GLOBAL RESEARCH ALLIANCE
Croplands Research Group

NEWSLETTER Nº4, December 2019

1. Cropland Research Group GRA Co-Chairs message

The CRG co-chairs would like to thank all members for the strong contribution to the different activities in the CRG. The GRA Council meeting in Bali, Indonesia in October and the CRG meeting in San Antonio, Texas a month later were a success. Both meetings were effective in expanding collaborative research efforts globally in support of agricultural greenhouse gas mitigation and climate adaptation. GRA participation at COP25 in Madrid, Spain highlighted the value of our efforts heading into the new year. The AFINET project has ended with a European Parliamentary Session in Brussels where recommendations on agroforestry innovation to

mitigate climate change and adapt arable systems to climate change were provided to policy makers. The CRG newsletter was initiated in 2020 and many new collaborative initiatives were initiated or are planned for 2020 (see forthcoming CRG meeting minutes for details). The co-chairs of the CRG would like to wish all of you a safe and enjoyable holiday season and a Happy New Year with a lot of success in our collective search for innovative solutions to climate change issues.

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

2. The United Nations Climate Change conference (COP25)

The annual United Nations climate change conference (COP25) provided a good opportunity for the GRA and its members and partners to showcase some of the activities taking place across its research groups and networks. Amongst them, a research update on the GHG impacts of improved animal health in dairying with case studies in Chile, Kenya and the UK was presented by the GRA, Global Dairy Platform and Dairy Sustainability Framework. The GRA's Special Representative joined colleagues from the Basque Centre for Climate Change (BC3) to discuss The role of ruminants on climate change mitigation: the good and the bad. With colleagues from INRAE, France we presented the latest advances in the CIRCASA project, the role of soil carbon in addressing climate change, and progress towards the development of an international research consortium. With ACIAR, Australia we presented updates on a project on climate change and Pacific food systems. Finally, AFINET coordinator and our own CRG co-chair participated in an event exploring the role of innovation in addressing climate change.

Figure 1: Representatives of the Global Research Alliance (Hayden Montgomery, María Rosa Mosquera-Losada and Jean-Francois Soussana) in the COP25 in Madrid, Spain.

Source: Hayden Montgomery (Special Representative, Global Research Alliance on Agricultural Greenhouse Gases).

3. Agroecology: a transformative approach that provides alternatives to conventional agriculture and foster transition to sustainable food systems

Nowadays we are facing some dramatic events, such as the collapse of our biosphere connected with the sixth mass extinction, the climate change tragedy and the human population migration emergency. The main challenges in the food systems are to provide food for the growing world population, reduce food waste, increase healthy diets, conserve natural resources as well as eliminate social injustice and cultural erosion, i.e. the loss of traditional knowledge.

Agroecology is an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. The European Association for Agroecology (Agroecology Europe) understands that Agroecology: "*is considered jointly as a science, a practice and a social movement. It encompasses the whole food system from the soil to the organization of human societies. It is value-laden and based on core principles. As a science, it gives priority to action research, holistic and participatory approaches, and transdisciplinarity that is inclusive of different knowledge systems. As a practice, it is based on sustainable use of local renewable resources, local farmers' knowledge and priorities, wise use of biodiversity to provide ecosystem services and resilience, and solutions that provide multiple benefits (environmental, economic, social) from local to global. As a movement, it defends smallholders and family farming, farmers and rural communities, food sovereignty, local and short food supply chains, diversity of indigenous seeds and breeds, healthy and quality food. Agroecology acknowledges that the whole is more than the sum of its parts and hence fosters interactions between actors in science, practice and movements, by facilitating knowledge sharing and action*."

Diversified agroecological systems are vital not only to address poverty, hunger, and climate change mitigation and adaptation, but also for directly realizing other Sustainable Development Goals in areas such as health, education, gender, water, energy and economic growth.

Agroecology Europe thinks that we have to move away from monoculture and conventional food system to develop agricultural and food diversity in all forms: use of local crop cultivar and traditional animal breeds, create appropriate habitats and landscape, enhance the recycling of biomass, develop agroforestry systems, conserve and regenerate soil, water and agrobiodiversity as well as bridging the gap between the producers of food and co-producers (consumers) and find solution for local problems, create collective knowledge and coping ability, foster farmers' independence from the global market, recognize the value of diversity of knowledge and know-how.

