SYSTEMIQ

SOILCAPITAL

REGENERATING EUROPE'S SOILS

Making the economics work

About Soil Capital

Soil Capital is a farm management and independent agronomy company, with activities across Europe, Latin America and beyond. As a team of farming and finance professionals, we are committed to scaling regenerative agriculture through market solutions.

Regenerative agriculture prioritises soil health, captures more carbon than it emits, produces nutrient-dense food and is more resilient to extremes of weather – all driven by the natural productivity of farm ecosystems rather than costly inputs. Our experience has shown us that, if managed well, the adoption of farming practices that build soil health can be the single most important driver in increasing farm productivity, reducing risk in operations and protecting profitability.

About Systemiq

SYSTEMIQ was established in 2016 with the mission to achieve the UN Sustainable Development Goals and the Paris Climate Agreement. SYSTEMIQ works to transform markets and business models across natural systems, including food, agriculture and oceans, as well as energy and the circular economy. Through its development of regenerative business models, SYSTEMIQ aims to manage the social and economic needs of society and conserve the integrity of nature.

With headquarters in London, Munich and Jakarta, SYSTEMIQ works with thought-leaders like the Food and Land Use Coalition, leading businesses and governments and communities around the world.

With many thanks to:

SITRA

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SUSTAINABLE DEVELOPMENT
SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

Regenerating Europe's soils: making the economics work

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Foreword

For decades, the world food system has been oriented to feeding the world as cheaply as possible. This orientation has produced an abundance of calories. But it is in danger of eroding the foundations of farming, including the resilience of natural systems and the vitality of the soil itself.

The cost of soil degradation across the European Union is estimated at €97 billion per year. Two-thirds of this is a cost to human health. There is growing understanding that farmers and food companies need to work together to change this, but it can be hard to know where to start.

"Regenerating Europe's soils: making the economics work" presents a business approach to scaling up regenerative agriculture. It shows how, by implementing practices progressively, farms can improve the economics of their businesses throughout the transition to regenerative practices. They can achieve greater yield stability, improved profitability and greater resilience, while also reducing greenhouse gas emissions.

Perhaps most crucially, the report recognises this potential at a regional level – where groups of farmers and landowners can make a real difference, and where agricultural systems have economies and ecologies in common. Soil degradation looks very different in different areas: erosion in dry and mountainous parts of southern Europe, contamination and organic carbon loss in the north west. This report looks at two contrasting hotspots - the orange-growing region of Valencia and the wheatfields of the Marne in northern France – as a testing ground for its approach.

The transition path to regenerative agriculture implies a different way of working, which uses fewer agrochemicals, disturbs the soil less, and values biodiversity more. It also implies a different way of thinking: whereas it has long been believed that 'a good farm is a clean farm', maintaining permanent soil cover, for instance with crop residues left in the field, goes against this grain. And in both cases, independent advice and better links to food buyers can maximise one of agriculture's strengths: a tradition of sharing knowledge and experience.

"Regenerating Europe's soils: making the economics work" shows that, even without extra subsidies, regenerative agriculture can be a more profitable option for farmers. And, most importantly, that the transition to soil-friendly practices can work without multiple years of investment and operational losses. Shifting, our work shows, is nothing to be afraid of. Farmers are best placed to lead the transition and inspire others, especially when given access to the new knowledge they need from agronomist advisors and peers.

But to do this, their business energy and practical skills must be redirected and supported. New economic signals must also serve to shift social norms that are such a strong cause of today's inertia. This is where the role of food buyers, policymakers and other market makers becomes so important.

The opportunity is compelling and the path forward clear. The priority now must be dynamic collaboration to put the superior economics of regenerative agriculture to work.

Martin R. Stuchtey
Founding Partner, SYSTEMIQ

Chuck de Liedekerke
CEO, Soil Capital

1. Context and methodology for this report

This report has been developed by SYSTEMIQ and Soil Capital, with financial support from Sitra, the Sustainable Development Solutions Network and the SUN Foundation. It is intended to address a gap in the understanding of soil health, namely how to make the economics of a transition to regenerative agriculture work for farmers, with a focus on the European Union. The report is complemented by the global picture provided by the 'Growing Better' report of the Food and Land Use coalition, to which SYSTEMIQ serves as secretariat, and associated research materials.[1,2]

The report is structured as follows:

- **The cost of soil degradation in Europe:** Section 2 reviews the extent and cost of soil degradation in Europe, and describes how regenerative agriculture can address this.
- **Regenerating soil at farm level:** Section 3 describes regenerative practices and how they are being implemented in Europe, including programmes in Belgium and Finland.
- **The economics of transition in two hotspots:** Section 4 presents a plan for transition to regenerative agriculture in two hotspots, based on field visits and modelling: they include a grain farming region in France and a fruit farming region in Spain.
- **Scaling up regenerative agriculture across Europe:** Section 5 describes the components needed to be able to achieve the transition described above at scale.

Experts from the following organizations were consulted during the development of this report:

Exhibit 1 – Overview of outreach

We would like to thank representatives of some of these organizations who reviewed this report prior to publication. None of those people or the organizations consulted should be held responsible for errors or omissions in drafting, which are those of the authors only.

[1] Food and Land Use Coalition (2019): *Growing Better: Ten critical transitions to transform food and land use.* Available at https://www.foodandlandusecoalition.org/global-report/

[2] Burgess PJ, Harris J, Graves AR, Deeks LK (2019): *Regenerative Agriculture: Identifying the Impact; Enabling the Potential.* Report for SYSTEMIQ. Cranfield University. Available at the site above

2. The cost of soil degradation in Europe

2.1 The importance of soils, and types of degradation

Soil is the foundation of most agricultural systems and an essential part of water and nutrient cycles. Despite decades of research and billions of investment, no alternative food production system (ocean-based, hydroponic or synthetic) has come remotely close to the importance of soil-based, land production systems that produce food, animal feed and increasingly bio-energy.

The European Union (EU) accounts for 2.8% of the world's land area, 6.7% of its population and 12% of its agricultural production by value. It is a significant exporter, to the tune of over €100 billion per year, is a global hub for trade in food products, and sets environmental and health standards that are emulated worldwide. Consequently, the state of Europe's soils is of global importance and Europe has an important role to play in leading soil regeneration both at home and worldwide. The risks of drought and disease became apparent in major crop growing areas of France and Germany during 2018 when drought led to billions in losses in the agricultural sector[3].

Europe was also the first region of the world to industrialize and then de-industrialize, giving it a leadership role in the fight against climate change. Europe's long agricultural history, going back to 3,000 years in some areas, has also resulted in significant land-use change and soil degradation. Assessments by the European Commission and UN Food and Agricultural Organization have identified the following principal channels of degradation:

- Erosion (water or wind) – physical loss of topsoil that is carried in to either neighbouring areas or into waterways and eventually to lakes or seas. Farm-level costs of lost productivity due to erosion were recently estimated to be €1.25bn per year in the EU[4], with significant additional costs from damage to infrastructure like dams or water treatment plants
- Compaction – an increase in soil density most commonly caused by heavy agricultural machinery or tillage. Compaction makes soils less able to retain water and creates barriers to plant root development. Estimates report that roughly 20% of European soils are moderately affected by compaction, with about 30-40% being highly susceptible or at risk
- Loss of organic carbon – decrease in the level of organic matter in soils that can occur from change in land use (particularly forest to grass or grass to arable) or intensive farming practices such as frequent tillage or heavy use of chemical inputs. Low levels of organic carbon reduce the soil's ability to absorb and store water and reduce nutrient availability to soil biota, which in turn reduces availability to plant roots. Low organic carbon levels (below 2%) are therefore associated with low and volatile yields.
- Loss of biodiversity – decreased microbial, nematode, earthworm or pollinator activity resulting from intensive agrichemical use. Many of these organisms perform important functions for free in soils, including nutrient cycling and pest resistance.
- Sealing – loss of agricultural land and topsoil due to urban or industrial development. Estimates are that about 4% of the EU's total area is covered and this is increasing at a rate of 3% per year (EC 2011).

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[3] https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters/climate-change/heatwaves-and-drought-in-europe.html

[4] Panagos et al (2018): *Cost of agricultural productivity loss due to soil erosion in the European Union.* https://onlinelibrary.wiley.com/doi/full/10.1002/ldr.2879

- Contamination – pollution, particularly from agrochemicals, as well as heavy metals and mineral oils from industrial development. There are an estimated 3 million sites in Europe affected by contamination.
- Salinisation – accumulation of soluble salts of sodium, magnesium and calcium in the soil to the extent that soil fertility is reduced. Salinisation can become particularly problematic for irrigated soils and is a major driver of desertification. In Europe, 1 – 3m hectares of land are affected by salinisation, concentrated in Mediterranean countries[5].

2.2 Estimating the cost of soil degradation

Estimates for the cost of degraded soils vary widely, based on the scope of costs considered. In 2010, the EU's Joint Research Centre stated that[6]:

"The total costs of soil degradation in the form of erosion, organic matter decline, salinisation, landslides and contamination could be up to EUR 38 billion annually for the EU-25."

