Topics -

- Fusobacterium nucleatum
- Orangutan
- Online Gaming Industry
- Carbon farming
- Magnetic resonance imaging (MRI)
- The International Union of Forest Research Organizations (IUFRO).
- Why flood in Brazil ??
- Mains

Target Mains -2024/25

Q ‘’El nino has two extreme impact ’’ Elaborate.

प्रश्न "अल नीनो के दो चरम प्रभाव हैं" विस्तार से बताएं।

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A mouth bacteria has starring role in colorectal cancer: study

According to a research team's experiments, some genetic factors could be boosting the ability of *Fusobacterium nucleatum* bacteria to associate with cancers of the gut. The team also showed that when mice were infected with this type of *Fusobacterium*, their intestines developed adenomas

Sayantan Datta

The bacteria known as *Fusobacterium nucleatum* live in the human mouth and are rarely found elsewhere. But in cases of cancer of the colon or the rectum, the bacteria are found in tumours in the gut, where they help cancer cells escape from the immune system and spread to other parts of the body.

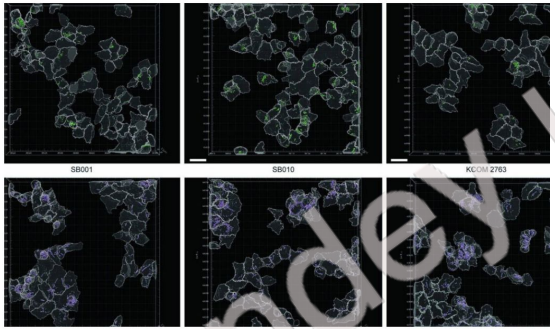
In a new study, a group of researchers from the Fred Hutchinson Cancer Center in the U.S. has identified a distinct subtype of the bacterium that's found in relatively greater quantities in colorectal cancer (CRC) tumours.

CRC is the seventh most common type of cancer in India, where the number of cases rose by 20% from 2004 to 2014. Worldwide, the overall CRC incidence has declined but, experts wrote in the journal *Science* last year, the incidence of age-adjusted early-onset CRC "has risen at an alarming rate of 2-4% in many countries, with even sharper increases in individuals younger than 30 years."

According to the team's experiments, described in a paper in *Nature* in March, some genetic factors could be boosting *Fusobacterium*'s ability to associate with cancers of the gut.

The team also showed that when mice were infected with this type of *Fusobacterium*, their intestines developed precancerous formations called adenomas.

Experts said the study's findings could be used in future to develop tests to detect CRC early and develop targeted treatment options.



Representative *Fna* C1 and *Fna* C2 strains co-cultured with human colon cancer cells. The grid shows the results of computational analysis of confocal imaging. Independent masks for cancer epithelial cells (grey), and intracellular bacterial cells (*Fna* C1 green, *Fna* C2 lavender) were generated. The masks were used to calculate the percent of cancer cells with intracellular *Fna*. The scale bar is 20μm. ZEPEDA-RIVERA, M., MINOT, S.S., BOUZEK, H. ET AL.

A clade of its own

The researchers began by culturing *Fusobacterium* bacteria collected from 130 human CRC tumours in the laboratory.

Then they mapped the entire genetic composition of the isolated bacteria and found that out of the four known *Fusobacterium nucleatum* subspecies, only *Fusobacterium nucleatum animalis* (*Fna*) was significantly associated with CRC tumours.

Individual members of the same species have slightly different DNA. Pangenomic analysis helps researchers map all the genes in a species as well as those parts of the genome that some but not all members of the species have.

This part is called the accessory genome. The members of a species can be further subclassified depending on the accessory genomes they have.

In their analysis, the researchers found *Fna* has the smallest core genome (the part that all members of the species have), indicating there could be different subtypes of *Fna*.

In response, they traced the evolutionary history of the bacteria by tracing the changes in its genes. This analysis revealed that *Fna*, instead of being one homogenous group, is composed of bacteria from two different evolutionary lineages.

Scientists call a group of life-forms belonging to one evolutionary lineage a clade. Thus, the researchers had identified two different clades of *Fna*: they called these *Fna* C1 and *Fna* C2.

They further found *Fna* C2 bacteria are significantly associated with CRC tumours and that they have extra genetic factors to help them in this regard.

Colonising the gut

Both physical and genetic differences between the two clades seemed to contribute to *Fna* C2 bacteria's ability to associate with CRC tumours. Physically, the *Fna* C2 bacteria looked longer and thinner than *Fna* C1 bacteria. Such differences can affect how bacteria are able to live in host tissue as well as evade the body's immune system, the authors wrote in their paper.

Genetically, *Fna* C2 bacteria had genes required to munch two compounds for energy in the human gut: ethanolamine and 1,2-propanediol. These genes were missing in *Fna* C1. So the researchers concluded *Fna* C2 bacteria's ability to associate with CRC tumours was at least partly contingent on them "having increased nutrient scavenging mechanisms and enhanced metabolic potential".

The researchers validated their findings by analysing genomes present in more than 1,200 human stool samples, roughly half of which were from people with CRC while others were from healthy individuals. They found that the *Fna* genes required to metabolise ethanolamine and 1,2-propanediol were more enriched in stool samples from CRC patients than in samples from people without CRC.

Mouth to gut

Scientists previously believed *Fusobacterium* bacteria could go from the mouth to the gut by infecting the bloodstream when, say, someone brushed their gums too hard or during routine dental procedures. The authors of the new *Nature* paper pitched a new route: that the bacteria could have descended through the gastrointestinal tract to reach the colon.

Bacteria don't usually take this path because they can't survive the highly acidic environment of the stomach.

> Across the world, overall CRC incidence has declined but the incidence of age-adjusted early-onset CRC has risen at an alarming rate of 2-4%

But the researchers found *Fna* C2 could. These bacteria could grow in more acidic conditions than could *Fna* C1 bacteria – and they also had specific genes that could resist the effects of acids. These genes came online when the acidity was comparable to that of stomach acid.

In mice as in humans

Next, the researchers investigated whether *Fna* C2 could induce the development of tumours in the gut. For this, they introduced *Fna* C1 bacteria in the inflamed guts of some mice and *Fna* C2 bacteria in the inflamed guts of others. (These mice are a common animal model used to investigate conditions that also affect humans.) They found a significantly higher incidence of adenomas in the intestines the mice treated with *Fna* C2 bacteria.

They also noted that the intestines of *Fna* C2-treated mice had different metabolic profiles – changes consistent with previously reported associations between differential metabolite levels and tumour progression.

"Overall, our results demonstrate the ability of *Fna* C2, but not *Fna* C1, to metabolically affect the intestinal milieu towards" conditions conducive to CRC, the authors wrote.

Finally, the researchers tested their hypotheses in a cohort of human patients. Working with CRC tissue and non-cancerous tissues from the same individual, the authors confirmed that *Fna* C2 was the only *Fusobacterium* subtype enriched in CRC tissues. They found similar results in stool samples from those with CRC but not in those from healthy individuals.

