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Regenerative Agriculture. An innovative approach towards mitigation of climate change through multi-tier learning

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Introduction

Among the 6 European Commission priorities for 2019-24, the European Green Deal is listed as first. According to the aim, Europe wants to be the first climate-neutral continent by becoming a modern, resource-efficient economy. In order to achieve this, there is an evident need to boost the efficient use of resources and to restore biodiversity and reduce pollution. Agriculture and food systems must be transformed away from wasteful, energy-hungry and exploitative approaches. The need to re-direct agriculture towards innovative approaches that would help to mitigate climate change is urgent and pressing. Students in the fields of agronomy, but also agroforestry and rural development, should be suitably equipped to look at such innovative approaches, which are often stemming from traditional methods, suitably revisited and redefined, so that they can lead, as professionals, the effort towards mitigating climate change. At the same time, farmers should be also helped, through non-formal and informal learning, to understand how they can change their farming methods to make them more environmentally sensitive, using natural resources wisely, without losing income.

REGINA is an Erasmus+ Cooperation partnership project, started in November 2021, with the participation of 5 European countries (Greece, Hungary, Slovenia, Italy and Ireland) and 8 project partners. The project places an emphasize on Regenerative Agriculture (RA), that can offer substantial results for sustainable farming by enhancing biodiversity “above and below the ground surface”, thus contributing to increased water and nutrient use efficiency and to improved and sustained crop production. The project aimed to promote the principles and practices of RA across Europe, and also to improve the quality of teaching in universities (along with other tiers of education), by offering students and educators a hands-on approach in the application of regenerative agriculture practices. Further and very important aim was to bring the concept of RA closer to farmers and stakeholders.

Nevertheless, regenerative agriculture (and sustainable agriculture practices in general) creates a great (and growing) interest among researchers, academics, students and practitioners. The REGINA International Conference had the idea to bring them together, offering them space for interaction, inspiration, debate and networking. The conference was held in Gyor, Hungary on 3rd October 2024. More than hundred participants justified the necessity of such events.

In this proceeding, you can read 9 selected short studies, all evolving around the topic of regenerative agriculture. Part 1 **‘Theory and concept of RA’** positions and introduces RA by putting an emphasis on the implementation possibilities, including the precision management techniques, the social aspects, the soil regeneration as well as the importance of networking and learning. Part 2 focuses on the ‘**Practice and examples of RA**’ by introducing case studies and good practices of real-world farmers in different settings and localities. You can read short examples from Italy, Hungary, Greece and Ireland.

We hope that this proceeding will serve the best interest of not only academics and researchers, but also practitioners, who are willing to build a more sustainable agriculture.

The editor

PART 1:

Theory & concept of RA

Multi-Sensor Data-Fusion approach for Precision Management of Farming Input Resources

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Extended Abstract

Precision management of farm input resources refers to the application of the right input, in the right rate, place and time using an integrated solution of sensing, modelling and control technologies. However, the first requirement for managing the within field spatio-temporal variability is the accurate measurement and mapping of parameters affecting crop growth and yield. But, the agriculture system even at field or sub-field scales is complex, as crops are affected by multiple limiting factors simultaneously, including soil attributes, crop biotic and abiotic stresses, topography and weather conditions. This necessitates an advanced sensing approach, consisting of multiple sensor technologies and data fusion to maximize the quality of data collected and the creation of accurate and science-based variable rate recommendations of different farm input resources, e.g., fertilisers, water for irrigation, seeds, agrochemicals and manure. Data particularly on soil and crop is needed at high sampling density to allow accurate quantification of the spatial variability, which cannot be achieved with the traditional laboratory analysis methods as they are costly, time-consuming, requires expert technical operators and expose hazard chemicals into the environment. Proximal and remote sensing have been immerged in the last few decades as alternative solutions that can overcome the disadvantageous of the traditional laboratory analyses, and fulfil the requirement for variable rate applications. One of advances implemented in precision agriculture is what is referred to multi-sensor and data fusion approach for variable rate applications. The majority of variable rate recommendations are made using either soil or crop data including yield. According to the agriculture system approach discussed above, recommendations derived with individual input parameter is not the ideal solution. This paper will discuss case studies of variable rate applications based-on the fusion of data on soil, crop normalised difference vegetation index (NDVI), present and historical yield and weather conditions. While this data fusion approach is implemented in map-based variable rate applications, case studies of sensor-based and sensor-map-based are discussed.

Results of cost-benefit analysis and environmental analysis demonstrated profitability and environmental savings in majority of case studies. Nawar et al. (2017) reported an average net profit of about 50€ per ha for VR nitrogen (N) fertilisation in cereals. Guerrero et al. (2021) demonstrated that VR N fertilization (VRNF) for barley and wheat has led to an increase in yield by up to 10.4% and a reduction in the amount of N fertilizer applied by up to 19.4%, compared to the traditional uniform rate fertilization (URF). These results are in line with previously obtained results in Germany, UK, Spain and Turkey. Therefore, we expect significant economic impacts with an increase in farmer profitability by 100-150 €/ha for VRNF, depending on the crop type, field variability, current fertilizer price (price tripled in 2021) and yield price. Zhang et al. (2021) also reported that VR manure application has increased crop yield by up to 2.3%, but reduced N applied through manure by up to 4.1% (11.01 kg/ha) and P by up to 7.1% (3.72 kg/ha) and led to a profit of 40 €/ha, compared to the uniform rate manure application. Over-application of nutrients from manure in the majority of agricultural fields, increases the risk for soil and water pollution. Nitrates from livestock manure and mineral fertilisers have been a major source of water pollution in Europe for decades. About half of the N in fertiliser and manure applied in Europe is lost to the surrounding environment.

With all advances made in the technology development for precision agriculture applications, the adoption rate by farmers lags behind. This is the most appealing issue that should be tackled so that the investment in precision agriculture can bring these technologies into the farmers hand. However, there

are several issues that hinders the adoption, including complexity of the solution, technology is still costly, and absence of a decision support system that enable the prediction of framer profitability ahead of adopting the. Although profitability is the main derive for farmers to adopt the technology, environmental benefits and sustainability that can be achieved by precision agriculture is another factor that of interest to the farmer but of ultimate interest to the policy makers.

Keywords
Proximal soil sensing; Precision agriculture; Data fusion; Simulation; Field experiments

References

Guerrero, A.; De Neve, F.; Mouazen, A.M., 2021. Data fusion approach for map-based variable-rate nitrogen fertilisation in barley and wheat. Soil and Tillage Research, V(5): https://doi.org/10.1016/j.still.2020.104789

Nawar, S.; Corstanje, R.; Halcro G.; Mulla, D.; Mouazen, A.M., 2017. Delineation of soil management zones for variable rate fertilisation: a review. Advances in Agronomy, 143: 175–245.

Zhang, J.; Guerrero, A.; Mouazen, A.M., 2021. Map-based variable-rate manure application in wheat using a data fusion approach. Soil and Tillage Research, Doi:10.1016/j.still.2020.104846

Social aspects of regenerative agriculture. Changing perception of farming, farmers and food in contemporary societies

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Extended Abstract

Regenerative agriculture (Reg.Ag.) is a paradigm shift in food production, which is led by many drivers, including changes in consumers' attitudes, but also by farmers themselves. As social idea and at the same time business strategy is based on the fundamental assumption to respect and work with the environment rather than downgrading it.

