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OUTER CAPE ENVIRONMENTAL AWARENESS NEWSLETTER



OCEAN 38 explores an extraordinary concept we all wish we had thought of: Edible water containers. We are also sharing an innovative technology we had never thought of, which grows vegetables from trash. We are continuing to track the Pacific Ocean's incredible thermal energy near Peru and updating our readers on how the neonicotinoid pesticides we were concerned about with Bees, seem to be appearing in some of our drinking water. **OCEAN** is the Environmental Education Newsletter of Safe Harbor, a small environmental consulting group in Wellfleet on Cape Cod and contains no advertising or solicitation. Thank you to our readers for your support and sharing of **OCEAN**, this is your newsletter. Gordon Peabody, Editor.

August 2017 Issue No. 38

CO2 Capture Technology

On May 31 of 2017, the Swiss company Climeworks began production at its CO² Capture Plant, the first carbon dioxide air capture technology of its kind. The plant, located in an agricultural region of Switzerland, looks like a giant wall of dryers stacked on top of each other. It uses air capture technology to suck carbon dioxide out of the air, and is selling that carbon dioxide to a neighboring greenhouse, which will use it to enhance vegetable growth. This is accomplished by accumulating carbon dioxide in special filters in the plant. When the filters are heated (using waste heat from a neighboring waste incinerator) this carbon dioxide can be extracted in its pure form. The carbon dioxide can then be used to enhance vegetable growth by 20%.



Photo credit: Tien Nguyen, News Vice 2017

Until now, this type of air capture technology has been restricted to extremely polluted areas. This is because ambient air is only 0.04% carbon dioxide and until now air capture has been too expensive and difficult to perform in ambient conditions. However, Climeworks hopes to break that mold and show that capturing carbon from the atmosphere can be profitable. The company hopes to eventually sell captured carbon for use as fuel, fertilizer, and even gas for beverage carbonation.

Climate scientists have said that this type of “negative emission” technology will be necessary in order to meet the goals set by the Paris Climate Accord. It is estimated that in order to meet the 2° temperature increase limit in the Paris Accord, 5 billion tons of carbon dioxide must be removed from the atmosphere each year. Climeworks wants to play a major role in meeting these goals. Its first plant will capture approximately 900 metric tons of carbon dioxide each year, but the company has goals to expand and scale up its operations and capture 1% of global CO² emissions by 2025 - this means building 750,000 more plants.

To make this technology feasible on that scale, Climeworks needs to get more customers. And to get more customers, Climeworks needs to cut costs by 25% to 33%. The research and development costs for the first plant were high, but Climeworks says its next plant could be put into operation for two million dollars.

One obstacle Climeworks faces is that markets and business models for carbon capture do not currently exist. Though the direct air capture costs of carbon are estimated to be between \$300 and \$1000, Climeworks is not sure what price consumers will be willing to pay for the product. However, with market research and business development, Climeworks will likely be able to grow its business and help our planet.

More information in the link below:

<https://news.vice.com/story/this-factory-will-suck-carbon-out-of-the-air-and-feed-it-to-plants>

Thank you to **OCEAN** Researcher Rae Taylor-Burns

OCEAN Environmental Innovation Award 2017:

The edible water bottle, an idea as innovative as it is practical. From the Skipping Rocks Lab in London comes the Ooho; a spherical flexible edible packaging that is cheaper than plastic. The Ooho is comprised of natural materials extracted from plants and seaweed and enveloping a mouthful of water.

Ooho is biodegradable in 4-6 weeks, like a piece of fruit, and is made fresh with a shelf life of a few days. The production creates five times less CO₂ and nine times less energy than bottled water. Americans used about 50 billion plastic water bottles in one year alone, using enough energy to power 190,00 US homes (Ban the bottle). The Ooho has the potential to curb this excessive waste source.

Currently the production is still growing and Ooho is primarily available at events, having been sold in London, San Francisco and even Boston. This has the potential to spread exponentially by providing an on the go water source that does not create waste. This startup has the potential to solve the problem of plastic water bottle waste. Although the Ooho is not yet available for purchase we will be keeping an eye out until we can buy it in our local market. Further, this new technology creates another inventive use of seaweed, a product that we are only begin to explore the potential of, into an environmentally pioneering path to a greener future. We are awarding the Ooho with our 2017 environmental innovation award.

