Issue 5
August 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.

The Research section this month covers a wide range of topics, and some highlights are how EU may transform agrifood system towards sustainability by developing circular economy, and how climate change may impact on plant pathogens and food security. The News section covers UN Food Systems Summit, IRRI's launch of carbon credit methodology for rice farming, as well as development of indicators to quantify ecological services and functions. The Policy section showcases national initiatives in emissions reduction and national GHG emission measurement and reporting. The highlight of the Open Data section this month is the introduction of the CGIAR's GUARIAN database and network that offers a wealth of research publications for accelerating agricultural innovation.

Content

RESEARCH

01 THEME: GHG emission reduction

Global food consumption and greenhouse gas emissions: Insights into supply chains

June 15, 2023 | Nature Food | Source |

This study, conducted by a research team from the Netherlands, China, and the UK, delves into the complex relationship between food consumption and greenhouse gas (GHG) emissions on a global scale. Traditional measures of GHG emissions tend to focus on production within a country's borders, but this study takes a broader perspective by considering the emissions associated with international trade in food.

The researchers analyzed data from 2000 to 2019 to assess the GHG emissions resulting from global food consumption. They used a unique approach that tracks the physical flow of traded goods and employs structural decomposition analysis to uncover the underlying drivers of emissions. What they found is that in 2019, GHG emissions linked to the global food supply chain accounted for a significant 30 ±9% of all human-caused GHG emissions.

Interestingly, the main culprits driving this increase in emissions were the rising consumption of beef and dairy products in rapidly developing countries. In contrast, developed countries with a higher proportion of animal-based foods witnessed a decrease in per capita emissions.

A notable trend identified in the study was the outsourcing of emissions through international food trade, particularly in beef and oil crops, which collectively contributed to an increase of approximately 1 gigaton of CO_2 equivalent emissions. This uptick was largely due to developing countries ramping up their food imports.

The study also highlights that two primary factors led to the overall rise in global emissions: population growth (+30%) and an increase in per capita food demand (+19%). Fortunately, emissions intensity from land-use activities decreased substantially (-39%), helping to offset some of the emissions growth.

In conclusion, the findings underscore the critical role of consumer and producer choices in mitigating climate change. To effectively reduce emissions, there is a need to incentivize the adoption of less emissions-intensive food products.

Read more: Changes in global food consumption increase GHG emissions despite efficiency gains along global supply chains

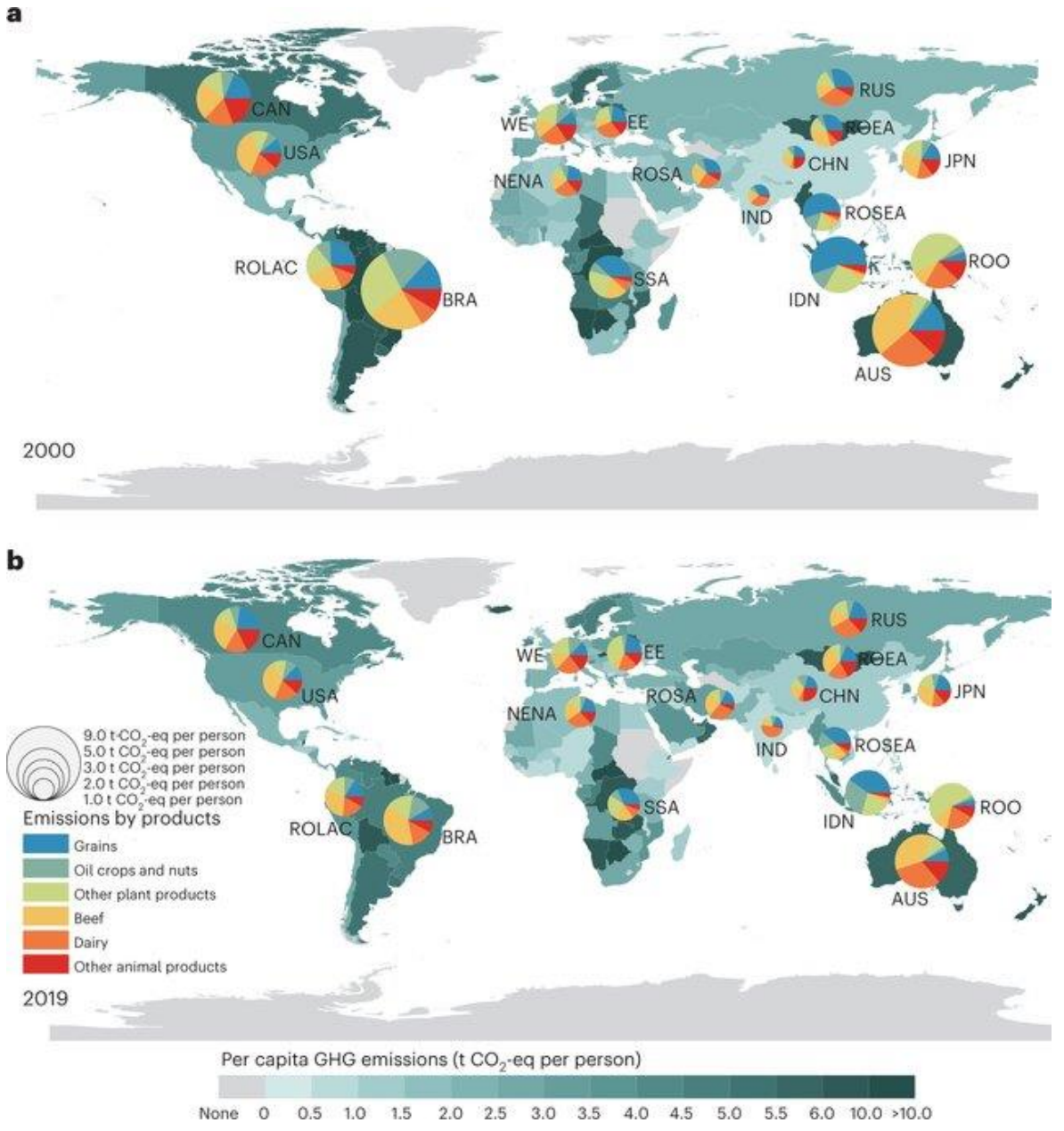


Figure | Per capita GHG emissions of food consumption by country in 2000 and 2019 a, b. The background map shows the level of per capita consumption-based emissions at the country scale in 2000 (a) and 2019 (b). The pie chart shows the fraction of average consumption-based emissions of animal-based and plant-based food products per person in 2000 (a) and 2019 (b), and the size represents per capita emissions of 18 countries/regions.

02 THEME: GHG emission reduction

Enhancing Sustainability in the Global Food System through Circular Practices in Europe

April 17, 2023 | Nature Food | Source |

This study, conducted by researchers from Wageningen University & Research, Cornell University, and others from Cyprus and Switzerland, examines how embracing circularity principles in the European food system can benefit both Europe and the world in terms of sustainability.

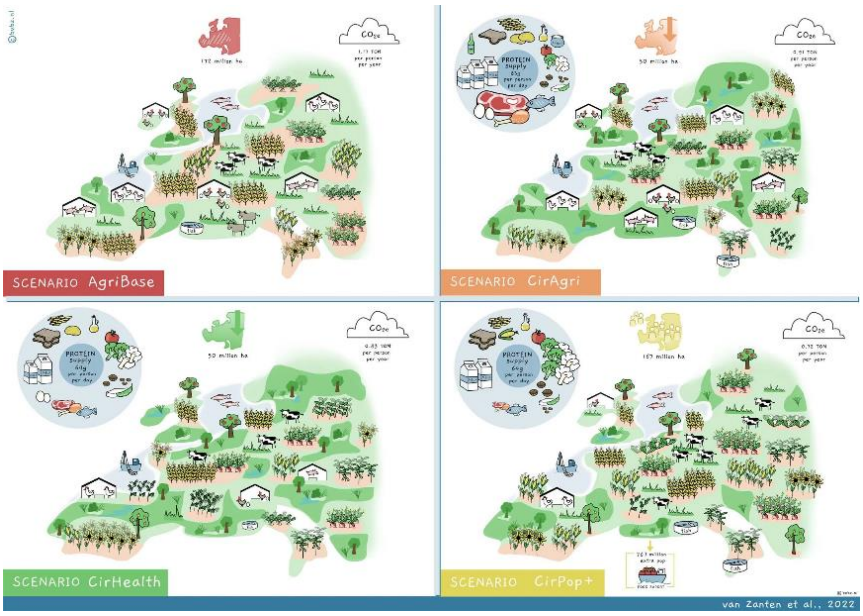
The research employs a biophysical optimization model to investigate the impact of three circularity scenarios within the European Union (EU)27 + UK. The findings indicate a potential 71% reduction in agricultural land use and a 29% decrease in per capita agricultural greenhouse gas emissions. These changes are achieved while maintaining the production of sufficient, nutritious food within a self-sustainable European food system.

