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

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University of Florence (Italy)

GYMSM Farmers' Association (Hungary)

REGINA

REGENERATIVE AGRICULTURE. AN INNOVATIVE APPROACH TOWARDS MITIGATION OF CLIMATE CHANGE THROUGH MULTI-TIER LEARNING

SYNTHESIS REPORT OF FINDINGS

RESEARCH ON THE CURRENT UPTAKE OF REGENERATIVE AGRICULTURE IN HUNGARY, ITALY, SLOVENIA, IRELAND AND GREECE, AND PROSPECTS FOR FUTURE TRANSITION

PRODUCED BY:

Euracademy ASSOCIATION

WITH CONTRIBUTIONS FROM PARTNERS OF THE REGINA PROJECT:

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SECAD PARTNERSHIP

UNIVERSITÀ DEGLI STUDI FIRENZE
DAGRI DIPARTIMENTO DI SCIENZE E TECNOLOGIE AGRARIE, ALIMENTARI, AMBIENTALI E FORESTALI

SLOVENSKO ZDRUŽENJE ZA OHRANITVENO OBDELAVO IN RODOVITNOST TAL

SGLŠ POSTOJNA

MARCH 2023

Contents

1. INTRODUCTION

The present report was produced in the framework of the project REGINA "Regenerative Agriculture – An Innovative Approach Towards the Mitigation of Climate Change through Multi-tier Learning", funded through the Erasmus+ Programme of the European Commission. The project focuses on the theme of Regenerative Agriculture (RA) as an alternative concept and method of sustainable farming employed in the fight against climate change, and foresees the development and pilot-testing of a Learning Methodology and Modules for introducing the theme in Higher Education.

The Report brings together and discusses the findings of a research conducted on Regenerative Agriculture in the partner countries – Hungary, Italy, Slovenia, Ireland and Greece – in order to provide valuable insight to be taken into account in the development of the Learning Methodology and Modules foreseen, and provide key learning content. The research performed in each partner country consisted of:

- A desk study on the basic characteristics of the agricultural sector in each country and current levels of uptake of RA
- Interviews with representatives of stakeholder organisations in each country, including farmers' associations, networks, educational institutions, NGOs, central government bodies, regional and local authorities, agricultural consortia etc. on the current levels of RA uptake, prospects for future transition to RA, limitations and necessary steps.
- An online farmers' survey in order to map the uptake of Regenerative Agriculture across the partner countries and identify the farmers' needs for skills, knowledge and attitudes towards RA.
- Identifying and presenting RA case studies in the partner countries as examples of farms making the transition to RA.

A discussion of the findings in the partner countries, as well as conclusions drawn, are presented at the final section.

The National Reports of the partner countries, presenting the research findings per country in detail, are accessible through the following links:

National Report – Hungary

National Report – Italy

National Report – Slovenia

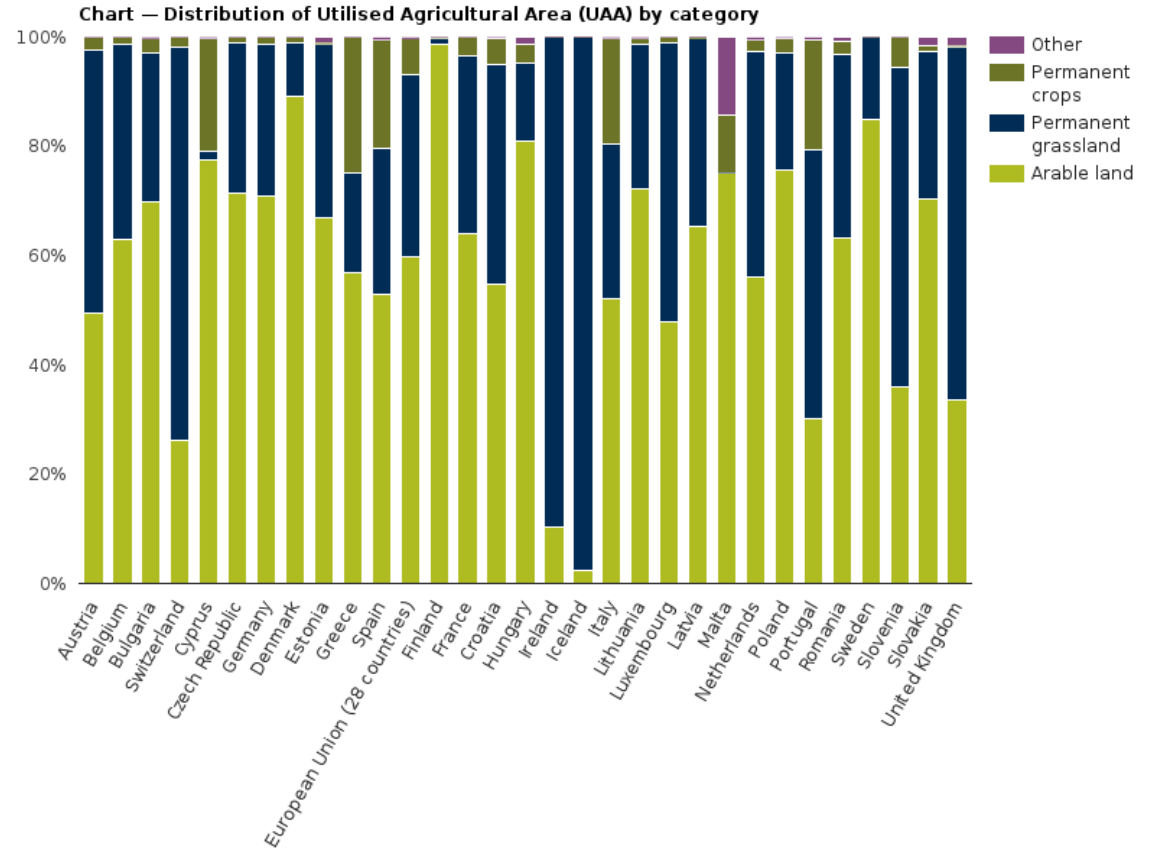
National Report – Ireland

National Report – Greece

2. OVERVIEW OF RA UPTAKE AND PROSPECTS

2.1 Overview of the agricultural sector in the partner countries and the EU

The distribution of the Utilized Agricultural Area (UAA) by category (arable land, permanent grassland, permanent crops and other) presented in the chart below offers an insight on the characteristics of the agricultural area in each EU country; while in Italy and Greece there is a similar distribution typical in Mediterranean countries with arable land taking up most of the UAA and an important percentage covered by permanent crops (20-25%), in Hungary more than 80% of the UAA is arable land, in Slovenia most of the UAA is attributed to permanent grassland with a smaller percentage of arable land, and in Ireland the UAA is mostly categorised as permanent grassland (90%).

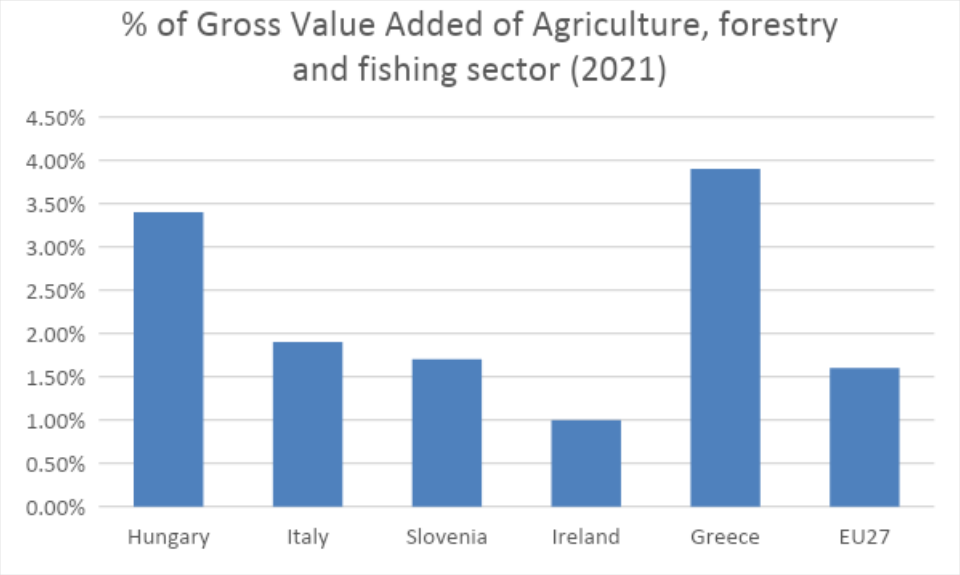


Data sources:

Utilised agricultural area by categories provided by Statistical Office of the European Union (Eurostat)

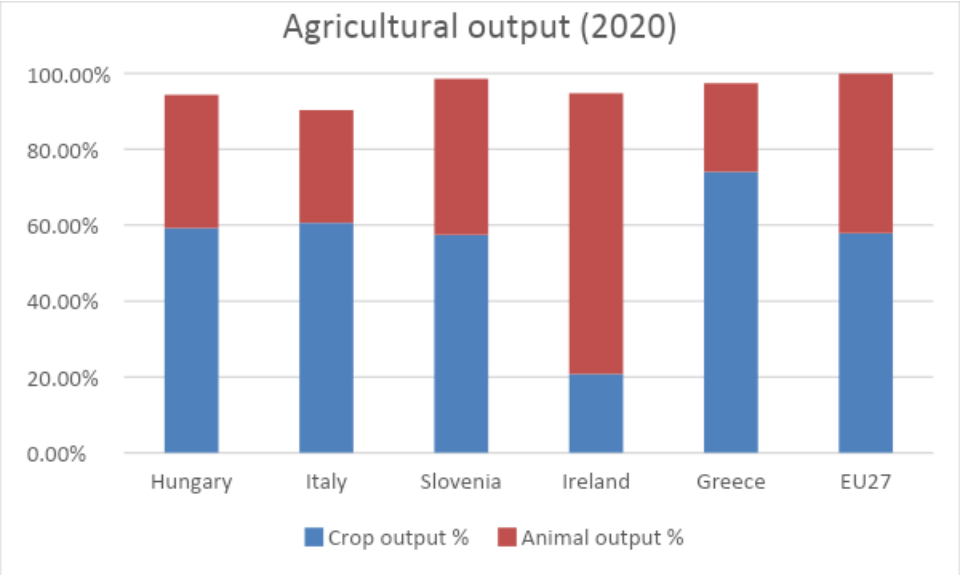
European Environment Agency

The Gross Value Added (GVA) of the sector of Agriculture, forestry and fishing as a percentage in the country GDP in 2021, presented in the following chart, indicates the share of the sector in the country's economy. The GVA are exceptionally high in Greece and Hungary (3.9% and 3.4% respectively), more than double of the GVA at EU level (1.6%), while the sector's GVA in Italy and Slovenia is closer to the EU levels and in Ireland it is lower than the GVA at EU level.



Source: Eurostat, own processing

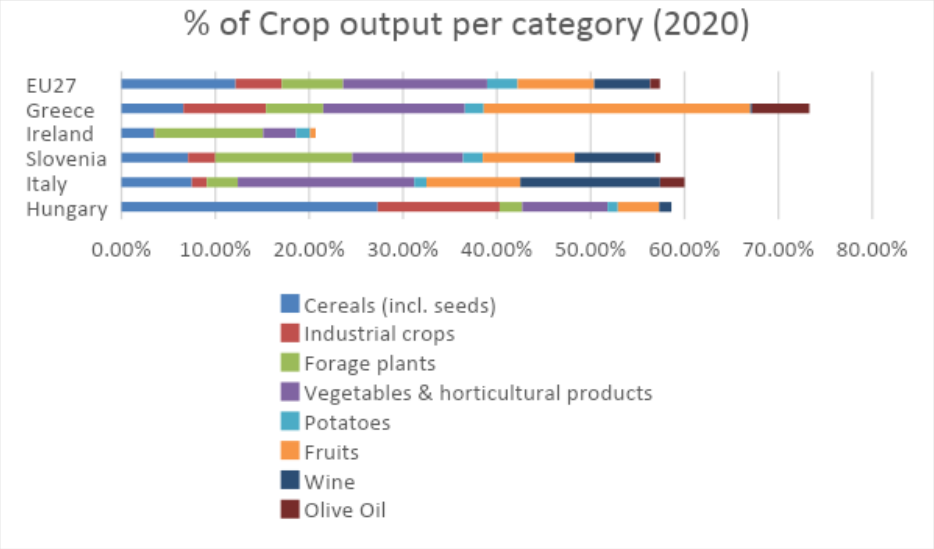
The percentage of agricultural output in terms of crop and animal output varies between the partner countries. In Greece the crop output dominates the total agricultural output (74.1 %), while in Hungary, Slovenia and Italy the crop output represents 60%, closer to the EU percentage. In Ireland, on the other hand, the trend is reversed with animal output representing 74% of the agricultural output.



