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ASIA PACIFIC

China MEE to revise list of controlled ozone depleting substances

2021-08-19

China MEE is consulting on the Revision to the List of Controlled Ozone Depleting Substances to reduce and phase out HFCs in China.

According to the *Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer* (hereinafter referred to as the Kigali Amendment), the Chinese Ministry of Ecology and Environment (MEE) drafted the amendments to the *List of Controlled Ozone Depleting Substances in China*^[1] (hereinafter referred to as the List) for public consultation on August 16, 2021. The deadline for comments is August 20, 2021.

[Read More](#)

Chemlinked, 19 August 2021

<https://chemical.chemlinked.com/news/chemical-news/china-mee-to-revise-list-of-controlled-ozone-depleting-substances>

Shanghai steps up new chemicals on-site inspections

2021-08-18

Random on-site inspection for new chemical substances will be stepped up to cover general enterprises that manufacture, use or import chemical substances.

Recently, Shanghai Municipal Bureau of Ecology and Environment announced to start the new chemical inspection under its purview in September.

For businesses, including domestic manufacturers, importers and representative agents that have registered new chemical substances, the focus will be placed on new chemical substances registered for (1) regular notification in 2020, (2) regular notification of hazardous chemical substances or hazardous chemical substances of priority environmental concern over the past five years (2016-2019), and (3) simplified notification (mainly for those imported for use or trade) in 2020.

It should be particularly noted that this time for enterprises manufacture, use or import chemical substances, on-site law enforcement and

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environmental supervision for new chemical substances will be initiated. At least one enterprise (1-2 substances) is subject to spot inspection. In this regard, the focus will be placed on finding out whether there is any chemical not listed on the Inventory of Existing Chemical Substances in China (IECSC) while hasn't been registered. The official inspectors may require enterprises to provide a list of their chemical substances, or enter the enterprises' management system, or on-site check relevant materials about environmental impact assessments, safety assessments for substance comparison against the IECSC.

In terms of the on-site inspections, priorities will be given to records kept by enterprises, information communication and disclosure (SDSs and labels), activities report, implementation of risk control measures, etc. The inspectors will focus on chemical exposure and see whether businesses have implemented the administrative management requirements and risk control measures specified in the registration certificates. In addition, the enterprises should also complete the hazardous chemical registration for new chemicals if they have hazardous properties and develop contingency plans accordingly.

[Read More](#)

Chemlinked, 18 August 2021

<https://chemical.chemlinked.com/news/chemical-news/shanghai-steps-up-new-chemicals-on-site-inspections>

AMERICA

Surface water vulnerable to widespread pollution from fracking, a new study finds

2021-08-20

Extracting coal, oil and gas has a huge impact on the surface of the earth, including strip mines the size of cities and offshore oil spills that pollute country-sized swaths of ocean.

Fossil fuels don't just damage the planet by emitting climate-warming greenhouse gases when they are burned. Extracting coal, oil and gas has a huge impact on the surface of the earth, including strip mines the size of cities and offshore oil spills that pollute country-sized swaths of ocean.

Years of research has shown how the fracking boom has contaminated groundwater in some areas. But a study published on Thursday in the

Extracting coal, oil and gas has a huge impact on the surface of the earth, including strip mines the size of cities and offshore oil spills that pollute country-sized swaths of ocean.

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journal *Science* suggests there is also a previously undocumented risk to surface water in streams, rivers and lakes.

After analyzing 11 years of data, including surface water measurements in 408 watersheds and information about more than 40,000 fracking wells, the researchers found a very small but consistent increase in three salt compounds—barium, chloride and strontium—in watersheds with new wells that were fracked. While concentrations of the three elements were elevated, they remained below the levels considered harmful by the EPA.

[Read More](#)

Inside Climate News, 20 August 2021

<https://insideclimatenews.org/news/20082021/water-fracking-pollution-study/>

NGOs say US FDA's PFAS approvals for plastic food packaging highlight need for action

2021-08-19

Environmental groups have strengthened calls for thorough regulatory review of per- and polyfluoroalkyl substances (PFASs) in food contact materials (FCMs) after discovering that the US FDA cleared several PFASs for plastic food packaging manufacture in the past decade.

The NGOs' findings – reached through a Freedom of Information Act (Foia) request – follow the detection of PFAS contamination in fluorinated polyethylene containers, which prompted EPA and FDA investigations and the latter's warning against unauthorised fluorination.

In a 12 August blog, the Environmental Defense Fund (EDF) and Green Science Policy Institute (GSPI) detailed their discovery of seven food contact substance notifications (FCNs), granted between 2002 and 2016, for four PFAS processing aids for plastic packaging such as bottles and wraps. Permitted at concentrations up to 2000 parts per million (ppm), the compounds “reportedly improve polymer extrusion, reduce build-up on the injection mould and improve surface roughness, among other technical effects”, the organisations said.

“While FDA has been focused on PFAS contamination from the environment and its use in paper packaging, it has been allowing PFAS-laden plastic to also contaminate the food supply without considering the cumulative effect of their dietary exposure on people’s health,” they said.

Permitted at concentrations up to 2000 parts per million (ppm), the compounds “reportedly improve polymer extrusion, reduce build-up on the injection mould and improve surface roughness, among other technical effects”, the organisations said.

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EDF, GSPI and other non-profits petitioned the agency in June to ban new PFASs and revisit already permitted ones by factoring in accumulating impacts from the chemical class.

[Read More](#)

Chemical Watch, 19 August 2021

<https://chemicalwatch.com/319208/ngos-say-us-fdas-pfas-approvals-for-plastic-food-packaging-highlight-need-for-action>

Vinyl flooring, carpets and rugs next in line for Washington state restrictions

YYYY-MM-DD

Washington state regulators have signalled plans to restrict phthalates in vinyl flooring and per- and polyfluoroalkyl substances (PFASs) in carpets and rugs under the Safer Products for Washington programme.

Officials from the state Department of Ecology said during a 17 August webinar that they had identified safer, feasible alternatives for the two priority product groups, which could open the door to regulating priority chemicals in those applications.

Ecology also offered an update on its plans for PFAS-containing leather and textile furnishings, saying its latest findings support restrictions on the substance class in furniture and home textiles.

The webinar follows a string of announcements from the department this summer in which it has shared its findings on feasible alternatives and potential regulations for chemicals of concern in 11 priority products.

[Read More](#)

Chemical Watch, 19 August 2021

<https://chemicalwatch.com/319205/vinyl-flooring-carpets-and-rugs-next-in-line-for-washington-state-restrictions>

Smoggy San Antonio facing further regulation as air quality continues to suffer

2021-08-16

San Antonio soon will join the ranks of smoggy cities such as New York and Sacramento, California, after failing to improve its air quality statistics over the past three years, state and federal officials said Monday.

... its latest findings support restrictions on the substance class in furniture and home textiles.

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Officials from the Texas Commission on Environmental Quality (TCEQ) and U.S. Environmental Protection Agency (EPA) said during a technical information meeting Monday that Bexar County will be bumped from “marginal” to “moderate” ozone nonattainment “sometime after September” — likely in early 2022. The new designation will mean San Antonio faces new air quality regulatory requirements with intensified federal oversight due to increased health concerns for residents breathing polluted air.

Houston and Dallas are facing the same reclassification, said Cara Scalpone, a TCEQ air modeling data analyst. Both the Dallas and Houston areas were recategorized from “serious” nonattainment under the 2008 standards to marginal by loosened standards in 2015.

In addition to New York and Sacramento, the only other areas of the country currently at moderate nonattainment are parts of two California counties: Nevada County, northeast of Sacramento, and Kern County, near Bakersfield.

The repercussions of the new designation could hit the local economy hard, according to a [study](#) co-conducted by Steve Nivin, associate professor of economics at St. Mary’s University. The increased oversight will make San Antonio more difficult to develop and less desirable for companies considering relocation or expansion, Nivin’s study found.

Read More

San Antonio Report, 16 August 2021

<https://sanantonioreport.org/san-antonio-epa-tceq-air-quality-regulations/>

EPA proposes first limits to PFAS in wastewater

2021-09-10

- Rules would set limits in organic chemicals, plastics and synthetic fibers industries and for metal finishing operations

(Reuters) - The Environmental Protection Agency on Wednesday announced plans for regulation that would for the first time set limits on levels of per- and polyfluoroalkyl substances, or PFAS, that certain manufacturers and users of the chemical compound discharge in wastewater.

The EPA said it will start preliminary work on a pollution rule for how much PFAS can be discharged into sewage treatment systems and surface

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waters from “facilities manufacturing PFAS” that are part of the organic chemicals, plastics and synthetic fibers industries. It will also work on a PFAS pollution rule for industries that perform metal-finishing operations.

There are currently no federal regulatory standards for PFAS discharges by these industries, said Albert Lin, a professor of law at the University of California Davis School of Law.

With the proposed rules, “for the first time, EPA is committing to limit PFAS in wastewater discharges,” Radhika Fox, the agency’s assistant administrator for water, said in a statement. The regulations would ultimately protect drinking water supplies, she added.

PFAS, nicknamed “forever chemicals” because they don’t break down easily, have been associated with various illnesses including kidney cancer. They have been used for decades in household products such as nonstick cookware, stain- and water-resistant textiles, rugs, food packaging, photo imaging, and in industrial products. Many states have already outlawed their use in food packaging.

Lin, who specializes in toxic torts and environmental law, said establishing the regulatory standards would likely take years, and called the upcoming process “potentially arduous.”

Ralph DeMeo, a shareholder at Guilday Law, said the development was “a very big deal” because of the ubiquity of wastewater treatment facilities that the regulations would touch upon.

The EPA says its surface water discharge regulations for the organic chemicals, plastics and synthetic fibers industries cover more than 1,000 chemical facilities producing over 25,000 products, from benzene to rayon and polyester.

Read More

Reuters, 10 September 2021

<https://www.reuters.com/business/legal/epa-proposes-first-limits-pfas-wastewater-2021-09-09/>

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EUROPE

Growers in France say EU's labelling plans may destroy lavender fields

2021-09-09

Under the draft EU regulation, the 600-plus chemical molecules found in lavender could be potentially relabelled as dangerous, threatening the future of the industry

Purple swathes of lavender flowers growing naturally in France could be a thing of the past if new EU laws go ahead, producers have claimed.

A draft European Commission regulation which aims to create "an environment free from toxic substances" will change the legislation on certain molecules present in essential oils.

Under the EU regulation, all chemical molecules – including the 600-plus found in lavender – will be quantified and qualified, and potentially relabelled as dangerous.

"It's a catastrophe," said Eliane Brès, president of France Lavande, a cooperative of more than 100 producers from southeast France.

"If essential oils are classed in this way, it will be calamitous for so many people. For those who do not know better, lavender will be thought of as dangerous and this isn't the case.

"Politicians now want to be whiter than white but this new law will not only have a dramatic effect financially on farmers and those who work in lavender, but also in every other aspect of our lives.

"It will be the end of lavender – it is that serious." The chemicals strategy for sustainability, presented in October 2020, is part of Brussels' Green Pact, which aims to steer Europe towards zero pollution.

[Read More](#)

The Connexion, 9 September 2021

<https://www.connexionfrance.com/French-news/Growers-in-France-say-EU-s-labelling-plans-may-destroy-lavender-fields-600-plus-chemical-molecules-found-in-lavender>

"It's a catastrophe," said Eliane Brès, president of France Lavande, a cooperative of more than 100 producers from southeast France.

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European Commission discusses implementation of the EU single-use plastic directive with member states

2021-09-10

The Commission [made available](#) the summary record of the most recent meeting of its Waste Technical Adaption Committee in June. The Commission replied to multiple questions from the Member States' representatives in that comitology committee with regard to the implementation of the [Single-use Plastics Directive 2019/904 \(SUPD\)](#), the Commission's [guidelines on the scope of the SUPD](#) and [Implementing Regulation 2020/2151](#) on marking specifications. The Commission also stated that it distributed the first draft on the implementing act on reporting and quality check of post-consumer waste from tobacco filters to the Member States for written comments. Regarding the calculation and reporting of the consumption reduction target for single-use plastic food containers and beverage cups, the Commission said that it would propose an approach based on the weight of plastic (including coatings) contained in those products in order to ensure consistency with the reporting under [Packaging and Packaging Waste Directive 94/62 \(PPWD\)](#). Reporting additionally on item count will be optional. This will likely motivate Member States to focus on reducing the weight of plastic in these products.

In addition, the Commission [made available](#) the draft of an explanatory document concerning the concept of "placing on the market" in the SUPD in view of its [Blue Guide on the implementation of EU product rules](#).

[Read More](#)

The National Law Review, 10 September 2021

<https://www.natlawreview.com/article/sustainability-outlook-european-union-august-2021>

~tMember states vote on rules on separate collection of single-use plastic beverage bottles

2021-09-10

The Member States representatives in the Commission Committee on Waste delivered a positive opinion on the draft [implementing act](#) laying down rules on the calculation, verification and reporting of data on the separate collection of waste single-use plastic beverage bottles. 26 Member States [voted](#) in favour and one against. The Commission implementing act under the SUPD is addressed to Member States to

The Commission also stated that it distributed the first draft on the implementing act on reporting and quality check of post-consumer waste from tobacco filters to the Member States for written comments.