Besides its ecological and economical dimension it is also a social phenomenon. It can be analysed within the broader framework of what farming is/was perceived as by the general society and what is the ideal type of farmer. The evidence from social research give us interesting and inspiring view of regenerative agriculture as "mission oriented" or "smart strategy".

To understand this phenomenon from the social side, we must first realize the importance of how deeply economic processes are immersed in culture. They are the result, but also the cause, of phenomena that lie deep in the social structure. They result from tradition and its strong connection with the identity of groups and regions. The same applies to regenerative agriculture. It is a social product. Agriculture in general has been strongly linked to constantly changing trends in the culture of consumption, food culture, and social aspects of food consumption for several decades. In community supported agriculture, but also in regenerative agriculture, the cultural story about food, its origins, the farmer who created it, and its positive impact on the community and the environment is of significant and growing importance. Thus regenerative agriculture is not only a production method, it is also a conscious decision of the farmer resulting from his declaration towards the environment and the local community. We can therefore talk about agriculture as a result of the social construction of knowledge. It increasingly reflects a vision of how society sees farmers, agriculture and food products.

This type of farming practice is particularly applicable to small and medium-sized family farms. This is an economic activity that is highly time-consuming, employs extraordinary labor resources, and is often based on tedious practices that exclude the use of machines. From this perspective, it is an interesting alternative to agriculture in Central and Eastern Europe, in those countries where a fragmented agrarian structure dominates, based on small family farms. We are talking about countries such as Poland, Hungary, Slovenia, Croatia, Serbia and Kosovo.

Regenerative agriculture from farmers' perspective is rational strategy in farming – obviously. It is a way that farmers' family seeks for additional value to increase the household income. It is capitalistic rationale that lies beyond, that points out the value of profit. But also it could be calculation of farmers on the basis of contract between farmers and society (the state). It is expected that in exchange for using regenerative farming practices, farmers will be able to benefit from subsidy schemes. So – biodiversity comes with the price tag. In other words it is a way to add subsidies as a part of this income. It's smart and it is calculated.

From farmers perspective RegAg must be seen as the effect of rather radical ethical shift in farmers' work ethos. It is a kind of moral change among farmers – from industrial to more sustainable philosophy of work, production and the economy in general. As such Reg.Ag. is the product of normative change. This includes changes of values and norms of growing number of farmers into the system of more sustainable farm practices. It should be honestly admitted, that it is a form of „social contract" between humans and

the nature. Indeed - when we realise, that food security could not be ensured on a long term basis by more and more intensive agriculture, then the only way is to promote rational use of natural resources in order to achieve regeneration effect. As such from farmers' side Reg.Ag. could be treated as rational strategy to achieve farm's durability through long-term accessibility of resources, such as fertile soil, water, biodiversity and so on.

On the other hand regenerative agriculture comes and it is supported in general society by substantial change in perception of farming and farmers. What I mean is changed expectations that society is placing on agriculture—from something that provides one good (food) to something that supplies many goods (food, access to green spaces, healthy rural environment, flood resilience, reduced greenhouse gas emissions). Widespread of sustainable lifestyles among food consumers generates different forms of pressure on farmers to dismiss industrial ideology of farming and introduce more holistic, long-term strategies that promise e.g. rapid carbon sequestration at global scale – for good of society. Thus we observe empirically proven changing expectations of citizens towards the role of farming (from food security to mitigation of climate change). Reg.Ag. then should be analysed as normative shift in perceiving farmers as 'bad guys': those responsible for reducing biodiversity, degrading soil by erosion and excess fertilisers, over-using water catchments and lowering water quality, destroying traditional rural landscape etc. Regenerative agriculture has received significant attention from producers, retailers, researchers, and consumers, as well as politicians and the mainstream media. As such it is a part of the debate on the future of farming in general.

Regenerative agriculture, apart of being production and market strategy, is a reproduction of interesting phenomena in social structures. It is located within broader social paradigm change – towards sustainable living, together with green economy, slow life, veganism, slow food, organic kitchen, fair trade. However, it should be remembered that just as its development is associated with changes in social choices and farmers' attitudes, other, unknown yet social changes may also limit its development in the future.

Soil regeneration following Conservation Agriculture principles

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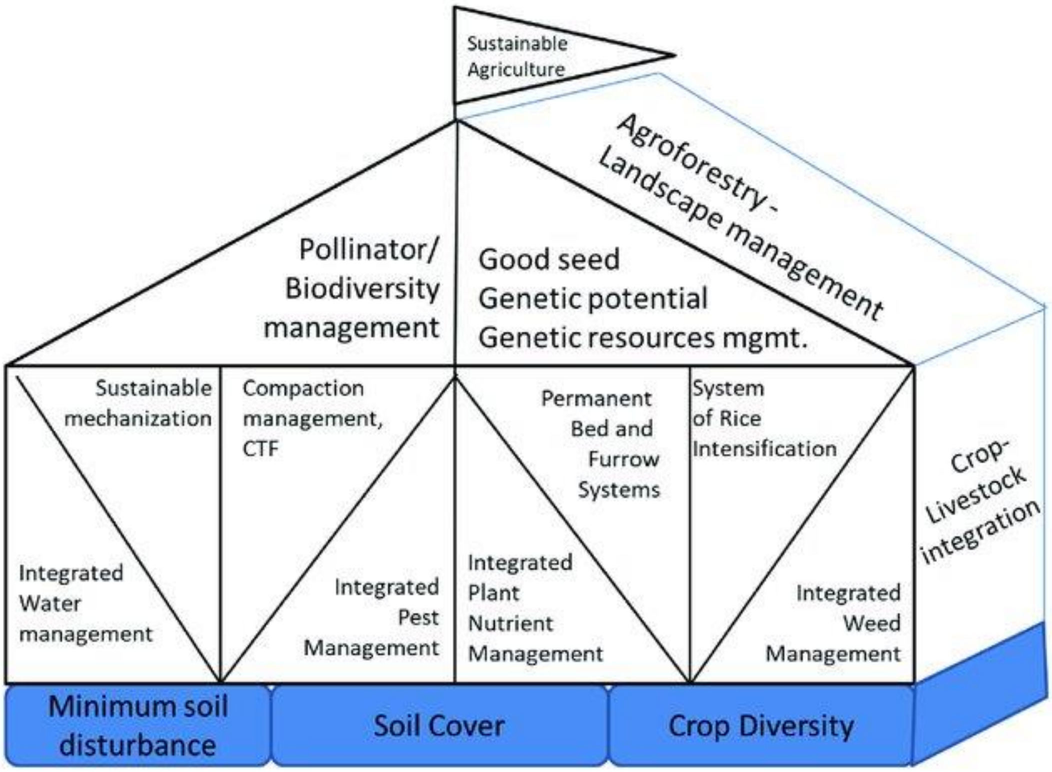
Extended Abstract

Conservation agriculture (CA) is based on three simple principles: no or just minimal soil mechanical disturbance, permanent cover of soil surface, and diverse crop rotation including cover-crops. These three principles, however, constitute the ecological foundation upon which sustainable agriculture can be built with complementary good agricultural practices (Fig. 1).

