Issue 7
October 30, 2023
(Revised March 10, 2024)

NEWSLETTER

Smart & Net-Zero Project

Overview

Welcome to the FFTC Smart & Net-Zero Newsletter! Explore innovative technologies, sustainable practices, policy initiatives, and knowledge sharing platforms worldwide.

In the Research section, you'll find wide range of carbon farming and GHG emission reduction measures, the application Life Cycle Analysis (LCA) to agroforestry, and innovative sensor technology to capture plant's physiological responses to field conditions. The highlight of the month is on Taiwan, with a Taiwanese research team recently published a paper on opportunities and challenges in promoting circular economy, while at the same time, the Taiwanese government sector is pushing forwarded with introducing carbon emission tax and carbon trading framework. The Policy section updates on Japan, Indonesia, and Korea's effort towards agrifood system sustainability; particularly in the case of Indonesia, emphasis has been placed on conservation and restoration of coastal mangrove forests. In the Open Data section, you would find several farming management apps developed by private software developers.

Content

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RESEARCH

01 THEME: ICT in agrifood sustainability

Internet of Plants: Revolutionizing Agriculture with Sensor Networks

August 03, 2023 | Nature Reviews Methods Primers | Source |

In the study conducted by researchers from Delft University of Technology and Wageningen University & Research, the focus is on introducing the concept of the "Internet of Plants" (IoP), which is a network of sensors designed to enhance agricultural productivity, climate resilience, and resource efficiency. While sensor technologies have rapidly advanced in consumer electronics, their adoption in agriculture, even in modern greenhouse horticulture, has been slow. The IoP acts as the eyes, nose, and touch of farmers, providing data on environmental parameters and plant physiology that are crucial for optimizing crop production.

The study discusses the two main aspects of sensor technology in agriculture:

- Sensing Environmental Parameters: Sensors are employed to monitor atmospheric conditions, gas levels, soil moisture, and other environmental factors that affect plant growth. These sensors are essential for predicting and managing biomass production.
- Sensing Plant Physiology: Advanced sensors can provide real-time insights into crop responses to the environment, helping detect stressors that hinder plant growth. Examples include weight measurement devices, sap flow sensors, multispectral cameras, and more.

To enable dense sensor networks, ease of installation and operation are crucial. The study explores the use of wireless sensor networks, autonomous sensor modules, and energy-harvesting technologies. It also discusses the challenges and potential solutions for deploying sensors in the field without disrupting farming operations.

Effective implementation of IoP networks requires collaboration among plant scientists, farmers, electrical engineers, and sensor experts. Comprehensive studies using dense sensor networks are needed to determine the predictive value of various sensors and optimize crop growth conditions. The study predicts a gradual adoption of IoP networks in agriculture, leading to reliable and sustainable food production in the future.

In summary, the study highlights the potential of IoP sensor networks to revolutionize agriculture by providing real-time data for precise and sustainable crop management.

Read more: Sensors in agriculture: towards an Internet of Plants

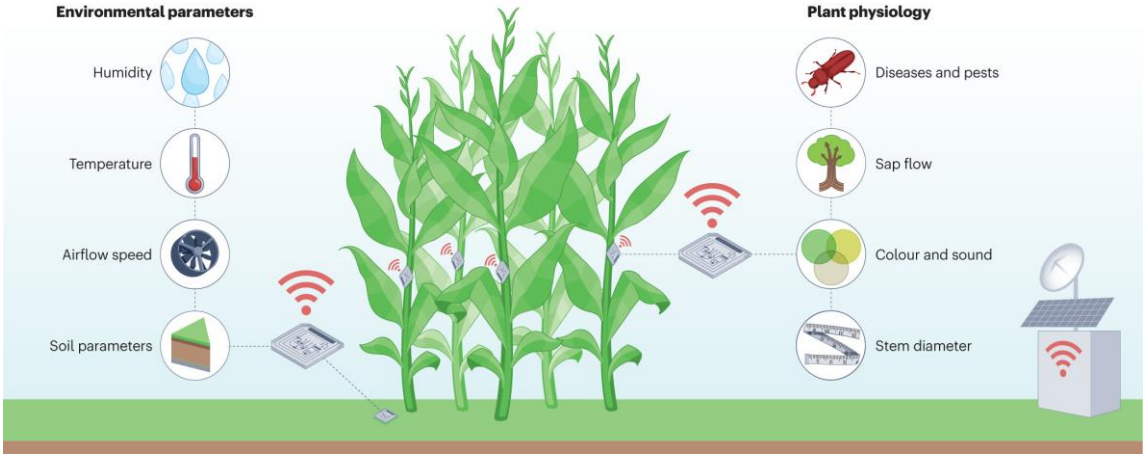


Figure | Envisioned architecture for the Internet of Plants. | Sensor modules comprising environmental sensors, physiological sensors and dedicated electronics for power and communication are distributed throughout the crops and wirelessly connected to a central processor.

02 THEME: Carbon sequestration, Policy incentives, financing, pricing

Future of US Rangelands: A Scenario Assessment of Ecosystem Services

September 04 2023 | Nature Sustainability | Source |

A recent study, led by a research team from Texas A&M University in collaboration with multiple US institutions, delves into the future of rangelands in the conterminous United States. Rangelands, which cover a significant 40% of the nation, provide vital ecosystem services to society. The study conducted a scenario assessment to explore how accelerating biophysical and societal factors might reshape the availability of these services.

The assessment revealed four distinct scenarios that could shape the future of rangelands:

- **Sustaining Rural Communities**: Two scenarios aim to maintain the existing rural communities by continuing the ecosystem service of beef cattle production. This traditional approach keeps these regions anchored in agricultural practices.
- **Transforming Rural Communities**: The other two scenarios envision a transformation of rural communities driven by the expansion of renewable energy technologies and the infusion of external capital from amenity land sales. These modern scenarios represent a shift towards a more diverse economic landscape.

The study emphasizes that collaborative organizations representing diverse sectors within society play a crucial role in identifying and managing the trade-offs between these various ecosystem services. This collaborative approach is vital for equitably prioritizing objectives such as food and energy security, environmental quality, and the preservation of cultural identity.

In summary, the research provides a scenario-based assessment of how rangelands in the United States might evolve in the face of changing biophysical and societal drivers. It highlights the importance of strategic planning and collaboration to ensure that ecosystem services are managed in ways that benefit both rural communities and the broader society.

Read more: Supplying ecosystem services on US rangelands

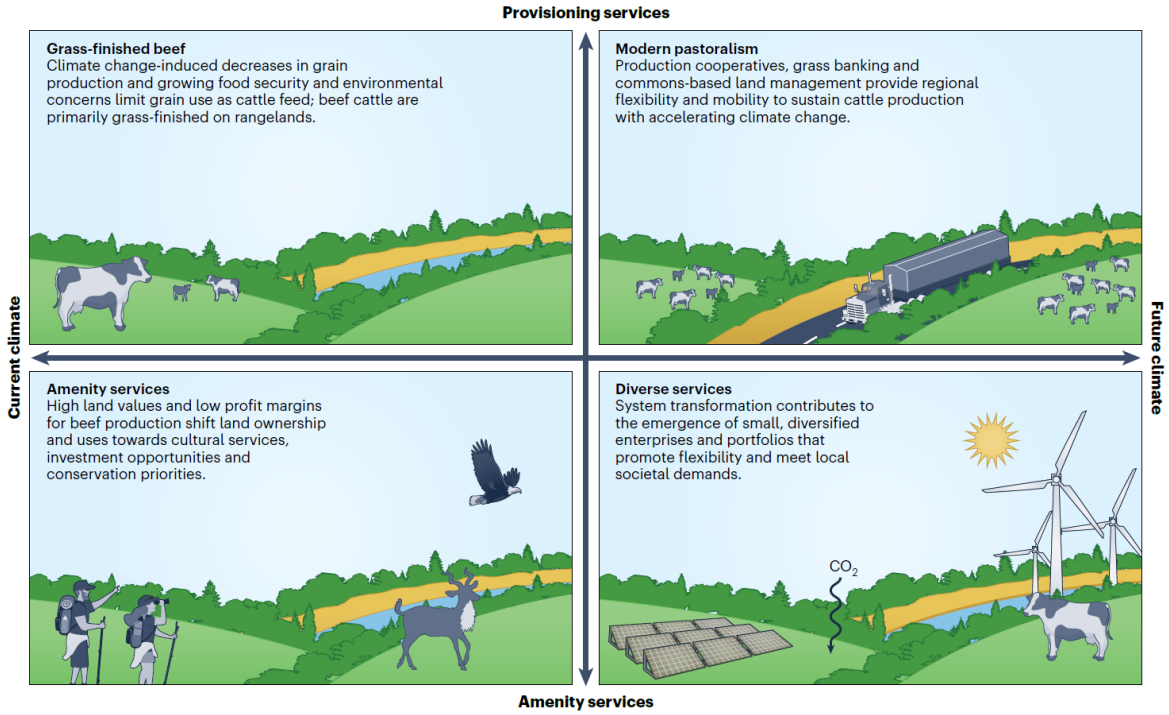


Figure | Plausible future scenarios for US rangeland. | Four scenarios depicting how climate change and a societal shift towards cultural (amenity) ecosystem services may modify the supply of ecosystem services from US rangelands in the twenty-first century.

03 THEME: ICT in agrifood sustainability

Harnessing Space Agriculture for Sustainable Earth-Based Controlled Environment Agriculture

June 29, 2023 | Nature Food | Source |

A collaborative research effort led by the University of Sheffield, University of Manchester, and Cranfield University in the UK has explored the potential of space controlled environment agriculture (SpaCEA) to revolutionize terrestrial controlled environment agriculture (CEA). The study focuses on the need for more sustainable and resource-efficient CEA systems on Earth, which play an increasingly vital role in food production.

At present, terrestrial CEA systems often face challenges such as high energy consumption and resource demands, making them less economically viable. The study argues that SpaCEA, which operates in the resource-constrained and circular environment of space, offers a unique opportunity to develop intrinsically circular CEA systems.

The key to this transformation lies in life-cycle analysis tools, which should be employed to optimize resource utilization in both terrestrial CEA and SpaCEA systems. These tools help fine-tune the provision and consumption of natural and electrical light, power, nutrients, and infrastructure in these environments. By focusing research and development efforts on subsystems with strong environmental advantages, the path to more sustainable CEA systems can be paved.

The study also highlights the potential of SpaCEA for public outreach. Space serves as a captivating gateway for showcasing advanced CEA food growing technologies to the public, which can improve the perception of terrestrial CEA on Earth.

In conclusion, this research encourages a substantial focus on the development of SpaCEA as an efficient strategy for addressing the major sustainability challenges faced by current CEA systems. By drawing inspiration from space agriculture, the future of controlled environment agriculture on our planet could become more resource-efficient and sustainable.