Source: Eurostat, own processing

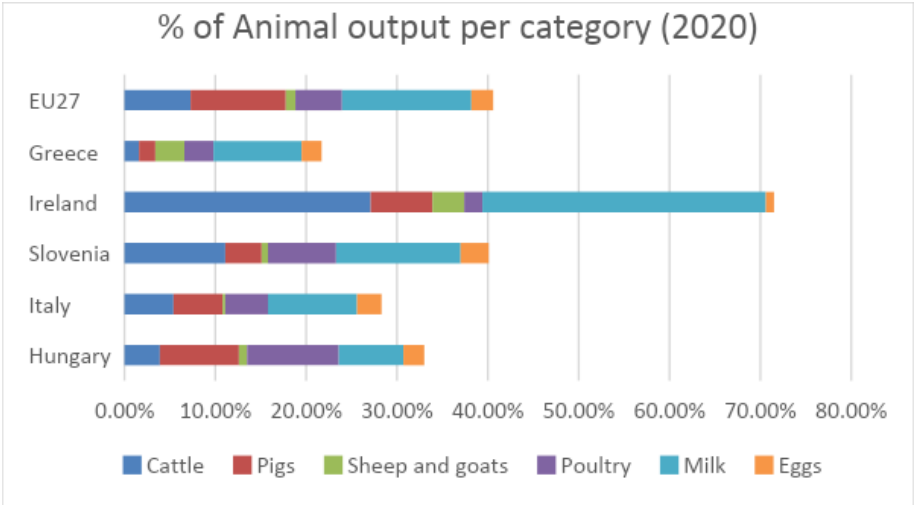
The crop and animal output is further broken down into general categories of output, in the following charts. With regard to the crop output per country, the crop output structure differs among the partner countries. In Hungary the output from cereals and industrial crops forms most of the total crop output, while in Italy the main output categories are vegetables, wine and fruits with wine taking up an important percentage of the total crop output. Slovenia presents a more balanced structure of crop output divided into output from forage plants, vegetables, fruits and wine. The smaller crop output of Ireland mainly includes the output

from forage plants. Finally, the crop output structure of Greece is mainly characterised by the great contribution of the output of fruits production, and to a smaller extent vegetables – the output from olive oil represents 6% of the total agricultural output of Greece.



Source: Eurostat, own processing

The structure of the animal output in Hungary, Italy and Slovenia is similar to the structure at the EU level, characterised mainly by the output related to milk production, and to a smaller extent poultry and pigs or cattle. The smaller animal output in Greece mainly includes the output related to the production of milk. Finally, the greater animal output in Ireland is strongly linked to the output related to cattle and milk production.



Source: Eurostat, own processing

The farm structure reveals differentiations between the partner countries that offer valuable insights regarding aspects of the agricultural sector. With regard to the **size of holdings by Utilized Agricultural Area (UAA)** in the partner countries and the EU, presented in the following chart, the very small size of holdings in Hungary and Greece where the vast majority

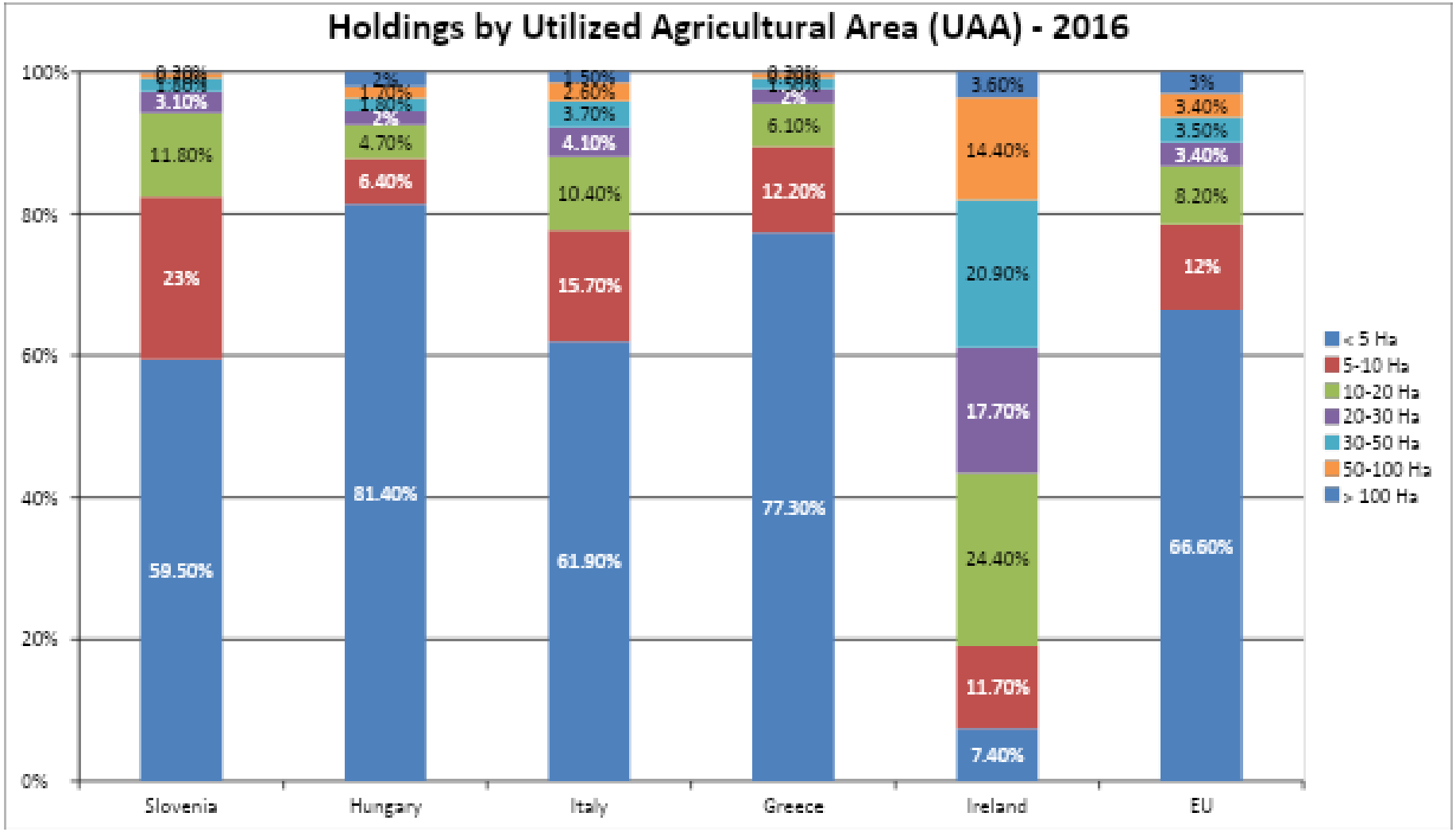
of holdings (81,4% and 77,3% respectively) has a UAA smaller than 5 Ha, and the more moderate size of holdings in Italy and Slovenia closer to the EU level but still with a majority of very small holdings (smaller than 5 Ha), come in contrast with the much greater size of holdings in Ireland where the majority of holdings have a UAA between 10 and 50 Ha.

A similar trend is revealed with regard to the **economic size of holdings** in the partner countries. In Hungary and Greece most holdings are very small in terms of economic size (74,1% and 50% respectively), in Italy and Slovenia holdings are moderate in terms of economic size with a stronger structure of holdings in comparison to the EU level, and the holdings in Ireland are much greater in terms of economic size; however it is reported that 27% of Irish farmers are 'vulnerable', meaning their farm is not viable and neither farmer nor spouse has an off-farm job.

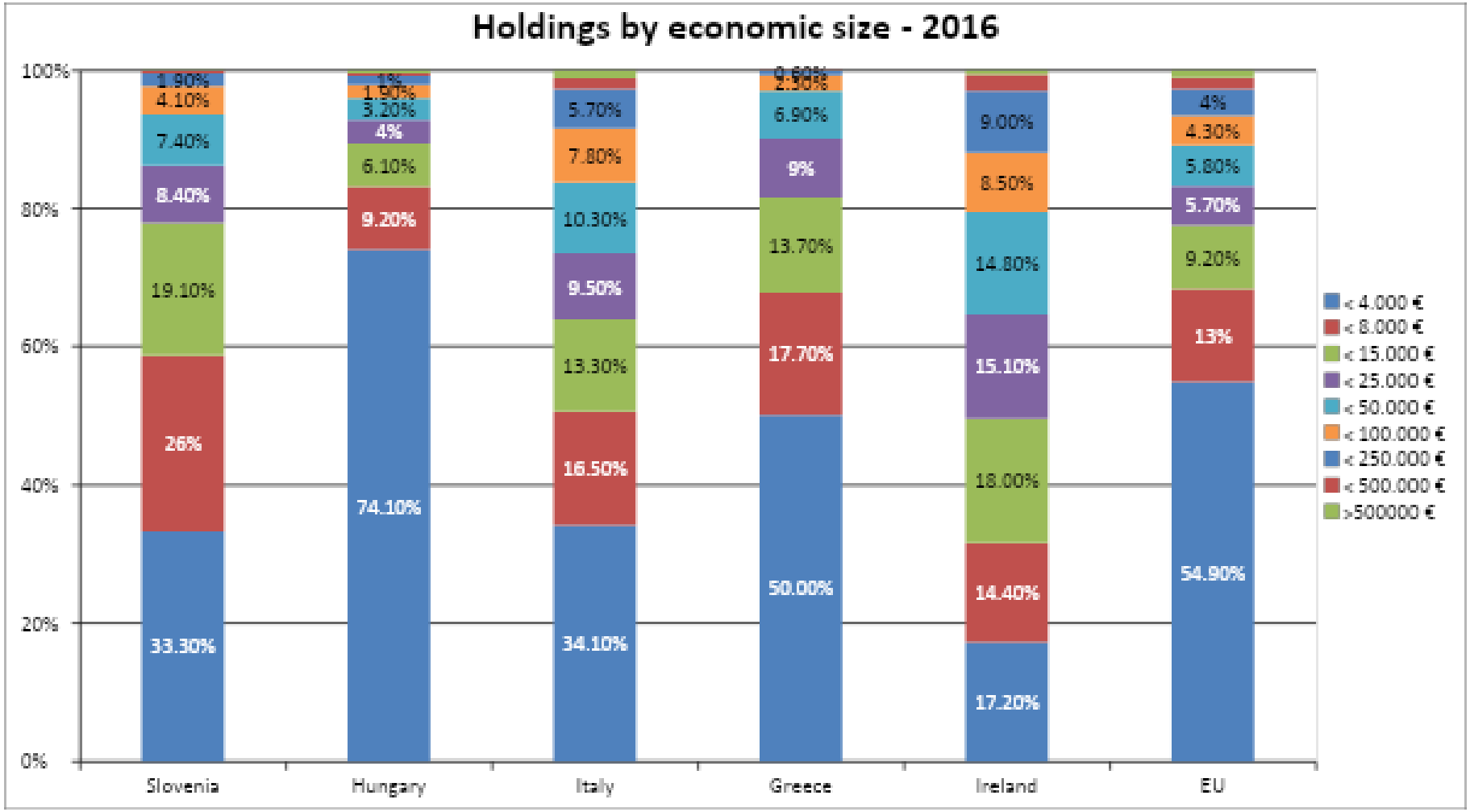
With regard to the **age of farm holders**, the trend of an ageing population of farm holders in the EU is confirmed in all partner countries, the majority of farm holders being above 55 years old. Between the age groups recorded in the Eurostat survey, i.e. younger than 35 years old, 35-44 years old, 45-54 years old, 55-64 years old and older than 64 years old, the older age group gathers the greater percentages in all partner countries and the EU; this percentage is greater in Italy where 40,9% of the farm holders are above 64 years of age. The immediately younger age group 55-64 years old comes second in all partner countries and the EU with percentages 24%-29%, the age group 45-54 years old follows with percentages 20%-26%, the age group 35-44 years old is represented by smaller percentages 10%-16%, and the younger age group below 35 years old represents only 4%-6% of farm holders in all partner countries and the EU.

The **proportion of women farm holders** varies between the partner countries. In Greece and Italy 1 in 3 farm holders is a woman, with a recorded proportion of women farm holders higher than the proportion at EU level (30.2%). The proportion of women farm holders is lower in Hungary and Slovenia (27.9% and 21.7% respectively). The lowest proportion of women farm holder among the partner countries is recorded in Ireland, where only 11.6% of the farm holders are women.