Long road to clinical trials

According to Neetu Kalra, a cancer therapeutics researcher at Azim Premji University, Bhopal, "The study presents promising prospects for the advancements of microbial cellular therapies, which involve the use of modified bacterial strains to directly administer treatments into tumours."

Varun Aggarwala is an assistant professor at Jio Institute, Mumbai, who also works on faecal transplants for infectious and inflammatory bowel diseases. He called the study "comprehensive" and said "studies like this provide a solid foundation for the broader community to design targeted microbial interventions and diagnostics for CRC."

He added that future research should track the gut and oral microbiome of high-risk individuals and their tumour microbiome after a CRC diagnosis to understand how certain strains of bacteria can cause cancer.

Similarly, Dr. Kalra said studies to come could look at the "colonisation timeline" of *Fna* C2 bacteria: the CRC stage at which the bacteria become associated with the tumours. "If colonisation occurs early," she explained, "it could facilitate early CRC diagnosis".

On the flip side, she also said developing a drug that could selectively target *Fna* C2 bacteria without affecting *Fna* C1 or other gut bacteria "presents a significant challenge".

(Sayantan Datta is a science journalist and a faculty member at Krea University. Datta tweets at @queersprings.)

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A male Sumatran orangutan named Rakus is seen two months after self-treating a wound with a medicinal plant in the Suaq Balimbing research site, August 25, 2022. REUTERS

Orangutan used plant to treat wound, scientists say

Associated Press

An orangutan appeared to treat a wound with medicine from a tropical plant – the latest example of how some animals attempt to soothe their own ills with remedies found in the wild, scientists reported Thursday.

Scientists observed Rakus pluck and chew up leaves of a medicinal plant used by people throughout Southeast Asia to treat pain and inflammation. The adult male orangutan then used his fingers to apply the plant juices to an injury on the right cheek. Afterward, he pressed the chewed plant to cover the open wound like a makeshift bandage, according to a new study in *Scientific Reports*.

Previous research has documented several species of great apes foraging for medicines in forests to heal themselves, but scientists hadn't yet seen an animal treat itself in this way.

"This is the first time that we have observed a wild animal applying a quite potent medicinal plant directly to a wound," said co-author Isabelle Laumer, a biologist at the Max Planck Institute of Animal Behavior in Konstanz, Germany.

The orangutan's intriguing behaviour was recorded in 2022 by Ulil Azhari, a co-author and field researcher at the Suaq Project in Medan, Indonesia. Photographs show the animal's wound closed within a month without any problems.

Scientists have been observing orangutans in Indonesia's Gunung Leuser

Rakus the orangutan plucked and chewed up leaves of a medicinal plant used by people throughout Southeast Asia. The orangutan then used his fingers to apply the juices to a wound on his cheek.

National Park since 1994, but they hadn't previously seen this behaviour.

"It's a single observation," said Emory University biologist Jacobus de Roode, who was not involved in the study. "But often we learn about new behaviours by starting with a single observation."

"Very likely it's self-medication," said de Roode, adding that the orangutan applied the plant only to the wound and no other body part.

It's possible Rakus learned the technique from other orangutans living outside the park and away from scientists' daily scrutiny, said co-author Caroline Schuppli at Max Planck.

Rakus was born and lived as a juvenile outside the study area. Researchers believe the orangutan got hurt in a fight with another animal. It's not known whether Rakus earlier treated other injuries.

Scientists have previously recorded other primates using plants to treat themselves.

Bornean orangutans rubbed themselves with juices from a medicinal plant, possibly to reduce body pains or chase away parasites.

Chimpanzees in multiple locations have been observed chewing on the shoots of bitter-tasting plants to soothe their stomachs. Gorillas, chimpanzees and bonobos swallow certain rough leaves whole to get rid of stomach parasites.

"If this behavior exists in some of our closest living relatives, what could that tell us about how medicine first evolved?" said Tara Stoinski, president and chief scientific officer of the nonprofit Dian

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Getting to a new level in India's online gaming sector

The Prime Minister's vision to establish India as a prominent global gaming hub has received renewed attention as he engaged with seven of the top gamers in the country. Spending a day with them, in April 2024, he discussed the trajectory of the gaming industry and sought to understand the challenges they encounter, particularly on the nuanced distinction between skill gaming and gambling (game of chance) – it could pave the way for a more conducive and forward-looking regulatory environment. The online gaming industry forms a critical part of the Digital India vision and initiative. Some of the key takeaways from the discussion included the opportunity offered by the increasing number of games based on Indian mythology and the scope to encourage the participation of women, besides fostering innovation. The players also highlighted the issue around the perception of gaming as a career in India.

Amar Patnaik

is a former Member of Parliament, Rajya Sabha, from Odisha and an advocate by profession. He was a CAG bureaucrat

There is much potential in India to shape the future of the gaming industry

Rapid growth

The online gaming industry in India has seen a rapid expansion of 28% CAGR between FY20 and FY23. Projections indicate further growth to ₹33,243 crore by FY28, with a sustained 15% CAGR. This sector not only attracts significant foreign and domestic investments but also generates substantial direct and indirect employment. Leveraging India's IT prowess, the industry holds natural potential for india. Notably, while the size of the global gaming industry crossed $300 billion in 2021 – more than the combined markets for the movie and music industry – the online gaming segment in India constitutes 1.1% of the global online gaming revenue. Thus, the potential for growth is enormous.

Not only is online gaming a multi-billion opportunity for Indian start-ups but it can also form an important part of 'India Techade' and the goal of a $1 trillion digital economy. The sector has witnessed an array of positive developments, including the establishment of the Animation, Visual Effects, Gaming, Comic and Extended Reality taskforce by Ministry of Information and Broadcasting, the identification of the Ministry of Electronics and Information Technology as the nodal ministry, the introduction of a series of regulations through the IT (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021, and clarification around the ambiguity concerning tax deduction at source on winnings.

All these measures have provided a sense of clarity and certainty in terms of a policy framework for all online gaming startups. This will go a long way in fostering innovation that is being powered by young Indians.

Issues that need scrutiny

Nevertheless, there are unresolved issues that require the attention of the government to enhance regulatory clarity. Primarily, despite the provision of self-regulatory bodies within the IT Rules of 2021 intended to regulate the industry, the effective implementation of these rules is pending, thus nullifying their intended impact. In an industry driven by innovation and fast-evolving technology, the role of self-regulation is crucial. NITI Aayog's discussion paper with draft guiding principles for the online fantasy gaming sector also proposed a self-regulatory model of governance with a self-regulatory organisation at its helm.

Further, recent revisions in taxation have placed the industry, particularly startups, in a precarious position. During the Goods and Services Tax Council meeting in July 2023, the Council decided to enforce a tax rate of 28% on the total face value of bets (effective October 1, 2023) regardless of whether the activity is classified as a game of skill or chance. Before this, online gaming firms in India were subjected to an 18% GST rate since the introduction of the indirect tax system in July 2017. While this measure has resulted in an initial uptick in tax revenue for the government, it raises concerns about the industry's sustainability in the long term and its consequential impact on jobs being created in this sector.