More recent estimates have reached higher values by including the cost of soil degradation to human health. The Food and Land Use Coalition (2019) estimated that the global food system has a hidden cost of $12 trillion, more than the market value of the global food system of $10 trillion. It is not possible to apportion these costs to soils directly, but the cost of pollution ($2.1 trillion), greenhouse gas emissions ($1.5 trillion) and natural capital loss ($1.7 trillion) are largely driven by modern industrial farming systems and have a significant soil component.

This report has used a methodology similar to the Ellen MacArthur Foundation's 2019 report on 'Cities and the Circular Economy for Food', which showed that the food system creates €1.80 of externalities for every €1 of food produced.[7] The major factors were human health, pollution and greenhouse gas emissions. The health costs include the effects of volatile ammonia, which is released by manure and mineral fertilizer and reacts atmospheric nitrogen and sulphur compounds with to create fine particulate matter that lodges in the lungs and causes damage if inhaled.[8]

Applying this methodology to the European Union, we estimated the costs of soil degradation across the European Union at €97 billion per year, two-thirds of which are costs to human health. The analysis looked at costs related to greenhouse gas emissions, nitrogen leakage into air and water ways, water & biodiversity impacts. This compares with a total agricultural output of €365 billion and a subsidy bill (through the Common Agricultural Policy) of €59 billion in 2018.[9] While EU soils are less degraded on average than global hotspots, like former rainforests and tropical peatlands, these figures conceal significant regional variations: erosion, for instance, is concentrated in dryland and mountainous areas of southern Europe, while contamination and organic carbon loss are most pronounced in the industrial areas of north-west Europe, and flood damage has been a particular problem in parts of the UK and Italy recently.

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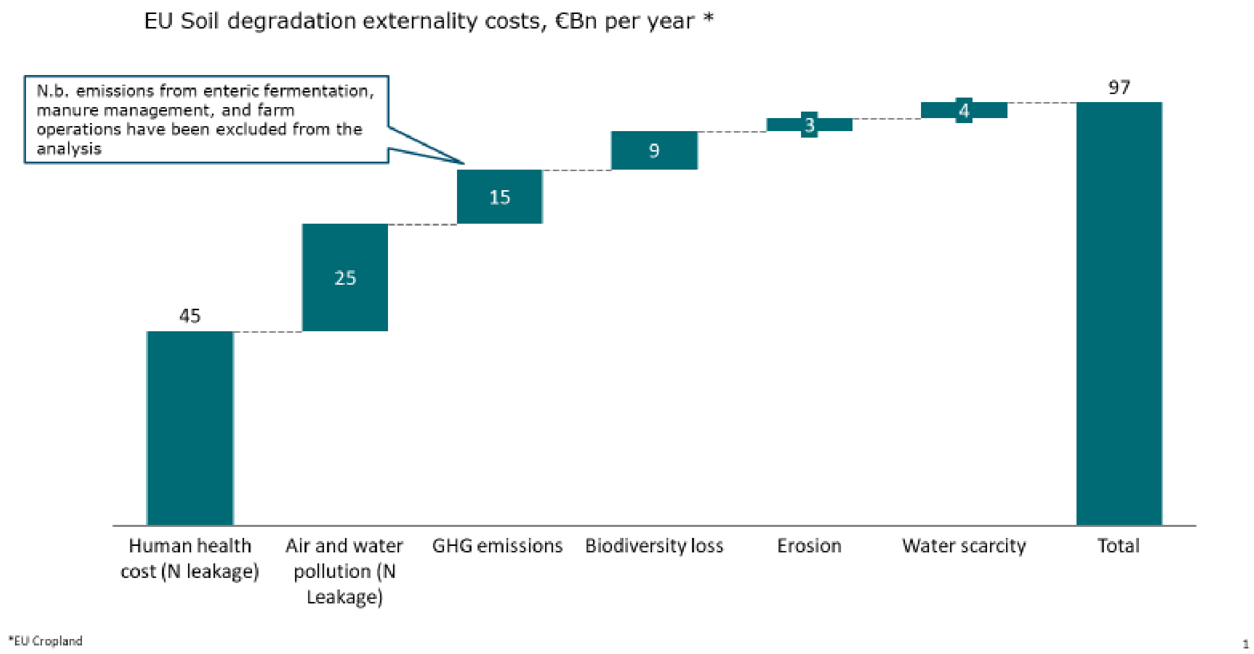
[5] https://esdac.jrc.ec.europa.eu/themes/soil-salinization#tabs-0-resources_by_type=1
[6] EU Joint Research Centre (2010): *The state of soil in Europe*. A contribution to the European Environment Agency's Environment State and Outlook Report. https://ec.europa.eu/jrc/en
[7] Ellen MacArthur Foundation (2019): *Cities and the Circular Economy for Food.* Available at https://www.ellenmacarthurfoundation.org/our-work/activities/food
[8] See for instance Royal Society and RAND Corporation (2018): *Impact of ammonia emissions from agriculture on biodiversity: An evidence synthesis*. https://www.rand.org/pubs/research_reports/RR2695.html
[9] European Commission factsheets (2019): https://ec.europa.eu/agriculture/statistics/facts-and-figures_en

Exhibit 2 – Estimated total costs of soil degradation in the EU



A senior FAO official gained attention with a statement in 2014 that at the present rate of degradation, there are "sixty harvests left".[10] We note that it is difficult to trace published studies in the literature to support this precise claim. However, there is evidence that soil may be approaching a 'tipping point'[11] in areas of particularly high degradation, particularly on the large shares of EU agricultural land where organic carbon levels are already below 2%. In some areas of southern Europe, soil degradation coupled with climate change may eventually lead to land being abandoned, something that was brought up by farmers on our visit to Valencia.

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[10] https://www.scientificamerican.com/article/only-60-years-of-farming-left-if-soil-degradation-continues/

[11] Environmental Tipping points and Food System Dynamics, (2017) https://www.foodsecurity.ac.uk/publications/environmental-tipping-points-food-system-dynamics-main-report.pdf

3. Regenerating soil at farm level

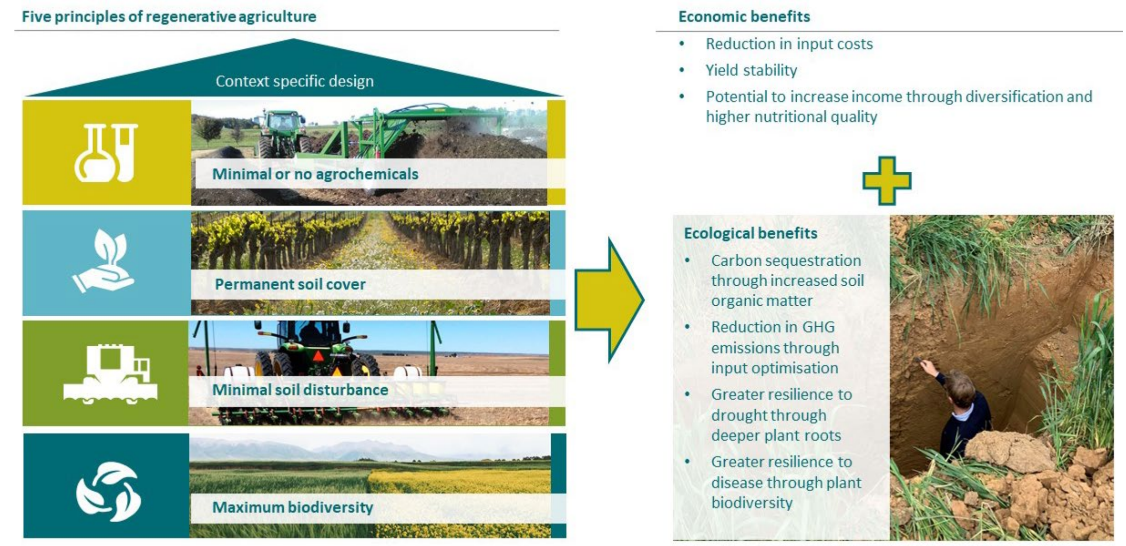
3.1 Overview of regenerative practices

There are extensive descriptions of regenerative agricultural practices in the agronomic literature, summarised in publications by the European Commission, FAO[12] and various national institutions. This report defines regenerative practices according to five widely accepted principles, which are also followed by Soil Capital[13]:

- Minimise or eliminate agrochemicals
- Maintain permanent cover of the soil, ideally with living roots
- Minimise soil disturbance
- Maximise functional biodiversity
- Adapt to context-specific design

The principles are summarized in the exhibit below:

Exhibit 3 – Principles and benefits of regenerative agriculture



Source: Soil Capital

Applying those principles leads to a wide range of different management practices, including changes in land preparation (reducing tillage and cover cropping); changes in fertility management (reduction in synthetic fertilizer and agrochemical use); and changes in land use through incorporating trees or animals to arable farms, and diversifying rotations. Done properly, these practices can be both economically and ecologically beneficial. For example, one long-term study published in 2015 found that longer rotations and use of cover crops increased productivity, reduced variation in yield, and made yields more resilient during particularly hot & dry or cold and wet seasons for corn and soybean crops[14].