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ensure the comparability of this data across the EU. The SUPD provides that Member States must collect 77% of single-use plastic beverage bottles by 2025 and 90% by 2029 and report data on this to the Commission each year. The draft the Committee voted on does not differ from the version on which the Commission publically consulted. The implementing act provides, among other details, that the weight of waste single-use bottles must include the weight of their caps and lids, and may include the weight of labels and adhesives *only if* the Member State also includes their weight in the bottles placed on the market. This weight may be determined by counting the bottles and applying conversion factors to take into account the weight of each bottle size and polymer type. Waste bottles are considered as separately collected if they have been collected separately from any other waste for recycling, or if they have been collected together with other waste under certain conditions (such as not mixing with hazardous wastes and collection and designed and carried out to minimise contamination). Member States may adjust the weight of the single-use bottles placed on the market adjustment where there are significant imports, exports or other movements within the EU of such bottles by operators or by natural persons for their own personal use. The Annexes to the implementing act provide the calculation formulas, as well as the reporting and quality check formats. The Commission is expected to adopt the implementing act in the near future.

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The National Law Review, 10 September 2021

<https://www.natlawreview.com/article/sustainability-outlook-european-union-august-2021>

European Commission sets up plastic expert group on packaging waste statistics

2021-09-10

The Commission Decision on establishing an expert group for statistics on plastic packaging waste (SPPW) foresees that a representative of the Eurostat, the statistical office of the EU, will chair it. The expert group will be composed of Member States' authorities responsible for reporting the data under the PPWD. Among other tasks, the group will advise the Commission on the comparability, reliability and exhaustiveness of the statistics on plastic waste generation and recycling and policy and legislative proposals on the harmonisation of statistics in this field. In addition, the group will be responsible for issuing annual opinions on

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the appropriateness of the data submitted by the Member States for the purposes of the own resource based on non-recycled plastic packaging waste (Council Decision 2020/2053, the so-called "EU plastic tax"; please see frESH Law Horizons July 2020).

Commission expert groups can be set up by a (formal) Commission decision or (informally) by an individual Commission department that has obtained the agreement of the Commissioner and Vice-President responsible, and of the Secretariat-General. They can be composed of public and/or private sector members and provide advice and expertise to the Commission.

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The National Law Review, 10 September 2021

<https://www.natlawreview.com/article/sustainability-outlook-european-union-august-2021>

European Commission registers citizen initiative on plastic bottle deposit system

2021-09-10

The European Citizen Initiative (ECI) "ReturnthePlastics" aims to implement an EU-wide deposit-return system (DRS) to recycle plastic bottles. According to its organisers, the system would be based on a €0.15 deposit for every plastic bottle purchased in the EU, which the consumer would receive back after returning the used plastic bottle to a reverse vending machine in a supermarket. In addition, they propose that plastic bottle manufacturers would bear the costs of putting this system in place.

Some Member States already have a DRS to collect beverage bottles (not only plastic bottles). The Single-use Plastics Directive 2019/904 (SUPD) encourages this measure to achieve the collection of 77% of single-use plastic beverage bottles by 2025 and 90% by 2029. However, introducing DRS is not mandatory.

If the ECI receives at least 1 million signatures of citizens from at least seven Member States within 12 months from a date chosen by the organisers, which must be not later than six months from its registration, the organisers may present it at public hearing of the European Parliament and meet with the Commission, which must set out its legal and political conclusions on the ECI in a communication. However, the Commission is not obligated to take any further action. Since 2012, to promote

In addition, they propose that plastic bottle manufacturers would bear the costs of putting this system in place.

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participatory democracy at EU level, the Commission has found 82 of 107 requested ECIs admissible (i.e. in the EU areas of competence); only six reached the required threshold of signatures. The period for the collection of signatures of this ECI has not started yet.

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The National Law Review, 10 September 2021

<https://www.natlawreview.com/article/sustainability-outlook-european-union-august-2021>

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REACH Update

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Does the titanium dioxide classification show chemicals legislation has a problem with solids?

2021-09-09

Chemical Watch science editor, Andrew Turley, examines the reasons for the longevity of the dispute over the classification – and asks whether the concept of ‘a substance’ is in need of overhaul

After a decade of dispute, the classification of titanium dioxide as a category 2 carcinogen under EU CLP is now the subject of three court cases. The outcome of those cases may eventually bring some closure to an issue that has been the subject of contention for far too long. But why exactly has the classification generated so much strife?

This is an important question, given the European Commission’s ambition to make the legislative process for the regulation of chemicals faster and more efficient – a goal described in its chemicals strategy for sustainability (CSS).

Much is at stake commercially. Titanium dioxide is widely used across a range of downstream sectors and manufacturers have warned of significant negative economic impacts as a result of the classification. Furthermore, there are many other compounds that have the potential to exhibit the same toxicological profile that underpins the titanium dioxide classification, prompting fears it could be just the first in a series of regulatory measures spanning a broad range of compounds. As a consequence, industry, which stands to take a significant financial hit, lobbied hard. But there is more than just commercial interest behind the controversy.

A broad scope

First, the original classification proposal applied to titanium dioxide in all its forms – but the toxicity did not. To many, classifying the substance generally on the basis of a subset of particle forms, seemed wrong. The hazard was carcinogenicity from inhalation. Therefore, what sense was there in classifying forms that could never be inhaled?

The classification we have today is more targeted, applying only to powder forms containing 1% or more of particles with an aerodynamic diameter of ten micrometres or more, but this narrower scope was introduced only relatively recently. It seems reasonable to assume that, particularly in the early phases of the dispute, a lot of time and energy might have been saved had it been more focused from the start.

Much is at stake commercially.

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REACH Update

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The proposal's broad initial scope was partly a result of uncertainty over what substance identity information the registrants were obliged to provide under REACH. In 2014, Echa told them that they had supplied insufficient information and requested the following for each form:

- the crystal phase;
- the impurity profile;
- whether there is a surface treatment and if so what it is; and
- whether the form is 'pigmentary' or 'sub-pigmentary'.

The agency also asked registrants to:

- specify whether the substance manufactured or imported by them only related to some of the forms and phases covered by the joint registration; and
- provide an explanation of how the phase-specific properties were addressed and how all test data accounted for that phase in relation to hazard and risk management measures.

The request was challenged by the lead registrant, plus eight co-registrants, arguing that, among other things, REACH did not compel them to provide such information. The appeal effectively stalled substance and dossier evaluation, leaving Echa and member state regulatory authorities in an awkward position. Evidence suggested to them that certain forms of titanium dioxide were carcinogenic. However, they could not target those specific forms with regulatory risk management measures because they did not have the information they needed to differentiate one form from another. They might yet get that information, but not for years, if at all.

France decided that it was not prepared to wait. It reasoned that if industry would not provide the information needed to differentiate the forms and target the ones of concern, it would have to consider the substance as a whole for the purposes of hazard assessment.

[Read More](#)

Chemical Watch, 9 September 2021

<https://chemicalwatch.com/330465/comment-does-the-titanium-dioxide-classification-show-chemicals-legislation-has-a-problem-with-solids>

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REACH Update

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Publication of GB mandatory classification and labelling (BG MCL) technical reports

2021-09-08

A GB MCL technical report is an independent scientific evaluation of the information submitted under the stand-alone GB MCL process or as part of the EU harmonised classification and labelling process.

It sets out whether there is adequate scientific evidence to support a new or revised GB MCL of a substance and what that GB MCL should be.

A new GB MCL technical report is now available for download at the end of the [GB MCL publication table](#).

This GB MCL technical report relates to a substance for which the Committee for Risk Assessment (RAC) published a RAC Opinion under Article 37(4) of EU CLP during 2021, based on information submitted under the EU CLP Regulation. The scientific information supporting the RAC Opinion is evaluated under the GB MCL system.

[Read More](#)

HSE, 8 September 2021

<https://www.hse.gov.uk/chemical-classification/gb-mcl-list.htm>

It sets out whether there is adequate scientific evidence to support a new or revised GB MCL of a substance and what that GB MCL should be.

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Janet's Corner

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Science Teachers

2021-09-17



<https://pixy.org/1563838/>

undefined.

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Hazard Alert

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Benzene

2021-09-17

Benzene is an organic chemical compound. It is composed of 6 carbon atoms in a ring, with 1 hydrogen atom attached to each carbon atom, with the molecular formula C_6H_6 . [1] It is a chemical that is a colourless or light yellow liquid at room temperature, has a sweet odour and is highly flammable. Benzene evaporates into the air very quickly. Its vapour is heavier than air and may sink into low-lying areas. It dissolves only slightly in water and will float on top of water. [2]

USES

Benzene is used mainly as an intermediate to make other chemicals. About 80% of benzene is consumed in the production of three chemicals, ethylbenzene, cumene, and cyclohexane. Its most widely-produced derivative is ethylbenzene, precursor to styrene, which is used to make polymers and plastics. Cumene is converted phenol for resins and adhesives. Cyclohexane is used in the manufacture of Nylon. Smaller amounts of benzene are used to make some types of rubbers, lubricants, dyes, detergents, drugs, explosives, and pesticides. [1] Benzene is used as a constituent in motor fuels; as a solvent for fats, waxes, resins, oils, inks, paints and plastics; in the extraction of oils from seeds and nuts; and in photogravure printing. [3]

SOURCES & ROUTES OF EXPOSURE [4]

The major sources of benzene exposure are tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions. About 50% of the entire nationwide exposure to benzene results from smoking tobacco or from exposure to tobacco smoke. Vapours (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure. Individuals employed in industries that make or use benzene may also be exposed. These industries include benzene production (petrochemicals, petroleum refining, and coke and coal chemical manufacturing), rubber tire manufacturing, and storage or transport of benzene and petroleum products containing benzene. Other workers who may be exposed to benzene because of their occupations include steel workers, printers, rubber workers, shoe makers, laboratory technicians, firefighters, and gas station employees.

Benzene is an organic chemical compound that is composed of 6 carbon atoms in a ring, with 1 hydrogen atom attached to each carbon atom and has the molecular formula C_6H_6 .

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Benzene enters the body through inhalation and ingestion. It is rapidly absorbed through the lungs; approximately 50% of the benzene in air is absorbed. Over 90% of ingested benzene is absorbed through the gastrointestinal tract. Absorbed benzene is rapidly distributed throughout the body and tends to accumulate in fatty tissues. The liver serves an important function in benzene metabolism, which results in the production of several reactive metabolites. At low exposure levels, benzene is rapidly metabolised and excreted predominantly as conjugated urinary metabolites. At higher exposure levels, metabolic pathways appear to become saturated and a large portion of an absorbed dose of benzene is excreted as parent compound in exhaled air.

HEALTH EFFECTS

Acute Effects

Co-exposure to benzene with ethanol (e.g., alcoholic beverages) can increase benzene toxicity in humans. Neurological symptoms of inhalation exposure to benzene include drowsiness, dizziness, headaches, and unconsciousness in humans. Ingestion of large amounts of benzene may result in vomiting, dizziness, and convulsions in humans. Exposure to liquid and vapour may irritate the skin, eyes, and upper respiratory tract in humans. Redness and blisters may result from dermal exposure to benzene.

Chronic Effects

Chronic inhalation of certain levels of benzene causes disorders in the blood in humans. Benzene specifically affects bone marrow (the tissues that produce blood cells). Aplastic anaemia (a risk factor for acute nonlymphocytic leukaemia), excessive bleeding, and damage to the immune system (by changes in blood levels of antibodies and loss of white blood cells) may develop. Benzene causes both structural and numerical chromosomal aberrations in humans. EPA has established an oral Reference Dose (RfD) for benzene of 0.004 milligrams per

Reproductive/Developmental Effects

There is some evidence from human epidemiological studies of reproductive and developmental toxicity of benzene; however the data do not provide conclusive evidence of a link between exposure and effect. Animal studies have provided limited evidence that exposure to benzene may affect reproductive organs; however these effects were only observed at exposure levels over the maximum tolerated dose.

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Adverse effects on the foetus, including low birth weight, delayed bone formation, and bone marrow damage, have been observed where pregnant animals were exposed to benzene by inhalation.

Cancer Risk

Increased incidence of leukaemia (cancer of the tissues that form white blood cells) has been observed in humans occupationally exposed to benzene. EPA has classified benzene as a Group A, known human carcinogen.

SAFETY

First Aid Measures

- Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. WARM water MUST be used. Get medical attention immediately.
- Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
- Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
- Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.
- Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
- Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Exposure Controls & Personal Protection

- Engineering Controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their

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respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

- Personal Protection: Splash goggles, lab coat, vapour respirator (be sure to use an approved/certified respirator or equivalent), gloves.
- Personal Protection in Case of a Large Spill: Splash goggles, full suit, vapour respirator, boots, and gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.
- Exposure Limits: TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m³) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m³) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m³) [Canada] TWA: 0.5 (ppm) [Canada] Consult local authorities for acceptable exposure limits.

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How metal-infused jaws give some ants an exceptionally sharp bite

2021-09-08

If you've ever felt the wrath of a biting or stinging insect, it may seem incredible that something so small can so easily slice or puncture human skin.

Scientists already knew that some small animals' piercing and slashing body parts are infused with metals such as zinc and manganese, making the parts tough and durable. Now, a study published September 1 in Scientific Reports shows how these toollike appendages form hard and extremely sharp cutting edges.