Soft power

By remedying these deficiencies, India stands at a distinctive juncture to emerge as a prominent global gaming hub. Another advantage lies in tapping India's rich cultural heritage (stories, legends, and folklore). With an increasing number of games inspired by Indian mythology, there is a unique opportunity to cater to domestic and international audiences.

Furthermore, there is a concerted effort to encourage the participation of women in the gaming industry, fostering diversity and inclusivity. As perceptions about gaming as a viable career option evolve, India stands to benefit from a growing pool of talented individuals driving innovation and pushing boundaries in the gaming landscape.

India stands at the threshold of a transformative era in the gaming industry. By fostering an enabling environment for skill gaming, promoting diversity and inclusion, and capitalising on its rich cultural narratives, India can not only realise its vision of a $1-trillion digital economy but also shape the future of gaming on a global scale.

The views expressed are personal

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120. Which of the following statements about 'Green Credit Initiative' is/are correct?

1. It is a response to the challenge of climate change.
2. It promotes plantations on wasteland and river catchment areas.
3. It is a scheme of the Government of India to replace the kerosene oil with solar power used by the rural poor.

Select the correct answer using the code given below.

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 only

(d) 1 and 3 only

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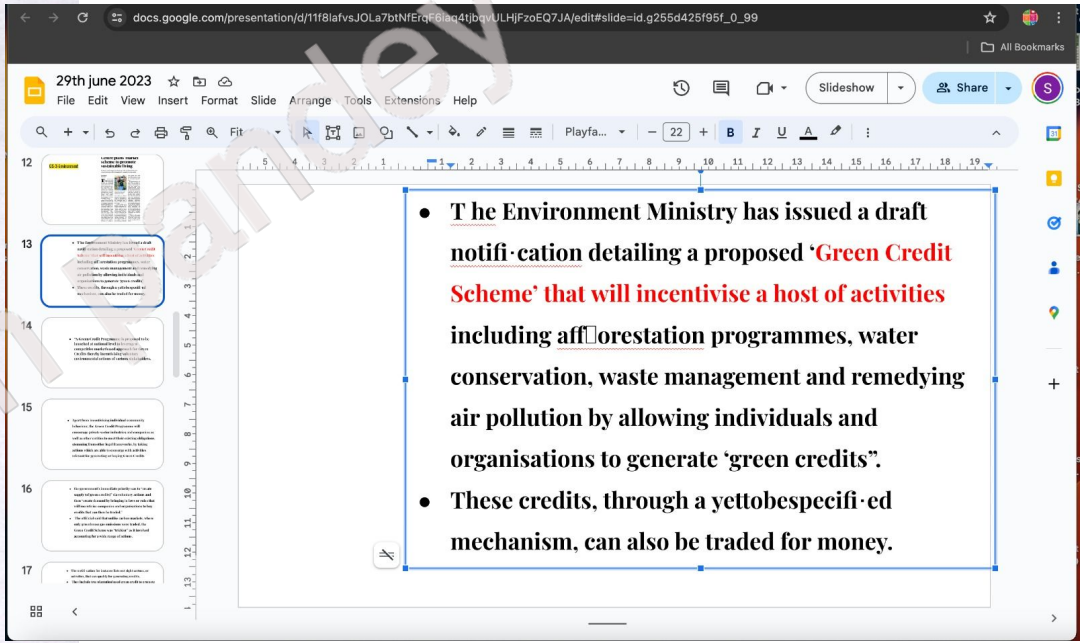
Cds -2024 qs



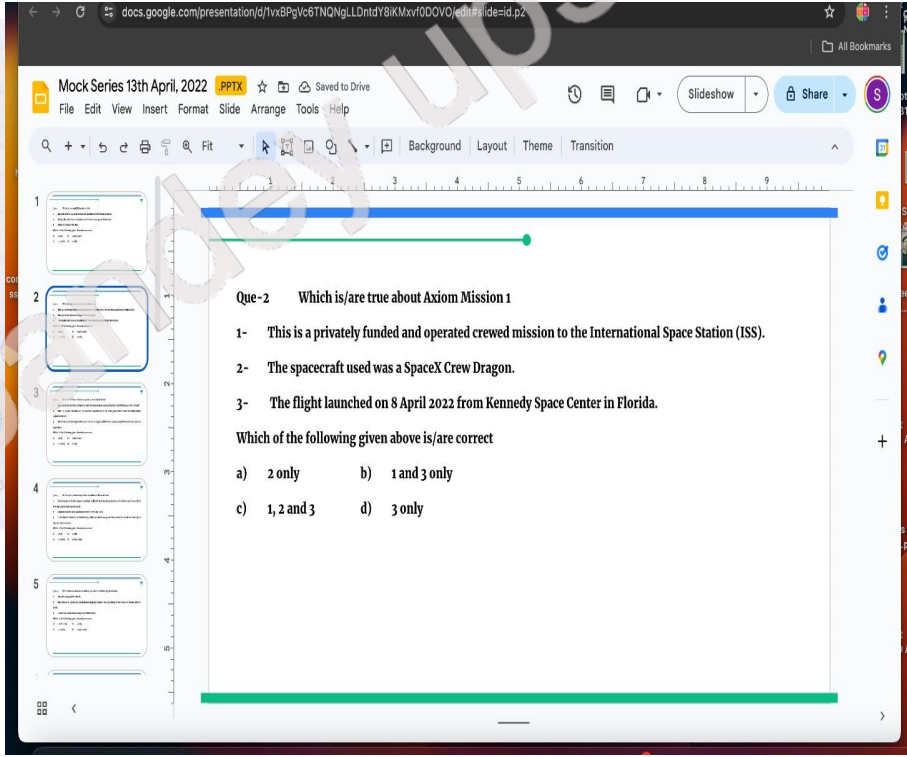
54. Which one of the following is the first commercial space station?

(a) Axiom Station

(b) International Space Station

(c) Galileo

(d) Voyager 1



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What is carbon farming?

What are some techniques within carbon farming which can reduce greenhouse gas emissions? What are the challenges in implementing such techniques, especially in developing countries such as India? What are some of the global initiatives?

EXPLAINER

Vinaya Kumar H.M.

Carbon is found in all living organisms and many minerals. It is fundamental to life on earth and plays a crucial role in various processes, including photosynthesis, respiration, and the carbon cycle. Farming is the practice of cultivating land, raising crops, and/or livestock for food, fibre, fuel, or other resources. It encompasses a wide range of activities, from planting and harvesting crops to managing livestock and maintaining agricultural infrastructure.

Carbon farming combines these two concepts by implementing regenerative agricultural practices that restore ecosystem health while improving agricultural productivity and soil health, and mitigating climate change by enhancing carbon storage in agricultural landscapes and reducing greenhouse gas emissions. The practice is easy to adopt across various agro-climatic zones. It can also help ameliorate soil degradation, water scarcity, and challenges related to climate variability.

How can carbon farming help?