Read more: Space controlled environment agriculture offers pathways to improve the sustainability of controlled environmental agriculture on Earth

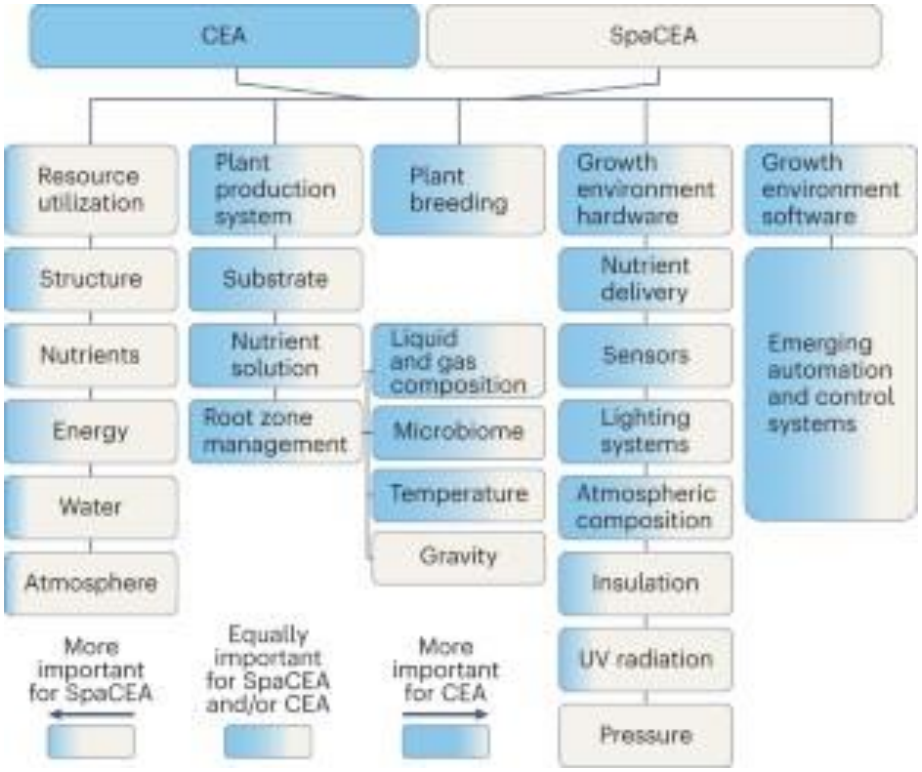


Figure | Technical framework for the design of a CEA or SpaCEA system.

04 THEME: GHG emission reduction, Policy incentives, financing, pricing

Revised Estimates Show Urgency in Addressing Methane and Nitrous Oxide Emissions

September 14, 2023 | Nature Climate Change | Source |

A study conducted by Tsinghua University in China presents updated estimates of the social cost of greenhouse gases (SC-GHGs), a critical metric for informing climate policies. The study focuses on methane (SC-CH_4) and nitrous oxide (SC-N_2O) emissions, providing fresh insights by incorporating the latest scientific findings in damage functions, climate models, and socioeconomic projections.

The research utilizes a multimodel assessment framework to re-evaluate SC-CH_4 and SC-N2O. Notably, the study highlights the effects of emissions on gross domestic product (GDP) levels, revealing a SC-CH_4 of US$2,900 per ton of methane and a SC-N_2O of US$49,600 per ton of nitrous oxide for the year 2020. These figures represent a substantial twofold increase compared to previous estimates.

However, the study doesn't stop there. It also considers the impact of GDP growth over time, which leads to a staggering 15–25-fold increase in these estimates. This temporal factor significantly dominates the uncertainty in social cost calculations.

While uncertainties still persist, the findings strongly advocate for more immediate and robust policies aimed at mitigating CH_4 and N_2O emissions. In essence, the study underlines the urgency of addressing these potent greenhouse gases and implies that their mitigation can yield greater benefits than previously recognized in climate policy discussions.

Read more: Damage function uncertainty increases the social cost of methane and nitrous oxide

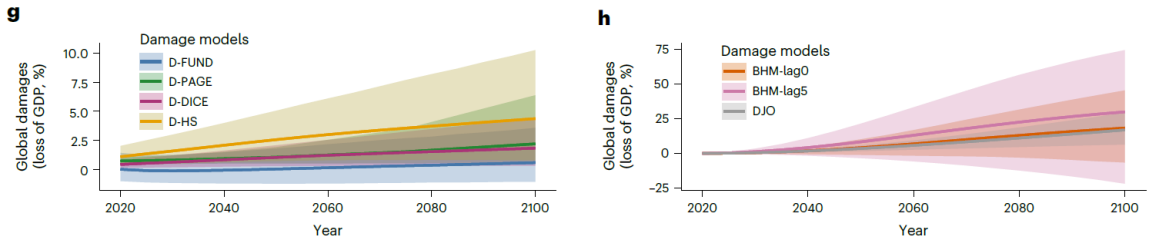


Figure | SC-CH_4 and SC-N_2O estimates for the emissions year 2020 and global climate damage obtained with various damage models, with Hector as are presentative climate model. | g,h, Percentage loss in global GDP due to climate change by the level-based damage models (**g**) and growth-based damage models (**h**); coloured lines show the simple mean values and the coloured uncertainty bands show the 5th to 95th range of changes in global GDP.

05 THEME: Others

A Harmonization Service for Improving Global Understanding of Salt-Affected Soils

August 12, 2023 | Scientific Reports | Source |

Salt-affected soils (SAS) cover approximately 1 billion hectares worldwide, and their distribution is influenced by factors such as climate, sea levels, and land use patterns. However, the existing literature has failed to account for these changes over time, leading to inconsistent data and persistent data gaps. In response, a collaborative effort led by the University of Nairobi, in conjunction with institutions from various continents, has developed a novel approach to address these challenges.

This study introduces a harmonization service aimed at managing inconsistencies in SAS data and minimizing data gaps. The core component of this service is a comprehensive global library of harmonization models specifically designed to rectify inconsistent soil data. These models not only facilitate the harmonization of existing data but also help identify areas where data gaps exist. In this way, they provide a clearer picture of the global distribution of salt-affected soils, highlighting regions where harmonization is necessary.

Benefits for Countries and Global Understanding: The harmonization service offers a valuable resource for countries seeking to develop and update their national SAS information. By using the service's data availability index, countries can identify the gaps in their SAS data and work towards filling them. Importantly, the service revealed that many countries have more SAS data than they currently share with global databases, indicating the potential for increased collaboration in updating our understanding of SAS distribution.

Read more: Harmonization service and global library of models to support country-driven global information on salt-affected soils

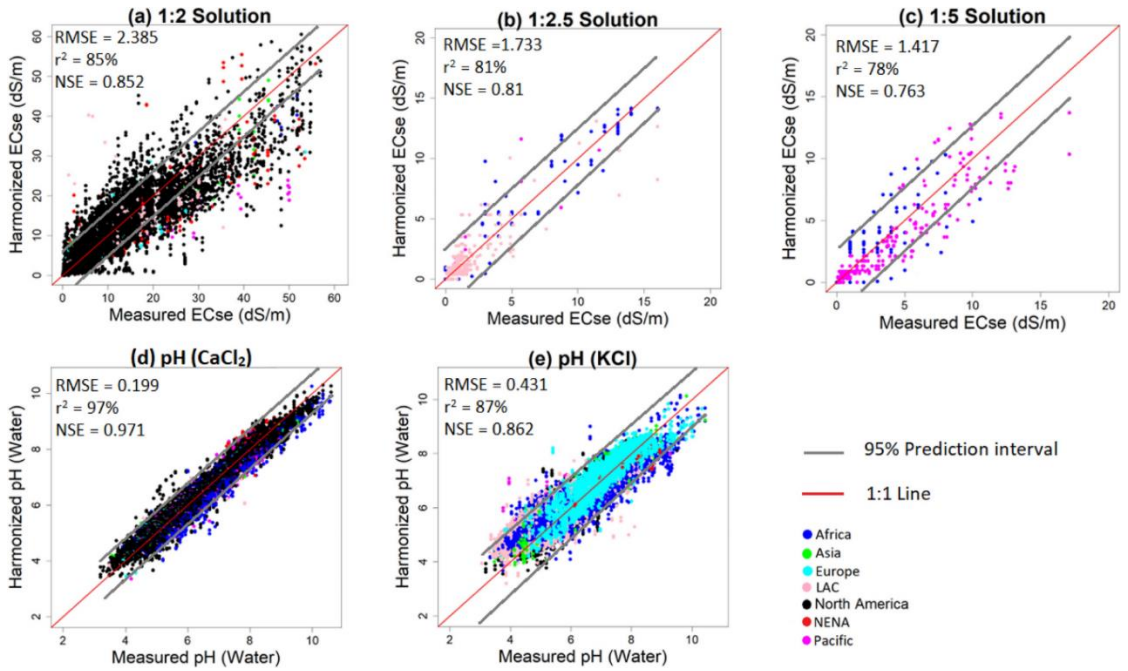


Figure | Comparison of ME polynomial harmonized and measured ECse and pH (water) using holdout samples.

06 THEME: Carbon sequestration, ICT in agrifood sustainability

Assessing the Impact of Crop Residue Cover on Agriculture and Soil Quality Using Remote Sensing

September 12, 2023 | Scientific Reports | Source |

Crop residue cover (CRC) is a critical but understudied factor in agriculture's impact on both productivity and soil quality. Researchers from Sapienza University of Rome, University of Tabriz, Golestan University, the University of London, and Kansas State University have collaborated to investigate these effects. They employ a novel approach combining remote sensing and geospatial analysis to detect CRC and monitor its consequences on agriculture and soil characteristics.

The research team collected Landsat images and ground control points (GCPs) from 2013, 2015, and 2021. They harnessed the power of convolutional neural networks (CNN) to distinguish between areas with and without CRC. To assess the impact of CRC, they utilized the Normalized Difference Vegetation Index (NDVI) from Landsat images in 2015, 2019, and 2022. Additionally, field observations were collected to evaluate how CRC affects soil fertility.

The CNN demonstrated impressive accuracy (>95%) in detecting CRC. The results suggest that CRC has a positive influence on agricultural productivity, as seen in increased vegetation density in the study areas between 2015 and 2022. Furthermore, CRC appears to enhance soil quality, indicated by changes in various chemical and physical characteristics. These improvements encompass parameters such as electrical conductivity (EC), pH, sodium (Na), magnesium (Mg), bicarbonate (HCO_3), potassium (K), and soil texture (silt, sand, and clay).

This study highlights the potential of an integrated approach that combines remote sensing and geospatial analysis to detect and evaluate the effects of CRC on agricultural productivity and soil fertility. The findings offer valuable insights for researchers and decision-makers in soil science, land management, and agriculture, demonstrating the significance of considering CRC in sustainable agricultural practices.