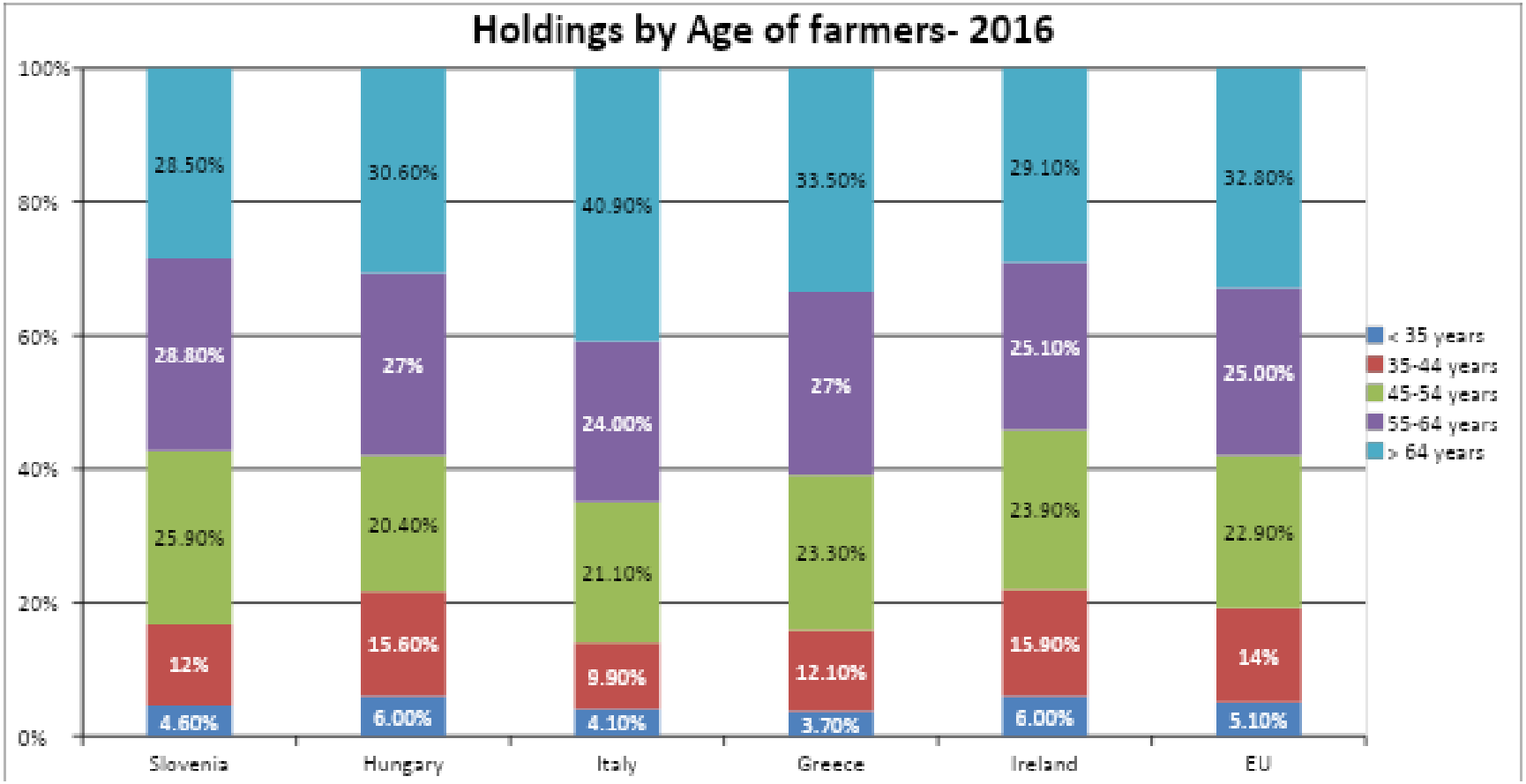
Finally, with regard to the **percentage of employment of the agricultural sector** in the partner countries and at the EU level, as presented below, although the employment of the agricultural sector has gradually declined in the period 1991-2019 in all partner countries and the EU, in Greece the sector is still a major employer with 12% of total employment in 2019, steadily above the employment rate of the sector at the EU level. In Slovenia, although the employment in the agricultural sector has been above the EU level in the period 1991-2019, the percentage has seen a steep decline since 2014 (10%) reaching the EU percentage at 4% in 2019. The share of employment in the agricultural sector in Italy, Ireland and Hungary has been below the EU levels in the last 20 years and in 2019 it reaches the EU percentage.



Source: European Commission, Statistical Factsheets (June 2021), own processing

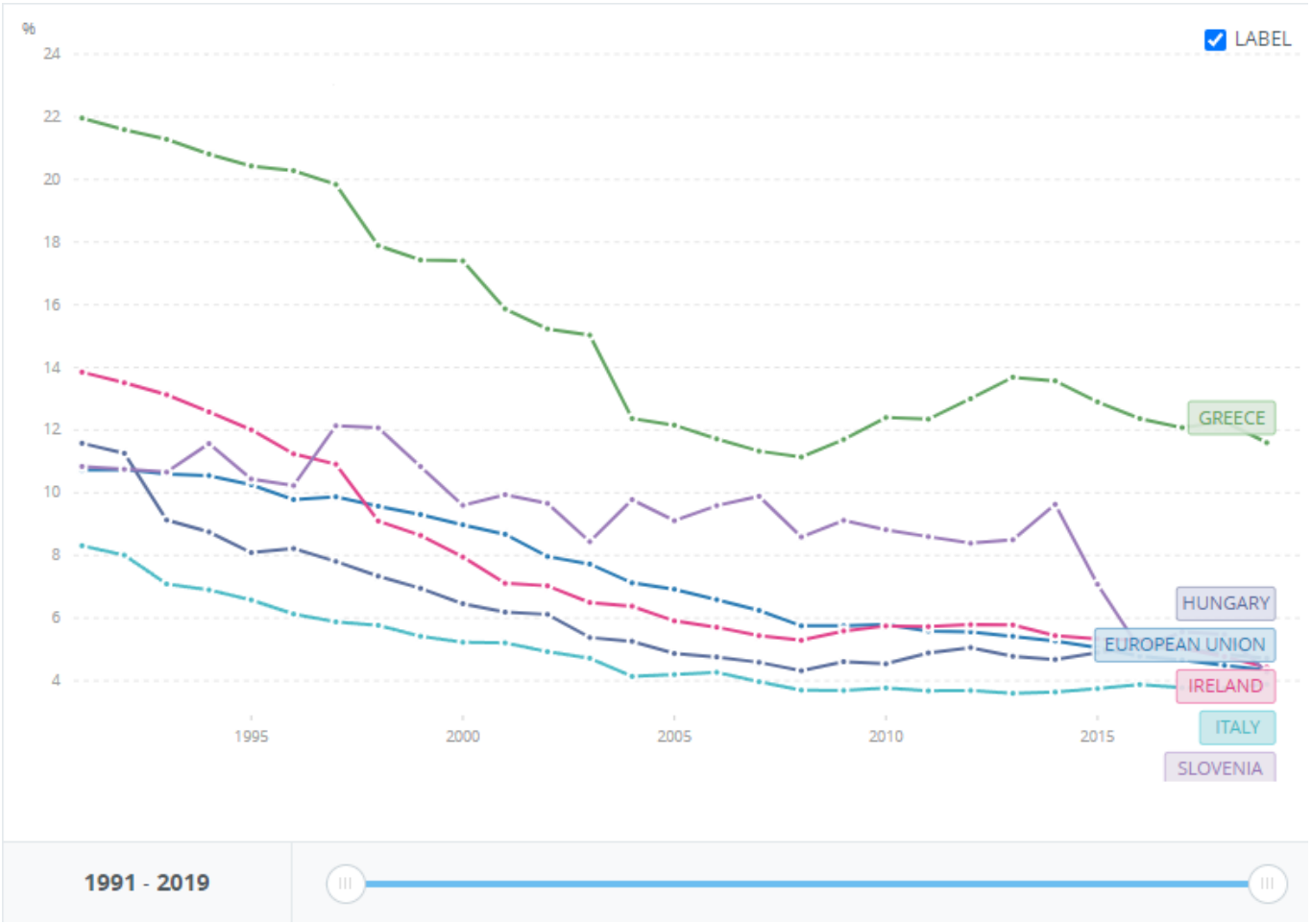


Source: European Commission, Statistical Factsheets (June 2021), own processing



Source: European Commission, Statistical Factsheets (June 2021), own processing

PERCENTAGE OF EMPLOYMENT IN THE AGRICULTURAL SECTOR (1991-2019)



Source: The World Bank, https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?end=2019&locations=EU-GR-HU-IE-IT-SI&start=1991&view=chart

2.2 Overview of Regenerative Agriculture and other alternative farming methods uptake

The development of alternative farming methods, like Organic Farming, Conservation Agriculture and Regenerative Agriculture, varies greatly among the partner countries regarding the level of integration in the countries' agricultural practices, integration into the countries' official policy framework, and prospects.

Organic Farming

Organic Farming (OF) is today the most widespread form of alternative farming in all partner countries. The introduction of OF was slower in some countries compared to others – in Ireland the Irish Organic Farmers and Growers Association (later renamed Irish Organic Association – IOA) was founded in as early as 1981, in Italy the first regulations on OF were published in 1986 and the Italian Association for Biologic Agriculture was founded in 1988, while in Greece the first organisation for the certification of organic products was established in 1992 and in Slovenia the Slovene Organic Farmers' Association was founded in 1997. However, the time of introduction of OF in each country does not necessarily connect to the level of integration in the country's agricultural practices; although in Ireland OF was introduced earlier than in the other partner countries, today only 1,3% of the farms in Ireland are organic, partly due to the OF policies (certification processes) being seen as counterintuitive and bureaucratic.

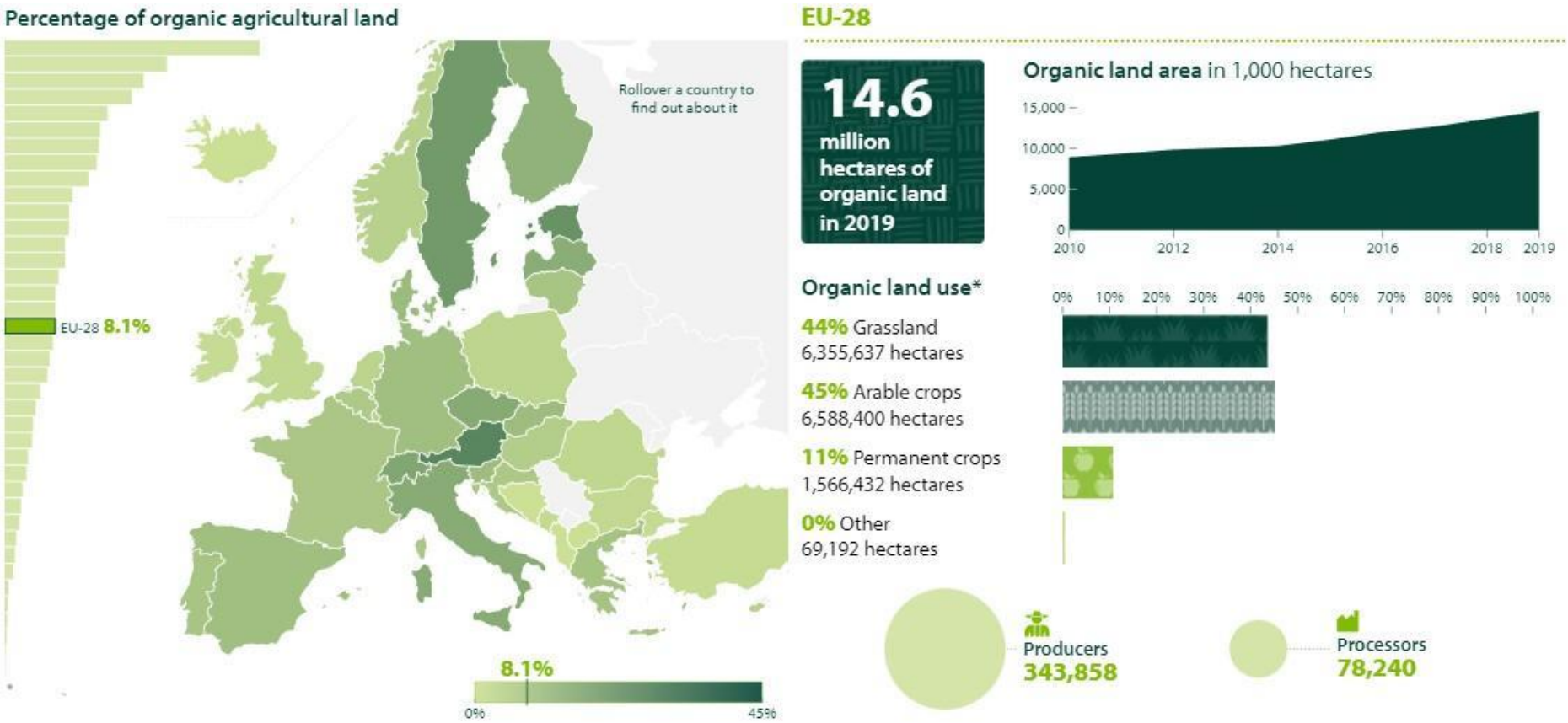
The European Union regulations on organic farming, designed to provide a clear structure for the production of organic products across the EU, have put in place a framework of OF for all EU countries, to satisfy consumer demand for reliable organic products while creating a fair market for producers, distributors, and retailers. The EU maintains a strict control and enforcement system to ensure that the rules and regulations on organic products are properly complied with. EU member states can put in place additional provisions to the EU regulations, and designate the "control bodies or authorities" responsible for inspecting operators in the organic food chain.

Today the level of integration of Organic Farming varies between the partner countries, as seen in the following maps[1] presenting the percentage of organic agricultural land, as well as the evolution of the organic land area over time (2010-2019), and the structure of the organic land area in the EU and in each partner country (grassland, arable crops, permanent crops, and other).