To date, the application of regenerative practices has been limited in Europe, owing to concerns over cost, potential loss of yield and cultural factors such as a preference for bare soils in some

[12] Food and Agriculture Organisation of the United Nations (2015): *Status of the world's soil resources (ch. 11 on Europe)* http://www.fao.org/documents/card/en/c/c6814873-efc3-41db-b7d3-2081a10ede50/
[13] Described in greater detail at https://www.soilcapital.com/
[14] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0113261

areas. Interviews with farmers suggest that a transition to regenerative practices typically takes the form of a ‘break with the past’ such as a generational transition, change in tenancy or a dramatic drought or disease event.

The argument of this report is that regenerative agriculture can benefit many more farmers if they can be persuaded that it is in their economic interest to do so. Consequently, it is necessary to develop an approach to regenerative agriculture that retains profitability throughout the transition, thereby making it possible for farmers to change their practices even without the additional incentive of a price premium, certification or subsidies. This can be done through a smooth step-by-step approach, so that the practices that are implemented first provide cost savings that then support later stages of the transition. The benefits at farm level include:

- Enhanced natural fertility through increased soil organic matter
- Reduction in input costs and GHG emissions through input optimisation and group purchase
- Greater resilience to drought through deeper plant roots and improved soil structure
- Greater resilience to disease through plant biodiversity and breaking disease cycles

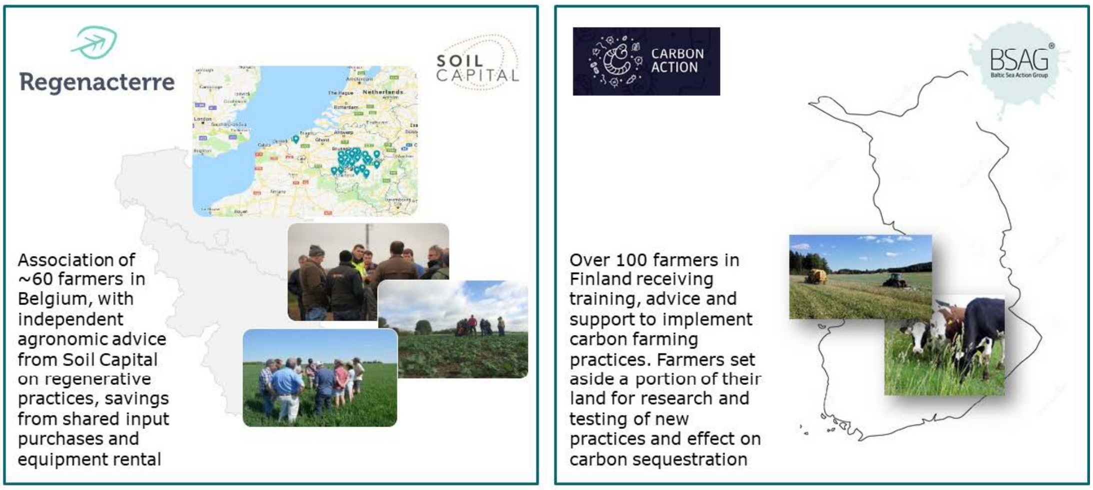
There are also potential nutritional benefits: for example, some studies indicate that organically farmed products have greater density of micro- and macro-nutrients. To date, however, there have not been any academic studies showing a direct link from regenerative farming or soil health to human health. Interviews with food producers and retailers suggest that soil health is not understood by most consumers, although related concepts like “zero pesticide residue” may be. That is why it is important to demonstrate that a transition to regenerative agriculture can be profitable without a price premium.

Regenerative practices have important consequences for the farming system, which go beyond the practices of individual farmers. The emphasis on more diverse rotations and cover cropping makes the farming system more complex, and may require the farmer to develop new offtake arrangements. They may require the development of new input supply models, for example for cover crop seeds. Finally, the adoption of regenerative practices calls for a change in mechanical equipment: from tillers and sprayers to seed drillers and mechanical weeding, for example. In some cases, this may permit the farmer to reduce the capital intensity of farming overall; in all cases, it requires the development of better tools for sharing knowledge and experience.

3.2 Applications of regenerative agriculture in Europe

As part of the review of experience, we consulted experts from two soil regeneration programs: the Carbon Action Program in Finland, which is implemented by the Baltic Sea Action Group and supported by Sitra, and the Regenacterre association in Belgium, to which Soil Capital serves as strategic and technical advisor. Their experiences are described in the exhibit below.

Exhibit 4 – Regenacterre and Carbon Action



Source: Regenacterre, Carbon Action Program

3.2.1 Regenacterre – a 'regenerative hub' improving farmer profitability in Belgium

In 2016 in the region of Wallonia in the south of Belgium, 15 farmers initiated a non-profit association called Regenacterre with the strategic support of farm management firm, Soil Capital. Their goal was to enable farmers throughout the region to work together to regenerate the health of their soil, while improving their profitability throughout the transition.

By 2018, Regenacterre had established itself as the principle hub for the region's regenerative farmers. The association now counts 59 farmers as members, farming over 4,500 hectares in total. Growth has been largely by word of mouth, which is all the more notable considering that each farmer pays a membership fee of up to €20 per hectare.

It is the financial benefits unlocked by Regenacterre's services that explains this growth. For while there is a clear cost to membership, the experience of those involved is that farmers consistently save at least €50 per hectare on their operating costs in the first year of membership alone, while their transition to regenerative practices gets started. Some save significantly more.

Today, three separate drivers of cost reduction have been built into the services provided by Regenacterre to its members, with support from Soil Capital. These are accompanied by training and peer learning events, that accelerate learning and build confidence around new practices.

1. **Agrochemicals**. These are systematically reduced throughout the transition to regenerative agriculture, with a view to their elimination. Experience has shown that the moment agrochemical advice is provided independent of input providers, reductions in volumes can be implemented without impacting yields.
2. **Regenerative inputs**. Features like multi-species cover crops in a rotation are powerful contributors to improving soil health and yet they represent a cost to the farmer. Combining many farmers' purchasing power has proven to deliver meaningful reductions in costs.
3. **Equipment**. A variety of new equipment needs, from strip tills to direct drills, emerge as farmers progress through their transition to regenerative farming. Group purchase of key equipment facilitates early trials and distributes costs, including amortisation.

As the association grows, its impact deepens, with around a fifth of members now aiming at regenerative organic standards. The key to success so far has been the consistent improvement in farmer profitability throughout the transition, driven by the range of cost savings the association has generated. Looking ahead, it is clear that connecting such farmer-led movements to buyers willing to reward their achievements holds potential to catalyse far greater progress.

Examining the deep roots of spelt, in a regeneratively managed wheatfield in Belgium – part of the Regenacterre project. The two-metre deep roots are a sign of a healthy, resilient crop. *Photo: Karl Fletcher*

3.2.2 Carbon Action Program – research and training on carbon farming practices in Finland

Established in 2017, the Carbon Action Programme is a collaboration among researchers, businesses and farmers to promote the development and training of "carbon farming" (or regenerative) practices in Finland. The aim of the programme is to identify and study practices such as cover cropping, reduced tillage, organic fertilisation, agroforestry, and others, that increase soil carbon content, thus improving soil fertility and resilience while providing a carbon mitigation solution.

There are around 100 farmers in the programme, who receive access to training, tools and networks to support the uptake of carbon farming. In return, farmers are asked to dedicate a portion of their fields for sampling and research to quantify the carbon sequestration potential of different methods. An important aspect of the programme is the involvement of corporate food buyers, like the dairy company Valio and the food brand Fazer, who can benefit from the research and learn how to support farmers in their own supply chains to transition towards regenerative practices. In doing so, these companies support their sustainable sourcing initiatives by securing lower-carbon supply, while also creating a more resilient value chain underpinned by healthy soils.

Following the success of the success of their first phase, Carbon Action is now scaling up their programme to include more farmers, broaden the scope of the analysis (to include, for example, measurements on soil biodiversity), and pursue more international collaboration. The research, coordinated by the Finnish Meteorological Institute, will help inform initiatives like "4per100" in France that aims to promote soil carbon sequestration as a climate mitigation solution, and also support Finland's own net-zero climate targets.