Read more: Monitoring the impacts of crop residue cover on agricultural productivity and soil chemical and physical characteristics

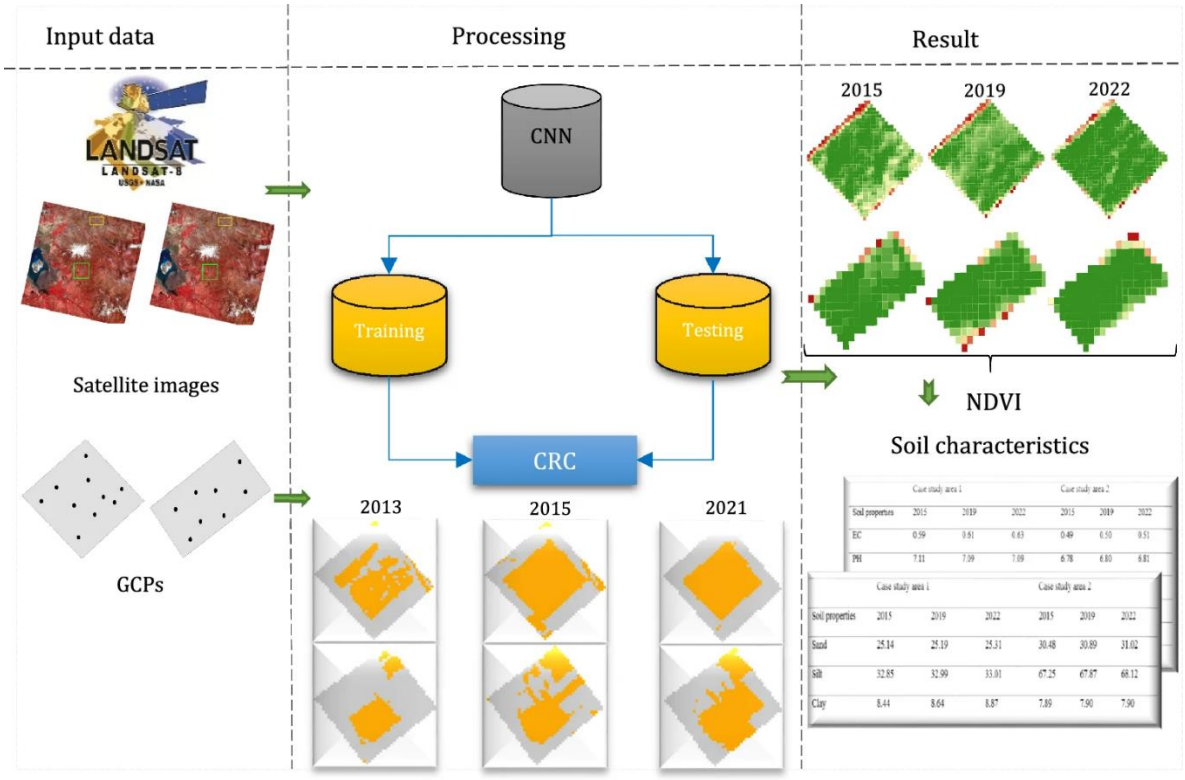


Figure | An overview of the employed methodology to evaluate the effects of CRC on agricultural productivity and soil fertility.

07 THEME: GHG emission reduction

Examining the Complex Interplay Between Irrigation, Climate, and Greenhouse Gas Emissions

August 17, 2023 | Nature Food | Source |

Researchers from University of Minnesota, Colorado State University, Chongqing University, and other institutions in the US and China delves into the intricate connections between agricultural irrigation, climate change, and their impact on greenhouse gas emissions. These interrelated factors form a complex web that warrants closer examination.

The research offers a comprehensive scoping review, bridging insights from diverse fields to shed light on the interactions between irrigation and climate. It explores the multifaceted ways in which agricultural irrigation contributes to greenhouse gas emissions, either directly from soils or indirectly through energy consumption and infrastructure development. Simultaneously, the study highlights how climate change influences irrigation practices, affecting water availability, demand, and the environmental footprint of irrigation energy.

The scoping review emphasizes the growing significance of climate change as a driving force behind future expansions in irrigation. Additionally, it uncovers positive feedback loops in this relationship, where climate change and irrigation practices reinforce each other, potentially exacerbating environmental impacts.

The study underscores the pressing need to embrace sustainable irrigation practices, especially in regions where these strong, positive feedback loops are prominent. By understanding the complex interplay between irrigation, climate, and greenhouse gas emissions, policymakers and researchers can work towards mitigating the environmental effects of agriculture and ensuring a more sustainable future.

Read more: Sustainable irrigation and climate feedbacks

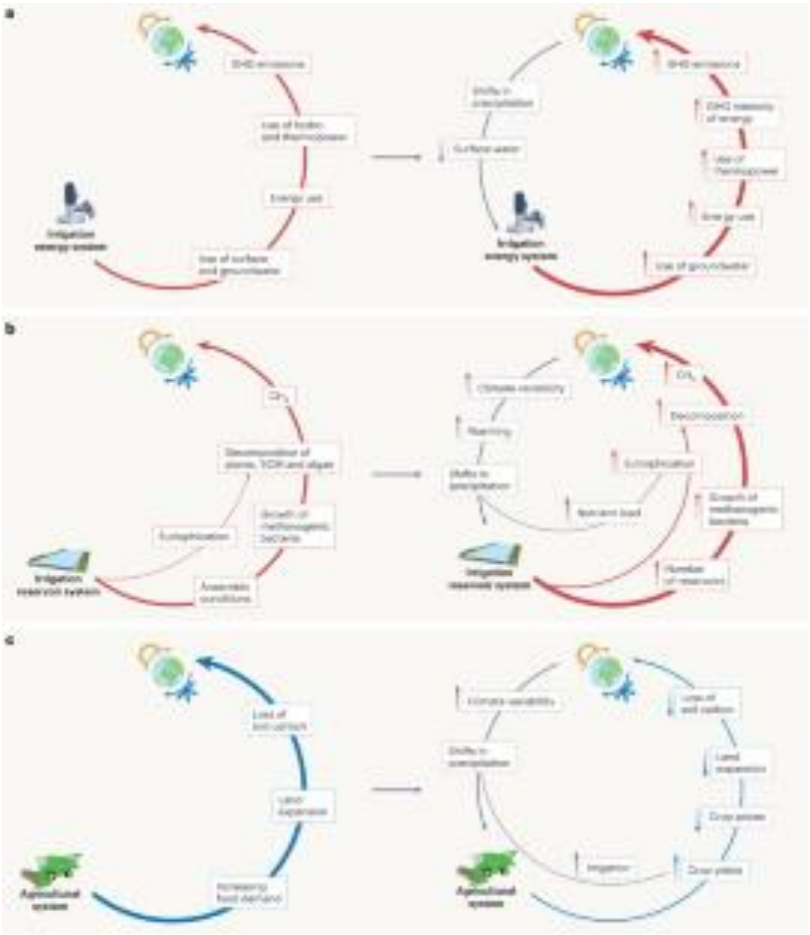


Figure | Conceptual models of climate–irrigation feedbacks.

08 THEME: GHG emission reduction

Unlocking the Drivers of Ammonia and Nitrous Oxide Emissions from Livestock and Manure Management

September 1, 2023 | Science of The Total Environment | Source |

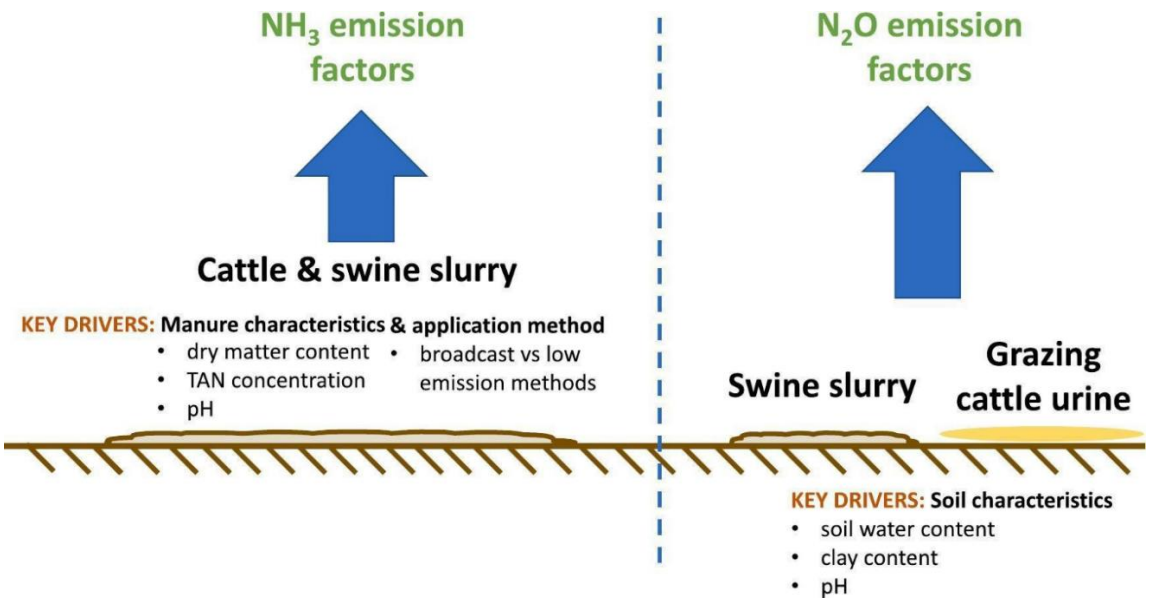
This collaborative study, involving researchers from AgResearch Ltd in New Zealand, INIA in Chile, Aarhus University in Denmark, ADAS UK, and ATB Germany, delves into the intricate factors influencing ammonia (NH_3) and nitrous oxide (N_2O) emissions associated with livestock manure management. These emissions play a significant role in both air quality and climate change, underscoring the need to better understand their underlying drivers.

By analyzing data from the DATAMAN ("DATAbase for MANaging greenhouse gas and ammonia emissions factors") database, the research focuses on identifying the key factors affecting NH_3 emission factors (EFs) for cattle and swine manure applied to land, as well as N_2O EFs for the same scenarios. Additionally, it examines the factors impacting cattle urine, dung, and sheep urine emissions during grazing.

The study reveals that several factors significantly influence NH_3 EFs, including slurry dry matter (DM) content, total ammoniacal nitrogen (TAN) concentration, and the method of application. These findings can explain a substantial portion of the variance in NH_3 EFs, making them vital focal points for mitigation strategies. In contrast, identifying key factors affecting N_2O EFs posed a more complex challenge due to the multitude of variables influencing microbial processes and soil properties related to N_2O production and emissions. Nonetheless, soil-related factors such as soil water content, pH, and clay content emerged as significant drivers.

Read more: Influence of key factors on ammonia and nitrous oxide emission factors for excreta deposited by livestock and land-applied manure

Graphical abstract



09 THEME: MRV (measurement, reporting, verification)

Unveiling Environmental Impacts of Agroforestry: A Comprehensive Review of Life Cycle Assessment

September 10, 2023 | Science of The Total Environment | Source |

A new study conducted by Aarhus University in Denmark takes a systematic approach to assess how environmental Life Cycle Assessment (LCA) has been utilized in agroforestry within the realm of food systems. This review lays the foundation for discussing methodological aspects in the context of agroforestry systems (AFS) and their associated environmental outcomes.

The research analyzed a total of 32 LCAs spanning a decade, drawn from 17 countries and four databases. Selection criteria, guidelines, and a well-defined review protocol were employed to ensure rigor in the study. Qualitative data were extracted and organized into several key themes, allowing for quantitative synthesis across the four phases of LCA for individual agroforestry practices, each characterized by its structural composition.

The study reveals that approximately half of the selected LCAs are concentrated in tropical climates, with the remainder in temperate climates, mainly in Southern Europe. The majority of studies used a mass functional unit and seldom considered post-farm gate system boundaries. Multifunctionality was taken into account in nearly half of the studies, and most allocation methods were based on physical properties. The impact category most commonly addressed was climate change, with variations observed within milk, meat, and crop production systems.

The systematic review underscores the need for methodological improvements in assessing the net environmental effects of food products derived from individual AFS. Areas like multifunctionality, carbon sequestration, and biodiversity remain ripe for further exploration and development.