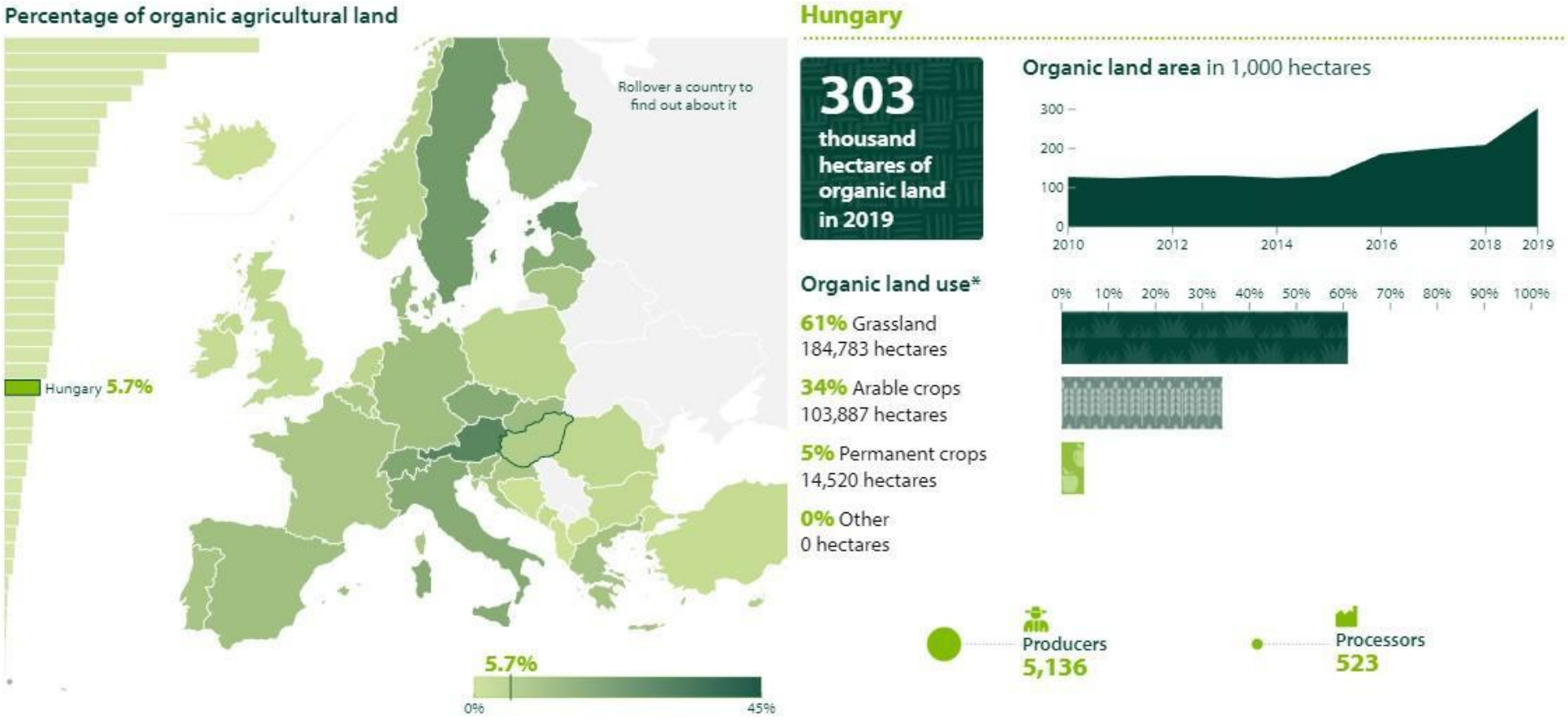
Italy is one of the leading countries in the EU in organic farming with a 15.2% of organic land area (well above the percentage at EU level – 8.1%) and 1 in 5 organic producers in the EU. Slovenia follows with 10.3% of organic land area, and Greece with 8.7% closer to the EU percentage. In Hungary the percentage of organic land area is well below the EU percentage (5.7%), while Ireland records one of the smallest percentages of organic land areas at just 1.6% of the country's total agricultural area.

[1] Source: Interactive map created by IFOAM Organics Europe (www.organicseurope.bio) using data compiled by the Research Institute of Organic Agriculture, accessed at www.organic-europe.net

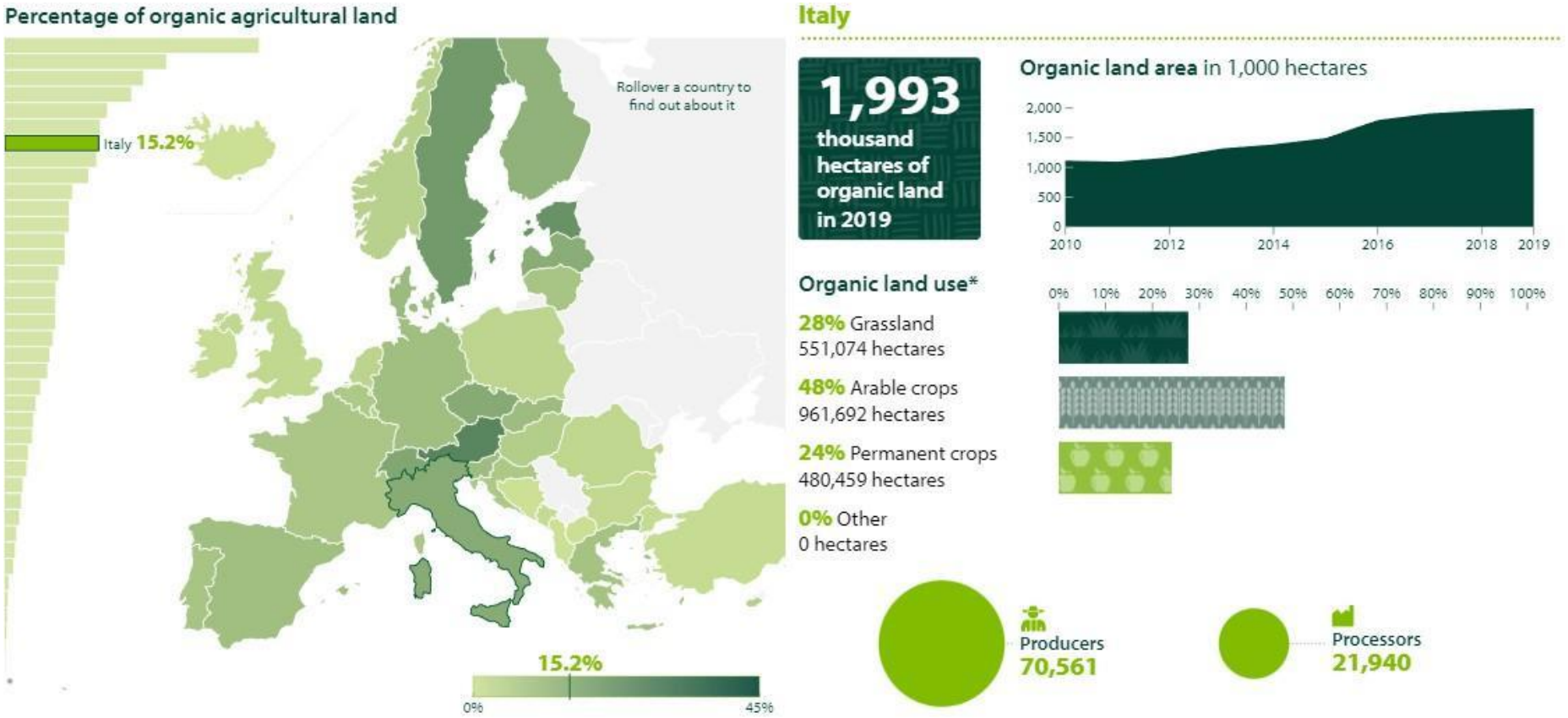
At the EU level, the percentage of organic land area has been increasing especially since 2014, reaching 8,1% of the total agricultural area in 2019. Most of the organic land is divided equally into grassland and arable crops, while a smaller percentage is permanent crops.



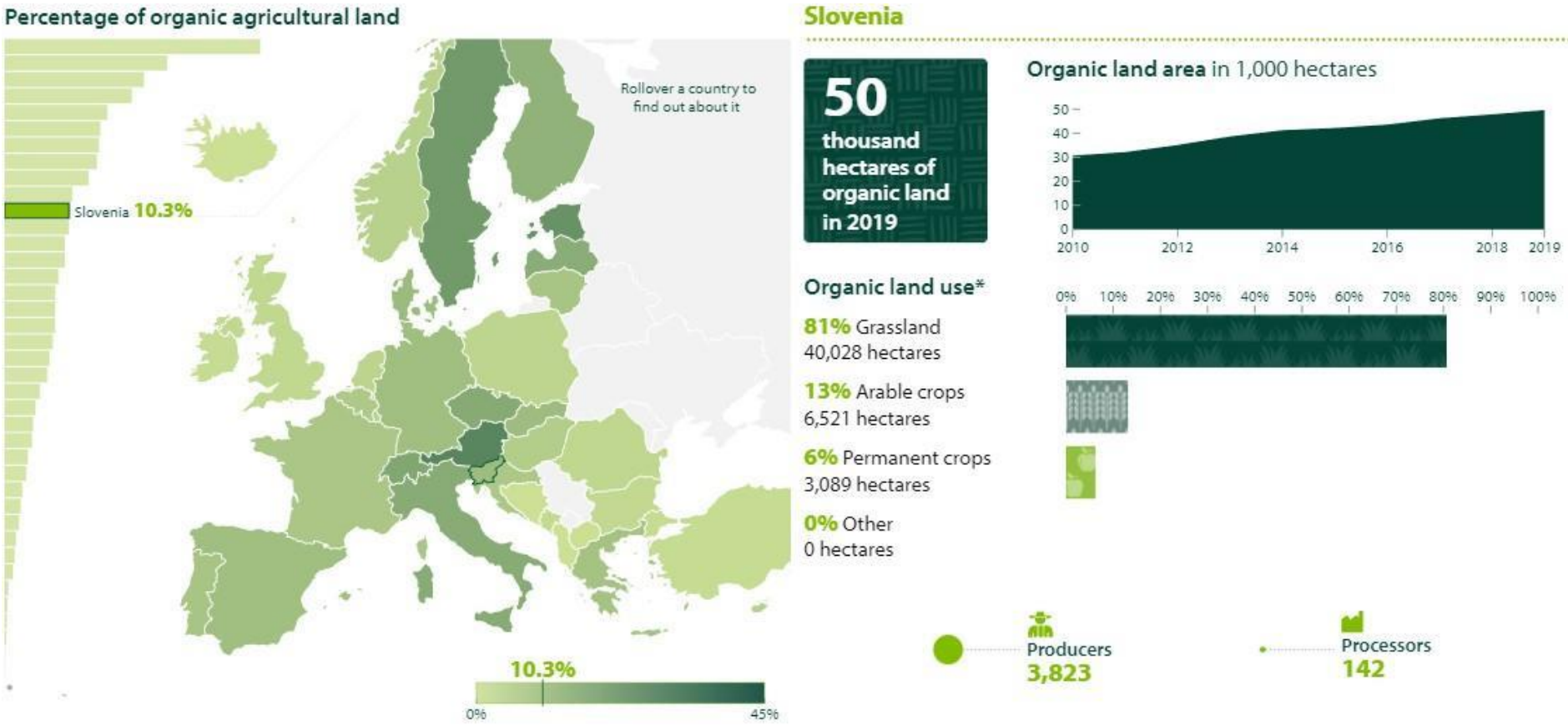
The percentage of organic land area in Hungary has been increasing since 2015, however in 2019 it is still well below the EU percentage, at 5.7% of the total agricultural area. Most of the organic land is grassland, with a smaller percentage representing arable crops and a very small percentage of permanent crops. The number of organic producers in Hungary represent just 1.5% of the organic producers at EU level, and processors of organic produce just 0.7% of the processors at EU level.



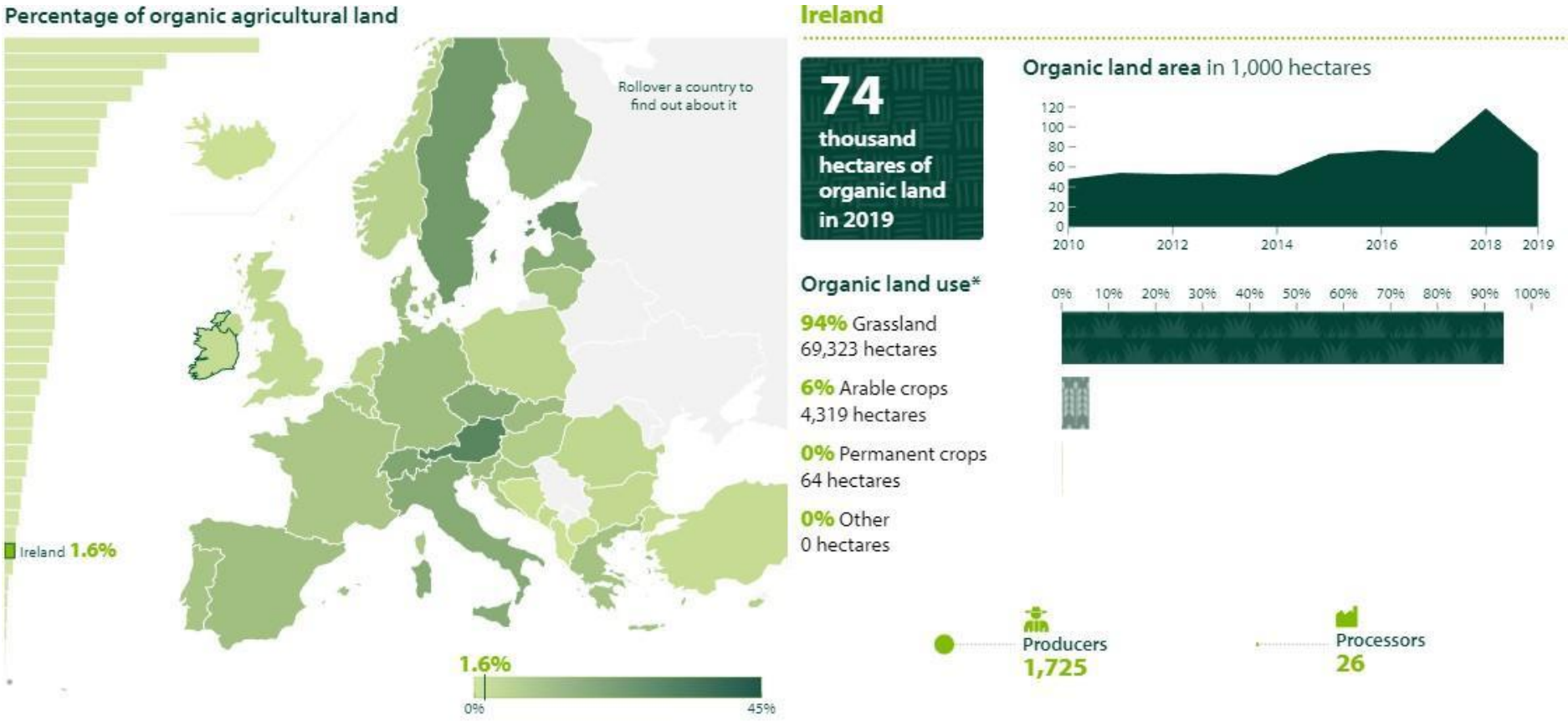
The percentage of organic land area in Italy has been steadily increasing since 2011, reaching in 2019 a percentage well above the EU percentage, at 15.2% of the total agricultural area. Most of the organic land is arable crops, with smaller percentages representing grassland and permanent crops. The number of organic producers in Italy represent 20.5% of the organic producers at EU level, and processors of organic produce 28% of the processors at EU level, confirming Italy as one of the leading countries in organic farming in Europe.



