AgriCaptureCO_2

Regenerating soils for climate and farmers

[30 April 2021]

D5.1 Use case operational plan & evaluation methodology

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Executive summary

The document presents plans of activities and timeplans that will take part in the AgriCapture use cases. This includes 6 use cases:

Use Case #1: Sustainable Olive Oil in Greece (Crete)

Mediterranean areas will *feel the heat* of climate change more than other place in Europe, with the largest ↑ in temperature and ↓ in rainfall. Mediterranean agriculture, including olive cultivation, must adapt to new challenges that affect local water, energy and ecosystems.

On the island of Crete in Greece, agriculture is already the largest user of water. Working with two farmer cooperatives and their olive mills, ELGO researchers will:

- Advance a new regenerative approach to cultivating olives, protecting soil while ensuring efficient use of water and other inputs.
- Develop and market a low-emissions olive oil brand, rewarding regenerative farmers and motivate new adopters.

Regenerative practices that will be applied

- Cover crops
- No weed mowing during winter / No soil tillage
- Weed mowing in spring and summer (soil mulching)
- Winter pruning/summer pruning - Shredding of pruning
- Application of organic material (winter period)
- Irrigation according to meteorological and soil moisture data
- Application of fertigation
- Foliar application of fertilizers (in case that is needed)
- Plant protection for minimizing the risk for pathogens - Recommendations

Use Case #2: Nutrient & soil management on Europe's large farms in Poland

Nutrient management and soil health have direct economic consequences on farming. They are key questions for all farms, including Europe's larger and more intensive farms.

SatAgro provides a Precision Agriculture platform, used by mid- and large-scaled farms in Poland and surrounding countries. Drawing on their network, they will encourage farmers

to explore and adopt regenerative practices, and access compensation for it. When AgriCaptureCO2 becomes fully operational, the services developed will be integrated with SatAgro as easy to use tools (soil management, profitability analysis) and information layers, reaching a larger audience already familiar with the rest of the platform.

Implementing Reg Agri in a post sovkhoz landscape, represented by Top Farms Głubczyce and OHZZ Chodeczek, the best arable lands in Poland. Top Farms Głubczyce is located in southern Poland, near the border with Czechia. OHZZ Chodeczek is located in central Poland.

Regenerative practices that will be applied

- Cover crops
- Crop rotations
- Low/no tillage
- Nature strips/Agroforestry
- Organic amendments application

Use Case #3: Scaling certified-regenerative businesses in the UK

A sustainable farm is suited to its specific context. It provides continuous benefits for the environment and society, and economic viability for the farmer.

LEAF has supported and promoted this site-specific approach for 30 years, and certifies farms practicing Integrated Farm Management with the LEAF Marque. Farrington's Oils in Northamptonshire (UK) is both a LEAF-certified business and LEAF demonstration farm.

We know that the decision to change and transform a farming system is a difficult one. We will support farmers in their own transition journey with:

- AgriCaptureCO2 data-driven decision-support tools.
- A short-term compensation scheme for regenerative practices.
- Peer-to-peer knowledge exchange as well as learning opportunities.

Regenerative practices that will be applied

- No/minimum tillage
- No inputs (fertilizer/pesticides, applications of manure/compost)
- Cover crops
- Intercropping (companion crops)
- Crop rotation

- Buffer/nature strips (beetle banks, flower rich margins, winter food margins, grass margins), field ponds, and hedgerows
- Mulching

Use Case #4: Managing public lands to meet net neutrality goals in the UK

Lancashire County has 1.4 million inhabitants and covers 3.000 km2 in the Western UK. Like many local, regional and national governments, Lancashire has committed to carbon neutrality. It aims to achieve this feat by 2030.

Using AgriCaptureCO2, Lancashire will explore how land under public ownership can be used to maximise carbon sequestration, and the associated costs from different options. This will include management options for former landsites, former collieries, and other reclaimed sites. It also includes making maximum use of garden & forestry waste processing to contribute to soil health.

