the weekly anthropocene

dispatches from the wild, weird world of humanity and its biosphere

by Sam Matey

Coral Reefs. Coral reefs are having a terrible Anthropocene. Under threat from warming temperatures, acidifying oceans, and diseases carried on plastic trash, coral reefs have been devastated around the world. The reefs around Isla Wolf and Isla Darwin, two of the remotest Galapagos Islands, had seemed no exception to this trend: massive bleaching events (where corals expel their symbiotic algae due to untenably warm waters) devastated them in 1982-83, 1997-98, and 2015. Although many of reefs around the more populous Galapagos Islands, even the ones situated in cooler waters, have yet to recover from this damage, a recent expedition found that the reefs around Wolf and Darwin are doing very well. The Reefscape survey found giant coral colonies covering over 50% of the seafloor around these two islands, with coverage of 80% or more in some areas. Sea life with also abundant, with hammerhead sharks, algae-pruning herbivores, and inquisitive moray eels (pictured) all present. Notably, these islands are two of the most isolated areas in the Galapagos, with very little human disturbance. In more populous islands, coral coverage was only 1 to 3 percent, even though the water was cooler. It appears that even in stressful, warm conditions, coral reefs can rebound as long as they are relatively unharmed by human overfishing and pollution. This survey's findings are encouraging news for the future of coral reefs: "refugia" like Wolf and Darwin could offer safe havens for the ecosystem to survive the Anthropocene. Spectacular news!

UK. A new paper in the *Proceedings of the Royal Society* has propounded a fascinating plan for a tidal power station in the UK's Bristol Channel. Engineer Rod Rainey outlines a plan for a row of 250 steel waterwheels, each 30 meters high and 60 wide, to be secured to the seabed in a line 15 kilometers long. The unique conditions of the Bristol Channel, where the difference between high tide and low tide is a whopping 15 meters, would provide lots of flow to turn these wheels: Rainey estimates that the entire line would provide 4 gigawatts of energy, or about twice as much as a large nuclear power plant. The plan is also cost-effective: one of these "Rainey wheels" contains about 1.5 times as much steel as a modern wind turbine but would produce 5 times as much power. If this plan gains funding and support, it would be an exemplar of a new era of distributed, localized energy generation, taking advantage of a region's natural features to create a unique, low-impact power source integrated with the landscape. May Rainey's work progress! More news as it develops.

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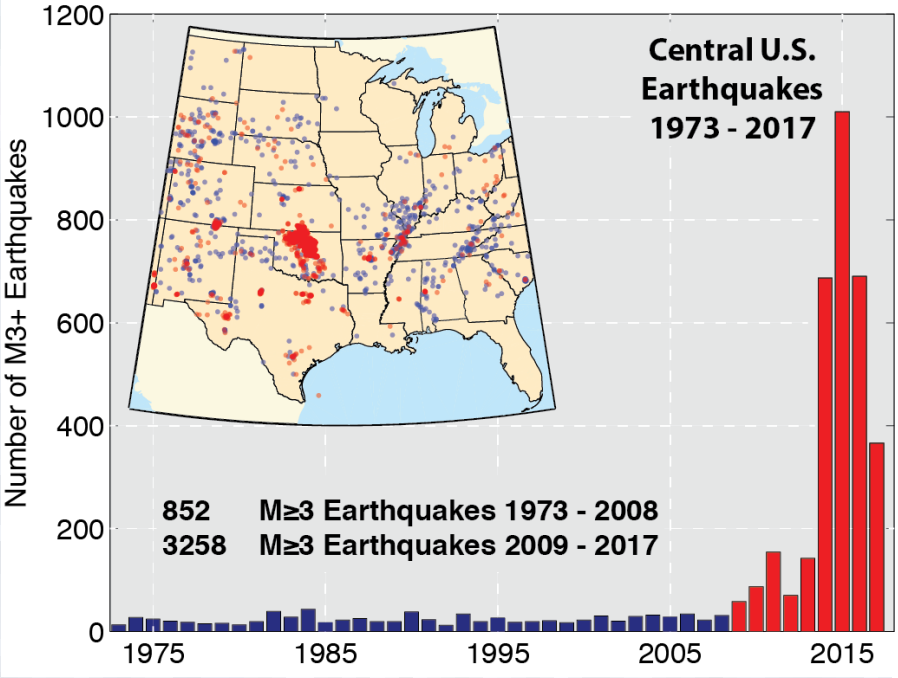

USA (1). Oklahoma has changed from a stable chunk of territory to an earthquake hotspot in the last few years, and the increase in fracking in the area has long been suspected as the culprit (pictured, US Geological Survey chart). Now, a new study from the University of Bristol has strongly linked these earthquakes and the depth at which frackers inject wastewater into the ground. The research team analyzed data on drilling injections versus earthquakes, and found that they were strongly associated. The study also posited that injecting at a shallower depth could reduce the danger. This disturbing finding shows that humanity's unrestrained resource extraction has even more consequences that we have thought. For more info, copy and paste goo.gl/tL7N3s.