More information in the links below:

<http://www.skippingrockslab.com/ooho!.html>, <https://www.banthebottle.net/bottled-water-facts/>

Thank you to **OCEAN** Researcher *Jessica Hillman*



Drinking Seawater

A new technology is arising that could bring clean drinking water to millions of people around the globe. Researchers from a team at The University of Manchester have found a way to sieve common salts from salt water using graphene-oxide membranes, something previously not thought possible without reverse osmosis. These graphene membranes are made by slicing an atom-thick lay of graphite and poking extremely small holes in the sheets. These small holes allow water to pass through the membrane and leaves salt and other debris behind.



Part of the reason this development is so important is because these graphene filters use 50% less energy than current filters for desalination. This would mean a big difference in the cost of desalination and allow this technology to grow. Unfortunately there is currently no good way to poke uniform holes in the graphene on a large scale which drives the cost for this technology up. Though this innovation looks promising it has a long way to go until it will be found in any desalination plants or hit the general market. It is estimated that when this does finally reach the plants that it will be about 15-20% cheaper than current methods.

(continued on next page)

Drinking Seawater (cont.)

Other potential uses for this technology includes cleaning brackish water, which has more salt than freshwater and not quite as much salt as seawater, such as that found in estuaries. In this scenario the energy required to clean the brackish water would drop by 50%. Another potential use would be in smaller desalination plants, this would require less energy for the same amount of water, and require fewer membranes.

It seems that graphene membranes are a few years from being commonplace in the market and at desalination plants, but when they are ready finished it will mean great things for the world. It is estimated that by 2025 1.8 billion people will face water shortage. This technology could mean a lot for lessening the effects for these shortages.

More information in the links below:

<https://www.economist.com/blogs/babbage/2013/04/graphene-and-desalination>, <https://www.sciencealert.com/this-new-technology-converts-sea-water-into-drinking-water-in-minutes>

Thank you to **OCEAN** Researcher Lindsey Stanton



Peru Devastated by Floods

In the spring of 2017, the South American nation of Peru suffered the worst floods it has seen in 20 years. Brought on by an El Niño event, intense rainfall lasted in Peru for weeks. During this time, 94 people lost their lives, and 115,000 homes were destroyed, leaving 700,000 people homeless. Peru was widely affected by the floods - 12 of the country's 25 regions suffered from the flooding. The rainfall this spring, which cumulatively brought ten times the typical precipitation Peru sees in a year, hit the coastal regions of Peru particularly hard.

Analysts say that rapid growth since 2000 brought many Peruvians from inland rural areas to desert towns along the coast. In particular, the outskirts of the nation's capital, Lima, have transitioned from sparsely populated desert to thickly settled sprawl. Opportunity for work in coastal cities caused this population shift, but because it happened so quickly, these coastal desert regions did not have time or resources to prepare for flash floods. This left many people vulnerable to the rain events this past spring, which ultimately leveled entire towns.

The rain caused large-scale infrastructure damage - roads across the country were washed out, and 117 bridges were destroyed. This left many remote communities isolated, and made evacuation of these places difficult. Some people were left without drinking water for nearly a week while police and military had to use inflatable rafts to bring relief to isolated and remote areas. Though Peruvian officials did what they could to bring assistance to those in need, there were many complaints that officials responded to the disaster too slowly.

The cost of this extreme rainfall and subsequent flooding is estimated to reach \$3.1 billion, which is nearly 2% of Peru's total gross domestic product. The road repairs alone will cost an estimated \$1 billion, and will take up to three years to complete. Countries around the globe have pledged to support Peru with relief funding: China pledged \$1.5 billion. And the United States pledged \$525,000. Though many South American countries also experienced flooding, Venezuela, Colombia, and Ecuador have also pledged support, along with South Korea and France, among others.

