GLOBAL RESEARCH ALLIANCE
Croplands Research Group

NEWSLETTER Nº10, June 2021

1. Cropland Research Group GRA Co-Chairs message

With the approaching holidays in Europe we send you this exciting newsletter full of news that aims to improve sustainable land management for mitigating and adapting farming systems to climate change. Our most recent webinar by Dr Mike Beare from New Zealand highlighted the role of full inversion tillage to increase soil C sequestration while reducing N_2O emissions. From Argentina, Dr Ana Lupi shares an exciting project focused on understanding the impact of forest management practices on climate change mitigation. The Foodlevers project described by Mercedes Rois points out the role of food systems in fostering sustainable production systems. The promotion of agroecology in Europe linked to the agroecosystem boundaries concept is

described by Dr. Mosquera-Losada through the explanation of two Coordination Scientific Actions that will develop new agroecology partnerships in the European Union: AE4EU and All-Ready. We finalize the Newsletter with invitations to contribute to a special issue of *Nutrient Cycling in Agroecosystems* focused on nitrogen dynamics, solicitation of proposals to enhance agroforestry in the United States, and a list of upcoming events. We wish you enjoyable reading and an excellent summer!

Source: Croplands Research Group Co-Chairs Team, María Rosa Mosquera-Losada, Ladislau Martin-Neto, Mark Liebig.

2. Full inversion tillage in mixed crop/pasture systems to sequester soil C and reduce the risk of N2O emissions

On the 12th of May 2021 the Croplands Research Group organized a webinar titled "Full inversion tillage in mixed crop/pasture systems to sequester soil C and reduce the risk of N_2O emissions". In this webinar the speaker was Dr. Mike Beare from Plant & Food Research NZ.

Dr. Mike Beare described a novel approach for accelerating soil organic carbon (SOC) sequestration to offset GHG emissions from agriculture. Whereas surface soils (0–15 cm) under continuous pasture/grassland management typically have high SOC stocks that are approaching steady state (i.e. saturated), subsurface soils (e.g. 15–30 cm) often have much lower SOC stocks and are capable of storing much more C. However, challenges exist in delivering sufficient C inputs to these deeper soil layers. Pasture renewal is actively promoted to farmers in New Zealand, Ireland and elsewhere to improve pasture and forage crop performance (i.e. both species composition and vigour). Renewal represents an ideal point in the management of pasture/grassland systems to use full inversion tillage (FIT; inversion ploughing to 30–40 cm depth) as a one-off event to bury C-rich topsoil (slowing its decomposition) and bring low-C (under-saturated) mineral soil to the surface where the high inputs of C from shallow, dense-rooted pasture/grassland species (new pasture) can fill the soil organic carbon (SOC) saturation deficit over time.

In this webinar, Dr. Mike Beare presented results from an international research programme aimed at:

1) Quantifying the rate and extent of soil C sequestration following FIT pasture renewal
2) Evaluating the agronomic (e.g. production, soil fertility) and environmental (e.g. N leaching, N_2O emissions) impacts and trade-offs of FIT compared with those of other traditional forms of pasture renewal
3) Developing practical guidelines for the use of FIT pasture renewal on-farm

Data from 247 pasture sites were used to model changes in C stocks following FIT pasture renewal. In the 20 years following FIT, soil C was predicted to increase by an average of 7.3 to 10.3 t C ha^{-1} (Sedimentary soils) and 9.6 to 12.7 t C ha^{-1} (Allophanic soils), depending on the assumptions applied (Lawrence-Smith et al., 2021). Adoption of FIT for pasture renewal across all suitable soils (~2.0–2.6 M ha) in New Zealand was predicted to sequester between 20–36 Mt C, sufficient to offset 9.6–17.5% of the country's cumulative greenhouse gas emissions from agriculture over 20 years at current emission rates. These annual rates of soil C sequestration agree well with field-based measurements made in this programme and other studies of SOC accumulation following pasture establishment on inversion ploughed or C-depleted cropping soils, which range from about 0.62 to 3.2 t C ha^{-1} y^{-1}.