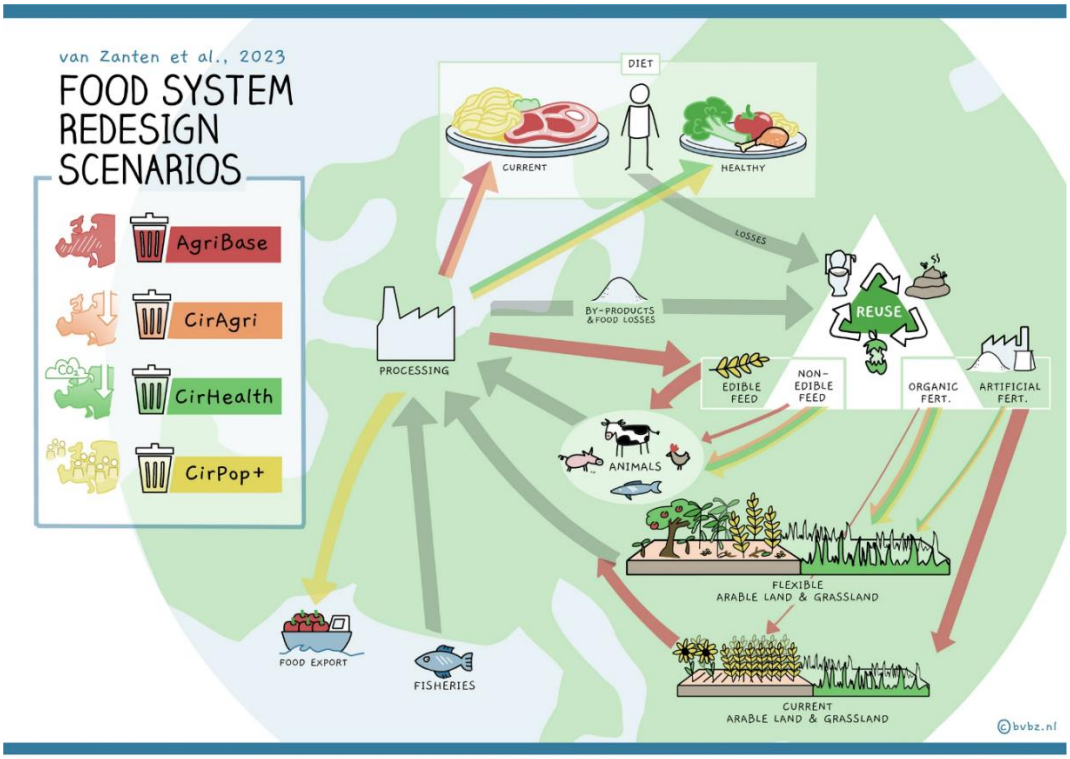
Furthermore, in times of global food scarcity, the saved agricultural land could potentially be utilized to provide nourishment for an additional 767 million individuals beyond the EU, representing a 149% increase. This transition would also lead to a notable 38% reduction in per capita greenhouse gas emissions. However, it's important to note that overall emissions would rise by 55% due to the increased population served.

In conclusion, the shift towards circularity in the EU's food system necessitates a series of transformative changes across all its components. Yet, this transformation holds substantial promise for safeguarding the health of both humans and the planet.

Read more: Circularity in Europe strengthens the sustainability of the global food system

Visual abstract





	AgriBase	CirAgri	CirHealth	CirPop+
Food supply based on current protein supply				
Food supply meets nutrient requirements & Eat Lancet recommendations				
Allow food losses and waste to be fed				
Current agricultural land use is fixed				
Objective function: minimize land use				
Objective function: minimize difference to current protein supply				
Objective function: maximize population				

Figure | Scenario configuration and illustration. The colours of the arrows and icons on the top left represent the different scenarios in the table. The arrows represent uses of biomass that differ among scenarios. In the case of the grey arrows, the assumptions related to the use of biomass are the same for all scenarios.

03 THEME: GHG Emission Reduction, Policy incentives, financing, pricing

Guiding sustainable and climate-resilient livestock systems investment

June 29, 2023 | Nature Sustainability | Source |

Livestock production, while crucial for economic growth, employment, and nutrition, also poses challenges related to climate change. A transition towards more sustainable and climate-resilient livestock systems is imperative, with the potential to positively impact the achievement of Sustainable Development Goals. Nevertheless, the question of where global investments should be directed to facilitate this transformation has remained unanswered.

A research team, comprising members from Wageningen University & Research, CG Centers in Kenya, France, and Colombia, has conducted a comprehensive assessment to determine priority regions for livestock system investments within 132 low- and middle-income countries, focusing on areas at mid- and low latitudes.

The study reveals a strong interplay between adaptation and mitigation objectives across the majority of these countries. By giving equal weight to both adaptation and mitigation indicators, the analysis identifies India, Brazil, China, Pakistan, and Sudan as the top five investment priorities. These nations function as pivotal control points in low- and middle-income countries, influencing how the livestock sector interacts with the climate system, land resources, and the livelihoods of their populations.

Read more: Priority areas for investment in more sustainable and climate-resilient livestock systems

Figure | Adaptation and mitigation options available for livestock systems in LMICs, constraints to their adoption in the selected countries and the relative importance of each constraint for the adoption of each option in general. Darker colours represent a higher constraint for the adoption of a particular option in each country, as determined by the quantile in which the country sits with respect to the global median. Indicators to represent each constraint include accessibility (research and development expenditure (percentage of GDP)), cost (GDP per capita), knowledge (literacy rate in the total adult population), labour (employment in agriculture) and land tenure (Rule of Law).

04 THEME: Others

Climate change, plant pathogens, and food security: Navigating the future

May 02, 2023 | Nature Reviews Microbiology | Source |

Plant diseases have emerged as a significant threat to global food security and the sustainability of our environment, leading to reduced productivity and biodiversity loss that detrimentally affect regions both socially and economically. The ongoing challenge is exacerbated by climate change, which alters the dynamics of pathogen development and host-pathogen interactions while promoting the emergence of new pathogenic strains. Climate shifts can also expand the geographic range of plant diseases, spreading them into new areas.

In this comprehensive review, researchers from Western Sydney University, the University of Alicante, and Colorado State University investigate how climate change is likely to reshape the landscape of plant diseases in the context of future climate scenarios. They explore the anticipated impacts on plant productivity within natural ecosystems and agriculture.

The study delves into the evolving biogeography of pathogens, changes in disease occurrence and severity, and the resulting consequences for natural ecosystems, agriculture, and food production. The authors propose that revising our current conceptual framework and integrating eco-evolutionary theories into research can enhance our understanding and predictive capabilities concerning pathogen spread in future climates, ultimately reducing the risk of disease outbreaks.

The research also underscores the critical need for a collaborative science-policy interface that collaborates closely with relevant intergovernmental organizations. This interface aims to effectively monitor and manage plant diseases under future climate scenarios, ensuring the long-term security of food and essential nutrients while safeguarding the sustainability of natural ecosystems.

Read more: Climate change impacts on plant pathogens, food security and paths forward

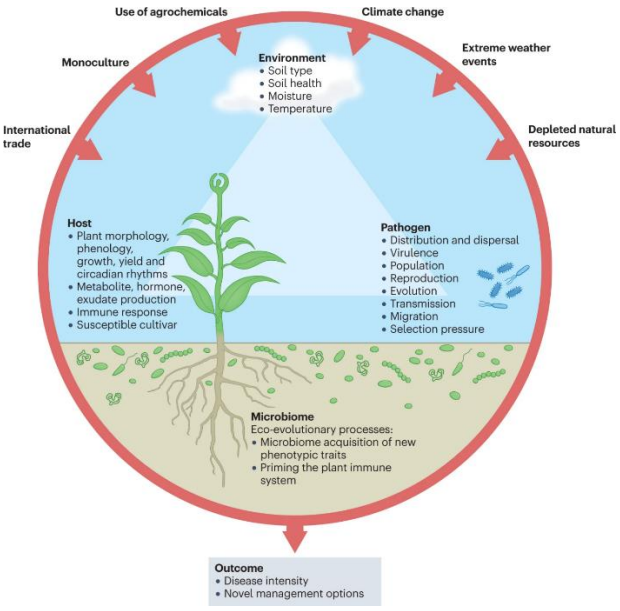


Figure | A new angle in the disease triangle paradigm that considers the plant microbiome as a pivotal factor influencing plant disease.

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

Implications of expanding organic farming on soil carbon stocks

June 29, 2023 | Nature Climate Change | Source |

Organic farming is often hailed for its potential to bolster soil organic carbon (SOC) stocks in croplands. However, the current footprint of organic farms on cropland is relatively small, leaving questions about how widespread adoption of organic farming might affect soil carbon dynamics, including carbon input and SOC stocks.

In this study conducted by researchers from INRAE, France, and the University of Aberdeen, UK, a spatially explicit biogeochemical model is employed to shed light on this matter. The model reveals that a global shift of all cropland to organic farming, without incorporating cover crops and plant residue (referred to as the normative scenario), could lead to a significant 40% reduction in global soil carbon input and a 9% decline in SOC stock.

However, there's a more optimistic scenario—termed the optimal organic scenario—that encourages widespread use of cover crops and enhanced recycling of plant residues. Under this approach, global soil carbon input decreases by 31%, but SOC can be preserved and even recover after 20 years of transitioning to organic farming.

These findings emphasize that expanding organic farming has the potential to hinder soil carbon sequestration unless it is accompanied by appropriate farming practices, such as cover cropping and residue recycling.

Read more: Soil organic carbon stocks potentially at risk of decline with organic farming expansion

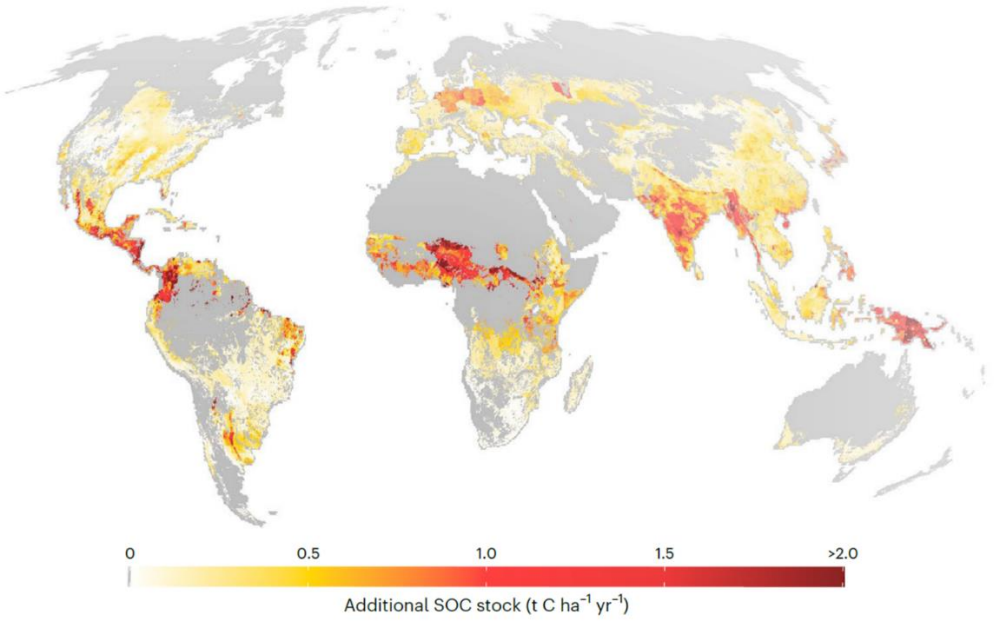


Figure | Additional SOC stocks per ha (t C ha^{-1} yr^{-1}) due to cover cropping in the optimal organic scenario compared to the normative organic scenario. The optimal organic scenario compared to the normative organic scenario.