Peruvian President Pedro Pablo Kuczynski said of the 2017 floods, "there hasn't been an incident of this strength along the coast of Peru since 1998." Before the El Niño event in 2017, 1998 was the last strong El Niño to hit the region. El Niño events typically occur every two to seven years, although the magnitude of these events varies. El Niño's are caused by warm ocean water in the Pacific Ocean shifting east - towards the coast of Peru. This creates large warm zones in the eastern Pacific, which has several effects. This typically causes poor fishery returns due to loss of nutrient rich upwelling. It also results in large amounts of heat and water vapor added to the atmosphere. This warm, moist air condenses in the upper atmosphere, resulting in extreme precipitation.

El Niño's have occurred in the Pacific Ocean for centuries, and though precipitation like this is abnormal, it is not unheard of. However, as climate change causes sea surface temperatures across the planet to increase, extreme El Niño events could become more severe - warmer sea surface temperatures combined with El Niño events could result in more precipitation and more flooding. Furthermore, as global populations rise, the populations of coastal cities in countries like Peru will continue to increase. This means that floods along the coast may be able to cause more damage and hurt more people as these regions become more populated. However, by preparing flood prone regions to deal with the effects of large floods, many lives can be saved in the future.

More information in the links below:

<https://weather.com/news/news/peru-deadly-flooding-impacts>,
<https://www.nytimes.com/2017/04/06/world/americas/peru-floods-mudslides-south-america.html>, <http://www.latimes.com/world/mexico-americas/la-fg-peru-floods-20170328-story.html>

Thank you to **OCEAN** Researcher Rae Taylor-Burns



Neonicotinoids Found in US Drinking Water

The public concern for disappearing honey bees has made speculation regarding neonicotinoids and colony collapse disorder a hot topic over the past few years. **OCEAN** has published multiple articles on this concern, from **OCEAN** 35's "Update on Bee-kind", to **OCEAN** 27's "Pollinator Mystery Update", and originally **OCEAN** 23's "The Effects Neonicotinoids have on Pollinators" which outlined Bayer chemical company's neonicotinoid usage and the E.U.'s neonicotinoid ban.

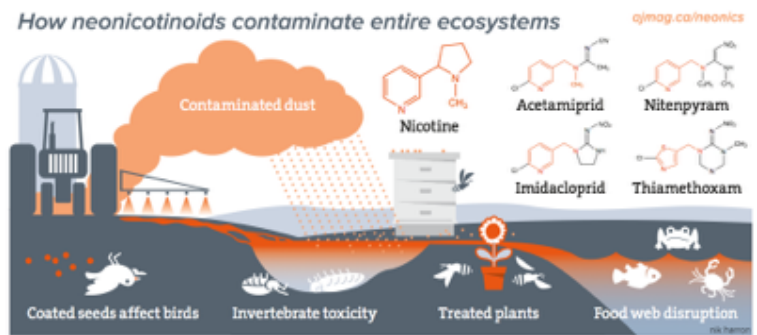
Neonicotinoids are a widespread, internationally used insecticide that affects its target (or non-target, such as bees) organism's brain, causing disorientation, memory loss, and even sometimes fatal paralysis. Neonicotinoids such as Imidacloprid are widely used despite insufficient research into their side effects. The MSDS for Imidacloprid lists that: "This product is highly toxic to aquatic invertebrates" then continuing to advise against application near water sources warning users to "keep out of lakes, streams, or ponds. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters" Imidacloprid MSDS, kellysolutions.com. The MSDS clearly states the adverse side effects of neonicotinoids in our water sources however it appears this warning has been ignored.

Recently, neonicotinoids have been found in drinking water. Although levels are very low and further filtration does greatly reduce their levels, scientist are concerned about this discovery and urge for further research. Prof Gregory LeFevre, a researcher the University of Iowa stated that while the discovered levels are very low, 0.24 to 57.3 nanograms of individual neonicotinoids per liter, he is still concerned as to how the low levels could affect humans at the exposure level. This discovery is concerning and worthy of notice, and hopefully further research will result in greater restrictions and mitigation of neonicotinoids.