A simple implementation of carbon farming is rotational grazing. Others include agroforestry, conservation agriculture, integrated nutrient management, agro-ecology, livestock management, and land restoration.

Agroforestry practices – including silvopasture and alley cropping – can further diversify farm income by sequestering carbon in trees and shrubs. Conservation agriculture techniques such as zero tillage, crop rotation, cover cropping, and crop residue management (stubble retention and composting) can help minimise soil disturbance and enhance organic content, particularly in places with other intense agricultural activities.

Integrated nutrient management practices promote soil fertility and reduce emissions by using organic fertilizers and compost. Agro-ecological approaches such as crop diversification and intercropping have benefits for ecosystem resilience. Livestock management strategies including rotational grazing, optimising feed quality, and managing animal waste can reduce methane emissions and increase the amount of carbon stored away in pasture lands.

What are the challenges to carbon farming?

While carbon farming does offer numerous benefits, its effectiveness varies depending on multiple factors – geographical location, soil type, crop selection, water availability, biodiversity, and farm size and scale. Its usefulness also depends on land management practices, sufficient policy support, and community engagement.

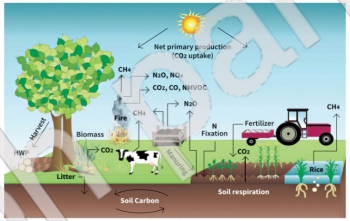
Regions with long growing seasons, sufficient rainfall, and substantial irrigation are best suited to practise carbon farming because they provide the best conditions in which to sequester carbon, through vegetation growth. In regions with adequate rainfall and fertile soil, the potential for carbon sequestration through practices like agroforestry (integrating trees and shrubs with crops) and conservation agriculture (minimising soil disturbance) may be particularly high.

On the other hand, carbon farming can be challenging in hot and dry areas where the availability of water is limited, and prioritised for drinking and washing needs. Limited water availability can hinder the growth of plants, thus restricting the potential for sequestration through photosynthesis. For example, practices like cover cropping, which require additional vegetation between main crop cycles, may not be viable due to the added water demand. Moreover, selecting which plants to grow also becomes crucial because not all species trap and store carbon in the same amounts or in an equally effectively manner. Fast-growing trees and deep-rooted perennial grasses tend to be better at this task – but on the flip side, these types of plants may not be well-suited to arid environments.

Further, the adoption of carbon farming practices may require financial assistance for farmers to overcome the costs of implementing them. In the context of developing countries like India, small-scale farmers may lack the resources to invest in sustainable land management practices and environmental services. In sum, while carbon farming holds promise as a mitigation strategy, addressing these challenges is essential to realise its full potential in combating climate change.

New ways of farming: A worker loads fertilizer into a tank attached to a large drone, preparing to spray it over the rice fields in the Long An province in southern Vietnam's Mekong Delta, on January 23. AP

The process of emitting and removing greenhouse gas emissions in managed farmland



Source: 'Carbon farming – Making agriculture fit for 2030', a study for the European Parliament's committee on Environment, Public Health and Food Safety

What are some carbon farming schemes worldwide?

In recent years, the practice of carbon trading in the agriculture sector has become important around the world, but especially in the U.S., Australia, New Zealand, and Canada, where voluntary carbon markets have emerged. Initiatives like the Chicago Climate Exchange and the Carbon Farming Initiative in Australia demonstrate efforts to incentivise carbon mitigation activities in agriculture. The processes range from no-till farming (growing crops without disturbing the soil) to reforestation and pollution reduction.

Initiatives like Kenya's Agricultural Carbon Project, which has the World Bank's support, also highlight the potential for carbon farming to address climate mitigation and adaptation and food security challenges in economically developing countries.

The launch of the '4 per 1000' initiative during the COP21 climate talks in 2015 in Paris highlights the particular role of sinks in mitigating greenhouse-gas emissions. As the oceans and the atmosphere are filled with carbon, and they approach their saturation points, we must manage the remaining carbon budget of 390 billion tonnes or so wisely.

What are the opportunities in India?

As climate change intensifies, climate-resilient and emission-reducing agricultural practices can benefit from adaptation strategies. Agriculture is crucial in this endeavour.

Grassroots initiatives and pioneering agrarian research in India are demonstrating the viability of organic farming to sequester carbon. In this regard, agro-ecological practices in India could yield significant economic benefits, with the potential to generate $63 billion in value from approximately 170 million hectares of arable land. This estimate includes an annual payment of around ₹5,000-6,000 per acre for farmers to provide climate services by adopting sustainable agricultural practices.

Regions with extensive agricultural land, such as the Indo-Gangetic plains and the Deccan Plateau, are well suited to adopt carbon farming whereas the mountainous terrain of the Himalayan region is less so. Coastal areas are prone to salinisation and have limited access to resources, thus limited the adoption of traditional farming practices.

Further, carbon credit systems can incentivise farmers by providing additional income through environmental services. Studies have shown agricultural soils can absorb 3-8 billion tonnes of CO2-equivalent every year over 20-30 years. This capacity can bridge the gap between feasible emissions reductions and the indispensable stabilisation of the climate. So carbon farming could also be a sustainable strategy to mitigate climate change and enhance food security in India.

But scaling it up requires concerted efforts to address several challenges, including limited awareness, inadequate policy support, technological barriers, and an enabling adoption environment. Yet promoting carbon farming is in India's interests – to mitigate climate change while improving soil health, enhancing biodiversity, and creating economic opportunities for its adopters.

Vinaya Kumar H.M. is an assistant professor of the Agricultural Extension, Office of the Vice Chancellor, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga.