In general, results of the field trials showed that the dry matter production (DMP) of new pasture following FIT was similar to pasture established following shallow tillage or direct drilling and consistently higher than in non-renewed continuous pasture (Beare et al., 2020; Calvelo Pereira et al., 2020). When a forage crop (e.g. forage oats or a summer brassica) was grown as a break between old and new pasture, crop DMP was often higher following FIT compared with shallow tilled or direct drilled crops. The higher DMP helped to remove excess mineral N from the soil, thereby reducing the risk of N leaching losses. The extra DMP achieved with FIT and forage crops was sufficient to offset the extra establishment costs of FIT, leading to better returns from pasture renewal. Combining FIT with a spring-sown forage crop reduced N leaching losses compared with renewal with shallow or no-tillage.

In addition to accelerating soil C sequestration, our research also demonstrated that FIT pasture renewal can reduce N_2O emissions. Overall, the N_2O emissions from urea fertiliser were relatively low and there were no consistent differences between no-tillage (NT) and FIT pasture renewal and non-renewed continuous pasture (CP) (McNally et al., 2020). In contrast, the cumulative emissions of N_2O from urine were 5 to 20 times higher than the emissions from urea or plots receiving no N inputs. The cumulative N_2O emissions from urine applied to FIT pasture were, on average, 30–40% lower than the emissions from continuous (non-renewed) pasture and 50–60% lower than emissions from pasture renewed with no-tillage. The emission factors derived for urine (EF_3) were all lower than the current default value across both sites and years regardless of treatment. However, the EF_3 values for FIT-pasture renewal (0.10–0.22%) were lower than those

of NT-pasture renewal (0.16–0.44%) and continuous pasture (0.14–0.45%) reflecting, in general, the lower emissions from FIT renewal at both sites. The apparent reduction in N_2O emissions from urine represents a co-benefit of FIT-pasture renewal that makes it an attractive practical management option to reduce GHG emissions from pastoral agriculture in New Zealand.

For more information the webinar is available here.

Figure 1: Experiments carried out by Dr. Mike Beare in New Zealand.

Source: Dr. Mike Beare (New Zealand Institute for Plant & Food Research, NZ).

Presented on behalf of collaborators at: Plant & Food Research, Massey University and Manaaki Whenua Landcare Research, New Zealand Thünen Institute for Climate Smart Agriculture, Germany Teagasc & Trinity College Dublin, Ireland.

3. Development of a sustainable forestry of high productivity planted forests

In the Argentine Republic, forestry occupies a total of 1.3 million hectares. Furthermore, an area of more than 2 million hectares is projected for this activity, so important for the economic development of the country and for the mitigation of climate change. In this sense, the National Institute of Agricultural Technology (INTA) is working in the development of a sustainable forestry of high productivity planted forests. The main objective of this project is to generate knowledge and develop tools for the sustainable management of high productivity forests, with adaptability to climate change, efficient in the use of environmental resources, and the achievement of raw material with technological characteristics adjusted to the industrial destination.

Work is carried out in the main forest regions of the country, centered on 13 INTA units, to obtain results that can contribute to the development of the forest chain at the national level. Progress will be made in the integration of information at the regional level of databases of soil, tree growth, climate, and product quality. New challenges of knowledge generation will be addressed through the installation of new assays. The structural project is organized in three modules: (1) Silviculture for the sustainable intensification of cultivated forests with subtropical and temperate *Pinus* species, with *Eucalyptus* and *Salicaceae* clonal species and with *P. alba* (native species), in different environments; (2) relationships between silvicultural management, productivity, technological and functional value of wood and the incidence of biotic and abiotic stress conditions: and (3) Planning tools and information management. It will seek to give the widest dissemination of the reached products to all participants of the forestry activity (National and Provincial Organizations responsible for forestry development and natural resource management, Human resource training organizations, Producers' Associations, Forestry Consortiums and private advisers).