Agroecology is not just a list of good practices but is also to reach the goal of transforming our agricultural and food systems to work together with rather than against nature, to ensure all people have access to sustainable diets.

Agroecology can play an important role

- For farmers: greater soil fertility, lower production costs, greater decision-making autonomy, agricultural systems becoming more resilient to cope with climate risks, and enhanced professionalism;
- For consumers: better health and nutritional quality of food and water, preservation of biodiversity and landscapes and connection to rural development.

Applying agroecology in agriculture represents a paradigm-shift towards fighting climate change, rebuilding living ecosystems and protecting water, soil and all the resources that agricultural production depends on.

Source: Paola Migliorini (President of Agroecology Europe).

4. Cornell University's climate smart farming program

Climate change is arguably humanity's most urgent challenge. Humans are already experiencing significant climate impacts, and these will only increase in frequency and severity over time. Climate change impacts to agriculture globally and in the United States have been increasing and are projected to become more severe through the end of the century. Climate change poses unprecedented challenges to agricultural production due to the sensitivity of

agricultural productivity to changing climatic conditions and the high costs of impacts and adaptations. Climate change will necessitate that agricultural, ecological, and social systems adapt and mitigate their greenhouse gas (GHG) emissions across multiple scales. Rapid change will be most successful if those stakeholders who are most directly affected are included in the decision-making processes.

Climate Change and Impacts to Agriculture

The earth's climate is changing, and the primary causes are anthropogenic emissions of greenhouse gases and changes in land use. According to the IPCC, "*Atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions*" (2013).

As a consequence of increased atmospheric concentrations of greenhouse gases, there have been observed increases in average temperatures globally, changes in precipitation patterns, and increases in some extreme weather events. According to the US national climate assessment, temperatures at the Earth's surface, and in the oceans, have increased in recent decades. Increases in global surface temperature have caused a ripple effect of numerous other changes to the Earth's climate. For example, snow and ice cover have decreased in most areas around the globe. Average temperatures in the Arctic are rising twice as fast as they are elsewhere on earth, and the world's ice sheets are melting faster than scientists expected. This has implications for sea level rise, since water expands as it warms and because melting ice sheets add water to the oceans. By 2100, the oceans may be one to four feet higher than they are now, threatening small island nations, low-lying coastal areas, and some of the world's largest cities. Scientists have also observed changes in precipitation over land between 1901 and 2010, with some of the driest areas of the globe becoming drier, and wet areas becoming more wet. Changes in the growing season length have been observed in many areas. Scientists also observe an increase in extreme weather events, including extremes in heat and heat waves, an increase in the number of heavy precipitation events over a short period of time, which often cause flooding, and increases in drought and short-term drought in many areas.

Climate change presents an incredible challenge to agriculture globally. According to the Food and Agricultural Organization (FAO), between 2013 and 2050, the world's population will increase by one-third, with most of the additional 2 billion people living in developing countries, and in cities. If the current trends in growth in global income and food consumption continue, FAO estimates that agricultural production will need to increase by 60% by 2050 to satisfy expected demands for food, fiber and feed. Agricultural production must adapt if it is to feed a growing global population, under increasingly difficult conditions brought by climate change.

Agriculture is a unique sector of the economy, in that it is a significant contributor of greenhouse gas emissions globally, but also contributes to carbon sequestration in soils. In 2010, agriculture, forestry, and other land use constituted 24% of global greenhouse gas emissions, with the majority of GHG emissions coming from agriculture production, cultivation of crops and livestock, and deforestation.

Farmers are also on the front lines with climate change, as one of the sectors of the economy most at risk from extreme weather and climate variability. Two concepts are important to clarify. Climate change mitigation is defined as "measures to reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing carbon dioxide from the atmosphere," while climate change adaptation is defined as the "adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects". Thus, it is critical to balance efforts that will reduce greenhouse gas emissions from the agricultural sector with those adaptation practices that will help farmers manage climate change effects. Several agricultural practices can synergistically contribute to both climate change adaptation and mitigation, but there may also be trade-offs required in prioritizing adaptation or mitigation practices.

Climate Smart Agriculture

Climate smart agriculture (CSA) is a concept that was defined by the FAO in 2010 in order to address the dual challenges of addressing food security and climate change. It is composed of three main pillars or goals, to 1) sustainably increase agricultural productivity and incomes; 2) adapt and build resilience to climate change; and 3) reduce and/or remove greenhouse gas emissions where possible.