Robert Schofield, a physicist at the University of Oregon in Eugene, and colleagues used a special microscope to examine the sharp "teeth" that line the jaws of leaf-cutting ants called *Atta cephalotes*, revealing the teeth's atomic structure (SN: 11/24/20). The team found that zinc atoms were dispersed homogeneously, rather than in chunks, throughout a single tooth. This uniformity allows the ants to grow much thinner, sharper blades, since "chunks of mineral limit how sharp the tool can be," Schofield says.

The team also tested a suite of properties of these metal-infused materials, known as heavy element biomaterials, in ant teeth, spider fangs, scorpion stingers and marine worm jaws, among others. These structures are stiffer and more damage resistant than biomineralized materials, like the calcium phosphate typically found in teeth or the combination of calcium carbonate and the protein chitin in many arthropod shells, the team found. The metal-fortified body parts have "the kinds of properties that you want in a knife or needle," Schofield says.

The team estimates that the zinc-infused teeth of *A. cephalotes* allow it to puncture and cut using only about 60 percent of the energy and muscle mass it would otherwise.

By making these sharp, precisely sculpted tools, ants and other small animals can make up for their tiny muscles, allowing them to acquire and process foods that would normally be beyond their reach.

sciencenews.org, 8 September 2021

<https://www.sciencenews.org>

This uniformity allows the ants to grow much thinner, sharper blades, since "chunks of mineral limit how sharp the tool can be," Schofield says.

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Bamboo fabric is less sustainable than you think

2021-09-07

If you love clothes but want to protect the planet, you might find yourself at a crossroads pretty often. The fashion industry as it stands isn't exactly sustainable, and tricky marketing means even the most environmentally aware consumers can fall victim to greenwashing.

Bamboo fabric is the perfect example. On paper it seems like a low-impact textile: The plant grows rapidly, doesn't need a lot of fertilizer or water when farmed, and may have carbon-sequestering powers (though this is still highly contested). But some sustainable brands, including Patagonia, have chosen to skip it entirely.

That's because of the hidden process that turns bamboo into a wearable product.

A history of bamboozling customers

After taking the commercial world by storm in the early 2000s, bamboo has been hotly contested as a sustainable material for more than a decade. In 2009, the Federal Trade Commission (FTC) went after a company that claimed products were made of 100 percent "bamboo fiber," when in actuality they were made out of rayon. According to the FTC, rayon is made from chemically treated and dissolved cellulose derived from plants like bamboo. But the material is hardly sustainable and may be driving deforestation in Indonesia, Canada, and Brazil.

Nowadays, the FTC bans companies from using "bamboo" in product names if the item doesn't contain the actual fiber. It also warns consumers from buying into such greenwashing. "There is virtually no actual bamboo fiber out there, so be highly skeptical if suppliers tell you their textile products are 'bamboo,'" the agency wrote in a 2015 post.

Despite the FTC's attempts, faux bamboo fabrics still pop up today, in everything from fast fashion to luxury "earth-friendly" textiles. A deep dive by Good Housekeeping earlier this summer found that 10 bedding and clothing products that claimed to contain bamboo, eucalyptus, or other tree fibers didn't have a single trace of the plants. Instead, Lexie Sachs, director and head fiber scientist at the Good Housekeeping Institute, reported that they all had rayon.

"The raw plant materials are chemically dissolved to the point that they no longer exist in the final fabric," Sachs told Good Housekeeping. The brands

That's because of the hidden process that turns bamboo into a wearable product.

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tried to sneak by with a bamboo-labeled product that hardly resembled the original plant.

The pollution-packed process of making rayon

Rayon and viscose first came about in the late 19th century as a way to recreate natural fibers in cases of scarcity. Unlike cotton, which pretty much pops off the plant as a soft, fluffy material, bamboo and other tough fibers have to be processed multiple times to produce the kind of silky pajamas you'd want to pay \$100 for. Broken down simply, suppliers source that hard, woody material from plantations across the world and break it down with chemicals like sodium hydroxide and carbon disulfide into a cellulose pulp. Then more chemicals come in, liquifying the cellulose to an even more unrecognizable state.

After all of that, the mixture is strained and formed into fibers through yet another round of chemicals—this time sulfuric acid. There are questions about how harmful the processing agents are: A 2016 book by Paul Blanc, a professor in environmental medicine at the University of California-San Francisco, found that substances used to make rayon poisoned workers and nearby bodies of water. Not to mention, the cellulose that goes into the process has to come from somewhere. According to the conservation nonprofit Canopy Planet, 200 million trees are logged yearly for cellulose-based fabric, which when pulped, wastes about 70 percent of the tree.

At the end of the day, rayon isn't recyclable and doesn't biodegrade well in landfills (and that's not taking the processing chemicals into account, either). So marking "bamboo" products as inherently sustainable misleads buyers on multiple levels.

So, what should you buy instead?

If you've fallen in love with the idea of bamboo, there's one way to wear the stuff and have it be truly sustainable. That's bamboo linen, which according to the Council of Fashion Designers of America, is created in the same way as hemp or flax linen: The fibers are picked, combed out, and formed into a fabric mechanically, so they're truer to the original source. The rub with that is that it's labor-intensive, expensive, and not nearly as soft.

The best thing to do when you want new clothing is to scavenge the forgotten pieces from your own closet or shop secondhand. When those options don't cut it, look for certified organic products like linen processed without chemicals, cotton, and wool. Of course, always buy things you

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know you'll use over and over, because that might be the most Earth-saving feature of all.

popsci.com, 7 September 2021

<https://www.popsci.com>

Weird 'dog bone' asteroid could be a pile of cosmic rubble

2021-09-10

Astronomers have fetched some cool new views of a dog-bone-shaped asteroid orbiting between Mars and Jupiter.

Kleopatra, better known as the "dog bone asteroid" for its two-lobed shape, is about 167 miles (270 kilometers) long and has its own pair of moons. The new observations suggest that the asteroid is a loosely accumulated pile of rubble that probably formed from debris from a giant impact.

"Kleopatra is truly a unique body in our solar system," Franck Marchis, an astronomer at the SETI Institute in Mountain View, California, and the Laboratoire d'Astrophysique de Marseille in France, who led the new research on the asteroid, said in a statement. "Science makes a lot of progress thanks to the study of weird outliers. I think Kleopatra is one of those, and understanding this complex, multiple-asteroid system can help us learn more about our solar system."

PLAY SOUND

Scientists first discovered Kleopatra's dog-bone shape about two decades ago. The moons were discovered in 2008 by Marchis and his colleagues, who dubbed them Alexhelios and Cleoselene after the real-life children of the Egyptian queen Cleopatra. (Kleopatra is the Greek spelling of Cleopatra, who ruled Egypt between 51 B.C. and 30 B.C.)

The new observations of the asteroid were made between 2017 and 2019 by the European Southern Observatory's Very Large Telescope in Chile. As the asteroid rotated, the telescope captured it from different angles, enabling new calculations of the asteroid's length and volume.

The results, published Thursday (Sept. 9) in two papers in the journal *Astronomy & Astrophysics*, also reveal the orbits of the asteroid's two moons. Along with the asteroid's length, this information allowed a team led by Miroslav Brož, an astronomer at Charles University in Prague, to

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calculate the mass of the asteroid, which, at 3.27 quadrillion tons (2.97 quadrillion metric tons), turned out to be 35% lower than previously estimated. Its density, now estimated at 3.4 grams per cubic centimeter, is also lower than the previous estimate of 4.5 grams per cubic centimeter.

The asteroid rotates very quickly, the researchers found — almost fast enough for it to start coming apart. At this rotation speed, very small impacts can easily chip away bits of the asteroid, which may have been how Alexhelios and Cleoselene formed. Tiny impacts with other space debris may have lifted small pebbles and rocks from Kleopatra's surface, and those small stones may have conglomerated into the asteroid's two moons.

Astronomers hope to have more detail on the dog bone asteroid in the coming years. In 2027, the European Southern Observatory will start up a new observatory called the Extremely Large Telescope (ELT).

"I can't wait to point the ELT at Kleopatra, to see if there are more moons and refine their orbits to detect small changes," Marchis said.

livescience.com, 10 September 2021

<https://www.livescience.com>

EPA proposes first limits to PFAS in wastewater

2021-09-10

(Reuters) - The Environmental Protection Agency on Wednesday announced plans for regulation that would for the first time set limits on levels of per- and polyfluoroalkyl substances, or PFAS, that certain manufacturers and users of the chemical compound discharge in wastewater.

The EPA said it will start preliminary work on a pollution rule for how much PFAS can be discharged into sewage treatment systems and surface waters from "facilities manufacturing PFAS" that are part of the organic chemicals, plastics and synthetic fibers industries. It will also work on a PFAS pollution rule for industries that perform metal-finishing operations.

There are currently no federal regulatory standards for PFAS discharges by these industries, said Albert Lin, a professor of law at the University of California Davis School of Law.

With the proposed rules, "for the first time, EPA is committing to limit PFAS in wastewater discharges," Radhika Fox, the agency's assistant

It will also work on a PFAS pollution rule for industries that perform metal-finishing operations.

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administrator for water, said in a statement. The regulations would ultimately protect drinking water supplies, she added.

PFAS, nicknamed “forever chemicals” because they don’t break down easily, have been associated with various illnesses including kidney cancer. They have been used for decades in household products such as nonstick cookware, stain- and water-resistant textiles, rugs, food packaging, photo imaging, and in industrial products. Many states have already outlawed their use in food packaging.

Lin, who specializes in toxic torts and environmental law, said establishing the regulatory standards would likely take years, and called the upcoming process “potentially arduous.”

Ralph DeMeo, a shareholder at Guilday Law, said the development was “a very big deal” because of the ubiquity of wastewater treatment facilities that the regulations would touch upon.

The EPA says its surface water discharge regulations for the organic chemicals, plastics and synthetic fibers industries cover more than 1,000 chemical facilities producing over 25,000 products, from benzene to rayon and polyester.

About 44,000 facilities perform various metal-finishing operations and discharge wastewater directly or indirectly into surface waters, the agency says.

EPA’s announcement comes amid renewed efforts to phase out the substance, with the Biden administration seeking funding to clean up PFAS-contaminated industrial sites and to conduct research on the chemical’s effects.

The agency will take comments on its proposal.

EPA last week published a draft of the first laboratory analytical method it has validated to test for PFAS in wastewater, surface water and soil.

reuters.com, 10 September 2021

<https://www.reuters.com>

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Stunning colorized footage provides a glimpse of the last known Tasmanian tiger

2021-09-09

Nearly a century ago, a filmmaker captured a short black-and-white movie of the last known thylacine, also known as a Tasmanian tiger, as it padded around its enclosure at the Beaumaris Zoo in Hobart, Australia. Now, that long-dead animal, which his keepers named Benjamin, has “come back to life” in a new colorized version of the footage.

In the enhanced footage, which the National Film and Sound Archive (NFSA) of Australia shared on YouTube on Sept. 6, Benjamin has yellowish fur striped with dark brown over his back and rump. When he gapes his astonishingly long jaws in a head-stretching yawn, his tongue and the inside of his mouth are a delicate shade of pink.

Australian naturalist David Fleay captured the footage on 35-millimeter film in December 1933. The film and negative are in the NFSA’s collection, and the negative was recently scanned at 4K resolution (horizontal resolution of at least 4,000 pixels) and then colorized under the supervision of film producer Samuel François-Steininger at Composite Films in Paris, NFSA representatives said in a statement.

Colorizing the footage at such high resolution was challenging because the thylacine’s fur was extremely dense, “and a lot of hair had to be detailed and animated,” François-Steininger said in the NFSA statement.

Experts with Composite Films referenced preserved thylacine skins in museums to make sure that the film’s new colors were accurate. They also read scientific descriptions of the animals and reviewed thylacine illustrations and paintings. Then, they turned to digital tools and artificial intelligence algorithms to seamlessly integrate color into each frame of the negative.

“More than 200 hours of work were needed to achieve this result,” François-Steininger said.

While thylacines (*Thylacinus cynocephalus*) are commonly known as Tasmanian tigers or Tasmanian wolves, they were neither wolves nor tigers. Rather, these extinct animals were once the biggest carnivorous marsupials in the world, with adults weighing as much as 66 pounds (30 kilograms) and measuring up to 77 inches (195 centimeters) long from their noses to the tips of their long tails.

Now, that long-dead animal, which his keepers named Benjamin, has “come back to life” in a new colorized version of the footage.

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Tasmanian tigers once roamed across Australia, but by about 2,000 years ago, they were found only on the island of Tasmania, where approximately 5,000 thylacines remained by the time Europeans colonized the continent in the late 18th century, according to the National Museum of Australia. By the mid-1930s, sightings of thylacines in the wild were exceedingly rare. After Benjamin's lonely death at the Hobart zoo in 1936, attempts to capture another thylacine were unsuccessful, and the species was declared officially extinct in 1986, the National Museum of Australia reported.

There are only 10 known film clips of living thylacines, and Fleay's footage is the longest, with a running time of about 80 seconds. But even a minute of filming may have been too much for Fleay's thylacine subject; shortly after the filmmaker captured the footage of Benjamin, the Tasmanian tiger bit Fleay on the buttocks, according to the NFSA.

Originally published on Live Science.

[livescience.com](https://www.livescience.com), 9 September 2021

<https://www.livescience.com>

California's thirst for water may accelerate global warming

2021-09-09

A new study finds the push to secure more water in California may hurt the state's ability to meet greenhouse gas reduction goals.

