



the weekly anthropocene



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

Northern White Rhinos. In March 2018, Sudan, the last male northern white rhino (*Ceratotherium simum simum*) died of natural causes. The last remaining members of the subspecies are two females, Najin and Fatu, neither of whom can reproduce. Now, scientists have used IVF (in-vitro fertilization) to create hybrid northern/southern white rhino embryos, which are apparently viable. A team of biologists from an array of universities and embryologists from the Italian biotech company Avantea combined frozen sperm from deceased male northern white rhinos with eggs harvested from living female southern white rhinos (pictured, the harmless egg recovery process). With this genetic material, the team has created seven hybrid embryos, currently frozen. The researchers are now investigating the possibility of harvesting eggs from Najin and Fatu, in the hope of creating “purebred” northern white rhino embryos. The researchers are also working to find southern white rhinos to implant the existing hybrid embryos into and hope to successfully implant one of them in the next year. As rhino pregnancies last 16 months, with luck, young animals carrying northern white rhino genes will be walking the earth in a little under three years.



Although substantial concerns remain (where will a new population of northern white rhinos live? How will we prevent from being poached into oblivion again?) this is a great step forward for conservation technology, with repercussions for the survival of species around the world. The northern white rhino is not alone at the brink of extinction. The vaquita (*Phocoena sinus*) is the most endangered marine mammal in the world, with the latest estimates finding pegging the surviving number at less than 12. In late 2017 a last-ditch captive-breeding program ended in failure (as chronicled in earlier issues of this newsletter), when they found that vaquitas were so sensitive they could not stay alive in captivity. The last hope for this species may be the vaquita tissue samples stored at the San Diego Frozen Zoo. Genetic manipulation and assisted reproduction technologies could someday offer a hope of resurrecting the species from that stored DNA. The vaquita is not an isolated case. The Hainan gibbon (*Nomascus hainanus*), the world’s most endangered primate, is down to 30 or less individuals living in a small nature reserve. In an even more directly relevant example, the Sumatran rhino (*Dicerorhinus sumatrensis*) is another incredibly rare rhino, with only nine individuals in captivity and an unknown number, thought to be between 30 and 90, left in the wild. Even with the most intensive conservation efforts, the fate of a species riding on so few individuals presents an incredibly high risk of extinction. Professor Cesare Galli of Avantea, one of the embryologists who helped create the new northern white rhino hybrids, has already suggesting using assisted reproduction to help the Sumatran rhino. Some are taking the idea of using stored DNA to save endangered species a step further, and plan to resurrect species that are already extinct. Revive & Restore, an organization co-founded by famed biologist Stewart Brand, has already sequenced the passenger pigeon genome and is investigating ways of implanting that species’ DNA in modern pigeons.

Although it remains to be seen how these strategies will play out, or if any species will be truly brought “back from the brink” by stored sperm, eggs, or genes, these efforts at least offer hope that humanity will be able to undo some of our gravest mistakes. More news as it develops.

For more, see goo.gl/zbnZtM and goo.gl/RYNcgd. Thanks to Avantea for the photo.