In order to help farmers in New York State and the Northeastern USA to increase their resilience to climate change and reduce impacts on the climate, Cornell University developed the Climate Smart Farming program, an integrated research and extension program driven by stakeholder needs (climatesmartfarming.org). Climate modelers, biophysical scientists and social scientists are working together to research the climate impacts and best management practices that will lead to increased agricultural resiliency. Focus group interviews have been held with farmers to learn their views on climate change risks, practices they are putting in place and programmatic needs; this baseline data supports models and tools that are being developed.

The program also supports a team of regional cooperative extension specialists working with the Cornell Climate Smart Farming Program. These Extension specialists provide direct outreach to farmers and serve as a resource for other extension specialists in the region, providing new resources for stakeholders, and input to help develop useful toolkits and decision tools. With Extension and farmer input, the program has built a comprehensive portal for climate

change and agricultural decision tools, videos, and resources in a centralized, easy to access website for the farmers. Examples include online growing degree day calculators, drought forecasts, cover crop calculators and water deficit calculators, that provide farmers with real time information on weather impacts to crops that consider the changing climate, but also longer-term projections of climate change (see: climatesmartfarming.org).

Cornell is committed to sharing its CSA expertise and resources with partners in the USA and globally, and participates with the Global Alliance for Climate Smart Agriculture (GACSA), facilitated by the FAO. Cornell helps facilitate the GACSA Knowledge Action Group, in order to share resources, we have developed through GACSA's voluntary information-sharing platform with countries from all over the world.

Source: Allison Chatrchyan (Cornell University, Ithaca, NY, USA).

5. Biochar: a tool to mitigate greenhouse gases

Biochar is a highly stable form of carbon with the potential to form an effective carbon sink, sequestering atmospheric CO_2. Therefore, its field application could likely be beneficial in mitigating greenhouse gases. Land application of biosolids (processed sewage sludge) is a common practice in several parts of the world. However, biosolids do have environmental risks of excess phosphorus loss from the soil when land-applied for a long time. The conversion of biosolids into biochar, however, would transform carbon into recalcitrant forms. There will also be other benefits such as volume reduction of biosolids, decline of heavy metal bioavailability and elimination of pathogens. Moreover, environmental concerns involving phosphorus loss associated with land application of biosolids is dramatically reduced. Freitas et al. (2019) showed in their studies that when biosolids from various processes and locations (Florida, Chicago, Spain and Brazil) were converted into biochar, phosphorus significantly increased total P in the final material, but the absolute water-soluble P decreased significantly. More importantly, plant available P, assessed as Mehlich-3 P, maintained the same levels after conversion to biochar. This finding shows that pyrolysis converted high P availability from biosolids to low P availability from biosolids biochar without compromising plant P uptake. In addition, the conversion of biosolids into biochar can be a potential tool to ameliorate the P problem associated with field application of biosolids while also addressing climate change. In this study, total carbon varied from 4-33% in the biosolids, which has the potential turnover of hundreds of years. This study was the second-place recipient of the graduate student

poster/rapid fire competition of the Agronomic and Environmental Applications of Biochar organized by the Biochar Community of the Environmental Quality Section in ASA, CSSA 2019 International Annual Meetings, San Antonio – Texas, USA.

Figure 2: Andress M Freitas from the University of Florida presenting her work in the ASA-CSSA-SSSA International Annual Meeting in San Antonio, Texas, USA.

Source: Andress M Freitas and Vimala Nair (University of Florida, USA).

6. Final events of the AFINET project: fostering transition to agroforestry systems in Europe

After three years of work to foster the exchange and the knowledge transfer between scientists and practitioners in the field of agroforestry, partners of the Agroforestry Innovation Networks (AFINET) concluded the project with two events in Brussels. On Monday 9th December 2019, a round table discussion hosted by MEP Isabel Carvalhais in the European Parliament and a final conference on the 10th of December by a practitioners' meeting to present the results and outputs of this Horizon2020-funded project, both moderated by Professor Anastasia Pantera.

"*Climate emergency and sustainability are two words that have never been so prominent in the EU political debates. But in front of key words and concepts, we need to put concrete solutions and highlight good practices. Agroforestry is one of them*" said Isabel Carvalhais, Member of the European Parliament from Portugal. She added that both research and policy must support farmers in the transition to agroforestry systems and climate-smart, environment-friendly practices in general: "*Change cannot be knocked on the head of farmers. We must make sure*

*that we do not leave some farmers behind in the transition towards a greener agriculture. Research and the Common Agricultural Policy are two gates to support them in the trans*ition".