06 THEME: Others

Elevated CO_2 and changes in global cropland nitrogen Cycles: Implications for food security and sustainability

June 22, 2023 | Nature Sustainability | Source |

Croplands play a critical role in ensuring global food security and are responsible for the largest nitrogen flows on our planet. Elevated levels of atmospheric CO_2 are a significant driver of climate change, impacting food production and environmental sustainability in various ways. However, our understanding of how the nitrogen cycle in croplands responds to elevated CO_2 remains limited.

In this study conducted by researchers from Zhejiang University, China and the University of Edinburgh, UK, demonstrated that elevated CO_2 (eCO_2) can have a profound impact on the nitrogen and carbon cycles in croplands. Specifically, eCO_2 leads to a synergistic enhancement of these cycles, resulting in a 19% increase in nitrogen-use efficiency and a remarkable 55% boost in biological nitrogen fixation within global croplands. This translates to higher crop nitrogen yields (+12 Tg yr^{-1}), reduced fertilizer requirements (−34 Tg yr−1), and a significant decrease in reactive nitrogen loss (−46 Tg yr^{-1}) by 2050 under future eCO_2 scenarios.

Crucially, the study estimates that the impact of eCO_2 on the altered nitrogen cycle in croplands could yield societal benefits totaling US$668 billion, primarily by preventing harm to human health and ecosystems. These benefits are anticipated to be most pronounced in China, India, North America, and Europe. Therefore, it is imperative to incorporate the influence of rising CO_2 levels on the nitrogen cycle into advanced Earth system models to provide robust scientific evidence for informed policymaking.

Read more: Nitrogen cycles in global croplands altered by elevated CO_2

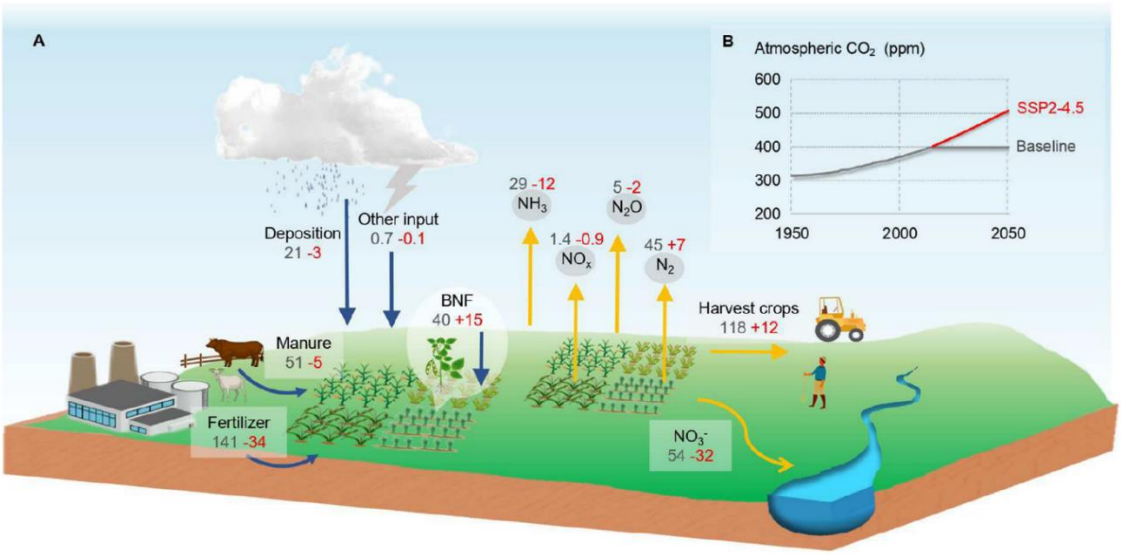


Figure | 3 N flows in global croplands under elevated CO_2 scenario (SSP2-4.5) by 2050. (A) N input and N output constitute the major N flows, represented by blue and yellow arrows, respectively. Values of N flows in dark grey denote flows in the baseline scenario with no climate change, while the red flows denote changes in flows under elevated CO_2 scenario (SSP2-4.5) relative to the baseline scenario. The numbers are future values derived from our simulations in Tg N per year by 2050. (B) Historical and future atmospheric CO_2 levels in the baseline scenario and elevated CO_2 scenario during 1950-2050.

07 THEME: ICT in agrifood sustainability

Creating a practical algorithm for real-time monitoring of crop growth using combined satellite data

June 26, 2023 | Remote Sensing of Environment | Source |

A research team comprising experts from South Dakota State University, the USDA, California State University Monterey Bay, and the University of Maryland has pioneered an advanced algorithm for real-time monitoring of crop development at the field level. They've achieved this by harnessing the power of various satellite data sources.

The challenge they addressed is the lack of timely, cloud-free satellite data to monitor crop growth as it happens. To overcome this, they've devised a novel algorithm that blends information from high-resolution satellites (Landsat and Sentinel-2) and geostationary satellites (which take frequent snapshots) to create uninterrupted time series data for assessing crop health.

What makes this algorithm unique is its ability to not only analyze current conditions but also predict how crops will progress. It uses information from previous years to anticipate future growth. This comprehensive system enables the identification of key stages in a crop's life cycle, such as when it starts to grow, matures, or goes dormant.

The real-time monitoring process is divided into three categories: near-real-time (detecting events shortly after they happen), real-time (identifying events as they occur), and short-term prediction (forecasting events before they occur). These predictions are continually updated every week throughout the growing season.

To validate the system, they compared their real-time predictions with established phenology methods, PhenoCam observations, and official Crop Progress Reports. The results demonstrate the algorithm's reliability, particularly in predicting when crops start growing in spring and when they go dormant in winter.

This innovation has the potential to revolutionize agriculture by providing farmers with timely and precise information about their crops, ultimately helping them make informed decisions for better yields and more efficient resource use. It's like having an advanced crop advisor available around the clock.

Read more: Developing an operational algorithm for near-real-time monitoring of crop progress at field scales by fusing harmonized Landsat and Sentinel-2 time series with geostationary satellite observations

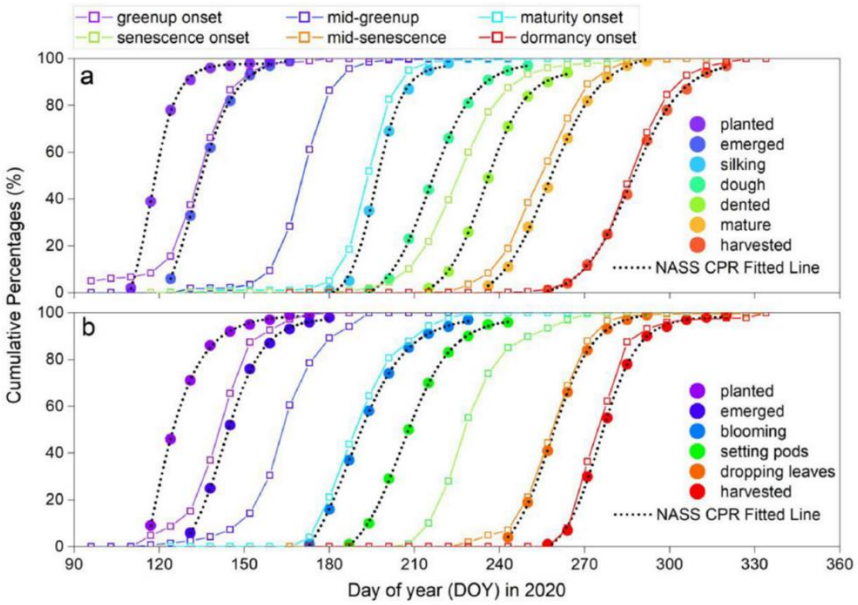


Figure | Comparisons of NASS CPR (solid circles) with HLS-ABI real-time predictions (hollow rectangles) for (a) corn and (b) soybean across Iowa in 2020. Note that the black dotted lines are fitted lines using logistic function.

08 THEME: Others

Nanotechnology in pest management for sustainable agriculture

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

In the pursuit of sustainable agriculture and higher crop yields, finding better ways to deal with pests is a top priority. Traditional pesticides have their shortcomings, including environmental harm and health risks. To address these issues, nanotechnology has emerged as a game-changer in agriculture. This review explores recent progress, environmental impacts, and the potential of nano-pesticides, drawing on the collaborative work of researchers from Chaudhary Charan Singh Haryana Agricultural University, All India Institute of Medical Science, India, University of Hohenheim, and Kansas State University.

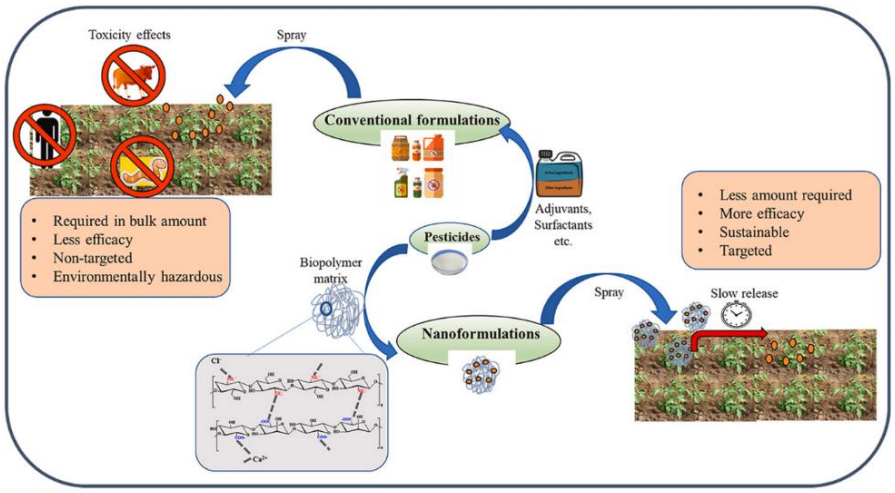
Nano-pesticides offer a promising alternative to conventional ones. They aim to reduce the excessive use of traditional pesticides while minimizing harm to the environment. Nano-pesticides use tiny particles, called nanomaterials, to enhance the effectiveness and longevity of pesticides. This review looks at various types of nano-pesticides, including those with nanomaterial-based active ingredients, nano-encapsulation, nano-emulsions, and nano-suspensions.