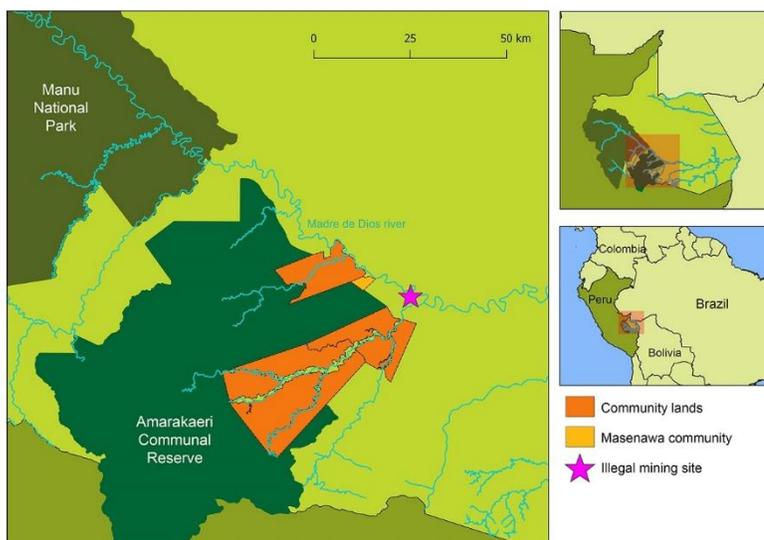


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New Tools: ForestLink. In a highly innovative new method of fighting deforestation, an app is helping local communities report illegal exploitation of their forests. ForestLink, developed by Rainforest Foundation UK (RFUK), allows “community monitors” to take pictures of illegal activity in their area, from mining to logging, and send the evidence to the local authorities via satellite link. ForestLink has already been deployed in tropical forests in Ghana, Cameroon, Peru, and the Democratic Republic of the Congo, and is racking up successes. To take the most recent example, in late June



community monitors from the Masenawa community in Peru came across an illegal gold mining camp in the Madre de Dios region of the Peruvian Amazon. They used ForestLink to alert the police, who destroyed the camp and arrested 5. “What this intervention shows is the power of harnessing technology for social good and putting it in the hands of local people, who are on the frontlines of the fight against deforestation,” said local RFUK coordinator Aldo Soto. This is a spectacular new way to empower local communities to protect their biological birthright, and an excellent example of the power of technology to unite ordinary citizens in the pursuit of a greater social good. Great news! For more, check out goo.gl/tW5MzU and goo.gl/kbhmKg.

New Inventions: Bacteria-Powered Solar Cell. In a fascinating development, a team of researchers from the University of British Columbia have developed a bacteria-powered solar cell. The UBC team created their “biogenic” cell by genetically engineering *Escherichia coli* bacteria to produce high levels of lycopene, a compound highly efficient at harvesting light for photosynthesis. They then coated the bacteria with a semiconductor mineral and applied the mixture to glass. The new cell produced 0.686 milliamps of electric current per square centimeter, considerably below silicon-cell (conventional) solar panels’ output levels but a record high for this new type of solar cell. “We recorded the highest current density for a biogenic solar cell,” said Dr. Vikramaditya Yadav, leader of the project (pictured). “These hybrid materials that we are developing can be manufactured economically and sustainably, and, with sufficient optimization, could perform at comparable efficiencies as conventional solar cells.” Most excitingly, these new biogenic solar cells work as efficiently in dim light as in bright light, potentially speeding adoption of solar power in often-cloudy regions. Great news! For more, see goo.gl/X4Et4i.





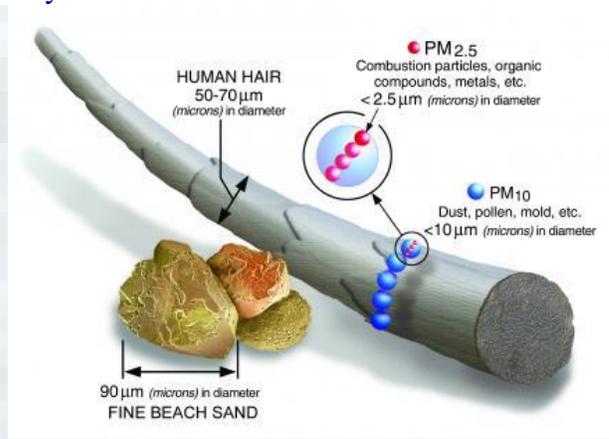
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New Hazards: Air Pollution and Diabetes. A

landmark new study published in *The Lancet Planetary Health* has found a strong link between PM_{2.5} concentrations (particulate matter smaller than 2.5 microns, a common type of air pollution, is often emitted by cars and trucks) and an increased risk of diabetes. (Pictured, size comparison of PM_{2.5} particles). The researchers analyzed anonymous data from both the annual Global Burdens of Disease study and a Veterans Affairs study following the medical histories of 1.7 million veterans and compared that information with EPA and NASA data



on local air pollution levels. They calculated that air pollution contributed to 3.2 million new cases of diabetes worldwide in 2016, and that 8.2 million years of healthy life were lost in that year due to air pollution-linked diabetes. In the US, they estimated that air pollution caused 150,000 new cases of diabetes and the loss of 350,000 years of life. "Our research shows a significant link between air pollution and diabetes globally," said Dr. Ziyad Al-Aly, senior author of the study. "We found an increased risk, even at low levels of air pollution currently considered safe by the U.S. Environmental Protection Agency (EPA) and the World Health Organization (WHO). This is important because many industry lobbying groups argue that current levels are too stringent and should be relaxed. Evidence shows that current levels are still not sufficiently safe and need to be tightened." This study adds even more urgency to the imperative need for stricter pollution controls-and an accountable, pro-public health EPA to enforce them. For more on this story, see goo.gl/MA7Lpx and goo.gl/A27e4w. For regularly updated reports on air pollution by zip code, check out airnow.gov.