Regenerative practices that will be applied

- Land use conversion (agro-sylvo-pastoral systems)
- Nature strips and hedgerows
- Composting and biochar production for applying to agricultural soils

Use Case #5: Promoting sustainable agriculture without public subsidies in Serbia

Every year, burning residual crop stubble contributes to low air quality in South-Eastern Europe. Other intensive agricultural practices common in the region (deep tillage, blanket applications of pesticide, large doses of fertilisers, and others) also result in damage to waterways, biodiversity, and air quality. Legal limitations do exist but are not effectively enforced.

Small networks of farmers experimenting with regenerative practices provide *the seeds to grow* a new regenerative approach in the region.

Working with these networks and their knowledge, GILab and UPOR will support interested farmers to make the change to regenerative practices. AgriCaptureCO2 provides decision-support tools and access to voluntary carbon credit markets.

Regenerative practices that will be applied

- Cover crops
- Minimum and no-tillage
- Soil mulching (with crop residues)
- Integrated crop protection management
- Avoid unnecessary passages in the field and less soil compaction
- Measuring the needs of plants for N and appropriate application

Use Case #6: Climate-proofing flower production in Kenya

The horticultural sector, specifically flower production, provides Kenya's second largest export after tea.

Horticulture is particularly sensitive to the impacts of climate change due to high-water demand and strict temperature requirements.

Involving the whole supply chain for cut flowers, AgriCaptureCO_2 will provide a clear path to building resilience, reducing emissions and increasing revenue from carbon credits for farmers in Kenya. Building from a representative sample, we will scale to offer opportunities to a critical mass of producers.

Regenerative practices that will be applied

- Timely pruning and cover crops to reduce plant transpiration and water use.
- Soil amelioration to improve water retention capacity.
- Reduced use of chemicals (pesticides, fertilizers etc.).
- Promote biodiversity and ecosystem services, etc.

Finally, the approach to evaluation of the use cases is presented. This includes components of management and oversight as well as of support, from both the WP-lead, ELGO, and the Project Management Team, Gilab.

List of abbreviations

C	Carbon
CAP	Common Agricultural Policy of the European Union
CDR	Clean Development Mechanism
ERW	Enhanced rock weathering
EU	European Union
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
ha	Hectares
IFM	Integrated Farm Management
IoT	Internet of Things
km	Kilometres
OHZZ	Breeding Centre for Pedigree Animals
PGR	Państwowe Gospodarstwo Rolne (State Agricultural Farms, in Poland)
SOC	Soil organic carbon
SOM	Soil organic matter
t	Metric tonnes
TBD	To be determined

TFG	Top Farms Głubczyce
UNFCCC	United Nations Framework Convention on Climate Change
UK	United Kingdom
VCS	Verified Carbon Standard
VRA	Variable rate application
WP	Work Package
WW2	World War Two

1.Introduction

The main aim of WP5 is to study five different pilot sites across Europe and another one in Kenya, capturing different operating environments, in which the functionality of the platform will be tested, verified and demonstrated. Also, in these areas, the farmers will become familiar with the use and the advantages that this platform can provide, including demonstration and supporting services. Regarding the partners involved in WP5, 11 out of a total of 14 partners are participating in this WP (Table 1 in red). The leader of WP5 is the Hellenic Agricultural Organization "ELGO".

Table1. With red the partners are involved in WP5.

Name	Abbreviation	Organization type	Country
1. GILab DOO Beograd (coordinator)	GILab	SME	Serbia
2. SatAgro	SatAgro	SME	Poland
3. One Carbon World Fund	OCW	Non-profit organisation	UK
4. European Environment Bureau	EEB	NGO	Belgium
5. Linking Environment and Farming	LEAF	NGO	UK
6. Game and Wildlife Conservation Trust	GWCT	Research organisation	UK
7. Agricultural University of Athens	AUA	Research organisation	Greece
8. Hellenic Agricultural Organization	DEMETER ELGO	Research organisation	Greece
9. Planet Lab Gmbh	Planet	Large company	German
10. EnvirometriX	ENMX	SME	the Netherlands
11. Farrington Oils ltd.	FrOils	SME	UK
12. Arthur's Legal	ARL	SME	the Netherlands
13. Lancashire County Council	LCC	Public authority	UK
14. Udruženje Poljoprivrednika Opštine Ruma	UPOR	Association AgriCoop	Serbia