Figure 1: Three principles of conservation agriculture are the foundation for regenerative, sustainable agriculture (Friedrich, 2013)



CA is now practiced on more than 200 million hectares worldwide under different soil and climatic conditions. It is a tried and tested concept with important advantages. The avoidance of soil disturbance and the retention of plant biomass promote the increase of organic matter in the agricultural soil. Avoiding tillage, which is associated with better structural resilience of the soil, generally reduces greenhouse gas emissions. Less soil disturbance, cover crops and mulch create an environment that encourages soil biodiversity, beneficial insects, reptiles, birds and small mammals. This can contribute to natural pest control and improve soil health. Increased bioavailability of nutrients and lower nutrient consumption per harvest unit – better NUE. Less traffic and compaction of the soil (less machine traffic and greater walking strength of the soil). These systems also sometimes result in compacted soil layers that need to be loosened periodically with suitable tools (adapted loosening equipment without mixing the soil layers). In general, CA reduces soil erosion by up to 90 %. Compared to conventional tillage, CA helps to maintain the structure of the soil and its ability to retain water and nutrients. By reducing erosion, runoff and leaching of nutrients, CA can help improve water quality in nearby rivers and water bodies. The water retention capacity of the soil is higher in CA fields. Since farmers do not cultivate the land, they have more free time or need to hire less labor. While switching to CA requires changes in practice, it can improve the resilience of farming systems in the long term and reduce the cost of external inputs such as diesel, pesticides and fertilizers. The machinery park on farms is smaller, so investment costs are also lower in the established CA system.

In our long-term field trials (shallow Cambisol in the Drava river alluvial plain), after 5 years of transition from ploughing in a soil layer of 0-10 cm, we measured 7 to 10 t organic C/ha more with no-till than with ploughing, which means an accumulation of 1400 to 2000 kg Corg/ha per year. Possible causes for Corg accumulation in no-till compared to ploughing are less oxidation of organic matter due to less intensive tillage, incorporation of organic matter into the soil aggregates, which becomes inaccessible to microbes (formation of stable humus), more weeds and therefore more organic matter excreted into the soil during the year (exudates) and more residues after harvest.

In order to benefit from all the advantages described above, conservation agriculture must be practiced permanently on the same land. Soil is a resilient system that fortunately degrades slowly, but also takes a long time to regenerate.

Having demonstrated all the important benefits of conservation agriculture, we claim: “There is no regenerative agriculture without observing the principles of conservation agriculture". However, the concept of regenerative agriculture encompasses a broader horizon. Regenerative agriculture is a way of managing agricultural landscapes whose main guiding principle is the regeneration or restoration of agroecosystems mimicking natural processes, focusing on the inclusion of different plant and animal species and the improvement and restoration of soils in terms of their health, biological activity and organic matter content. In doing so, farmers, as custodians of these ecosystems, do not follow prescribed practices, but through observation, critical thinking and trial and error, discover and apply sustainable practices that guide their specific agricultural ecosystem towards maximum adaptability, robustness and resilience. Concepts related to, but not entirely synonymous with, regenerative agriculture include: "agroecology", "permaculture", "organic agriculture", "biodynamic agriculture", "holistic planned grazing", "agroforestry".

Knowledge transfer organizations and networks for promoting sustainable agriculture in Hungary

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Abstract

The challenges posed by climate change are raising numerous questions about conventional agriculture. Protecting our natural environment and accessing healthier food has become increasingly important, not only for people in rural spaces but also in urban areas. Different forms of sustainable agriculture, such as regenerative agriculture or permaculture, provide great opportunities to meet these needs and even play a role in building communities. This paper aims to introduce the conceptual framework of sustainable agriculture and give a brief overview of the professional organizations that promote the knowledge transfer and spread of different sustainable forms of agriculture in Hungary, particularly regenerative agriculture and permaculture, at various territorial levels, such as international, national and local. These organizations and networks can be considered drivers of these agricultural innovations.

What does sustainable agriculture and permaculture mean?

According to the definition provided by Rajbhandari (2019), agriculture and rural development are considered sustainable when they are ecologically non-degrading, economically viable, politically non-discriminatory, socially acceptable, technologically appropriate, and founded on a holistic scientific and systems approach. One of the most well-known sustainable alternatives to conventional farming is permaculture. The terms "permanent culture" and "permanent agriculture" were introduced by Bill Mollison along with his student David Holmgren (Tóth 2017). In 1988, Mollison published a comprehensive guidebook titled Permaculture: A Designer's Manual, which details the principles and methods of permaculture. According to Mollison's (1988) definition, "Permaculture is the conscious design and maintenance of agriculturally productive ecosystems that possess the diversity, stability, and resilience of natural ecosystems. It is the harmonious integration of landscape and people, providing food, energy, shelter, and other material and non-material needs in a sustainable way. Without permanent agriculture, there is no possibility of a stable social order."

Permaculture uses various methods, such as plant combinations with protective plants, composting, mulching, rainwater harvesting (Fig. 1.), and improving plant resilience, to tackle the challenges posed by climate change. These practices help plants thrive even under extreme weather conditions, such as prolonged droughts, changing seasons, and soil erosion.

Figure 1. Permaculture methods - composting, mulching and rainwater harvesting

Source: Uszkai A, 2024

The table below provides a sustainability assessment of permaculture based on Rajbhandari's (2019) definition. As seen, permaculture is ecologically non-degrading, politically non-discriminatory, and based on a holistic scientific and systems approach. Its weak points are social acceptability, economic viability and technological applicability.

Table 1. Sustainability assessment of permaculture

Agriculture and rural development are sustainable when they are	Permaculture farming/gardening	Comments
socially acceptable	False	It is considered an innovation, and not everyone accepts it. Conflicts with neighbors may occur.
ecologically non-degrading	True	-
economically viable	False	The crop yield is less predictable compared to a standardized, mono-cropping organic farm.
politically non-discriminatory	True	-
technologically appropriate	False	Mechanization can be difficult.
based on a holistic scientific and system approach	True	-

Source: Edited by the Author, 2024

What organizations and networks can support the wider understanding and adoption of this farming approach?

At a global level, Permaculture Global (Permaculture Research Institute) collects and publishes a map featuring permaculture projects from around the world. As of September 20, 2024, there are 2,765 projects listed. This is the premier resource for discovering who is involved in permaculture and where these projects are located. You can search for projects using keywords or by climate zone, and filter them according to specific project types. Additionally, they organize Permaculture Design Certificate (PDC) courses, and their publications provide valuable insights into the field. Another organization worth mentioning at a global level is WWOOF, which was founded in 1971 in the UK and is one of the world's first educational and cultural exchange programs. Today, there are over 40 national WWOOF organizations and independent WWOOFers in 80 countries around the globe. As a WWOOFer, you will participate in the daily life of your host, help on the farm, learn about sustainability, experience a new culture, and meet new people. In exchange for your assistance, you will receive free room and board during your stay. As a host, you will welcome visitors who are eager to connect with organic food and farming while supporting the sustainability movement. In Hungary, there are 17 hosts offering various experiences, including permaculture gardens, biodynamic and biointensive farms, organic cheese farming, and forest gardens, among others.

In Europe, the European Permaculture Network (EuPN) aims to be a key platform for promoting permaculture. The membership is free. They organize various courses and events, including PermaTalks, an online lecture series focused on permaculture. This series has been running annually in Finland since 2020, with lectures taking place at the beginning of each year.

As far as the national level is concerned, permaculture design and its professional community have grown significantly in Hungary in recent years. The Hungarian Permaculture Association (MAPER) has been operational since 2016 to introduce permaculture to a wider audience, organize permaculture education throughout the country, build relationships with permaculture organizations in other countries, engage in research, design, and education and manage a permaculture club in Budapest. Besides the Hungarian Permaculture Association, other organizations, such as Tree of Life Permaculture, are making notable contributions. Various organizations and individuals offer Permaculture Design Courses (PDCs) in Hungary. Additionally, some universities are incorporating permaculture principles into their curricula or providing one-day courses, which helps to introduce permaculture concepts to a broader audience (Gál et al., 2022).