THE GIST

- Implementing regenerative agricultural practices that restore ecosystem health while improving agricultural productivity and soil health, and mitigating climate change by enhancing carbon storage in agricultural landscapes and reducing greenhouse gas emissions is carbon farming.
- Regions with extensive agricultural land, such as the Indo-Gangetic plains and the Deccan Plateau, are well suited to adopt carbon farming whereas the mountainous terrain of the Himalayan region is less so.
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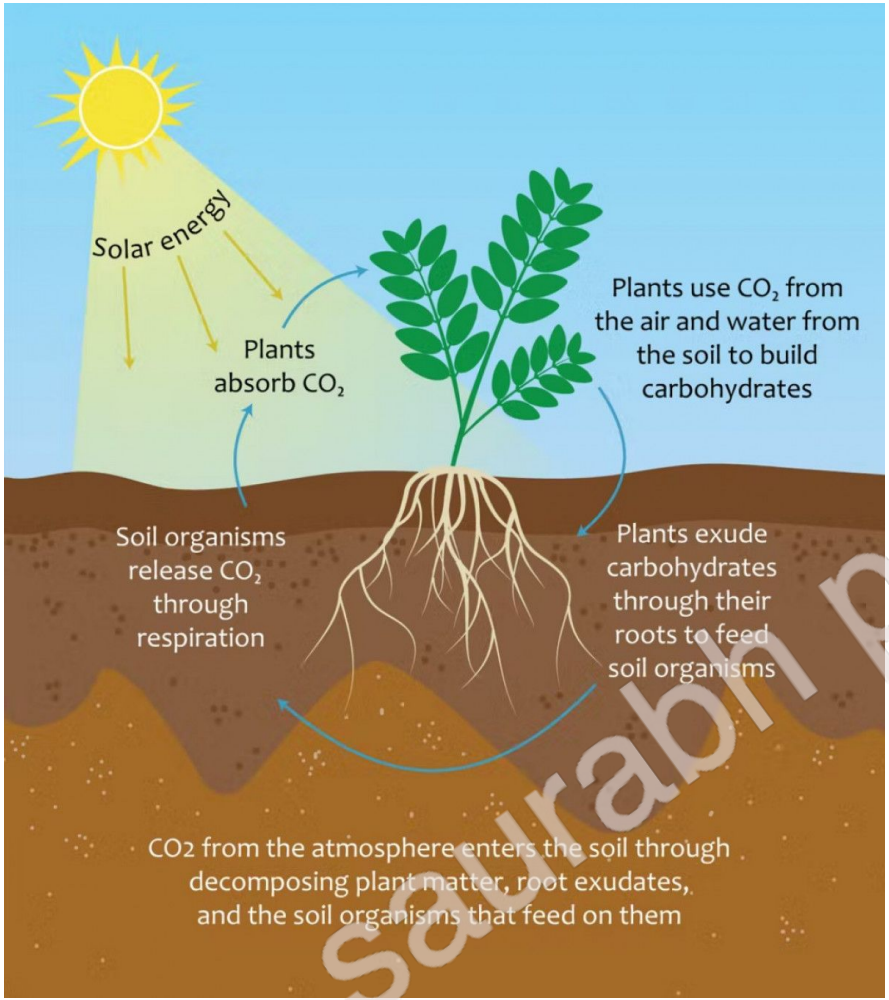
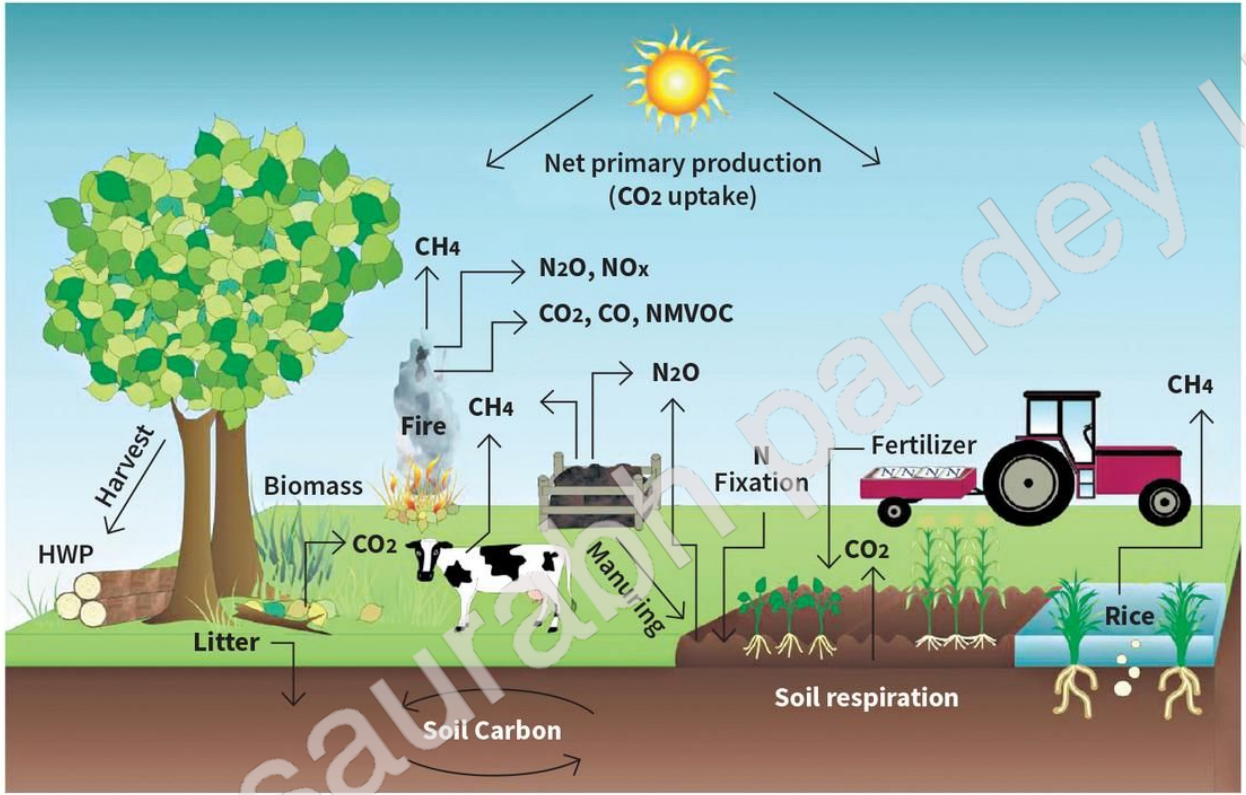
- Carbon Farming is a whole farm approach to optimizing carbon capture on working landscapes by implementing practices that are known to improve the rate at which CO2 is removed from the atmosphere and stored in plant material and/or soil organic matter.
- Carbon Farming is a framework for engaging with the agroecosystem processes that drive system change.
- Carbon farming explicitly recognizes that it is solar energy that drives farm ecosystem dynamics and that carbon is the carrier of that energy within the farm system.