The nonpartisan group Next 10 and the Pacific Institute, a think tank focusing on water issues, found the state's drive for drinkable water may exacerbate the conditions that are warming the global climate.

The warming climate is increasing the frequency and length of droughts in Southern California which heightens the urgency to develop new water sources.

The study concludes that finding new water sources frequently carries a hidden environmental cost and the report predicts carbon emissions could spike in coming years.

"It takes a tremendous amount of energy," said Peter Gleick, Pacific Institute president emeritus. "To collect, to produce, to treat, to distribute and to use the water that we use."

"It takes a tremendous amount of energy," said Peter Gleick, Pacific Institute president emeritus. "To collect, to produce, to treat, to distribute and to use the water that we use."

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Two San Diego strategies, desalination and treatment of used water, both carry high energy price tags. Consuming high amounts of energy can release more greenhouse gasses, increasing the chance of drought, and which then circles back to drive up the need for more water.

But there is a solution.

"Water conservation and efficiency can help us meet, not only our water goals but or energy and climate goals," said Heather Cooley, Pacific Institute's research director. "And there are many things that we can be doing in our homes and businesses and agriculture to help advance efficiencies."

Cooley said conservation has tamped down the demand for more water in the region.

In fact, water use has been flat in Southern California for more than a decade even as the state's population has grown.

Conservation can come inside the home, with more efficient appliances and practices and outside the home where nearly half of the region's water is used.

"We spend a tremendous amount of water irrigating our landscape," Cooley said. "In many cases irrigating very water-intensive lawns for example. We have tremendous opportunities now to be moving away from lawns and putting in low water use plants."

Beyond conservation, the report calls on local leaders to encourage the use of renewable power.

"We need to electrify our residential houses in California," said Noel Perry, the founder of Next 10, "The way to do that is to move away from natural gas to use heat pumps in order to heat our water both for heating and also domestic use."

The report says relying on fossil fuels to move and make water only compounds the situation creating the region's thirst.

The report authors identify specific water policy recommendations that could help the state meet its energy and greenhouse gas reduction goals:

Expand urban water conservation and efficiency efforts;

Accelerate water heater electrification;

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Maintain groundwater levels and expand more flexible, high-efficiency groundwater pumps;

Provide financial incentives and regulatory pathways for water suppliers to invest in less energy- and greenhouse gas-intensive water systems, including through existing financial incentives and programs for energy efficiency and greenhouse gas reduction;

Expand and standardize water data reporting and energy usage tracking; and

Formalize coordination between water and energy regulatory agencies about forecasted energy demand changes.

[kpbs.org](https://www.kpbs.org), 9 September 2021

<https://www.kpbs.org>

Earth's tipping points could be closer than we think. Our current plans won't work

2021-09-09

If there's one thing we know about climate breakdown, it's that it will not be linear, smooth or gradual. Just as one continental plate might push beneath another in sudden fits and starts, causing periodic earthquakes and tsunamis, our atmospheric systems will absorb the stress for a while, then suddenly shift. Yet, everywhere, the programmes designed to avert it are linear, smooth and gradual.

Current plans to avoid catastrophe would work in a simple system like a washbasin, in which you can close the tap until the inflow is less than the outflow. But they are less likely to work in complex systems, such as the atmosphere, oceans and biosphere. Complex systems seek equilibrium. When they are pushed too far out of one equilibrium state, they can flip suddenly into another. A common property of complex systems is that it's much easier to push them past a tipping point than to push them back. Once a transition has happened, it cannot realistically be reversed.

The old assumption that the Earth's tipping points are a long way off is beginning to look unsafe. A recent paper warns that the Atlantic meridional overturning circulation – the system that distributes heat around the world and drives the Gulf Stream – may now be “close to a critical transition”. This circulation has flipped between “on” and “off” states several times in prehistory, plunging northern Europe and eastern North America into unbearable cold, heating the tropics, disrupting monsoons.

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Other systems could also be approaching their thresholds: the West and East Antarctic ice sheets, the Amazon rainforest, and the Arctic tundra and boreal forests, which are rapidly losing the carbon they store, driving a spiral of further heating. Earth systems don't stay in their boxes. If one flips into a different state, it could trigger the flipping of others. Sudden changes of state might be possible with just 1.5C or 2C of global heating.

A common sign that complex systems are approaching tipping points is rising volatility: they start to flicker. The extreme weather in 2021 – the heat domes, droughts, fires, floods and cyclones – is, frankly, terrifying. If Earth systems tip as a result of global heating, there will be little difference between taking inadequate action and taking no action at all. A miss is as good as a mile.

So the target that much of the world is now adopting for climate action – net zero by 2050 – begins to look neither rational nor safe. It's true that our only hope of avoiding catastrophic climate breakdown is some variety of net zero. What this means is that greenhouse gases are reduced through a combination of decarbonising the economy and drawing down carbon dioxide that's already in the atmosphere. It's too late to hit the temperature targets in the Paris agreement without doing both. But there are two issues: speed and integrity. Many of the promises seem designed to be broken.

At its worst, net zero by 2050 is a device for shunting responsibility across both time and space. Those in power today seek to pass their liabilities to those in power tomorrow. Every industry seeks to pass the buck to another industry. Who is this magical someone else who will suck up their greenhouse gases?

Their plans rely on either technology or nature to absorb the carbon dioxide they want to keep producing. The technologies consist of carbon capture and storage (catching the carbon emissions from power stations and cement plants then burying them in geological strata), or direct air capture (sucking carbon dioxide out of the air and burying that too). But their large-scale use is described by the Intergovernmental Panel on Climate Change as “subject to multiple feasibility and sustainability constraints”. They are unlikely to be deployed at scale in the future for the same reason that they're not being deployed at scale today, despite 20 years of talk: technical and logistical barriers. Never mind: you can keep smoking, because one day they'll find a cure for cancer.

So what's left is nature: the capacity of the world's living systems to absorb the gases we produce. As a report by ActionAid points out, there's not

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enough land in the world to meet the promises to offset emissions that companies and governments have already made. Even those who own land want someone else to deal with their gases: in the UK, the National Farmers' Union is aiming for net zero. But net zero commitments by other sectors work only if farmland goes sharply net negative. That means an end to livestock farming and the restoration of forests, peat bogs and other natural carbon sinks. Instead, a mythical other will also have to suck up emissions from farming: possibly landowners on Venus or Mars.

Even when all the promised technofixes and offsets are counted, current policies commit us to a calamitous 2.9C of global heating. To risk irreversible change by proceeding at such a leisurely pace, to rely on undelivered technologies and nonexistent capacities: this is a formula for catastrophe.

If Earth systems cross critical thresholds, everything we did and everything we were – the learning, the wisdom, the stories, the art, the politics, the love, the hate, the anger and the hope – will be reduced to stratigraphy. It's not a smooth and linear transition we need. It's a crash course.

theguardian.com, 9 September 2021

<https://www.theguardian.com>

A newfound boa sports big eyes and a square nose

2021-09-10

A wide-eyed snake has made scientists do a double take. The Hispaniolan vineboa, with its large protruding eyes and square snout, is the first boa species to be discovered in the Dominican Republic in more than a century.

Naturalist Miguel Landestoy of the Universidad Autónoma de Santo Domingo in the Dominican Republic and colleagues discovered the snake, *Chilabothrus ampelophis*, slithering in a patch of mountainous dry forest near the country's southwestern border with Haiti on the island of Hispaniola. The last time researchers described a new boa species on the island was in 1888.

"The fact that an animal could have gone undetected for so long on this island that has a lot of people on it is pretty remarkable," says R. Graham Reynolds, a herpetologist at the University of North Carolina Asheville.

What's more, the Hispaniolan vineboa may be among the smallest boas in the world, Reynolds, Landestoy and colleague Robert Henderson of the

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Milwaukee Public Museum report August 17 in Breviora. Adult boa species typically reach 2 meters or more in length (SN: 10/13/09). The longest Hispaniolan vineboa that the team found, an adult female, measures less than 1 meter. The shortest, probably a juvenile male, is less than a half meter long.

Compared with the three other boa species found on the island, the Hispaniolan vineboa's small size, large eyes and dark, zigzag patterned scales tipped off the researchers that they had spotted something new. Genetic analyses and close inspections five different snakes plus one shed skin confirmed the team's hunch that the Hispaniolan vineboa is a species new to science.

But the species may already be in trouble. All serpents that the team found were within one kilometer of each other. That's "a little bit alarming in the sense that they might be restricted to a very small area," Reynolds says. Agricultural activities such as charcoal burning threaten the species' habitat. The team's next steps will be to figure out the boa's true range and how big individuals can get.

sciencenews.org, 10 September 2021

<https://www.sciencenews.org>

How ancient farmers throttled their immune systems to survive

2021-09-07

When early farmers of the Vinca culture first sowed barley and wheat 7700 years ago in the rich soil of the Danube River and its tributaries, they changed more than their diet: They introduced a new way of life to the region. They crowded together in mud huts, living cheek by rump with aurochs, cows, pigs, and goats—and their poop—in settlements that eventually swelled to thousands of people. Togetherness brought a surge in diseases such as influenza, tuberculosis, and other maladies spread from animals to people and through early farming communities.

Now a new study of ancient DNA shows how the immune systems of those early farmers responded to this new, pathogen-ridden environment. The Neolithic Revolution was a "turning point" in the evolution of immune responses to infectious disease, according to a paper published today in *eLife*. The study suggests that in Europeans, evolution favored genes that throttled back inflammatory reactions to pathogens like influenza,

Togetherness brought a surge in diseases such as influenza, tuberculosis, and other maladies spread from animals to people and through early farming communities.

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restraining the hyperalert inflammatory response that can be deadlier than the pathogen itself.

“This study does a great job of showing that our immune system has continued to evolve in response to pathogen pressure,” says population geneticist Joseph Lachance of the Georgia Institute of Technology. But he notes that the paper relies on an unproven method of predicting ancient immune responses. “I buy it, but it needs to be studied [more] when we have more ancient DNA.”

Researchers have long suspected that early farmers got sick more often than nomadic hunter-gatherers. Studies suggest farmers in large Neolithic sites such as Çatalhöyük in Turkey faced a flurry of new zoonotic diseases such as influenza and salmonella, as well as new animal-borne strains of diseases like malaria and tuberculosis. “If farmers got sick more, how did their immune systems change?” asked infectious disease specialist Mihai Netea of Radboud University Nijmegen Medical Centre, who led the study.

To approach that question, his team first studied genetically based variation in the immune responses of living people. They took blood samples from more than 500 people in the Human Functional Genomics Project (HFGP), a biobank based in Nijmegen, Netherlands, and challenged the samples with various pathogens. Then they measured levels of specific cytokines—immunoregulatory proteins such as interleukin and interferon that are secreted by immune cells—and looked for correlations between those levels and a suite of immune gene variants.

In the new study, the team used those results to come up with what’s called a polygenic risk score that predicts the strength of the inflammatory response in the face of specific diseases, based on an individual’s immune gene variants. The researchers then applied their technique to the past: From existing databases they downloaded ancient DNA sequences from 827 remains found across Europe, including Vinca farmers from today’s Romania. They calculated the cytokine levels ancient people would likely have produced and their polygenic risk scores for inflammation.

The remains dated from between 45,000 and 2000 years ago, enabling the team to look for changes over time. They found that when faced with infections, Europeans who lived after agriculture likely produced dramatically lower levels of systemic cytokines than earlier hunter-gatherers. Those lower levels were likely adaptive, Netea says. “When people first encountered new pathogens, some overreacted and died, like we see with COVID today,” he says. “The children of the people who

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survived didn’t produce as many cytokines, so the whole population becomes more resistant.”

The study also revealed a flip side: When infected with the fungus *Candida* and *Staphylococcus* bacteria—pathogens that tend to start as localized infections—farmers likely mounted more robust inflammatory responses than earlier hunter-gatherers. A strong inflammatory response can quell a localized infection before it spreads, but a robust systemic response, as sparked by the flu or malaria, can spiral out of control.

The study is exciting because it clearly shows that the population frequencies of genes regulating inflammation “change strongly from the beginning of the Neolithic,” says molecular anthropologist Ben Krause-Kyora of Kiel University.

But Lachance questions whether polygenic risk scores developed for modern people can predict inflammation for people in other places and times. Pathogens have evolved over time, he notes, and modern risk prediction might not apply to ancient disease strains. Population geneticist Luis Barreiro of the University of Chicago, agrees, saying the authors “don’t formally demonstrate the predictive value of these polygenic risk scores.”

More samples of ancient DNA from people and pathogens, especially on other continents, is needed to test whether evolution scaled back the production of inflammatory cytokines in farmers everywhere. But the study clearly demonstrates that somehow or other, European’s inflammatory responses to pathogens did change dramatically during the Neolithic, Lachance says. To Netea, the findings suggest the ancient burst of evolution may have an impact even today: If a coronavirus like SARS-CoV-2 had swept through Europe before agriculture, he says, “more people would have died than today because they produced more proinflammatory cytokines.”

science.org, 7 September 2021

<https://www.science.org>

New details emerge about coronavirus research at Chinese lab

2021-09-07

NEWLY RELEASED DOCUMENTS provide details of U.S.-funded research on several types of coronaviruses at the Wuhan Institute of Virology in

“This is a road map to the high-risk research that could have led to the current pandemic,” said Gary Ruskin, executive director of U.S. Right To Know, a group that has been investigating the origins of Covid-19.

