CLIMATE CRISIS NEWSLETTER

A fortnightly newsletter brought to you by XR Gairloch

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Editorial

The right side of history……

After a recently heated discussion with a close family member about the Climate and Ecological emergency and whether various activist groups were taking the right approach and using the right tactics. We eventually agreed to disagree but did agree on a couple of fundamental things:

- that we (this generation) would be judged (by future generations) on what we have done to mitigate the damage we have caused and are still causing to the planet.
- although people may not always agree with climate activists methods there is no doubt that they will be regarded by future generations as being on the Right Side of History.
- Although some people may be inconvenienced by disrupt protests on our streets, it seems slight when it is balanced against the threat to life itself
- and as we (climate activists) question our worth and talk of giving up activism, as most of us do from time to time, the question shouldn't be will I give up, it should always be when will we succeed, as success is really our only option.

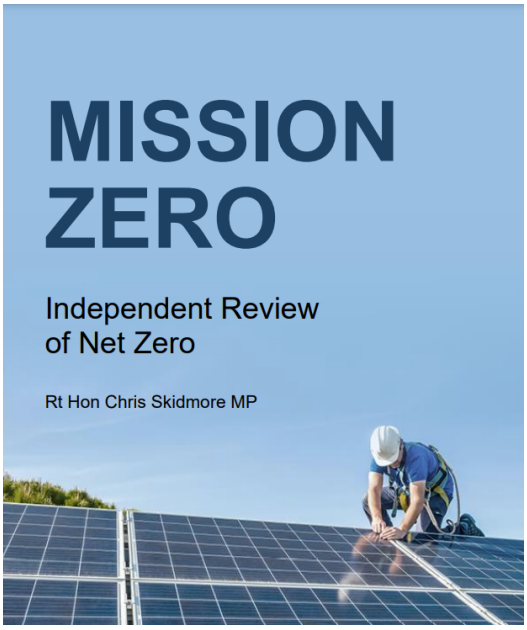
Jacinda Arden the former Prime Minister of New Zealand, who recently resigned had spoken at the Safeguarding the planet session at the World Economic Forum in Davos, Switzerland. 2019.

She said that "what the world needs now is empathy. What greater threat to our wellbeing is there than the current threat of climate change.

Do you want to be a leader that you look back in time and say that you were on the wrong side of the argument when the world was crying out for a solution? It was about being on the **"right side of history"**.

She then went on to say "Ten years ago, when I first came to parliament I remember standing at a town hall meeting and speaking passionately about the issue of climate change and being roundly booed, including I think by members of my own family,"

'The Mission Zero Report highlights major risks in the UK governments strategy……..



A Conservative MP (Chris Skidmore) has said delaying climate action risks damaging the UK's economic prospects, in a major review of the government's net zero plan

A review into the UK's approach to reaching net-zero emissions by 2050 was published on Friday (13 January), detailing 129 recommendations. **The Mission Zero Report**

'Delay is a significant risk': UK's Net-Zero Review calls for accelerated climate action from Government. **Read article.**

Announcement of Scotlands Green Freeport…….

The winners of the Green Freeport bids were announced a couple of weeks ago and the 2 Scotlands Green Freeport winners were a bid by

Cromarty Firth which included Port of Cromarty Firth, Global Energy Group, and the Port of Inverness as well as Inverness Airport. Its aims to build a world-beating floating offshore wind manufacturing sector, with sites in the Cromarty Firth, Invergordon, Nigg, and Inverness. Unfortunately at the moment Cromarty Firth Ports carry out major works servicing oil and gas rigs (rather than decommissioning) to go out to new fields, Global Energy are heavily involved in the fossil fuel industry and Inverness Airport want to expand their airport.

The other bid was Forth which included Grangemouth, Rosyth, Leith Burntisland and Edinburgh Airport. The Forth Green Freeport will have a focus on renewables manufacturing, alternative fuels, carbon capture utilisation and storage and shipbuilding, as well as the development of a creative hub. Ineos in Grangemouth is the worst CO2 emitter in the UK and is no doubt very keen have a free port where it can develop carbon capture so as it can continue using fossil fuels for decades to come.

The sites are expected to bring forward an estimated £10.8 billion of private and public investment and create over 75,000 high-skilled jobs.

The awarding of Green Freeport status will also provide the winners with a number of relief benefits such as tax breaks and rebates for green investment (carbon capture is regarded as a green investment) as well as simplified planning zones.

Renewables groups welcome Scottish Green Freeports. **Read article.**

Tipping points and have we reach some already?……

Tipping points are thresholds where a tiny change could push a system into a completely new state . When crossed, this leads to large and often irreversible changes in the climate system. Passing an irreversible tipping point would mean a system would not be able to revert back to its original state even if CO2 emissions were reduced at a later date.

Nine critical tipping points likely to be crossed in the near future. if we don't reduce our emissions in line with what scientist are telling us, are:

1. Shutdown of the Atlantic Meridional Overturning Circulation
2. West Antarctic ice sheet disintegration
3. Greenland ice sheet disintegration
4. Sudden thawing of the northern permafrost
5. Amazon rainforest dieback
6. Boreal forest shift
7. West African monsoon shift
8. Indian monsoon shift
9. Coral reef die-off

Temperatures have increased by almost 1.2°C since the Industrial Revolution and are still climbing. At an increase of 1.5 °C we're at risk of crossing irreversible thresholds, if we haven't already.

Possible evidence that we have reach the tipping point for permafrost melting

Lockdown methane INCREASE!! What's going on? **See video.**

Small interventions on electric cars and plant-based meat could unlock rapid emissions cuts, say experts.

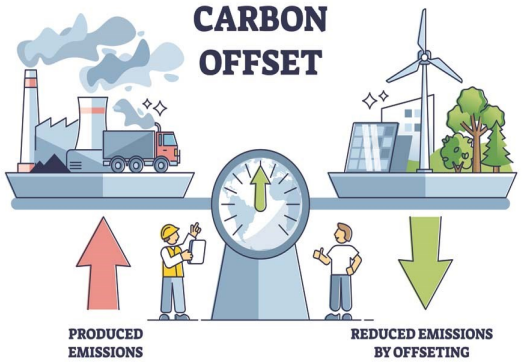
Climate tipping points in Amazon, Tibet 'linked': scientists. **Read article.**

Super-tipping points' could trigger climate action cascade. **Read article.**

Carbon credits and Carbon offsets, are they both worthless……

"Climate neutral," "carbon neutral," "100% CO2 compensated"

These phrases all sound promising — who doesn't want their carbon impact neutralized? But words like these can also indicate that a company isn't reducing emissions by improving its own practices, but rather by relying on offsets.