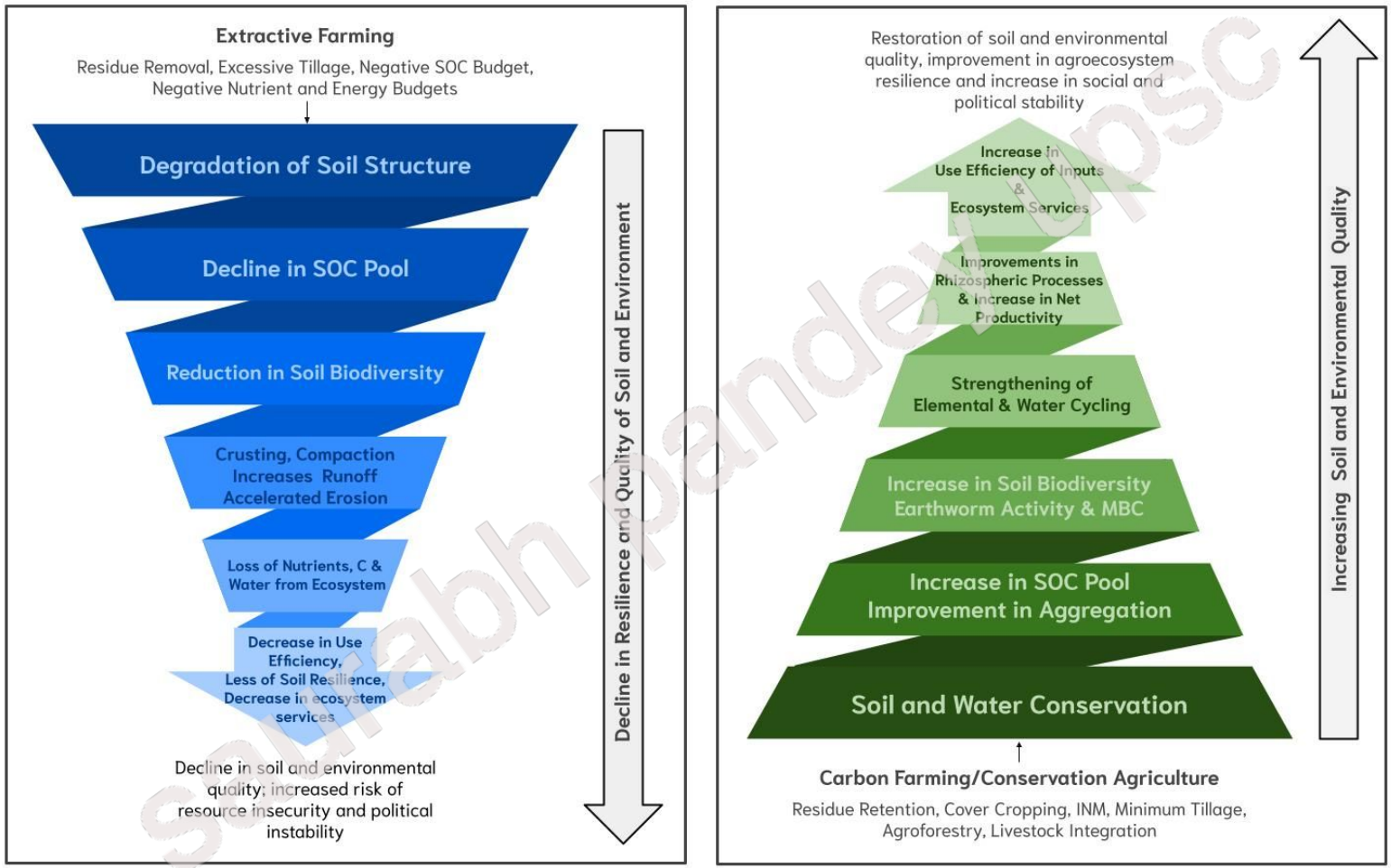


The process of emitting and removing greenhouse gas emissions in managed farmland



Source: 'Carbon farming – Making agriculture fit for 2030', a study for the European Parliament's committee on Environment, Public Health and Food Safety

- **Carbon farming is synonymous with the term ”regenerative agriculture” when that term is explicitly rooted in an understanding of the underlying system dynamics and positive feedback processes that actually make a “regenerative” upward spiral of soil fertility and farm productivity possible, as depicted in the figure below.**



Adapted from Lal 2015

Challenges

- Regions with long growing seasons, sufficient rainfall, and substantial irrigation are best suited to practise carbon farming because they provide the best conditions in which to sequester carbon, through vegetation growth.
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- **In the context of developing countries like India, small-scale farmers may lack the resources to invest in sustainable land management practices and environmental services.**

Examples

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Case of India

- Grassroots initiatives and pioneering agrarian research in India are demonstrating the viability of organic farming to sequester carbon.
- In this regard, agro-ecological practices in India could yield signi□cant economic bene□ts, with the potential to generate $63 billion in value from approximately 170 million hectares of arable land.
- This estimate includes an annual payment of around ₹5,000-6,000 per acre for farmers to provide climate services by adopting sustainable agricultural practices.

- Regions with extensive agricultural land, such as the Indo-Gangetic plains and the Deccan Plateau, are well suited to adopt carbon farming whereas the mountainous terrain of the Himalayan region is less so.
- Coastal areas are prone to salinisation and have limited access to resources, thus limited the adoption of traditional farming practices.
- Further, carbon credit systems can incentivise farmers by providing additional income through environmental services.
- Studies have shown agricultural soils can absorb 3-8 billion tonnes of CO2-equivalent every year over 20-30 years.
- This capacity can bridge the gap between feasible emissions reductions and the indispensable stabilisation of the climate
-

- **But scaling it up requires concerted e□orts to address several challenges, including limited awareness, inadequate policy support, technological barriers, and an enabling adoption environment.**

GETTY IMAGES

Understanding the science behind magnetic resonance imaging

MRI scans are used to obtain images of soft tissues within the body. It is a non-invasive diagnostic procedure widely used to image the brain, the cardiovascular system, the spinal cord and joints, various muscles, the liver, arteries, etc

Vasudevan Mukunth

The story so far:

For those trying to look inside the human body without surgery, magnetic resonance imaging is an indispensable tool. The underlying techniques were worked out in the early 1970s and later in the same decade, Paul Lauterbur and Peter Mansfield refined them to pave the way for their commercial use. For these efforts, they were awarded the Nobel Prize in medicine in 2003, speaking to the significance of the technique and its place in modern medical diagnostics.

What is magnetic resonance imaging?

Magnetic Resonance Imaging (MRI) is used to obtain images of soft tissues within the body. Soft tissue is any tissue that hasn't become harder through calcification. It is a non-invasive diagnostic procedure widely used to image the brain, the cardiovascular system, the spinal cord and joints, various muscles, the liver, arteries, etc.

Its use is particularly important in the observation and treatment of certain cancers, including prostate and rectal cancer, and to track neurological conditions including Alzheimer's, dementia, epilepsy, and stroke. Researchers have also used MRI scans of changes in blood flow to infer the way the activity of neurons is changing in the brain; in this form, the technique is called functional MRI.

Because of the MRI technique's use of strong magnetic fields, individuals with embedded metallic objects (like shrapnel) and metallic implants, including pacemakers, may not be able to undergo MRI scans. In fact, if they have a credit card in their pocket, the magnetic fields will wipe its magnetic strip!

How does MRI work?

An MRI procedure reveals an image of a body part using the hydrogen atoms in that part. A hydrogen atom is simply one proton with one electron around it. These atoms are all spinning, with axes pointing in random directions. Hydrogen atoms are abundant in fat and water, which are present almost throughout the body.

An MRI machine has four essential components. The machine itself looks like a giant doughnut. The hole in the centre, called the bore, is where the person whose body is to be scanned is inserted. Inside the doughnut is a powerful superconducting magnet whose job is to produce a powerful and stable magnetic field around the body. Once the body part to be scanned is at the centre of the bore, the magnetic field is switched on.

Each hydrogen atom has a powerful magnetic moment, which means in the presence of a magnetic field, the atom's spin axis will point along the field's direction. The superconducting magnet applies a magnetic field down the centre of the machine, such that the axes of roughly half of the hydrogen atoms in the part to be scanned are pointing one way and the other half are pointing the other way. This matching is almost exact: in around a million atoms, only a handful remain unmatched – that is, a small population of 'excess' atoms pointing one way or the other.

