it hit New Jersey’s shores) in 2012 electrified the state’s collective attitude towards climate change and sea level rise—so much so that both major party candidates in the state’s recent gubernatorial election cited Superstorm Sandy as impetus for aggressive mitigation and resiliency measures against climate change and future storms.

With an ocean economy regularly valued at several billion dollars and a substantial tourism industry around the “Jersey Shore,” New Jersey’s Atlantic coastline is vital to the state’s economy. Perhaps unsurprising, then, has been the state’s robust “Blue Acres” program, a state- and federal-funded program meant to mitigate flood damage in coastal communities.
communities by purchasing damaged flood-prone properties at market price and reserving them as open space.

The state impulse to acquire properties prone to flooding may seem counterintuitive at first, but is often quite favorable to state interests in the long term. Under the National Flood Insurance Program, participating property owners who sustain flood damage can make claims for government funds to aid recovery. But due to peculiarities of topography, drainage, or placement in a floodplain, certain homes and properties carry an elevated risk for repeated flooding, making reinvestment in that property a dubious use of government funds.

Even if owners of flood-prone properties wish to sell, doing so is often difficult in the wake of a natural disaster. Few buyers want to take on flood-damaged homes, leaving homeowners with few options but to rebuild and hope for the best.

In these cases, it is often in the state’s best interest to buy these properties and redesignate them as open space, preventing future floods from damaging homes there, and saving money on flood insurance payouts in the long term. The New Jersey government has thus invested heavily in floodplain property acquisitions, pledging after Superstorm Sandy alone to spend $300 million in federal FEMA funds on Blue Acres acquisitions.

The New Jersey government’s acquisition of coastal properties and subsequent reclassification as open space has not been without its critics. Blue Acres buyouts are only conducted with voluntary landowners—not invoking eminent domain—but nevertheless draw criticism from many coastal municipal governments. As residential and commercial properties are demolished and left undeveloped, shore towns may see their taxable base shrink, squeezing municipal budgets.

To many, though, Blue Acres buyouts are a lifeline, offering landowners a price for their property that they would be unlikely to receive on the private market. Blue Acres property buyouts generally purchase properties at their pre-flood market value—a hard bargain for homeowners confronting costly repairs to a property that may flood again.

**Houston Parallels**

New Jersey’s Blue Acres program is far from the only floodplain property acquisition program in the nation. Much as Superstorm Sandy spurred state buyouts in New Jersey and New York in 2012, Hurricane Harvey and its associated flooding have fueled talk of aggressive buyout initiatives in Houston, Texas. In fact, much of the funding for New Jersey Blue Acres buyouts shares the same federal source as buyouts across the country, Houston included.

As in New Jersey shore towns, however, the push to move communities out of the most at-risk areas of Houston’s floodplain has highlighted tensions between floodplain management and other community needs. Houston municipal officials have voiced concern over possible reductions in affordable housing availability as apartment buildings are bought out by floodplain reclamation programs. Other Houston locals balk at the prospective decline of cherished midcentury neighborhoods that find themselves most at risk of repeated flooding in years to come.

**A Changing of the Guard**

From New Jersey to Houston, extreme weather events tend to expose weaknesses in floodplain communities’ infrastructure—exerting even worse catastrophe on areas where flooding wasn’t incorporated into development plans. Weather pattern predictions indicate that such exclusion of flooding from the community planning process may already be a luxury governments can quite literally no longer afford. The resulting transition in sensibilities around flood adaptation is already changing how communities and governments respond to major flood events—buyout programs that encourage people to settle outside of a floodplain being an illustrative example.
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