More information here.

Figure 2: Some pictures of high productivity forests in Argentina.

Source: Ing. Ftal. (MSc) Ana María Lupi (Project coordinator), Ing. Agr. (Dr.) Marcelo Beltrán (National Institute of Agricultural Technology, Buenos Aires, Argentina).

4. FOODLEVERS – leverage points for organic and sustainable food systems

FOODLEVERS is one of 12 funded research projects under the Joint Call of ERA-NETs SUSFOOD2 and CORE Organic Cofunds ‘Towards sustainable and organic food systems’.

FOODLEVERS is grounded on the premise that despite the recent uptake of innovative production systems, food systems continue to move on unsustainable trajectories. This can be explained by many sustainability interventions addressing solely more obvious but less powerful

areas of intervention rather than engaging with the root causes of unsustainability. Instead, FOODLEVERS focuses on those leverage points at which interventions promise far more potential to transform food systems into sustainable ones by looking at the three realms of "deep leverage" proposed by Abson et al. (2017):

- "re-connect" people to nature to encourage sustainable behaviours
- "re-structure" institutions and consider how institutional dynamics can create an enabling environment for sustainability
- "re-think" how knowledge is created and used, shared and validated

To investigate potential leverage points in food systems, FOODLEVERS applies a multi-disciplinary systems and multi-actor approach to consider all dimensions and actors of food systems (FSs) as well as their interlinkages, synergies, and trade-offs, rather than treating each unit of FSs separately. Therefore, this project analyses different case studies of organic and sustainable FSs in different geographical (rural, urban) and institutional (e.g. community supported agriculture) contexts throughout Europe and identifies best practice processes from multiple perspectives of resource efficiency: environment, economy, social and governance.

This holistic sustainability assessment of innovative examples of FSs consists of measuring their environmental impacts, resource efficiency and other sustainability aspects from farm to fork e.g. by "cradle-to-grave" life cycle analysis considering all steps from mining raw materials to waste-disposal. Additionally, it takes the role of all actors in the FSs into account by analysing their value chains from a socioeconomic perspective and assessing consumer behaviour and food choices. Based on the resulting identification of critical points, FOODLEVERS will then build scenarios and models (agent-based modelling, stakeholder decision modelling, qualitative scenario modelling) to reveal potential levers for sustainability and discuss future scenarios by drawing on the expertise and experience of FS actors.

The project will identify critical points in the innovative organic FSs studied including barriers, levers and points for intervention. The modelling of scenarios will allow to understand the potential of micro-level changes to achieve system-level change and transition towards sustainable and resilient FSs. Finally, leverage points will be formulated to re-connect, re-structure and re-think FSs.

Partners:

- University of Marburg (DE) (coordinator)
- The Royal Agricultural University (UK)
- Institute of Research on Terrestrial Ecosystems (IT)
- Institute of Soil Science and Plant Cultivation - State Research Institute (PL)
- University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca (RO)
- European Forest Institute (FI)
- The Progressive Farming Trust Organic Research Centre (UK)

- Flanders Research Institute for Agriculture, Fisheries and Food (BE)

More info here.

Source: Mercedes Rois (European Forest Institute).

5. Agroecology and agroecosystems in Europe

Agroecology is a discipline that seeks to provide an objective, ecologically based assessment of the structure, function, multidimensionality, and special scale of the food systems. It is a complex science, that links the ecological, economic, social, ethical, and legal aspects of food production. All spatial scales are considered, from farm field to global, and systems approaches are emphasized. The agroecosystems can be considered as the basic structure of agroecology that could be spatially but also socially defined by considering the whole value chain. The size of the agroecosystem differs considering its own environmental and socio-economic framework. At both levels, biodiversity plays a key role to optimize the use of resources, as different species have complementary functions when living together in a stabilized agroecosystem, which also provides a set of different and diverse good and services that enhance resiliency at productive, environment and social scales. Sustainable agroecosystems are complex systems in which many species interact, with ecological processes that take place at different spatial and time scales, and with strong interactions between ecological and management processes.

