Issue 1
April 30, 2023
(Revised March 2024)

NEWSLETTER

Smart & Net-Zero Project

Overview

Welcome to the FFTC Smart & Net-Zero Newsletter! The newsletter features global updates of research, policies, news related to agriculture's journey to net-zero emissions. This month's edition includes research updates on topics like measurement, reporting, and verification (MRV) for carbon offset projects, ICT in sustainable agriculture, biochar application in carbon farming, and cost-effective mitigation measures of controlling nitrogen emissions. The policy section features UK's Net Zero Growth Plan for the farming sector, as well as in terms of conservation of land and natural resources. The news highlights of the month include small farmers in Taiwan working collaboratively on agricultural carbon offset project that seeks to be certified by the international certification body called the Gold Standards.

Content

RESEARCH

01 THEME: GHG emission reduction

Cost-effective mitigation of nitrogen pollution from global croplands

January 04, 2023 | Nature | Source | T23.04.01

Introduction: Croplands globally serve as a significant contributor to nitrogen pollution, posing a formidable challenge due to its non-point-source nature and various constraints hindering pollution-reduction efforts. A Chinese research team led by Zhejiang University in China, with the help of collaborators from Australia, Austria, Netherlands, Germany, and UK, has reviewed 1,521 field observations worldwide to identify measures for controlling nitrogen pollution.

Key findings: The research has identified 11 key measures capable of curbing nitrogen losses from croplands by 30–70%, while simultaneously boosting crop yield and nitrogen use efficiency by 10–30% and 10–80%, respectively. Implementing this comprehensive set of measures on a global scale could yield remarkable results: producing 20% more crop nitrogen, while using 21% less nitrogen fertilizer and emitting 32% less nitrogen pollution by 2015 standards. Moreover, the societal benefits are substantial, estimated at 476 ± 123 billion US dollars, outweighing the mitigation costs (19 ± 5 billion USD). Notably, significant economic gains stem from reduced premature mortality, primarily by averting respiratory diseases due to PM2.5 pollution, alongside preservation of ecosystem services. Climate impacts, although minimal at −2 ± 1 billion USD, underscore the importance of considering potential drawbacks in improved cropland nitrogen management. Innovative policies like a nitrogen credit system could play a pivotal role in promoting and subsidizing the adoption of these measures, thus ushering in a more sustainable future for global agriculture. However, improved cropland nitrogen management could possibly affect carbon sequestration and exacerbating global warming in some regions.