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China. The Intercept has obtained more than 900 pages of documents detailing the work of EcoHealth Alliance, a U.S.-based health organization that used federal money to fund bat coronavirus research at the Chinese laboratory. The trove of documents includes two previously unpublished grant proposals that were funded by the National Institute of Allergy and Infectious Diseases, as well as project updates relating to EcoHealth Alliance's research, which has been scrutinized amid increased interest in the origins of the pandemic.

The documents were released in connection with ongoing Freedom of Information Act litigation by The Intercept against the National Institutes of Health. The Intercept is making the full documents available to the public.

"This is a road map to the high-risk research that could have led to the current pandemic," said Gary Ruskin, executive director of U.S. Right To Know, a group that has been investigating the origins of Covid-19.

One of the grants, titled "Understanding the Risk of Bat Coronavirus Emergence," outlines an ambitious effort led by EcoHealth Alliance President Peter Daszak to screen thousands of bat samples for novel coronaviruses. The research also involved screening people who work with live animals. The documents contain several critical details about the research in Wuhan, including the fact that key experimental work with humanized mice was conducted at a biosafety level 3 lab at Wuhan University Center for Animal Experiment — and not at the Wuhan Institute of Virology, as was previously assumed. The documents raise additional questions about the theory that the pandemic may have begun in a lab accident, an idea that Daszak has aggressively dismissed.

The bat coronavirus grant provided EcoHealth Alliance with a total of \$3.1 million, including \$599,000 that the Wuhan Institute of Virology used in part to identify and alter bat coronaviruses likely to infect humans. Even before the pandemic, many scientists were concerned about the potential dangers associated with such experiments. The grant proposal acknowledges some of those dangers: "Fieldwork involves the highest risk of exposure to SARS or other CoVs, while working in caves with high bat density overhead and the potential for fecal dust to be inhaled."

Alina Chan, a molecular biologist at the Broad Institute, said the documents show that EcoHealth Alliance has reason to take the lab-leak theory seriously. "In this proposal, they actually point out that they know how risky this work is. They keep talking about people potentially getting bitten — and they kept records of everyone who got bitten," Chan said.

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"Does EcoHealth have those records? And if not, how can they possibly rule out a research-related accident?"

According to Richard Ebright, a molecular biologist at Rutgers University, the documents contain critical information about the research done in Wuhan, including about the creation of novel viruses. "The viruses they constructed were tested for their ability to infect mice that were engineered to display human type receptors on their cell," Ebright wrote to The Intercept after reviewing the documents. Ebright also said the documents make it clear that two different types of novel coronaviruses were able to infect humanized mice. "While they were working on SARS-related coronavirus, they were carrying out a parallel project at the same time on MERS-related coronavirus," Ebright said, referring to the virus that causes Middle East Respiratory Syndrome.

Asked about the grant materials, Robert Kessler, communications manager at EcoHealth Alliance, said, "We applied for grants to conduct research. The relevant agencies deemed that to be important research, and thus funded it. So I don't know that there's a whole lot to say."

The grant was initially awarded for a five-year period — from 2014 to 2019. Funding was renewed in 2019 but suspended by the Trump administration in April 2020.

The closest relative of SARS-CoV-2, which causes Covid-19, is a virus found in bats, making the animals a focal point for efforts to understand the origins of the pandemic. Exactly how the virus jumped to humans is the subject of heated debate. Many scientists believe that it was a natural spillover, meaning that the virus passed to humans in a setting such as a wet market or rural area where humans and animals are in close contact. Biosafety experts and internet sleuths who suspect a lab origin, meanwhile, have spent more than a year poring over publicly available information and obscure scientific publications looking for answers. In the past few months, leading scientists have also called for a deeper investigation of the pandemic's origins, as has President Joe Biden, who in May ordered the intelligence community to study the issue. On August 27, Biden announced that the intelligence inquiry was inconclusive.

Biden blamed China for failing to release critical data, but the U.S. government has also been slow to release information. The Intercept initially requested the proposals in September 2020.

"I wish that this document had been released in early 2020," said Chan, who has called for an investigation of the lab-leak origin theory. "It would

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have changed things massively, just to have all of the information in one place, immediately transparent, in a credible document that was submitted by EcoHealth Alliance."

The second grant, "Understanding Risk of Zoonotic Virus Emergence in Emerging Infectious Disease Hotspots of Southeast Asia," was awarded in August 2020 and extends through 2025. The proposal, written in 2019, often seems prescient, focusing on scaling up and deploying resources in Asia in case of an outbreak of an "emergent infectious disease" and referring to Asia as "this hottest of the EID hotspots."

[theintercept.com](https://www.theintercept.com), 7 September 2021

<https://www.theintercept.com>

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This early ocean predator was a giant 'swimming head'

2021-09-08

The mothership has landed. Two years after scientists dubbed one of Earth's first sea-dwelling predators the "Millennium Falcon" for its sci-fi carapace, the same researchers have identified an even larger spaceshiplike creature at the same site, in Canada's Burgess Shale. The half-meter-long arthropod, described in a study out today, was essentially a giant "swimming head" that prowled the Cambrian seas half a billion years ago, says Joseph Moysiuk, a paleontologist at the University of Toronto (U of T) who helped uncover the fossil in 2018. "The first word that comes to mind when I think of this new species is big."

Titanokorys gainesi, whose head takes up nearly half the length of its body, was covered in a domed, spike-tipped carapace that inspired its Latin name: "Titan's helmet." The creature likely swam along the ocean floor, Moysiuk says, flushing prey from the mud with appendages built like "baskets of spines" (see video, above). And whereas its spiky helmet might have helped with that digging, its eyes, which sat at the back of its carapace, facing straight up, would have been useless for finding prey. Those were probably for spotting other predators—threats to *Titanokorys* itself.

"Predation was a big evolutionary innovation that happened during the Cambrian," says co-author Jean-Bernard Caron, curator of invertebrate paleontology at the Royal Ontario Museum and a paleontologist at U of T. "Here, we are illustrating the complexity of that."

Titanokorys belongs to a diverse group of arthropods called radiodonts that split from the ancestors of spiders, insects, and horseshoe crabs by 520 million years ago, soon after the Cambrian explosion of animal diversity. At a time when vertebrates—the lineage that led to us—were little more than pinkie-size fish, radiodonts terrorized the Cambrian seas. The ranks of these now extinct creatures included *Anomalocaris*, a predator with front-facing eyestalks and a pair of clawlike appendages on its face, and *Cambroraster falcatus*, the species with the sleek head carapace reminiscent of Han Solo's spaceship.

All radiodonts shared three traits, Caron says: a circular mouth that looks like a pineapple cross-section and contains flesh-ripping teeth, a pair of spiny appendages in front of the mouth, and large compound eyes. This new species fits all those traits onto a supersize, carapace-covered head. Allison Daley, a paleontologist at the University of Lausanne who was not involved in the new research, says she is "delighted" by the find.

"The first word that comes to mind when I think of this new species is big."

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"It's one of those discoveries that you never forget," Moysiuk says. It was the end of the day during a dig near Marble Canyon in Canada's Kootenay National Park, when Caron decided to split open one last rock. "And lo and behold, he uncovered this absolutely massive, spaceship-shaped carapace just shimmering there in the Sun," Moysiuk says. "Everyone was pretty stunned." After taking a few selfies, the team carefully wrapped the specimen in newspaper and packed it in a big metal can to safely helicopter it down the mountain.

At first, the researchers thought the fossil might simply be a supersize Cambroraster, because that species was found in abundance at the same site. But the shape and size of the new fossil—and 11 related specimens—were just too different. It had to be something new, Moysiuk and Caron write today in Royal Society Open Access. Daley says the authors make a "very convincing argument" that Titanokorys should get its own genus.

Finding Titanokorys at the same site as Cambroraster underscores the diversity of Cambrian ecosystems, Caron adds—and the remarkable abundance of predators. Earth's early seas must have had enough prey to feed a large range of hunters coexisting in the same space, including some animals that have so far eluded paleontologists.

Next summer, the researchers hope to go out and search the site for a more complete Titanokorys fossil, with its full body intact. They might even find a new and even more outlandish species hidden away within the rocks.

science.org, 8 September 2021

<https://www.science.org>

A punch of saturated fat could make tempering chocolate a breeze

2021-09-07

Glossy, velvety chocolate that snaps in the fingers and melts in the mouth is the chocolatier's dream.

But crafting cocoa confections with this optimal texture is no easy feat. The endeavor, known as tempering, demands carefully warming and cooling liquid chocolate until it crystallizes into its most delectable form. Now, scientists may have found a shortcut: adding a small pinch of fatty molecules called phospholipids, researchers report August 31 in Nature Communications.

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With phospholipids, "you can simplify the whole tempering process, making sure you always have the right quality of the chocolate," says food chemist Alejandro Marangoni of the University of Guelph in Canada.

Curious about what occurs on a molecular level during tempering, Marangoni and colleagues focused on the ingredient that gives chocolate its texture — cocoa butter. While previous tempering research had targeted cocoa butter's main component, triglycerides, the team set its sights on a different sweet spot: the minor components, which include free fatty acids and phospholipids. Removing these minor components from the cocoa butter and adding them back in one by one allowed the researchers to figure out each component's role during tempering.

With just a pinch of phospholipids added to the cocoa butter — achieving a weight concentration of 0.1 percent of the chocolate's total — the mixture rapidly crystallized into the elusive, melt-in-the-mouth texture. The process required a single cooling to 20° Celsius rather than multiple heating and cooling cycles as tempering typically demands.

Next, the team increased the phospholipid weight concentration in melted dark chocolate by an extra 0.1 percent, and easily produced high-quality textures again. The result suggests that phospholipids could be used to simplify chocolate tempering.

The hack could help small-scale chocolatiers avoid the complications and expenses associated with tempering machines, Marangoni says. Large-scale manufacturers, on the other hand, would need to figure out how to evenly disperse phospholipids in a large vat of molten chocolate, he says.

sciencenews.org, 7 September 2021

<https://www.sciencenews.org>

A search for Chesapeake's vanishing saltmarsh sparrow

2021-09-08

It seemed like an inauspicious start to a morning of birding.

Ever so slowly, Pete McGowan guided a small powerboat into the marsh at the mouth of the Transquaking River on Maryland's Eastern Shore. McGowan, a biologist with the U.S. Fish and Wildlife Service, threaded the vessel through a grassy maze of increasingly narrow channels. Finally, he ran out of water, blocked by a towering green wall of phragmites.

"We know that over 80% of the population has disappeared since 1998."

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With that, Kevin Reifenberg and Olivia Tran — a pair of “on-call biologists,” as they described themselves — slipped over the side and plunged into the thicket of 7-foot high reeds. They quickly vanished from sight, their slog through the morass evident only from the sound of thrashing, splashing and their increasingly faint voices.

The trio was one of 15 crews searching in marshes from Virginia to Maine this summer for the rare, vanishing saltmarsh sparrow, a secretive little brown and gray bird with orange around its cheeks and a whitish belly. They nest only in grassy tidal marshes along the northeastern Atlantic Coast.

And they’re in big trouble. Rising sea level is inexorably drowning their nests and nestlings.

“It’s in pretty dire straits, to be honest,” said Rebecca Longenecker, another USFWS biologist working on the survey. “We know that over 80% of the population has disappeared since 1998. Four of every five saltmarsh sparrows are gone. So it’s pretty striking, pretty alarming stuff.”

The birds were living dangerously even before climate change began to hit them. Saltmarsh sparrows build their nests beneath the grass in “high marsh,” the most elevated parts of the squishy interface between land and water. High marsh typically floods only once or twice a month — on spring tides, when the sun, Earth and moon align to pull the water higher — or during coastal storms.

By nesting in such a precarious setting, the birds have evolved a reproductive cycle that just fits into the lunar timetable. They can lay eggs, hatch them and nurture the chicks within about 28 days, between the extra-high tides.

But high marsh is increasingly turning into waterlogged low marsh. Sea level is rising faster than marshland can build itself up with accumulating sediment and decomposing plants. Along the Delmarva Peninsula, the water is rising even faster because the land, itself, is ever so slowly sinking — a geologic aftereffect of the end of the ice age 10,000 years ago.

Those rising waters, coupled with historic human alteration of marsh and nest predation by other animals, have put saltmarsh sparrows in a tailspin, biologists say. A survey conducted a decade ago found that the birds’ population had plummeted 87% since 1998.

Surveys amid silence

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This year, federal and state wildlife agencies, in partnership with universities and nonprofit conservation groups, launched a survey to check up on the saltmarsh sparrow population. They also checked for some other marsh-dwelling birds, such as the black rail and seaside sparrow — which are also at risk from the loss and degradation of salt marsh habitat.

As best they could, survey crews revisited 1,700 locations from Maine to Virginia that had been surveyed a decade ago, so they could track any differences in habitat and bird abundance over that time. One spot that was checked along Maryland’s coastal bays in the 2011–12 survey proved impossible to reach, Longenecker recalled, because it is now about 70 yards out in the water.

Hitting each assigned spot twice for consistency, Reifenberg and Tran helped to canvass an important portion of the sparrow’s range. Delaware, Maryland and Virginia accounted for more than a third of the bird’s population in the last survey.