The overall objective is to provide several varied real-world operational contexts, in which to test and co-develop AgriCapture iterations together with end-users;

- To define operational plans for each case study
- To provide trainings and worskhops to participating farmers
- To iteratively the test AgriCapture platform and its services with end-users across several case studies and to collect feedback to drive improvements
- To define evaluation methodology, and to evaluate the case studies each year to improve the next

This section provides an overview of the envisioned use cases, their context, the intended use of AgriCapture, and how the deployment scenario is representative of larger market opportunities that AgriCapture seeks to exploit.

Figure 1 depicts the 5 case studies as well as an extra one in Kenya, positioned on the equator on Africa's east coast. The overall 6 case studies represent different climatic and environmental conditions concerning both biotic and abiotic factors and crop systems, where the platform will be tested and demonstrated. So, in this project the study areas are gathered in the following topics:

- Sustainable olive oil: Water-efficiency in semi-arid agriculture - **Greece**
- Capturing ecological value: Large-scale sequestration on Europe's large farms - **Poland**
- Scaling certified Regenerative Agriculture businesses: concerning reward and support for regenerative agriculture conversions –**UK**
- Meeting public climate commitments: Informing public land management for climate action –**UK**
- Overcoming financial barriers to sustainable agriculture: Carbon farming under United Nations' Clean Development Mechanism – **Serbia**
- Creating a certified methodology that applies an integrated model of sustainable flower cultivation supported by digital decision tools and financial incentives, to be disseminated – **Kenya**

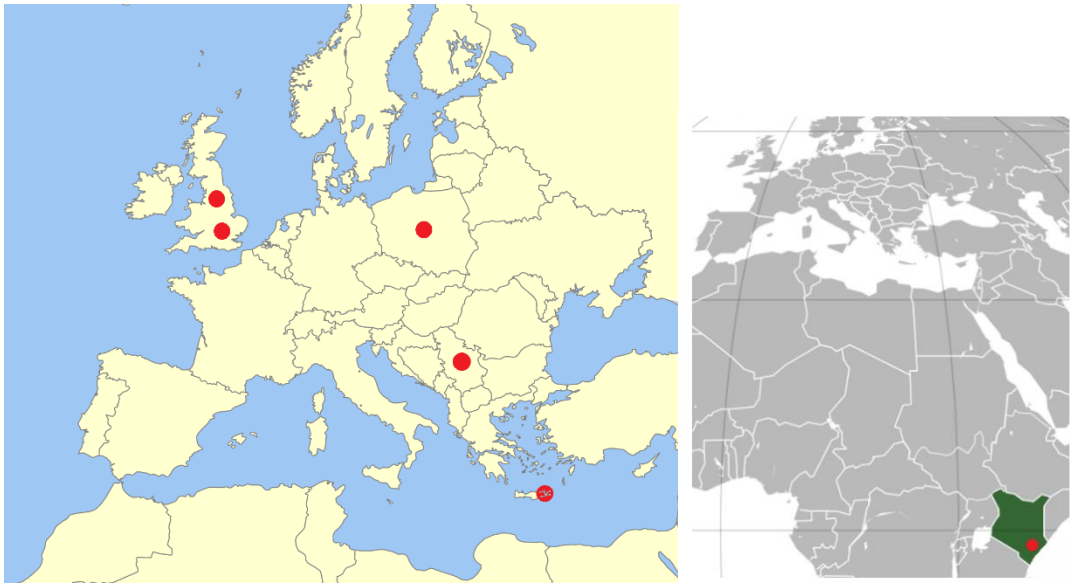

Figure 1. Spatial distribution of the 5 Europe case studies plus one case study in Kenya (with red dots).