More information in the links below:

<http://www.bbc.com/news/science-environment-39504487>, http://www.kellysolutions.com/erenews/documentsubmit/KellyData%5CND%5Cpesticide%5CMSDS%5C81959%5C81959-16%5C81959-16_IMIDACLOPRID_TEC_HNICAL_11_6_2006_8_03_38_AMSecured.Pdf

Thank you to **OCEAN** Researcher Jessica Hillman



France's "Eco Roof" Law



Photo credit: Livingroof.com

Recently it has been announced that France has passed a law requiring all new buildings built in commercial zones to have either plants or solar panel roofs. Though this announcement sounds monumental it is not entirely true. This movement began back in 1992 at the Rio Earth Summit where France signed the Biological Diversity treaty which promised to develop strategies for the conservation and sustainable use of biodiversity. From there in 2010 the Nagoya Protocol was adopted, an action plan for the preservation of biodiversity through 2020. As a part of the Nagoya Protocol in 2011 France developed the National Biodiversity Strategy which incorporated the green roof policy. (Lyon, Burchell, 2016). Unfortunately in 2015 the French senate removed the green roof policy from their biodiversity initiative, meaning the law didn't actually pass (N/A, 2016).

Had the law passed it would have had a large positive impact. Green roofs help to reduce the heat island effect in cities and reduce pollutants which can be damaging to health. They also add natural beauty, and when used in conjunction with solar panels usually increases energy output by 10-18% (Lyon, Burchell, 2016). It is still possible that the introduction of this bill, even though it was not ratified, may inspire other nations to introduce similar ideas; resulting in a more environmental friendly world.

Currently the green roof industry ADVET is lobbying to revive the green roof article. The biggest hurdle to overcome is the disconnect between building owners who do not want to bear additional expenses and adhere to the green roof policy, and consumers who would also rather not front the bill (Lyon, Burchell, 2016).

More information in the links below:

<http://www.urbanstrong.com/frances-famous-eco-roof-law-too-green-to-be-true/>, <https://livingroofs.org/french-solar-green-roof-law-kicked-out/>

Thank you to **OCEAN** Researcher Lindsey Stanton

A Few Easy Steps to Conserve Water!

In the coming years the need for water conservation may grow exponentially more important. With the human population expected to grow to 9 billion by 2050 it is important to keep in mind that that accessible freshwater only makes up about 1% of water worldwide. In order to ensure that enough freshwater is around for everyone, water conservation techniques are an important part in reducing water consumption. Following are a few general techniques that could reduce water consumption and even save you money! Some examples include:

Fix and find leaks- small drips of water can add up big both out of your wallet and for water loses, but fixing any leaks you could save 53 gallons of water per year

Buy water efficient appliances- water efficient appliances may cost a little more upfront but in time save you money by reducing water consumption

Turn water off before vacation- turning off the water can prevent any pipe burst or leaks during your absence

Water houseplants with ice cubes- this trick will prevent you from overwatering your plants and may even improve your green thumb!

Reuse old water- this will prevent you from using freshwater for tasks that don't necessarily need it like, watering plants

Insulate hot water pipes- this cuts down on the time you wait for water to warm up, saving you time and money

Winterize pipes- any exposed pipes can be winterized to prevent any freezing or line breaks, saving you a major headache

These recommendations come from "Water Conservation Tips: 110+ Ways to Save Water." There are countless more suggestions if you are looking for more ways to conserve water. For more information you can access their website at <http://www.sustainablebabysteps.com/water-conservation.html>. Good luck and happy conservation!

Thank you to **OCEAN** Researcher Lindsey Stanton



Safe Harbor: Who We Are



Safe Harbor Environmental Consulting hosts interns every summer, training the next generation to preserve our beaches and natural habitat. This year Safe Harbor is proud to work with Summer Interns Sarah Billeau an Environmental Policy major at Boston University and Jonathan Bruce an Environmental Engineering major at Norwich University in Vermont. These Coastal Restoration Interns are passionate about Cape Cod and learning how to preserve it. Many of these interns are local college students who are passionate about our home, Cape Cod. Interns have also come from as far as California and Canada to learn about the unique environment of the Cape while gaining practical experience and knowledge of native species and beach restoration.

Interns are expected to bring an enthusiasm for our environment and are trained thoroughly through a Safe



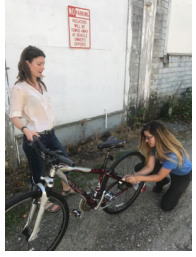
Harbor basic orientation program and several seminars ranging from Erosion Control to Coastal Ecology and Biomimicry Development.