Read more: How does Life Cycle Assessment capture the environmental impacts of agroforestry? A systematic review

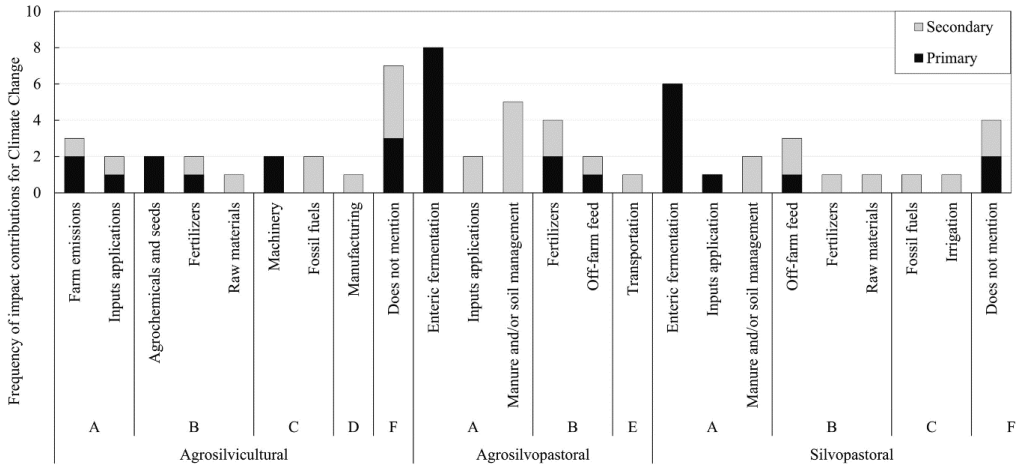


Figure | Frequency of environmental hotspots for the climate change impact category (n = 27) where: A = Direct/indirect field emissions; B = Raw material extraction; C = Operation; D = Manufacturing; E = Transportation; F = Does not mention.

10 THEME: Others

Irrigation Impacts on the Earth System: A Comprehensive Review

August 17, 2023 | Nature Reviews Earth & Environment | Source |

A recent study conducted by New York University and NASA Goddard Institute for Space Studies, in collaboration with institutions across the globe, provides an extensive review of the effects of irrigation on the Earth system. This review offers a comprehensive overview of how irrigation practices affect various components of the Earth's complex system.

The research highlights that irrigation plays a substantial role in global freshwater withdrawals, accounting for around 70% of these withdrawals and consuming approximately 90% of the utilized water resources. It points to over 3.6 million square kilometers of currently irrigated land, with notable hotspots including regions like the intensively cultivated US High Plains, California Central Valley, Indo-Gangetic Basin, and northern China.

The study utilizes process-based models to estimate that more than 2,700 cubic kilometers of irrigation water are withdrawn globally each year, aligning closely with values reported by individual countries. This consistency is maintained despite inherent uncertainties in these estimates. The widespread adoption of irrigation has resulted in the alteration of surface energy balances and biogeochemical cycling. A shift from sensible to latent heat fluxes, coupled with land-atmosphere feedbacks, leads to regional reductions in growing season surface temperatures of approximately 1-3°C. Although irrigation can mitigate temperature extremes in some areas, it may intensify moist heat stress.

Precipitation responses vary among different regions, with some experiencing suppressed local precipitation while others benefit from enhanced downstream precipitation due to interactions within atmospheric circulation patterns. Moreover, the practice of irrigation can contribute to increased carbon uptake in croplands, while simultaneously elevating methane emissions in rice systems and leaching nitrogen into groundwater.

The comprehensive review underscores the need for cross-disciplinary research efforts that integrate various aspects of irrigation's impact on the Earth system. It emphasizes the importance of identifying and reducing uncertainties, biases, and limitations to advance our understanding of these complex irrigation-Earth system interactions.

Read more: Irrigation in the Earth system

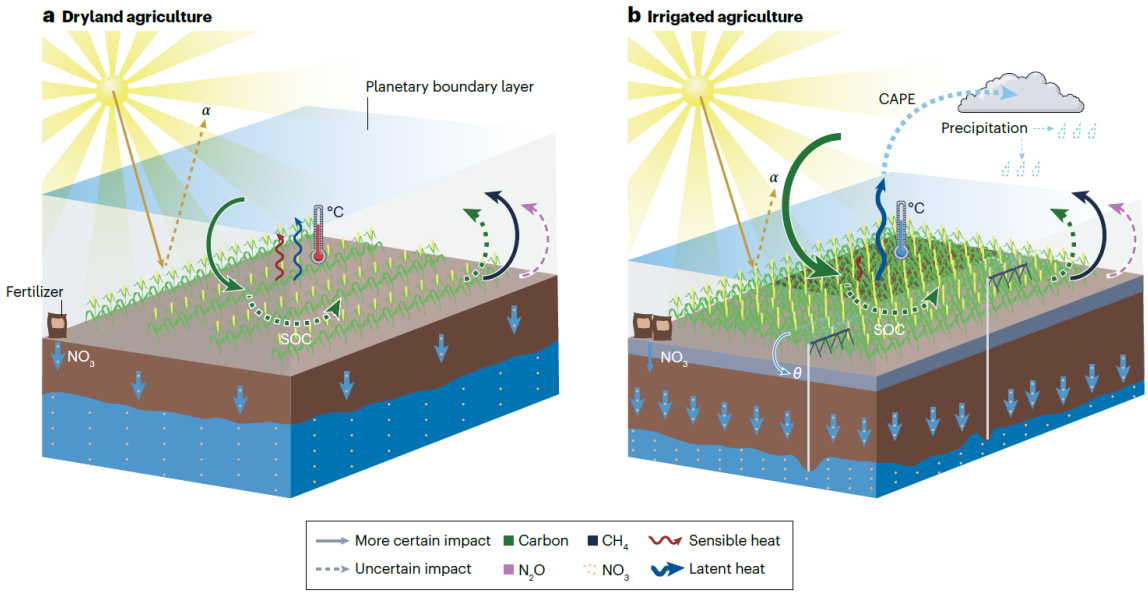


Figure | Irrigation–Earth system interactions. | a,b, The key processes and mechanisms through which dryland agriculture (panel a) and irrigated agriculture (panel b) interact with the climate system and biogeochemical cycles. Dark green lines indicate the flows of carbon as CO2 assimilated from the atmosphere from crop photosynthesis, carbon contained in decomposing biomass and soil organic carbon (SOC), and CO2 emitted back to the atmosphere. α, albedo; CAPE, convective available potential energy; θ, soil water content. Dashed arrows indicate interactions with high uncertainty. Irrigation generally increases latent heat fluxes, while reducing sensible heat fluxes, and thus cools the surface during growing season daytime. Irrigation can also increase atmospheric water vapour, leading to changes in cloud cover or local and/or remote rainfall, while further mobilizing mineral nitrogen and increasing crop productivity and carbon assimilation.

11 THEME: GHG emission reduction, MRV (measurement, reporting, verification), Policy incentives, financing, pricing

Transitioning Agriculture to a Circular Economy: Challenges and Opportunities in Waste Recovery

August 20, 2023 | Journal of Cleaner Production | Source |

National Taiwan University conducted a comprehensive study focusing on the agricultural sector's shift from linear resource consumption to a circular economy. The research identifies key challenges and barriers in four critical areas: conversion technology and research, business models and material flow within the supply chain, analytical tools for the circular economy, and stakeholder involvement.

The study highlights anaerobic digestion (AD) as a commonly used technology for converting organic waste into valuable resources. AD's success hinges on factors like feedstock properties and operating conditions, which directly affect the quality and quantity of biogas and digestate produced. Other processes, including pretreatment, pyrolysis, and hydrothermal liquefaction, show potential for enhancing biogas production and generating valuable byproducts. However, challenges persist in terms of feedstock composition, high operating temperatures, and the need for appropriate infrastructure.

Efficient business models are identified as essential for a successful circular economy in agriculture. Complex business models, financial uncertainties, and stakeholder involvement pose challenges.

The establishment of a sustainable supply chain, ensuring the synchronization of feedstock and byproduct availability with demand, is crucial. Suitable infrastructure, management expertise, and continuous training also play a pivotal role.

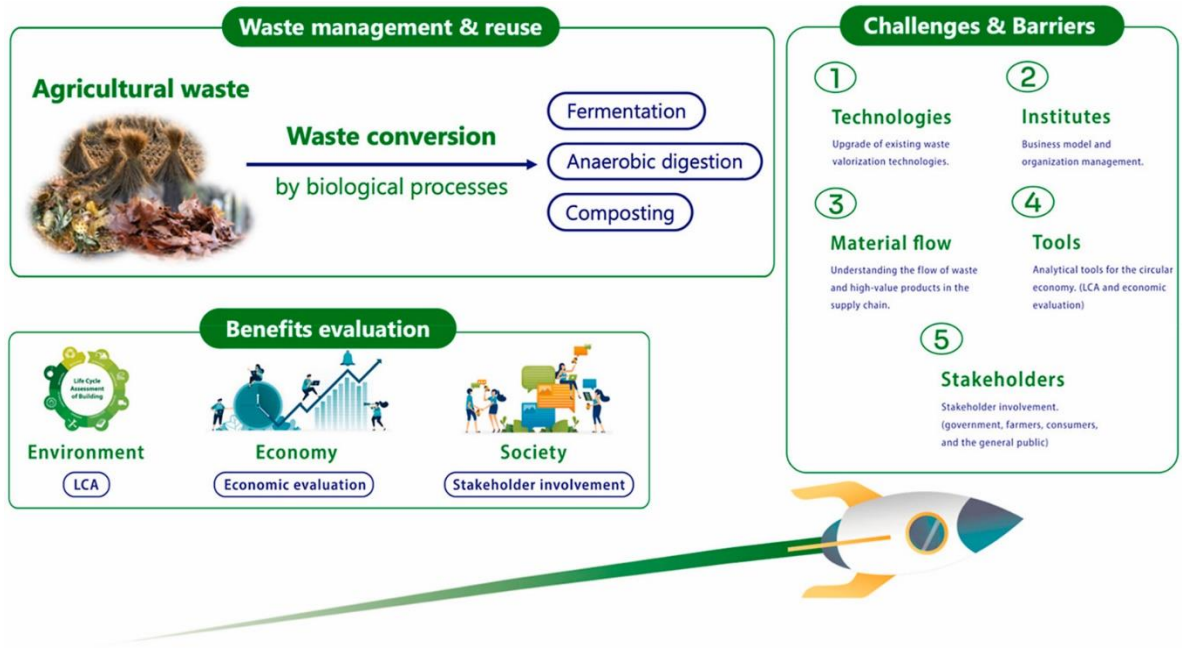
Analytical tools, including life cycle assessment (LCA) and economic evaluation, are crucial for assessing the feasibility of circular economy practices. However, challenges include limited data availability and the need to account for feedstock characteristics.

Stakeholder involvement, from governments and farmers to consumers, is identified as another key factor in achieving a successful circular economy in agriculture. Government policies and regulations can incentivize the use of waste-derived products, while farmers' willingness to adopt circular practices depends on their location, legislative rules, and available incentives.

The study underscores that the transition to a circular economy in agriculture requires collaborative efforts, innovative technologies, and effective communication among stakeholders. Integrating conversion technologies into existing infrastructure, designing sustainable supply chains, and developing appropriate analytical tools are crucial steps toward achieving a successful circular economy in the agricultural sector.

Read more: From waste to value: Addressing the relevance of waste recovery to agricultural sector in line with circular economy

Graphic abstract



12 THEME: ICT in agrifood sustainability

Automated Tomato Fruit Detection for Efficient Harvesting

August 26, 2023 | Plants | Source |

A recent collaborative study by National United University, Taiwan, and HCMC University of Technology and Education, Vietnam, addresses the need for efficient and automated fruit harvesting in the agricultural sector, emphasizing the importance of a circular economy approach.