Carbon offsets let individuals or companies continue emitting, as long as they pay to remove an equivalent amount of carbon elsewhere — by supporting a tree-planting project in the Amazon, for example. But the concept only works if the carbon being removed truly would not have been otherwise, a concept known as additionality. Many projects don't meet that threshold. Renewable-energy developments in particular rarely need the additional funding, especially now that solar is the cheapest source of new energy in most of the world. For the time being, offsets lack transparency and accountability, and the actual positive impact from these payments can be hard to measure and easy to misrepresent. That's why claims like these are often used by companies as a free pass to continue down a damaging environmental road. As the EU says, "these factors result in offset credits of low environmental integrity and credibility that mislead consumers when claims are based on such offsets."

Carbon offsets are flawed but we are now in a climate emergency. **Read article.**

The fraudulent nature of nature-based offsets. **Read article.**

Carbon offsets are a licence to pollute. **Read article.**

Exposing rainforest carbon credits: why offsetting isn't working. **Listen to podcast.**

Shell to spend $450m on carbon offsetting as fears grow that credits may be worthless. **Read article.**

Amazon, Meta and Google buy more clean energy than any other companies. **Read article.**

You are likely funding the climate crisis…….

You may not know it but you are more than likely funding a fossil fuel project in some shape or form. The Bank where you have your savings is likely to be using your money to fund fossil fuel projects. Your pension fund is also likely to be doing the same , which is obviously a bad thing for the planet but is also likely a bad thing for you personally.

Once fossil fuels become outlawed, which they will undoubtedly become in the not so distant future, you may find that it will effect you financially as a lot of your indirect investments turn into stranded assets..

Therefore bank with ethical banks and ensure the pension fund you are with is divested away from fossil fuels.

The worst banks are highlighted in this report. **Banking on Climate Chaos Report 2022.**

Banks still investing heavily in fossil fuels despite net zero pledges – study. **Read article.**

World's largest asset managers voting against stricter ESG rules at corporations. **Read article.**

UK facing £675bn market crash from stranded fossil fuel assets. **Read article.**

DAVOS 2023……...

Davos, Switzerland, is where the World Economic Forum holds its annual meeting. Delegates from many sectors converge for several days of talks and meetings to address urgent global issues like the climate crisis.

Davos 2023: Who said what on climate and environment? **Read article.**

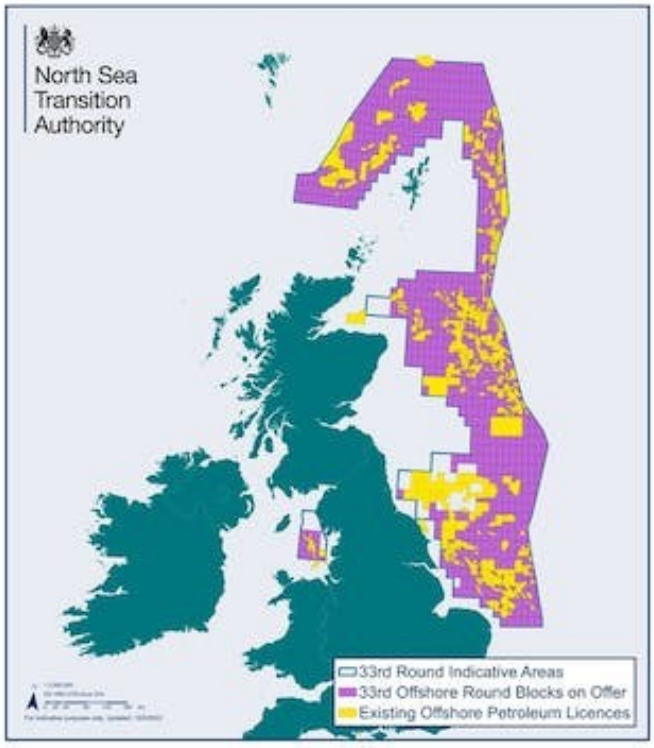
Resiliency, decarbonisation and regeneration: What were the key climate themes at Davos 2023? **Read article.**

In Davos, activists warn against climate inaction and greenwashing. **Read article.**

UN head accuses fossil fuel firms of business models 'inconsistent with human survival'. **Read article.**

UK government ask for bids for new oil and gas licenses …...

In the 33rd Round of UK government oil and gas licenses, 115 bids across 258 blocks or part-blocks, from 76 companies, were received by the governments North Sea Transition Authority (previously known as the Oil and Gas Authority but renamed for greenwashing purposes as issuing new oil and gas licenses is not a transition.).



Energy and Climate Minister Graham Stuart (who has financial links with the fossil fuel industry) said "Putin's illegal invasion of Ukraine has led to volatile global energy markets. It's fantastic to see such interest from industry in this round, with the awarded licenses set to play an important role in boosting domestic energy production and securing the UK's long-term energy security of supply."

But the truth is the average time it takes from trying to find oil and gas fields to actually coming on stream is 26 years. That means these oil and gas fields will likely start producing by 2049 a year before the UK has legally pledge to be net zero in 2050. This would lead us to believe that the UK has no intention of meeting its net zero target.

Greenwash, misinformation, hypocrisy and deceit

'Greenwashing hydra': New report warns of six types of greenwashing from corporates. **Read article.**

Nigel Lawson, Founder of Tufton St. Climate Denial Group, Quits Parliament. **Read article.**

Tory-Linked Think Tank Appoints 'Brazen' Climate Denier as Director. **Read article.**

UK climate minister received donations from fuel and aviation companies. **Read article.**

Fossil Fuel Groups 'Spent Millions' on Social Media Ads Spreading Climate Disinformation During COP2. **Read article.**

Drax 'Lobbying Efforts' Revealed in Internal Treasury Memos. **Read article.**

Competition and Markets Authority (CMA) to scrutinise eco claims on fast-moving consumer goods (FMCG) in next phase of greenwashing clampdown. **Read article.**

Ryanair: Low-cost airline warned about misleading carbon offset claims. **Read article.**

Is Carbon Capture An Excuse To Burn More Fossil Fuels? **See video.**

Corrupt Politicians and Climate Criminals…….