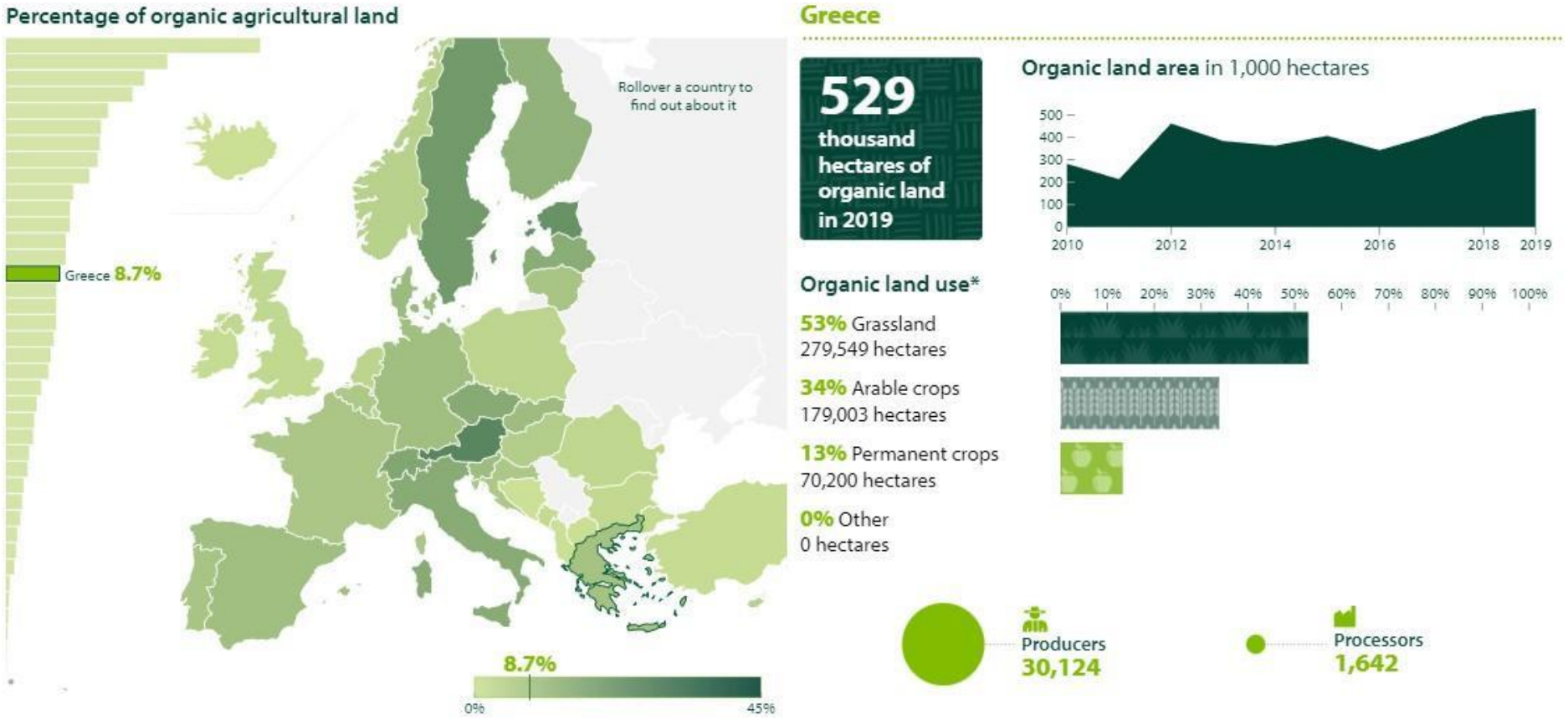
The percentage of organic land area in Slovenia has been steadily increasing since 2011, reaching in 2019 10.3%, above the EU percentage. Most of the organic land is grassland (81%), with much smaller percentages representing arable crops and permanent crops. The number of organic producers in Sovenia represent just 1.1% of the organic producers at EU level, and processors of organic produce just 0.2% of the processors at EU level.



The percentage of organic land area in Ireland is one of the smallest in the EU with fluctuations since 2014, reaching in 2019 just 1.6% of the total agricultural area. Almost all organic land is grassland, with a very small percentage representing arable crops. The number of organic producers in Ireland represent just 0.5% of the organic producers at EU level, and processors of organic produce just 0.03% of the processors at EU level. However, the new CAP offers financial incentives that may encourage the transition to Organic Farming in Ireland – the training of farmers through the National Organics Training Skillnet (NOTS) may assist in this direction.



The percentage of organic land area in Greece has been fluctuating over the last 20 years, showing a steady increase since 2016 and reaching 8.7% of the total agricultural area in 2019, close to the percentage at EU level. Most of the organic land is grassland, with smaller percentages representing arable crops (34%) and permanent crops (13%). The number of organic producers in Greece represent 8.8% of the organic producers at EU level, and processors of organic produce 2% of the processors at EU level.



Conservation agriculture

Conservation agriculture (CA) was promoted in the Common Agricultural Policy of the EU as a way to address primary environmental problems connected to the agricultural sector, like the CO2 emissions from farming, the decreasing biodiversity and the limited water availability. The focus of CA lies on soil conservation and enhancing biodiversity, and follows three fundamental principles:

1. **Minimizing mechanical soil disturbance** (reduced tillage or no-till) to preserve its structure, organic matter content, and living beings. In this way, the mixing of the surface layer of soil takes place naturally by the fauna present in the soil (earthworms and other organisms) and by the roots of the plants.
2. **Permanent cover of the soil with organic material** (crop residues, cover crops) to protect it from the sun, rain, and wind and to provide food for the living beings that inhabit the soil (microorganisms, earthworms, insects, etc.) and contribute to maintaining its fertility. The biomass covering the ground reduces the mineralization of the organic matter, which is maintained and gradually increased. Furthermore, the development of weeds is prevented, while the infiltration of water into the soil is facilitated by reducing evaporation.
3. **Crop rotations**, which reduce weed and disease pressure on crops. The alternation of crops with different root systems favours the exploration of the soil at different depths and better extraction of nutrients useful for the crops.

The benefits of CA reported in the literature include a reduction in production cost (fuel and energy costs are reduced by 65%), a reduction in the cost of labour as the labour requirements drop by 50%, and a reduction in machinery depreciation. The yields under CA are comparable to the conventional farming yields and depend on the use of herbicides.

Among the partner countries, conservation agriculture has mainly been introduced into the farming practices in Italy and Slovenia – in the rest of the partner countries, there was no report of CA being introduced apart from individual farmers or small-scale projects devoted to CA. In Italy, soil conservation is a priority in the Rural Development Plan, granting support to farmers in order to adopt soil-friendly practices like no-tillage, cover crops, and mulching. Although there is no official data on the number of farms practicing CA in Italy, estimates by the ALIGACOS (Italian Association for the agronomic and conservation management of the soil) – based on projections of the sixteen Italian Regions that have adopted RDP measures in favour of CA and direct surveys carried out by the various Regions – indicate that the land area practicing CA in Italy has been increased tenfold in 10 years from 80.000 Ha in 2008-2009 to 800.000 Ha in 2018. In Slovenia, the Slovene Association for Conservation Agriculture (SACA) was founded in 2016 with the purpose of introducing/promoting CA and Regenerative Agriculture for wider practice through networking, developing awareness, implementing initiatives, informing/training farmers, and cooperating with domestic and international organisations. The association also promotes cooperation between different stakeholders, i.e. Universities, research organisations and professionals in projects, educational programmes and research activities. SACA contributed into the new Slovenian Strategic Rural Development

Plan for 2023 – 2027 with proposals for regenerative actions which promote proper soil management and indirectly supports regenerative-conservation agriculture.

Regenerative Agriculture

Regenerative agriculture (RA) or regenerative farming has gained attention more recently in Europe as an alternative sustainable farming concept. The concept was developed in the 1970's, however there is still no consensus definition (Newton et al. 2020, Giller et al. 2021). It is viewed as a broader concept in relation to other alternative farming concepts like organic farming, conservation agriculture, agroecology, ecological intensification and carbon farming etc., and does not necessarily connect to specific farming practices. RA does not exclude modern plant and animal breeding technology, tilling or the use of inorganic fertilisers or pesticides, but aims at their more targeted and limited use[2]. The objective of RA is not just to reduce the negative environmental impact of agriculture, but to have positive impacts on the environment. RA has 2 main aims:

- Restoring the soil health in order to increase its capacity to sequester and store CO2, thus contributing to the mitigation of climate change, and
- Enhancing biodiversity in agricultural lands and reversing biodiversity loss.

There are several farming practices at the farm level that, according to the existing literature, are part of RA – many of them are also included in other alternative farming concepts like organic farming, conservation agriculture and agroecology. The list below, published in EASAC's publication "Regenerative Agriculture in Europe", indicates several practices suggested to contribute to the 2 main aims of RA.

In the partner countries, RA has only recently gained some interest from researchers, NGOs and individual farmers, expressed mainly through farmers' networks, projects pilot-testing RA implementation and promoting RA, and events aimed at introducing the concept. Official policies regarding RA have not yet been developed. The farmers expressing interest in learning about or making the transition to RA are usually already involved in organic farming, biodynamic farming or other alternative agriculture methods, and implement RA without any financial incentives. One of the advantages of RA, especially in comparison to organic farming, is that RA is employed freely by farmers and does not carry the certification and bureaucracy burdens of organic farming. In most countries, unofficial groups of farmers, researchers etc. interested in RA have been developed through the social media and offer opportunities to share experience and information. However, in countries like Ireland where regenerative farming has been gaining substantial awareness, there are reports of "greenwashing" by multinational companies that misuse the work of RA and use it as a marketing buzzword.

[2] European Academies Science Advisory Council, "Regenerative Agriculture in Europe – A critical analysis of contributions to European Union Farm to Fork and Biodiversity Strategies", April 2022 (www.easac.eu)

Farming practice	Suggested for carbon capture and storage	Suggested for biodiversity
Conversion of arable land to grassland	X	X
Grassland managemenbt (to capture carbon)	X	X
Woodland (wood pastures;silvo-pasture)	X	X
Native tree plantations on arable land	X	(X)
Agroforestry	X	X
Hedgerows, woody buffer strips, farmland trees	X	X
Improved crop rotations	X	
Crop diversity in rotations	X	X
Crop diversity - intercropping	X	(X)
Crop diversity - in sown/relay cropping	X	(X)
Minimize tillage: reduced, minimum or no tillage	X	X
Cover crops	X	
Retaining crop residues/Leaving crop residues on soil surface	X	
Organic amendments	X	(X)
Biochar	X	
Perennial crops	X	
Avoid insesticides, fungicides and herbicides	(X)	X
Field borders, etc. for beneficial insects (mainly pollinators and natural enemies to pests)	(X)	X
Flower strips (pollinators)		X
Buffer strips (often mandated for environmental/erosion reasons)	(X)	(X)
Herbal leys and summer fallows in crop rotations		X
Natural and semi-natural habitats		X
Landscape mosaics in space and time	(X)	X
Switch from large to small-scale landscape patterns, e.g. decreased field size	(X)	X
Supporting transitional habitats, reducing sharp boundary structures		X

List of field- to farm-scale agricultural practices suggested in the literature to be part of regenerative agriculture. Source: EASAC, "Regenerative Agriculture in Europe – A critical analysis of contributions to European Union Farm to Fork and Biodiversity Strategies", April 2022, own processing

2.3 Findings from stakeholder interviews

The project partners conducted interviews with key stakeholders in each partner country, in order to draw conclusions on aspects of Regenerative Agriculture (RA) in each country, like the overall knowledge of the term and concept, the current uptake of RA, obstacles to a wider transition to RA, benefits of RA, prerequisites for the wider take-up of RA, and the policy framework that would promote it. Overall, the stakeholder views collected and reported in detail in the respective National Reports converge, with the exception of some aspects raised with regard to the feasibility and effectiveness of RA. The findings of the stakeholder interviews are presented below.

<u>On the knowledge of the term "Regenerative Agriculture"</u>

In general, the term is not yet widespread in the agricultural sector of the partner countries. Moreover, even in cases where people have heard or read about it, usually they do not know what it means and have limited knowledge of its objectives and how to make the transition. Terms like organic farming and, in some countries (Italy, Slovenia), conservation agriculture or sustainable farming, are more widespread. Additionally, stakeholders from Greece reported that there is often confusion between the different terms used to describe different or overlapping sustainable farming approaches; although the term "organic farming" is now widely spread and understood, terms like "integrated management", "permaculture", "agroforestry", "conservation farming", "biodynamic farming", "agroecology" and "regenerative agriculture" often create confusion as to whether they constitute different or overlapping approaches or methods.