4. The economics of transition in two hotspots

4.1 Identifying hotspots of soil degradation

The extent of soil degradation varies widely across Europe, within different farming systems and soil types. To accelerate action on soil health regeneration, it is essential to identify the most important production areas with high degrees of degradation, and develop solutions targeted to these areas. SYSTEMIQ and Soil Capital have together developed a methodology diagnose soil degradation hotspots in important sourcing areas for either row crops or fresh fruits and vegetables. This methodology consists of two layers:

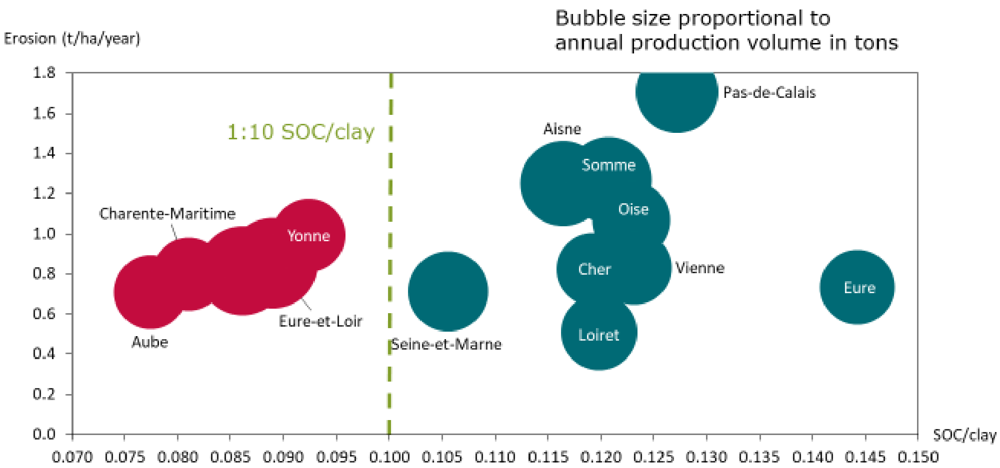
Layer 1 identifies crops that are economically significant in a particular country, and for which that country is a significant contributor to the EU total. For example, France accounts for over 30% of Europe's wheat production, making this a priority sector for further investigation.

Layer 2 identifies areas of high soil degradation within the country/crop combinations identified above. This analysis draws on geospatial data sets provided by the European Soil Data Centre (ESDAC) which report soil organic carbon, clay content, erosion rates and other parameters. These are complemented by production data (volume and area) from national databases where available or the onesoil.ai field measurement tool[15] where national data sets could not be obtained.

The main soil health metrics used for the layer 2 analysis were soil organic carbon (SOC, expressed in %) and soil erosion rates (tonnes/hectare/year). We also included a clay content (%) parameter and calculated the ratio of SOC/clay to control for natural variation in SOC content due to soil type. No consistent measure of soil biodiversity or microbiology could be obtained, although we understand that one is under development by ESDAC.

An example output from our layer 2 analysis is shown below, showing the state of soil health in major wheat-producing departments in France.

Exhibit 5 – Layer two analysis of regional soil health metrics versus production volume



Source: SYSTEMIQ analysis based on ESDAC soil data and

[15] https://map.onesoil.ai/2018#3.06/51.03/14.55

The above graph synthesises soil health metrics (expressed as SOC/clay and erosion rate, on the x and y axes) with production volume (represented as bubble size) for the top 15 departments. A threshold value of less than 10% SOC/clay was used to identify soils whose structure is at risk due to low organic carbon content[16].

In the future, it should be possible to add a third layer using remote sensing and computational agronomy technology to derive farm-level insight on soil degradation/regeneration.

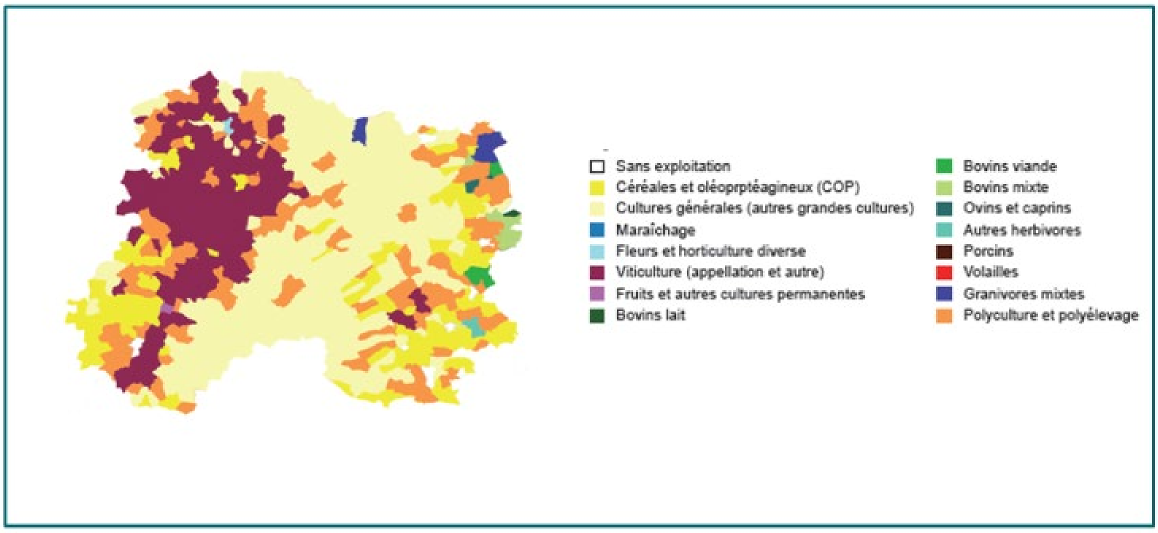
4.2 Designing a soil regeneration programme for arable farms in Marne, France

Having identified hotspots of soil degradation, we proceeded to design soil health regeneration programmes for the selected regions, based on a field visit and financial analysis using data gathered on the visit.

4.2.1 Soil degradation and current practices in Marne

Marne is a department within the 'Grand Est' region of France, located approximately 150km east of Paris. Two thirds of the department's area is dedicated to agriculture, mostly arable farming with a small but economically important area dedicated to wine, most of which is used for champagne. Marne is a specialized grain producing region, with cereals accounting approximately 290,000 ha generating 310 m euros of revenue through less than 2,500 farming establishments[17] - over half the total agricultural area and agricultural revenue of the department. The exhibit below shows the main cereal cultivating areas in yellow.

Exhibit 6 – Production areas in the Marne region



Source: IGN, ASP, DRAAF Grand Est (OSCOM), 2010

The open landscape of the Marne area allows for large fields, and its light chalky soil is easy to work, which supports low costs of production**.** However, historical data shows that operational returns have been falling in recent years, owing to a combination of stagnant yields, high input costs and falling output prices. The area is also facing significant soil erosion, reflecting high levels of soil disturbance

[16] The threshold of 10% SOC/clay (or clay/SOC of 10) is taken from Dexter et al (2008), who show that at ratios below this level soil is prone to reduced functionality and aggregate instability https://www.sciencedirect.com/science/article/pii/S0016706108000219?via%3Dihub

[17] Source: Agreste 2017 and 2018 data

and naturally shallow soils with soil depths ranging from 20 cm to 50 cm before reaching the underlying chalk zone.

The most common farming practices in Marne are conventional, including ploughing and use of synthetic fertilizers. Monoculture dominates, aided by the high level of mechanization. Practices that contribute to regenerate soils and revitalize ecosystems are also present in Marne and increasing, but still accounted for a small share of the total area. For example, organic farming (which has regenerative components) accounted for just 1% of arable land in Marne in 2010, although anecdotal evidence suggests it has since grown rapidly. Cover crops and reduced tillage practices were more widespread, covering about one fifth and one third of the arable area respectively, although some of this may reflect legal requirements rather than conviction[18].

4.2.2 The transition to regenerative agriculture at farm level

Data from the field visit has been used to design a transition plan that is specific to the shallow, chalk soils of Marne, summarised in the chart below.

Exhibit 7 – Regenerative transition pathway in the Marne

Major changes year 1-5

- Farmer hub enabling input use reduction through independant advice as well as cost reduction (pooled purchase and equipment sharing)
- Multi species cover crops
- Minimum disturbance tillage including strip-till
- Companion crops (legumes with main crop)
- Integration of organic fertilisation
- Mechanical weeding enabling further pesticide reduction
- Hedge building from year 2 (in 5 rounds)

Expected outcomes after 5 years

- Elimination of glyphosate after year 3
- Lowered production costs creating room for further investments
- Lower environmental impact through lower soil disturbance and use of chemicals.
- Increased organic matter level
- Hedges act as windbreaks and biodiversity islands

Major envisaged changes after year 5

- Agroforestry implementation when possible
- Integration of cattle through cover crop or temporary pasture rotational grazing.
- (Optional) Progression towards certified regenerative organic practices
- Local food supply (150km from Paris)
- Organic transition

Expected outcomes after 10 years

- Increased soil fertility and water retention capacity
- Better crop health leading to further chemical reduction
- Better fertility thanks to agroforestry when possible (nutrient cycling and windbreak)
- (Long term) new income source from wood sales

The transition pathway envisaged builds off a traditional Marne crop rotation. Key first steps include the minimization of soil disturbance and input optimization whilst introducing organic fertilization. The intent is to implement multispecies cover crops as well as companion and associated cropping (canola with legume companion crop). On top of these regenerative agriculture practices, grouped purchases and shared equipment rental are intended to improve the impact on the economic margin, especially for inputs and equipment that are not provided by existing cooperatives.

After a few years, farmers could choose to invest the resulting margin in hedgerows which protect crops and soil from wind damage and enhance biodiversity. EU subsidies are available for hedgerow installation, but their uptake is limited by delayed payments.