Sen. James (Jim) Inhofe was the senior senator from Oklahoma and a member of the Republican Party.

According to OpenSecrets.org, Inhofe has received almost $2 million in political contributions from the coal and oil industry. Koch Industries is Inhofe's top contributor, having contributed at least $105,150 since 1989. Murray Energy is the second-largest, at over $90,000. In 2003, the Natural Resources Defense Council reported Inhofe had scored zero with the League of Conservation Voters since 1997 and "was the only senator to oppose Everglades restoration, and once compared the Environmental Protection Agency to the Gestapo." Inhofe has made regular speeches rejecting mainstream climate science, and has consistently voted in favor of big oil companies on oil-related bills.

Events/Actions/Education and Information

THE BIG ONE: APRIL 21ST at PARLIAMENT SQUARE See video.

XR Highlands& Islands and Moray - Talks, Training and Information

We are holding an event on 18 February at the Spectrum Centre in Inverness, from 10.00am - 2.00pm. This will cover sessions on -Heading for Extinction talk, Outreach training, Forming Groups (Affinity groups) talk, On an Action and Update on 21st April Action talk, Non-Violent Direct Action training and Know Your Rights talk

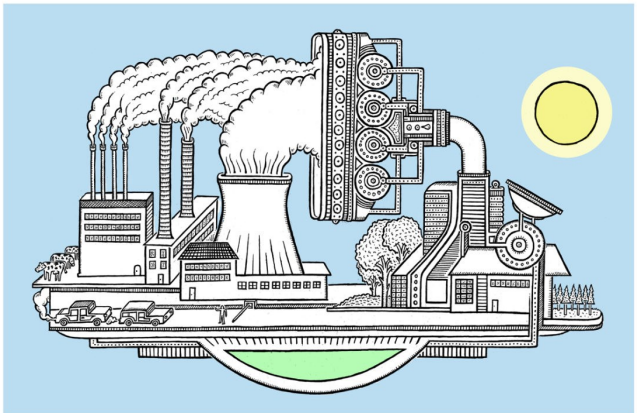
So if you are interested in going to London, or just interested in knowing more about Extinction Rebellion we'd love to see you there. If you could let us know what talks/training you are interest in, please let us know so as we can get an idea of numbers. If you can't make this date but are still interested in going to London please contact us at xrinverness@protonmail.com as we will be arranging more training events before the 21st.

Technological Advances

Electric motors without rare earth metal magnites. **See video.**

Chinese-Swiss researchers declare path to cheaper clean energy with advance in perovskite solar cell manufacture. **Read article.**

World's First Semi-Submersible Floating Offshore Wind Farm Exceeds Expectations. **Read article.**



Sustainable Farming/Food

Farmers paid to protect nature in dramatic overhaul of subsidies scheme. **Read article.**

Lab-grown alternatives aim to cut palm oil dependence. **Read article.**

The Scales of Justice

EU to slap penalties on companies making false green claims, leaked documents reveal. **Read article.**

France to take legal action over 'nightmare' plastic pellet spill. **Read article.**

Exxon's predictions about the climate crisis may have increased its legal peril. **Read article.**

New measures to silence climate activists? They'll only spur us on. **Read article.**

Eco'nomic Recovery—Building Back Better

Fresh £32m in UK Government funding for innovations reducing heavy industry's fossil fuel reliance. **Read article.**

Government to offer £600m for green steel switch. **Read article**

The Fight Against Fossil Fuels

Whitehaven coal mine: Two legal challenges lodged. **Read article.**

Rosebank oil field 'climate wrecking'. **Read article.**

India Plans To Double Domestic Coking Coal Output By 2030. **Read article.**

The gas-fired plants tasked with keeping UK lights on – but at what cost? **Read article.**

Higher UK energy bills here to stay, warns oil company boss. **Read article.**

The Amazon Rainforest Is Still Burning

Brazil's new president works to reverse Amazon de-forestation. **Read article.**

Brazil begins first operations to protect Amazon. **Read article.**

Brazil launches first raids against Amazon tree-cutters under Lula's new government. **Read article.**

Protecting Amazon a tough task, says Brazil's environment minister. **Read article.**

Why Brazil's Yanomami are being decimated by disease, mining. **Read article.**

The Circular Economy

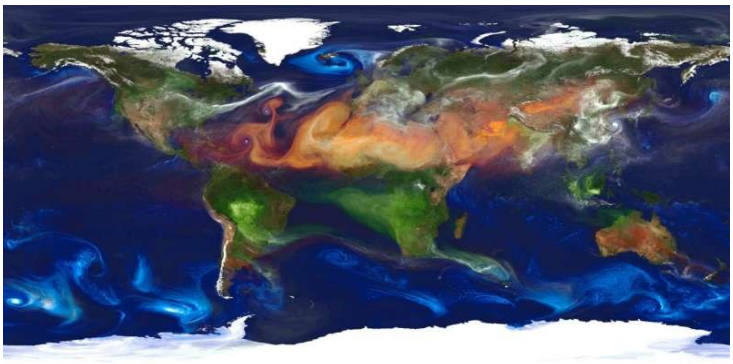
Danish deposit system reaches full economic circularity. **Read article.**

Report: Global economy becoming less circular, posing major risks to climate efforts. **Read article.**

What uncertainties remain in climate science?

By Renee Cho, State of the Planet

The favored refrain of climate deniers and those who oppose climate policies is that "the science is not settled." To some degree, this is true. Climate scientists are still uncertain about a number of phenomena. But it is the nature of science to never be settled—science is always a work in progress, constantly refining its ideas as new information arrives.What uncertainties remain in climate science?

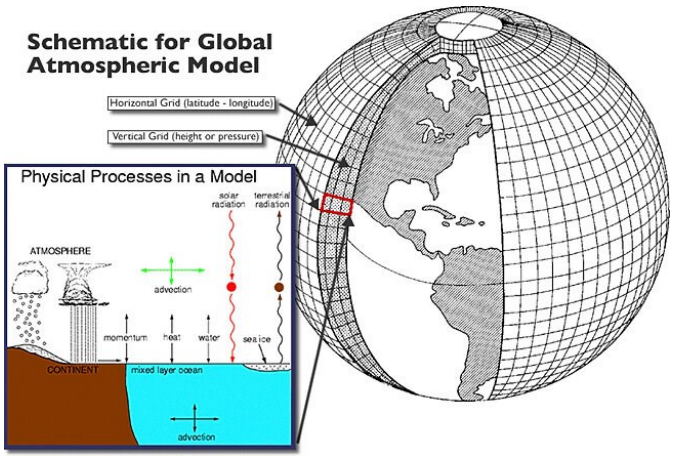


Certain evidence, however, is clear: global temperatures are rising, and humans are playing a role in it. And just because scientists are uncertain about some other areas, does not negate what they are sure about.