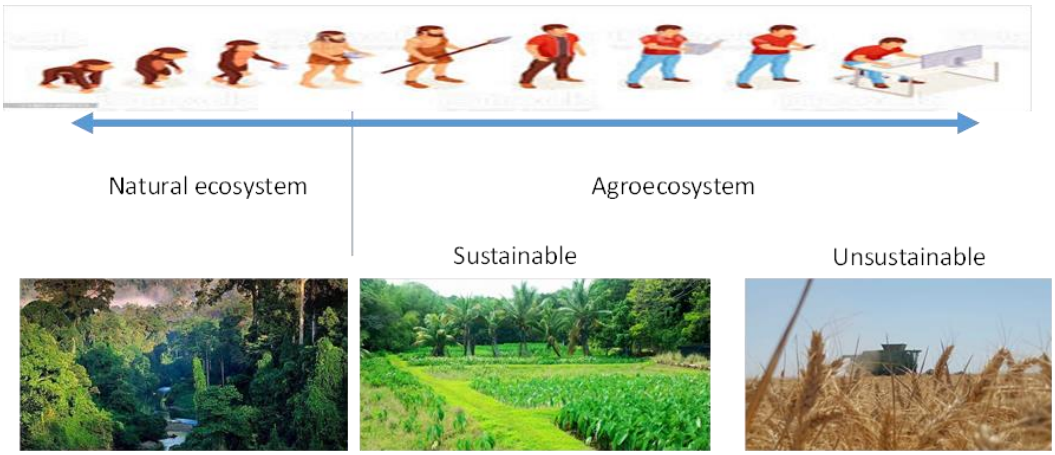

Figure 3: Spatial definition of agroecosystem and the conventional human intervention which could be sustainable and unsustainable when considering the land management.

The key basis for the development of the Agroecology is therefore the deployment of a Partnership aiming at increasing the implementation of agroecology in Europe through the creation of the Horizon Europe partnership on agroecology living labs and research infrastructures. This Partnership will be based on the mapping of existing initiatives, the development of two support actions All-Ready and AE4EU. The creation of infrastructures linked to living labs where stakeholders can develop locally adapted sustainable technologies is also key for the agriculture innovation as shown in the series of webinars developed by the EU. Living labs are interactive innovation ecosystems in which users co-create new solutions, integrating research and innovation processes in real life settings. The establishment of living labs is key to initially understand the main challenges that local farmers must overcome to implement agroecosystem practices, which is essential to co-develop innovations. These innovations can be tailored at local levels considering social, economic, and environmental aspects in order to facilitate the adoption of sustainable farming systems throughout Europe.

Source: Maria Rosa Mosquera-Losada, Ferreiro-Domínguez N (University of Santiago de Compostela, USC, Spain).

6. Special issue on "Use of 15N tracers to study nitrogen flows in agro-ecosystems: transformation, losses and plant uptake"

A special issue of the Nutrient Cycling in Agroecosystems journal will be accepting review and research papers, including modelling studies and short communications, on 15N tracer studies on nitrogen flows in agro-ecosystems. The Guest Editors of this Special Issue are Clemens Scheer (Karlsruhe Institute of Technology, Germany) and Tobias Rütting (University of Gothenburg, Sweden).

This special issue considers manuscripts using 15N tracers to study cycling and flows of N in agroecosystems, including natural abundance studies that focus on the use of the isotope. Studies should typically include multi-year field observations, but this special issue also welcomes contribution of shorter field observations and studies in controlled environment provided they contribute to the understanding of N cycling and flows on a field-scale. Collectively, the papers in this special issue will contribute to advancing our mechanistic understanding of N cycling and help to decrease N losses and improve NUE of cropping systems.