The agricultural industry faces a significant challenge in labor-intensive and inefficient harvesting processes. To tackle this issue, the research introduces three object classification models based on Yolov5m, incorporating BoTNet, ShuffleNet, and GhostNet convolutional neural networks (CNNs). These models are designed for the automatic detection of tomato fruit.

The study involved training these models using 1508 normalized images representing three classes of cherry tomatoes: ripe, immature, and damaged. The results were promising, with the modified Yolov5m + BoTNet model demonstrating impressive detection accuracy. Specifically, the model achieved detection accuracy rates of 94% for ripe tomatoes, 95% for immature tomatoes, and 96% for damaged tomatoes. These outcomes signify a substantial advancement in the development of automated harvesting systems for tomato fruit.

The study showcases the potential of automated systems in revolutionizing the agricultural sector, particularly in the context of fruit harvesting. By efficiently detecting different tomato classes, this technology offers a sustainable solution that aligns with the principles of a circular economy, where waste recovery and resource efficiency play pivotal roles in addressing the challenges faced by the agricultural industry.

Read more: Tomato Fruit Detection Using Modified Yolov5m Model with Convolutional Neural Networks

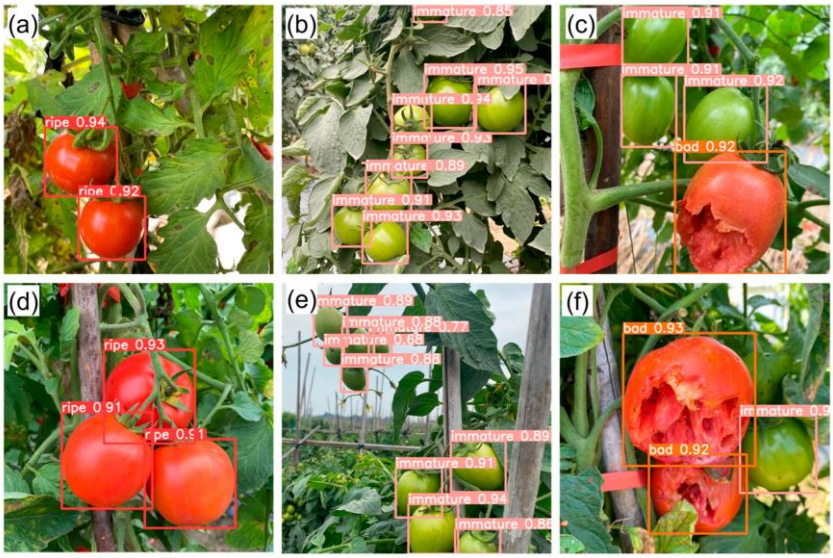


Figure | Real-world detection results obtained using the modified-Yolov5m-BoTNet model for: (**a**) ripe tomatoes, (**b**) immature tomatoes, (**c**) immature and damaged tomatoes, (**d**) ripe tomatoes, (**e**) immature tomatoes, and (**f**) damaged and immature tomatoes.

NEWS

01 THEME: Policy incentives, financing, pricing

Organic Fertilizer: Cultivating Greener Fields and Healthier Crops

September 12, 2023 | Earth.org |

The global organic fertilizer industry is on the cusp of significant growth, with projected revenues of $27.48 billion and a compound annual growth rate (CAGR) of 11.31% by 2030, according to Kings Research. This growth is underpinned by technological advancements and increased awareness of the harmful effects of chemical fertilizers. Organic fertilizers have the potential to revolutionize agriculture and enhance environmental sustainability. They can boost crop yields, reduce carbon footprints, and enrich soil quality.

The escalating global population and rising food consumption have put pressure on the agriculture sector to maximize crop yields despite limited arable land. This demand has led to a shift towards organic fertilizers, driven by concerns about the environmental and health impacts of chemical alternatives. The popularity of organic food and consumers' willingness to pay a premium for it further bolster the adoption of organic fertilizers.

Europe and North America, which import food from the Asia-Pacific region, are witnessing a surge in demand for organic food, supported by government initiatives like the European Union's Common Agricultural Policy (CAP). The Asia-Pacific region, especially China and India, has seen rapid growth in organic farming due to increased income, better organic farming practices, and higher awareness of healthier food options.

Government regulations and incentives worldwide are further promoting organic farming, which is seen as a sustainable solution. Organic fertilizers can enhance soil structure and minimize nutrient loss, offering a greener alternative to traditional chemical fertilizers. The choice between conventional and organic fertilizers is a matter of personal preference, with organic materials reviewed by organizations like the Organic Materials Review Institute (OMRI) gaining popularity among environmentally conscious consumers.

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02 THEME: Policy incentives, financing, pricing

The Future of Farming: Can We Feed the World Without Destroying It?

September 11, 2023 | Earth.org |

The article discusses the challenges of feeding a growing global population while mitigating the environmental impact of current industrial food production practices. It highlights the urgent need for sustainable farming solutions.

- **Feeding a Growing Population**: The world's population is projected to reach 10 billion by 2050, increasing the urgency of addressing food security. A quarter of the global population already faces moderate or severe food insecurity.
- **Environmental Impact of Industrial Farming**: Current industrial farming practices are described as a major cause of environmental destruction, using excessive fertilizers,

pesticides, and herbicides, contributing to aquifer depletion, overgrazing, and soil erosion. Farming covers 30 times more land than urban areas.

- **Complexity of the Issue**: There is no single "silver bullet" solution to address the problems associated with industrial farming. A variety of pathways to sustainability are available, including technology-led, market-based, state-led, or citizen-led approaches, depending on the context.
- **Technological Solutions**: Cutting-edge technologies like vertical farming, data-driven hydroponics, and carbon-neutral animal feed production offer promising solutions. These technologies can increase yields while reducing resource consumption and environmental impact.
- **Challenges in Scaling Technologies**: While these technologies show promise, many are still in their early stages and not yet viable on a global scale. Scaling them up requires investment from governments and the private sector.
- **Sustainable Traditional Farming**: Traditional farming can also improve its sustainability through practices like rewilding, pasture-fed beef herds, regenerative agriculture, and community-led urban farming projects. These approaches reduce the environmental impact of farming while increasing food self-sufficiency.
- **Diversifying Food Sources**: Community-led projects not only provide local fresh produce but also engage people in food production, promoting transparency in the supply chain. Urban farming and community projects diversify food sources and contribute to health and well-being.

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03 THEME: GHG emission reduction

Circular fertilizer and net zero: examining the potential of digestate for indoor farms

August 9, 2023 | AFN Network+ |

A collaborative project is addressing the challenge of greenhouse gas emissions from synthetic fertilizers in agriculture. At an AFN Network+ Crucible event, experts including Nicholas Pitts from the Scotch Whisky Research Institute, India Langley, Lilly Manzoni from LettUs Grow, and Dr. Alexandros Stratakos of UWE Bristol came together to explore the potential of digestate for indoor farming.

LettUs Grow, specializing in aeroponic technology and farm management software for indoor farming, faces year-round fertilizer requirements with a heavy reliance on emissions-producing synthetic fertilizers. The surplus of digestate from anaerobic digesters, rich in essential plant nutrients like nitrogen, phosphorus, and potassium, offers a climate-friendly alternative. However, digestate's use in indoor farming remains largely unexplored.

The project aims to assess plant-based and animal-based digestates' effectiveness on indoor basil farming systems, evaluating their nutrient content, pathogen risks, and their performance compared to synthetic fertilizers. A Scotch Whisky distillery anaerobic digestion plant will provide plant-based digestate. The project will also identify locations where indoor farms and anaerobic digestion plants can be beneficially combined.

The collaboration seeks to promote synergy between energy, fertilizers, and food production, connecting containerized farms with anaerobic digesters for resource efficiency. The project, led by Dr. Alexandros Stratakos, aspires to provide tangible, data-driven solutions that can be adopted by the agriculture and anaerobic digestion industries, advancing sustainability and circular economies.

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04 THEME: ICT in agrifood sustainability

NASA data helps Bangladeshi farmers save water, money, energy

August 4, 2023 | Phys.Org |

Researchers from the University of Washington and Bangladesh's Ministry of Agriculture have collaborated to provide farmers with irrigation advisories using NASA data. Through their Integrated Rice Advisory System (IRAS), satellite data is used to help Bangladesh's rice farmers efficiently manage their water resources. With rice being a critical crop in the country, this initiative seeks to reduce the environmental and financial costs associated with irrigation during the dry season, which typically involves pumping groundwater and burning fuels. IRAS leverages specific satellite data, including information from the NASA/USGS Landsat mission and the Global Precipitation Measurement mission, to assess water use and precipitation in farming locations. Global Forecast System data provides precipitation forecasts, allowing the development of location-specific irrigation recommendations. The program, which reached over 10 million farmers across Bangladesh in June 2023, has the potential to reduce agricultural water waste by about 30%, decrease fuel consumption by 45%, save $115 million annually in fuel subsidies, and cut carbon emissions by 300,000 tons per year. The success of IRAS could lead to the development of similar programs for water-intensive crops worldwide.

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05 THEME: ICT in agrifood sustainability

Precision agriculture technologies optimize returns on crops and livestock, use resources as efficiently as possible

August 25, 2023 | Phys.Org |

A study conducted by researchers from South Dakota State University's Ness School of Management and Economics has found that barriers hinder the widespread adoption of precision agriculture (PA) technologies. These technologies aim to enhance farming efficiency and resource management. The survey, conducted in 2021 among corn producers in the Upper Midwest region, found that cost concerns, including initial investment, software subscriptions, maintenance, and operating costs, were the primary hindrance to PA adoption. Data privacy and brand compatibility were also significant concerns. The research indicates that farmers' age, farm size, and education influence their perceptions of these barriers. To address these issues, the study suggests offering financial support, such as farm loans and subsidies, to new adopters of PA technology. The adoption of PA technologies can have public benefits, including decreased fuel consumption, reduced greenhouse gas emissions, and improved water quality, through the efficient use of fertilizers and pesticides. The findings aim to help stakeholders identify target groups, customize development and research efforts, and promote efficient PA adoption on a broader scale.

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06 THEME: GHG emission reduction, ICT for agrifood sustainability

Use of digital tools in sustainable rice production in the Mekong Delta, Vietnam

September 11, 2023 | Rice Today (IRRI) |

A review of the digital ecosystem in the rice value chain in Vietnam highlights the limited presence of digital tools focused on rice production. Although a small proportion of surveyed farmers use agriculture-specific digital apps for rice farming, 75% express their willingness to use mobile apps for farming needs. This suggests a potential gap between farmers' needs and the offerings of existing tools. Face-to-face interactions with field agents remain the most common and trusted methods for technical advice and performance assessment for farmers. Digital messaging tools complement these processes but do not replace in-person interactions. Information flows in digital formats are strongest for weather, crop variety, and market-related Theme, while Theme like irrigation, drainage, harvest, and post-harvest have the least digital exchange. The majority of farmers who can access agricultural applications are male, indicating the need for gender-inclusive digital tools and a deeper analysis of gender roles in agriculture. The findings support the Agroecological TRANSITIONS program and the Agricultural Transition Digital Tools (ATDT) project, which focuses on research and engagement with digital tools for sustainable rice production in the Mekong River Delta.