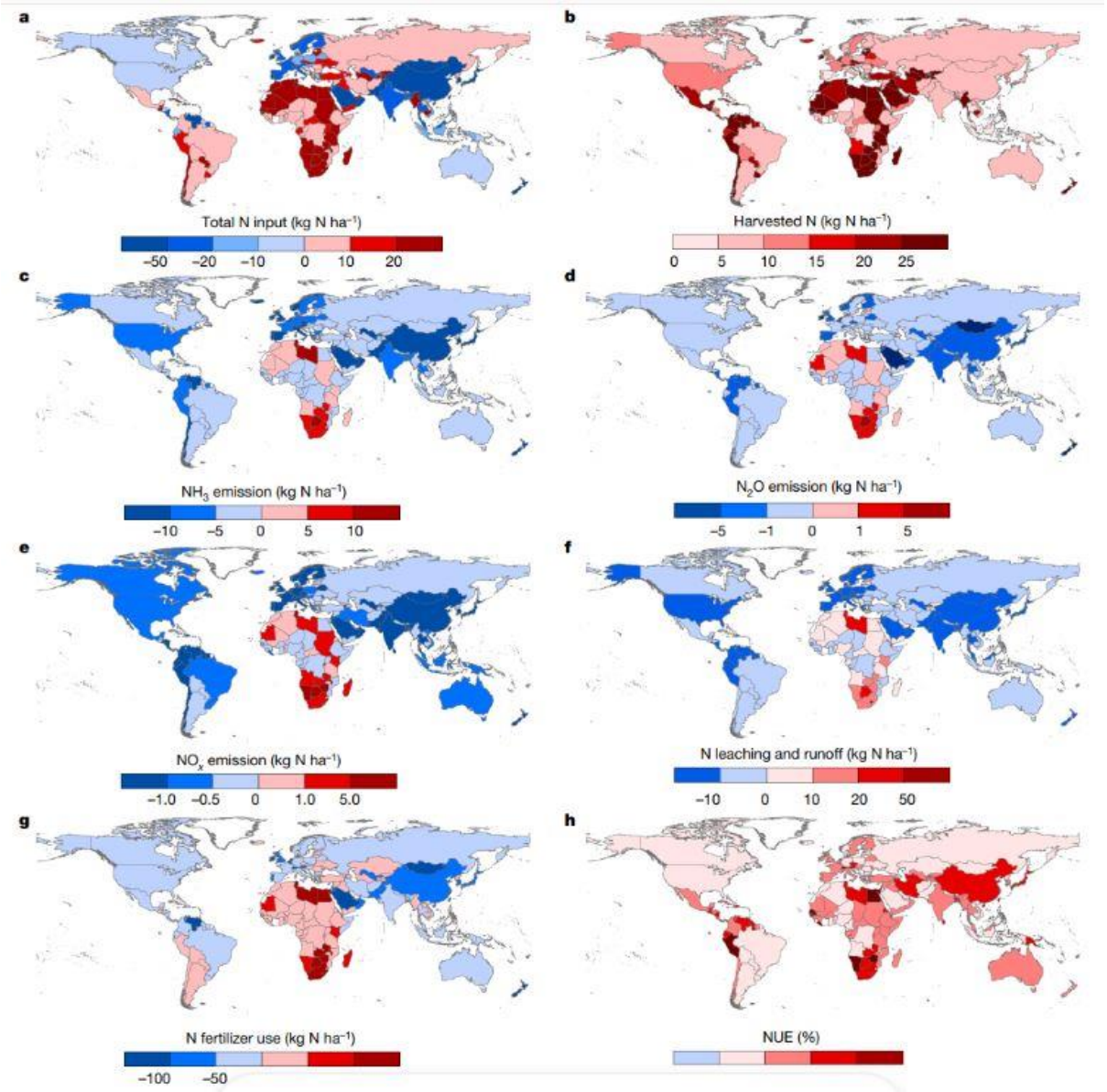

Figure | Changes in global N budget in croplands with the best adoption of the 11 selected measures. a, Total N input. b, Harvested N. c, NH_3 emission. D, N_2O emission. E, Nox emission. F, N leaching and runoff. G, N fertilizer use. H, NUE. The base year is 2015 and the changes are calculated on the basis of the differences between the N fluxes in 2015 before and after the implementation of the most appropriate set of measures at the national level. The changes in NUE are in percentage points; for instance, the NUE increased by 17 percentage points in China. The base map is applied without endorsement from GADM data (https://gadm.org/).

02 THEME: GHG emission reduction

Strategies for mitigating N_2O and N_2 emissions from an intensive sugarcane cropping system

February 25, 2023 | Nutrient Cycling in Agroecosystems | Source | T23.04.02

Introduction: In sugarcane farming, excessive nitrogen fertilizer use, combined with warm climates and high crop residue retention, leads to significant emissions of nitrous oxide (N_2O), a potent greenhouse gas. However, the overall losses of nitrogen in the form of N_2 and N_2O remain unclear. In Bundaberg, Australia, a research team from Queensland University of Technology examined the impact of removing sugarcane trash and using a nitrification inhibitor on N_2 and N_2O emissions.

Key findings: Under standard practices of retaining cane trash and applying nitrogen fertilizer, substantial emissions of N_2 and N_2O were observed. However, removing cane trash reduced N_2 emissions by 34% and N2O emissions by 51%. The use of DMPP further decreased emissions, with a 35% reduction in N_2 and a staggering 98% reduction in N_2O emissions. Importantly, the use of DMPP also significantly lowered the proportion of emissions released as N_2O, making it a promising strategy to minimize greenhouse gas emissions.