What's certain and what's not

Reputable climate scientists around the world are in almost unanimous agreement that human influences have warmed the atmosphere, ocean, and land and that the speed of the changing climate exceeds what can be attributed to natural variability. They are also virtually certain that this warming has been driven by the carbon dioxide and other greenhouse gases produced by human activities, mainly the burning of fossil fuels.

Climate scientists are highly confident about these things because of fundamental principles of physics, chemistry, and biology; millions of observations over the last 150 years; studies of ice cores, fossil corals, ocean sediments, and tree rings that reveal the natural influences on climate; and climate models.



Despite this evidence, "In the climate change field, with its countless socioecological factors and interdependent systems, its known unknowns and unknown unknowns, deep uncertainty abounds," said the World Resources Institute. The uncertainties are due to an incomplete understanding of Earth's systems and their interactions; natural variability in the climate system; the limitations of climate models; bias; and measurement errors from imprecise observational instruments. In addition, there is great uncertainty about how the climate will be affected by humans and the demographic, economic, technical, and political developments of the future.

Ben Cook, a climate scientist at the Columbia Climate School's Lamont-Doherty Earth Observatory who studies drought and interactions between land and the climate system, said, "There are a few different sources of uncertainty and depending on the source, there are different kinds of difficulties. On one level, there are the process

uncertainties that we have an incomplete understanding of because we don't have the full spectrum of observations that we would want, and/or we're limited in the ability to represent those processes within our climate models. There are other uncertainties related to things outside the physical climate system. A good example is the scenario uncertainty. We want to understand what the climate is going to look like at the end of 21st century. That depends on the physics of the climate system. But it also depends upon how many greenhouse gases we ultimately wind up emitting over the next century."

The rate at which our climate will warm also depends upon the interplay of emissions and interactions between various processes that either lessen or exacerbate disruptions to the climate system, some of which scientists are still uncertain about: cloud formation, water vapor and aerosols, unpredictable natural phenomena like volcanoes, tipping points, and human behavior. What are the reasons behind this uncertainty?

Cloud formation

Clouds play an important role in determining the planet's energy balance. As the planet warms, cloud patterns everywhere will change: Certain types of clouds will increase in some places and decrease in others. And depending on the type of clouds and the landscape below them, clouds can have a cooling or a warming effect on the planet. Low clouds have a cooling effect because they reflect solar radiation back to space.

High cirrus clouds, on the other hand, warm Earth because they trap heat. Climate models have generally suggested that the warming and cooling effects of clouds will balance each other out over time, but some new studies suggest that global warming could cause more clouds to thin or burn off, leaving Earth increasingly exposed to the sun and warming.

"Cloud feedbacks tend to be very uncertain because observations are a bit limited," said Cook. "They are kind of restricted to the satellite era, over only the last 40 years. And it's difficult to understand some of the causality. We want to understand how clouds cause the climate system to change. But at the same time, clouds respond to the climate system."

In addition, climate models have difficulty incorporating certain information about clouds. Most climate models map features over areas of 100 kilometers by 100 kilometers, though some cloud models may have grids of five kilometers by five kilometers; but even within five kilometers there is a lot of variation in cloud cover.

Allegra LeGrande, adjunct associate research scientist at Columbia Climate School's Center for Climate Systems Research, said, "Sometimes there are processes that are just too small, too complicated, too hard to measure. And you just can't explicitly include them in the climate models. These tend to be processes like the ephemeral, little wispiness of the clouds. How are you going to translate these tiny ephemeral cloud bits into a climate model of the whole world?"

And yet, "Clouds can make a huge contrast in what kind of climate you simulate for an area," said LeGrande, who works with climate models to better understand climate more extreme than that of the past. "A cloudy field versus an uncloudy field can make a huge impact on everything—the temperature, the precipitation, the evaporation, the surface energy balance, everything."

Water vapor and aerosols

Water vapor, the most abundant greenhouse gas, amplifies the warming resulting from other greenhouse gases. Rising temperatures caused by rising levels of carbon dioxide and methane result in more evaporation, which increases the amount of water vapor in the atmosphere. For every added degree Celsius of warming, water vapor in the atmosphere can increase by about 7 percent. Scientists estimate this effect more than doubles the warming that would result from rising carbon dioxide levels alone.

On the other hand, the cars, incinerators, smelters, and power plants that emit climate-warming greenhouse gases also release aerosols—liquid or solid particles in the atmosphere that block sunlight and have a cooling effect on the planet. Natural aerosols like sulfate aerosols produced after volcanic eruptions also cool Earth. But clouds can also form around aerosols, using them as nuclei, so their overall effect is uncertain.

There is also uncertainty about aerosols because no one knows how society will change over time. Will we eventually ban their fossil fuel–burning sources? Will cleaning up air pollution make climate change worse?

Because of these uncertainties, scientists don't know how water vapor and aerosols will ultimately balance each other out.

Natural variability

There are natural changes in the climate that occur due to different high- and low-pressure areas and air circulation that affect temperature and rainfall. These are particularly important for making projections over smaller regions and shorter time frames.

"On shorter time periods, for example, the next year out to maybe 30 or 40 years, the internal random variability in the climate system is really important," said Cook. "At regional scales, that kind of time period can be a bit more difficult to predict because you can have just the internal natural variations in the climate system amplifying the effects of climate change, or in some cases, diminishing the effects of climate change."

There is also natural variability that results from phenomena such as El Niño and La Niña, which produce cyclical natural global temperature variations. And there is natural variability that stems from unpredictable changes in solar intensity and volcanic eruptions. Volcanic gases condense in the stratosphere to form sulfate aerosols which cool the planet. Scientists have concluded, however, that natural factors contributed far less than humans to the global warming of recent decades.