However, introducing nano-pesticides into agriculture raises important questions. We still have much to learn about how they behave in the environment, their impact on ecosystems, and how to regulate their use globally. Researchers are divided on whether nano-pesticides will significantly benefit agriculture or pose new risks. There's also an ongoing debate about how to fit these innovative pesticides into existing regulatory frameworks.

Given these complexities, it's crucial to weigh the pros and cons of nano-pesticides carefully. This review, informed by the collaborative work of a diverse team of experts, provides valuable insights into how nanotechnology could shape the future of pest management in agriculture, making it more sustainable and efficient.

Read more: Are nano-pesticides really meant for cleaner production? An overview on recent developments, benefits, environmental hazards and future prospectives

Graphical Abstract



09 THEME: Carbon sequestration, MRV (measurement, reporting, verification)

Remote estimation of soil organic carbon and nitrogen along tropical altitudinal gradients: A spectral imaging approach

July 15, 2023 | Journal of Cleaner Production | Source |

Efficiently monitoring soil organic carbon (SOC) and nitrogen content is essential for understanding and mitigating climate change and supporting sustainable land management. Historically, SOC estimation has primarily relied on labor-intensive laboratory analysis. However, as the need for large-scale, cost-effective monitoring of soil properties in remote and diverse environments has grown, there is a demand for innovative and mobile techniques.

In a collaborative effort, researchers from the University of Helsinki, the Helsinki Institute of Life Science (Finland), and Wuhan University (China) explored the potential of a portable hyperspectral imaging spectrometer, Specim IQ, operating in the visible-near infrared wavelength range. Their aim was to develop a practical approach for estimating SOC and nitrogen content across tropical altitudinal gradients, enabling more accessible and efficient monitoring of soil properties.

To achieve this, the team collected 191 soil samples from Taita Taveta County, Kenya, representing a diverse altitudinal gradient encompassing five typical land use types: agroforestry, cropland, forest, shrubland, and sisal estate. These soil samples were meticulously imaged using the Specim IQ hyperspectral camera under controlled laboratory conditions, and their carbon and nitrogen content was quantified through combustion analysis.

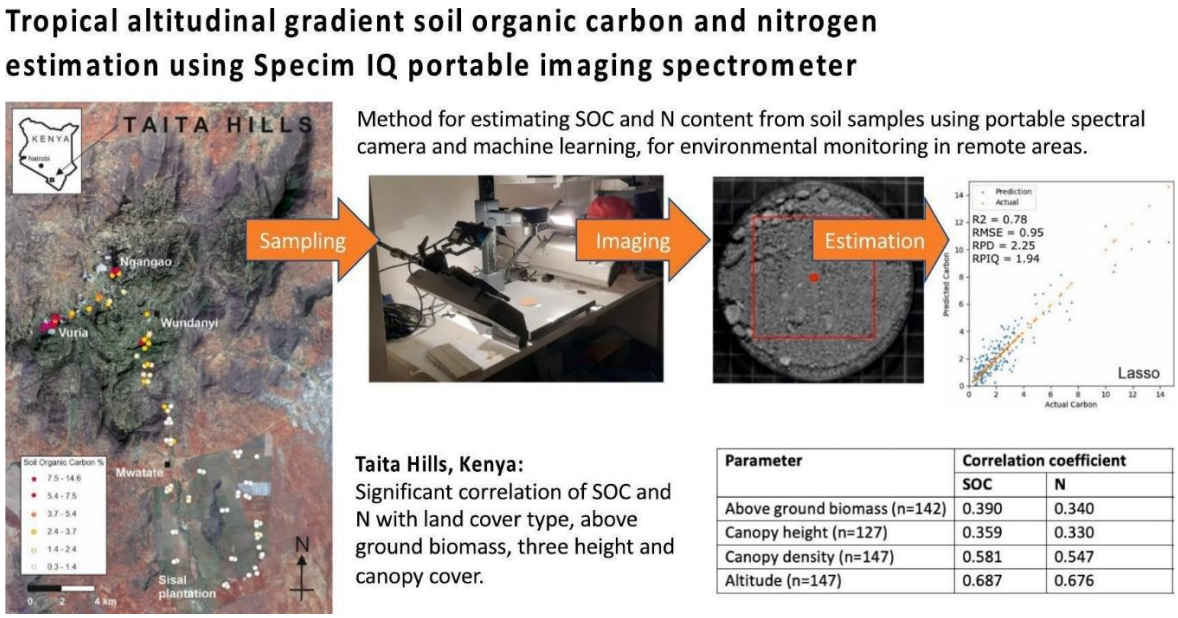
The study employed machine learning techniques to establish a relationship between the spectral images and the soil properties of interest. It also investigated the automatic selection of informative wavelengths and the quantification of prediction uncertainty. Remarkably, all five

alternative methods examined demonstrated robust performance, achieving a cross-validated R^2 value of approximately 0.8 and a root mean square error (RMSE) of just one percentage point. These outcomes underscored the feasibility of the proposed spectral imaging approach and the associated computational pipeline.

By showcasing the efficacy of this innovative imaging setup, the research offers a promising pathway toward cost-effective and mobile monitoring of SOC and nitrogen content in remote and environmentally diverse regions, providing valuable insights for land management and climate change mitigation.

Read more: Tropical altitudinal gradient soil organic carbon and nitrogen estimation using Specim IQ portable imaging spectrometer

Graphical abstract



Parameter	Correlation coefficient	
	SOC	N
Above ground biomass (n=142)	0.390	0.340
Canopy height (n=127)	0.359	0.330
Canopy density (n=147)	0.581	0.547
Altitude (n=147)	0.687	0.676

10 THEME: MRV

Assessing the environmental impact of Finnish broiler chicken production: Insights into climate change and water scarcity

July 20, 2023 | Science of The Total Environment | Source |

The consumption of poultry meat, particularly broiler chicken, has been steadily increasing in Finland. However, there has been a lack of updated information regarding the environmental impact of broiler production in the country. Notably, the specific impacts of broiler production on climate change and water scarcity have not been thoroughly investigated. To address this knowledge gap, researchers from the Natural Resources Institute Finland (Luke) undertook a comprehensive study utilizing Life Cycle Assessment (LCA) methodology to quantify the environmental effects of Finnish broiler chicken meat production.

In this study, a two-fold focus was placed on climate change and water scarcity impacts. To assess the latter, the AWARE (AWARE - Water Use in Life Cycle Assessment and Resource Efficiency) method was employed, marking its debut as a characterization method in the context of broiler chicken production. The research adhered to the European Commission's Product Environmental Footprint (PEF) guidelines wherever applicable to ensure consistency in LCA calculations.

The dataset used in this study was extensive, encompassing 89% of Finnish broiler chicken production in 2018, making the findings highly representative of the industry. The results revealed that the climate impact of Finnish broiler chicken meat was 2.37 kg CO_2 equivalent per kilogram of carcass weight (CW), accounting for the impact of land use change (LUC). Excluding LUC, the climate impact was measured at 1.82 kg CO_2 equivalent per kilogram of CW. Notably, the feed chain emerged as a significant contributor, responsible for nearly four-fifths (79%) of the climate change impact associated with Finnish chicken meat.

The study also shed light on the water scarcity impact, measuring it at 0.55 cubic meters equivalent (AWARE) per kilogram of CW. Intriguingly, the feed chain was identified as the primary driver, responsible for more than four-fifths (82%) of the water scarcity impact attributed to broiler production.

Furthermore, the research ventured beyond national-level assessments by providing farm-specific results for 20 individual farms. These farm-level insights not only highlighted variations in environmental impact but also outlined potential areas for improvement. The study underscores the critical role of feeds in influencing both climate change and water scarcity impacts in broiler chicken production, offering valuable insights for sustainable agricultural practices.

Read more: Environmental life cycle assessment of Finnish broiler chicken production – Focus on climate change and water scarcity impacts

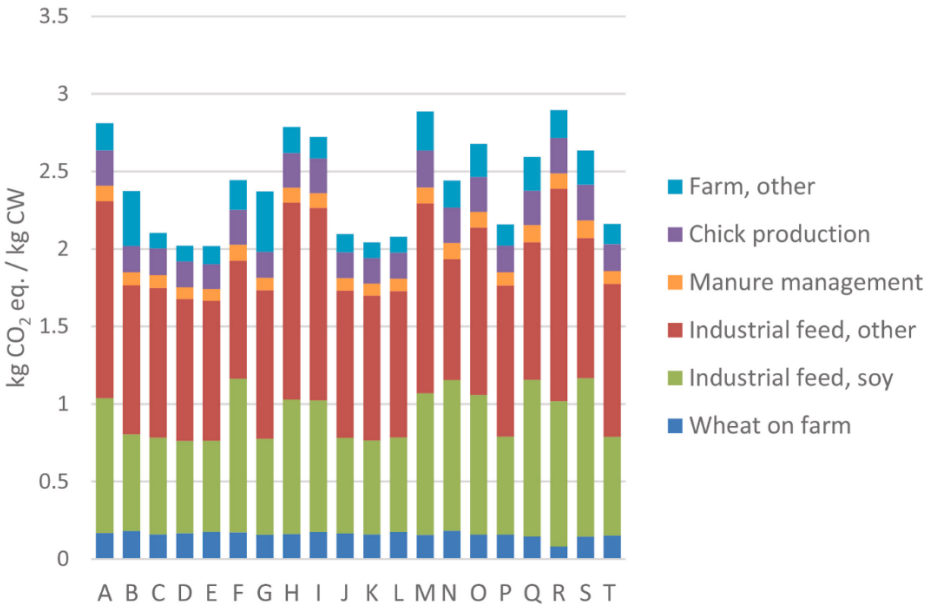


Figure | Broiler chicken climate change impact in 20 farms kg CO2 eq./kg CW (without slaughter process).

11 THEME: ICT in agrifood sustainability

Boosting agriculture's climate resilience: Mapping soil water capacity digitally

July 15, 2023 | Science of The Total Environment | Source |

Soil plays a crucial role in agriculture, but understanding its water-holding capacity, called available water capacity (AWC), can be challenging. Traditional methods for measuring AWC are labor-intensive, and creating detailed maps of AWC across a region is complex. To tackle this, researchers from the University of São Paulo in Brazil explored digital soil mapping (DSM) techniques, which use computers to predict AWC.