The first task of WP5 (Task 5.1) named "Use case operation plan & evaluation methodology" concerns detailed plans to lead the execution of the various case studies on

a common understanding basis of cooperation with local partners and the technical and exploitation teams. Analytically, this will include: specific objectives, activities to be undertaken, responsible and participating individuals, milestones, inputs to be received, outputs to be delivered, available local data sources

- *The plans will cover all 3 years, although they will be visited again after each evaluation to improve performance in successive years*
- *The task will also define the methodology for evaluation of the use cases and will define specific and achievable KPIs for each year*

2. Case studies templates

In this section the proposed template for each case study is presented. These templates include all necessary information related to each case study, as each case study is different but all will support the AgriCapture objective. Specifically, the main contents of each template includes the following:

- *Overall Objective and Specific Aims*
- *AgriCapture Services to be used*
- *End users involved*
- *Characterisation of test farms*
- *Use case activities (frequency)*
- *Steps for the implementation – Methodology*
- *Milestones*
- *Map the timeline*
- *Business case in brief & Expected results*
- *Key performance indicators*

Analytically, the Templates for each case study will presented below

2.1. The Case of Greece
Sustainable olive oil: Water-efficiency in semi-arid agriculture

The case study is located on the island of Crete, which has large climatologic variations due to the complex geomorphology of the island. For instance, annual rainfall ranges from 300 mm/yr in lowlands, to 1000 mm/yr in semi-mountainous areas. Climate change has intensified the hydrological cycle over the last few decades leading to an increased frequency of floods and droughts. For instance, 2018 witnessed extreme drought, leading to very low production, while 2019 marked one of the wettest on record, causing many floods and soil erosion in agricultural areas. In general, the Western part of the island receives higher amounts of precipitation compared to the eastern part, with droughts having become particularly frequent in AgriCapture's study area in Eastern Crete.

As established in ELGO's previous applied research projects, agronomic practices for climate change mitigation in olive cultivation must consider the Water-Energy-Food-Ecosystems nexus:

- better management of existing water resources (the largest consumer of water in the region is agriculture),
- higher soil water retention capacity through boosting SOM and lower transpiration through timely pruning and cover crops,
- promote ecosystem services, etc.

The project has selected Eastern Crete as an area that faces the most acute issues with water availability, low amounts of SOC, and salt water intrusion. 10 pilot farms of ~0.2 ha from 2 farmers' organizations will be studied in this project. New adopters as well as those already using Reg Agri from ELGO's previous LIFE project, oLIVE-CLIMA, will be included, and a larger number of farmers will be reached in years 2 and 3, to be fully representative of olive cultivation across the entire Mediterranean area.

For the project, proposed services will be used by researchers of ELGO, while during the project agronomists from different farmer organizations will be trained so as to be the end users of the proposed services after the end of the project.

2.1.1. Overall Objective and Specific Aims

The overall objective is to promote, support and monitor Reg Agri practices in olive cultivation that boost water use efficiency, enhance soil health, and ensure productivity; and to translate "better agricultural practices" by farmers into an added-value brand. Thus, to create a model of sustainable olive cultivation supported by digital decision tools and financial incentives, to be disseminated across S Europe.

To deliver this objective, the specific objectives are:

- To provide the necessary inputs, at farm level, for the establishment of the Agricapture Platform and also, demonstrate actions regarding the benefits and the use of the Agricapture Platform.
- To apply appropriate actions in order to promote regenerative agricultural practices and/or reduce emissions (at farm level or in different parts of the whole olive production chain (Farm Level, Olive Mill, Agricultural cooperation or Private trader, Marketing of olive oil).

2.1.2. AgriCapture partners involved

The lead partner of the use case is ELGO.

OCW will measure the climate footprint of the farm-to-store product of the new brand, and the offset from farm changes to certify a climate-friendly zero-emissions Olive Oil product with the OCW Carbon Neutral Gold Standard (via T5.2 measure use case baseline).

Close liaison with WP3 tech partners is also envisioned with regards to co-development activities.