McGowan, the boat’s skipper, is a longtime staffer in the USFWS Chesapeake Bay field office. Reifenberg and Tran are members of the service’s “rapid response team,” recruited from elsewhere to help with the survey. Reifenberg is almost local, from Spotsylvania County, VA. But Tran hails from South Florida. She said she enjoyed spending time in the “Everglades of the North” — the Chesapeake Bay, with its “cute” birds like the saltmarsh sparrow.

On the *Transquaking*, Reifenberg used a handheld GPS to find the right spot in the phragmites jungle. The reeds were so tall and thick that he and Tran could only see a patch of sky overhead. Instead of pulling out binoculars, they unpacked a waterproof portable speaker. After listening intently for five minutes, they began to play a series of pre-recorded bird calls, with short gaps in between. Clipboards in hand, they cocked heads to listen for any calls back from the wild.

In that 12-minute span, they heard the grunting call of a Virginia rail, a chickenlike bird that’s not in the same trouble because of its much broader range.

Virginia rails are “pretty cryptic,” Reifenberg explained. “They’re really small and just run around in the marsh. You rarely see them, but you do hear them. They’re super-boisterous.”

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But at that first stop, Reifenberg and Tran didn't hear any soft chips or high-pitched notes of saltmarsh sparrows. That was almost to be expected: Saltmarsh sparrows prefer to nest in shorter, wispy grasses. Phragmites, an invasive non-native wetland plant, grows too densely and tall.

The next sites on their day's survey sheet took them into Fishing Bay, where they found better habitat — vast marshy meadows of light, wavy cordgrass and saltgrass. Reifenberg kept an eye and ear out for birds while Tran took inventory of the marsh vegetation before joining in the search. They scanned the marsh with binoculars and strained to hear the calls of their target species amid a cacophony of tweets, chirps, trills and twitters carried on a breeze from the orchestra of the more common birds flitting about the marsh.

Finally, the payoff. "All right, got one," Reifenberg whispered, pointing to where he saw a saltmarsh sparrow poke up from some distant grass before disappearing a moment later. Spotting one is like playing the arcade game whack-a-mole, he said. They're tough to identify on sight with confidence because they appear so fleetingly.

When the survey is completed next year, it could provide a fresh warning about the fate of the saltmarsh sparrow population. Experts have estimated it's declining 9% a year. If that's so and it continues, Longenecker said, "we could see a pretty substantial population collapse within 50 years."

A rescue plan

Biologists hope the survey results can guide (and possibly goad) them as they attempt to rescue the birds from oblivion. Slashing emissions of climate-warming greenhouse gases would slow the rise in sea level and give tidal marshes more time to migrate inland or raise elevation.

But that's far from certain and could take decades. So, a conservation plan has been developed by the Atlantic Coast Joint Venture, a partnership of state and federal wildlife agencies and conservation groups working to save this and other native bird populations on the Atlantic Flyway.

The plan lays out a menu of stopgap measures, some relatively untried, to restore some of the marsh habitat that's been lost and to give the birds more room to nest. One potentially fruitful effort would be to try to undo or remedy the widespread ditching of the marshes that took place decades ago, either for farmland drainage or to control mosquitoes. The ditches have trapped water in the marsh and prevented it from building

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itself up with new deposits of sediment. The resulting marshscape looks like a waffle pockmarked with pools of water — unsuitable now for ground-nesting birds.

The plan proposes "runneling" or digging little shallow ditches to drain those pools. Another option, tested so far in a couple New England states, involves cutting marsh hay and rolling it into the ditches, where it can trap sediment and over a period of years naturally fill in the open water. Yet another, quicker but more expensive and logistically complicated, approach that has already been tried at Blackwater National Wildlife Refuge involves pumping a thin layer of river sediment onto a low marsh to raise its elevation.

Promising as any those might be, experts say it's not clear how much can be done, or how quickly, or what the costs would be.

"No doubt it is a formidable challenge," said Aimee Weldon, a USFWS biologist who helped write the plan. "We're trying to react to sea level rise and other impacts on a very shortened time scale, trying to learn as we go as quickly as we can. Our focus right now is getting as much habitat on the ground as we can."

The plan acknowledges that the saltmarsh sparrow numbers are likely to keep falling over the next decade, and by 2030 could drop to a critical threshold of 10,000 birds. But the plan aims by then to have 23,000 acres of high-quality breeding habitat to halt the slide and then slowly rebuild the population to around 25,000 by 2069. To do that, they estimate they'll need more than three times as much marsh habitat — 80,000 acres.

"It can be a pretty dire feeling," Weldon acknowledged, "but we still believe that there's hope — if not for the saltmarsh sparrow then for the other birds that aren't quite as affected. ... We are hoping to rapidly learn about the restoration techniques that work and then scale up."

Meanwhile, at the end of their morning in and around Fishing Bay, Reifenberg and Tran had tallied sights or sounds of three swamp sparrows, seven seaside sparrows (including one that flew closer to check out the recorded come-ons), two Virginia rails (one of which also ventured closer), nine marsh wrens and several other birds.

Plus, they had confirmed two saltmarsh sparrows. That seemed encouraging. But then again, Fishing Bay is the bird's stronghold in the Chesapeake, according to earlier survey data.

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“You sample eight points a day for five days, and you see maybe one saltmarsh sparrow,” Reifenberg said. “And some days, you don’t see any at all.”

bayjournal.com, 8 September 2021

<https://www.bayjournal.com>

How do cats get their stripes?

2021-09-09

Ever wonder how your favorite furry feline got its stripes? A new study of domestic cats has revealed which genes give felines their distinctive fur patterns and hints that the same genetics may grant wild cats, such as tigers and cheetahs, their characteristic coats.

How cats get their stripes is a decades-old mystery in the life sciences, senior author Dr. Gregory Barsh, a geneticist at the HudsonAlpha Institute for Biotechnology in Huntsville, Alabama, told Live Science in an email. About 70 years ago, scientists began developing theories as to why and how organisms come to bear periodic patterns, like the stripes on a zebra or the squidgy segments of a caterpillar’s body.

In some animals, like the zebrafish, these patterns emerge due to the arrangement of different types of cells. “But in mammals, the skin and hair cells are exactly the same across the entire body, and the color pattern comes about because of differences in genetic activity between, say, cells underlying a dark stripe and cells underlying a light stripe,” Barsh said. So the question of how cats get their stripes comes down to how and when various genes switch on in their cells and how those genes influence the animals’ development. In short, it’s complicated.

But now, in a new study, published Tuesday (Sept. 7) in the journal *Nature Communications*, Barsh and his colleagues identified several genes that work together to give cats their coat patterns.

One gene, called Transmembrane aminopeptidase Q (Taqpep), they’d identified previously, in a study published in 2012 in the journal *Science*. Cats that carry one version of the Taqpep gene end up decked out in dark, narrow stripes, while those with a mutant version of the gene bear “large whorls” of dark fur; the “whorl” version of the gene is most common in feral cats.

To investigate what additional genes might shape the diverse markings on cats’ coats, the team began collecting discarded tissue from clinics that

In short, it’s complicated.

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spay feral cats; some of the resected cat uteruses contained non-viable embryos, which the researchers examined in the lab.

They noticed that, at about 28 to 30 days old, cat embryos develop regions of “thick” and “thin” skin; at later stages of development, the thick and thin skin gives rise to hair follicles that produce different types of melanin — eumelanin for dark fur, and pheomelanin for light fur.

Remarkably, “the developmental mechanism responsible for color pattern takes place early in development, before hair follicles are formed and within cells that do not actually make any pigment but instead contribute to hair follicle structure,” Barsh said. Spotting this pattern, the team examined which genes were active leading up to the development of the thick skin, to see if specific genes directed the patterns’ formation.

The team found that, in 20-day-old embryos, several genes involved in cell growth and development suddenly switch on in the skin later destined to thicken and give rise to dark-fur-producing follicles. These genes are known to be involved in a “Wnt signaling pathway,” a molecular chain reaction that drives cells to grow and develop into specific cell types, and one gene in particular, called *Dkk4*, stood out as particularly active.

Dkk4 codes for a protein that turns down Wnt signalling, and when it comes to cat fur, the tug-of-war between *Dkk4* and Wnt seems to dictate whether a patch of fur ends up dark or light, the authors found. In the dark patches, *Dkk4* and Wnt balance each other out, but in the light patches, *Dkk4* beats out the Wnt.

This finding supports a theory that computing pioneer Alan Turing developed in the 1950s, *Science* magazine reported. Turing proposed that animals’ periodic patterns, like stripes, crop up when an “activator” molecule boosts the production of an “inhibitor” molecule, and these two molecules mingle in the same tissue; in this case, Wnt would be the activator and *Dkk4* the inhibitor. Following Turing’s hypothesis, Barsh’s team thinks that *Dkk4* spreads through tissue more quickly than the Wnt signalling travels, and that this uneven distribution generates periodic patches of light and dark in cats.

What’s more, a cat’s Taqpep genotype — meaning whether it carries the “stripe” or “whorl” version of the gene — also dictates where the *Dkk4* gene can be activated, Barsh said. “But we don’t know exactly how that happens,” he added. Taqpep codes for a protease, an enzyme that breaks down other proteins, but for now, the team doesn’t know whether this enzyme affects *Dkk4* activity directly or indirectly.

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As a follow-up to the embryo analyses, the team examined cat genome sequences from a database called the 99 Lives collection. They found that Abyssinian and Singapura breeds, which bear no stripes or spots and instead have a uniform appearance, carry mutant versions of *Dkk4* that disable the gene. In future work, the team wants to see whether similar mutations crop up in wild cats.

Previous studies suggested that for cheetahs (*Acinonyx jubatus*), at least, a cat's *Taqpep* genotype affects the appearance of its spots, and the same might go for *Dkk4*, the authors noted. Then there's the serval (*Felis serval*), an African wild cat that usually sports bold, black spots but occasionally grows a coat of tiny, tightly packed specks instead. Could a *Dkk4* mutation explain this variation?

"Our observations to date are only on domestic cats," Barsh said. "It is quite likely that the molecules and mechanisms studied in domestic cats apply to all of the more than 30 species of wild cats, but we will need to carry out additional studies of wild cat DNA to know that for sure."

Beyond wild cats, the team wants to study whether the same mechanisms are also at play in distantly related mammals, such as zebras and giraffes.

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[livescience.com](https://www.livescience.com), 9 September 2021

<https://www.livescience.com>

Supercell storm clouds act like atmospheric mountains

2021-09-09

Last week, the remnants of Hurricane Ida spawned tornadoes and high winds that tore across the northeastern United States, destroying buildings and taking dozens of lives. Now, scientists have identified a key feature of big storms that could make such extreme weather events easier to predict.

When most storms form, they stay in the troposphere, the layer of the atmosphere where the majority of our planet's weather takes place. But occasionally, they "punch up" into the stratosphere, creating mountains of clouds that trail wispy formations called above-anvil cirrus plumes (AAPs). These high-flying clouds have been linked to high winds, hailstorms, and tornadoes on the ground.

These high-flying clouds have been linked to high winds, hailstorms, and tornadoes on the ground.

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To find out why, researchers combined lightning data, radar, and severe storm warnings to build a 3D visualization of AAPs. Their model revealed that—just like winds rushing over real mountains—stratospheric winds rush over the high-level clouds as if they were solid objects. This generates powerful, downward winds and turbulent events called hydraulic jumps, they report today in *Science*.

These plumed storms, which can inject more than 7 tons of water per second into the normally dry stratosphere, might also have an impact on our climate, the researchers write. Because water vapor acts as a greenhouse gas once it enters the stratosphere, it could lead to warming temperatures on Earth—which would in turn spur more supercell storms. Knowing how these storms work, and when and where they occur, could improve climate models—and give advanced warning to people on the ground.

[science.org](https://www.science.org), 9 September 2021

<https://www.science.org>

We're eating and drinking Great Lakes plastic. How alarmed should we be?

2021-09-09

Thirsty? Would you like a little plastic with your drinking water?

That may sound ridiculous, but researchers say it has, unfortunately, become a serious problem that bears further study as evidence mounts that people are eating, drinking and inhaling microscopic pieces of plastic on a regular basis.

In Michigan, water utility managers say microplastic contamination is a matter of emerging concern, but the problem ranks lower on the priorities list because research into the overall ubiquity and health implications of such contamination is in its infancy.

The story is similar for microplastics in food — particularly in fish harvested from the Great Lakes, which are, sadly, awash in plastic fragments. The smallest pieces are entering the base of the food web and showing up in fish guts. But how those tiny particles are affecting the health of animals and potentially the humans that eat them isn't well understood.

"We're breathing this stuff in, too," said Sherri Mason, sustainability coordinator at Penn State Behrend who studies microplastic in the Great Lakes.

"We're breathing this stuff in, too," said Sherri Mason, sustainability coordinator at Penn State Behrend who studies microplastic in the Great Lakes.

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Ever since Mason began speaking in public about plastic pollution, the question of how the manmade material is affecting humans has been frequently asked.

“That is always where it leads to,” Mason said. “It’s frustrating that we don’t have all the answers. But the data we have right now is not (encouraging).”

When it comes to plastic in tap water, all eyes are on California as the most populous U.S. state develops regulatory guidelines for microplastics in drinking water. The state’s Water Resources Control Board is expected this year to issue a preliminary safety threshold for the microscopic particles, which are defined as three-dimensional in shape and less than five millimeters long.