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07 THEME: Carbon sequestration, GHG emission reduction, Policy incentives, financing, pricing

FACT SHEET: Marking One Year of the Inflation Reduction Act (USDA)

August 16, 2023 | USDA |

The Inflation Reduction Act, signed one year ago by President Biden, represents a significant investment in climate action and various aspects of the U.S. economy. The law aims to lower energy costs, foster economic opportunity, and address climate change by focusing on agriculture, forest restoration, and rural communities. Key provisions of the law include increasing access to lower-cost clean energy and improving energy efficiency, promoting climate-smart agriculture and conservation, and enhancing wildfire and extreme heat resilience in communities.

Under this act, the U.S. Department of Agriculture (USDA) has been allocated significant funding to facilitate the transition to clean and affordable energy in rural areas. The USDA has launched initiatives like the Empowering Rural America program, Powering Affordable Clean Energy program, and Rural Energy for America Program to support the purchase of renewable energy systems, energy efficiency improvements, and the availability of domestic biofuels.

The legislation also allocates substantial funding to address climate change through conservation, forestry, and climate-smart agriculture programs. It offers resources for the Natural Resources Conservation Service, dedicated to improving conservation programs. Additionally, the act emphasizes the importance of scientific research, allocating $300 million to track carbon sequestration and greenhouse gas emissions.

The Inflation Reduction Act furthers the goal of creating a diverse and equitable agricultural future by providing support to distressed borrowers, investing in land access programs, offering

financial assistance to farmers who faced discrimination, and launching the NextGen program to develop the next generation of leaders in food, agriculture, and natural resources.

This legislation is part of a broader effort to build a more equitable, sustainable, and climate-resilient future for the United States.

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08 THEME: Carbon sequestration, Policy incentives, financing, pricing; ICT for agrifood sustainability

Indigo's $250M Raise Boosts Agricultural Carbon Credits Generation

September 15, 2023 | Carbon Credits |

Indigo Ag, a leader in sustainable agriculture, has secured over $250 million in funding to expand its sustainable agriculture initiatives and bolster farmers' revenues through carbon credit generation. The investment was led by Flagship Pioneering, an existing investor, and saw participation from new investors, including Lingotto, an investment management company owned by Exor, one of Europe's largest diversified holding firms. This funding is expected to almost double the company's revenue.

Indigo Ag's unique carbon farming program offers companies high-quality agricultural carbon credits across 14 countries, providing a market-based approach to carbon capture and storage in soils. The program combines soil sampling and modeling to enable farmers to generate carbon credits that meet industry quality standards, which are then verified and issued by the Climate Action Reserve.

By implementing climate-friendly practices, such as regenerative farming, farmers can participate in this program and generate carbon credits. These practices include activities like planting cover crops and reducing soil tillage. With this new capital injection, Indigo aims to achieve up to $100 million in revenue by 2024, providing a boost to farmers' incomes and supporting their sustainability efforts.

Indigo Ag has been successful in expanding its digital sustainability program and delivering sustainable products to partners in various sectors, helping reduce carbon emissions across the agriculture value chain. With its innovative approach, the company is actively contributing to decarbonizing the agricultural industry and addressing climate change.

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09 THEME: GHG emission reduction, Policy incentives, financing, pricing

Greenhouse gas emissions will increase by more than 4% in 2021. Scholars call on the Ministry of Environment to review industrial emission reductions (In Chinese)

August 28, 2023 | Environnemental Information Center, Taiwan |

In 2021, Taiwan experienced a 4.56% increase in net greenhouse gas emissions, with the manufacturing industry's increased energy consumption being a major contributing factor. The nation's carbon emissions rose due to strong industrial activity. To achieve the legally mandated 10% reduction target by 2025, it's estimated that Taiwan would need to reduce emissions by 3% each year for the next 2-3 years. Environmental experts are urging the new Minister of the

Environment, Xue Fusheng, to follow Germany's example by convening a Climate Expert Committee to reassess carbon reduction measures across various sectors.

In 2021, post-pandemic economic growth, along with increased investment from Taiwanese businesses returning home, resulted in a 4.4% increase in electricity consumption in the manufacturing sector. With an additional 12 billion kWh of electricity consumed, manufacturing accounted for 10.7 billion kWh. It is worth noting that the government has not introduced proactive policies in the energy-intensive manufacturing sector, which is a major contributor to carbon emissions, in areas like industrial energy efficiency, renewable energy usage, and the retirement of coal boilers. Experts emphasize that to meet Taiwan's 2025 carbon reduction goals, more ambitious policies are needed, especially in the manufacturing sector.

The Climate Action Network in Taiwan is encouraging the government to promote energy efficiency and a low-carbon transformation in manufacturing, as well as to stimulate the use of renewable energy and energy-saving practices.

These efforts would help the nation meet its carbon reduction targets and move towards a more sustainable future.

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10 THEME: MRV (measurement, reporting, verification), Policy incentives, financing, pricing

Climate Change Administration, Ministry of Environment: Carbon trading regulations in place by the end of this year, carbon fees to be levied in 2025 (in Chinese)

August 24, 2023 | Environmental Information Center, Taiwan |

Taiwan's newly established Climate Change Administration, Ministry of Environment, has unveiled its schedule for implementing carbon fees. By early 2024, the carbon fee rates will be determined, followed by a review of carbon emissions in 2024, and the actual collection of carbon fees beginning in 2025. Approximately 500 regulated entities across Taiwan, responsible for emissions exceeding 25,000 tons annually, will be required to pay their first carbon fees in 2025. The fee amounts will be calculated based on the emissions reviewed in 2024. Taiwan aims to align with the EU's Carbon Border Adjustment Mechanism (CBAM), enabling Taiwanese companies to offset EU carbon tariffs by paying carbon fees in Taiwan.

Environmental groups have criticized the delay in implementing carbon fees, highlighting the potential loss of nearly NT$60 billion in revenue if collection is delayed by just one year. To be effective in advancing the net-zero goal, the Climate Action Network in Taiwan suggests the importance of proceeding with the carbon fee collection without further delay. The carbon fees will be adjusted individually for different industries to encourage emissions reduction aligned with sector-specific targets. The goal is to have the carbon fees system fully operational by year-end.

The creation of the Taiwan Carbon Solution Exchange, set to announce its "Voluntary Emission Reduction Measures" next month, and the "measures for the management of transfer, transaction or auction of carbon credits" in November, is expected to further enhance the country's carbon emissions control framework. Additionally, the rules governing the proportion

of "carbon credits offsetting carbon fees" will be revealed by year-end, but how this impacts international carbon rights is yet to be determined.

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11 THEME: GHG emission reduction, ICT in agrifood sustainability

Smart farms showcase innovative technologies to propel the aquaculture industry into new areas of smart energy saving (In Chinese)

August 26. 2023 | China Times, Taiwan |

The article discusses the initiative led by the Kaohsiung City Government's Marine Bureau to promote smart aquaculture equipment deployment in collaboration with National Kaohsiung University of Science and Technology's aquaculture team and smart aquaculture equipment manufacturers. This collaborative effort aims to share intelligent aquaculture technologies, reduce aquaculture risks and labor requirements, and enhance the environment for setting up intelligent aquaculture systems, ultimately increasing fishermen's income and promoting sustainability and productivity in the aquaculture industry.

The director of the Marine Bureau, Zhang Hanxiong, visited the Gangshan aquaculture area to observe the successful aquaculture equipment integration and had discussions with fishermen, engaging in two-way communication. During this visit, the general manager of the Gangshan Aquaculture Fishery Development Association, Yeh Jitian, showcased and explained innovative technologies such as drone-assisted aquaculture, independent regional network aquaculture, energy-saving systems with rotating cameras, and smart hydroelectric systems.

Recognizing that electricity costs are a significant part of aquaculture production costs and with a goal of achieving net-zero carbon emissions by 2050, the initiative aims to improve aquaculture efficiency and reduce carbon emissions by adopting energy-efficient, data-driven, and Internet of Things (IoT) technologies. These advancements are expected to enhance production efficiency, save energy, minimize waste, and support the sustainable development of the aquaculture industry. The Marine Bureau will continue to promote education on the latest aquaculture technology for fishermen, assist them in adopting smart aquaculture equipment through subsidies, and push for the widespread adoption of these innovative technologies to transform the aquaculture industry into a smart, energy-efficient era.

POLICY

01 THEME: Climate smart agriculture

Comprehensive Package for Promoting Smart Agriculture (Japan)

Japan Ministry of Agriculture, Forestry and Fisheries| Source | Download |

Introduction: After conducting an extensive analysis of the "Smart Agriculture Project" in alignment with the Basic Plan for Food, Agriculture, and Rural Affairs, the Ministry of Agriculture, Forestry, and Fisheries has crafted a comprehensive strategy with the aim of accelerating the integration of smart agriculture practices within the agricultural sector. This strategy, aptly named the "Comprehensive Package for Promoting Smart Agriculture," encompasses a wide range of initiatives presently underway in agricultural demonstration projects across the nation.

This comprehensive package revolves around six key pillars that delineate the direction of their efforts:

- **Demonstration and Analysis of Smart Agriculture:** The ministry is wholeheartedly committed to conducting thorough demonstrations and in-depth analyses of smart agriculture practices.
- **Cultivation and Dissemination of Agricultural Support Services:** There is an active push to promote the cultivation and widespread dissemination of agricultural support services, with the primary objective being the reduction of initial costs associated with adopting smart agriculture technologies.
- **Further Technology Development:** A dedicated focus on the continuous development of cutting-edge agricultural technologies is a top priority.
- **Strengthening Technological Responsiveness and Human Resource Development:** Simultaneous efforts to fortify their ability to swiftly respond to technological advancements while nurturing a pool of skilled human resources within the field.
- **Practical Environment:** The ministry is committed to creating a practical and enabling environment conducive to the successful implementation of smart agriculture practices.
- **Overseas Expansion:** Their strategy also includes plans for extending the reach of smart agriculture initiatives beyond national borders.

Of significance is the ministry's ambition to enable nearly all farmers to engage in data-based agriculture by the year 2025. To achieve this ambitious goal, they have devised a series of strategies:

- **Smart Support Teams:** The establishment of smart support teams, consisting of producers, private businesses, and other stakeholders with expertise acquired through demonstrations. These teams will play a crucial role in providing essential support to production areas actively embracing new technologies.

- **Agricultural Support Services:** A comprehensive support system will be extended to producers and production areas that express interest in smart agriculture but encounter obstacles in pursuing it independently. Agricultural support services are set to be instrumental in facilitating this journey.
- **Data Support from Extension Instructors:** The ministry is unwavering in its commitment to providing data support through the expertise of extension instructors, which will further enhance the adoption of smart agriculture practices.

Through this all-encompassing approach to supporting producers and guiding production areas, the ministry's goal is to harness local data to its fullest potential while concurrently cultivating a skilled workforce fully dedicated to the advancement of smart agriculture.

02 THEME: Climate smart agriculture; Nature-based solution; Net zero stratgy; Supply chain; Sustainable consumption

Strategy for Sustainable Food Systems, MIDORI (Japan)

Japan Ministry of Agriculture, Forestry and Fisheries| Source | Download |

Introduction: A multitude of global challenges loom over the agriculture, forestry, fisheries, and food sectors, most notably the pressing issues of climate change and the escalating frequency of large-scale disasters. Compounding these challenges, Japan's agriculture, forestry, and fisheries industries are grappling with a labor shortage, primarily due to the aging of the population. In response to these critical concerns, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) introduced the Strategy MIDORI (green), a blueprint for building a sustainable food system, on May 12, 2021.