2.1.3. AgriCapture Services to be used

The use case will include deployment and testing the following AgriCapture services:

Explore	Support	Validate	Quantify
Tools to assess how sustainable practices affect fields, farms and income	*Digital agricultural advisory services tailored to sustainable farming*	*Remote assessment of whether sustainable practices are being implemented*	*Cost-effective & accurate estimates for changes in soil carbon overtime*
✓	✓	✓	✓

AgriCapture Support services will be tailored for the needs of olive production in arid areas according to the regenerative agriculture approach developed by ELGO, for:

- Optimal timing/quantity of irrigation and fertigation,
- Optimal timing of pruning and cover crop mowing activities, and
- Risk of pathogens.

Also, soil organic carbon (SOC) data taken on the fields will be used to generate the SOC map at field level for quantification and monitoring of SOC sequestration. Soil moisture data will be visualized through Support service and is relevant for the farmers. Meteo data will be also visualized through Support service and is relevant for the farmers. The data on activities will be used to calibrate and test the Verify models.

2.1.4. End users involved

The use case includes the following end-users in testing AgriCapture services:

Farmers	Farmer coops/ groups	3rd party auditors	Agri-service providers	Public bodies	Sust. agri. certifier	Zero emissions certifier
✓	✓		✓	✓		✓
via coops.	Olive oil Cooperative of Fourni,		GILab, SatAgro	Prefecture of Greece		OCW

	Olive oil Cooperative of Mirambello					

2.1.5. Characterisation of test farms

The 10 selected farms are located at Eastern Crete as an area that faces the most acute issues with water availability, low amounts of SOC, and salt water intrusion. The test farms for the first year have the following characteristics:

- 10 parcels/farms (capturing all the different olive cultivation characteristics in the extended area of Eastern Crete), covering about 0.2 ha each one, where the historical data (regarding the practices and monitoring parameters) already exists.
- Farm types: family owned/corporate in which "traditional" production practices are used.
- Crop types involved: olives

In all of the selected farms, regenerative agriculture practices such as no-tillage, proper pruning, proper weed management (weed mowing), and proper plant protection have been applied since 2017.

Each year, the use case will scale test activities to a larger number of farmers.

2.1.6. Use case activities

Table 1. Activities in use case 1

Activities		Frequency				
		Once	Several times	Monthly	Annually	Cont-inuous
1	Use case kick-off	●				
1.1	Prepare required materials		●			
1.2	Workshops to introduce AgriCapture to new farmers (based on new farmers included in the process of the project)				●	
2	Establish a baseline	●				
2.1	Define parcels to be used				●	
2.2	Create shape file and send to WP3 partners				●	

2.3	Provide data to OCW to measure footprint of farm/value chain operations				●	
2.4	Soil samples taken and analysed				●	
3	Train farmers (use app, agronomic practices, etc.)		●			
3.1	Training/ Support workshops		●			
3.2	Collecting data and feedback from farmers					●
4	Support/liaise with end-users					●
4.1	Recruit new farmers				●	
4.2	Provide help and technical support in reaction to end-user requests					●
4.3	Collect and provide data to OCW, WP3, etc.		●			
5	Promote		●			
5.1	Promoting AgriCapture at national/regional opportunities (e.g. farmer events)		●			
5.2	Translate communication materials		●			
5.3	Organise final demo day	●				
6	Manage use case					●
6.1	Maintain financial records					●
6.2	Maintain contact list of farmers					●
6.3	Implement & maintain GDPR best practices					●

2.1.7. Steps for implementation – Methodology

Implementation will have the following sequence:

Step 1.
Defining the relevant monitoring parameters from the studied parcels that are needed to establish the Agricapture platform

Monitoring parameter or procedure in parcels	Number of samples/monitoring parameters per time	Parameters per sample
Soil moisture monitoring	Telemetric soil moisture system in irrigated parcels / Frequency: Continuous	soil moisture %
Soil nutrient content and soil organic matter	Soil sampling at specific locations/ Frequency: Every year	Soil basic properties and mineral nutrient content
Leaf nutrient content	One sample for each farm/ Frequency: Every year	Leaf nutrient content
Fuel use per ha	Collecting data and feedback from farmers/Frequency: Continuous	amount
Irrigation water data sets	Collecting data and feedback from irrigated farms/Frequency: During irrigation period	Irrigation water amount and frequency
Fruit yield (Quality and Quantity of olive oil)	Collecting data and feedback from farmers/Frequency: Every year	Fruit yield
Multi-spectral UAV imagery	One demonstration survey at the end of the project	Images
Meteorological data sets – telemetric station	Telemetric station / Frequency: Continuous	meteorological parameters
Effects of Soil Salinity	Monitoring in saline irrigation parcels/ Frequency: before and after irrigation period	Portable instrument for Measuring stress of plants