Manuscripts should be submitted online at https://www.editorialmanager.com/fres. The paper submission deadline is 28 February 2022. More information here.

Source: Marta Camps (Massey University, New Zealand).

7. Grant funding of the Edwards Mother Earth Foundation (EMEF)

The Edwards Mother Earth Foundation (EMEF) opened its next round of solicitations for grant funding. EMEF is conducting an open request for proposals for projects designed to catalyze the adoption of agroforestry in the United States as a means to help mitigate or reverse climate change. Proposals are due 27th August 2021.

EMEF seeks to identify and support bold, multi-year, multi-partner strategies to catalyze greater adoption of agroforestry in the U.S. The RFP's parameters have been designed to support a wide range of organizations, approaches, and strategies, and to encourage aspirational thinking and new forms of collaboration. The RFP submission process will be coordinated by Gordian Knot Strategies. For instructions on how to prepare and submit an application, please see the full RFP here.

Source: Sean Penrith (Gordian Knot Strategies, USA).

8. Upcoming events

Due to the global development of the Covid-19 outbreak, some events were postponed. Please see below the new available dates

17th International Conference on Environmental Science and Technology

The 17th International Conference on Environmental Science and Technology (CEST2021) will be held in Athens, Greece, during **1st - 4th September 2021**. This conference is a leading environmental conference where top experts, scientists, entrepreneurs, representatives of public administration and social initiatives present state-of-the-art research on current and emerging environmental issues. More info here.

ASA-CSSA-SSSA Annual Meeting

The 2021 ASA-CSSA-SSSA International annual meeting will be held in the Salt Lake City, UT USA, during **7th - 10th November 2021**. The 2021 meeting theme is "A Creative Economy for Sustainable Development". Details about this year's meeting may be found here.

14th European Farming Systems Conference (NEW DATE)

The 14th European Farming Systems Conference (IFSA – European Group) will be held at the University of Évora, Portugal, and hosted by the Institute of Mediterranean Agricultural and Environmental Sciences during **10th – 14th April 2022**. The main focus of this years' conference will be Farming Systems Facing Climate Change and Resource Challenges. More information here.

2nd International Symposium on Climate-Resilient Agri-Environmental Systems

The 2nd International Symposium on Climate-Resilient Agri-Environmental Systems (ISCRAES 2022) will be held in Dublin, Ireland, during **7th – 10th June 2022**. The main theme of this symposium is "Implementing the New Green Deal: The Path Towards Sustainable Agriculture", which refers mainly to European Green Deal having the opportunity and resources to achieve the primary objective of a sustainable Europe and planet by tackling the current major environmental, climate, and societal challenges facing by the world. More information here.

22nd World Congress of Soil Science

The 22nd World Congress of Soil Science will be held in Glasgow, Scotland during **31st July – 5th August 2022**. The Congress theme, "Soil Science – crossing boundaries, changing society" focuses on the link between soil and society, with sessions covering soil systems, soil processes, soil management and how we interact with and use soils around the world. More information may be found here.

18th International RAMIRAN Conference (NEW DATE)

The 18th International RAMIRAN Conference will be held in Cambridge, UK, during **19th – 21st September 2022**. The conference will focus on developing strategies to maximize the efficiency of organic materials against a background of changing regulation, policy, and market forces, as well as increasing pressure on the environment, soil quality, and food production. More information here.

4th Agriculture and Climate Change Conference (NEW DATE)

The 4th Agriculture and Climate Change Conference will be held in Dresden, Germany, during **8th – 10th May 2022**. The Conference will focus on the likely impact of climate change on crop production and explore approaches to maintain and increase crop productivity into the future. More information here.

This is your newsletter! If there's anything you think should be included, please send suggestions to mrosa.mosquera.losada@usc.es for the next issue

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