The effort is complicated by the lack of standardized test methods for microplastics in drinking water and a relative scarcity of research on their ubiquity and health impacts. But researchers say it’s an important precautionary step that’s probably overdue.

“We now know that we live in a soup of plastic that is getting ever denser. And we don’t seem to be changing our ways. And the contaminants, they live longer than we do, meaning that the soup will get thicker,” Rolf Halden, director of the Biodesign Center for Environmental Health Engineering at Arizona State University, told the nonprofit news site CalMatters.

“So, is it too early to do something? No, it is actually a bit late.”

In the Great Lakes region, Mason co-led a 2018 study that found microplastic fibers in 159 samples of tap water from around the world, including 12 brands of beer brewed with Great Lakes source water and 12 commercial sea salt brands.

Most of the plastics in the water samples were tiny fibers, which are suspected to have come from the air. That makes it a difficult problem for utilities to control.

“As soon as your water comes into contact with air, that’s got microplastics in it,” Mason said. “I think utilities feel like there’s nothing they can do.”

Utility managers discuss microplastics at conferences, but “I can’t say that utilities are particularly focused on it,” said Bonnifer Ballard, director of the Michigan Section of the American Water Works Association, a trade group that represents municipal water utilities. “It’s clearly getting through the

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system, but I don’t think its pervasive, so it doesn’t rise to the top in terms of concerns.”

The longevity of plastic — which can last for hundreds of years, breaking down into smaller pieces as time goes by — is a major concern for Myron Erickson, public utilities director for the city of Wyoming, which draws its water from Lake Michigan.

But Erickson is less concerned about people consuming microplastic through municipal water systems because conventional treatments that process surface water from lakes and rivers are meant to remove solid particles. Once the water percolates through a filter bed, Erickson said it doesn’t see the light of day again until it comes out someone’s tap.

“It’s a closed, pressurized system by design. There really isn’t a way for it to become contaminated,” he said. “That’s not to say it’s impossible, but that’s not where I’m worried when I think microplastics. I’m worried about the oceans, the air we’re breathing and the fact that there isn’t ever going to be a Flint or a Belmont of microplastics to bring it to population’s attention. The Belmont and Flint of microplastic is Planet Earth.”

But evidence suggests that some plastic is coming out of the tap. The 2018 study which found microplastic in tap water samples from around the globe included 33 samples from the United States with an overall average of more than nine plastic particles per sample. Researchers in the effort took precautions to avoid potential airborne fiber contamination.

Tap water from Holland, Alpena, Chicago, Milwaukee, Duluth, Buffalo and Clayton, N.Y., all contained at least one microplastic fiber. Each of those utilities draws water from a Great Lakes intake. But beer brewed with that water contained more particles overall, leading study authors to conclude the results “indicate that any contamination within the beer is not just from the water used to brew the beer itself.”

“That’s almost certainly coming from employees and humans making and handling and bottling the beer,” said Erickson. “Drinking water doesn’t really work that way.”

Bottled water — typically packaged in single-use plastic bottles and generally subject to less regulatory oversight than public utilities — appears to contain more plastic on average than tap samples, according to another 2018 study led by Mason. Analysis of nearly all major bottled brands sourced from around the world found an average of 10 particles per liter. Water bottled in glass had lower particle counts and authors

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wrote that “data suggests the contamination is at least partially coming from the packaging and/or the bottling process itself.”

When it comes to the Great Lakes, another major point of concern for human ingestion of plastic is through contaminated fish. Microplastic fibers are showing up in high quantities in fish guts, but the question researchers are still driving toward is whether those particles are being absorbed into fish tissue that people would consume.

What is abundantly clear is that rivers are bringing plastics from various sources to the Great Lakes and, along the way, fish in those rivers are eating them. In 2016 and 2017, Loyola University Chicago biologists sampled 74 fish from the Muskegon and St. Joseph rivers in Michigan and the Milwaukee River in Wisconsin. They found that 85 percent had microplastics in their digestive tract, with an average of 13 particles per fish.

Canadian researchers published a study this year which found a record 915 particles in the digestive tract of a Lake Ontario brown bullhead. High particle counts were found in other fish, including white suckers from Humber Bay and Toronto Harbor, which had more than 500 particles apiece. A longnose sucker from Lake Superior’s Mountain Bay had 790 particles. In the Humber River, up to 68 particles were found in common shiner minnows.

“Microplastic is interacting with aquatic wildlife,” said Rachel McNeish, a post doc researcher on the Loyola study. “Fish are consuming it — either actively eating it thinking its food, eating insects with microplastic in them or maybe just drinking water with microplastic. Or they may consume it through contact with sediment. In any case, microplastic is entering the food web.”

Does that mean fish which ate plastic pose a health risk to humans?

John Scott, a chemist at the Illinois Sustainability Technology Center (ISTC) who studies microplastics, said particles in the lakes are known to absorb and concentrate contaminants such as PCBs, PFAS, DDT, flame retardants and other toxic chemicals. When it comes to chemicals, the question is whether or not the plastics eaten by fish amplify biomagnification of contaminants up the food chain. In other words, are they making larger fish more unsafe to consume than they otherwise would be?

In 2018, researchers suspended plastic nurdle pellets in Muskegon Lake for three months. After one month, they found pollutants like PFAS, PCBs and

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PAHs had concentrated in a biofilm that developed on the pellets at levels hundreds of times higher than background levels.

“There is that potential for magnification,” said Alan Steinman, a Grand Valley State University researcher who led the study — which led to more questions. “If it’s taken up by an organism, we don’t know if it will be further biomagnified and have a negative impact.”

Scott, who was co-author on the Muskegon Lake study, said chemical additives in plastic — which is primarily made using fossil fuels — are also a concern. “There’s thousands of these additives in plastic and not at trivial levels,” he said.

To cross biological membranes and not be simply expelled by the body as waste, plastic particles would have to break down to nanoplastic levels. Research on the toxic effects of plastic on humans micro and nano levels is still in its infancy, but some studies have indicate the potential for serious problems. A 2021 scientific review in the journal *Nanomaterials* noted that researchers have already been able to demonstrate the microscopic particles are “able to cause serious impacts on the human body, including physical stress and damage, apoptosis, necrosis, inflammation, oxidative stress and immune responses.”

“Everyone is talking about microplastic, but down the road, I think that might shift to nano or even pico plastics,” Scott said. “Those things are more liable to get into the body and stay there.”

[mlive.com](https://www.mlive.com), 9 September 2021

<https://www.mlive.com>

Smoke sets off alarms on the International Space Station

2021-09-10

Alarms blared aboard the Russian side of the International Space Station (ISS) early Thursday (Sept. 9), and the crew reported seeing smoke and smelling burnt plastic, according to news reports.

The incident occurred in Russia’s Zvezda module as the station’s batteries were recharging, Russia’s space agency, Roscosmos, reported, according to the BBC. The systems are now back to normal, and the crew has returned to “regular training,” Roscosmos said. The ISS crew activated air filters, which cleared the air, according to the Associated Press.

Though this incident has been resolved, it wasn’t the first time the ISS has dealt with worrisome events. SOUND

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Though this incident has been resolved, it wasn't the first time the ISS has dealt with worrisome events. And it likely won't be the last. **PLAY SOUND**

Much of the equipment aboard the ISS is outdated and could lead to irreparable failures, Vladimir Solovyov, chief engineer of rocket and space corporation Energia, told state media on Sept. 1, according to the BBC. At least 80% of in-flight systems on the Russian segment of the ISS have expired, Solovyov said.

On Aug. 30, Russian cosmonauts discovered cracks on the ISS' Zarya module, which was the first ISS component to be launched into orbit, in 1998, Live Science previously reported. Solovyov told Russian state-owned news agency RIA that these fissures could begin to spread over time. He also previously warned of an "avalanche" of broken equipment after 2025, according to Reuters.

The ISS is aging, and it can't last forever; but how it will eventually retire is unclear. If humans don't eventually grant the station retirement, such as by de-orbiting it, the ever-threatening risk of impacts from space debris and micrometeorites will lead to its demise, according to Live Science sister site Space.com.

Still, the ISS is cleared to operate through at least December 2024 and from a technical standpoint, to fly until the end of 2028, NASA officials previously told Space.com. "Additionally, our analysis has not identified any issues that would preclude us from extending beyond 2028 if needed."

A 6-hour spacewalk to work on a recently-docked Russian Nauka science lab that is scheduled for Thursday is still a go, according to the Associated Press.

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[livescience.com](https://www.livescience.com), 10 September 2021

<https://www.livescience.com>

Nose-clearing orgasms, inverted rhinos, and other winners of the 2021 Ig Nobel Prizes

2021-09-10

With awards handed out for research into cat meows, germs on pavement gum, and the reason for human beards, the latest iteration of the Ig Nobel prizes is as ridiculous as usual.

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It's that awesome time of year again when we get to poke fun at and also celebrate the weirder side of science. The 2021 Ig Nobel prizes were awarded yesterday, and, as was the case last year, the ceremony had to be held online on account of covid-19. This was the 31st running of the contest, which is sponsored by the Annals of Improbable Research magazine.

Among the 10 winners is a team led by Olcay Cem Bulut from University Hospital Heidelberg in Germany. Their research showed that nasal breathing "improved significantly after sexual intercourse with climax," comparable to taking decongestant drugs, and that the sinus-clearing effect lasted for over an hour. Sounds like a good study to have been a test subject in—stuffed up nasal passages are such a pain.

A team from the Max Planck Institute won an Ig Nobel for chemistry, in which they tested the air inside of movie theaters to see if odors produced by the audience can "reliably indicate the levels of violence, sex, antisocial behavior, drug use, and bad language in the movie the audience is watching," as summarized by the Annals of Improbable Research. Pavlo Blavatsky from the University of Montpellier in France discovered—if that's the right word—that obesity among post-Soviet politicians correlates positively to levels of corruption in their respective countries, earning him an Ig Nobel in economics.

The award for ecology went to Leila Satari and her colleagues from the University of Valencia. They studied the bacteria that lingers and grows on discarded chewing gum, as well as how the "wasted chewing gum bacteriome" changes over time, as the researchers wrote in their study, published in *Scientific Reports*. The team analyzed chewing gum tossed onto pavements around the world, finding that multiple bacterial strains will emerge after just a few weeks and last for upwards of three months. "Our findings have implications for a wide range of disciplines, including forensics, contagious disease control, or bioremediation of wasted chewing gum residues," the researchers wrote.

Studies on variations in "purring, chirping, chattering, trilling, tweedling, murmuring, meowing, moaning, squeaking, hissing, yowling, howling, growling, and other modes of cat-human communication" earned Lund University biologist Susanne Schötz the Ig Nobel prize for biology. Her work spans five papers written from 2011 to 2016 (here and here, for example), and includes observations of cats named Donna, Rocky, and Turbo. Among the many findings, the research shows that a murmur combined with a meow is the most common cat vocalization and that

Sounds like a good study to have been a test subject in—stuffed up nasal passages are such a pain.

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cats will make different sounds depending on the context, such as when observing birds through a window or when meowing for food.

Human males evolved beards to protect against punches to the face, according to a paper co-authored by Ethan Beseris from the University of Utah. For this stunning hypothesis, the team was awarded the Ig Nobel peace prize. No humans were actually punched during the course of this study; instead, weights were dropped onto a bone-like fiber epoxy composite wrapped in sheepskin (with fleece still attached during certain tests). As the researchers wrote in their study:

[The] results of this study indicate that hair is indeed capable of significantly reducing the force of impact from a blunt strike and absorbing energy, thereby reducing the incidence of failure. If the same is true for human facial hair, then having a full beard may help protect vulnerable regions of the facial skeleton from damaging strikes, such as the jaw. Presumably, full beards also reduce injury, laceration, and contusion, to the skin and muscle of the face.

The Ig Nobel prize for transportation went to Cornell University's Robin Radcliffe and his colleagues, which they earned by evaluating multiple methods for transporting endangered black rhinos. These rhinos are under threat from poachers, and they need to be relocated to prevent excessive inbreeding. An ideal way to transport sedated rhinos is by using a helicopter to lift them up by their feet, requiring them to hang upside down. Radcliffe and his team were worried that the rhinos might experience breathing and cardiovascular problems while inverted, so they studied 12 rhinos, both upright and upside down, to test the theory. Turns out it makes no difference, and that it's totally cool to transport sedated, upside-down rhinos.

Alessandro Corbetta and colleagues from Eindhoven University of Technology won the prize in physics for conducting experiments to "to learn why pedestrians do not constantly collide with other pedestrians," according to the Ig Nobel organizers. The award for entomology went to team of U.S. Navy researchers for investigating the best way to eradicate cockroaches on submarines. This study dates back to 1971, so it's never too late to win an Ig Nobel.

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Congratulations to all the "winners." Be sure to check out the Ig Nobel prizes from 2020, 2019, and 2018.

[gizmodo.com](https://www.gizmodo.com), 10 September 2021

<https://www.gizmodo.com>

Grass is good. Lawns are terrible.

2021-09-10

Sometime in our recent past, we became obsessed with planting trees. First, the goal was 1 billion new trees worldwide. Now it's 1 trillion by the year 2030.

Trees offer all kinds of benefits, from absorbing climate-warming emissions to providing refuge for animals, and we're losing them at a blistering pace. But in our push to restock the world's forests, we've largely ignored — and in some cases harmed — another important ecosystem that offers a similar set of benefits: grasslands.