In their study, the team focused on the AWC in a southeastern region of Brazil. They collected data from various sources, including soil samples, remote sensing data, and weather information. The heart of their approach was a powerful algorithm called Random Forest (RF), which helped them create digital maps of AWC. These maps can be valuable for planning agriculture, especially in the face of local climate changes.

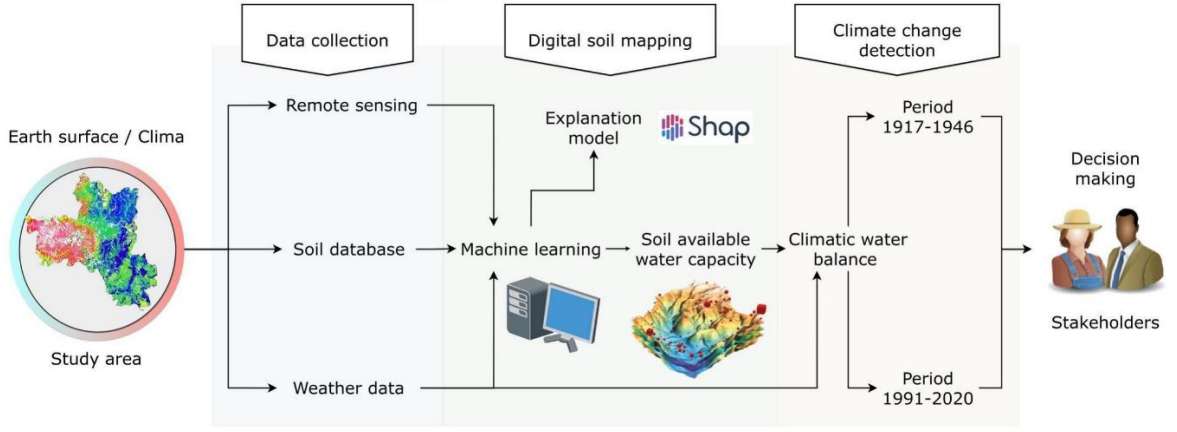
The study had two main parts. First, they used their data to develop a digital AWC map, and in the second part, they used this map alongside historical weather data to calculate how soil water levels changed over time. The results were promising, with the digital model accurately predicting AWC levels.

One exciting finding was that certain factors, like temperature and soil type, had a big impact on AWC. For example, during the dry season (from April to August), the soil could hold more water due to specific temperature patterns.

Overall, this research offers a practical way to understand and map soil water capacity, providing essential information for farmers to adapt their crop schedules to changing local climates, ultimately making agriculture more resilient.

Read more: Digital mapping of the soil available water capacity: tool for the resilience of agricultural systems to climate change

Graphical Abstract



NEWS

01 THEME: Policy incentives, financing, pricing

As UNFSS+2 closes, FAO reiterates its commitment to support nations in accelerating the pace of transforming agrifood systems

July 26, 2023 | FAO | Source |

The UN Food Systems Summit +2 Stocktaking Moment concluded after three days of high-level events, meetings, and dialogues with over 2,000 participants from 180 countries, including more than 20 Heads of State and Government and 125 Ministers. The event aimed to explore challenges and opportunities for transforming agrifood systems.

FAO Director-General QU Dongyu highlighted the importance of recognizing the complexity of food insecurity and malnutrition, driven by climate change, economic shocks, and conflicts. He emphasized the need for a high-level, long-term political commitment and the acceleration of efforts to address these challenges.

The United Nations Deputy Secretary-General, Amina Mohammed, presented a Call-to-Action on behalf of UN Secretary-General António Guterres, advocating for urgent action to close the implementation gap. She stressed the linkages between food systems, financing for development, debt relief, inclusion, engagement with non-state actors, and access to science, technology, and innovation.

The event highlighted the significance of various factors, including investment in infrastructure, circular economy and bio-economy, understanding the true cost of food, legal infrastructure, value chains, trade, and putting people at the center, especially youth and women.

Key messages included the importance of science, technology, and innovation for better production, efficient use of natural resources, aquatic foods to combat hunger and malnutrition, data and geospatial data, international cooperation, enabling policies and governance structures, digitalization, and the role of farmers in driving innovation and technology adoption.

The UN Food Systems Summit +2 Stocktaking Moment reviewed progress on commitments and identified priorities, building on the momentum of the 2021 Food Systems Summit. The next meeting, the UN Food Systems Summit +4, is scheduled for 2025.

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02 THEME: GHG emission reduction; Policy incentives, financing, pricing

UNFSS+2: FAO highlights the power of transforming agrifood systems for climate action

July 24, 2023 | FAO | Source |

The UN Food Systems Summit+2 Stocktaking Moment in Rome focused on climate action, with discussions on building climate-resilient agrifood systems and reducing their carbon footprint to meet global food demand while protecting the environment. FAO Director-General QU Dongyu emphasized that climate change is a key driver of food insecurity, with agrifood systems responsible for a third of global greenhouse gas emissions. He highlighted the need for urgent transformation to make these systems more efficient, inclusive, resilient, and sustainable. FAO is

taking bold climate action, including innovations to curb methane emissions, improve value chain efficiency, reduce food loss and waste, and restore ecosystems.

Italian Deputy Prime Minister Antonio Tajani stressed Italy's support for strong climate action and its commitment to the upcoming UN Climate Conference COP28. The UAE Minister of Climate Change Mariam Almheiri officially launched the COP28 Food Systems and Agriculture agenda, calling on governments to integrate climate adaptation and mitigation into national food system strategies. The event included participation from heads of state, government, and climate envoys, highlighting the importance of climate resilience for food security and sustainable livelihoods.

FAO will continue working with countries to ensure that agrifood systems contribute to climate, biodiversity, land degradation, and sustainable development goals.

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03 THEME: Others

OECD-FAO Agricultural Outlook 2023-32 maps key output, consumption and trade trends

June 7, 2023 | FAO | Source |

The FAO and OECD's Agricultural Outlook 2023-2032 predicts slower agricultural and food production growth over the next decade due to demographic trends. Global production of crops, livestock products, and fish is projected to grow at an average annual rate of 1.1%, down from the previous decade. Total food consumption is expected to rise by 1.3% annually, leading to an increase in the share of agricultural commodities used as food.

The report emphasizes the impact of rising fertilizer prices on food costs, with a 10% increase in fertilizer prices leading to a 2% increase in food costs, disproportionately affecting the poor. It calls for policies to ensure greater efficiency and resilience in the face of inflationary pressures.

While cereals production growth is expected to slow, driven by saturation levels in many countries, global crop production will be driven by yield improvements (79% of growth), cropland expansion (15%), and higher cropping intensity (6%). Meat consumption will increase in middle and lower-income countries, while per capita consumption in high-income countries will decline. Global trade in agricultural commodities is projected to expand at half the previous decade's pace, with slower demand growth from middle-income countries. Greenhouse gas emissions from agriculture are expected to increase by 7.5% in the next decade, with the livestock sector accounting for 86% of the increase.

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04 THEME: GHG emission reduction

What do we know about the future of aquatic foods in global agri-food systems?

June 8, 2023 | CGIAR | Source |

The CGIAR Foresight Initiative has released a series of notes summarizing research on the future of food systems. This note focuses on aquatic foods and highlights the following key points:

- **Rising Demand:** Demand for aquatic foods is increasing due to population growth, higher incomes, and recognition of their health benefits.
- **Role of Aquaculture:** Aquaculture has been crucial in meeting the growing demand for aquatic foods.
- **Nutrient-Rich and Low Impact:** Aquatic foods are nutrient-rich and have low emissions and land/water impacts, contributing to health, wellbeing, and rural livelihoods.
- **Complex Challenges:** Challenges include environmental issues, pollution, disease outbreaks, climate change, and governance.
- **Foresight Studies:** Recent studies have integrated aquatic foods into agricultural foresight models, projecting future supply, demand, and prices. They show that prices are expected to rise, especially in 2022 due to post-COVID recovery.
- **Regional Insights:** Different regions have varying prospects for aquatic food production and consumption. For example, ASEAN countries are expected to play a significant role, and Africa has great growth potential. Europe is projected to consume substantial amounts of fish.
- **Risks and Challenges:** Disease outbreaks, overfishing, climate change, and other factors pose risks to future aquaculture production and consumption.
- **Gaps in Research:** There is a need for more comprehensive and disaggregated foresight modeling for aquatic foods to address their complexity and diversity. Research should focus on areas like poverty alleviation, nutrition, gender equity, and environmental sustainability.

In summary, aquatic foods have a vital role in future food systems, but addressing challenges and harnessing their potential requires more in-depth and region-specific research and policy attention.

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05 THEME: Policy incentives, financing, pricing; ICT in agrifood sustainability

2022 WorldFish Annual Report

July 27, 2023 | WorldFish | Source |

The 2022 WorldFish Annual Report, titled "Harnessing Aquatic Food Systems for Sustainable Development," highlights seven stories of positive change achieved through sustainable fisheries and aquaculture. These stories demonstrate that shared prosperity can be realized for millions of people by focusing on these aquatic food systems.

The report also sheds light on the importance of digital innovations in enabling data-driven policies and practices, which help bridge data gaps and address systemic barriers. These interventions are essential for ensuring equal access to aquatic food systems for low-income, marginalized groups, and small-scale actors within the value chains.

The report emphasizes the collaborative effort with various partners to develop country-responsive solutions, which are crucial for achieving sustainable and scalable impact. It provides insights into the ongoing transformation of food, land, and water systems, with aquatic foods playing a central role. Through the stories of fishers, farmers, and coastal communities, the report showcases the gradual but steady progress in achieving sustainability and positive outcomes in these critical food systems.

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06 THEME: GHG emission reduction; MRV

Milestone carbon credit methodology for rice launched with help from IRRI

July 26, 2023 | IRRI | Source |

Gold Standard has launched a new carbon credit methodology, developed with input from the International Rice Research Institute (IRRI), aimed at reducing greenhouse gas emissions from rice cultivation. Rice cultivation is responsible for about 10% of human-made methane emissions globally, primarily from bacteria in flooded rice paddies. Reducing water use can significantly cut methane emissions from rice fields by up to 50%. The new Methodology for Methane Emission Reduction by Adjusted Water Management Practice in Rice Cultivation provides instructions for estimating baseline and project emissions, monitoring guidelines, and requirements for field stratification. It can be applied to projects of various scales and offers a practical pathway for smallholder farmers to earn carbon credits from emissions reductions.