USA (2): Texas. In a strong sign of renewable energy's bright future, Texas produced 18 percent of its energy from wind and solar power in 2017. This is especially impressive as Texas has its own grid, so all of that power was produced locally. That share looks likely to expand, renewable energy is still growing in the Lone Star State, and electricity prices are decreasing in tandem. Great news!

North America. A new study from the University of Wyoming used analysis of lake sediments to determine that the last decade has been warmer than most of the 11,000 years before that. Their work relied on ancient pollen trapped in the lakebed. "When we collect sediment from the bottom of the lake, we can recognize sequences of plants that grew in a given area based on the shape of the fossil pollen left behind," explained Dr. Bryan Shuman, a UW professor, to ScienceDaily. "Because different plants grow at different temperatures, we can constrain what the temperatures were in a given place at a certain time." This data gave a result that underlines the significance of human-caused climate change. "I would say it is significant that temperatures of the most recent decade exceed the warmest temperatures of our reconstruction by 0.5 degrees Fahrenheit, having few -- if any -- precedents over the last 11,000 years," Dr. Jeremiah Marsicek, lead author of the paper. Sobering news.

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Microplastics. Tiny, broken-down pieces of plastic, or microplastics (pictured), are known to be a harmful type of pollution in the oceans, where they accumulate in fish and crowd out plankton. Now, a study from a team of German researchers has found that their impact on land and freshwater ecosystems is also profound. The study found that microplastics in soils carry diseases, affect earthworms' burrowing, and accumulate in foods eaten by many animals (including humans) with potentially damaging effects such as disruption of hormones and inflammation. This is a new, disturbing way in which humans are offloading toxic substances into the biosphere, and is likely to have complex long-term effects we don't even know about yet. For more information, check out goo.gl/X46WE6. More news as it develops.

Cambodia (1). Three men have been murdered by soldiers in the Mondulkiri (or Mondol Kiri) province of Cambodia, apparently for daring to confront illegal loggers. Forest ranger Teurn Sokthai, military police officer Sek Wathana, and Wildlife Conservation Society (WCS) officer Thul Khna did their jobs by confiscating chainsaws and motorcycles from Vietnamese illegal loggers. Although much of the province is protected, illegal logging is common along the Cambodia-Vietnam border, with government officials often complicit. That appears to have been the case here, as all three men were attacked, shot, and killed by Cambodian border guards, who were likely profiting from the illegal logging. "Every day, rangers and law enforcement staff risk their lives to protect wildlife and forests," said Ken Serey Rotha of WCS Cambodia in a public statement. "We should not allow criminals to destroy the forests of Cambodia and to threaten and murder those working tirelessly to protect this country's natural heritage. Soknai, Wathana, and Khna will always be remembered as conservation heroes." Amen.

Cambodia (2). In happier news from Cambodia, three nests of the critically endangered red-headed vulture have been discovered in Chhep Wildlife Sanctuary. There may be as few as 50 red-headed vultures (Sarcogys calvus) left in Cambodia, and the discovery of new breeding sites is cause for rejoicing. The Wildlife Conservation Society has employed six local villagers to protect the nests, incentivizing the community to defend their local wildlife. Great news!

Hong Kong. In good news for world elephant populations, Hong Kong has followed mainland China's lead by resolving to criminalize the sale of ivory within its borders. The "blood trade" in elephants' hacked-out tusks is a major cause of their decline, and Hong Kong's status as a major ivory market means that its decision to shut down all ivory shops by the end of 2021 should have a broad impact. This could also encourage the shutdown of other ivory markets, like Thailand and Laos. Good news!

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Indonesia. In 2015, Indonesia was ravaged by over 100,000 wildfires, many of them due to the drying of peatlands for wood plantations. Now, the nation is planning to re-soak the swamps, with an unprecedented plan to restore 2.5 million hectares of peatland by 2020 while at the same time developing a sustainable "paludiculture" to keep the land agriculturally productive. In 2017, the Peatlands Restoration Agency restored 200,000 hectares. For more information on this complex and ambitious project, check out goo.gl/TMy4Gf. More news as it develops.