Step 2. Reference points 1, 2 and 3 (Baseline)	Based on the historical data of the parcels, OCW will count emissions for each parcel regarding the already applied practices - (Reference point 1). Based on the historical data of the parcels, KPIs will be counted for each studied parcel - (Reference point 2). OCW will count emissions for the other parts of the olive production chain (Olive Mill, Agricultural cooperation or Private trader, Marketing of olive oil) - (Reference point 3)
Step 3. Farm level under the proposed practices – comparison with Reference points 1 and 2.	In each parcel separately, the already (historically) applied practices should be redesigned in order to achieve lower emissions and promote regenerative agriculture. Redesigning means that, based on the already known Reference points 1 and 2, the scientific team of ELGO will support and advise farmers to follow appropriate soil practices. For instance, advice for: no tillage, applied soil organic matter at specific dose, applied proper irrigation (amount and rate), proper pest/weed control/ In turn, based on the proposed changes in the applied practices, the emissions and the KPIs will be recounted and recorded in each year and for each studied parcel, compared to the Reference point 1 and 2, respectively. Regenerative Agricultural Practices that will be advised to be applied in farm scale (recorded): • Cover crops • No weed mowing during winter / No soil tillage • Weed mowing in spring and summer (soil mulching) • Winter pruning/summer pruning - Shredding of pruning • Application of organic material (winter period) • Irrigation according to meteorological and soil moisture data • Application of fertigation • Foliar application of fertilizers (in case that is needed)

Step 4.	• Plant protection for minimizing the risk for pathogens - Recommendations Define the actions to minimize the emissions in the other parts of the olive production chain – comparison with Reference point 3.

2.1.8. Milestones

The major milestones of the use case are:

Table 2. Major milestones of Use Case 1

#	Name	Month	How you know you reached it
1	Baseline definition	5	All parcels defined, shapefiles provided to WP3, historical data provided to OCW
2	Use case operation plan & evaluation methodology	5	Agreement on an operation plan
3	Informative session with farmers	7, 19, 30	Trainings
4	Workshop	32	Final event
5	Evaluation processes of the AgriCapture platform	15, 27	AgriCapture platform validation

2.1.9. Timeline

The activities, steps and major milestones cover the following:

Table 3. Gantt chart of Use Case 1

Activities		Duration		2021												2022												2023											
		Start	End	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Use case kick-off**	**M1**	**M27**																																				
1.1	Prepare required materials	M1	M26																																				
1.2	Workshops to introduce AgriCapture to new farmers	M4	M27																																				
2	**Establish a baseline**	**M3**	**M30**																																				
2.1	Define parcels to be used	M3	M27																																				
2.2	Create shape file and send to WP3 partners	M3	M27																																				
2.3	Provide data to OCW to measure footprint of farm/value chain operations	M6	M30																																				
2.4	Soil samples taken and analysed	M6	M30																																				
3	**Train farmers (use app, agronomic practices, etc.)**	**M5**	**M35**																																				
3.1	Training/ Support workshops																																						

3.2	Collecting data and feedback from farmers																																							
4	**Support/liaise with end-users**	**M3**	**M36**																																					
4.1	Recruit new farmers	M3	M27																																					
4.2	Provide help and techincal support in reaction to end-user requests	M3	M36																																					
4.3	Collect and provide data to OCW, WP3, etc.	M3	M36																																					
5	**Promote**	**M3**	**M36**																																					
5.1	Promoting AgriCapture at national/regional opportunities (e.g. farmer events)	M3	M36																																					
5.2	Translate communication materials	M3	M27																																					
5.3	Organise final demo day	M33	M33																																					
6	**Manage use case**	**M1**	**M36**																																					
6.1	Maintain financial records	M1	M36																																					
6.2	Maintain farmer contact list	M1	M36																																					
6.3	Implement & maintain GDPR best practices	M1	M36																																					