Tipping Points

There is uncertainty about how close the Earth is to tipping points—when small changes accumulate to cause a larger change that can be abrupt, irreversible, and lead to cascading effects. Because the limits of computing power make it impossible to exactly represent the climate system's tipping points or their interactions, there is significant uncertainty about these major potential tipping points.

Ocean circulation changes

The Atlantic Meridional Overturning Circulation (AMOC) is a major source of uncertainty when it comes to predicting future climate. The AMOC is the ocean circulation system that carries heat from the Tropics and the Southern Hemisphere north until it loses it in the North Atlantic, Nordic, and Labrador Seas, where the now cooler waters sink deep. The overall circulation depends upon these cold dense waters that sink into the deep oceans in the high latitudes.

Global warming, however, can affect this circulation by warming surface waters and melting ice, adding fresh water to the system; these factors make the water less saline and dense, preventing it from sinking. Because of this effect, AMOC's circulation has slowed between 15 and 20 percent in the 20th century, an anomaly unprecedented over the last millennium. Climate models suggest that the AMOC will continue to slow as the climate warms, but how much and what its effects will be are uncertain.

Climate models suggest that if AMOC's decline is great, Europe will warm slightly, but wind patterns in Europe and precipitation patterns in the Tropics will change significantly. If AMOC slows less, the Northern Hemisphere will get much warmer, wet regions will get wetter, and dry regions will get dryer. While some scientists fear the AMOC could pass a tipping point and collapse altogether, most are fairly confident that this could not happen before 2100.

Thawing permafrost

Permafrost, ground that remains frozen for two or more consecutive years, covers about 24 percent of the exposed landmass of the Northern Hemisphere. Some permafrost, which stores the carbon-based remains of plants and animals that froze before they could decompose, has been frozen for tens or hundreds of thousands of years. Scientists estimate that the world's permafrost holds 1,500 billion tons of carbon, almost double the amount of carbon currently in the atmosphere.

As temperatures rise, permafrost begins to thaw, releasing its carbon as both carbon dioxide and methane, an even more potent greenhouse gas. There is a great uncertainty about how much carbon thawing permafrost could release as global warming proceeds, and how much will be CO2 versus methane. Climate models suggest that for every degree Celsius the planet warms, 3 to 41 billion metric tons of CO2 could be released. Some scientists feared that permafrost could pass a tipping point where the released carbon drastically speeds up warming, but recent models suggest the runaway scenario is unlikely (THIS MAY NOW BE SUPERSEDED BY REPORTS OF INCREASED METHANE EMISSIONS FROM THE PERMAFROST). Nevertheless, the IPCC has projected that thawing permafrost would increase warming "enough to be important."

Ice sheet collapse and sea level rise

Scientists understand how much warming oceans will eventually contribute to sea level rise, and it's a relatively small amount, perhaps a meter, said LeGrande. They do not know, however, how much melting ice sheets could potentially add to sea level rise. The ice sheets covering Antarctica and Greenland present the greatest uncertainty. Ice loss from these ice sheets were most responsible for the sea level rise of the last few decades and will potentially make the largest future contributions to sea level rise.

The uncertainty about the ice sheets stems from scant observations of the full range of ice sheet behaviors, incomplete understanding of their processes, and limitations in defining conditions for models. This is because ice sheets are remote and the harsh environments make research difficult.

Although scientists have little empirical evidence of big ice sheets melting away and collapsing, they do have ideas about how it happened in the past to help with projections for the future. "A lot of those ideas require us knowing what exactly is going on in the ice sheet and around it, and some of those things are hard to measure," said LeGrande. "Visualizing what's going on underneath is tricky. And it's really important because if it's slippery, then the ice sheet can flow into the sea pretty fast. But if it's sticking on the bottom, then the ice sheet can actually hold itself in place rather well."

As the reflective white glaciers and ice sheets melt, the area they cover shrinks, exposing darker land or water, which absorb more solar energy and warm the atmosphere further. Some research suggests the Greenland and West Antarctic ice sheets could pass a tipping point if temperatures warm more than 1.5°C, but because of their enormity, this collapse would likely take thousands of years.

As a result of the uncertainty about ice sheets, projections about the rate and amount of sea level rise vary widely. The IPCC calculates that it's possible that in a scenario of high greenhouse gas emissions, sea level rise could approach two meters by 2100 and five meters by 2150.

Amazon rainforest

Another potential tipping point is the Amazon rainforest, one of the planet's largest natural carbon sinks. Because of deforestation and climate change, some parts of the Amazon have already begun to emit more carbon than they store. As temperatures rise, the Amazon will likely become drier, more prone to wildfires and stress, and could cross a tipping point if the rainforest turns into grassy savannas.

In addition to losing the trees that store carbon, the rainforest-turned-savanna would absorb much less carbon and provide habitat for fewer species. According to some research, it's possible that the Amazon could suffer significant dieback by 2100. This would have dire consequences for biodiversity and climate change, as it could result in 90 billion tons of carbon dioxide added into the atmosphere.

Modeling limitations

Scientists use climate models to try to understand how all these various processes, which are represented by mathematical equations, have affected past climate and how they will affect future climate. Because the climate system is so complex and computing power has limits, however, it's difficult for a model to calculate all the processes for the whole planet. Consequently, a climate model must divide Earth up into grid cells; it then calculates the climate system in each cell incorporating factors such as temperature, air pressure, humidity, and wind speed, the amount of solar energy, CO2 and methane, and aerosols.

Climate models can help analyze why climate changed in the past and how it could change in the future. But models are not perfect and they have limitations. Moreover, climate models can differ in their level of simplification, grid size, and in how they represent

physical phenomena such as clouds, surface atmosphere exchanges, or vegetation cover. Climate modelers must make compromises and settle on one possible variant of the many possible variants, each of which could result in different outcomes. To deal with these limitations, sets of climate models are often run with different variables to generate a range of possible outcomes.

The human factor

The state of our planet in the future depends on how much greenhouse gas is emitted into the atmosphere. Perhaps the biggest uncertainty of all is how much carbon, other greenhouse gases, and aerosols humans will emit in the years to come. This will depend on population and consumption growth, economic development, technological progress, land use changes, and international agreements, as well as all their interactions. Changes in societal preferences and priorities, and political trends will also be critical factors. All these elements will influence how societies and countries take action to fight climate change—how robust and effective their policies are, how much money is put into mitigation and adaptation efforts, and how much synergy results from international cooperation.