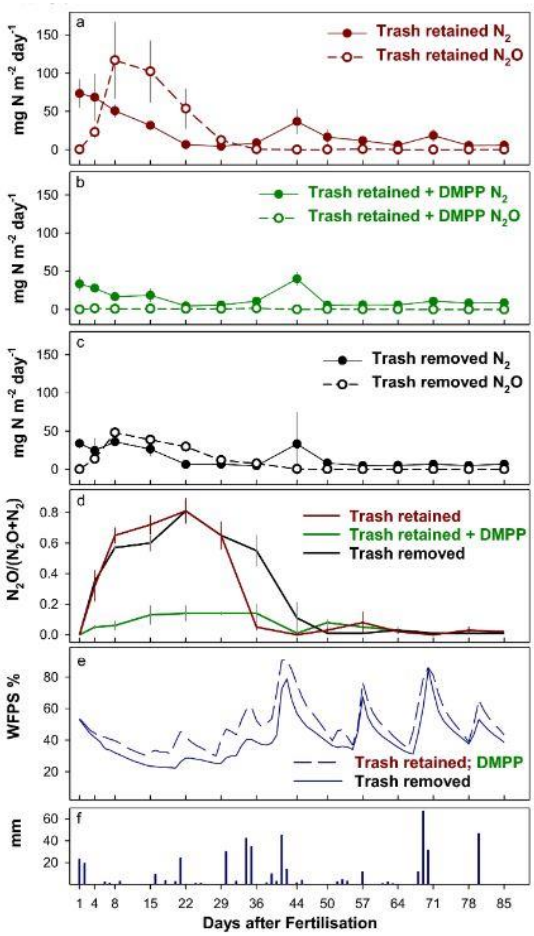

Figure | Average daily N_2 and N_2O fluxes for for the different treatments a, b and c with the corresponding product ratio $N_2O/(N_2 + N2O)$ (d), soil water filled pore space (WFPS) 0-10 cm depht, (e) and daily precipitation (f).

03 THEME: Carbon sequestration; GHG emission reduction

A global synthesis of biochar's sustainability in climate-smart agriculture - Evidence from field and laboratory experiments

February 01, 2023 | Renewable and Sustainable Energy Reviews | Source | T23.04.03

Introduction: Biochar, a proposed solution to combat greenhouse gas (GHG) emissions in agriculture and boost crop yields sustainably, has garnered attention. Yet, its overall impact remains uncertain due to conflicting results from field and lab studies. Analyzing nearly 10,000 data points from over 500 research papers, an US research team led by University of Connecticut sheds light on biochar's effects in field experiments.

Key findings: Field data revealed significant benefits: increased soil organic carbon (SOC) stocks and crop yields, alongside reduced methane (CH_4) and nitrous oxide (N_2O) emissions, ammonia (NH_3) volatilization, and nitrogen leaching. However, its influence on soil CO_2 emissions was negligible. Conversely, lab experiments often showed more pronounced effects. Both sets of experiments highlighted factors influencing biochar's efficacy, such as soil properties, biochar application rate, and nitrogen fertilization. Importantly, high biochar rates in labs might exaggerate its benefits on carbon sequestration and underestimate its mitigation potential.

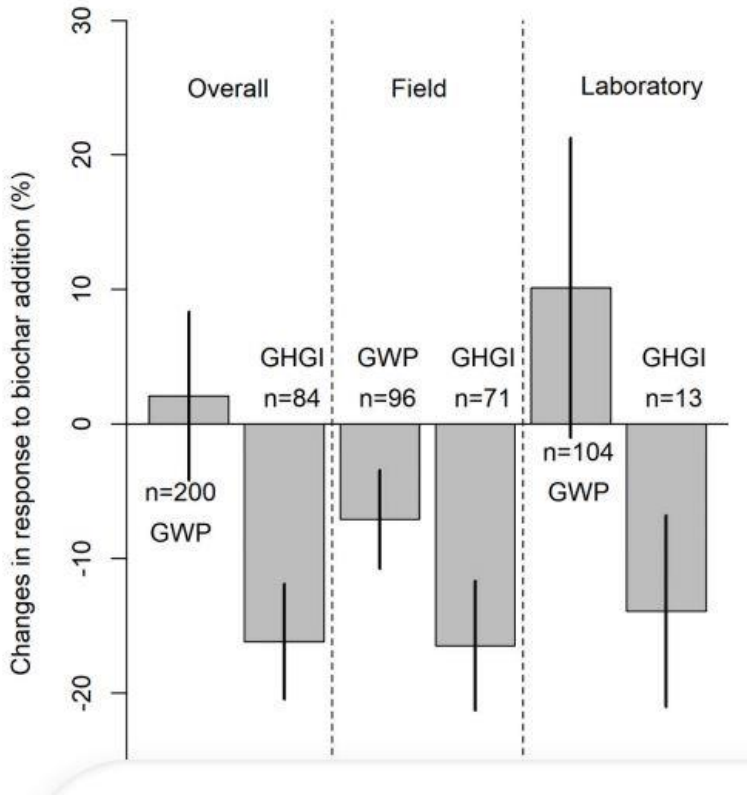

Figure | Effects of biochar addition on global warming potential (GWP) and greenhouse gas intensity (GHGI)

04 THEME: MRV (measurement, reporting, verification)

How does uncertainty of soil organic carbon stock affect the calculation of carbon budgets and soil carbon credits for croplands in the U.S. Midwest?