Named "MIDORI," this medium- to long-term strategy charts the course for the future and focuses on two key pillars:

- **Enhancing Stakeholder Engagement:** The strategy underscores the importance of involving stakeholders at every juncture of the food supply chains, fostering collaboration and shared responsibility.
- **Promoting Innovation for Reduced Environmental Impact:** Innovation will be a cornerstone of efforts to mitigate the environmental footprint of these industries.

By the year 2050, MAFF has set ambitious targets that encapsulate its commitment to sustainability:

- **Zero CO_2 Emissions from Fossil Fuel Combustion:** MAFF aims to eliminate carbon dioxide emissions resulting from the use of fossil fuels in agriculture, forestry, and fisheries.
- **50% Reduction in Risk-Weighted Use of Chemical Pesticides:** This reduction will be achieved through the widespread adoption of Integrated Pest Management practices and the implementation of newly-developed alternatives to chemical pesticides.
- **30% Reduction in Chemical Fertilizer Use:** A significant reduction in the reliance on chemical fertilizers is envisaged.

- **Expansion of Organic Farming:** The goal is to increase the land under organic farming to 1 million hectares, which would be equivalent to 25% of total farmland.
- **30% Enhancement in Productivity of Food Manufacturers by 2030:** This target underscores the drive for greater efficiency and productivity among food manufacturers.
- **Sustainable Sourcing for Import Materials by 2030:** MAFF aims to ensure that the sourcing of import materials aligns with sustainability principles.
- **Superior Varieties and Enhanced Forestry Seedlings:** The aim is to have over 90% superior varieties and F1 plus trees in forestry seedlings.
- **100% Artificial Seedling Rates in Aquaculture:** The objective is to achieve a 100% rate of artificial seedlings in the aquaculture of species such as Japanese eel and Pacific bluefin tuna.

MIDORI's Approach to Sustainable Food System

- **Input**

1. Reducing Environmental Impact
2. Sustainably sourcing materials and energy.
3. Effective utilization of local and unused materials.
4. Encouraging research and development for the reuse and recycling of resources.

- **Production: Innovating for Sustainability and Productivity**

1. Transitioning to more sustainable and productive methods.
2. Implementing eco-friendly materials and machinery.
3. Developing and propagating plant varieties with reduced environmental impact.
4. Carbon sequestration in farmlands, forests, and oceans.
5. Enhancing the work environment.
6. Responsible management of fisheries resources.
7. Processing and Distribution: Promoting Sustainable Practices
8. Shifting to sustainable imported materials.
9. Enhancing efficiency through data science and AI.
10. Research and development of long-lasting packaging materials.
11. Strengthening the competitiveness of a decarbonized, eco-friendly food industry.

- **Consumption: Engaging with Consumers**

1. Minimizing food loss and waste.
2. Bridging the gap between consumers and producers.
3. Promoting the Japanese diet as a balanced model.
4. Incorporating sustainability into daily life.
5. Advocating for sustainably-harvested and cultured seafood.

03 THEME: Climate smart agriculture; Nature-based solution

Plan for Global Warming Countermeasures of the Ministry of Agriculture, Forestry and Fisheries (Japan)

Japan Ministry of Agriculture, Forestry and Fisheries| Source | Download |

Introduction: The "Plan for Global Warming Countermeasures of the Ministry of Agriculture, Forestry, and Fisheries" is a strategic initiative crafted by Japan's Ministry of Agriculture, Forestry, and Fisheries to confront the pressing issues brought about by global warming. This comprehensive plan is designed to not only combat the adverse effects of climate change but also advance sustainability within the realms of agriculture, forestry, and fisheries.

This multifaceted plan encompasses several key components and strategies:

- **Greenhouse Gas Reduction:** The plan delineates specific measures aimed at curbing greenhouse gas emissions within the agricultural, forestry, and fisheries sectors. These measures encompass the promotion of sustainable agricultural practices, the preservation and restoration of forests, and the advocacy of sustainable fishing methods.
- **Sustainable Production Methods:** A central emphasis of this plan is the adoption of more efficient and eco-conscious production methods across agriculture, forestry, and fisheries. This entails optimizing land utilization, undertaking reforestation efforts, and safeguarding precious fishery resources.
- **Adaptation Strategies:** In recognition of the challenges posed by climate change, the plan incorporates adaptive strategies. These encompass the introduction of cutting-edge technologies in agriculture and fisheries, alongside the reinforcement of risk management measures.
- **Contribution to Local Communities:** The Ministry actively collaborates with local communities to implement climate change countermeasures that align with their distinct requirements. The plan places great importance on region-specific initiatives that harness local attributes and resources to address climate change effectively.

In October 2021, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) revised this plan to align with the "Strategy for Sustainable Food Systems" and other measures. This revision is intended to maximize efforts in advancing global warming prevention measures within the agriculture, forestry, and fisheries sectors. The primary objectives of this revision are to achieve new greenhouse gas reduction targets for Fiscal Year 2030, which entail a 46% reduction from Fiscal Year 2013 levels, with the aspiration of further pushing for a 50% reduction. Additionally, MAFF's revised plan aligns with the broader goal of attaining carbon neutrality by the year 2050.

04 THEME: Nature-based solution; Net zero strategy

FOLU NET SINK Indonesia's Climate Actions Towards 2030 (Indonesia)

Indonesia Ministry of Environment and Forestry| Source | Download |

Introduction: "FOLU NET SINK Indonesia's Climate Actions Towards 2030" is a comprehensive and strategic initiative undertaken by the Republic of Indonesia to address climate change and reduce greenhouse gas emissions. The acronym "FOLU" stands for "Forests, Land Use, and Land Use Change," highlighting the central role of these aspects in Indonesia's climate mitigation efforts.

Key features and objectives of the "FOLU NET SINK Indonesia's Climate Actions Towards 2030" initiative include:

- **Emissions Reduction:** The primary goal of the initiative is to significantly reduce Indonesia's greenhouse gas emissions, with a focus on emissions related to land use, deforestation, and forest degradation. Indonesia is one of the world's largest emitters of carbon dioxide due to deforestation and peatland degradation.
- **Reforestation and Afforestation:** The initiative promotes reforestation and afforestation efforts to increase forest cover and sequester carbon. This involves planting new trees and restoring degraded forest ecosystems to enhance their capacity as carbon sinks.
- **Sustainable Land Use Practices:** Indonesia aims to adopt sustainable land use practices, including improved agricultural techniques and land management approaches, to reduce emissions from agriculture and land use change.
- **Conservation of Peatlands:** Peatlands play a significant role in carbon storage and the preservation of biodiversity. The initiative emphasizes the conservation and restoration of peatland ecosystems to prevent carbon release and protect these important natural resources.
- **Engagement with Stakeholders:** Collaboration with various stakeholders, including government agencies, local communities, non-governmental organizations, and international partners, is crucial for the success of the initiative. This collaboration helps ensure that climate actions are effective, inclusive, and sustainable.
- **Policy Framework:** Developing a comprehensive policy framework and regulatory measures to support emissions reduction and sustainable land use practices is a key component of the initiative.
- **Monitoring and Reporting:** Regular monitoring and reporting mechanisms are put in place to track progress toward emissions reduction targets and to ensure transparency and accountability.
- **Climate Resilience:** In addition to mitigation efforts, the initiative also focuses on enhancing Indonesia's climate resilience, which includes measures to adapt to the impacts of climate change, such as rising sea levels and extreme weather events.

05 THEME: Climate smart agriculture; Net zero strategy

Agriculture and rural carbon neutrality and climate change adaptation in Korea, 2021

Ministry of Agriculture, Food, and Rural Affairs in Korea| Source |

Introduction: The Ministry of Agriculture, Food, and Rural Affairs (MAFRA) in Korea has laid out a comprehensive roadmap for achieving carbon neutrality in agriculture and rural areas while also enhancing resilience to climate change. The contributions to carbon neutrality in Korea's agriculture and rural regions are centered on two key strategies: minimizing greenhouse gas emissions and transitioning to renewable energy sources, all while bolstering climate change response capabilities.

2nd Basic Plan for Climate Change: The development and announcement of the "2nd Basic Plan for Climate Change Response in the Agricultural and Rural Sectors," which contains a detailed action plan to achieve carbon neutrality goals.

- **Expansion of Low-Carbon Agricultural and Livestock Production:** Focusing on establishing a foundation for low-carbon farming practices for both agricultural and livestock industries.
- **Cultivating Subtropical Income Crops:** Promoting the cultivation of income crops that are adapted to changing climate conditions and technological advancements.
- **Enhanced Meteorological Disaster Early Warning Services:** Expanding nationwide meteorological disaster early warning systems to better prepare for climate-related challenges.
- **Support for Low-Carbon Agriculture Practices:** Prioritizing practices in sectors like livestock farming and rice farming that contribute significantly to greenhouse gas emissions. This includes:
- **Livestock Farming:** Measures include reducing emissions from livestock by optimizing breeding practices, supplying high-quality forage, and distributing low-methane feed.
- **Fertilizers and Pesticides:** Development and dissemination of farming methods that reduce greenhouse gas emissions, such as innovative irrigation techniques and precision spraying technology.
- **Energy Conversion:** Establishing an "Agricultural and Rural Energy Conversion Plan" that includes the transition to renewable energy sources for major agricultural facilities, including the 'RE100' initiative.

In addition to these strategies, MAFRA is committed to supporting the early scrapping of outdated agricultural machinery and vehicles that do not meet air pollutant emission standards, thereby further contributing to the reduction of emissions and advancing the goals of carbon neutrality and climate change adaptation in Korea's agriculture and rural sectors.

06 THEME: Climate smart agriculture

Working Plan for Korea MAFRA in 2023

Korea Ministry of Agriculture, Food, and Rural Affairs| Source | Download |

Introduction: The Ministry of Agriculture, Food, and Rural Affairs (MAFRA) is dedicated to accomplishing ten key objectives that encompass critical areas such as food security, the industrialization of future growth, ensuring the safety net for farm management, fostering appealing rural communities, and enhancing animal welfare. MAFRA's overarching mission is to advance core tasks, emphasizing agricultural innovation, self-reliance, creativity, and increased support for vulnerable populations through solidarity and cooperative efforts.

For the year 2023, MAFRA has outlined four major priorities:

- **Enhancing Rural Support and Cultivating a Growth-Oriented Environment:** Strengthening support systems for rural villages while creating an environment conducive to growth.
- **Industrializing Future Agricultural Growth:** Focusing on the industrialization of agriculture to drive future growth in the sector.
- **Ensuring Food Sovereignty and Enhancing Farm Management Stability:** A commitment to securing food sovereignty and bolstering the stability of farm management.
- **Safeguarding Companion Animals and Promoting a Culture of Animal Protection:** Guaranteeing the well-being of companion animals and fostering a culture of animal protection within society.

The task of future growth industrialization of agriculture implied the plan for smart agriculture and climate change. The goals of this task include:

- Cultivating 30,000 young farmers to lead agricultural innovation and fostering an innovation ecosystem in the agricultural and food sector.
- Establishing a foundation for sustainable development through the transition to an environmentally friendly agricultural and livestock industry.

Here are the main contents of the industrialization of agriculture:

- **Nurturing Young Farmers**
- **Agricultural Digital Innovation:** Introducing rental smart farms to promote smart agriculture at 15 locations by approximately 2027. Establishing a smart farm big data platform by 2022 to facilitate data collection and utilization. Digitally transforming the agricultural product distribution chain, from production to consumption areas, which includes the expansion of smart Agricultural Production Centers (APCs), launching an online exchange platform from 2023 onwards, and digitizing transaction information in wholesale markets.