Key IRRI scientists, including Dr. Bjoern Ole Sander, Dr. Katherine Nelson, and Dr. Reiner Wassmann, contributed technical inputs to the methodology, addressing the lack of guidance for field stratification and accounting for changes in nitrous oxide emissions. The methodology's interventions and technologies focus on mitigating anaerobic decomposition of organic matter in rice-cropping soils through various water management practices and cultivation methods. This initiative was part of a Gold Standard-IRRI partnership funded by the Australian Department of Foreign Affairs and Trade, with co-funding from the German Corporation for International Cooperation (GIZ) and additional technical inputs from the Eurecat Centre Tecnològic de Catalunya. A webinar presenting the methodology is scheduled for July 28, 2023.

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07 THEME: Carbon sequestration; MRV

Bridging the gap between traditional and regenerative agriculture with the agro-biodiversity index

July 24, 2023 | IRRI | Source |

Regenerative agriculture aims to enhance soil fertility, carbon content, and nutrient availability while integrating biodiversity into farming systems. To assess the impact of these practices on agrobiodiversity, the development of an Agro-Biodiversity Index (ABI) is essential. Agrobiodiversity includes cultivated and wild crops, livestock, and ecosystems that support agriculture through pollination, nutrient cycling, and pest control.

For evaluating the ABI in regenerative agriculture, indicators should assess agrobiodiversity diversity and conservation within these systems. These indicators could include crop diversity,

the presence of native species, habitat complexity, and ecosystem services. Calculating the ABI involves:

- Determining indicators.
- Collecting data from surveys, agricultural reports, or other sources.
- Normalizing data for comparability.
- Assigning weights to indicators based on importance.
- Calculating sub-indices for each indicator.
- Aggregating sub-indices to obtain the overall ABI.

Customizing indicators should align with regenerative agriculture's core principles of biodiversity enhancement, soil health, and ecological resilience. Policy measures to encourage native pest and pollinator populations and genetic diversity conservation are crucial for ecological agriculture. Standardizing the ABI allows for landscape-scale assessment of agricultural systems, promoting sustainable practices.

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08 THEME: Others

How Water Shortages Impact Food Security

July 25, 2023 | Earth.Org | Source |

Water shortages significantly impact food security, which encompasses sufficient, safe, and nutritious food access for all. Several factors link water scarcity and food insecurity:

- **Agriculture:** Agriculture consumes 70% of global freshwater, and with population growth, its water demand increases. To meet demand, agricultural output needs to expand, straining water resources.
- **Climate Change:** Rising temperatures and erratic precipitation patterns due to climate change lead to droughts and floods, reducing water availability and affecting food production.
- **Water Contamination:** Pollution from sewage, agriculture, and industry contaminates water sources, limiting their availability for agriculture and consumption.
- **Population Growth:** Growing populations demand more freshwater, straining resources. Some regions already experience water crises.

Effects of Water Shortages on Food Security:

- **Conflict:** Water scarcity can lead to conflicts, exacerbating food insecurity, as conflict disrupts access to water and food supplies.
- **Natural Disasters:** Droughts and floods, intensified by climate change, impact water supplies and reduce food availability.
- **Agriculture:** Water-intensive agricultural practices harm the water cycle and exacerbate water scarcity, jeopardizing food production.
- **Food Waste:** Food waste, linked to water-intensive agriculture and population growth, contributes to food insecurity.

Effects of Food Shortages:

- **Malnutrition:** Food shortages lead to malnutrition, affecting billions worldwide, and can result in health-related issues.

- **Rising Food Prices:** Reduced food production increases prices, making food inaccessible to vulnerable populations.
- **Conflict:** Food insecurity can cause conflicts, further straining water and food supplies.

Solutions for Hunger Prevention amid Water Scarcity:

- **Sustainable Agriculture and Irrigation:** Implementing sustainable farming practices and efficient irrigation, alongside drought-resistant crops, can improve food security.
- **Infrastructure:** Investment in infrastructure, such as reducing water leaks, enhances water management and accessibility.
- **Addressing Climate Change:** Combating climate change through water-efficient practices and crop choice helps secure the food cycle.
- **Building Resilient Communities:** Groundwater extraction and drilling for reliable water sources aid communities in water-induced food insecurity regions.
- **New Approach to Food:** Reducing food waste, diversifying diets, and emphasizing local food production can improve nutrition and accessibility.
- **Coordinated Global Response:** Global organizations are working to boost food and nutrition security by supporting producers and consumers, facilitating food trade, aiding vulnerable households, and investing in sustainable food systems.

In conclusion, tackling water scarcity through sustainable practices, addressing climate change, and focusing on food accessibility can mitigate food security challenges, ensuring access to nutritious food for all.

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09 THEME: MRV; Carbon sequestration

Planetary Health: Measuring and Managing Planetary Biomarkers

June 27, 2023 | Earth.Org | Source |

The article highlights the importance of measuring and managing the five fundamental elements of nature: Water, soil, air, energy, and space, to ensure a sustainable and circular economy. While Gross Domestic Product (GDP) has traditionally been used as a metric for economic progress, it fails to account for the environmental costs of economic activities, such as pollution.

To complement GDP, the author suggests measuring these five elements as planetary biomarkers, akin to human biomarkers for health assessment. These biomarkers are essential for guiding strategies to achieve sustainability and addressing climate action goals.

- **Measuring Water:** The health of water bodies is crucial for carbon sequestration and marine life. Monitoring fish diversity, water quality, and other factors can help gauge water health.
- **Measuring Soil:** Soil health, measured by soil organic carbon content, plays a significant role in carbon sequestration. Sustainable and organic farming practices are vital for maintaining soil health.
- **Measuring Air:** Monitoring CO_2 and methane levels is essential for assessing air quality. Aggressive reforestation and transitioning away from fossil fuels are proposed solutions.
- **Measuring Energy:** Evaluating the percentage of carbon-free energy and per capita energy consumption can guide energy production strategies.
- **Measuring Space:** Tracking space debris to prevent threats to spacecraft is essential.

Initiatives like Clearspace-1 aim to clear space debris.

The author emphasizes that addressing each element independently can lead to a systems approach to managing the environment. Developing a simple Environmental Health Index (EHI) that combines these elements can help countries benchmark their contributions to planetary health, alongside GDP, which measures wealth.

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10 THEME 3: ICT in agrifood sustainability; MRV

The Environmental Benefits of Precision Agriculture Quantified

July 17, 2023 | Global Ag Tech Initiative | Source |

A study by the Association of Equipment Manufacturers (AEM) explores the environmental benefits of precision agriculture, emphasizing its potential to enhance sustainability by efficiently using resources like land, water, fuel, fertilizer, and pesticides. Precision agriculture utilizes technologies such as auto guidance, machine section control, variable rate technology, machine and fleet analytics, and precision irrigation. The study reveals significant environmental improvements attributed to precision agriculture, including:

- A 4% increase in crop production.
- A 7% increase in fertilizer placement efficiency.
- A 9% reduction in herbicide and pesticide use.
- A 6% reduction in fossil fuel consumption.
- A 4% reduction in water usage.

These improvements translate into substantial environmental gains, such as conserving 2 million acres of cropland, avoiding 30 million pounds of herbicide, saving 100 million gallons of fossil fuels, and preserving enough water to fill 750,000 Olympic-size swimming pools. Furthermore, the study suggests that broader adoption of precision agriculture could yield even greater benefits, highlighting the importance of government policies, increased farm income, improved infrastructure, and enhanced consumer communication to accelerate adoption.

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11 THEME: ICT in agrifood sustainability

USDA introduces geospatial data product to show crop rotation patterns

July 25, 2023 | NASS, USDA | Source |

The U.S. Department of Agriculture (USDA) has introduced Crop Sequence Boundaries (CSB), a geospatial product that provides public access to national-scale visual crop rotation data. Developed by USDA's National Agricultural Statistics Service (NASS) and Economic Research Service (ERS), CSB uses satellite imagery and public data to offer crop acreage estimates and historical planting decisions across the contiguous United States. This open-source tool benefits farmers by allowing them to analyze historical crop rotations, aiding in farm record-keeping and decision-making. It can also assist new or prospective farmers in selecting crops based on past rotations. Researchers can conduct field-level analyses, studying practices like conservation efforts.

CSB addresses the need for comprehensive field-level data in one accessible location and employs technological advancements in satellite imagery and cloud computing. It supports USDA's Science and Research Strategy by enhancing understanding of crop production and its impacts, particularly in terms of conservation programs. The CSB datasets from 2015 to 2022 are available for download and can be viewed interactively at the state and county levels. This tool contributes to USDA's mission of supporting farmers and ranchers with innovative resources and data-driven insights.

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

Marginal Abatement Cost Curve 2023

July 12, 2023 | Teagasc, Ireland | Source |

Teagasc, the Agriculture and Food Development Authority –the national body providing integrated research, advisory and training services to the agriculture and food industry and rural communities, has introduced the Marginal Abatement Cost Curve (MACC) to assist the agriculture industry in reducing greenhouse gas (GHG) emissions. The MACC aims to provide cost-effective pathways for GHG reduction and carbon sequestration within the agricultural sector. Key findings from the MACC indicate the importance of maximizing the adoption of GHG mitigation measures to meet emissions reduction targets. Different scenarios and adoption rates for mitigation measures were explored, highlighting the potential role of diversification into organic farming, increased tillage and forestry, and biomethane feedstock production in achieving emissions targets.

While reductions in GHG emissions from Land Use, Land Use Change & Forestry (LULUCF) were challenging to achieve due to uncertainties in inventory emission factors, the MACC emphasizes the significance of bioenergy production, particularly biomethane and woody biomass, in decarbonizing Ireland's energy sector. The report also underscores the need for increased advisory and extension services to guide farmers and landowners toward reduced GHG emissions and climate neutrality.

The Teagasc MACC represents a dynamic tool that evolves with ongoing research and changing socio-economic conditions, reflecting the fluid nature of GHG abatement potential and associated costs. Different agricultural activity scenarios and adoption pathways were considered to provide insights into cost-effective emissions reduction strategies.