January 01, 2023 | Geoderma | Source | T23.04.04

Introduction: Understanding the carbon dynamics within croplands is crucial for combating climate change. This necessitates accurate assessments of carbon budgets and soil carbon credits, which reflect the carbon flow and storage in agroecosystems. However, uncertainties in soil organic carbon (SOC) data pose challenges to precise calculations, especially in regions like the U.S. Midwest. To address this, a US research team led by University of Illinois at Urbana-Champaign utilized a robust agroecosystem model to examine the impact of SOC data discrepancies on carbon budget assessments, focusing on corn-soybean rotation systems.

Key findings: The analysis uncovered significant variations in simulated carbon budgets depending on the soil dataset used, highlighting the critical role of precise SOC measurements. Interestingly, while initial SOC percentages heavily influenced carbon budget components, the calculation of soil carbon credits proved less sensitive to SOC inputs. Despite uncertainties, existing soil datasets like gSSURGO are suitable for soil carbon credit calculations, offering valuable insights for climate mitigation strategies in agriculture.

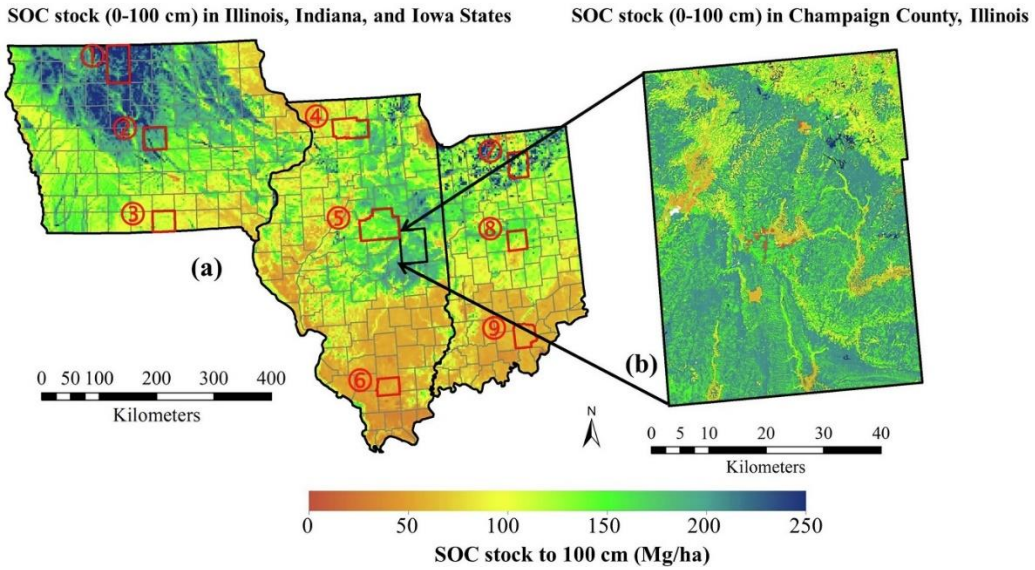

Figure | (a) Soil organic carbon (SOC) stock of Illinois, Indiana, and Iowa integrated over 0–100 cm using data from gSSURGO, and the location of Champaign County, Illinois; (b) The distribution of 0–100 cm SOC stock in Champaign County, Illinois.

05 THEME: Carbon sequestration

Carbon for soils, not soils for carbon

January 16, 2023 | Global Change Biology | Source | T23.04.05

Introduction: The concept of soil organic carbon (SOC) sequestration as a solution to both climate change and food insecurity is gaining attention. Scientists from Wageningen University in Netherlands critically evaluates the potential benefits of global SOC sequestration strategies on climate change mitigation and food production.

Key findings: Considering SOC saturation, the research team reveals that the expected contribution of SOC sequestration to climate change mitigation could decrease significantly by 2100. Additionally, an analysis of multiple studies shows inconsistent yield effects associated with increasing SOC, suggesting that the promised win-win outcome depends on specific land management practices and conditions. In conclusion, the authors advocate for a shift towards soil-smart agriculture, tailoring practices to local contexts and considers multiple soil functions simultaneously, maximizing synergies for land sustainability and meeting agronomic needs for food security.