<u>On the current uptake of RA</u>

Currently, the uptake of RA is very limited. The transition to RA is usually attempted by individual environmentally conscious farmers who have become disillusioned by the organic farming movement that has evolved to focus mainly on the certification process rather than environmental sustainability objectives. With regard to the feasibility of RA, stakeholders' views vary; Italian stakeholders believe that RA currently represents a good opportunity for farmers who can easily make the transition to RA because it is profitable to do so, while stakeholders from the other partner countries express doubts on whether it is possible to implement RA holistically due to:

- The need for mindset formation of the farmers, especially taking into account the challenges that the farmers face today both in terms of their reduced income and the impacts of climate change. Farmers are caught up in an effort to make ends meet and save their productions and incomes, therefore they are less likely to make middle or long-term plans and lack the time and positive mentality to listen about new alternative farming methods or invest time in the transition to RA.
- A currently underdeveloped technology for weed control.

Obstacles to a more widespread transition to RA

The obstacles reported by stakeholder organisations in the partner countries refer to:

- The prevailing mentality of farmers who put the emphasis on increasing their production on the short term rather than reducing production costs. The focus is on increasing the production quickly in order to be able to supply large supermarket chains, using chemical fertilisers and pesticides to achieve this and also produce much earlier (e.g. produce watermelons in May).
- The ageing population of farmers. Older farmers are less likely to try out something different and change their production methods, or invest in time to make the transition to RA.
- Significant gaps in education and knowledge/knowhow on RA, both with regard to experts with a consultative role (e.g. agronomists) and to the farmers themselves. Currently, RA is absent from the curricula of relevant University courses (e.g. Agronomy courses) and there is no official training on RA for farmers. It should be stressed that RA is not a resource-intensive model but a knowledge-intensive model; in a sense, for a more widespread transition to RA it is necessary to change the producer model rather than the production model. In this direction, the role of education and training is key, and should focus on changing the mindset of farmers so that, instead of permanently relying on pesticides and other products to support their production, they are in a position to support their production using alternative methods and through knowledge, experimentation and monitoring. The change in attitudes and mindsets is also necessary, instilling to the farmers a culture of initiative, encouraging them to explore, try out and monitor the results of alternative methods. Education and training would also help to respond to farmers' questions and misgivings, like for example whether RA can be applied in different climate conditions and crops. Moreover, although there may be empirical knowledge on RA in all partner countries, this knowledge is not recorded or organised so that it can be used as training material.
- Lack of incentives for farmers to make the transition to RA, as at the moment there is no financial support that would encourage and facilitate the transition.
- The farm structure in Hungary and Greece, mainly in terms of the small size of holdings and the property status, making it difficult on the one hand to reach out to farmers and promote RA widely and efficiently due to the greater number of producers, and on the other hand posing obstacles in terms of the farmers investing time for the transition to RA.
- Social issues that the farmers who adopt alternative methods may experience in their local communities. Stakeholders in Greece reported that these farmers are in some cases seen as different or bizarre by their local community and may feel marginalised.
- The costs of purchasing new machinery, organic fertilizers and seeds of appropriate crops, that are additional obstacles according to the Slovenian stakeholders.
- The uncertain production levels and great reduction of yields, as supported by the interviewed stakeholders in Hungary. The Hungarian participants express views that have not been raised in the stakeholder interviews in the other partner countries, strongly criticizing the feasibility of RA due to great estimated yield losses and

uncertain production levels. In their views, concepts like RA unambiguously push Hungary's agriculture towards extensification: *The scientific data published on the yield differences of organic production systems compared to conventional systems are quite frightening: if in conventional farming, depending on the season, pests cause a 30% yield loss in an average year, this figure can exceed 70% in the absence of reasonable chemical crop protection, not to mention other abiotic factors or yield losses due to the absence of fertilisers. If applied correctly (efficiency and precision) chemical fertilisation has minimal chance of polluting the environment; on the opposite, if chemical fertilisers are actually used to make up for soil deficiencies or correct soil deficiencies (correcting nutrient ratios and imbalances, moderating excessive acidity or alkalinity, etc.), they can result in healthier soil, soil life, vegetation, animal and human communities on previously infertile lands*. Although Hungarian stakeholders recognise there are useful and adaptable parts in the toolbox of regenerative agriculture, like soil cover or minimal soil disturbance (no-till and min-till systems), they believe that the use of RA techniques leads to reduced yields and losses, placing the EU agricultural production at disadvantage in comparison to the production by conventional agriculture in third countries where there are limited or no restrictions on production.

Benefits from a transition to RA

The benefits of RA reported through the stakeholders interviews in the partner countries include:

- Economic benefits for the farmers, as reported from stakeholders in Greece, Italy and Slovenia. Although it is generally recognised that the transition to RA requires a time investment of 4-5 years, the results of studies are overwhelmingly in favour of the regenerative model on the long term as the farms become productive with much lower inputs and thus the production costs are reduced, resulting in a higher income for the farmers. Moreover, RA results in better quality crops, enhances the farmers' self-sufficiency as well as their knowledge and experience, and benefits the future generations on the farm as it revitalises the soil. Also, at European level there is an increasing demand for RA products, particularly products related to the clothing industry (e.g. cotton, hemp) and this could serve as a strong incentive for the transition. Moreover, a shift towards more sustainable agricultural production models is expected in the Common Agricultural Policy (CAP), directing funding in this field; therefore the producers who have made the transition will be in a favourable position to apply for funds.
- Broader social and environmental benefits. The transition to RA, besides enhancing the quality of the water and food we consume and minimizing the impact of the agricultural activity on the environment, increases biodiversity and helps fight climate change through sequestering greater amounts of CO_2 from the atmosphere. Additionally, RA is a strategy for enhancing soil health/achieving healthy soils in line with the EU soil Strategy for 2030.. Moreover, it could also contribute to enhancing

the farmers' social profile and sustaining a younger population in rural areas, not just as producers of our food, but also as guardians of biodiversity with a sustainable income.

- Stakeholders in Greece also reported there are benefits for the farmers' health. The uncontrolled use of pesticides in past decades has been connected with serious health problems and deaths of farmers from cancer. It is also necessary to battle the mentality that wants Greek farmers willing to risk the health of immigrant farm labour (e.g. Pakistanis) who come into contact with pesticides, rather than their own. Moreover, it is often reported that farmers who make the transition to RA claim to have improved their wellbeing because of reduced stress and pleasure from working in a natural environment rich in biodiversity.

Prerequisites for a wider spread of RA among farmers

The representatives of the stakeholder organisations interviewed in all partner countries agree that the most important condition for a wider transition to RA is the education and training of expert consultants (e.g. agronomists) and farmers on RA. Support in terms of policies and funding for farmers in order to attempt the transition to RA was also included as an important condition. Also, the issue of marketing and selling the RA products was reported as significant. In specific, the views of stakeholder organisations regarding the prerequisites for a wider spread of RA relate to:

- Education and training. The education of farmers is widely recognised by participants in all partner countries as the main prerequisite for more farmers to try the transition to Regenerative Agriculture. However, the training of farmers should not be limited to conventional training methods (in a class or online) but should incorporate alternative methods such as educational visits to farms applying such methods in the country and abroad, so that training is more effective both in terms of knowledge retention and development of positive attitudes and mentality. The education and training of experts (e.g. agronomists, adult trainers, consultants) on RA is seen as a crucial step in this direction, so they can act as multipliers of knowledge and skills. Experts (e.g. agronomists) possess the necessary background and work closely with farmers, therefore their education on RA is key to supporting more farmers to make the transition. This may also help in enhancing their profile and role as consultants. Moreover, it is important that the education/training is based on scientifically sound, evidence-based and credible material in order to provide a solid basis of knowledge, taking into account the different climatic conditions and crops in each area.
- Support in terms of direct funding and policies. An economic support in the form of subsidies (including incentives for purchasing machinery, fertilizers and seeds) may offset the initial investments in the 4-5 year period needed to make the transition and encourage farmers to move towards RA, but only as long as this is connected with measurable indicators assessing the impacts in terms of increasing biodiversity (e.g. the FBI — Farm Bird Index) and soil regeneration (e.g. increase of organic matter in soil). In terms of a policy framework, RA is currently not officially regulated in any of the partner countries; however, a regulatory framework for RA should not follow

the example of organic farming and involve less bureaucracy, cultivating a mentality of initiative among farmers.

- The issue of marketing and selling RA products. This issue was mainly raised by the stakeholders interviewed in Italy, who proposed that the joint marketing practice that has been implemented by farmer groups in organic agriculture is also employed to ensure the viable marketing of RA products. Moreover, creating rural districts to encourage the dissemination of RA practices among the farmers and creating a local identity around these districts will encourage the marketing of the RA products.

Stakeholder organisations' willingness to contribute to education/training on RA

All stakeholder organisations who participated in the interviews in the partner countries expressed their willingness to support education and training on RA, as organisers, trainers, participants and promoters, depending on their profile. In Greece, ELGO DIMITRA (the public organisation offering official training to farmers) expressed an interest to carry out a train-the-trainers course on RA, based on the learning methodology and material that will be developed in the REGINA project. The trainers can then provide training to farmers using the available training material of the project. Moreover, there is a potential for cooperation between the Organisation, EURACADEMY ASSOCIATION and the REGINA partnership in the framework of organising information events, workshops and train-the-trainers programmes on Regenerative Agriculture.

Necessary EU/national policies on RA

The participants interviewed in general agree that, although RA policies at European level should in principle be promoted through the Common Agricultural Policy of the European Union, it is the policy framework at national level that should set a clear strategy, targets and incentives for the transition to RA based on the local conditions and needs.

Overall estimates of RA spreading in the partner countries

Spreading RA among farmers in the partner countries in the short term is difficult. Through education/training, support and a clear national strategy, it is possible to create a critical mass of farmers who will implement RA over the next 10 years and set an example for others to follow. This is very important because, as the example of the development of organic farming has taught us, change is slow and must be based on concrete examples in the country that other farmers can relate to.

The Hungarian stakeholders expressed their concerns that the use of certain technological elements and production systems (organic farming, no pesticide use, no fertiliser use) would create serious food supply problems. This would in turn set in motion a process that would run against to the whole movement, that is, new areas would have to be taken in to supply

the growing population with food of sufficient quantity and quality. Finally, they state that It is exactly by intensifying agriculture and using more precise inputs that we can achieve a greater output per unit of land, reducing the conversion of green areas for agriculture.

3. FINDINGS OF THE FARMERS' ONLINE SURVEY

An online survey was conducted through the REGINA online questionnaire for farmers translated into the partner languages and disseminated to stakeholder organisations (i.e. farmers associations, networks, etc.) and farmers in the partner countries in the period from August 2022 until September 2022 (in Greece the online form was open from October 2022 until February 2023). The online form aimed at inviting farmers to map the uptake of Regenerative Agriculture across the partner countries and to get familiarised with their needs for skills and knowledge, as well as their attitudes towards RA. The number of responses per country is presented below:

Hungary: 269 responses

Italy: 141 responses

Slovenia: 51 responses

Ireland: 72 responses

Greece: 20 responses

The poor response rate in Greece, despite the intensive dissemination of the online form and follow-up, may be attributed to the low level of digital skills, no access to necessary equipment or the internet, or lack of experience by the majority of the farmers in Greece in filling in an online form, although for some of the responses the Euracademy team offered telephone support and walkthrough. Finally, it is also possible that farmers who do not know of or implement alternative farming methods like RA did not complete the questionnaire or did not submit it as they considered it irrelevant and therefore their views were not registered – this is strongly indicated by the results of the registered responses that reflect the participation of farmers who are aware or have already implemented alternative farming methods.

The survey results per country were analysed and are presented in depth in the corresponding National Reports. In the present section, the findings in the 5 partner countries are brought together and compared in an effort to draw overall conclusions. The findings are presented below according to the survey sections, i.e. Profile of the participants, Knowledge/Awareness on alternative farming methods and practices, and Attitudes and Learning Needs towards taking up Regenerative Agriculture.

Profile of the participants

The vast majority of participating farmers in all partner countries are male, with the greatest percentages of female farmers recorded in Greece (35%), Italy (22.7%) and Slovenia (21.6%). In terms of age of the participants, while in Slovenia and Italy the participants are evenly distributed between the different age groups, in Hungary and Greece most farmers are in the age group 36-45 years old, and in Ireland the majority (54.2%) is above 55 years old. In terms of the farm locations within the country, in Hungary most responses came from farmers located in the Transdanubian region, Italian responses came from farmers in the regions of

Tuscany, Campania, Apulia and Emilia Romagna, the responses in Slovenia mostly came from farmers in the NE region of Pomurje (where most arable land in Slovenia is located), in Ireland most responses came from farmers in the south of Ireland, and the spread of the respondents throughout Greece was satisfactory, with responses from farmers throughout mainland Greece and Crete.

Regarding the size of holdings of the participants in each partner country, a rather small size of holdings was recorded in Greece and Slovenia (vast majority between 1-50 Ha), a moderate size of holdings was recorded in Italy and Ireland (vast majority between 11-100 Ha), and a larger size of holdings was recorded in Hungary (majority between 50-1.000 Ha). The vast majority of farmers in all partner countries reported that the staff working in their farms are less than 5 persons.