Conclusion

The impact of climate change on traditional agriculture has raised important questions. The demand for clean, chemical-free food has grown, not only in rural areas but also in urban spaces. The different forms of nature-based agriculture provide an opportunity to address these needs and foster community participation. Permaculture farming is a promising approach to environmental sustainability. However, the economic and social aspects of sustainability still require attention, particularly in Hungary. There are effective organizations and networks focused on permaculture operating at various levels, a key question remains: can this type of agriculture expand more widely in Hungary, Europe, and globally?

References

Gál, I., Szalai, M. Z., Divéky-Ertsey, A. & Pusztai, P. (2022). Permakultúra és ökológiai gazdálkodás jelentése és oktatása a MATÉ-n. In Bujdosó, Z. (ed.) XVIII. Nemzetközi Tudományos Napok [18th International Scientific Days] : A „zöld megállapodás" – Kihívások és lehetőségek [The 'Green Deal' – Challenges and Opportunities] : Előadások és poszterek összefoglalói [Summaries of Presentations and Posters] Gyöngyös, Magyarország: Magyar Agrár- és Élettudományi Egyetem Károly Róbert Campus. 156 p. pp. 54-54., 1 p.

Mollison, B. (1988). Permaculture: A Designer's Manual. Tagari Publications, Tyalgum.

Rajbhandari, B.P. (2019). Fundamentals of sustainable agriculture and rural development. Kathmandu: HICAST Publication. ISBN: 978-9937-2-9544-4, 244 p.

Tóth, P. (2017). Permakultúra a városban. [Permaculture in the city]. Szakdolgozat [Thesis], Budapest: Szent István University.

Permaculture Global (Permaculture Research Institute) https://www.permaculturenews.org/ (30.10.2024).

World Wide Opportunities on Organic Farms (WWOOF) (2024). What is WWOOF? https://wwoof.net/ (30.10.2024).

European Permaculture Network (EuPN) (2024) Read about the EuPN. https://permaculture-network.eu/ (30.10.2024).

Hungarian Permaculture Association (MAPER) (2024). Introduction. https://permakultura.hu/en/ (30.10.2024).

Learning content for university education, experiences of a pilot testing

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Extended Abstract

The presentation titled "Learning Content for University Education, Experiences of a Pilot Testing" at the International Conference on Regenerative Agriculture: An Innovative Approach towards Mitigation of Climate Change through Multi-Tier Learning (REGINA) focused on developing an advanced educational program on regenerative agriculture (RA) within the REGINA Erasmus+ project. This course was created with the objective of equipping university students with knowledge and skills to implement sustainable farming practices aimed at enhancing soil health, promoting biodiversity, and improving ecosystem resilience. Regenerative agriculture represents a comprehensive approach to farming, centering on restoring the land's natural fertility and structure, promoting diverse biological systems, and fostering a more resilient agricultural ecosystem overall. By adopting these practices, students are expected to contribute to the global movement toward more sustainable and environmentally sound farming.

The course content covered essential topics, including soil health, crop rotation, cover cropping, agroforestry, and the use of organic fertilizers and natural pest management methods. These areas are not only fundamental for students' understanding of sustainable agriculture but are also crucial for enabling farms to achieve long-term environmental and economic benefits. The course is broken down into four structured modules that build upon each other to deepen student knowledge and provide practical insights into regenerative agriculture.

In Module 1, titled Regenerative Agriculture Orientation, students are introduced to the fundamental concepts, historical development, and evolving significance of regenerative agriculture. This introductory module provides a foundation by outlining the holistic nature of RA and the emphasis on long-term soil and ecological health over short-term productivity. It teaches students key RA principles, such as minimizing soil disruption, maintaining soil coverage, and promoting biodiversity within farm ecosystems. These principles form the core tenets of regenerative agriculture, as they help increase soil organic matter, boost water retention, and prevent soil erosion. By grasping these principles, students gain insight into the ways RA differs from conventional agriculture and how it can produce nutrient-rich crops with reduced environmental impact.

Module 2: Agronomic Aspects of Regenerative Agriculture expands on the foundational knowledge from Module 1 by diving into the specific agronomic practices that make RA successful. In this section, students explore techniques like crop rotation, cover cropping, and minimal tillage, which serve to maintain soil fertility and protect against pests naturally. Students learn about various plant and soil interactions that can restore soil nutrients, balance soil pH, and increase resilience to adverse weather conditions. The agronomic aspect module also highlights practical methods for reducing reliance on synthetic fertilizers and pesticides, instead emphasizing natural alternatives that support soil and plant health. This module is structured to give participants a comprehensive understanding of the practical steps involved in transitioning a farm to regenerative agriculture and the overall benefits these methods offer to soil health, biodiversity, and farm productivity.

The third module, Sustainability Concepts of Regenerative Agriculture, explores RA from a sustainability standpoint, examining how RA practices contribute to broader ecological, economic, and social goals. This module covers essential aspects such as biodiversity enhancement, carbon sequestration, water conservation, and energy efficiency, all of which are critical for creating resilient agricultural ecosystems. Additionally, it discusses the social and economic dimensions of sustainable agriculture, such as fair labor practices, community engagement, and economic viability, emphasizing how sustainability in agriculture can extend beyond environmental factors. Students also learn about the policy implications of RA, including government incentives for sustainable practices and the role of regulatory frameworks in encouraging environmentally responsible farming. By studying the sustainability aspect, students gain a holistic perspective on how RA supports ecological balance and climate mitigation, while also fostering socioeconomic stability for rural communities.

The final module, Insights on Specific Crops & Livestock in Regenerative Agriculture, provides an in-depth exploration of individual crops and livestock species within a regenerative framework. This module goes beyond general principles, focusing on the unique characteristics, requirements, and potential contributions of specific plants and animals in a regenerative system. Students learn how to integrate diverse crop species, such as legumes and grasses, to promote nitrogen fixation, build soil organic matter, and enhance pest resistance naturally. Similarly, the module covers livestock integration, demonstrating how rotational grazing and mixed-species grazing can improve soil health, prevent overgrazing, and promote plant diversity. By focusing on specific crop and livestock management techniques, students gain practical insights into building a regenerative agricultural system that is tailored to the particular needs and goals of individual farms

The second portion of the presentation discussed the pilot testing of this RA course, which was implemented in two separate university programs to gauge its effectiveness. These programs included a bachelor’s course in Scienze Faunistiche (Wildlife Sciences) and a master’s course titled Innovazione Sostenibile in Viticoltura ed Enologia (Sustainable Innovation in Viticulture and Oenology) at the Department of Agriculture, Food, Environment and Forestry (DAGRI) of the University of Florence.

During the pilot testing phase, the regenerative agriculture (RA) course developed under the REGINA Erasmus+ project was introduced to students from diverse academic backgrounds, fostering a multidisciplinary learning environment. This diversity included students from areas such as wildlife sciences and viticulture and enology, broadening the perspectives on how regenerative agriculture principles can be applied across different agricultural and environmental fields. This varied academic context highlighted the importance of adapting regenerative practices to multiple specializations, reflecting how RA principles support both environmental resilience and field-specific objectives.