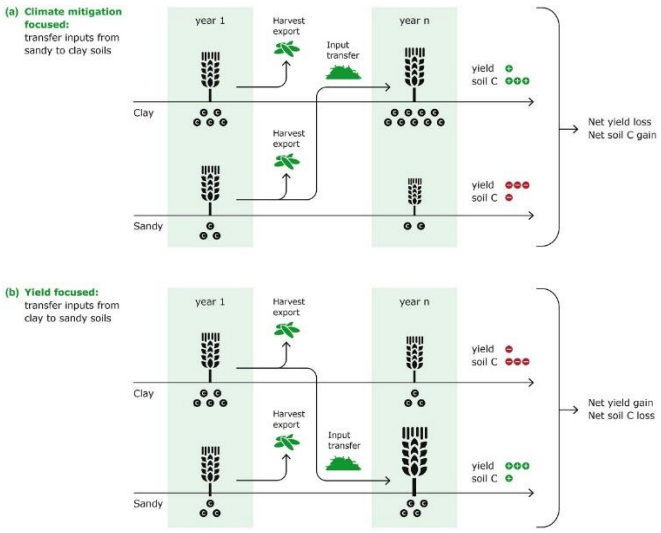

Figure | Conceptual figure illustrating potential conflicts between soil organic carbon (SOC) sequestration and food production. The figure depicts two hypothetical cases in which crop residues are removed from one field after harvest to be applied as OM inputs to another crop field. In panel a, residues are transferred from a sandy soil to a clay soil. After some years, a new equilibrium for SOC stock is reached. The clay soil gains more SOC than the sandy soil loses, due to its higher C stabilisation capacity. Therefore the net overall effect is that C is sequestered, to the benefit of climate (provided that no additional N_2O or CH_4 emissions would arise). The clay soil also sees crop yield increasing, but not as much as the yield in the sandy soil decreases, due to the stronger yield effect of organic amendments in sandy than clay soils. The net effect for yield is that less crops are produced overall. The reciprocal transfer, in panel b, leads to mirrored effects: Small yield loss in the clay soil and high yield gain in the sandy soil, and large CO_2 emissions in clay soil and small SOC sequestration in the sandy soil with an overall SOC loss and aggravated climate change, but more food produced overall. Importantly, assuming that each field is owned by a different farmer, someone always loses. This clearly illustrates that local win-win scenarios can occur at the expense of fertility elsewhere.

NEWS

01 THEME: GHG emission reduction; Carbon sequestration

UConn Researcher Explores Biochar's Role in Advancing Climate-Smart Agriculture

February 20, 2023 | UConn Today | N23.04.01

In Connecticut, with its abundant forests and farmland, Wei Ren, a researcher at the UConn Department of Natural Resources and the Environment, sees an opportunity to lead in climate-smart agriculture (CSA) using biochar.

Ren's team recently reviewed nearly 600 global studies on biochar, exploring its potential as a CSA practice. Biochar, made from organic waste through pyrolysis, enhances soil health, water retention, and nutrient density while sequestering carbon. Their research suggests that biochar, alongside other CSA practices, can sustainably boost food production, reduce emissions, and enhance soil quality. Ren envisions utilizing Connecticut's resources, like tree waste, to produce biochar locally, fostering a circular economy and climate-resilient agriculture.

Ren emphasizes collaboration and interdisciplinary efforts, leveraging UConn's outreach via UConn Extension to disseminate findings and gather feedback from farmers. As they seek further funding, Ren's team aims to keep biochar production local, aligning with the shift towards resilient and sustainable food systems amid the pandemic.

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

Carbon Credits Farming (Everything You Need To Know)

February 17, 2023 | Carbon Credits | N23.04.02

As farmers seek new avenues for profitability amidst climate change, carbon farming emerges as a lucrative solution. By sequestering carbon in soil, farmers not only enhance soil health but also earn additional income through carbon credits. This article outlines the process of carbon farming, emphasizing its financial incentives and environmental benefits. It explains how carbon credits work, why they matter, and considerations for farmers interested in participating. With growing demand for carbon credits, driven by businesses aiming to offset emissions, carbon farming is poised to become a significant aspect of agriculture. The article underscores the importance of rigorous standards and verification processes to ensure the credibility and impact of carbon farming initiatives. Overall, carbon farming presents an opportunity for farmers to contribute to climate change mitigation while improving farm profitability and sustainability.

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03 THEME: Policy incentives, financing, and pricing; MRV

Regional Carbon Farming? An Italian Example

February 23, 2023 | ARC2020 | N23.04.03

The Rete Rurale Nazionale (RRN) has proposed a pioneering approach to carbon farming, focusing on district-level certification schemes. By implementing agroforestry practices, farmers can produce sustainability credits sold to livestock farmers. This initiative underscores the importance of local governance in climate change mitigation, with regional authorities playing a key role.