In terms of the main products produced in the farms, the recorded responses confirm the production characteristics in each partner country:

- Hungary: Mainly arable crops, and fruit production to a lesser extent
- Italy: Mainly arable crops, but also fruit and vegetables production
- Slovenia: Mainly arable crops, and to a lesser extent livestock (dairy and dry stock)
- Ireland: Mainly livestock (dairy and dry stock) and to a much lesser extent arable crops
- Greece: Mainly fruit production, but also arable crops and vegetables production

Within this section the participants were also asked to identify themselves as farmers who mainly follow conventional farming methods or alternative farming methods, or both. The responses vary between the countries; in Hungary and Ireland the majority of farmers reported they mainly follow conventional methods (while 1 in 4 farmers stated the follow both conventional and alternative methods), in Italy most farmers reported they follow conventional farming methods but an important percentage reported they follow alternative farming methods (37%), in Slovenia the respondents are evenly distributed, and finally in Greece most of the respondents reported they follow alternative farming methods.

Knowledge/Awareness on alternative farming methods and practices

In terms of knowledge, farmers in all partner countries seem to be familiar with the concept of climate change, its causes and impacts. With regard to alternative farming methods, farmers are more familiar with organic farming, conservation agriculture and sustainable farm management, while they do not seem to be so familiar with the term regenerative agriculture.

In general, the participating farmers in all partner countries agree there is need to re-direct agriculture to new approaches, however the responses of farmers in Hungary, Slovenia and Ireland indicate that the participants are divided on whether conventional agriculture is sustainable or not. Moreover, although the views of the participating farmers in Italy, Greece and Hungary converge regarding the potential of new alternative farming methods to increase the income of farmers, the responses of farmers in Slovenia and Ireland reveal a more sceptical view. In addition, the participating farmers in all countries apart from Greece seem to be divided on whether conventional farming is the only method that can produce enough

food. Finally, most participants in all countries agree that there is not enough support in terms of education and financial support to introduce alternative farming methods.

When asked to rate the level of uptake of RA in their farm, their country and the EU, the responses in all partner countries gave mixed signals, however overall it seems farmers consider the level of uptake of alternative practices higher or moderate in their farm and in the EU, and at lower levels in the country.

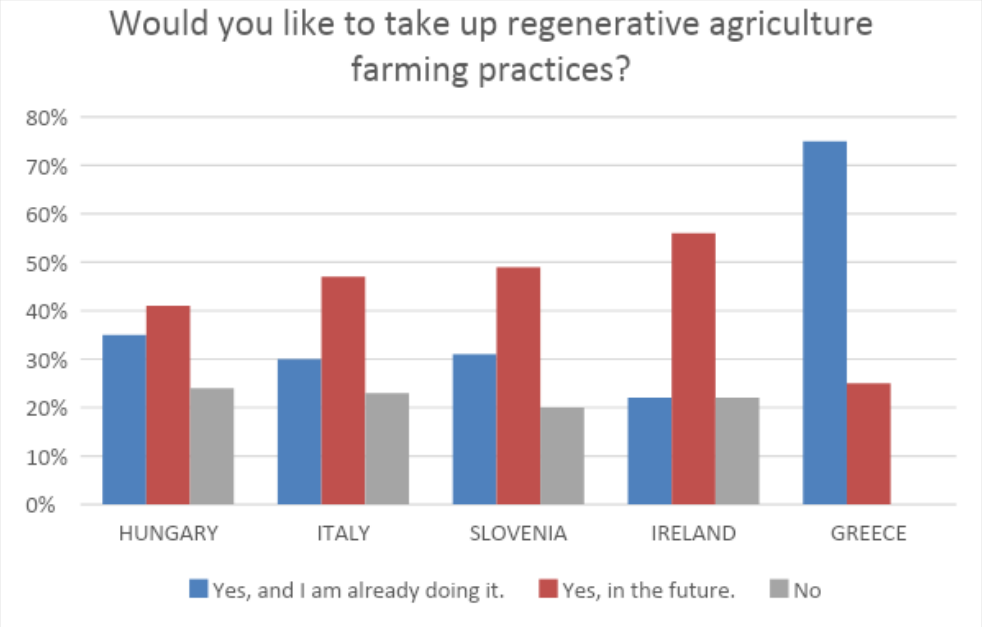
The majority of farmers report they are familiar with different techniques of regenerative agriculture and have either already implemented them on their farms or are planning to implement them in the future. However, an important percentage of the Italian farmers (≈40%) state they are not familiar with techniques like "including livestock in farmland to fertilize the soil", and "implementing habitat conservation techniques, e.g. Preserving hedgerows, leaving field margins to grow".

The farmers' awareness regarding the benefits of regenerative agriculture varies greatly between the partner countries, and the survey results highlight the need to communicate and educate farmers on the benefits of RA. The only benefit of RA recognised by the majority of the farmers in all partner countries is the enriched soil. From country to country the survey reveals different gaps regarding the awareness of RA benefits, as presented in the table below. In Greece most of the participating farmers stated they are aware of all benefits proposed. In Hungary and Slovenia, benefits like the reduction of labour, less farm mechanisation, increased farm revenue and less problems with plant diseases are not recognised. The Irish farmers who participated in the survey demonstrate lower levels of awareness on RA benefits; the majority are not aware of RA benefits like reduction of labour, need for substantially less water, higher crop quality, greater crop stability, increased farm revenue and less problems with plant diseases. Finally, the responses of the Italian participants reveal a lack of awareness for most of the proposed RA benefits, including the need for substantially less water, higher crop quality, higher CO_2 retention in the soil, increased farm revenue, less problems with plant diseases, benefits for insects (pollinators), and the varied appearance of the cultural landscape.

Gaps of knowledge on benefits of Regenerative Agriculture by the participants in each partner country					
	HUNGARY	ITALY	SLOVENIA	IRELAND	GREECE
Reduction of labour for farming	X		X	X	
Need for substantially less water		X		X	
Higher crop quality		X		X	
Greater crop stability		X		X	
Higher CO2 retention in the soil		X			
Enriched soil					
No need for farm mechanisation	X		X		
Increased farm revenue	X	X	X	X	
Less problems with plant diseases	X	X	X	X	
More beneficial for insects (pollinators)		X			
The varied appearance of the cultural landscape		X			

With regard to the obstacles for taking up RA, the majority of the participating farmers agree on the proposed main obstacles, including the lack of know-how, the lack of financial support from the state, the suspicion regarding the results, the necessary change in farming practices, the financial uncertainty regarding the short-term future, and organizational difficulties in achieving the year-round coverage of the soil. It should be noted that most farmers in Greece do not consider expensive investments as an obstacle to making the transition to RA. Based on their responses, the participants identify “lack of financial support from the state”, “financial uncertainty regarding the short-term future” and “lack of know-how” as the most important obstacles for taking up regenerative agriculture.

The majority of the participants in all partner countries are positive in taking up RA; they stated they are either already implementing RA practices or they plan to do so in the future, as presented in the chart below. With the exception of the Greek participants, where all respondents stated they are currently implementing RA practices or plan to do so in the future, approximately one in five participants stated they would not like to take up RA. The main reason these participants identified for not planning to take up RA is “economic barriers”, followed by “knowledge gaps” and “lack of interest”.



The vast majority of the participants in all partner countries reported they would like to receive information and training on all proposed topics including “regenerative agriculture farming practices (techniques)”, “economic benefits of RA practices”, “environmental benefits of RA practices”, “obstacles/difficulties of RA” and “financial support possibilities for regenerative/alternative farming practices”, giving equal attention to all topics. The participants were asked to record their preference between receiving further information or receiving training, and the findings highlight an interesting differentiation between countries regarding the level of commitment of participants: in Greece most of the participants prefer to receive training, in Italy there is an almost equal distribution between participants who would prefer to receive training and participants who would just prefer more information, while in Slovenia, Ireland and Hungary the majority of participants state they prefer to just receive more information on the topics proposed.

Finally, the participating farmers were asked to rate a set of proposed factors in terms of their potential in enhancing the uptake of RA in their farm. These factors included:

- More financial support from government or EU
- More opportunities for training and technical support (e.g. by agronomists)
- Good practice sharing among farmers, network
- Knowledge: lectures, workshops, demonstrations, instructions

Although the responses indicate that most participants in all countries think all proposed factors would contribute significantly in enhancing the uptake of RA, the financial support at national or EU level was identified as the most important factor – especially among the Irish, Hungarian and Slovenian participants.

4. THE REGENERATIVE AGRICULTURE CASE STUDIES

The project partners in Hungary, Italy, Slovenia, Ireland and Greece collected Regenerative Agriculture case studies in their respective countries through a survey using a case study form that the targeted farmers were requested to fill in, as well as through online interviews and face-to-face meetings to follow-up with aspects not clarified in the forms.

The case study form was structured as follows:

- **Profile/general information:** Name of the farmer/farm, name of the respondent, location of the farm, size of the holding (in Ha), number of farm staff (permanent, seasonal), main production of the farm (e.g. arable crops, fruits, vegetables, livestock, etc.).
- **Regenerative agriculture (RA) practices currently used:** What RA practices they currently implement, if not yet what practices they plan on implementing, what area of the farm they implement RA on and on which production (crops, livestock)
- **Starting regenerative farming and their motivation for doing so:** When did they start the transition to RA, what motivated them to do so, whether they received any education on the subject and if so where, if not how they accessed the necessary information, whether they received any financial support to start RA and if so from whom.
- **Results of regenerative agriculture:** benefits, obstacles, difficulties, satisfaction, intention to continue, intention to change their current practices.

In total, 40 RA case studies were collected as follows:

- Hungary: 14 case studies
- Italy: 6 case studies
- Slovenia: 6 case studies
- Ireland: 7 case studies
- Greece: 6 case studies

The case studies collected are presented in the respective National Reports and in the Library of RA material on the project website www.regina-ra.eu. The main findings from the case studies collected are presented below.

Profile

The RA case studies collected serve as examples of how the transition to regenerative agriculture can be applied in various locations in the different partner countries, in farms of various sizes and with different productions (crops, livestock), as well as in different contexts regarding the climate conditions. The profile of the case studies in the partner countries is presented below:

- **Hungary**: The case studies are located in the Győr-Moson-Sopron County, the sizes of holdings fall between 26 to 1100 hectares apart from one case study (vegetable community) operating on a very small area (3 hectares in total), the number of permanent (full-time) employees on holdings with a crop production profile is typically less than 5 people while livestock profile farms employ a staff of 82 employees. These numbers are typically supplemented by a few (up to 10) seasonal

employees. The production of the case studies includes arable crops (winter wheat, winter barley, winter swede rape, maize, poppyseed, soybean, sunflower, purple clover, phacelia, buckwheat, seed maize, seed green peas, alfalfa, Egyptian clover, potatoes, winter fodder peas, silage maize, rye), livestock (dairy cattle breeding, pig breeding, pig fattening) and vegetables/fruits (carrot, parsley, strawberry, sour cherry, squash, sweetcorn, sweet potatoes, and in the vegetable community case study 50 species of vegetables and 25-30 species of fruit).

- **Italy**: The case studies are located in the regions of Tuscany (central Italy) and Apulia (south Italy), the size of the farms is between 100-300 Ha (apart from one smaller holding of 36 Ha), employ less than 5 permanent staff and produce durum wheat, common wheat, oat, Italian sainfoin, field bean, chickpea, white clover, Egyptian clover, crimson clover, sunflower, barley, olives, and trifolium squarrosum. It must be noted that the case studies from Italy implement mainly conservation agriculture practices.
- **Slovenia**: The case studies are located in the Primorsko-Notranjska, Podravska, Pomurska, Posavska and Osredenjeslovenska regions in southwest, southeast, middle and nort-east Slovenia, the size of the farms lies mainly between 40 and 60 hectares with the exception of one farm of 316 Ha, and they typically employ less than 5 people with the exception of the 316 Ha livestock farm with 50 staff. The crop farms produce arable crop species like corn, barley, alfalfa, triticale, grass clover mix, barley and wheat, and the livestock farm implements dairy cattle breeding, horse breeding, cattle and pig fattening.
- **Ireland**: The case studies are located around the Midlands, West and South regions of Ireland. The size of the farms are generally around 50 hectares, with the smallest being 1 hectare and the largest being 161 hectares. The farms vary across a few farming systems; Arable (tillage), Livestock, Horticulture and Dairy. The main crops produced are Arable Crops (such as oats, peas, oil seed rape, winter wheat, spring wheat, malting barley and feed beans), Livestock (Dairy, dry stock, Pork and Poultry), and Vegetable/Fruit Crops (Blueberries, Aronia Berries, Apples, with one case study producing over 25 different crops for weekly sale in a local market).
- **Greece**: The case studies are located on the regions of Thessaly (central Greece), Peloponnese and Attica (south), are in general very small holdings of around 1-3 Ha, employ less than 3 permanent staff with seasonal staff or volunteers who work on a seasonal basis, and produce a great variety of fruits, herbs and grains like pomegranates, olives, wormwood, sage, mint, oregano, figs, peaches, vanillas, gooseberries, almonds, apricots, arbutus, apples, cherries, hazelnuts, pecan nuts, walnuts, feijoas, elderberries, **c**hickpeas, lentils, grains, table sultanas (grapes), must, molasses, raisins, pears, blackberries, goji berries, oranges, lemons, lime, tangerines, plums, loquats, as well as seasonal vegetables.

