the weekly anthropocene

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

By Sam Matey

Maine, USA. On January 2, 2019, Janet Mills (pictured) officially replaced Paul LePage as Governor of Maine, ending eight years of regressive anti-environmental policies under a climate-denying governor. In the early days of the Mills Administration, the signs of progress are already bright. Governor Mills has appointed an array of qualified, experienced individuals to Cabinet posts, pledged to put solar panels on the roof of the Blaine House (Maine's governor's mansion), set a goal of generating 50% of the state's energy from renewables, and pledged to establish an Office of Innovation and the Future. She is also keenly aware of the threat of climate change, as evidenced by her inaugural address that placed the issue front and center. "Climate change is threatening our jobs, damaging our health and attacking our historic relationship to the land and sea. Tonight I say, enough. Enough with studies, talk, and debate. It is time to act!" Already, the newly data-driven, action-focused Governor is inspiring a ripple effect of new policies in other areas of government. Representative Michael Brennan of Portland has already proposed a bill for a new referendum question that would give voters the chance to support a $50 million bonds package to help Maine's coastal communities prepare for sea level rise. With a Democratic Party-controlled state legislature and a spokesman for Mills promising that the bill will receive careful consideration, this measure has a strong chance of helping to protect Maine's seaboard far into the future. In short, the Mills Administration appears to be working strenuously to prepare the Pine Tree State for the challenges of the Anthropocene. Great news! For more, see goo.gl/Yac1Lo.

Brazil. In sharp contrast to Maine's new governor, incoming Brazilian President Jair Bolsonaro is making it clear that he values the needs of special interests over the health and environmental safety of his people. Sworn in on January 1, Bolsonaro has already shifted responsibility for indigenous land demarcation from the indigenous affairs office to the ministry of agriculture. This is a seismic shift in Brazilian land management, as indigenous peoples are widely known as the best stewards of the Amazon and are often in conflicts with farmers who seek to convert the forest to fields. Bolsonaro has also pledged to increase access to guns for Brazil's rural poor, which will likely further inflame attacks on Amazonian indigenous peoples. Researchers from the Brazilian space agency have calculated that if all of Bolsonaro's radical anti-environmental policies (which include pulling Brazil out of the Paris Agreement and making the Ministry of Environment subordinate to the Ministry of Agriculture) are enacted, deforestation in Brazil could rise from 6,900 to 25,000 square kilometers per year. Bolsonaro is up for reelection in 2022, and it is to be hoped that Brazilians rise up in resistance against his agenda as Americans have done against Trump's. For more, see goo.gl/vXbgDT.

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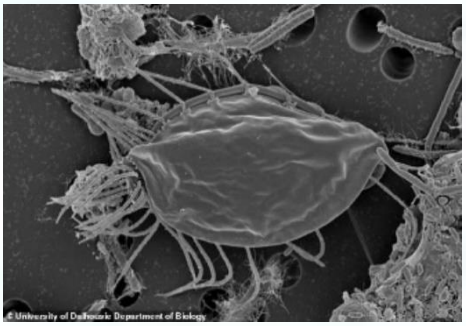

New Kingdom: *Hemimastix kukwesjijk*. In an astonishing new discovery, researchers have found a new microbe (*Hemimastix kukwesjijk*, pictured right) that represents an entirely new kingdom of life, as distinct from any other known life-form as animals are from plants. Amazingly, this microbe was found in a soil sample collected by a graduate student on a whim during a hike in Nova Scotia. This discovery underscores the fact that humanity has only just began to understand Earth's staggering diversity of life. For more, see goo.gl/p3rLTx.