The governance structure involves district governance bodies, higher authorities with technical committees, credit sellers, and buyers. The "Measure, Avoid, Reduce, Compensate" (MARC) approach ensures that buyers first take steps to reduce emissions before purchasing credits, enhancing the effectiveness of the program.

Transparency and integrity are ensured through public registries managed by district bodies, providing visibility into emissions and credit transactions. Monitoring periods for credit issuance vary, and credits cannot be resold to maintain transparency and credibility. Verification processes, including spot checks, further uphold integrity.

Lessons from RRN's approach highlight the importance of integrity, transparency, and verification in regional carbon farming governance. The model facilitates local transition dynamics and fosters collaboration among stakeholders. Similar initiatives are emerging across Europe, indicating a growing trend towards regional carbon farming governance, albeit with variations in implementation and governance structures.

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04 THEME: Carbon sequestration; ICT in agridfood sustainability; MRV

Taiwanese small farmers lead the charge towards carbon neutrality (In Chinese)

March 04, 2023 | Credere Media, Taiwan | N23.04.04

In Taiwan's push towards achieving carbon neutrality by 2050, small-scale farmers are spearheading innovative solutions. Over 300 farmers across 270 hectares of land have joined the "Small Farmers Carbon Sequestration Project." Recently, their project design received Gold Standard certification from an international carbon reduction standard institution, marking a significant milestone in Taiwan's sustainability journey.

The project focuses on increasing soil organic carbon through sustainable farming practices, aligning with global Sustainable Development Goals (SDGs). Utilizing the "Hardworking Farmers App," farmers log carbon reduction activities and transparently market their products, promoting accountability and consumer trust.

This initiative, developed in collaboration with the Green Consumers' Alliance and Weather and Climate Corporation, fosters a holistic approach to agricultural sustainability. By integrating

innovative communication technology and transparent verification processes, it sets a precedent for global agricultural carbon reduction initiatives.

Moreover, the project aims to market certified farmers' products and design ecotourism initiatives, enhancing local agricultural exposure and rural economic development. Corporate participation is encouraged, offering an opportunity for impactful ESG investments that benefit the environment, agriculture, food security, and rural communities.

Through collective efforts and transparent verification processes, Taiwan's agricultural sector emerges as a beacon of innovation and sustainability, contributing to global climate action and paving the way for a carbon-neutral future.

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05 THEME: Others

Dry farming could help agriculture in the western U.S. amid climate change

March 09, 2023 | ScienceNews | N23.04.05

Amid escalating water shortages aggravated by climate change, a resurgence of interest in dry farming is sweeping through agricultural communities in the Western United States. Dry farming, an age-old practice that eschews irrigation in favor of relying on stored soil moisture, is gaining traction as farmers seek sustainable alternatives to traditional methods. While not a new concept, dry farming fell out of favor in the 20th century with the advent of irrigation technology. However, its resurgence is driven by the urgent need to conserve water in regions where agriculture accounts for a significant portion of water usage.

Despite its challenges, such as smaller yields and labor-intensive practices, dry farming offers compelling benefits. By tapping into natural soil moisture, farmers can reduce reliance on irrigation, mitigating the strain on dwindling water resources. Moreover, dry-farmed produce is renowned for its superior flavor and longer shelf life, appealing to both growers and consumers alike.

As interest in dry farming grows, ongoing research aims to identify crop varieties best suited to this practice, ensuring its viability in the face of changing climatic conditions. While not a one-size-fits-all solution, dry farming represents a promising pathway toward sustainable agriculture, offering hope for a future where farmers can thrive while safeguarding precious water supplies.

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06 THEME: ICT in agrifood sustainability

Smart transformation of agriculture in Yunlin, moving towards a Net Zero (In Chinese)

March 26, 2023 | Economics Daily, Taiwan | N23.04.06

The Yunlin County Government has won the 2023 Smart City Innovation Award for its project "AI-Driven ESG Smart Farming Demonstration Site - Yunlin Agriculture Carbon-Neutral Transformation Service." This project aims to construct a locally distinctive smart agriculture system, balancing industry development, food security, and environmental sustainability. Through digital and green transformation, agriculture is upgraded, productivity is enhanced, and alignment with international carbon reduction trends is achieved.

The project, trialed in Shuilin Township and Dapi Township, focuses on smart greenhouses and smart farms. Smart greenhouses utilize sensors to monitor and automate irrigation and nutrient supply, achieving precise cultivation and labor savings. Collaboration with Chung Hsing University quantifies greenhouse carbon sequestration, ensuring soil carbon increase. Smart farms feature intelligent environmental control buildings powered by solar energy, addressing energy needs, and automated loading systems, solving labor demands.