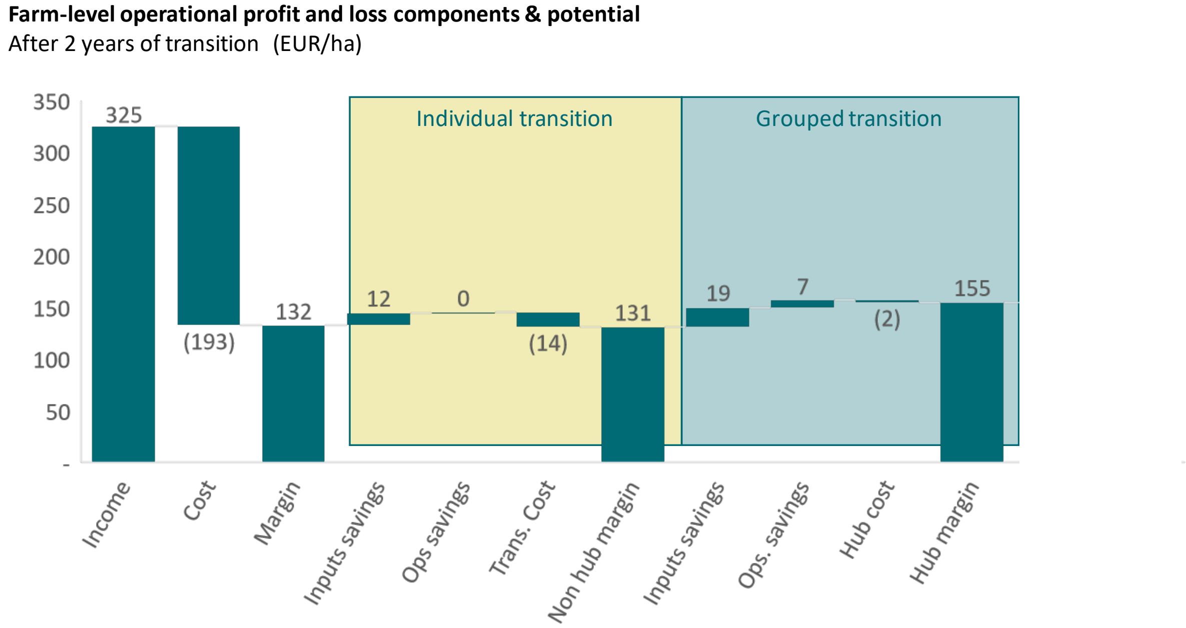
4.2.3 Outcomes of the transition at farm level

The chart below shows the forecast changes in margin following the transition above. We looked at forecast changes in margin for farmers undertaking a transition individually, and for farmers

[18] Including fallowing and non-cultivation areas; Source: Agreste 2017 and 2018 data

undertaking a grouped transition by forming a 'hub' with other farmers, which undertakes shared input and equipment purchase or rental in return for a small membership fee.

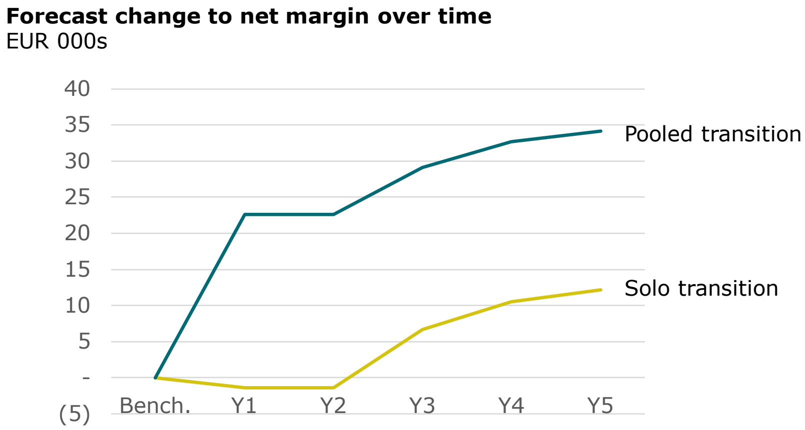
Exhibit 8 – Forecast changes in margin following a regenerative transition in Marne



When a farmer undertakes the transition alone, the most important economic outcome is a reduction in production cost from lower input use, comparable to the one achieved by Regenacterre farmers in Belgium If the farmer undertakes the transition together with an organized group of farmers, this generates extra savings. For example, inputs and operations savings can be further enhanced by grouped input purchases and equipment rental with nearby farmers undergoing the same transition. This is modelled on real experiences of Regenacterre farmers in Belgium and built off detailed farm-level transition planning conducted by agronomists after site visits and informed by locally benchmarked production cost data.

Income is forecast to remain relatively constant because of the steady yield, provided that there are no changes to output prices and offtake is assured throughout the transition, including for new products if applicable. The forecast suggests that the transition turns net positive from year 3 if farmers make the transition by themselves, or as early as year 1 if they pool their input purchases and equipment rentals with other farmers undergoing a similar transition, contrary to the widely held belief that a regenerative transition requires accepting a temporary drop in yield.

Exhibit 9 – Forecast changes in margin for individual or grouped transitions over 5 years



The transition also has leads to positive environmental outcomes, such as lower soil disturbance, reduced use of chemicals, increased organic matter level, increased soil fertility. In the longer term, the potential development of hedgerows and agroforestry could provide additional benefits such as nutrient cycling and windbreak capacity, improved water retention, increased resilience to drought and pests and diseases, better crop health leading to further reduction in agrochemical use, and improvements in biodiversity, for example by providing shelter or habitat for birds.

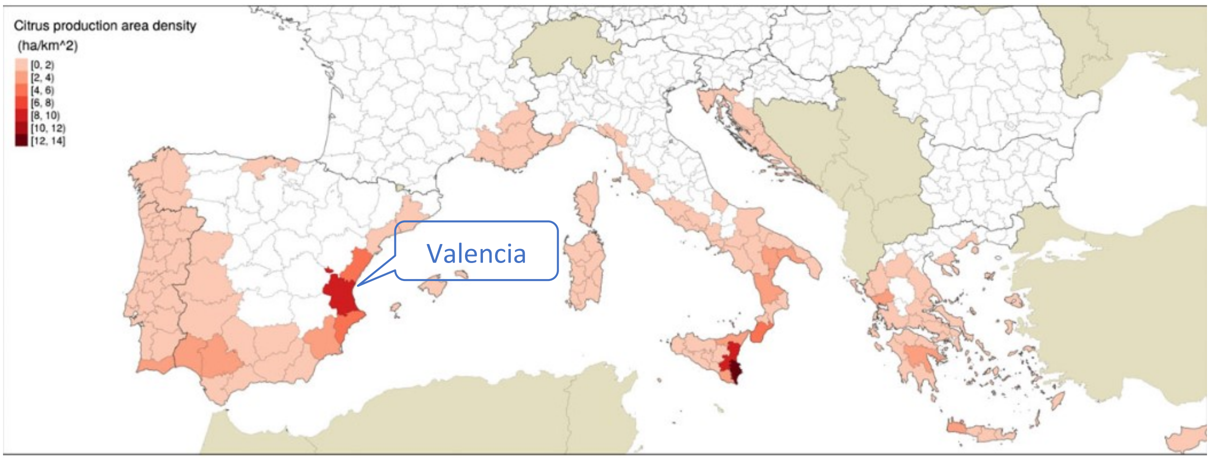
4.3 Designing a soil regeneration programme for orange growers in Valencia, Spain

In contrast to the broad-acre, arable production in the Marne, Valencian farming is dominated by the production of citrus, particularly oranges, pomelo and lemon. Our field visits and subsequent analysis focused on developing a regenerative transition pathway for orange production, which is the region's most significant citrus crop by volume.

4.3.1 Soil degradation and current practices in Valencia

The Valencian community is home to around 5 million people, and has a long tradition of citrus production. It is one of Europe's most densely planted regions for citrus fruits, with over 3 million tonnes produced in the 2017/2018 growing season[19], over half of which was oranges.

Exhibit 10 – Citrus production density in the EU



[19] https://www.efeagro.com/noticia/la-produccion-citricola-las-ultimas-cinco-campanas/

The total area under citrus cultivation in Valencia exceeds 150,000 hectares, but over the past decade several challenges have emerged in the sector that are threatening the livelihoods of Valencian farmers and, in some cases, leading to abandonment of fields. Competition from international markets (in particular Morocco, Egypt and South Africa) has squeezed orange prices and margins. Prices have remained level or fallen for years (CAGR of negative 0.5% to 1.0% since 2007), increasing only with some new varieties. With little opportunity for efficiency due to the small size of operations (typically 1 hectare or less), farmers have seen their margins fall consistently.

Many Valencian citrus farmers today consider soil just as a physical base for the trees, without any influence on its nutrition. Nutrients are provided through drip irrigation and soil biology is not considered. As a result, soil fertility is degraded and benefits from healthy soils (crop nutrition, increased water retention, better pest resilience) are lost. Under this set up, a typical grower will spend roughly 50% of total growing costs on water, fertilisers and pesticides[20]

During our field visits to Valencia all farmers indicated that water is increasingly becoming an issue. Farms are fed from both irrigation canals and on-farm wells. Water restrictions in the region are becoming more common, especially in the summer. However, water tables are not monitored and there was little use of technology such as moisture sensors or rainwater harvesting.