Covering about 40 percent of the Earth, grasslands are sometimes considered little more than blank wastelands — but they're anything but barren. Grasslands harbor a diversity of species that rivals forests, and their deep root systems store carbon that won't go up in smoke during a wildfire.

"As we're seeing increasing drought and increasing fire, we're likely to rely on grasslands more because they're a more resilient carbon sink," said Elizabeth Borer, a grassland expert at the University of Minnesota.

Yet nearly half of the world's grasslands are now degraded. And unlike forests, they have drawn little attention even within the conservation community, according to a recent article in *Nature*. That's why experts are calling for a reimagining of which ecosystems are important — and urging people to look beyond forests to humble blades of grass.

Don't confuse grasslands with grass

By "grasslands," I do not mean lawns. Most lawns are resource-intensive monocultures of invasive plants. Each year, Americans douse their lawns and gardens with almost 3 trillion gallons of water and, as of 2012, 59 million pounds of pesticides. That's to say nothing of the carbon pumped into the air by lawn equipment. All those inputs provide very little in return other than a bright patch of green. Manicured lawns are the real wastelands.

Grasslands harbor a diversity of species that rivals forests, and their deep root systems store carbon that won't go up in smoke during a wildfire.

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The tallgrass prairie of the Great Plains or the tropical savanna in the Cerrado of Brazil, by contrast, are natural grasslands full of life. In just a quarter of an acre in the Cerrado, for example, scientists have recorded 230 species of plants. Those plants in turn feed countless animals, from the critically endangered blue-eyed ground-dove to the lanky maned wolf. Research has found that natural grasslands — loosely defined as open ecosystems with low-lying vegetation and few trees — harbor a similar number of vertebrate species, like birds and mammals, as forests.

Unlike lawns, grasslands are also superstars of ecosystem services, which describe the ways that landscapes benefit human society. Natural grasses have enormous root systems — often far larger than the plant you see above ground — which hold the soil together and help prevent erosion. Research suggests grasslands also hold more than a third of the world's land-based carbon. "You don't see the carbon that grassland plants are pumping below ground, but they're storing enormous amounts of it," Borer said.

Most of that carbon is protected from wildfires, which typically just burn through above-ground vegetation, she said. In fact, fires can actually promote the growth of grasslands and even help them store carbon more efficiently, said John Blair, a professor of ecology at Kansas State University. In forests, severe wildfires release large quantities of carbon into the air, and it can take decades for the trees to recover.

Nearly half of all grasslands are degraded

As much as 49 percent of grasslands, worldwide, are degraded to some extent. And in the tropics, the Earth is losing these ecosystems faster than it's losing forests — which, as you might guess, is really fast.

Alarmingly, some grasslands are nearly gone already. More than 94 percent of North America's tallgrass prairie has been wiped out, for example, while we've lost more than half of the Brazilian Cerrado in the last 50 years — "exceeding the rate of forest loss in the Brazilian Amazon," authors of one study wrote.

As you'd expect, populations of animals that depend on these systems are dwindling, too. In North America, grassland birds, such as meadowlarks and grasshopper sparrows, "are declining all over the place," Blair said. "They just may be a harbinger of the greater biodiversity loss we'll see in the future."

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The most obvious culprit behind the degradation of grasslands is farming and ranching. Grassland soil is full of nutrients, after all, and it's much easier to convert into a farm or pasture than, say, a forest. Between 2008 and 2016, the US converted more than a million acres of grasslands and other ecosystems into cropland each year, according to one 2020 study. It came at a great cost to wildlife, the authors wrote. During that period, the Midwest alone lost an estimated 220 million milkweed plants, which is one of the only food sources for the monarch caterpillar. (Populations of eastern monarch butterflies have fallen by more than 80 percent in the last two decades.)

The poor reputation of grasslands has only made the problem worse — and left these ecosystems largely undefended. "Natural grasslands are often erroneously considered to be degraded lands," the authors of the Nature article wrote. As a result, these ecosystems have been overlooked in some major international efforts to curb biodiversity loss, they wrote.

While stopping the destruction of ecosystems is a "central goal" of major international treaties including the UN Framework Convention on Climate Change (which includes the Paris Agreement) and the Convention on Biological Diversity, "there is no explicit mention of grasslands in any of them," the authors wrote.

"There's lots and lots of emphasis on forests but there's very little emphasis on grasslands," said Richard Bardgett, the article's lead author and a professor of ecology at the UK's University of Manchester.

Planting trees sometimes comes at the expense of grasslands

In some cases, efforts to restore forests harm grasslands. If you view grasslands as degraded forests, you might decide to seed them with trees instead, especially if you're trying to hit lofty tree-planting targets.

Over the past 25 years, China — which has invested massively in tree planting through its Grain to Green initiative — increased the coverage of trees in areas that were not traditionally forested by an average of more than 370,000 acres per year. "Similarly, large tracts of natural grassland in Brazil have been identified as targets for tree planting, posing a major threat to these ancient and highly diverse ecosystems," authors of the Nature perspective wrote.

Tree-planting programs are designed in part to reduce carbon dioxide emissions and slow climate change. But planting in grasslands can work directly against that goal, Bardgett says. "Tree roots can penetrate into the

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soil and can actually degrade organic matter and lead to the breakdown and release of carbon from the soil," he said. Trees also require more water than grasses and can sap the ground of moisture and shrink nearby streams.

That's one reason why some scientists are skeptical about mass tree-planting efforts. "It's a great concept and has brought some clear attention to ecosystem services provided by our landscape, but its narrowness is problematic for true conservation," Borer said.

What if humans treated grass like they treat trees?

The first step to saving grasslands is to expand our definition of natural, carbon-rich ecosystems beyond just forests, experts say. "We need to shift people's perception of how diverse and complex grassland ecosystems are," Blair said.

The next priority should be protecting the small number of grasslands that are still unharmed, Bardgett said. Currently, protected areas cover only about 8 percent of grasslands and savannas, according to his paper, compared with roughly 18 percent of forests.

Restoration also poses a big opportunity, said Diane Debinski, a professor of conservation biology at Montana State University who's studied grasslands for more than two decades. Even restoring grasslands on the side of the road, at the edge of a farm, or along a small stream can offer major benefits, such as preventing erosion and flooding, she said.

The US government could fuel some of those efforts. Earlier this year, President Joe Biden announced plans to conserve at least 30 percent of American land by 2030, which will include working lands like farms and ranches. His administration already expanded its Conservation Reserve Program, as part of the 30-by-30 push, which pays farmers to plant beneficial species and take environmentally sensitive land out of production.

But restoration is far from perfect. One challenge, Debinski said, is funding. Seeds of a Great Plains flower called the prairie violet, for example, are pricey, so scientists often don't plant them, even though they're one of the few host plants for the regal fritillary butterfly, a vulnerable species.

We also rely on grasslands for much of our food, so "it's not realistic to say we just need to restore all of the grasslands," Borer said. "We need an integrated approach," she said. In other words, we should consider the whole suite of benefits that grasslands provide, from land for grazing to

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habitat for threatened species, when thinking about restoration. "The key thing is understanding what the tradeoffs are," Bardgett said.

There's another, easier solution: Rip up your lawn and replace it with native plants. Across the US, there are as many as 50 million acres of lawn — an area roughly the size of Nebraska. Restoring even a small portion of that area would be a major boon for wildlife and the climate. "If you have a fraction of an acre, you can make part of that into habitat that's valuable for insects and for songbirds," said Debinski. "Restoration and conservation can be done at a fractional level."

vox.com, 10 September 2021

<https://www.vox.com>

Brazil: Who can still save the world's green lung?

2021-09-12

For the second year in a row, more than 10,000 square kilometers (3,860 square miles) of the Brazilian Amazon rainforest have been eradicated. The rate of destruction has doubled since 2014 and risen to a level last seen in 2008.

Environmentalists and climate scientists are worried about the development, as are human rights activists and defenders of a state based on the rule of law.

Indigenous peoples know how to protect the rainforest

The acceleration of deforestation has less to do with the laws in Brazil than with the current government. The private initiative MapBiomias found that 99% of the deforestation in 2019 was illegal, with it either being conducted without the necessary licenses or in protected areas.

Indigenous territories are also being adversely affected by illegal logging more and more. Though logging is not prohibited in principle, it is supposed to take place only with the consent of local populations. However, this rarely happens, says German journalist Thomas Fischermann, who has written several books about the Amazon and its indigenous peoples.

"Every now and then you will find a leader who sells a piece of forest to be able to afford a refrigerator," Fischermann says. "But generally, there is nobody more interested in preserving the rainforest than indigenous

The private initiative MapBiomias found that 99% of the deforestation in 2019 was illegal, with it either being conducted without the necessary licenses or in protected areas.

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peoples living in protected areas," he said adding that they maintained their traditional way of life by using resources sustainably.

Government supports illegal deforestation

So far, the Brazilian government has preferred to give its support to those committing crimes in the Amazon.

Since Congress and the Senate have blocked legislation that would legalize deforestation, partly because of doubts regarding the long-term economic viability of overexploiting the rainforest, the government has resorted to other means.

It has deprived the Brazilian Ministry of Environment and the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) of funds, staff and responsibilities. "Previously, IBAMA was allowed to destroy confiscated machines in the middle of the forest so as to render them harmless. But [Brazilian President Jair] Bolsonaro banned that," said forest engineer Paulo Barreto of the nonprofit Institute of Man and Environment of the Amazon (Imazon).

He added that the president had also virtually invited cattle ranchers to illegally appropriate land: "They've started thinking to themselves that 'Bolsonaro will sort it out.'"

And that's exactly how it is: In December, the president signed a decree making illegally appropriated land the official property of occupiers and in February, the government even launched an app to simplify the process. Public land that should be submitted for tender and auctioned for use is being sold under the table at well below the market price, explained Barreto.

Global demand for Brazilian soy

But it is not only the Brazilian government that is driving deforestation. There is a global demand for soy from Brazil. In China, it is already an important part of the diet and the same is becoming increasingly true in the US and Europe, where so far it has been used mainly as animal feed.

Barreto explained that though the rainforest was largely cleared for the timber industry and to create pasture for cattle grazing, grain farming was one of the main drivers of deforestation: "Since soybean cultivation is more productive, the extensive livestock farming is moving into other pastures, which are primarily being wrested from the rainforest," he said.

Disastrous droughts

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At first, the destruction of 10,000 square kilometers of forest might not sound like that much considering that Brazil's Amazon region comprises some 5 million square kilometers. But since large-scale deforestation began in 1970, some 20% of the rainforest has been destroyed. The situation is similar in Brazil's neighboring states, where the rainforest extends for another 2.5 million square kilometers.

The Amazon is the most biodiverse area on earth. It is a huge CO2 reservoir and thus considered the green lung of the earth. But Fischermann says there is another major aspect: "Green lung is actually not a correct term. The most important function of the Amazon forest in terms of climate is that it's a huge water reservoir."

In many places, after just a few years of grazing or farming, nothing grows anymore because the thin layer of humus has worn away. In other places, biotopes have emerged that have little in common with the original rainforest.

The new vegetation that has emerged cannot absorb the huge amounts of water that flow in the catchment area of the largest river on earth, evaporate and fall as rain again. Brazilian climate scientist Carlos Nobre believes that a critical point is coming when the Amazon will no longer be able to supply itself with enough water.

2021 is the sixth year in the last two decades in which Brazil has suffered drought. with an impact on all sectors of the economy and private households, in the form of more expensive electricity. Brazil derives about three-quarters of its electricity from hydropower. It was the energy minister, Bento Albuquerque, who in May warned of "the worst water crisis for 91 years."

This cannot be good for any government. But a populist such as Bolsonaro, who depends on short-term successes to win an election, will be driven into a corner by such a development. Moreover, because he hardly has any financial leeway to provide subsidies if prices rise, given the amount of pandemic-related aid already allocated. On the other hand, he can little afford to alienate his supporters in the agriculture and mining sectors, either.

External pressure needed

Though Brazil itself would have its own reasons to protect the Amazon, it is outside pressure which is crucial, say experts. Some members of the

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country's business sector are aware of this and becoming worried that their goods will suffer from the country's poor image.

In the past year, representatives from the country's three biggest private banks — Bradesco, Itau and Santander — met with Vice President Hamilton Mourao, who is also the head of the country's new Amazon Council, to discuss how to save the rainforest.

The huge Brazilian meatpacking companies JBS and Marfrig have also announced that they will stop processing meat from the Amazon in 2025. That is something, says Barreto of Imazon, but he adds that much more could be done considering cattle could already be farmed in areas that have been cleared.

"Even though around 80% of the meat is consumed in Brazil, the most effective pressure right now is from abroad," he said, explaining that the biggest buyers were supermarket chains in Brazil controlled by the French multinationals Carrefour and Casino Guichard-Perrachon and the US giant Advent International.

Fischermann, who partly lives in Brazil, thinks that the EU is a sideshow and that it is China and the US, which are Brazil's largest trading partners, that have to exert an influence if there is to be real change. He believes that they should tie their purchasing power to certain rules, and he is convinced that China is heading in the right direction. "I believe it when they say they don't want to ruin the climate. By forcing Brazil to protect the climate more at its own expense, China would have a relatively cheap way of influencing the climate."

dw.com, 12 September 2021

<https://www.dw.com>

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