Working to reduce uncertainty

Researchers at the Columbia Climate School are constantly working to reduce the gaps in scientists' understanding, and improve their models, predicated on their observations.

LeGrande is working on paleoclimate simulations using a special sampling approach that requires less computer processing and constrains the simulations against satellite measurements, as well as against paleoclimate archives. In addition, she said, "There are lots and lots of observational campaigns, trained on our ice sheets, trying to understand the surface processes. There are increasingly moves to try to visualize that area underneath the ice sheet. They do drilling missions, and they have plenty of [techniques for] remote sensing at the surface where they're trying to visualize that interface between the bottom of the ice sheet and the bed. Then, with more powerful computers, they're able to plug in these empirical observations into ice sheet models."

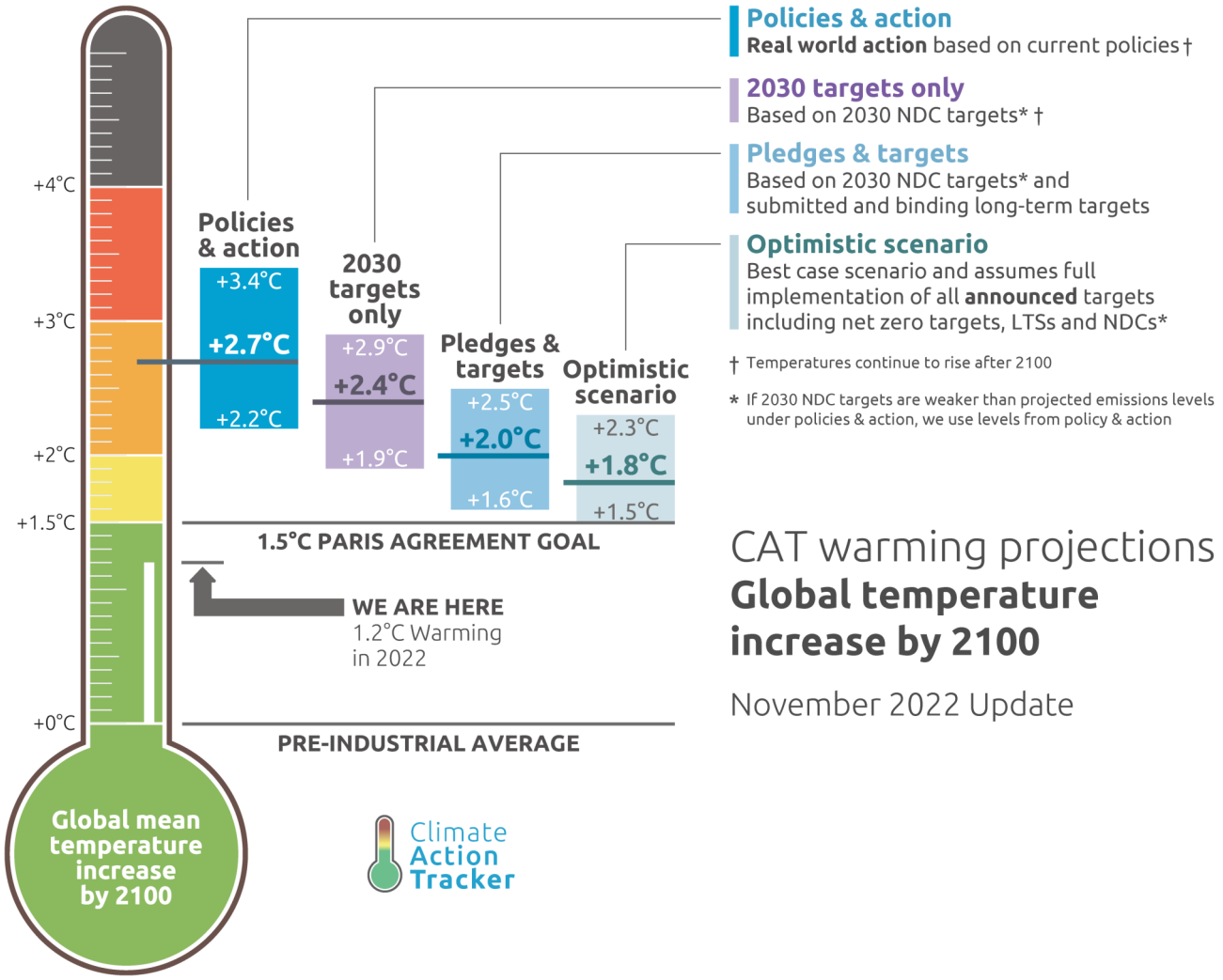
"There's also a lot of work with machine learning now," said Cook. "Machine learning and AI are very good at finding patterns [and relationships]. Within the climate model community, a lot of people who build these big computer simulations of the climate system are exploring machine learning to identify parameters that give us a much better match to reality. The idea is to reduce some of the process uncertainty and improve the fidelity of our models. The challenge is interpreting those patterns and relationships, and making sure they're meaningful in a physical or scientific sense, but it [machine learning] can be really valuable for the exploratory process and identifying the sorts of things that might be important."

Even as the science advances, however, it is critical to recognize and deal with the existing uncertainties in climate science in order to make sound decisions about adapting to climate change. Ignoring uncertainties could increase risks. "Only in understanding the range of plausible possibilities can you really inform adaptation, and policy and planning," said Cook.

Strategies for adapting to climate change should consider multiple potential outcomes, leave many options open, and identify a variety of solutions. The solutions need to be

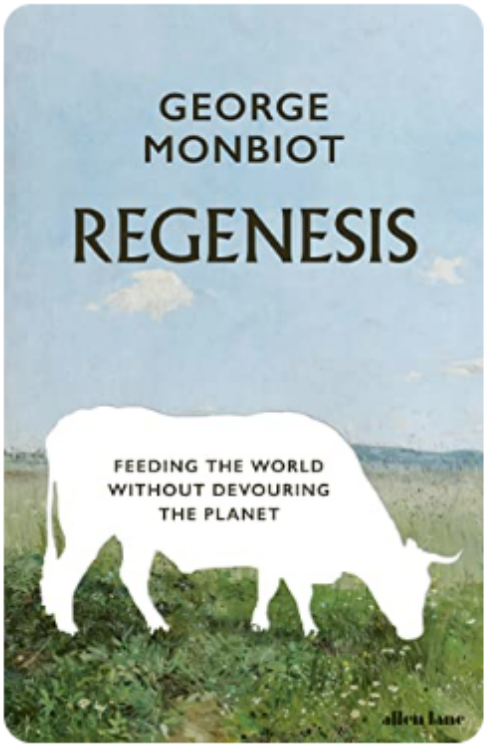
robust and able to withstand different pressures—for example, farmers diversifying their livelihoods in case of extreme weather, or the expanded use of microgrids to protect communities against power outages. Adaptation measures need to be flexible, able to work under a range of possible future scenarios, and be able to be reassessed or adjusted as the science advances.