USA. After strong grassroots resistance to his radical policies, Environmental Protection Agency Administrator Scott Pruitt has resigned. At the time of his resignation, Pruitt was subject to 18 separate federal ethics investigations, and had accumulated a track record of abuses of power ranging from bizarre to illegal. To take just a few examples, Pruitt ordered aides to purchase him a used mattress and moisturizers, spent public money lavishly on a bulletproof desk, a 24/7 security detail, and first-class plane tickets, and routinely texted with coal industry executives to discuss actions that affect their industry. He has also ardently pursued Trump's policy of impeding and attempting to dismantle the EPA's regulatory framework, attempting to weaken or eliminate rules ranging from fuel-economy standards for cars to the Obama-era Clean Water Rule. His resignation, after seventeen months of corrupt mismanagement, is a victory for the American people.

However, his likely replacement is little better. Andrew Wheeler, Deputy EPA Administrator and now Acting EPA Administrator, is a former coal industry lobbyist who concurs absolutely with the Trump Administration's policy of rejecting public health in favor of fossil fuel interests. Wheeler will continue the culture of cronyism and corruption that Pruitt fostered at the EPA. Within the next few months, Wheeler must face Senate confirmation. It is our responsibility to learn from the ghastly mistake that was Pruitt's appointment and urge our Senators to demand an EPA Administrator who prioritizes the people, not polluters. For more, check out goo.gl/8kTG6y.



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Portland, Maine. On July 5th, Maine Conservation Voters held a beach cleanup at Portland's Eastern Promenade park. Our team of volunteers (a subset, pictured) combed the shorelines for plastic, styrofoam, broken bottles, cigarette butts, and all of the other litter that doesn't belong in a park. Overall, we collected approximately 5 pounds of the stuff (it doesn't sound like a lot, but plastic is really light!). Some of the strangest items we encountered included an empty antifreeze bottle, a gray plush "door snake" draft stopper, and a long tangle of fishing line, which is often deadly to seabirds. All of our volunteers did great work and helped keep the Eastern Prom safe for all creatures. Good news!



Heroes of the Anthropocene: Anna Du.

In an inspiring story of ingenuity and determination, a 12-year-old girl from Andover, Massachusetts has invented a robot that hunts down microplastics pollution in the ocean. Anna Du (pictured) began her project when she noticed the high concentrations of plastic particles on the shore of Boston Harbor. "One day when I was at Boston Harbor, I noticed there was a lot of plastics on the sand," said Ms. Du. "I tried picking some up, but there seemed to be so many more, and it just seemed impossible to clean it all up." In response, she built a low-cost remote-operated vehicle (ROV) that scans for microplastics in the ocean using an infrared light. The chemical bonds that hold plastic together absorb much more infrared than water, so her robot's readings can be used to map microplastics concentrations in the ocean. This is a considerable technological advancement, and if widely produced could be a vital tool for citizen scientists and local authorities to gather data on the extent of microplastics pollution in their local waters. "Science has always been a big part of my life," said Ms. Du. "I'm super excited to make something that can actually help the world." Ms. Du's work has already earned her a place as one of ten finalists into tech company 3M's Young Scientist Lab challenge. As a finalist, she has access to mentorship and resources from 3M, which she hopes to use further develop her technology. Ms. Du's long-term goal is to upgrade her remote-controlled robot into a fully autonomous microplastics-mapping drone. Her work so far is groundbreaking and immensely impressive, and we have no doubt the world will be hearing much more from Anna Du in the future! For more on her incredible work, check out goo.gl/3BCnbY and goo.gl/5479Tr. For her awesome YouTube video on her invention, see goo.gl/G7zqVr.

