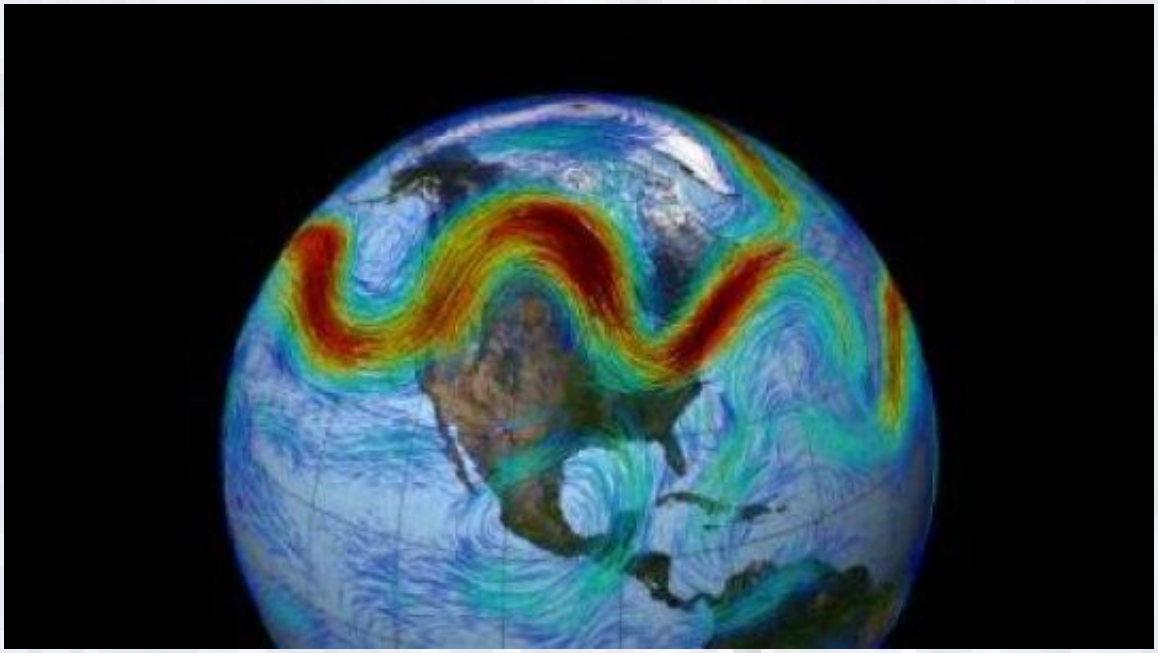
the weekly anthropocene

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

by Sam Matey



Earth's Atmosphere. A new study published in the journal *Science* offers an explanation for one of atmospheric science's most perplexing mysteries: blockages in the jet stream. The jet stream (pictured) is a system of rapid air currents circling the Earth. Sometimes, the jet stream moves off course, an event known as "blocking," which wreaks havoc with local weather systems. The California heat wave of 2014, Superstorm Sandy's strange trajectory in 2012, and several of New England's recent unusually cold winters. Until recently, it was unclear exactly how and why these blockages formed, and near-impossible to forecast them. Now, two atmospheric scientists at the University of Chicago have found a new mathematical model that predicts blocking and offers insight into why it occurs in the first place. After testing several new metrics, they found that the model's equation was very similar to the ones used to describe traffic jams. This insight led to their finding that blockages, in jet streams as in traffic, occur when multiple threads of movement converge. "It turns out the jet stream has a capacity for 'weather traffic,' just as highway has traffic capacity, and when it is exceeded, blocking manifests as congestion," said Clare S.Y. Huang, coauthor of the new study. According to the new model, climate change appears to be increasing blocking. This was expected: for example, climate change is implicated in the well-known individual case of unusually warm Arctic air causing the jet stream to swing southward, resulting in cold winters for the northeastern US. However, its effects are uneven; the model even suggests that some regions, such as the Pacific, could see a decrease in blocking in the next few decades. The researchers are currently working on using the model to predict more long-term weather patterns. This is fascinating work that could greatly increase humanity's understanding of our atmosphere, how we are changing it, and what we can do to adapt. For more on the new study, see goo.gl/AyK8Wj. For more on the specific case of Arctic/New England jet stream anomalies, see goo.gl/Vm3MHK. Illustration credit: NASA's Goddard Space Flight Center.