The exposure of students from diverse fields to RA created a platform for exchanging ideas and assessing regenerative principles through various lenses. For instance, wildlife science students could explore how regenerative agriculture contributes to habitat preservation, while viticulture students could examine how RA improves soil health in vineyards, leading to more sustainable grape production. The pilot testing phase allowed for practical learning experiences through field visits, where students observed real-life implementations of RA techniques like soil regeneration, crop rotation, and organic pest management. These practical insights not only reinforced the theoretical knowledge from the course but also underscored RA’s adaptability and relevance across different agricultural and ecological systems.

Furthermore, students were exposed to field visits, enabling them to witness the practical application of RA principles. Field trips allowed students to directly observe regenerative farming practices, such as soil regeneration techniques, crop rotation, and biological pest management. These experiences helped reinforce the theoretical knowledge gained in the classroom, as students were able to see firsthand the practical benefits and challenges of implementing regenerative agriculture on farms.

The pilot testing provided valuable insights and feedback, revealing strong student engagement with the course content. Students responded positively to the interdisciplinary nature of the RA course and the opportunities for hands-on learning provided by field visits. This feedback highlights the potential of RA education to inspire and prepare students for careers in sustainable agriculture. The success of this pilot testing phase underscores the REGINA course’s effectiveness as a resource for teaching regenerative agriculture principles in higher education. The RA course developed through the REGINA project holds promise for broader application in university curriculums, as it equips students with the knowledge and skills needed to advance sustainable farming practices that address climate change and promote ecosystem resilience. This course serves as an educational model for integrating regenerative principles into agriculture education, ultimately aiming to foster a new generation of agricultural professionals who are well-equipped to contribute to ecological restoration and sustainability.

PART 2:

Practice and examples of RA

Tenuta di Alberese: an example of sustainable agriculture, history and tradition in Central Italy

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Extended Abstract

The presentation, "Tenuta di Alberese: an example of sustainable agriculture, history, and tradition in Central Italy," showcased at the International Conference on Regenerative Agriculture, explored Tenuta di Alberese as a remarkable model of sustainable, organic agriculture within the broader scope of Tuscany's rich agricultural and cultural heritage. Managed by the Ente Terre Regionali Toscane (ETRT), Tenuta di Alberese represents one of several agricultural estates under the Ente's administration, all dedicated to promoting sustainable agricultural practices, biodiversity conservation, and the preservation of historical land management traditions.

Ente Terre Regionali Toscane was established in 2012 under regional law (lr 80/2012) with a mission to coordinate sustainable agricultural practices, preserve Tuscany's agrobiodiversity, and manage heritage estates across the region. The organization's duties extend across a range of agricultural, environmental, and socio-economic initiatives that are carried out in collaboration with local communities, educational institutions, and governmental agencies. Among its notable roles, the Ente oversees the Banca della Terra (Land Bank), which seeks to make abandoned or underutilized land accessible to new farmers and agribusinesses, particularly for regenerative and organic agriculture. Furthermore, the Ente maintains the Germplasm Bank, a repository for local plant varieties crucial to preserving regional biodiversity and adapting crops to the challenges of climate change.

The Ente Terre Regionali Toscane's initiatives also include organizing Demofarms, or demonstration farms, where innovative agricultural techniques are showcased, and research projects are conducted in collaboration with scientists and universities. These projects focus on developing sustainable agricultural solutions that can be transferred to local farmers, helping them adopt practices that improve productivity while respecting the environment. Another aspect of the Ente's work is the promotion of legality through the management of the Tenuta di Suvignano, an estate with a history of association with organized crime, which the Ente now operates as a symbol of community resilience and lawful land stewardship.

Tenuta di Alberese, situated in Grosseto, in the heart of the Maremma region, is one of the largest organic farms in Europe, covering an area of over 4,200 hectares. The estate encompasses a diverse range of ecosystems and land types, including arable fields, natural pastures, coastal dunes, Mediterranean shrub forests, and extensive pine woodlands. This diversity supports various agricultural activities, including crop production, livestock grazing, and conservation efforts, all managed under organic farming principles. Through its holistic approach, Tenuta di Alberese embodies a model of sustainable land use that balances agricultural productivity with environmental stewardship.

The Ente's management of Tenuta di Alberese emphasizes organic farming as a means of supporting both local biodiversity and sustainable production systems. Organic farming techniques used at Alberese include crop rotation, integrated pest management, and the avoidance of synthetic fertilizers and pesticides. Additionally, the estate integrates livestock into its agricultural practices, rotating herds across fields to promote soil fertility and ecosystem health. By reducing chemical inputs and enhancing soil biology, these practices aim to restore and maintain the land's natural fertility, ultimately creating a self-sustaining agricultural system that minimizes environmental impact.

Tenuta di Alberese exemplifies regenerative agriculture principles by promoting soil health, biodiversity, and ecosystem resilience. The estate's agricultural practices are grounded in organic principles, with an emphasis on maintaining soil structure and fertility. One of the key practices at Alberese is rotational grazing, particularly with the Maremmano cattle breed, which has adapted to the regional climate and landscape. This grazing strategy contributes to soil health by promoting natural nutrient cycling and reducing erosion, while also providing the cattle with a natural and varied diet.

The integration of crop rotation with livestock grazing is a cornerstone of the estate's regenerative approach. Through this system, Tenuta di Alberese is able to improve soil fertility, enhance water retention, and reduce pest and disease pressure, all without relying on synthetic inputs. Crop rotation practices at Alberese involve alternating between various types of grains, legumes, and forage crops, which helps to prevent soil depletion and maintain nutrient balance. By rotating crops with grazing periods, the estate creates a dynamic agricultural landscape that supports both plant and animal biodiversity, while also contributing to the overall health and resilience of the soil.

One of the most distinctive features of Tenuta di Alberese is its preservation of the buttero tradition, a centuries-old role similar to that of a cowboy, though with deeper historical roots in Tuscany. The butteri are responsible for managing the Maremmano cattle herds, which are raised in open pastures throughout the estate. This traditional role requires extensive knowledge of the landscape, the cattle, and the unique challenges of herding animals across vast and diverse terrain. Butteri are responsible for tasks such as herding, protecting, and capturing the cattle, which include cows, bulls, and calves, all of which roam freely across the estate.

The presentation highlighted the importance of the buttero as both a cultural and practical asset. The buttero's expertise in cattle management and land stewardship is essential to maintaining the health and productivity of the estate's pastures. Additionally, the buttero tradition is an integral part of Tuscany's cultural heritage, representing a connection to historical land-use practices that date back centuries. The Ente places a strong emphasis on preserving this tradition, recognizing the need to pass on the skills and knowledge of the buttero to future generations as a means of safeguarding this cultural heritage. By maintaining the buttero tradition, Tenuta di Alberese not only sustains a valuable cultural practice but also supports a form of land management that aligns with the principles of regenerative agriculture.

As part of its commitment to advancing sustainable agriculture, Tenuta di Alberese serves as a research hub where new techniques and technologies are tested and refined before being shared with the broader agricultural community. The estate conducts research on various topics, including organic pest management, soil fertility enhancement, and crop diversification. Much of this research is done in partnership with universities and research institutions, enabling the Ente to leverage academic expertise and resources to develop solutions tailored to the needs of local farmers.

The research conducted at Tenuta di Alberese is disseminated through workshops, field days, and educational programs, allowing local farmers and agricultural students to learn about sustainable practices and their benefits. By acting as a center for research and knowledge transfer, the estate plays a vital role in promoting the adoption of regenerative and organic farming techniques throughout Tuscany. This emphasis on education and outreach aligns with the Ente's mission of fostering a sustainable agricultural sector that supports environmental health, economic viability, and social well-being.