The uncertainties in climate science that remain are not a justification for not acting to slow climate change, because uncertainty can work both ways: Climate change could prove to be less severe than current projections, but it could also be much worse.



Excerpts from 'Regenesis' the book

By George Monbiot



Let's imagine it was the other way round. Imagine that the world was currently producing most of its protein and much of its fat from microbes in breweries, occupying, in total, the land area of a small European province, and fed and powered by clean electricity. Imagine that my evil, anagrammatic twin, Tom Go-Bioregen, wrote a book with the following argument.

I've got this great idea. Let's shut down the food factories. Let's replace the food they make by catching some wild animals - aurochs, wild boar, jungle fowl and a woolly ruminant from Mesopotamia would do - modifying them drastically and breeding them in stupendous numbers. Let's separate the young from their mothers, castrate them, dock their tails, clip their beaks, teeth and horns without anaesthesia, herd them into barns and cages, subject them to extreme boredom and sensory deprivation for their short, distressing lives, then corral them into giant factories where we stun them, cut their throats, skin, pluck and hack their bloody flesh into chunks that you, the lucky customer, will want to eat (Oh yes you will.). I've done the sums - we'd need to slaughter only 75 billion animals a year.

Let's kill the baby aurochs, extract a chemical from the lining of their fourth stomachs and mix it with milk from lactating mothers of the same species, to create a wobbly mass of fat and protein. We'll stir in some live bacteria to digest this mass, then let their excrements sit till they go hard and yellow and start to stink. You're really going to want this!

Let's fell the forests, drain the wetlands, seize the wild grasslands, expel the indigenous people, kill the large predators, exclude the wild herbivores, trigger the global collapse of wildlife, climate breakdown and the destruction of the habitable planet. Let's fence most of this land for our captive animals to graze, and plant the rest with crops to make them fat. Let's spray the crops with biocidal toxins and minerals that'll leach into the soil and water. Let's divert the rivers and drain the aquifers. Let's pour billions of tonnes of shit into the sea. Let's trigger repeated plagues, transmitted to humans by the animals we've captured, and destroy the efficacy of our most important medicines.

'Sure, it will trash everything after a while, but think of the fun we'll have. Come on, you know you want this.'

I hope you would run this scoundrel out of town.

Pastures New

The Covid-19 pandemic blew away two political ideas that had defined the previous forty years: that governments should not govern, and that people are not prepared to put the public interest ahead of individual interest. The notion that governments should be passive - the can't-do culture - assiduously promoted by the selt-hating state, collapsed. So did the idea that citizens will not respond to the signals they send. When governments want to govern, they can, in some countries (Taiwan, New Zealand, Kenya, South Korea and Vietnam, for example) to great effect. When money is needed, it is found. When people are mobilized, they respond.

The changes we were asked to make to contain the virus were far more extreme than those required to stop environmental collapse. We were asked to stop working, shopping, playing sport, visiting bars and restaurants, throwing parties, going to games and concerts, taking holidays: activities we considered essential to our lives and identity.

Children were kept back from school, travel ground to a halt, we were asked to cover our faces in public, sterilize our hands, keep our dis-tance, to live, for long periods, as if we were under house arrest.

No reasoned environmental demand comes anywhere near the severe measures the pandemic required. And yet, when we were asked to make these drastic changes, most of us did so willingly. We recognized our public duty and acted on it. Changing the sources of some of our foods, slightly altering our diets, reducing the land area occupied by farming, ending its most damaging practices, expanding protected places: these changes are tiny by comparison. It's not human capacity we lack; it's the political will to invoke it.

If governments communicated our environmental crisis - which presents a threat to humanity far greater even than Covid-19 - with the urgency it requires, changed the rules and explained our public duty to respond, we would do so. Political systems were made by people. They can be changed by people.

The world's carbon price is a fraction of what we need – because only a fifth of global emissions are priced.

By Bei Cui,Nga Pham and Unmul Ruthbah

At the end of last year, the world's average price to emit one tonne of greenhouse gases was around US$5.29 (AU$7.77). For pricing to work as we want – to wean us off fossil fuels – it needs to be around $75 by the end of the decade, according to the International Monetary Fund.

Why is the price still so low? Because even in 2023, close to 80% of the world's emissions from land clearing, power plants, cars and industry are pumped into the atmosphere without any cost to the polluter.

Carbon prices have long been favoured by economists and experts as a way to drive faster change. If you want to discourage something, the easiest way is to make it cost more. Pricing the three main greenhouse gases – carbon dioxide, methane and nitrous oxide – is an elegant and effective way to force polluters to find alternative ways of producing power or creating forms of transport. (Carbon price refers to pricing a tonne of carbon dioxide equivalent, CO_2-e, which covers all three gases).

There's long been a strange disconnect between the minute-by-minute updates on financial asset prices and the the lack of information on carbon prices. In 2023, as extreme weather, droughts and floods propel climate change to the front of our minds, it's far easier to access streams of data on share markets, commodities, foreign exchange than it is to find data on the measure most critical to global survival – the price of carbon. That's why our research team worked to produce the first global carbon price index as a way to easily track changes in pricing globally – and see change over time.

How did we determine the true price of carbon?

To nail down the global price of carbon, we took into account every national or supranational scheme as well as the price of carbon traded through emissions trading schemes. We did not use carbon credits or offsets, as these tend to lack transparency, be rubbery and often questionable.

Different countries and jurisdictions have come at the problem of atmospheric pollution from different directions.

The simplest is to simply tax the pollutants you don't want. This works if the price is set at the right level – not too low or too high at first – and increased as necessary.