Together the issues of small farm size, low and falling prices, and declining fertility from neglected soils have created a vicious cycle that has put strong pressure on orange growers in the region. These pressures have led to a lack of young farmers entering the market, and in some areas abandonment of farmlands. This leads us to propose a model to revitalise the orange sector in Valencia, with soil restoration using regenerative practices at its foundation.

4.3.2 Regenerative transition pathway in Valencia

Analysis from the field visit has informed the creation of a farm-level transition plan that combines regenerative practices with structural changes to purchasing and off-take arrangements. The changes are split into “upstream” and “downstream” changes, described in the diagrams below.

On the “upstream” side (on farm), the plan seeks to break the vicious cycle Valencian farmers currently experience through input savings from group purchases, independent agronomic advice (where input sales are not tied to a commission), and enhanced soil carbon and biodiversity. On the downstream side, the plan envisages creating revenue uplift by allowing citrus farmers to capture more value from the sale of their fruit, and possibly creating a premium market for high quality, environmentally friendly Valencian oranges in European markets over time.

[20] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.902.823&rep=rep1&type=pdf

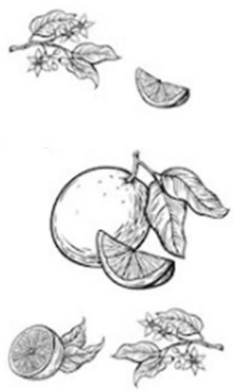
Exhibit 11 - Regenerative transition pathway for Valencian orange production: Upstream changes

Spanish citrus – 1 Upstream changes	Major changes	Expected outcomes after 5 years
	• Independent advice to farmers (through an independent farmer hub) providing: o Reduction of input costs through grouped purchases o Gradual optimisation of inputs and practices through improved knowledge o Possibility to gradually shift to a biological system o Overall strenghtening of the local ecosystem (plants, soil, insects) • Pooling of farming operations to increase size and enable more efficient machinery use • Gradual increase in local ecosystem health (green cover, biological inputs, kickstart of biological activity)	• Increased resilience to drought and flood • Reduction in irrigation needed • Reduced soil erosion • No increase to production costs • Increased carbon sequestration • Healthier farming ecosystem

Sequence of main value creation drivers through the transition:

1. Grouped purchases offering a buffer to the farmer ▶ 2. Green cover, some substitution of synthetic inputs with biological ▶ 3. Professionalisation of operations – in parallel with aggregation ▶ 4. System-wide gains: sector survival, climate resilience, product quality, carbon sequestration

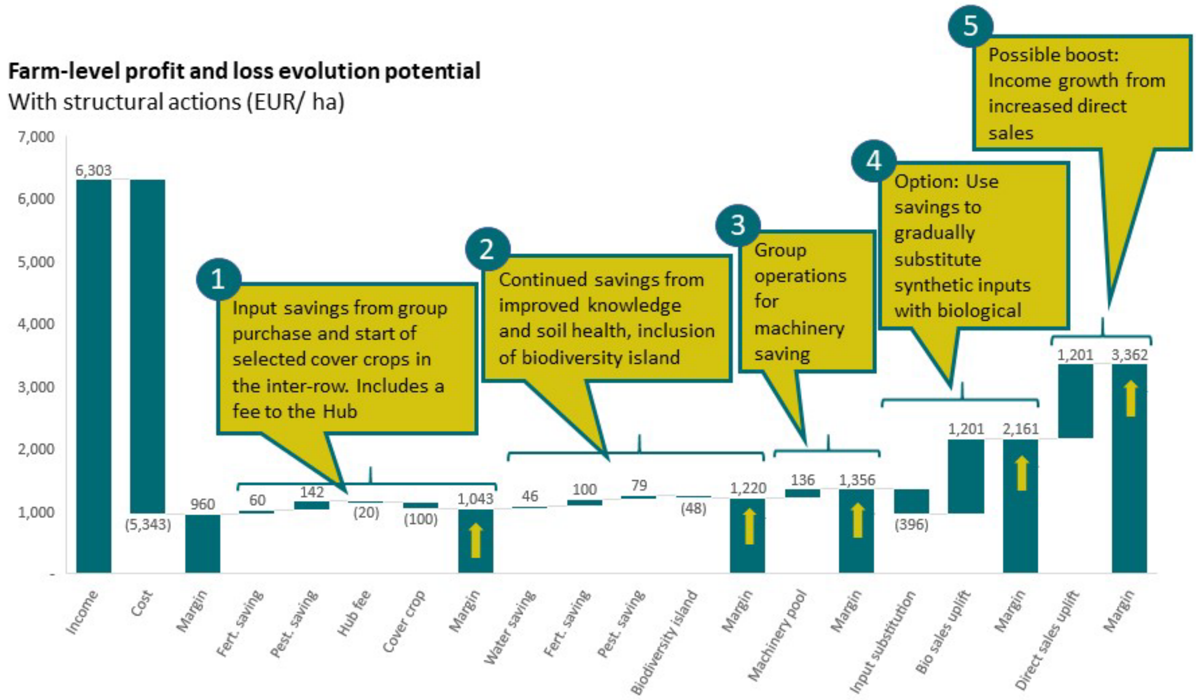
Exhibit 12 - Regenerative transition pathway for Valencian orange production: Downstream changes

Spanish citrus – Downstream changes	Major changes	Expected outcomes after 5 years
	• Two main (possibly overlapping) avenues for all sales that continue through traditional channels: o The farmer can maintain ownership of fruit further into the value chain, paying a "service fee" to coops, capturing increased margin – also includes additional risk o Large buyers can offer collared prices to long-standing suppliers, with downside protection (compensated with upside limitation), to enable long-term operational strategy, integrating soil health as a key factor. Initiating and growing direct sales through a growing number of channels (websites such as crowdfarming.com) o To initiate and develop a direct sales channel, we see the need for the farmer to create a "story", which a positive soil health cycle o Substitution of all synthetic inputs by biological/ organic inputs	• Elimination of glyphosate (after 2/3 years) • Zero measurable residues • Higher fruit quality (shelf life) • Improved water use efficiency • Further increased carbon sequestration • Profitable farming ecosystem, enabling generational continuation

As it stands there are important structural barriers to kickstarting this transition, namely the very small average size of most farms (1 hectare or less) which therefore brings little bargaining power of individual farmers to the market. We believe an important enabler will be the pooling of individual farming operations to create efficiencies in both the purchase of inputs and sale of produce.

Financials of the upstream, downstream, and structural changes are summarised below.

Exhibit 13 – Overview financials of a regenerative transition in Valencia



The chart tracks the per hectare financials of a five-year transition from conventional to regenerative orange production of a typical "Minifundio" producer in Valencia. The first "block" of the transition includes input savings in both price from group purchasing through the regenerative hub, and volume through the provision of independent agronomic advice. Actions by the farmers here include reduction in overall application of pesticides and fertilisers, and introduction of cover crops in the inter-row space to improve soil structure and introduce new nutrients into the system. For access to group input purchasing and agronomic advice, farmers pay a hub fee of €20/hectare.

In block two, further savings are generated by steadily improving soil biology from green covers and organic fertilisation which is able to further reduce the need for synthetic inputs and create savings on water. These savings would be partially offset by the inclusion of "biodiversity islands", which reduce overall growing area but are important for relieving pest pressure.

Block three envisages creating efficiencies in machine use by creating a sharing service between farmers.

Blocks four and five are optional, but showcase the potential of using improved practices to create a premium market and brand for Valencian citrus. In block four, the transition is carried forward to include full organic certification. Some additional costs are incurred to replace remaining synthetic input use with organic substitutes, but this is more than compensated for by an increase in sale price. Block five takes this further by introducing direct sales channels between farmers and consumers. While many direct to consumer models are still in early stages, examples such as CrowdFarming are showing the ability of growers to use internet channels to tell the story of their farm and further improve their margin as a result.

4.3.3 Outcomes of the transition at farm level

The transition plan seeks to improve the profitability and resilience of Valencian orange farms, kickstarted by regenerative practices. Using green covers and organic fertilisers improves soil structure, nutrient content and biodiversity while also increasing water holding capacity. The transition can be complimented by an integrated pest management plan that incorporates biological predators to typical orange tree pests that reduces cost of synthetic pesticides.

In many ways, a regenerative approach goes against the mindset and approach of most Valencian farmers, who prefer to rely on drip irrigation and spraying for crop nutrition and protection, respectively. One farmer we visited stated that a “clean farm is a good farm”, referencing a dislike of using green-covers (or weeds, as he called them) between rows of trees that he suspected would attract pests and waste valuable water resources. A conventional, “clean” Valencian orange farm can be seen below, contrasted with another orange producer that was in the process of transitioning to organic and using cover between rows.

Exhibit 14 – Comparing two different production approaches in Valencia

Conventional

Organic transition

Photo: Karl Fletcher

The two cases above illustrate the potential, as well as the limitations, for a soil regeneration programme to be implemented with the enthusiastic support of farmers. The next section considers how to scale this type of programme up across Europe, with a focus on how to make the transition profitable and thus retain the support of farmers without the need for extra subsidies.