The machine's third component is a device that emits a radiofrequency pulse at the part under the scanner. When the pulse is 'on', only the small population of 'excess' atoms absorbs the radiation and gets excited. When the pulse goes 'off', these atoms emit the absorbed energy and return to their original, lower energy states. The frequency of pulse the 'excess' atoms have to absorb is called the Larmor frequency. Its value depends on the strength of the magnetic field and the type of tissue in which the atoms are present. The fourth and final component, a detector, receives the emissions and converts them to signals, which are sent to a computer that uses them to recreate two- or three-dimensional images of that part of the body.

What are the pros of MRI?

After the big, powerful magnetic field comes on, the MRI machine activates three magnets that produce smaller magnetic fields that are weaker than the main field by about 80-times, if not more. These fields also have a gradient, that is, they are not uniform. These fields interfere with the main field at the part to be scanned such that the resulting field highlights very specific portions, which can be the focus of the scan.

By turning the gradient magnets on and off in specific sequences, the MRI machine can thus scan portions that are just a few millimetres wide. The sequences can also be organised such that the machine scans different parts of the individual's body without asking them to move inside the bore.

In fact, because of the way the machine is built and the magnets are organised inside it, an MRI scan can practically image the body from all useful directions and, if required, in very small increments.

When the 'excess' atoms emit the energy they'd absorbed to return to their lower energy states, the return happens over a duration called the T1 relaxation time. The hydrogen atoms in water have different values of T1 depending on the tissue in which they're present. An MRI machine exploits this fact to show different tissues in different shades of grey. Clinicians may also inject an individual with a contrast agent – typically a gadolinium-based compound – that lowers the T1 time in some tissues, improving their visibility in an MRI scan.

Finally, researchers have deeply investigated the effects of strong magnetic fields on the body. MRI scans don't pose any threats; once the magnetic fields are taken away, the atoms in the scanned part don't remain affected. There is no long-term harm associated with scans. However, a scan's effects on pregnant women aren't as well-studied, so many scanning facilities simply refuse such appointments.

What are the cons of MRI?

MRI machines are expensive: depending on the specifications, including the strength of the magnetic fields and the imaging quality, they cost from a few tens of lakh rupees to a few crores. Diagnostic facilities pass this cost on to its patients. Based on the clinical requirements, scans often cost ₹10,000 or more each – a sizeable sum in India, especially for those without insurance, and more so for those required to get multiple MRI scans.

These costs are compounded by the discomfort of using the machine. While it's an advantage that an individual inside the bore doesn't have to move for the machine to scan different parts, the individual is actually expected to lie still for tens of minutes, until the scan is complete. If the individual moves, the resulting image will be distorted and the scan will have to be repeated. The problem is exacerbated if the individual is claustrophobic (although some 'open-bore' MRI machine designs can alleviate this issue).

Generating a magnetic field of strength 1 tesla or more – as the main magnet does – is no mean feat. To do so, a heavy current is passed through coils of wire made of a superconducting material. When the setup is cooled with liquid helium, the wires become superconducting and the current passing through them plus the geometry of the wires produces a strong magnetic field. While the wires don't lose any energy as heat – which a non-superconducting material would – maintaining the setup is energy-intensive, which is expensive.

Further, the switching of such heavy currents within the machine, as the gradient coils are operated in sequence, means the machine produces loud noises when operating.

This can be an additional source of discomfort for the individual.

- Magnetic resonance imaging (MRI) is a medical imaging technique that uses a magnetic field and computer-generated radio waves to create detailed images of the organs and tissues in your body.
- Most MRI machines are large, tube-shaped magnets. When you lie inside an MRI machine, the magnetic field inside works with radio waves and hydrogen atoms in your body to create cross-sectional images — like slices in a loaf of bread.
- The MRI machine also can produce 3D images that can be viewed from different angles.

- **Because of the MRI technique’s use of strong magnetic fields, individuals with embedded metallic objects (like shrapnel) and metallic implants, including pacemakers, may not be able to undergo MRI scans.**
-

Magnetic Resonance Imaging	Computed Tomography
Pros: Imaging modality of choice. High sensitivity. Low radiation risk. Detects small/subtle cortical abnormalities and temporal lobe abnormalities (e.g., mesial temporal sclerosis)	**Pros:** Used for assessment in emergency conditions. Fast scanning speed. Accessibility. Easy to use. Comparatively lower cost. Sedation not required. Better than MRI for calcified lesions (congenital infections) and neurocutaneous malformations (e.g., Sturge–Weber syndrome, tuberous sclerosis)
Cons: Sedation required. Slow scanning speed. Limitations in accessibility (less-developed countries). Comparatively higher cost. MRI cannot be done in presence of dentures, pacemakers and other metallic implants. Motion artifacts (esp. with 3 T & 7 T)	**Cons:** Risk of radiation exposure. Low-resolution images. Low sensitivity (30%). Limitations in detecting some pathologies of temporal fossa such as mesial temporal sclerosis and small/subtle changes

‘Market-based schemes not reducing deforestation, poverty’

Agence France-Presse
PARIS

Market-based approaches to forest conservation like carbon offsets and deforestation-free certification schemes have largely failed to protect trees or alleviate poverty, according to a major scientific review published on Monday.

The global study found that trade and finance-driven initiatives had made “limited” progress halting deforestation and in some cases worsened economic inequality.

Drawn from years of academic and field work, the report compiled by the International Union of Forest Research Organizations (IUFRO), a group of 15,000 scientists in 120 countries, will be presented at a high-level UN forum starting Monday.

Its authors urged a “radical rethink” of increasingly popular market-based approaches often promoted as effective at saving forests, curbing global warming and raising living standards in developing nations.

“The evidence does not support the claim of win-wins or triple wins for environment, economy and people often made for market mechanisms as a policy response to environmental problems,” said contributing author Maria Brockhaus from the University of Helsinki.

“Rather our cases show that poverty and forest loss both are persistent across different regions of the world... where market mechanisms have been the main policy option for decades,” she told AFP by email.

Little succour: The policy, in some cases, worsened economic inequality. AP

Since the last IUFRO assessment in 2010, the report noted a rise in complex and overlapping market-based schemes “with financial actors and shareholders more often interested in short-term profits than long-term just and sustainable forest governance”.

Its lead author, Constance McDermott from the University of Oxford, said this may not be true of all individual projects “but overall... it’s hard to say they’ve been a rousing success”.

The report said a $120 million project in the Democratic Republic of Congo had “reinforced entrenched interests” by restricting local people from forests without addressing logging by powerful extractive businesses.

In Malaysia, indigenous groups promised better livelihoods from a foreign-backed plantation venture on their customary land received no benefit, the report said.

“As both cases show, ‘wins’ are often gained elsewhere, while the burdens of forest loss, enclosures and forestland conversion are carried locally,” said Ms. Brockhaus.

In Ghana, deforestation rates had risen despite a slew of sustainable cocoa standards, corporate pledges, and carbon offset projects, while farmers were earning less today than decades ago, said Ms. McDermott.