The Yunlin County Government believes that agriculture plays an essential role in achieving the 2050 net-zero emission goal. Establishing the 2040 Yunlin Agricultural Carbon-Neutral Pathway will contribute to realizing the net-zero emission goal, rallying consensus for agricultural sustainability. The success of this project demonstrates the feasibility of agricultural transformation and brings a glimmer of hope for global agriculture. Looking ahead, Yunlin agriculture will move towards greater prosperity and sustainability under the guidance of smart and green transformation.

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07 THEME: ICT in agrifood sustainability

Unlocking Agricultural Potential Through Data: A Call for Digital Infrastructure

April 05, 2023 |The Commonwealth | N23.04.07

In his recent blog, Benjamin Kwasi Addom, a trade policy adviser, emphasizes the critical role of agricultural data in driving innovation and ensuring food security. Addom highlights the complexity of the agricultural data ecosystem and the challenges arising from fragmented data management at the national level. To address these issues, he proposes the adoption of Digital Public Infrastructure (DPI) for agricultural data, drawing on successful examples from Commonwealth nations. Addom argues that DPI can facilitate coordinated data management, enhance digital sovereignty, and drive sustainable agricultural development. He calls for collaborative efforts to develop and implement DPI, positioning the Commonwealth Connectivity Agenda as a key facilitator in this transformative initiative.

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08 THEME: ICT in agrifood sustainability

Tech collaboration revolutionizes agricultural sector to achieve supply chain transparency

January 31, 2023 | Trade Finance Global | N23.04.08

Modern farming faces escalating challenges, with accelerated operations demanding increased on-farm grain storage. Veridapt and GrainCorp collaborate to revolutionize the commodity and agricultural sectors. Veridapt's IoT solutions offer real-time insights, empowering farmers to manage stored grain effectively. Despite remote landscapes posing installation hurdles, advancements in IoT technology streamline setup, lower costs, and enhance reliability, catering to the sector's evolving needs.

Beyond agriculture, digital innovations find applications in diverse industries, addressing challenges like supply chain transparency. The collaboration between Veridapt and GrainCorp exemplifies how technology transcends boundaries, fostering a cycle of innovation across sectors. As the agricultural sector embraces technology-driven solutions, it navigates modern challenges, driving efficiency and sustainability in its wake.

POLICY

01 THEME: Net zero strategy; Climate smart agriculture; Nature-based solutions; Carbon market

UK's Net Zero Growth Plan: Farming Sector

UK Department for Environment, Food & Rural Affairs| Source | Download | P23.04.01

The UK government's Net Zero Growth Plan outlines a comprehensive strategy to achieve net-zero emissions by 2050 while fostering economic prosperity. Agriculture presents unique challenges in this mission, given the inherent emissions from activities like animal husbandry and fertilizer use. However, the government is committed to reducing emissions while ensuring thriving farm businesses and food production sustainability.

Policy Measures

- Carbon Budget Delivery Plan: The government's Carbon Budget Delivery Plan, introduced alongside the Net Zero Growth Plan, delineates specific measures to decarbonize agriculture. Notably, it acknowledges farmers' efforts in reducing emissions by 12% since 1990 and aims to support further reductions through targeted interventions.
- Feed Additives: Addressing ruminant livestock emissions, the government aims to mandate the introduction of methane-inhibiting feed additives, expected in the UK market by 2025. This initiative underscores the collaborative role of industry and government in driving uptake within cattle farm systems.
- Carbon Audits: Recognizing the need for a harmonized approach to carbon audits, Defra intends to support farmers with standardized auditing processes by 2024. Such audits are crucial for demonstrating carbon savings and attracting private finance to complement public funding.
- Agroforestry: Emphasizing farmers' role in broader land use emissions reduction, the government aims to introduce agroforestry systems on 10% of arable land by 2050. To incentivize adoption, an agroforestry standard will be integrated into the Sustainable Farming Incentive by 2024, providing farmers with financial support.

02 THEME: Net zero strategy; Nature-based solutions; Climate smart agriculture; Supply chain

UK's Net Zero Growth Plan: Land and Natural Resources

UK Government| Source | Download | P23.04.02

Achieving net zero emissions requires a holistic approach that not only addresses carbon reduction but also maximizes co-benefits for climate and nature. This policy brief outlines key strategies and progress made towards decarbonizing land use sectors, enhancing natural resource management, and promoting economic growth while supporting biodiversity, water quality, and climate adaptation.