5. Scaling up regenerative agriculture across Europe

5.1 Barriers to scale up

As we have seen in section 3, there are a number of existing pilot programmes that test and promote regenerative agriculture in Europe. There is no data on regenerative agriculture *per se*, but farms with an organic certification (which has regenerative components) account for less than 10% of production everywhere, and less than 1% of arable land in the Marne. By contrast, conventional technologies have spread much more quickly in the past, such as the use of hybrid seeds and fertilizers in the 1960s 'Green Revolution' in Asia, or GMOs in the Americas since the 1990s.

The challenge is therefore to find a change model which has the capacity and is economically attractive enough to be adopted by a majority of farmers, not just in the medium to long term, but also during the period of transition. This starts with understanding the barriers to change, which we argue are principally about knowledge, risk and social norms, rather than economics.

Overcoming these barriers means first and foremost developing and showcasing a positive business case to farmers, as Regenacterre has done in Belgium and is proposed in both of the case studies in section 4 above, although the Marne case is more attractive. Once farmers are persuaded of that case, we then see five components that could contribute to a successful transition:

a. The role of farmer and agronomists
b. The role of offtakers
c. The role of technology
d. The role of finance
e. The role of government and regulators

5.2 The role of farmers and agronomists

As previously noted, one of the features of a regenerative farming system is higher complexity in both space (by introducing companion or cover crops), and time (more diverse rotations). This additional complexity creates barriers to adoption of regenerative methods as there are risks or perceived risks to farmers of transitioning their practices, particularly with current adoption rates (and thus examples) of these practices being so low. Regenerative agriculture is also more knowledge intensive than conventional approaches, and farmers may not have ready access to this knowledge.

This issue is exacerbated by declining farm profitability across Europe and high levels of debt, leading to very little "breathing room" for farmers to consider changes in their operation, let alone ones that they believe will further decrease their profitability in the short term. A final compounding factor is the implicit and sometimes explicit social pressure that comes from within farming families and communities to continue with practices that have been tried and tested over generations. This can be such a strong source of inertia that change that can appear from the outside as comfortably the strongest option a farmer faces will very often not be taken.

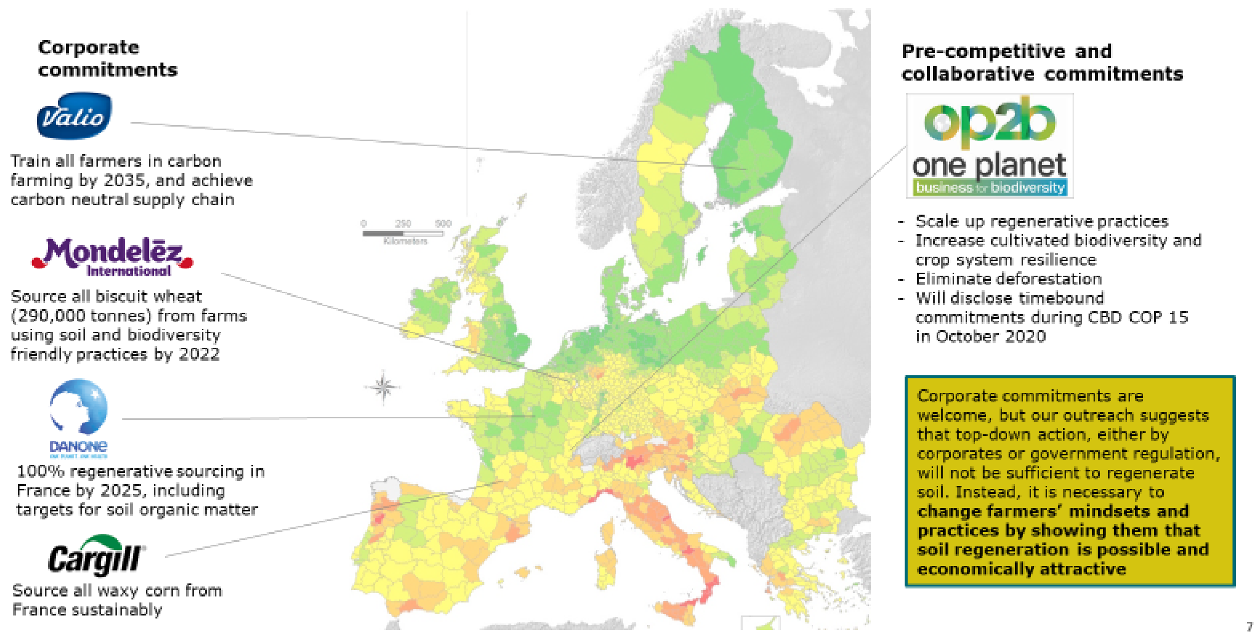
To overcome these barriers, two important steps are needed: 1) pilot and demonstrate examples of profit-enhancing regenerative transitions in which farmers are able to increase their returns by improving soil health and 2) develop and scale a model of sharing knowledge and practices between farmers to reduce social pressures against changing practices and create a sense of shared experience.

One example of this approach is implemented by the Savory Institute for Holistic Management, which has adopted a "training the trainers" model to disseminate regenerative grazing techniques developed by their founder, Allan Savory. In this model, local land managers are trained and given support and tools to translate the principles of holistic livestock management into their farming context. Over 40 training hubs have been established worldwide, where farmers (or indeed non-farmers) can visit and receive training and develop a community of practice. According to the Savory Institute website, over 7,000 farmers have attended these trainings, with total land under management of around 10 million hectares.

5.3 The role of offtakers

Corporate actors are starting to take an interest in soil health, and we have noted a number of commitments by companies to incorporate soil into their sustainable sourcing programmes, some shown in the exhibit below. There are also commitments made through pre-competitive collaboratives like SAI Platform, certification schemes like LEAF and business associations like the World Business Council for Sustainable Development. However, interviews suggested that it was difficult achieving buy-in from farmers to these schemes unless there was support with the practice changes required, and a multi-year commitment from offtakers to underwrite the changes.

Exhibit 15 – Corporate commitments to sustainable or regenerative production in the EU



One example is Mondelez's wheat sourcing programme called Harmony. The focus of the programme is to protect biodiversity (particularly for pollinators) and promote more sustainable production practices. Mondelez has developed a charter that farmers can sign up to, which now includes more than 1,700 producers and over 70% of Mondelez's wheat sourcing for biscuits, with an ambition to reach 100% by 2022[21]. To implement the programme, Mondelez has engaged over 20 cooperatives to ensure "line of sight" to the farmers and certify they are keeping to practices laid out in the Harmony charter. This model could be augmented to incorporate not only practices to protect biodiversity but also regenerative practices to improve farm profitability and soil health.

[21] For more detail see: https://www.mondelezinternational.com/Newsroom/Our-Stories/Harmony

Such an approach would bring several advantages:

1. It builds on existing farmer, offtaker and advisor relationships, thus hopefully mitigating some trust barriers for farmers to begin a transition to regenerative practices
2. Food buyers can further incentivise or de-risk the transition by providing longer-term offtake guarantees to farmers
3. Food buyers or brands can improve the greenhouse gas impacts of their supply chain by measuring soil carbon sequestration achieved through regenerative practices
4. Food buyers can strengthen the security of their supply by supporting lower risk, more resilient production methods from their sourcing regions.

In many regions, offtakers do not have a direct relationship but work with agricultural cooperatives. Cooperatives have the potential to play a significant role in the transition to regenerative agriculture, as they are frequently suppliers of inputs and advice, as well as playing the immediate offtaker role. One approach to the transition is therefore to engage with cooperatives or other farming association to incorporate a regenerative advisory capability into their existing service offering. The benefit of this approach is that cooperatives are usually closer to farmers, and more trusted than offtakers; a potential disadvantage is that cooperative members and staff may be heavily invested in a conventional model, and have some hesitation about moving to a regenerative model.

5.4 The role of technology

There is an increasing movement, particularly in the US but also globally, towards digital farming technologies and innovations in ag-tech that provide data, analysis, and other support services to farmers in order to improve their productivity or production efficiency. These so-called digital farming platforms seek to inform farm-management decisions by collecting and analysing data on weather, field and crop conditions, plant/harvest timing, and more. Several ag-tech firms have extended their services to include digital marketplaces for buying/selling of inputs or crops, access to agronomic services, logistics and storage solutions, and, in the case of some (e.g. Boston-based Indigo Ag), a carbon market for farmers to be paid for sequestering CO2 into their soils using regenerative practices.

Incorporating the principles of profit-enhancing soil regeneration into a digital farming platform could complement existing services provided to farmers by including a "soil regeneration package" of agronomic advice and input provision for growers to embark on a regenerative transition supported by the platform. There are many different forms this could take. For example, farmers who sign up to Indigo's seed supply and marketplace programmes are also offered access to advisory services to optimise their inputs and improve revenue through carbon payments.

A tech-enabled model of expansion offers the greatest theoretical possibility of rapidly scaling adoption of regenerative practices but sacrifices highly localised, in person, engagement of farmers needed for context specific design of regenerative practices. The possibility of providing extra incentive through carbon payments, and perhaps developing regional 'archetypes' of regenerative transitions, may help overcome this barrier, but we note that since some of the most pernicious barriers are social in nature, it is only the solutions that work through the most trusting relationships farmers have that will likely break through.