Regenerative agriculture practices currently employed by the case study farms

A wide range of RA practices is implemented in the case study farms, including:

- ✓ Succession planting

- ✓ Integration of companion species
- ✓ Rotation of crops using crop rotation and/or fallow periods
- ✓ Minimum or No-till practice
- ✓ Use of legumes/native vegetation islets for green fertilization
- ✓ Use of botanical plants as insect repellents and/or soil improvers
- ✓ Preparation of organic matter and use as a soil improver or working manure residues back into the soil to increase organic matter content and improve soil water holding capacity
- ✓ Systematic soil cover
- ✓ Optimal use of irrigation (drop irrigation)
- ✓ Near-zero inputs for plant protection and fertilisation-nutrition
- ✓ Harmonisation of agricultural practices through the biodynamic process (Moon Cycle)
- ✓ Alley cropping
- ✓ Use of activated carbon
- ✓ Application of syntropic agroforestry principles
- ✓ Use of bacterium fertilisers
- ✓ Maintaining hedges to enhance the biodiversity of birds and other animals

Starting RA and the motivation

In general, the farmers of the case studies had already an increased awareness regarding climate change, the impact of conventional agriculture to the environment and the products themselves, as well as the limitations of conventional farming in terms of economic and environmental sustainability, even before they attempted the transition to RA. In many of the cases the farms had already experimented with and implemented alternative farming methods (i.e. organic farming, conservation agriculture, biodynamic farming etc.) before they turned to RA. Moreover, a common characteristic of the case study farmers is their culture of initiative and their curiosity about the potential benefits of RA and especially its potential for minimizing the production costs. An important factor that led the case study farmers to attempt the transition to RA is that RA is not (at the moment) formulated in any of the partner countries and therefore is not subject to certification and bureaucratic processes like organic farming or – to an extent – conservation agriculture. It is important to note that there is no financial incentive in the form of substantial direct subsidies in the partner countries to make the transition to RA; the only exception is Slovenia, where one of the motives of the farmers to take up RA was the subsidies for the bird mowers and margin subsidies in place.

In general, due to the lack of know-how and education/training on RA, the farmers of the case studies have received training and/or information on RA through their own initiative, either by searching for information online, or by participating in training seminars (online or face-to-face) often held abroad, visiting farms that already apply RA practices, or sharing information through informal farmers' networks on RA.

Results of Regenerative Agriculture

The case study farmers reported that the transition to RA requires a minimum of 3-4 years until the results can be fully recorded. Some of the farms included in the case studies (e.g. in

Greece) have only recently attempted the transition to RA and have reported that it is too early to draw valid conclusions on the benefits of the transition.

The **benefits** reported include benefits relating to the environment, the economic sustainability of the farm, as well as personal/social benefits for the farmers:

Benefits for the environment: increase of biodiversity, regeneration of the soil and enhancement of fertility and CO2 sequestration, minimizing the danger of soil erosion, reduction of natural resources (water) used in farming, achieving more balanced temperatures.

Benefits contributing to the economic sustainability of the farm: nutritional and taste supremacy of products, reduced production costs (in terms of less water used, reduced input in terms of fertilizers and pesticides/herbicides, lower fuel costs and costs to maintain machinery, and usually reduced needs for labour although in some cases labour needs may increase), resistance of crops to diseases-entomological infestations-abiotic agents, farm's overall resilience and ability to produce all year round contributing to financial security, ease of soil cultivation, subsidies (reported by the Slovenian farmers), and opening to other commercial opportunities like agrotourism.

Personal/social benefits for the farmers: the knowledge and experience in an alternative sustainable way of farming enhances the personal development of the farmers who work in a healthy and pleasant (also therapeutic) environment; some participants described the experience as empowering and fulfilling, while some reported mental and psychological benefits, and a reduction of feelings of stress and insecurity, as well as social benefits in terms of having a sense of accomplishment, gaining recognition for their efforts to contribute in a more sustainable future and being part of a vibrant community of like-minded farmers.

The main **obstacle** reported by the case study farmers in the process of the transition to RA is the lack of knowhow and support from the experts/consultants (e.g. agronomists); the farmers attempting the transition to RA often have to do their own research and seek guidance abroad, experiment and learn in practice. Moreover, farmers implementing RA are often the only ones in their region and they lack support from other farmers in order to share concerns and seek solutions together. An additional obstacle relates to marketing the RA products, as there is no certification of the RA products and it is not easy to achieve a good premium price; the RA farmers can try to sell their products directly to the consumers (short supply chains), however this adds to their workload. Also, most farmers reported that there are no subsidies or other financial incentives to encourage the transition to RA (the Slovenian case study farmers could receive some subsidies aimed at encouraging sustainable farming practices). Additionally, the Italian farmers reported a lower yield per Ha, however this is offset by the substantial reduction of the production costs. Also, farmers in Hungary, Italy and Slovenia reported there is an issue with weed management. Finally, the slow return on investment is an obstacle reported by most farmers.

Overall, despite the difficulties they face, all the farmers who participated in the survey for RA case studies across the partner countries plan to continue applying RA and express the belief that RA is the future in agriculture. The need for continuous training and development was

highlighted by most farmers. Finally, a key element of RA reported by farmers in all countries is experimentation, and involves a trial and error process; this makes networking and sharing experiences and successes/failures with other RA farmers very important. As a farmer in Ireland said, “Don’t let “perfect” get in the way of good”.

5. CONCLUSIONS

The overview of the agricultural sector in the partner countries and the EU reveals differentiations in terms of:

- the distribution of UAA by category (arable land, permanent grassland, permanent crops),
- the Gross Value Added of the agricultural sector indicating the share of the sector in the countries' economy (higher shares in Greece and Hungary),
- the shares of crop and animal output (differentiating Ireland as a country with mainly animal output),
- the analysis of the crop and animal output per country, the farm structure in terms of the area and economic size of holdings (very small size of holdings in Hungary and Greece, moderate in Italy and Slovenia, larger in Ireland),
- the gender analysis of farm holders (more women farm holders in Greece and Italy, lower percentage in Hungary and Slovenia and the smallest percentage in Ireland), and
- the percentage of the countries' employment in the agricultural sector (the sector is still an important employer in Greece, smaller percentages in Slovenia and below the EU average in Italy, Ireland and Hungary).

The ageing population of farm holders is confirmed in all partner countries.

In terms of the alternative farming methods uptake, **Organic Farming** is by far the most widespread form of alternative farming today in all partner countries. Although its evolution in some countries took place earlier than in others, this does not necessarily connect to the current level of integration in the countries' agricultural practices. Today, the level of integration of organic farming varies between the partner countries in terms of organic land area and number of organic producers; Italy is one of the leading countries in the EU in organic farming, Slovenia and Greece follow (closer to the EU average), in Hungary organic farming is well below the EU average and Ireland records one of the smallest percentages of organic land areas in the EU at just 1.6% of the country's total agricultural area. **Conservation agriculture**, a farming method focusing on soil conservation and enhancing biodiversity through the principles of minimizing mechanical soil disturbance, applying permanent soil cover with organic material, and crop rotations, has mainly been introduced into the farming practices in Italy and Slovenia and is to an extent formulated through policies. **Regenerative Agriculture** (RA), a concept that has gained attention more recently in Europe, focuses not just on mitigating the negative environmental impacts of farming but achieving positive impacts through restoring the soil health and thus increasing its capacity to sequester and store CO_2 (contributing to the mitigation of climate change), and reversing the biodiversity loss in agricultural lands. RA does not necessarily connect to specific farming practices; on the opposite, according to the existing literature there are several farming practices that are part of RA. The concept has gained interest in the partner countries recently from researchers, NGOs and individual farmers, mainly expressed through farmers' associations and informal networks, initiatives pilot-testing and promoting RA, and events. Currently there is **no official**

policy framework on RA in any of the partner countries, however this is also seen as an advantage because RA does not carry the certification and bureaucracy burden of organic farming. The increasing interest and awareness on RA has also had negative impacts; in Ireland there are reports of "greenwashing" by multinational companies that misuse the work of RA and use it as a marketing buzzword.

The interviews with representatives of stakeholder organisations (farmers associations, NGOs, networks, national bodies, etc.) on aspects of Regenerative Agriculture in each partner county revealed points of convergence as well as different views especially regarding the feasibility of RA. The term "Regenerative Agriculture" and its meaning is not yet widespread in the partner countries, while there were reports that there is often confusion between the different terms used to describe different or overlapping sustainable farming approaches (e.g. organic farming, conservation agriculture, biodynamic farming, etc.). The current uptake of RA is very limited in the partner countries and is usually attempted by individual environmentally conscious farmers who have previously implemented organic farming and/or conservation agriculture. According to the interview participants, the obstacles to a more widespread transition to RA relate to the prevailing current mentality of farmers who focus on increasing their production and surviving in a harsh economic environment, the ageing population of farmers, the significant gaps in education and knowledge/knowhow on RA of experts/consultants and farmers, the lack of financial incentives for farmers to attempt the transition, the costs of purchasing new machinery/seeds, and the uncertainty of the production levels (especially the Hungarian participants express serious doubts about RA's feasibility claiming it would result in a massive reduction of the yields with impacts on food security). The participants recognise the economic benefits of RA for the farmers (the time investment needed for the transition pays off on the long term as the farm becomes productive with a much lower production cost), as well as broader environmental and social benefits like minimizing the impact of the agricultural activity on the environment, increasing biodiversity and helping mitigate climate change through sequestering greater amounts of CO2 from the atmosphere, enhancing the soil structure and quality, reducing soil erosion, enhancing the farmers' social profile and potentially sustaining a younger population in rural areas, and benefits for the farmers' health and overall wellbeing). The key prerequisites for a wider transition to RA relate to the education/training of experts/consultants (e.g. agronomists) and farmers, and the support of farmers through direct funding (subsidies) to offset the initial investments in the 4-5 years necessary to make the transition, connected to measurable indicators on biodiversity and soil regeneration. All stakeholder organisations who participated in the interviews in the partner countries expressed their willingness to support education and training on RA, as organisers, trainers, participants and promoters, depending on their profile.

The results of the online farmers' survey conducted in all partner countries highlight the following points:

- The participating farmers are generally familiar with the concept of climate change, its causes and impacts, and alternative farming concepts like organic farming and conservation agriculture, however they are not so familiar with the term "regenerative agriculture".
- The participants' views seem to be divided on whether conventional farming is sustainable or not.

- The participants in Slovenia and Ireland are more sceptical on whether RA can increase the income of farmers.
- Most participants are familiar with different techniques related to RA.
- The participants' awareness regarding the benefits of RA varies between countries; generally the participants expressed doubts regarding benefits like the reduction of labour, less farm mechanisation, increased farm revenue, less problems with plant diseases, need for substantially less water, higher crop quality, and greater crop stability.
- The lack of know-how and financial support are seen as the main obstacles for taking up RA.
- Most participants in all partner countries stated they are positive in taking up RA. The participants who responded negatively stated the reasons for their negative response mainly relate to economic barriers and knowledge gaps.
- The vast majority of respondents in all countries reported they would like to receive more information or training about RA.

The RA case studies collected across the partner countries cover a wide range of holdings size, production (crop and animal), and RA practices implemented. In general, the farmers of the case studies had already an increased awareness regarding climate change and limitations of conventional farming in terms of economic and environmental sustainability, before they attempted the transition to RA. The culture of initiative and an intrinsic curiosity to explore the benefits of RA are also common traits among the farmers who attempted the transition to RA. Also, the absence of a certification system and bureaucratic burden was reported as being an additional motive. Most of the farmers received information or training on RA through their own initiative (e.g. online search, participation in informal farmers' networks etc.). The case study farmers reported significant environmental, economic and personal/social benefits of RA in line with the benefits reported through the interviews with representatives of stakeholders, while the main obstacles reported are the lack of knowhow and support from experts, the lack of financial support for the transition period, and issues in marketing the RA products. Overall, the case study farmers plan to continue applying RA, express the belief that RA is the future in agriculture, and highlight the need for continuous training and development.

The findings presented in the present report strongly highlight the need for providing education of experts/consultants (e.g. agronomists, rural development consultants, etc.) on RA so they are in a position to guide farmers in the transition to RA taking into account their specific context in terms of climatic conditions, production type, farm structure, etc. The training of the farmers themselves is also key in order to dissolve misconceptions and points of uncertainty on the results and benefits of RA, provide credible evidence, collect empirical knowledge as learning material, and promote a wider uptake of RA. RA, as a knowledge-intensive model, requires a change in the producers' profile and mindset so that, instead of permanently relying on pesticides, herbicides, chemical fertilisers and other products to support their production, they are in a position to support their production themselves using alternative methods and through knowledge, experimentation and monitoring. This change in attitudes and mindsets is also necessary in order to instil in the farmers a culture of initiative, encouraging them to explore, try out and monitor the results of alternative methods.

The farmers' training should Incorporate alternative methods such as educational visits to farms applying RA practices in the region or in the country and abroad, so that training is more effective both in terms of knowledge retention and development of positive attitudes and mentality. Incorporating "field schools", i.e. learning activities held exclusively through field visits in farms that have made the transition or are currently in the process, to share good examples, problems and possible solutions, and encouraging learning by doing, would be most effective with the target group of farmers who are not used to sitting in front of a screen or in a classroom. In addition, instead of bringing the farmer to the information, it is more effective to bring the information to the farmer: approaching farmers in places where they gather (e.g. the local coffee shop) would be much more effective than providing information on the internet.

Finally, the creation and maintenance of RA networks in each country is also an important step in promoting a wider take up of RA. Through these networks the farmers can share their experiences, successes and failures with other farmers and experts, and enter a cycle of continuous training and development. Moreover, these networks can also contribute to the marketing and promotion of RA products directly to the consumers, without the need to introduce a certification system like in organic farming.