Professor Mosquera-Losada, Coordinator of the AFINET project recalled that "*the fact that agroforestry is traditional in many places in Europe does not mean that it is simple. It still requires research, knowledge sharing and practicable innovations, in particular given the increasing environmental pressures*". She explained that "*the achievement of the AFINET project is to have created networks of practitioners across Europe, to exchange best practices and support each other, as well as two accessible tools, the knowledge cloud and the alive handbook, that will continue to exist after the end of the project*".

The two events were attended by agroforestry farmers, academics and EU institutions' and Member States' representatives. Reports of the events will be available on the AFINET website shortly.

Figure 3: Pictures taken during the final AFINET events in Brussels, Belgium.

Source: María Rosa Mosquera-Losada (University of Santiago de Compostela, Spain.

7. Upcoming events

3rd Symposium on Climate Change Adaptation in Africa

The 3rd Symposium on Climate Change Adaptation in Africa will take place in Nairobi, Kenya, Africa during 23rd-24th January 2020. The aims of the Symposium are: i) to provide research institutions, universities, NGOs and enterprises from Africa and those working in Africa with an opportunity to display and present their works in the field of climate change adaptation; ii) to foster the exchange of information, ideas and experiences acquired in the execution of climate change adaptation projects, especially successful initiatives and good practice across the African continent; iii) to discuss methodological approaches and experiences deriving from case

studies and projects, which aim to show how climate change adaptation may be implemented in practice; iv) to network the participants and provide a platform so they can explore possibilities for cooperation. More information here.

3rd Latin American Symposium on Climate Change Adaptation

The 3rd Latin American Symposium on Climate Change Adaptation will take place in Puebla, Mexico during 5th – 6th March 2020. The Symposium will be a truly interdisciplinary event, mobilizing scholars, practitioners and members of governmental agencies, undertaking research and/or executing climate change projects in Latin America. More information here.

14th European Farming Systems Conference

The 14th European Farming Systems Conference (IFSA – European Group) will be held in the University of Évora, Portugal, and hosted by the Institute of Mediterranean Agricultural and Environmental Sciences during 20th – 26th March 2020. The main focus of this years' Conference will be Farming Systems Facing Climate Change and Resource Challenges. More information here.

VIII REMEDIA Workshop

The VIII REMEDIA workshop will be held in Elche, Spain, during 21st – 22nd April 2020. REMEDIA is a scientific network for mitigation of greenhouse gas emissions in the agroforestry sector and the main focus of this years' workshop will be the circular economy as a catalyst for sustainability environmental of the Spanish primary sector. More information here.

5th European Agroforestry Conference

The 5th edition of the European Conference on Agroforestry will be held in Nuoro, Sardinia, Italy during 18th - 20th May 2020. The conference will bring together worldwide researchers, practitioners, policy-makers, public authorities to discuss the role of research and innovation in agroforestry towards the development of a sustainable European Bioeconomy, while exploring its potential in fostering environmental, economic and social prosperity. More information here.

28th General Meeting of the European Grassland Federation

The 28th General meeting of European Grassland Federation (EGF) will be hosted by the University of Helsinki in Helsinki, Finland during 22nd – 25th June 2020. The meeting will give delegates the first hand opportunity to see and experience how today's state-of-the-art practices in grassland and ruminant production are utilised in Finland to produce milk and beef products that have been ranked as one of the highest quality products in the world. The meeting will be also the stage for you to represent and hear about the recent advances and novel approaches in grassland research. More information here.

71st Annual Meeting of the European Federation of Animal Science

The 71st Annual Meeting of the European Federation of Animal Science will be held in Porto, Portugal during 31st August – 4th September 2020. The program of this annual meeting will cover various areas of knowledge, such as nutrition, genetics, physiology, animal health and welfare, livestock farming systems, precision livestock farming, insect production and use, cattle, horse pig, sheep and goat production. More information here.

XVII European Society for Agronomy Congress

The sixteenth edition of the congress of the European society for agronomy (ESA) will be held in Seville, Spain during 1st- 4th September 2020. The main focus of the congress will be smart agriculture for great human challenges. 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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