5.5 The role of finance

The argument of this report is that a transition to regenerative agriculture can and should be self-financing. Consequently, it should not be necessary to establish a 'transition finance facility' or other working capital loans, and in view of the high level of debt that many farmers already have, we would not recommend this. Nevertheless, there is scope for finance to smooth the transition to regenerative agriculture in other ways. For example:

- Farmer cooperatives or associations can acquire regenerative equipment, and lease them to farmers at cost to make it easier to experiment with new techniques such as reduced tillage
- Offtakers can pre-finance a portion of a multi-year offtake agreement, to give both sides an incentive to continue with the transition
- Finance or insurance providers can offer preferential terms to farmers who implement regenerative practices, for example, by reducing premiums or lowering interest rates
- Carbon farming, an approach that involves paying farmers to sequester carbon in the soil. Government schemes already exist in Australia and parts of Canada, and there are initiatives to adapt it to Europe, both voluntary (such as Indigo Agriculture's 'Terraton Initiative') and regulatory (as discussed by the Finnish Presidency in September 2019[22])
- Subsidies can be provided to incentivise aspects of the regenerative transition, for example, setting up biodiversity strips or reserves on farmland

A growing number of investors are interested in regenerative agriculture. One report published in the US estimates that $47.5 billion of investable strategies have regenerative agricultural features, approximately half of which are in farmland and other real assets.[23] This interest reflects the promise of regenerative agriculture to protect and enhance the value of farmland over time. Most land valuation models do not take soil health or farm management practices into account, but as the regenerative approach becomes more widespread, it is likely that tools and metrics will develop that allow land agents to value land more accurately.

5.6 The role of government

There is no single policy or regulatory framework for soils at the EU level or in most member states. The EU proposed a Soil Framework Directive in 2006, but withdrew it in 2014 in the face of concerted resistance from major member states.[24] As a result, soil objectives are delivered through a mix of Europe-wide policies and directives that were principally designed to fulfil other objectives, and supported by national action in some cases. The principal ones are:

- **Common Agricultural Policy (CAP):** Since 2009, farmers receiving direct support payments (€42b or ~70% of the CAP budget) have been required to comply with Good Agricultural and Environmental Conditions (GAEC), which set standards for minimum soil cover, minimum land management conditions to limit erosion and maintenance of soil organic matter level, including a general ban on burning arable stubbles. However, the application and enforcement of these standards is a matter for member states, and our assessment suggests that less than 1% of farm support payments have been delayed or reduced because of non-compliance. Similarly low proportions are reported for voluntary environmental payments and 'greening obligations', although these are now increasing.
- **Nitrate Directive (1991):** This directive is intended to reduce eutrophication and oxidation of soil organic carbon from excess nutrient use, and has been tightened over time. It sets an upper limit for fertilizer and manure application of 170kg N/ha in all 'nitrate vulnerable zones', whose designation is left to member states. Some member states (e.g., Germany, Ireland and the Netherlands) have designated the entire country as vulnerable, while others

[22] See for example https://www.euractiv.com/section/agriculture-food/news/carbon-capture-crops-need-incentives-through-cap-eu-ministers-said/
[23] Croatan Institute, Delta Institute and OARS Project (2019), available at www.soilwealth.org
[24] https://ec.europa.eu/environment/soil/index_en.htm

like France have applied it only to specific regions at high risk of eutrophication. At the time of writing (November 2019) there have been major protests by farmers in France, the Netherlands and Germany who are upset about the tightening of this directive.

- **Licensing of agrochemical compounds:** Agrochemical and phytosanitary products are typically licensed and regulated at the European level, and heavy restrictions are imposed on compounds which are detrimental to human health and the environment. Neonicotinoid insecticides have already been banned because of their perceived impact on bee populations. The next compound at risk is the broad-spectrum herbicide glyphosate, whose licence expires in 2023 because of its perceived effect on insect populations and carcinogenic potential. A glyphosate ban could have the unintended consequence of leading farmers to increase tillage, one reason why France's President Macron committed to exempt farmers to a nationwide ban where there is no realistic alternative to glyphosate use.[25] The government of Germany, on the other hand, recently confirmed it would legislate for a total ban on glyphosate once its EU licence expires in 2023.[26]

Beyond the Common Agricultural Policy, national governments also play a significant role in shaping acceptable agricultural practices. Most EU governments have disbanded or privatised agricultural extension services, but retain regulatory powers over how agronomists operate, for example, by restricting their ability to earn commission from the sale of fertilizer or agrochemicals. A French ordinance from 2019 will separate the provision of advice from sale of these products with effect from 1 January 2021.[27]

At the time of writing, there have been protests across many EU agricultural sectors. If farmer-government relationships have deteriorated to this extent, it suggests that trying to unilaterally push regenerative agriculture through regulatory and legislative means will meet heavy resistance from farmers. Instead, this report argues that the best approach is to engage the business energy and practical skills of farmers to regenerate the soil and improve their farming business. The transition will be led by farmers with the strong encouragement of independent agronomists and offtakers. This transition can be catalysed, but will not be led by, policy measures and we do believe that policy can play a strong role in helping to shift social norms in farming communities. Examples of meaningful policy interventions include:

- Continue shifting CAP funding to reward environmental services, with particular focus on rewarding biodiversity and changes to practices that enhance soil health without taking land out of production entirely
- Reduce incentives for agronomists to over-prescribe inputs, for example by increasing transparency of commission payments, or formally separating advisory from sales
- Develop technologies and standards for measuring soil carbon sequestration, as a necessary condition for future 'carbon farming' schemes to be effective
- Use trade agreements to set high environmental standards and reduce the risk that regenerative farm products will be 'undercut' by those from regions with less stringent ones

[25] https://www.euractiv.com/section/agriculture-food/news/france-to-exempt-farmers-from-glyphosate-ban-when-no-alternative/
[26] https://www.zeit.de/wissen/umwelt/2019-09/tierwohl-label-nutztiere-insekten-glyphosat-julia-kloeckner
[27] https://www.vie-publique.fr/actualite/dossier/alimentation-prix-producteur/agriculture-alimentation-essentiel-loi-egalim.html

6. Conclusion

The ecological case for regenerative agriculture in Europe has been well documented: it reduces air, soil and water pollution, enhances biodiversity, and mitigates agriculture's climate footprint by sequestering carbon in the soil. The economic case has been less well documented, until now. The argument of this report is that farmers can improve the profitability and resilience of their business during a well-managed transition to regenerative agriculture, based on experience in Belgium and Finland, and modelling transitions in France and Spain.

Making the transition requires a number of conditions to be put in place to address barriers in three categories: knowledge, economics and social norms. These include access to independent agronomic advice; support from food buyers (or 'offtakers') to farmers making the transition; access to shared equipment services; and if appropriate or desired, financial incentives in the form of carbon payment mechanisms or higher subsidies for regenerative practices:

1. **Independent agronomic advice** from people experienced in designing regenerative transitions are key to unlocking cost-savings to farmers that facilitate the early transition process. In this model, independent agronomists are paid by farmers for their advice and support and do not receive commission on the inputs sold. Data from Regenacterre farmers in Belgium (and anecdotal findings elsewhere) suggests that this can lead to a 30% reduction in input costs, which more than compensate for the cost of the advisory service.
2. After the advisor, the farmer's next most important relationship is with their **food buyers or offtakers**, which range from on-the-spot commodity transactions to long-term sourcing relationships. For farmers, having a guaranteed market to sell their crop allows for longer-term planning and increased willingness to make changes that will benefit longer-term profitability. For buyers, reducing the number of disruptions of supply can save costs created from switching sourcing arrangements. The challenge for business is to share the commercial benefits of long-term, reliable sourcing with farmers, which will in turn help reduce the risk to the farmer.
3. Regenerative agriculture may require new kinds of inputs and farm equipment, so many farmers will benefit from **grouped purchase and pooled equipment services** that reduce the cost of buying regenerative inputs and equipment. There may be scope to partner with a local farmers' association, cooperative or plant hire service to provide this equipment, provided that they can address their conflict of interest as providers of conventional inputs.
4. Lastly, **finance** can play a role in further incentivising regenerative practices. Healthy soils with increased carbon content and biological activity are more resilient to drought, flood and pest pressure. The findings of this report suggest that regenerative agriculture can be a profitable option for farmers, even without extra subsidies. However, transition will differ according to crop, region and farm type, and there is no single recipe for success. That is why the transition needs to be planned and implemented carefully, so that farmer profitability can be improved from the beginning.

Much of the agricultural debate in the EU is focused on the Common Agricultural Policy and associated subsidies and regulations. This report finds that the necessary change is already happening – and can progress further – in spite of widespread policy reform. The initiative sits with farmers, their advisors and food buyers and there is room for substantial more leadership from these groups and those that support them. Policy reforms should aim to support and catalyse these trends further, ensuring that this early leadership is harnessed to address the knowledge, economic and social barriers that prevent this much-needed transition from happening at scale.