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13 THEME: ICT in agrifood sustainability; GHG emission reduction; MRV

AgNav – a Sustainable Digital Platform to Support Farmers

July 4, 2023 | Teagasc, Ireland | Source |

A new digital sustainability platform called AgNav has been jointly developed by Teagasc, ICBF, and Bord Bia, with support from the Department of Agriculture, Food and the Marine. AgNav aims to provide farmers with accurate and verifiable farm-specific data to aid decision-making and support efforts to address climate action in agriculture. The platform has undergone trials with Teagasc advisors and Signpost demonstration farms, and is currently in use by a team of Teagasc Signpost Advisors, who collaborate with farmers to create tailored action plans for mitigating greenhouse gas emissions.

AgNav aggregates data from various sources, including the Bord Bia Quality Assurance Scheme audit and the ICBF database, to build a comprehensive overview of farm operations. It facilitates a Life Cycle Assessment (LCA) of the farm, which calculates greenhouse gas and ammonia emissions and other environmental indicators. The platform offers features like 'Assess,' 'Forecast,' and 'Action Planner' to provide farmers with actionable insights into their farm's environmental performance and the impact of mitigation strategies.

Initially, AgNav will be available to Irish beef and dairy farmers participating in the Teagasc Signpost advisory program, ensuring farmers maintain control over their farm-related data within the platform.

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14 THEME: Others

Plum production threatened by natural disasters and pests has a solution! Miaoli Field introduces improved greenhouse cultivation technology to greatly enhance fruit flavor

June 24, 2023 | Food Next | Source (in Chinese) |

Taiwan's lychee production, threatened by natural disasters and pests, has found a solution in improved greenhouse cultivation techniques. The Miaoli District Agricultural Research and Extension Station, under the Ministry of Agriculture, established lychee trees in reinforced greenhouses with irrigation systems in 2019. These greenhouses utilize advanced cultivation techniques and provide an environment that is immune to issues like drought, continuous rainfall, and the Oriental fruit fly, which have historically affected lychee production.

After four years of greenhouse cultivation, lychee varieties like Early Jade Lychee, Red Flesh Lychee, and Watermelon Lychee have reached commercial production levels. They benefit from a controlled environment that allows fruit to be harvested at 8-9 degrees of ripeness, resulting in a 3°Brix increase in soluble solids (sugar content) compared to open-field cultivation, significantly enhancing the fruit's flavor.

The greenhouse cultivation technique also minimizes the impact of adverse weather conditions and the Oriental fruit fly, reducing the need for pesticide spraying. White insect-proof nets surrounding the greenhouses effectively block fruit fly infestations, ensuring safe and flavorful lychees. While greenhouse cultivation is more expensive, its advantages include resistance to strong winds, automated watering, and shading systems that reduce environmental stress on lychee trees, leading to more stable fruit production.

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15 THEME: ICT in agrifood sustainability

Lighting up the lights and having a party in the field can protect peaches, guavas and green onions, and pests are OUT!

July 4, 2023 | Agri Harvest | Source (in Chinese)|

Taiwan's Taoyuan District Agricultural Research and Extension Station is using innovative lighting techniques to protect peaches, guavas, and spring onions from pests. They have developed

"rotating moth-repelling lights" and "suction-type insect-catching lights" based on the natural inclination of crop pests to be either repelled or attracted to light. These technologies have reduced peach damage rates by 20%, and they are ten times more effective at attracting sweet potato weevils than pheromone attractants.

Taoyuan is a major peach-producing region in Taiwan, and peaches are often affected by pests like the fruit-piercing moth. These moths lay their eggs in wooded areas, and adult moths fly into fields to damage fruit, making pesticide control challenging. To combat this, the station developed "rotating moth-repelling lights" that use special yellow light sources to repel moths effectively, reducing peach damage from 25.1% to 5.2%.

The station has also introduced the "suction-type insect-catching light" to capture pests in vegetables, rice, and flower cultivation areas. These lights use specific wavelength light sources to attract pests and then trap them in a net with an integrated fan, preventing their escape. These innovations demonstrate that physical pest control can reduce the reliance on chemical pesticides, offering farmers more sustainable and cost-effective pest management solutions.

POLICY

01 THEME: Climate smart agriculture; Nature-based solution; Carbon market

FAO Action Plan 2022–2025 for the implementation of the FAO Strategy on Climate Change

Food and Agricultural Organiztion of the United Nations| Source | Download |

Introduction: The Action Plan is a strategic tool developed by the Food and Agriculture Organization (FAO) to support the implementation of the FAO Strategy on Climate Change 2022–2031. It has undergone extensive consultation processes with FAO Members, senior management, technical divisions, and decentralized offices. The purpose of the Action Plan is to align FAO's efforts with the vision of creating sustainable, inclusive, and resilient agrifood systems that mitigate climate change impacts while ensuring food security and nutrition.

Key Objectives

- **Global and Regional Levels:** Strengthening global and regional climate policy and governance to integrate considerations of food security, nutrition, and agrifood systems into international agendas. Information support provided by FAO would cover emission reductions in agrifood systems, land and ecosystem restoration, and carbon sequestration in different ecosystem types such as agricultural and forest lands, pastures, rangelands, peatlands and wetlands, seascapes, marine and other aquatic environments.
- **Country-Level:** Building capacities of FAO Members to implement, monitor, and report on climate commitments, promote climate-resilient policies, and integrate climate considerations into national strategies and investments.
- **Local Level:** Scaling up climate action on the ground by empowering local actors, enhancing resilience, and fostering low-emission development pathways in agrifood systems.
- **Crosscutting:** Enhancing FAO's operational modalities by developing human resources, mobilizing financial resources, raising awareness, and fostering partnerships for effective climate action delivery.

Policy Recommendations

- **Integration:** Ensure the integration of climate considerations into international agendas and national strategies, emphasizing the importance of agrifood systems in climate action.
- **Capacity Building:** Provide technical and policy support to FAO Members to enhance their capacity in climate change adaptation and mitigation, including access to climate financing and partnerships.
- **Mainstreaming:** Support the mainstreaming of climate resilience, adaptation, and mitigation into policies, legislation, and investments across agrifood systems at the national and local levels.
- **Empowerment:** Empower farmers and local communities to adopt climate-resilient practices and technologies, fostering collective action and ecosystem resilience.

- **Operational Enhancement:** Strengthen FAO's operational capacities through human resource development, financial mobilization, awareness-raising, and partnership development for effective climate action implementation.

02 THEME: Carbon market; Climate Smart Agriculture; Nature-based solution

Federal Strategy to Advance Greenhouse Gas Measurement and Monitoring for the Agriculture and Forest Sectors (USA)

USDA | Source | Download |

Introduction: The Federal Strategy to Advance Greenhouse Gas Measurement and Monitoring for the Agriculture and Forest Sectors is a pivotal initiative announced by Agriculture Secretary Tom Vilsack, aligning with President Biden's ambitious climate goals. Backed by a $300 million investment from the Inflation Reduction Act, this strategy marks a monumental step towards enhancing the precision and reliability of greenhouse gas emissions and carbon sequestration data in agriculture and forestry practices.

- This comprehensive strategy outlines a strategic framework and priority actions to reduce uncertainties and improve accuracy in greenhouse gas estimates, aiding the United States in achieving its target of a 50-52 percent reduction in greenhouse gas emissions by 2030. It complements President Biden's broader climate agenda and emphasizes the critical role of data and science in climate-smart agriculture and forestry.
- Key focus areas within the strategy include the establishment of monitoring networks for soil carbon and greenhouse gas research, enhancing data infrastructure, improving modeling tools, and strengthening greenhouse gas inventory programs. These initiatives are pivotal in empowering farmers, ranchers, and the broader agriculture and forestry sectors to contribute to climate solutions and make them more attractive to private sector investments.
- This strategy underscores the administration's commitment to addressing the climate crisis, fostering innovation, and supporting rural communities in their efforts to combat climate change. Public input is encouraged to shape and refine this groundbreaking initiative.

03 THEME: Nature-based solution

National Mission on Natural Farming (India)

India Department of Agriculture & Farmers' Welfare| Source | Download |

Introduction: The National Mission on Natural Farming (NMNF) aims to promote Bhartiya Prakratik Krishi Paddhati (BPKP), a chemical-free farming approach deeply rooted in Indian tradition. By emphasizing indigenous practices and reducing dependence on external inputs, NMNF seeks to enhance sustainability, increase farmers' income, and provide safe and healthy food to citizens.

Key Components of Natural Farming:

- **Traditional Practices:** NF-BPKP relies on livestock, locally available resources, and traditional practices like biomass mulching, green manuring, and botanical concoctions for pest control.
- **Evolution:** While desi cow-based inputs remain central, farmers have adopted innovations like pre-monsoon dry sowing and vermi-composting.
- **Need for Change:** Concerns over soil health, resource depletion, and environmental contamination highlight the urgency of transitioning to sustainable farming methods.
- **Difference from Organic Farming:** NF-BPKP excludes all off-farm purchased inputs, focusing solely on on-farm resources, in contrast to organic farming which permits such inputs.

Government Initiatives:

- **Promotion:** The Government promotes both organic and natural farming, with NMNF focusing exclusively on BPKP.
- **Scaling Up:** BPKP, initially a sub-scheme of Paramparagat Krishi Vikas Yojna, is now being upscaled to NMNF to realize the Prime Minister's vision of a nationwide natural farming movement.

Objectives of NMNF:

- **Reduce Input Dependence:** Promote farming practices that reduce reliance on external inputs, thereby cutting costs and increasing farmers' incomes.
- **Integrated Models:** Encourage integrated agriculture-animal husbandry models based on desi cow and local resources.
- **Research and Documentation:** Collect, validate, and document natural farming practices, while fostering participatory research with farmers.
- **Awareness and Capacity Building:** Conduct activities for awareness creation, capacity building, promotion, and demonstration of natural farming.
- **Standardization and Certification:** Establish standards, certification procedures, and branding for natural farming products to access national and international markets.