Another common approach is to create a market for pollution through an emissions

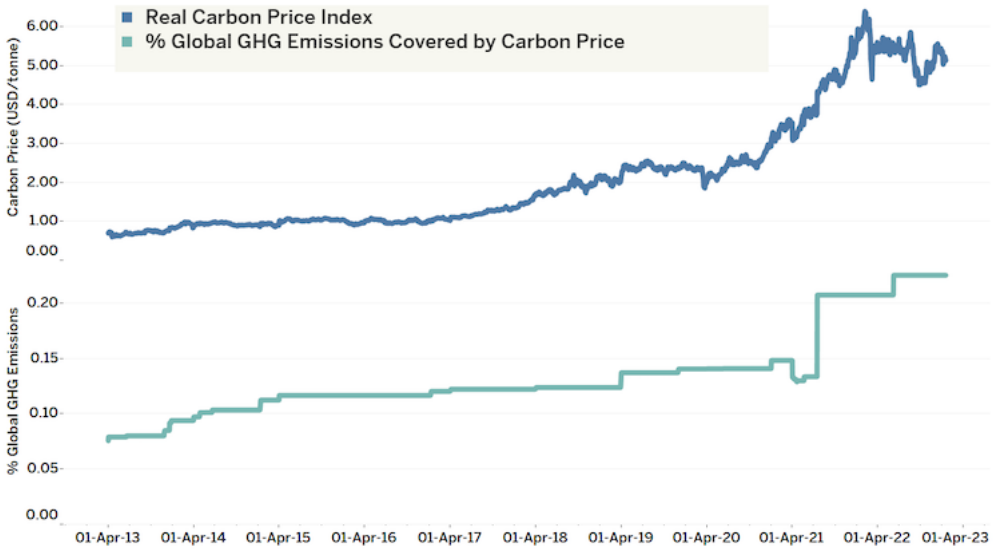
trading scheme, where high emitters have to purchase allowances. Over time, the new market will set the price on polluting as emitters and others compete for this finite pool of allowances. Regulators progressively cut the number of allowances, driving up the price of each allowance. The end result is to nudge large polluters to cut more and more of their emissions.

We didn't include carbon credits or offsets in our indices, as their use is largely voluntary, they tend to be unregulated or loosely regulated, their supply is uncapped, and their impact varies widely. Whistleblowers have claimed Australia's main carbon offset scheme is largely useless, for instance.

So what changes have we seen?

We first calculated this index a decade ago, when it became possible to pull together reliable price and scope information. When the index began, the global carbon price was just $0.67 per tonne of CO_2-e (or carbon dioxide equivalents). Back in 2013, only 20 jurisdictions had a price on carbon, covering just 8% of global emissions. At the time, Australia was one of them, before the so-called "climate wars" took over national politics.

Over the last decade, however, we've seen significant progress. The current price of around $7.77 per tonne of CO_2-e is almost eight times higher than 2013. From 20 countries or jurisdictions, we now have 58, accounting for 22.5% of global emissions. That includes the European Union's emission trading scheme and China's new national scheme, which respectively account for around 3% and 9% of emissions globally. The schemes don't cover their whole economies.



That's the good news. The bad news is there's still a way to go. More than three-quarters of emissions go unpriced – costing the polluter nothing. That's why the global carbon price is still so low. Nations like India, Iran, Russia, Indonesia and Australia have no carbon price or trading scheme.

Australia still bringing up the rear

Australia's domestic emissions account for 1.27% of global greenhouse gas emissions. When you include our staggering fossil fuel exports as the world's top LNG exporter and major coal exporter, our impact on the world climate almost quadruples to 5%. That's depressingly high, given our population is just 0.3% of the world's total.

Despite our vastly outsized carbon footprint, Australia still doesn't have a mandated carbon price. We do have a safeguard mechanism – a baseline above which its big polluters need to pay. At present, the baseline is too high, meaning only a small number of polluters participate. The mechanism is currently under review.

Until the baselines are set lower and penalties enforced, Australia will remain a laggard in the fight against climate change. Labor's pledge to cut emissions 43% by 2030 came without mention of a price on carbon.

Will the rest of the world embrace carbon pricing?

Political pushback killed Australia's first effort at pricing carbon in 2012. Similarly, political gridlock in America has made carbon pricing a non-starter at the national level. In response, left of centre governments have turned to different approaches, such as spending heavily on newly cheap clean energy.

Does this mean we'll never see the global carbon price hit the point where it will be effective? It's hard to say, but at present, it seems unlikely every major nation will price carbon.

That doesn't mean it's a waste of time for the nations and jurisdictions like the European Union which are embracing it. Far from it. It's well established we can drive behaviour change by measuring it against a benchmark or expectation. That's where we hope the real carbon price index can play a role. After all, this is one of the numbers that really matters.

Almost all of the trillion tonnes of carbon dioxide we've emitted since the Industrial Revolution were emitted for "free". As global heating intensifies, the true cost is becoming ever more apparent.

Other regular stories in this newsletter

Good and Bad News

Reports and Research

Plastic and Pollution

Land. Sea and Ecology

Good and Bad News

Good News

- Colombia announces halt on new oil and gas exploration at Davos. **Read article.**
- Wales eyes 100% renewables target **with** at least 1.5GW to be locally owned by mid-2030s. **Read article.**
- Vattenfall Norfolk wind farm to power 10pc of UK homes. **Read article.**
- Centrica plans battery storage, solar and hydrogen at former gas power plant. **Read article.**
- Celebrities call on UK banks to stop financing new oil, gas and coalfields. **Read article.**

Bad News

- Warning of unprecedented heatwaves as El Niño set to return in 2023. **Read article.**
- Banks providing just 7% of energy finance to renewables. **Read article.**
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- CBI: £4.3bn opportunity to be squandered by UK's 'complacency' on green technologies. **Read article.**
- Britain uses Brexit freedoms to continue use of bee-killing neonicotinoid pesticide banned in the EU. **Read article.**

Reports and Research

- Earth's ozone layer on course to be healed within decades, UN report finds. **Read article.**
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- Elephant extinction must be avoided for sake of climate, study warns. **Read article.**
- Emperor penguin at risk of extinction, along with two-thirds of native Antarctic species, research shows. **Read article.**
- Forests face fierce threats from multiple industries, not just agricultural expansion. **Read article.**

Thanks again to everyone who supplied information/links/articles and please feel free to send more to xrgairloch@protonmail.com