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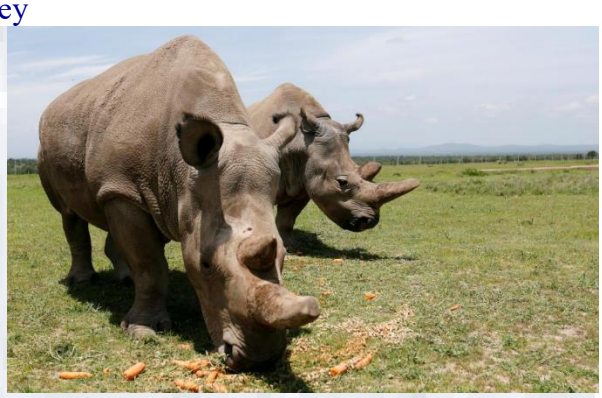
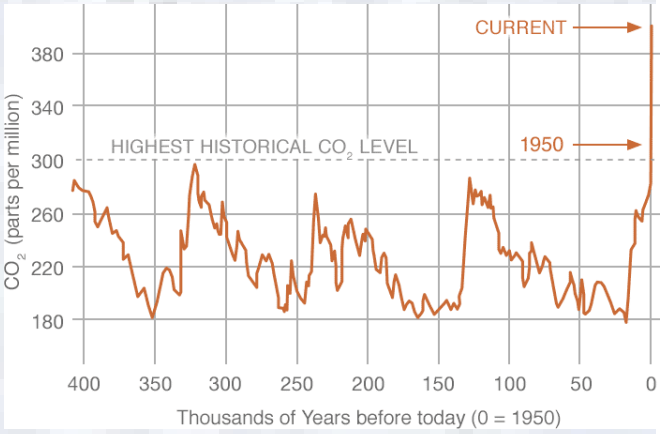


Northern White Rhino. The northern white rhinoceros (*Ceratotherium simum cottoni*) is in bad shape. Only two individuals remain, both females who can no longer bear young. However, scientists at the San Diego Zoo have cryopreserved genetic material from nine northern white rhino individuals and are working with an international team of researchers to use this material to create a northern white rhino embryo that could be implanted in a southern white rhino. This high-tech resurrection plan is expected to take years, but a new study published in *Genome Research* shared some good news. Geneticists at the San Diego Zoo have found that genetic diversity among the nine frozen DNA samples is surprisingly high, more than enough to avoid inbreeding in the event that the species was able to be restored. So, once the technology has been perfected, there's nothing stopping a healthy, diverse population of reborn northern white rhinos from roaming the African plains once again. For more, see goo.gl/Y2wJZ7 and goo.gl/sbAfSr. Photo credit: Reuters/Thomas Mukoya. Great news!



Rice. A highly disturbing new study published in Science Advances has found that rice becomes less nutritious when grown under high CO_2 concentrations. The international research team evaluated 18 different types of commonly grown rice that had been grown under ambient CO_2 levels of 568 to 590 parts per million (ppm), levels that could be reached by the end of the 21st century. (For comparison, the current level of atmospheric CO_2 is 407 ppm. Before the Industrial Revolution, CO_2 levels stayed below 300 ppm for hundreds of thousands of years.) The researchers found that although some rice showed higher productivity with more CO_2, all 18 types of rice showed declines in their levels of protein, iron, zinc, and vitamins B1, B2, B5, and B9, all vital nutrients. Vitamin E was the only nutrient that increased. "We have some rice varieties that show a stronger response to CO_2 and they are able to convert more of that CO_2 into seed, which can be good," said Lewis Ziska of the US Department of Agriculture, senior study author. "On the other side of that coin is the quality of that seed also being diminished in response to CO_2." Rice is a staple food crop for billions of people, and a decrease in its nutritional quality would have wide-reaching and long-lasting implications. For more on this new study, check out goo.gl/e2Mk81. For NASA's awesome overview of the rise in atmospheric carbon dioxide levels, see https://climate.nasa.gov/vital-signs/carbon-dioxide/. Graph credit: NASA, NOAA. Sobering news.