04 THEME: Climate Smart Agriculture; Supply Chain

Food Vision 2030 - A World Leader in Sustainable Food Systems (Ireland)

Ireland Department of Agriculture, Food and Marine| Source | Download |

Introduction: Food Vision 2030 is an ambitious strategy that envisions Ireland as a global leader in sustainable food systems by 2030. This initiative, launched in August 2021, aims to bring about profound changes within the Irish agri-food sector, benefiting not only the sector itself but also Irish society and the environment. The strategy was developed by a committee comprising 32 representatives from the agri-food sector and chaired by Tom Arnold. It outlines a vision and key objectives to ensure the economic, environmental, and social sustainability of the sector. The core of Food Vision 2030 lies in four missions and 22 goals with 218 detailed actions that provide a framework for progress toward greater economic, environmental, and social sustainability.

Embracing an integrated food systems approach, Ireland aims to emerge as a global pioneer in innovative and sustainable food and agriculture systems. This vision entails producing safe, nutritious, and high-value food of exceptional taste while simultaneously safeguarding and enhancing the country's natural and cultural resources. Additionally, this endeavor seeks to contribute to the prosperity of rural and coastal communities, as well as the national economy. The four overarching missions include:

- **A Climate Smart, Environmentally Sustainable Agri-Food Sector:** This mission focuses on implementing climate-smart practices and promoting sustainability to ensure that the agri-food sector operates in harmony with the environment.
- **Viable and Resilient Primary Producers with Enhanced Well-Being:** This mission seeks to support primary producers by bolstering their viability, resilience, and overall well-being, recognizing the critical role they play in the agri-food supply chain.
- **Food, which is Safe, Nutritious and Appealing, Trusted and Valued at Home and Abroad:** This mission emphasizes the production of safe, nutritious, and appealing food products that are trusted and highly valued both domestically and internationally.
- **An Innovative, Competitive and Resilient Agri-Food Sector, Driven by Technology and Talent:** This mission underscores the importance of innovation, competitiveness, and resilience in the agri-food sector, with technology and talent as driving forces.

05 THEME: Climate Smart Agriculture

Towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's first emissions reduction plan

New Zealand Ministry of the Environment| Source | Download |

Introduction: Agriculture is a cornerstone of Aotearoa New Zealand's economy, but it also contributes significantly to greenhouse gas emissions, particularly nitrous oxide and biogenic methane. Addressing these emissions is crucial for meeting climate targets and ensuring the long-term sustainability of the sector.

Key Challenges: Farmers face barriers to adopting low-emissions practices, including limited awareness of mitigation options and cost-effectiveness concerns. Additionally, Māori communities, who have significant investments in agriculture, may face unique challenges due to historical inequities and land tenure issues.

Policy Recommendations

- **Price Agricultural Emissions:** Introduce an emissions pricing mechanism by 2025 to incentivize emissions reductions and provide clarity on market expectations for sustainable products.
- **Accelerate Mitigation Technologies:** Establish a Center for Climate Action on Agricultural Emissions to drive innovation and uptake of mitigation technologies.
- **Support Producers:** Fund tikanga-based programs and climate-focused extension services to assist farmers in adopting low-emissions practices.
- **Transition to Sustainable Land Use:** Encourage the transition to lower-emissions farming systems and invest in research on regenerative agriculture.
- **Māori Involvement:** Partner with Māori communities to ensure that climate policies are equitable and support Māori-led solutions for emissions reduction.

OPEN DATA

01 THEME: Climate smart & Net zero toolkit

farmOS

farmOS | Source | Database |

FarmOS is a comprehensive web-based application designed to facilitate farm management, planning, and record-keeping. The platform has been collaboratively developed by a diverse community consisting of farmers, developers, researchers, and organizations. Their shared goal is to establish a standardized platform for collecting and managing agricultural data efficiently.

At its core, the farmOS server is constructed using Drupal, a popular content management framework. This choice ensures that the system is both modular and extensible, allowing for seamless integration with various components and customization to suit specific farm requirements. Moreover, the use of Drupal ensures a robust and secure foundation for the application.

One of the standout features of farmOS is the availability of the FarmOS Field Kit app. This app serves as a valuable tool for farmers, providing offline data entry capabilities on both Android and iOS platforms. Additionally, the Field Kit app is also accessible as a progressive web app (PWA) through farmOS.app, allowing users to access the platform across various devices and browsers.

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02 THEME: Climate Smart and Net Zero toolkit

Carbon calculator

Solagro | Source |

The "Carbon Calculator" is a user-friendly and comprehensive software tool developed as part of a project aimed at assessing and promoting carbon-neutral or low-emission farming practices among European farmers. In response to the European Union's target of reducing greenhouse gas (GHG) emissions by 20% in 2020 compared to 1990 levels, the tool calculates GHG emissions from farming practices and suggests mitigation actions at the farm level.

The calculator is accessible to users with basic computer and agronomic knowledge and is available for free download. It features a user interface built in Excel with Visual Basics for Applications (VBA) for macros and user forms, making it user-friendly. The accompanying User Guidance Manual provides step-by-step instructions for data entry and result analysis.

Assessments using the Carbon Calculator are conducted at the farm scale, covering a one-year reporting period and considering EU-27 specificities. It employs a life cycle approach, encompassing all emissions from inputs to the farm gate, including both direct and indirect GHG emissions. Additionally, the tool evaluates carbon stock changes in soils and on-farm trees.

The Carbon Calculator is a valuable resource for a wide range of users, including farmers, agricultural advisors, and trainers. It enables comparisons of farming practices among farms producing similar products and even offers a GHG label for farms and their primary products.

While the tool is highly beneficial, it has limitations such as not accounting for end-of-life inputs and not extending GHG assessment beyond the farm gate. It is recommended that users refer to the User Guidance Manual to maximize the tool's effectiveness.

Overall, the Carbon Calculator plays a crucial role in assessing and mitigating GHG emissions in European agriculture, aiding in identifying relevant mitigation measures and promoting sustainable farming practices.

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03 THEME: Agrifood system; Land cover and soil; GHG emission inventory; Environment and climate; Climate action plan & programs

Global Agricultural Research Data Innovation Acceleration Network (GARDIAN)

CGIAR | Source | Database |

GARDIAN, as a flagship data harvester for CGIAR, plays a pivotal role in facilitating the discovery of publications and datasets spanning across more than thirty institutional publications and data repositories associated with CGIAR Centers and beyond. It serves as a fundamental component in the Platform's overarching mission to establish robust infrastructures, tools, and methodologies that align with the principles of making CGIAR data Findable, Accessible, Interoperable, and Reusable (FAIR).

Employing advanced text-mining techniques, GARDIAN effectively enriches the metadata associated with the data it encompasses, thereby significantly enhancing the discoverability of resources within its vast repository. Furthermore, it is poised to embark on testing data mining techniques, specifically designed for cleaned and well-annotated datasets, with the primary aim of bolstering interoperability.

GARDIAN's plans encompass demonstrating the substantial value of interoperable data by seamlessly integrating discovered data with key analytical and visualization tools. This includes models and maps, ultimately fostering a more comprehensive and interactive data ecosystem. As CGIAR's flagship data harvester, GARDIAN stands at the forefront of efforts to harness the full potential of data-driven research and innovation in the realm of agriculture and beyond.

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04 THEME: Agrifood system; Climate action plans and programs

FAOLEX Database

FAO | Source | Data |

FAOLEX is a database of national legislation, policies and bilateral agreements on food, agriculture and natural resources management. It is constantly being updated, with an average of 8,000 new entries per year. It currently contains legal and policy documents drawn from more than 200 countries, territories and regional economic integration organizations and originating in over 40 languages.

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05 THEME: Climate Smart and Net Zero toolkits; Agrifood system; GHG emission inventory

Tools for Greenhouse Gas Assessments

FAO | Source |

Tools for greenhouse gas assessments
A series of tools and databases to support countries in assessing GHG emissions and removals from the agriculture, forestry, and other land use (AFOLU) sector through useful tools.

Brochures

- Estimating GHG emissions and carbon sequestration in agriculture, forestry and other land use with EX-ACT | PDF
- EX-Ante Carbon-balance Tool | EX-ACT | PDF

Databases

- FAOSTAT Emissions – Agriculture | Website
- Global database of greenhouse gas emissions related to feed crops | Website
- FAOSTAT Emissions shares | Website
- FAOSTAT Emissions – Land use | Website
- Global database of national greenhouse gas inventory capacity in developing countries | Website
- FAOSTAT Emissions intensities | Website
- GLEAM v 3.0 Dashboard | Website

Methodologies and guidelines

- Ex-Ante Carbon balance Tool | PDF
- EX-Ante Carbon-balance Tool for value chains | PDF
- Global Livestock Environmental Assessment Model (GLEAM): Model description. version 3.0 | PDF

Studies and reports

- Emissions due to agriculture: Global, regional and country trends 2000–2018 | PDF

Tools

- EX-Ante Carbon-balance Tool (EX-ACT) | Website
- EX-Ante Carbon-balance Tool (EX-ACT) for value chains | PDF
- Emissions overview | Website
- Quality assurance/Quality control (QA/QC) and verification | Website
- Global Livestock Environmental Assessment Model (GLEAM) | Website
- Collect Earth | Website
- IPCC 2020. IPCC Inventory Software | Website
- EPA. 2020. U.S. EPA Toolkit for Building National GHG Inventory Systems | Website
- AFOLU Carbon Calculator | Website
- Agriculture and Land Use national Greenhouse Gas Inventory software (ALU) | Website

06 THEME: Agrifood system; Land cover and soil; Environment and climate

Ireland' Department of Agriculture, Food and the Marine – Open Data

Department of Agriculture, Food and the Marine, Ireland | Source |

The Department of Agriculture, Food, and the Marine proudly presents its Open Data Portal, a valuable and extensive resource encompassing a diverse range of information covering all aspects of the Department's activities. This initiative underscores the Department's commitment to the principles of open data, recognizing its pivotal role as a foundational asset for governments, businesses, and civil society alike.

The data hosted on this portal is readily accessible online, adhering to the Government's Open Data Directive, and is made available for the purposes of reuse and redistribution. It serves as a cornerstone for enhancing transparency and efficiency within the Department while simultaneously fostering an environment ripe for innovation in the business sector, job creation, and a broad spectrum of social and personal benefits.

In alignment with the Government's Open Data Strategy for 2017-2022, the Department aspires to position Ireland as a leader in the realm of open data. This strategic approach aims to fully realize the economic, social, and democratic advantages that open data can offer.

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