The presentation emphasized that Tenuta di Alberese's approach to agriculture is not only environmentally sustainable but also economically viable. By reducing reliance on synthetic inputs and optimizing natural processes, the estate minimizes production costs while enhancing the quality and resilience of its crops and livestock. Additionally, the estate's organic certification allows it to command higher prices for its products, providing a source of income that supports its conservation and research efforts.

Moreover, Tenuta di Alberese's regenerative practices contribute to climate change mitigation by sequestering carbon in the soil and reducing greenhouse gas emissions associated with synthetic fertilizers. The estate's emphasis on biodiversity and ecosystem health also helps to create a more resilient agricultural landscape that is better equipped to withstand the impacts of climate change. Through its holistic approach, Tenuta di Alberese demonstrates that sustainable agriculture can be both profitable and ecologically beneficial, offering a model for other farms in Italy and beyond.

In summary, the presentation on Tenuta di Alberese at the International Conference on Regenerative Agriculture illustrated how this estate serves as a model of sustainable agriculture that integrates organic practices, cultural heritage, and scientific research. Managed by Ente Terre Regionali Toscane, Tenuta di Alberese embodies a holistic approach to farming that prioritizes environmental health, biodiversity, and economic resilience. By preserving traditional practices such as the buttero and implementing regenerative agricultural techniques, the estate contributes to the conservation of Tuscany's agricultural heritage while promoting sustainable food production.

Tenuta di Alberese's efforts in organic farming, rotational grazing, and research make it an exemplary case study in regenerative agriculture. Its commitment to education and knowledge transfer further amplifies its impact, allowing local farmers to adopt sustainable practices that enhance soil health, protect biodiversity, and support community resilience. Through its comprehensive approach to land management, Tenuta di Alberese offers valuable insights into the potential for regenerative agriculture to address the environmental, economic, and social challenges facing the agricultural sector in the 21st century.

Rábapordányi Agricultural Ltd.'s path towards sustainability

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Extended Abstract

Rábapordányi Agricultural Ltd. is a production-focused company based in North-Western Hungary, managing 1,000 hectares of arable land and 160 hectares of grassland. Our animal husbandry division includes 550 dairy cows, producing 7 to 7.5 million litres of milk annually, and nearly 1,000 sows, yielding 24,000 to 25,000 fattening pigs per year. Additionally, we sell approximately 5,000 piglets annually.

Since 2011, we have transitioned from conventional tillage-based farming to regenerative soil management practices. In 2016, we began expanding the cultivation of soybeans and peas, which now cover 35-40% of our fields. We completed our move away from ploughing in 2019, selling the associated machinery. From 2021 onwards, our soil processing machinery operates at a maximum depth of 15 cm, with periodic medium-depth soil loosening in select areas. We incorporated cover crops in 2022 to enhance soil health, and in 2024, we introduced strip-till technology, anticipating positive outcomes. To optimize efficiency and reduce field trips, we continuously invest in advanced machinery combinations. Manure is our most valued product, as it enriches soil fertility, supporting sustainable crop production.

In our animal husbandry division, we integrate intensive livestock practices with precision technologies. Our pig production facilities feature an advanced air filtration system, ensuring high biosecurity standards and reducing the need for medications and toxin binders. In our dairy operations, the CowManager® system—an innovative ethological monitoring tool—enables us to meet the real-time needs of our animals. High milk production levels (40-45 kg per cow daily) are achieved through a combination of intensive ventilation systems and optimized housing conditions, ensuring the comfort and health of our livestock.

Our commitment to sustainable practices and technological innovation underpins our dedication to responsible, efficient agricultural production. A recent Sustell® audit assessed our carbon footprint, revealing emissions of 1.53 kg CO_2 per kg of milk produced and 3.11 kg CO_2 per kg of live pork. These metrics provide a clear benchmark for our environmental impact, allowing us to identify areas for improvement and pursue strategies to further reduce emissions across our production processes.

Our objective is to significantly reduce our ecological footprint by localizing protein production and integrating renewable energy sources. Key actions include eliminating imported soybean meal, with a plan to fulfill our protein needs within a 25 km radius. To support this, we'll install a new protein extruder in 2023, facilitating the use of locally grown grain legumes as sustainable protein sources. This approach will help lower transport costs, ensure quality control over raw materials, and strengthen our self-sufficiency.

Additionally, our commitment to renewable energy will be reinforced by a solar farm with a 369 kW capacity, reducing our reliance on non-renewable energy sources. These measures are designed to build a sustainable, efficient, and environmentally responsible production system.

To investigate the polluting, and independent audit by Wattler Ltd. was made and revealed the distribution of energy consumption across various sources. The breakdown is as follows: electricity (23.2%), fossil gas (15.3%), LPG (9.9%), diesel (50.1%), and petrol (1.5%). Additionally, energy consumption is

categorized by subarea, with 93% attributed to business activity, 3% to buildings, and 4% to transport. The annual output of CO_2 is 1272,9 tons.

On the other hand, another audit by Agreena® assessed carbon sequestration on 1,096 hectares, marking a step toward offsetting emissions and enhancing sustainable land management. In this audit the amount of fixed CO_2/year is 1294 tons. Which means, that now we fix more than pollute.

Regenerative farming practices. An example of Greek olive orchards.

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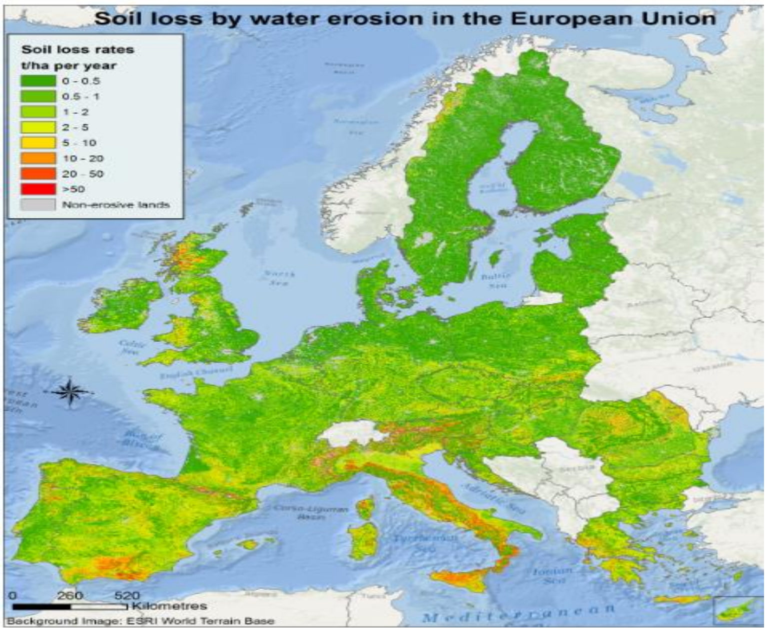
Introduction

Land degradation and desertification in the Mediterranean basin is intensifying due to climate change and the continued pressures on agricultural and forest land (Douglas et al., 2009). The environmental situation for many olive groves across the Mediterranean region is aggravated by over 50 years of intensive agriculture.

Pesticide use and deep tillage result in loss of floral diversity and compaction of soil layers (Jongrungrot and Kheowvongsri, 2021). Gully erosion, particularly severe, is common in Spain, Italy, and Greece, leading to erosion rates of up to 455 tons per hectare per year (Fig. 1).