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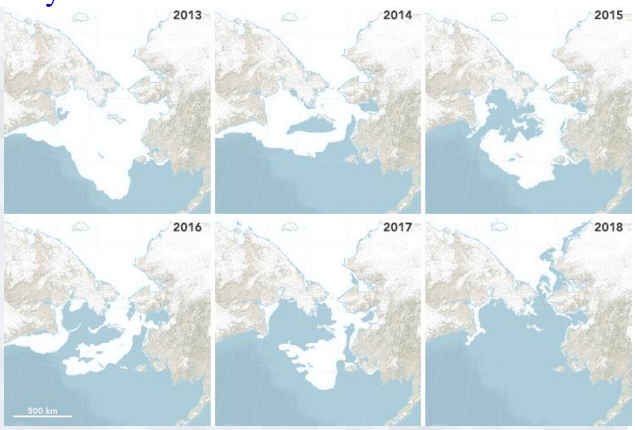

Bering Sea. In the past few years, the Bering Sea (between Russia and Alaska) has reached historic sea ice lows (pictured, a map of Bering Sea ice on April 29th in six sequential years). Its new accessibility has been attracting increased ship traffic seeking a quicker route between the Arctic and Pacific Oceans. Now, the UN's International Maritime Organization (IMO) has designated six new shipping routes to organize sea traffic in the area, as well as designing "areas to be avoided" that are home to fragile environments or local communities. It's unfortunate that this is necessary, but it's good that the nations of the world are working to responsibly manage the new Bering Sea. For more on the new IMO actions, check out goo.gl/d4h3Lo. For more on the melting Bering Sea, see NASA Earth Observatory's page on it at goo.gl/YkZDao. Map credit: NASA Earth Observatory.

New Inventions: Charged Copper-Mesh Membrane. A research team from the University of British Columbia has developed a copper-mesh membrane that can efficiently, cheaply, and cleanly separate oil and water. The team's copper mesh can remove both heavy and light oils, removing heavy oils by allowing the oil to pass through the mesh while the water remains and removing light oils by allowing water to pass through the mesh while the oil remains. It can be switched between the two different modes with a simple electric charge. This is a substantial improvement in oil-cleanup technology. "This technology offers an effective and eco-friendly way to reduce the negative impacts of oily water and wastewater, which are being produced by domestic, municipal and industrial processes every day," said Chun Haow Kung, UBC chemical engineering graduate student and study leader. "Other oil-water separation methods, such as those that rely on skimming, combustion and solvents, are either too expensive, too cumbersome, or inefficient." For more info, see goo.gl/Veu9eQ. Great work!

Heroes of the Anthropocene: Khanh Nguy Thi. In 2011, the Vietnamese government published its 2016-2030 Power Development Plan, which relied heavily on highly unsustainable coal plants. Enter Khanh Nguy Thi. Ms. Khanh (pictured) is the founder of the Hanoi-based Green Innovation and Development Center, or GreenID, one of Vietnam's only environmental NGOs. She successfully lobbied for (and then co-developed) a revised national power plan that cut 20,000 megawatts of coal in favor of more renewable energy. Recently, she won the 2018 Goldman Environmental Prize for this amazing achievement. She's now planning a public sustainable energy fund. For more on this incredible woman, check out goo.gl/mMe56h. Photo credit: Goldman Environmental Prize.

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Waldoboro, Maine. On May 23rd, this writer was privileged to assist in a fascinating non-profit startup enterprise, the Waldoboro Collective. Ms. Kate O'Connor (pictured, below right) saved for years to buy a plot of land in Waldoboro, Maine (pictured above), which she is in the process of transforming into a sustainable community. Ms. O'Connor has already partially refurbished the formerly uninhabitable cabin on the property, arranged for a hundred-foot artesian well to be drilled to provide drinking water, cut down several dangerous dead trees (which together are estimated to provide enough firewood for 10 years) and begun construction on the first of many "tiny houses" which will be the main living area of the collective. The tiny houses are intended to provide Section 8 government-subsidized housing for at-risk communities suffering housing discrimination elsewhere, potentially including veterans and the LGBTQ+ community. Ms. O'Connor's current goal is to finish two tiny houses by the end of the summer, with ten tiny houses in total to be built over the next few years. The plan is then for the cabin to function as a community meetinghouse where tenants of the tiny houses can gather to work together on improving the property.

One amazing thing about the Waldoboro Collective is that it can be a platform for a wide variety of future expansions. Ideas currently under consideration include planting an organic garden, planting a wildflower garden to provide sanctuary for bees and butterflies, holding festivals on the property, installing solar panels to provide a renewable energy source, and growing medical marijuana to help ease chronic conditions and provide additional funds for the collective.

If you're interested in helping out with this project in any way, contact this writer at Samuel.matey@maine.edu and I can connect you with Ms. O'Connor. More news as it develops!