Meanwhile green trade policies imposed by wealthy countries–like the EU’s ban on imports linked to deforestation–might look good from Brussels but did not consider the knock-on effects, she added. “There’s no accountability. If this doesn’t work–or farmers are pushed off their farm as a result–it’s not going to hurt the person eating chocolate in the UK or Germany,” she said.

‘Radical rethink’

Despite recent turmoil, carbon markets are projected to grow into a multi-billion-dollar industry as corporations increasingly turn to credits to meet their net-zero climate targets.

Credits are purchased from projects, often in developing nations, that reduce or avoid the release of planet-heating emissions, such as protecting CO2-absorbing rainforests or peat swamps.

Kenya’s President William Ruto has called Africa’s carbon sinks an “unparalleled economic goldmine” that could generate billions of dollars every year.

But there are growing concerns about how much of that revenue poor communities might expect to see, with unscrupulous actors accused of exploitation.

- The International Union of Forest Research Organizations (IUFRO) is “the” global network for forest science cooperation. It is open to all individuals and organizations dedicated to forest and forest products research and related disciplines.
- It is a non-profit, non-governmental and non-discriminatory organization with a tradition dating back to 1892.
- The mission of IUFRO is to promote the coordination of and the international cooperation in scientific studies embracing the whole field of research related to forests and trees for the well-being of forests and the people that depend on them.

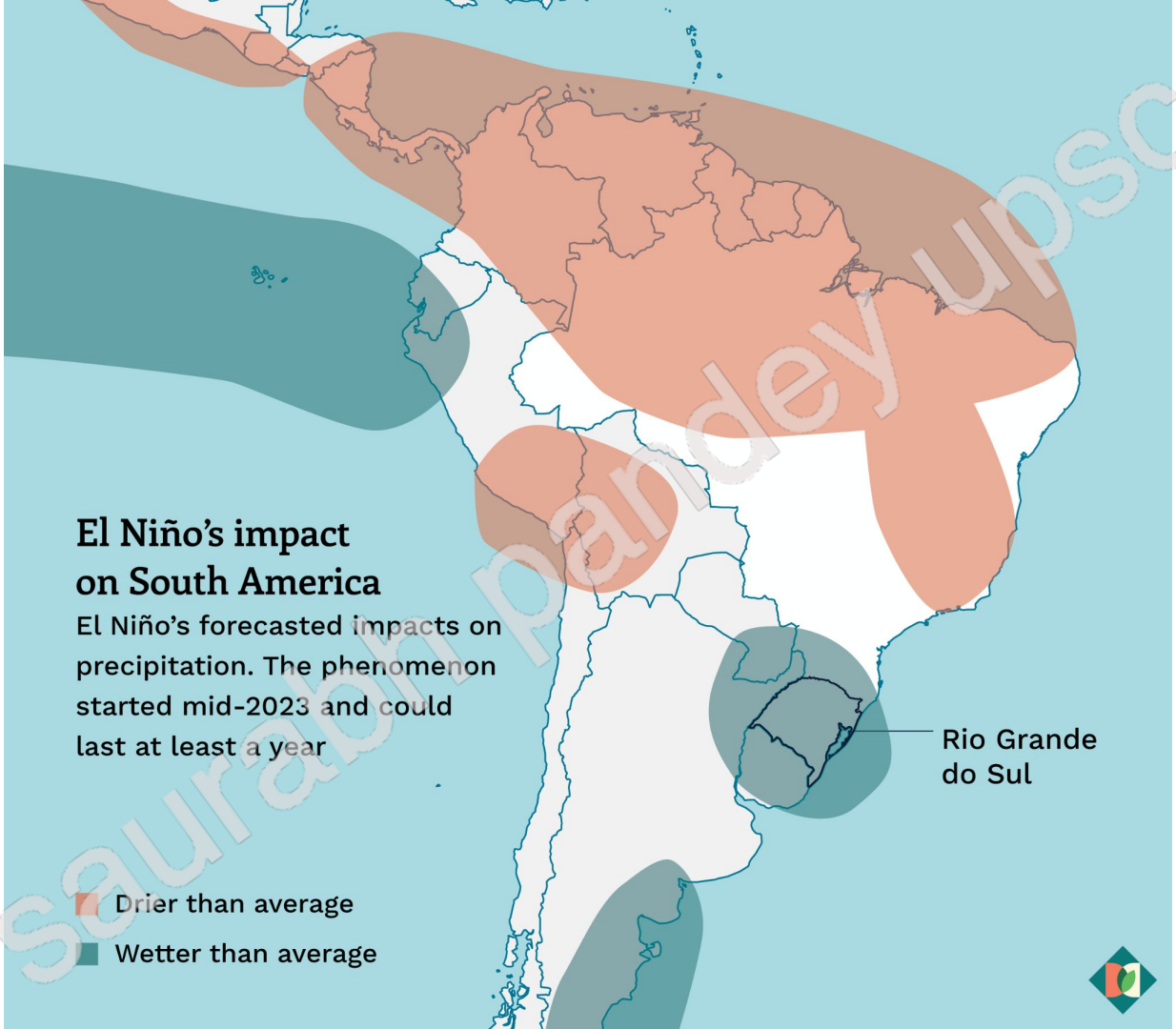
- The scientific activities of IUFRO are spread over a number of Divisions and Task Forces.
- Divisions are subdivided into Research Groups and Working Parties and support researchers in collaborative work.
- Task Forces are established for a limited period of time to deal with and synthesize scientific information about topical cross-cutting issues that go beyond the scope of any one Division or Research Group.

- IUFRO is a non-profit, non-governmental international network of forest scientists, which promotes global cooperation in forest-related research and enhances the understanding of the ecological, economic and social aspects of forests and trees.
- IUFRO is "the" global network for forest science cooperation. It unites more than 15,000 scientists in around 630 Member Organizations in almost 120 countries, and is a member of the International Science Council. Scientists cooperate in IUFRO on a voluntary basis

Brazil pounded

An aerial view of Porto Alegre, Brazil, during an overfly by Brazil's President Luiz Inacio Lula da Silva of areas affected by floods triggered by torrential storms. Authorities are trying to avoid greater tragedy than the one already caused, where 66 people died in the floods. AFP

- Record rainfall linked to El Niño has caused unprecedented flooding in the southern Brazilian state of Rio Grande do Sul, with a growing number of casualties and infrastructure and economic losses.
- dam at a hydroelectric plant between the cities of Bento Goncalves and Cotipora partially collapsed on May 2 while a bridge was swept away in the town of Feliz. The situation is bad in the state capital Porto Alegre



- According to Brazil's National Institute of Meteorology (Inmet), the climate phenomenon El Nino caused above average rain and heat in the country.
- It added that the largest accumulations of rain in the last 30 days occurred in the centre-north of the country, due to the combination of heat and high humidity that contributed to the formation of rain clouds, in addition to the Intertropical Convergence Zone (ITCZ) which contributed with increased instability, causing locally heavy rains in the northern part of Brazil

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