Figure 1. Map of projected surface soil organic carbon content in Europe (g C kg-1), (de Brogniez et al., 2015).



The loss of natural habitats is also affected by intensive monocultures. This functional biodiversity can provide various services directly or indirectly related to agricultural production, affecting nutrient cycling, pollination and biological control of pests and diseases (Duru et al. 2015). Moreover, ecologically artificial and genetically homogeneous production systems are often highly vulnerable to climate change and pathogen invasion, as they lack compensation or resilience mechanisms (Nicholls and Altieri 2004). However, regenerative / agroecological practices work best when basic principles are combined, such as i) avoiding soil disturbance, ii) maintaining a land cover that provides both surface protection and substrate for organisms, iii) sequencing different crops and cover crops, and iv) applying manure or compost. An enriched soil not only acts as a physical and biochemical support for plants, but also plays a vital role in the formation of soil aggregates that improve soil texture and structure.

In the present study three different olive groves were monitored regarding their transition to regenerative farming systems.

Case studies

Kakkavas
The first example is represented by a 3.5 ha commercial olive orchard, located 15 km north of Kyparissia, Peloponnese, Greece; planted with Koroneiki cv, in a 8x8m planting density, 95m above sea level.
The herbaceous cover of the productive area is dominated by various species, including the notable presence of daisies and mallows (Malva spp). According to the farm managers, soil management is exclusively carried out using a destroyer (every year) and a cultivator (every 4 years).
In addition, in order to support local biodiversity, woody species and animal supporting infrastructures were installed in the frames of the European founded progrmme LIFE Olivares Vivos+ (LIFE20 NAT/ES/001487) in collaboration with ELGO-DIMITRA.
More specifically, the plantation of woody species took place in 10 different areas of the farm including 20 different species in each area (e.g. Thymus sp., Salvia officinalis, Rosmarinus officinalis, Spartium junceum etc.). Similarly, animal supporting infrastructures were placed in different part of the field, including bird nests, a pond and three drinking troughts (Fig. 2).

Figure 2: Pond for mammals and serpents and rodents

Amira
A 0.8 ha traditional olive orchard, is located in south Crete, Greece; planted with Koroneiki cv, in a 10x10m planting density, 175m above sea level. The annual rainfall is 400mm in a Loam soil.
The farm is managed mainly for agroturistic purposes focusing on the overall land production rather than only olive oil. For this reason two main areas were chosen for implementing a syntropic farming system with a plant density of 25 cm; including cover crops, bushes, productive and forestry trees. This system was chosen for increasing the total biomass production, as it is designed to exploit the solar energy to the maximum. In addition, cover crops and forest crops are regularly chopped and trimmed in order to be incorporated in the soil.
In one of the syntropic systems, an inverted hoogle-culture (Hügelkultur) was implemented in order to retain more water to the soil, while providing aeration and organic matter for the root growth (Fig. 3). In an 1 meter deep hole a base of logs, branches, and twigs was placed. Then layers of organic materials (e.g. manure and compost) were added on top. Another layer of woodchip was added followed by an additional thin layer of compost. Finally, a layer of dried plat material was added, such as grass clippings,

hay, straw, leaves and finally top soil. The intention was to mimic natural woodland composting, attracting and hosting beneficial microbes.

Figure 3: Syntropic agroforestry system in southern Crete.

Messara
Also in southern Crete, a commercial olive farm has been transitioning to agroecological / regenerative farming the past 5 years. The farm is 4 ha; planted with Koroneiki cv, in a 7x7m planting density, 75m above sea level. The annual rainfall is 400mm in a Calcareous soil.
No till is performed while the branches are trimmed. Mowing is taking place with the help of a horse that is mostly fed from the field herbs. Annually, the farmer seeds of vetch and fava beans covered with mud and zeolite to support their sprouting.
To avoid harsh winds acacias and eucalyptus trees were planted in the field borders. They are regularly pruned and their carbon and nitrogen rich biomass is trimmed and later spread in the farm.

Results & conclusions
Cover crops
Cover cropping was preferred by the farmers due to the nutrient dense mulch & organic matter provided. Because of the slow decomposition of the plant tissues important nutrients become available to the plants according to their demand without leaching or volatilize. Additionally, a rich ground cover eliminates surface evaporation maintaining humidity in the soil. The above are confirmed also according to the NRCS Cover Crop (340) standard that recognizes the following functions:

- Reduce erosion from wind and water;
- Increase soil organic matter content;
- Capture and recycle or redistribute nutrients in the soil;
- Promote biological nitrogen fixation and reduce energy use;
- Increase biodiversity;
- Suppress weeds and pests;
- Manage soil moisture;

- Minimize and reduce soil compaction; and
- Reduce particulate emissions into the atmosphere.

In the case of Messara, the farmer is also profited by the horse that is cutting and digesting the cover crops, lessening the investment in herbicides, pesticides and fertilizers. Additionally, the products are sold as biodynamic; gaining a higher price in already established networks.

Windbreaks

Windbreaks have been planted in Messara's farm five years now and the results are clear; olive trees more vivid and green due to their protection from the cold winter and hot summer winds. Shelter can improve photosynthetic rate and water-use efficiency by crop plants, in this occasion the olive trees, and can lead to locally buffered temperatures in the sheltered areas. Because hedgerows and windbreaks often contain flowering plants they can be attracting beneficial insects or cover the odors of the main crop to reduce infestation of the olive fly. Additionally, a great amount of biomass is produced that is used for mulching.

Syntropic system

The farm in Amira has been addressing positive results with the intercropping system, since there is a smaller need for water and a higher biomass production per square meter. It has been also proven beneficial for increasing predator and parasitoid damage to crops. These positive effects are confirmed by a review paper indicating that intercropping enhances ecosystem services by strengthening trophic interactions, conserving beneficial arthropods, regulating herbivores and enhancing plant productivity (Li et al., 2021). Though, there is a need for a greater labor for pruning and managing the high density plants.

Biodiversity infrastructures

By installing and improving structures such as ponds, troughs, nest boxes for birds & bats, the availability of key resources (shelter, water) for wildlife can be increased. These interventions come together with a set of additional good practices (e.g. recommendations for a rational use of pesticides). Such structures have been recently implemented in Kakkavas olive grove where an average recovery was addressed of up to 15% of species and 50% of their abundance, from an olive grove that started with low levels of biodiversity. To transform this biodiversity recovery into profitability, a certification scheme and regulation has been designed by the EU programme Olivares Vivos, which establishes the indicators to quantify biodiversity, its recovery requirements to obtain the seal and the procedures to guarantee traceability from field to market.

References

Arrobas, M., Claro, A. M., Ferreira, I. Q., & Rodrigues, M. Â. (2015). The effect of legume species grown as cover crops in olive orchards on soil phosphorus bioavailability. Journal of Plant Nutrition, 38(14), 2294-2311.

de Brogniez, D., Ballabio, C., Stevens, A., Jones, R. J. A., Montanarella, L., & van Wesemael, B. (2015). A map of the topsoil organic carbon content of Europe generated by a generalized additive model. European Journal of Soil Science, 66(1), 121-134.

Cover Crops and Soil Health is a NRCS resource which includes cover crop plant guides and other resources. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/plantsanimals/plants/projects/?cid=stelprdb1077238

Derpsch, R., Friedrich, T., Kassam, A., & Li, H. (2010). Current status of adoption of no-till farming in the world and some of its main benefits. International journal of agricultural and biological engineering, 3(1), 1-25.