Key Strategies:

- **Decarbonizing Land Use Sectors:** Implement measures to decarbonize agriculture, forestry, and other land use sectors. Support farmers and land managers through environmental land management schemes to reduce greenhouse gas emissions while providing multiple public goods.
- **Sustainable Management of Natural Resources:** Accelerate efforts to sustainably manage natural resources and ecosystems. Develop frameworks for multifunctional landscapes that prioritize net zero, biodiversity, and environmental recovery, ensuring resilience to climate change.
- **Investment in Nature-Based Solutions:** Establish a pipeline of investable nature-based solutions projects to monetize the benefits of nature. Mobilize private finance into nature's recovery through initiatives like the Natural Environment Investment Readiness Fund and the Green Finance Strategy, aiming to surpass £1 billion per year by 2030.
- **Reduction of Waste and F-Gas Emissions:** Drive forward action to reduce emissions from waste and F-gases. Implement collection and packaging reforms, near-elimination of biodegradable waste sent to landfill by 2028, and consult on amending existing F-gas legislation to further reduce emissions.

Progress and Delivery: Significant progress has been made across various areas, including the publication of environmental improvement plans, updates on environmental land management schemes, and acceleration of sustainable farming incentives. Initiatives such as the Paludiculture Exploration Fund and the Nature for Climate Fund demonstrate commitment to peatland restoration and woodland creation.

Upcoming Delivery Milestones: Future milestones include the full rollout of environmental land management schemes, publication of a Land Use Framework for England, and the development of methodologies for voluntary food ecolabeling. Additionally, plans to achieve near elimination of biodegradable municipal waste and expand the UK Emissions Trading Scheme highlight ongoing efforts to reduce waste and emissions.

03 THEME: Net zero strategy

UK Net Zero Growth Plan: analysis methodoloy

UK Government | Source | Download | P23.04.03

This annex provides an overview of the methodological approach taken to analysis in the Carbon Budget Delivery Plan and the Net Zero Growth Plan.

Emissions Analysis

- **Accounting Framework:** Utilizes UK Greenhouse Gas Inventory figures, annually revised for methodological enhancements and updated data.
- **UK Territorial Emissions:** Reduced 48% from 1990 to 2021, despite short-term fluctuations due to pandemic responses.
- **Carbon Accounting:** Includes potential use of international carbon units under Article 6 of the Paris Agreement, while focusing on domestic emission reductions.

Carbon Markets

- Historical adjustments for net trading of EU ETS emissions allowances are no longer necessary post-2020 due to the UK's exit from the EU ETS.
- Future adjustments may arise from voluntary cooperation or linking the UK ETS to other trading systems.

International Aviation and Shipping (IAS): IAS emissions are included from 2033, estimated through bunker fuel sales, aligning with UNFCCC reporting guidelines.

04 THEME: Climate smart agriculture; Nature-based solutions; Supply Chain; Sustainable consumption

EU Common Agricultural Policy (CAP) 2023-27 Reform

European Commission| Source | Download | P23.04.04

The reformed CAP 2023-27, which came into effect on January 1, 2023, marks a significant step towards a fairer, greener, and more performance-driven agricultural policy in the European Union (EU). Aligned with the European Green Deal objectives, the new CAP aims to ensure sustainability, support small-scale farmers, and empower EU countries to tailor measures to local needs.

Key Areas of Reform

- **Environmental Sustainability:** The CAP 2023-27 integrates higher environmental ambitions, with each EU country required to demonstrate increased commitment to environmental and climate actions. Eco-schemes, comprising at least 25% of direct payment budgets, incentivize climate-friendly farming practices and animal welfare improvements.
- **Social Equity:** Income support redistribution, with a minimum of 10% of direct payments dedicated to smaller farms, addresses income disparities. Active farmer definitions and social conditionality ensure CAP benefits are directed to those actively engaged in farming and compliant with EU labor standards.
- **Competitiveness:** Enhancing farmers' bargaining power through strengthened producer cooperation fosters a fairer supply chain. Market-oriented policies and crisis reserves bolster market stability and support sectors like wine production.

Budget Allocation: The CAP receives substantial funding of €387 billion for the 2021-27 period, with allocations from the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD). A portion of the EAFRD budget is sourced from Next Generation EU funds to drive rural areas' green transition and digitalization.

Knowledge and Innovation: Investing €10 billion from the Horizon Europe program in food, farming, and rural development research underscores the CAP's commitment to innovation. Strengthened Agricultural Knowledge and Innovation Systems (AKIS) facilitate knowledge dissemination and the implementation of innovative projects, supported by farm advisory services.