Those interested in learning more about Safe Harbor's intern program should visit: <https://www.safeharborenv.com/who-we-are-2/intern-program> or contact our Intern Coordinator Kristyna for more information at kristynasafeharbor@gmail.com.

An Important Reminder from OCEAN: Our Research Coordinator Jess also manages your email delivery of **OCEAN**. We pay to send out our newsletter through Constant Contact because we want a secure system. However, email servers direct these mailings to SPAM. We have noticed that many people may not be receiving our newsletter. If you would like to ensure you receive your copy we would highly recommend that you add oceansafeharbor@gmail.com to your address book or safe sender list. Thank you Jessica.

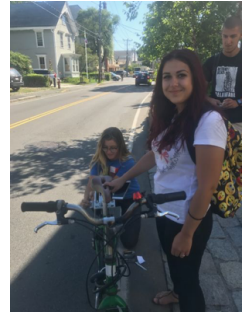
“SAVE A LIFE FOR 50 CENTS”

OUTER CAPE ADVOCACY INITIATIVE TO REDUCE BICYCLE ACCIDENTS



The shortage of safe, pathways herds bicycle riding summer workers and visitors onto roads with traffic. This can be manageable during daylight but in the dark, bicyclists are much harder to see and things don't always go well. Safe Harbor grew tired hearing complaints about near misses and decided to do something more meaningful. We applied a strategy used with environmental problems: Double Loop Learning (an established business model also), focuses on addressing the cause of a problem, rather than the problem itself. This brought Kristyna Smith, our Advocacy Coordinator, to a simple solution. Safe Harbor Volunteers on the Outer Cape Towns, have been hitting the streets, offering to place highly reflective tape on bicycles. The tape would preferably be wrapped around a part of the frame, to provide reflectivity from any direction. This is a heavy duty, weatherproof product used on safety equipment. It is expensive but when cut into individual pieces, it only costs about 50 cents per bicycle. That could translate to 50 cents per life saved. The entire operation takes less than a minute per bike. **Contact Kristyna if you want to be a part of this effort.**

kristynasafeharbor@gmail.com



Cape Cod experienced profound transitions, beginning after the Civil War. As ecological resources began to diminish, Cape Codders realized the one time fleet of 100 fishing boats in Wellfleet Harbor would never come back. They gradually began looking at people (tourists) as a new industry. The trains that once carried fish and later up to two box cars of oysters each day to New York, could now deliver consumers, directly to the Cape. This transitional period is well detailed in John Crumbler's book: **Cape Cod**

An Environmental History of a Fragile Ecosystem, John T. Cumbler <http://www.umass.edu/umpress/title/cape-cod>

TURNING BACK TIME

Cape Codders now have a unique opportunity to turn back the hands of time, to reconnect with a once lost resource, the 1,200 acre Herring River, which was diked 100 years ago. For more information on giving a river back it's voice, go to:

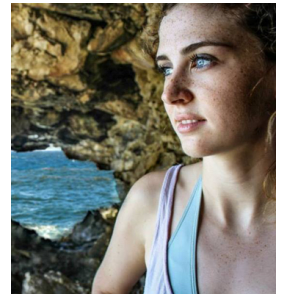
<http://www.capecod.com/newscenter/friends-of-herring-river-to-take-on-blue-carbon-at-9th-annual-meeting/meeting/>

Up next in **OCEAN 39!**

The next issue of OCEAN will share some possibilities we just didn't think of: One Acre Roof Top Farms, reducing CSO loading from rain events, and using light weight mushroom compost to grow 50,000 pounds of Organic vegetables for local restaurants and Farmer's Markets in Brooklyn. We will also introduce our initial research into Biodegradable materials for Helium Balloons.



OCEAN would like to recognize Samantha Thywissen, for her time bending efforts as Associate Editor of **OCEAN 38**. Samantha is also very busy with her Internship at Woods Hole Oceanographic Institute this summer. Thank you Samantha.



Thank you to Jessica Hillman, **OCEAN 38** Research Coordinator. We appreciate her communication skills with our far flung researchers. Jessica is also preparing for an intense, accelerated Masters Program at Brandeis. Thank you Jess.

Check out our website for other free publications: <http://safeharborenv.com/free-publications/>

Thank you for your support!