Douglas, E. M., Beltrán-Przekurat, A., Niyogi, D., Pielke Sr, R. A., & Vörösmarty, C. J. (2009). The impact of agricultural intensification and irrigation on land–atmosphere interactions and Indian

monsoon precipitation—A mesoscale modeling perspective. Global and Planetary Change, 67(1-2), 117-128.
Duru, M., O. Therond and M. Fares (2015). Designing agroecological transitions: a review. Aronomy for Sustainable Development 35: 1237–57.
Espejo-Pérez, A. J., Rodríguez-Lizana, A., Ordóñez, R., & Giráldez, J. V. (2013). Soil loss and runoff reduction in olive-tree dry-farming with cover crops. Soil Science Society of America Journal, 77(6), 2140-2148.
Gliessman, S. R. (1997). Ecological processes in sustainable agriculture. EE. UU, 5-30.
Gómez, J.A., P. Romero, J.V. Giráldez, and E. Fereres. 2004. Experimental assessment of runoff and soil erosion in an olive grove on a Vertic soil in southern Spain as affected by soil management. Soil Use and Management 20: 426-431.
Hart, M. M., & Reader, R. J. (2004). Do arbuscular mycorrhizal fungi recover from soil disturbance differently?. Tropical Ecology, 45(1), 97-112.
Hulugalle, N. R. (1994). Long-term effects of land clearing methods, tillage systems and cropping systems on surface soil properties of a tropical Alfisol in SW Nigeria. Soil Use and Management, 10(1), 25-29.
Jongrungrot, V., & Kheowvongsri, P. (2021). Comparative study between rubber agroforestry systems and rubber monocultures and soil erosion decrease via rubber agroforestry profile and crown cover in lower southern Thailand. Kasetsart Journal of Social Sciences, 42(2), 255-261.
Khan, K. S., Mack, R., Castillo, X., Kaiser, M., & Joergensen, R. G. (2016). Microbial biomass, fungal and bacterial residues, and their relationships to the soil organic matter C/N/P/S ratios. Geoderma, 271, 115-123.
Li, X. F., Wang, Z. G., Bao, X. G., Sun, J. H., Yang, S. C., Wang, P., ... & Li, L. (2021). Long-term increased grain yield and soil fertility from intercropping. Nature Sustainability, 4(11), 943-950.
Melero, S., López-Garrido, R., Madejón, E., Murillo, J.M.,Vanderlinden,K., Ordónez, ˜ R., Moreno, F., 2009. Long-term effects of conservation tillage on organic fractions in two soils in southwest of Spain. Agric. Ecosyst. Environ. 133, 68–74.
Montgomery, D. R. (2007). Soil erosion and agricultural sustainability. Proceedings of the National Academy of Sciences, 104(33), 13268-13272.
Nicholls, C. I., & Altieri, M. A. (2004). Designing Species-Rich, Pest-Suppressive Agroecosystems through Habitat Management. Agroecosystems analysis, 43, 49-61.
Shahzad, T., Chenu, C., Genet, P., Barot, S., Perveen, N., Mougin, C., & Fontaine, S. (2015).

Practical Challenges and Opportunities of Regenerative Agriculture; REGINA findings on the Irish Farmer Perspective

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Abstract
Providing an overview of the Irish farming context and exploring the prevalence of alternative farming methods in Ireland. Case studies were used to demonstrate the challenges and opportunities encountered when adopting regenerative agriculture methods from the farmers' perspective, and to investigate suitable methods to encourage uptake within the Irish farming community.

Keywords
regenerative agriculture, peer-to-peer learning, innovation, farming policy

The agri-food sector is Ireland's oldest and largest indigenous exporting sector. In 2020, the sector accounted for over 6% of GNI and 9% of exports in value terms. The five main farming systems are Cattle (Rearing & Other), Dairy, Sheep, Tillage and Mixed Livestock. Only 1.3% farm holdings are organic in Ireland. Rural youth out-migration and the ageing farmer profile are key issues facing rural areas. Young farmers make up only 6.9% of the farming population in Ireland. 31% of Irish farms are 'vulnerable', meaning their farm is not viable and neither farmer nor spouse has an off-farm job.

Alternative farming methods in Ireland are a relatively small percentage of the overall farming outputs. Regenerative Agriculture is a very small but growing sector in Ireland, and it is largely led through self-taught farmers who are adopting a 'trial and error' approach. The sector is very community orientated with strong social, knowledge sharing networks and groups such as BASE Ireland and Farming for Nature.

Through the REGINA Project, seven farmer case studies were conducted which explored a diverse range and types of farms. They not only looked at the various methods and approaches which were being adopted in each individual case, but also at the challenges and opportunities which each of the farmers faced. The farmers had very positive stories to share in relation to the impacts of adopting these measures. In addition to the case studies, the importance of community support and building resilience was demonstrated through a representative of the BASE Ireland group who highlighted the critical 'trial and error' approach and need for a facilitated knowledge sharing vehicle to support the growth of the sector.

Several challenges to adoption of RA methods were identified such as risk aversion, farm viability concerns, lack of financial incentives and lack of consumer recognition. Looking to the future growth of the sector, the need for farmers to be supported from 'bottom up' to trial and test methods without restrictive policy measures being imposed from 'top down' was seen as important.

There is an appetite within the general farming community to learn sustainable and climate friendly methods. Those practicing RA are highly passionate and committed to their journeys with very positive and encouraging stories to share with their peers. They are ideally placed to offer peer support, motivation and lived experience. Fostering a sense of community and knowledge sharing will be instrumental in supporting the farming community to further explore RA.

While there appears to be a growing policy interest at national level, there is limited Government funding to support farmers wishing to adopt regenerative farming methods. There is also a level of resistance amongst the farming community to the potential introduction of restrictive regulation. There is no ‘one-size-fits-all’ approach and as a result, Regenerative Agriculture methods are particularly difficult to regulate. Farmers are very much the leaders in their RA journeys, holding control over the practices they employ. The RA practices that a farmer employs are completely contextual to their own land, and it is this flexibility to adapt to their own context that is crucial to the economic success for the farmer. They do, however, identify a need to be supported financially through the trial-and-error phase in order to reduce the economic risk of adopting alternative methods.

In terms of consumer engagement and market growth, sustainability overall has a relatively modest influence on Irish shopper’s choices right now when compared to global norms. There is work to be done to improve consumer knowledge, appreciation and value of supporting RA practices. There are significant community development and community engagement opportunities in this space to connect farmers with consumers through encouraging dialogue and social exchange. Regional branding and education are some potential initiatives to be further explored in this field.

References

Dillon, E., Donnellan, T., Moran, B., and Lennon, J., Teagasc National Farm Survey 2023, Agricultural Economics and Farm Surveys Department, Teagasc, https://www.teagasc.ie/media/website/publications/2024/National-Farm-Survey-2023.pdf

Macra na Feirme, Pre Budget Submission 2025, 2024, https://cdn.shopify.com/s/files/1/0501/8530/6264/files/Macra_Pre_Budget_2025_R5.pdf?v=1719482450

Bord Bia, Irish Food Board, Global Insights, 2021, https://www.bordbia.ie/industry/insights/global-sustainability-insights/ireland-key-headlines/

Jaskyte, K., 2018, "Board Attributes and Processes, Board Effectiveness, and Organizational Innovation: Evidence from Nonprofit Organizations", VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations, vol. 29, no. 5, pp. 1098-1111.

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