Perovskites. Solar panels are a clean, renewable energy source, and they're growing cheaper every year. How can they be improved? By building panels that are even better at harvesting the sun's energy. Nearly all modern solar cells are made from silicon, which generally have an efficiency rate (a measure of how well they convert light into electricity) of around 10%. However, experimental solar cells made out of perovskites, a type of crystalline mineral, are reaching efficiency rates of 26% in the lab, with potential to go much higher. An innovative new company called Oxford Photovoltaics is investing heavily in developing perovskite solar technology, working on creating printed, flexible perovskite cell sheets and tandem perovskite-silicon cells to better integrate into the existing silicon-based solar market. Perovskite cells hold the potential to transform the energy landscape, making solar an even more efficient and cost-effective power source. For more info, check out goo.gl/k5fieu. Excellent news!

South Australia. The state of South Australia is rapidly emerging as a world hub of renewable energy, thanks to several farsighted collaborative projects with Tesla. Last year, Tesla delivered the world's largest lithium-ion battery to South Australia to serve as an energy store for its grid. Now, the state government has announced plans for the world's largest virtual power plant, a network of homes with their own solar systems that together generate power for the grid. South Australian Premier Jay Weatherill said "we lead the world in renewable energy with the world's largest battery, the world's largest solar thermal plant and now the world's largest virtual power plant," in an interview, reflecting on his state's progress. Great job, South Australia! Keep it up!

Benin. On January 31st, the National Geographic Society, African Parks, the Wyss Foundation, and the Republic of Benin announced that they were uniting in a conservation initiative to restore Benin's Pendjari National Park. This Delaware-sized piece of land is a natural jewel, home to elephants, lions, cheetahs, hippos, and buffalo, but is under threat from poachers. The new partnership will spend $23.5 million to restore and protect the park, with future management actions for Pendjari including the hiring 60 new rangers and reintroducing rhinoceroses and wild dogs. "The international collaboration for this reserve is extraordinary, especially because it comes at a time when my government is committed to making tourism a lever for long-term development." said Benin's President Patrice Talon in a press release. "It is all at once a matter of preservation of our environment and our natural resources, sustainable tourism and social impact." Great news!

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Climate Problems (1): Permafrost. A new study from the US Geological Survey has found that northern permafrost soils hold a massive amount of mercury. Large amounts of this danger neurotoxin are now at risk of being released as permafrost (pictured, with ice wedge) melts due to climate change. "24 percent of all the soil above the equator is permafrost, and it has this huge pool of locked-up mercury," said Paul Schuster, a USGS hydrologist and lead author of the study. "What happens if the permafrost thaws? How far will the mercury travel up the food chain? These are big-picture questions that we need to answer." This is a powerful new threat posed by climate change. For more info, check out goo.gl/jSyGX4.

Climate Problems (2): Ozone. The Antarctic hole in Earth's protective ozone layer was one of the great environmental threats of the 20th century, a crisis averted by the 1987 Montreal Protocol outlawing ozone-destroying CFCs. Several recent studies have found that the Antarctic ozone hole is indeed healing, as reported on in a previous *Weekly Anthropocene*. However, a new analysis published in *Atmospheric Chemistry and Physics* has found that ozone layer thickness is decreasing in the lower stratosphere of Earth's tropical regions. Confusingly, upper stratosphere ozone has slightly increased in the same place and timespan, which could possibly be explained by researchers' suspicion that VSLSs, a class of "very short lived substances" like the dichloromethane found in paint removers, are partially to blame. Climate change could also be a contributor, with changes in world weather patterns sweeping ozone away from the tropics. This is a complex and important new issue. More news as it develops.

Climate Fixes (1): Agroforestry. Agroforestry, a practice in which trees are grown on farmed land, is already a great conservation tool, letting a field double as a farm and habitat for local species (pictured, an agroforestry cornfield). Now, a new study has found that it's also a great way to fight climate change, with the transition from normal farms to agroforestry increasing soil organic carbon (pulled from the air by the plants) by 34%. Great news!

Climate Fixes (2): Methane. Chemists have discovered a new way to transform methane, a potent greenhouse gas, into the valuable plastic components ethylene and propylene. Their process, reliant on a new catalyst known as H-SAPO-34, could reduce emissions while offering a sustainable way to source plastic. For more info, check out goo.gl/WUueGK. Spectacular news!