New Crops: A Photorespiration "Shortcut". In an amazing breakthrough with profound long-term implications for agriculture, researchers from the international RIPE (Realizing Increased Photosynthetic Efficiency) project have created plants that create a shortcut for a natural "glitch" in photosynthesis to become 40% more productive. Photosynthesis turns carbon dioxide and water, with an energy boost from sunlight, into sugars used for growth, with oxygen as a waste product. However, there's a big, built-in inefficiency in this process. Rubisco, the enzyme plants use to collect carbon dioxide, collects oxygen instead about 20% of the time, resulting in toxic compounds that the plant cell has to expend energy to clean up, in a complicated chemical process. This lengthy and energy-expensive clean-up process is known as photorespiration. Now, RIPE researchers have engineered three alternate chemical pathways to speed up photorespiration and make it more efficient. After two years of field studies, they found that plants engineered with these "shortcuts" grew taller and produced 40% more biomass! (See above: the four plants on the left are unmodified, the four on the right were engineered with the photorespiration shortcuts). This new research could be vital for the future of agriculture as climate change continues. "Rubisco has even more trouble picking out carbon dioxide from oxygen as it gets hotter, causing more photorespiration," said Dr. Amanda Cavanagh, a RIPE researcher from the University of Illinois. "Our goal is to build better plants that can take the heat today and in the future, to help equip farmers with the technology they need to feed the world." The RIPE team is now working to translate their photorespiration avoidance pathways into soybeans, rice, potatoes, tomatoes, cowpeas, and eggplant. Although it will likely take more than a decade for these technologies to reach the market, the researchers and their sponsors are committed to ensuring that smallholder farmers in sub-Saharan Africa and South Asia will have royalty-free access. This is a spectacular example of how farsighted scientific innovation can create new technologies that will help all of human civilization survive, and thrive, in the Anthropocene. Spectacular work! For more, see goo.gl/8Ca3im.

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Hawaii, USA. On New Years' Day, 2019, an old snail died in a lab at the University of Hawaii, and Earth lost a species. George (pictured, right), named after the famous giant tortoise Lonesome George, was the last known *Achatinella apexfulva*, a species of Hawaiian land snail driven extinct in the wild years ago by a combination of invasive species, habitat loss, climate change, and collection for their colorful shells. George was a hermaphrodite, with both male and female sexual organs, but unfortunately did not appear to be able to breed on their own. George was 14 years old at the time of his death, and was a descendant of the last 10 known wild *Achatinella apexfulva*, who were brought to the University of Hawaii in 1997. George outlived all other members of his species. However, there is still a sliver of hope. In 2017, a two-millimeter fragment of George's foot was collected and sent to the San Diego Frozen Zoo, where it will be preserved for the future. Although humanity has not yet discovered how to clone snails, we soon will. George-and *Achatinella apexfulva*-may someday ride again! For more, see goo.gl/WTUdGg.

Science Spotlight: Spectacular Salamanders. Those of us living in the eastern United States may not realize it, but we reside in a global diversity hotspot for one of the most fascinating orders of species in the world: the salamanders! The ancient Appalachian Mountains are the homeland of the Plethodontidae, the largest family of salamanders, which gives America over 200 species of salamanders. (Pictured, right: the Blue Ridge two-lined salamander). These adorable amphibians are not only cute and interesting, they're a vital component of the temperate woodland ecosystem. They eat arthropods that consume fungi, which in turn help break down leaf litter into nutrients that trees use to grow-so the salamanders help ensure that the trees get enough nutrients. Salamanders are even a surprisingly vital part of the carbon cycle, and so help to fight climate change. They also eat insects like ants, beetles, and snails that eat leaf litter and emit carbon dioxide and methane, so without salamanders, there'd be a lot more natural greenhouse gas emissions from forests. Unfortunately, researchers are currently worried about a new threat for North American salamanders: a fungal disease known as "Bsal," which is already harming European salamanders and may soon reach America. The good news is, we're more prepared than we have been for any other wildlife pandemic in history. A multidisciplinary supergroup called the Bsal Task Force is already working on fixes, ranging from releasing copepods to eat Bsal spores to harvesting defensive bacteria from the skin of certain naturally immune salamanders. For more, see goo.gl/uJWpHK.