- **Fostering the Food Industry:** Strengthening research and development in green bio and new materials while improving systems to promote their industrial application. Identifying and promoting promising next-generation export foods. Enhancing Korean Wave marketing for traditional and Korean foods.
- **Agricultural Industry Innovation Ecosystem:** Establishing a platform for open and shared research data by around 2024. Expanding research and development efforts in emerging growth areas and increasing the agri-food fund to support agricultural and food venture startups.
- **Environmentally Friendly Agriculture:** Integrating eco-friendly agricultural production practices at 120 locations by around 2027. Making significant investments in research and development for carbon reduction. Expanding non-agricultural uses, such as energy conversion, for livestock waste, aiming to increase it from 10% in 2021 to 23% by 2027.
- **Enhancing the Quarantine System:** Developing and applying a livestock infectious disease risk assessment model by approximately 2024. Advancing the livestock quarantine system using big data by around 2027.

OPEN DATA

01 THEME: Land cover and soil

Soil Geographic Databases from ISRIC

ISRIC | Source | Data |

ISRIC – World Soil Information is an independent foundation with a mission to serve the international community as a custodian of global soil information. It supports soil data, information and knowledge provisioning at global, national and sub-national levels for application into sustainable management of soil and land. Simultaneously, numerous national, regional, local, and non-governmental organizations contribute soil information specific to their respective areas, often adhering to their unique procedures and standards.

ISRIC's data offerings are diverse and encompass critical resources for soil research. Among their notable products are the SoilGrids, which provide predictive maps of soil properties and classifications at a high-resolution of 250 meters, with broader generalizations available at 1km and 5km resolutions. Additionally, they maintain the WoSIS Soil Profile Database and the WISE v3.1 harmonized Global Soil Profile Dataset, both of which serve as valuable resources for soil scientists and researchers.

In its pursuit of advancing global soil knowledge, ISRIC goes beyond fundamental soil parameters. The organization is committed to developing information layers for soil functional parameters such as carbon stocks, water-holding capacity, and land degradation indicators. An exemplary project in this realm is "Soils Revealed," a visualization platform that offers insights into the changes in global soil organic carbon stocks resulting from historical and anticipated land management practices. ISRIC has played a pivotal role in the creation of this platform, underscoring its dedication to advancing our understanding of soil on a global scale.

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02 THEME: Land cover and soil

FAO Soils Portal

FAO | Source | Data hub |

The FAO Soils portal serves as an invaluable source of information and knowledge encompassing the various components and facets of soils. It underscores the significance and indispensability of this vital yet finite resource for a diverse audience, including policy makers, development planners, soil scientists, agricultural extension officers, students, and other practitioners.

This comprehensive portal offers access to an array of essential soil maps and databases, which include:

- Global Map of Salt-affected Soils
- Global Soil Organic Carbon Sequestration Potential Map (GSOCseq)
- Global Soil Organic Carbon Map (GSOCmap)
- FAO/UNESCO Soil Map of the World
- Harmonized World Soil Database v1.2

- Additional Global Soil Maps and Databases
- Regional and National Soil Maps and Databases
- Soil Profile Databases

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03 THEME: Land cover and soil

European Soil Data Centre (ESDAC)

The European Soil Data Center | Source | Data hub |

The European Soil Data Centre (ESDAC) is a comprehensive repository of soil-related information and datasets, offering a wealth of resources primarily focused on the European scale. The European Soil Database (ESDB) is an important source of data from many other data and services are derived. For instance, the "European Soil Database v2 Raster Library" contains raster (grid) data files with cell sizes of both 1km x 1km and 10km x 10km for many soil related parameters. The 10km x 10km raster data are in the public domain access and allow expert users to use the data for instance to run soil, water and air related models. The 1km x 1km raster data are available after a prior registration. However, where feasible, the center also provides links to national and global datasets to ensure a broader perspective.

The datasets within ESDAC are thoughtfully categorized into several key groups:

- **European Soil Database (ESDB) and Soil Properties:** In this category, you will find datasets that have been generated using the ESDB, as well as general European datasets that encompass various soil properties. These resources serve as a foundation for understanding soil characteristics across the European continent.
- **Soil Threats:** The second category encompasses datasets related to various soil threats, including erosion, soil organic carbon levels, landslides, compaction, salinization, soil biodiversity, contaminated sites, soil sealing, and more. These datasets offer insights into the challenges and vulnerabilities that soils in Europe may face.
- **Soil Functions:** In the third category, you'll discover datasets that delve into soil functions. These datasets shed light on the roles and capabilities of soils in supporting ecosystems, agriculture, and other critical functions. Understanding these functions is essential for sustainable land management.
- **Soil Point Data:** The fourth category houses soil point data, including information from initiatives such as LUCAS and SPADE. These point datasets provide detailed, location-specific information that can be invaluable for localized studies and analyses.
- **Project-Derived Data:** Lastly, the fifth category comprises data originating from various projects. These datasets result from collaborative efforts and research endeavors, offering specialized insights into specific soil-related Theme.

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04 THEME: Agrifood system, Climate action plans and programs, Land cover and soil

Carbon Action Agricultural Soil Carbon Sequestration Platform

Baltic Sea Action Group | Source | Dataset |

The Carbon Action Agricultural Soil Carbon Sequestration Platform, hailing from Finland, serves as a vibrant community dedicated to gathering and disseminating free data derived from their

extensive Carbon Action research initiatives. At the core of this research endeavor lies the STN MULTA research consortium, a driving force behind the Carbon Action investigations.

Coordinated by the Finnish Meteorological Institute, this collaborative research transcends geographical and disciplinary boundaries. Key participants in this expansive network include esteemed institutions such as the Natural Resources Institute Finland, the Finnish Environment Institute, the University of Helsinki, the University of Tampere, the University of Zurich, and the Ruralia Institute. Notably, several companies affiliated with the Carbon Action corporate platform also actively contribute to research projects.

Carbon Action research primarily focuses on exploring the impact of diverse carbon farming practices and land management strategies on the carbon balance, crop yields, and other crucial ecosystem functions. To gain insights into these critical questions, the research team establishes experiments and monitoring arrangements across Carbon Action farms, alongside other agricultural sites.

The hallmark of this research approach is the implementation of tailored carbon farming methods on 1.5-hectare plots within Carbon Action farms. These plots are juxtaposed with neighboring 1.5-hectare plots that serve as business-as-usual references. Importantly, each technique is rigorously tested across multiple farms, recognizing that outcomes are contingent on a multitude of factors, including the farmer's practices, soil characteristics, and geographic location. Notably, the repository highlights the experiences and findings from 20 of these so-called Advanced Carbon Action farms, among the 105 Carbon Action farms in the Field Observatory.

Currently, the repository houses a diverse range of data, including:

- Ongoing monitoring data from 20 intensive sites engaged in split-plot carbon farming trials, spanning from 2019 onward.
- Continuous records of soil moisture and temperature data gathered from the same 20 intensive sites.
- Detailed carbon farming plans and estimated carbon balance figures for 105 farms, spanning the duration of the experiment from 2019 to 2023.

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05 THEME: Land cover and soil

ESA Biomass Climate Change Initiative (Biomass_cci): Global datasets of forest above-ground biomass for the years 2010, 2017, 2018, 2019 and 2020, v4

European Space Agency | Source | Dataset |

The dataset at hand presents a collection of estimates pertaining to forest above-ground biomass (AGB) spanning the years 2010, 2017, 2018, 2019, and 2020. These estimations are the outcome of a sophisticated process that combines Earth observation data from various sources, depending on the specific year. These sources include data from the Copernicus Sentinel-1 mission, Envisat's ASAR instrument, and JAXA's Advanced Land Observing Satellite (ALOS-1 and ALOS-2), in conjunction with supplementary information from other Earth observation sources. It's essential to

note that this dataset is a product of the European Space Agency's (ESA's) Climate Change Initiative (CCI) program, executed by the capable Biomass CCI team.

This release, designated as version 4, represents a significant update compared to its predecessor, version 3. Version 4 introduces updated AGB maps for the years 2010, 2017, and 2018, along with entirely new AGB maps for 2019 and 2020. Furthermore, it includes novel AGB change maps covering consecutive years (2018-2017, 2019-2018, and 2020-2019) as well as a decadal interval (2020-2010). What sets version 4 apart is the inclusion of multi-temporal L-band observations across all biomes and years, enhancing the dataset's accuracy and comprehensiveness. The AGB maps now incorporate revised allometries, underpinned by an extended dataset of spaceborne LiDAR data sourced from missions such as GEDI and ICESat-2. Additionally, temporal dynamics are integrated into the retrieval algorithm to faithfully represent biomass changes as observed in remote sensing data. Notably, biases between the 2010 dataset and more recent years have been mitigated.

The dataset consists of two global layers:

- **Above Ground Biomass (AGB):** Measured in tons per hectare (i.e., Mg/ha), this layer quantifies the mass of woody components (stem, bark, branches, and twigs) of all living trees, excluding stumps and roots, expressed as oven-dry weight.

- **Above-Ground Biomass Uncertainty:** This layer provides per-pixel estimates of the uncertainty associated with above-ground biomass measurements, expressed as standard deviations in Mg/ha. It offers valuable insights into the precision and reliability of the biomass estimations.

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06 THEME: Climate smart & Net zero toolkit

Agricultural Emissions Online Calculator (New Zealand)

Ministry for the Environment, New Zealand | Source | Guide |

The Agricultural Emissions Calculator offers a convenient means of estimating the greenhouse gases emitted and sequestered by your farm. This user-friendly tool simplifies the process of assessing greenhouse gas emissions arising from livestock, manure management, nitrogen fertilizer utilization, and the carbon stored in forests on your farm. It employs the same methodologies and emission factors as outlined in the 2022 Measuring Emissions Guidance by the Ministry for the Environment, New Zealand.

Developed to provide valuable support to the He Waka Eke Noa | Primary Sector Climate Action Partnership, this calculator aligns with the environmental initiatives undertaken by the Ministry for the Environment in New Zealand.

The calculation method employed in this tool mirrors that of our Measuring Emissions Interactive Workbook 2020, a methodology already endorsed by He Waka Eke Noa. It's important to note that this tool employs a straightforward approach and does not account for variables such as emissions-efficient production practices, keeping the estimation process accessible and user-friendly.

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07 THEME: Agrifood system

Agricultural and Food Big Data Platform (Korea)

Korea Agrifood Data eXchange | Source |

The Agricultural and Food Big Data Platform serves as a pivotal data reservoir within the agricultural and food sector, aligned with the goals of the Korean New Deal policy. This platform facilitates the online buying and selling of agricultural and food data from both public institutions and the private sector. Furthermore, leveraging agricultural and food big data, it identifies and offers innovative services tailored to meet the public's needs while also providing data visualization.

Key Business Activities

- Accumulating a diverse and substantial volume of data within the agricultural and food sector.
- Acting as an intermediary for data transactions between suppliers and consumers.
- Creating and distributing customized data for users.
- Delivering services that encourage data convergence, innovation, and visualization.

How to Utilize the Platform

- **For buyers:** becoming a member of the Agrifood Big Data Exchange grants you access to purchase the desired products, with no special qualifications required. (Note: Some products are available for free without membership registration.)
- **For sellers:** if you intend to sell your data outside of the Big Data Platform Business Participating Center, you can initiate the process by consulting with the Korea Agro-Fisheries and Food Trade Corporation to obtain seller membership.