2.1.10. Business case in brief

This use case deploys AgriCapture to empower a new added-value brand using better agricultural practices. As such, it represents AgriCapture use across a value chain, allowing for brands to capture added-value to the environment/climate from agronomic practices, and to transfer financial benefits to all actors (including higher prices for farmers). This is representative of the offer that AgriCapture has for agri-cooperatives (like those involved) and agri-corporates that seek to seize upon increasing consumer valorisation of (certified) zero-emissions/"climate-friendly" products.

In addition, the use case will tailor AgriCapture for olive production, with transferable benefits to citrus production also explored. Olive oil is €7.3 B business, of which Europe accounts for >70% of the world's production. Annual growth in the past decade has been 6%, projected to continue at 5%, driven by consumer health consciousness. Climate change has brought widespread challenges to water management in olives, and threatens the industry (IPCC predicts lower precipitation and agricultural production in the Mediterranean). AgriCapture support to a new Reg Agri approach to olive farming is timely in this context. In addition, the resulting benefits to oil quality from Reg Agri are in line with quality-based differentiation as a major trend in the olive oil market.

2.1.11. Expected results

The expected results of the project are to promote, support and monitor regenerative agricultural practices in olive cultivation that boost water use efficiency, enhance soil health, and ensure productivity; and to translate "better agricultural practices" by farmers into an added-value brand. Thus, to create a model of sustainable olive cultivation supported by digital decision tools and financial incentives from carbon (C) offsets, to be disseminated across South Europe.

2.1.12. Key performance indicators

Table 4. Key performance indicators for Use Case 1

Result	Indicator	Target
1	Added value to products	+20%
2	C sequestration per ha	+10%
3	Water efficiency	+20%
4	Fuel use per ha	-10%
5	Effects of soil salinity	-20%

2.2. The Case of Poland
Capturing ecological value: Large-scale sequestration on Europe's large farms

The structure of agricultural land in Poland reflects distinct historical processes of the last few centuries. Among these, the post WW2 policy of agricultural collectivization during the Stalinist regime period has made a clear mark. While generally large-scale collectivization failed to take root in Poland, in this period a number of State Agricultural Farms, or *PGRs* (*Państwowe Gospodarstwo Rolne*) were created, a form of collective farming in the People's Republic of Poland, similar to Soviet *sovkhoz* and to the *East German Volkseigenes Gut*. In course of time these farms came to control approximately 10% of Poland's arable land.

After moving to the market economy in 1991, the generally inefficient PGRs were liquidated and their assets were taken over by the Agricultural Property Agency of the Treasury (now Agricultural Property Agency, or *Agencja Nieruchomości Rolnych*). As nearly half a million PGR workers were laid off at once, this event is an important element of societal conscience as regards the transitional period of the Polish economy. The process of selling and leasing of the post-PGR land still continues.

The two Polish Agricapture use cases represent two scenarios of post-PGR land management. The first scenario is management under a long-term land lease contract. 2 830 ha out of 10 620 ha were earmarked for a Reg Agri project. The managing entity is a private company Top Farms Głubczyce (TFG), which is a branch of the pan-European holding Spearhead International. The second scenario is management through a Polish and partly State-owned company. Here, the managing entity is OHZZ (Breeding Centre for Pedigree Animals) Chodeczek, and 710 out of 1 800 ha were earmarked for a regenerative agriculture project.

The motivation to conduct a case study with the above companies was threefold.

First, the two farms are already using the SatAgro platform as a mean to implement various aspects of precision agriculture. Their experience with satellite-informed crop management, combined with the size of the land and individual crop fields they manage, places them well as testing grounds for various methods of regenerative agriculture support which involves satellite monitoring. Together these factors increase the likelihood that these farms will successfully adopt the new reg agri-oriented tools implemented on the SatAgro platform within the scope of Agricapture.

Second, these farms are particularly open to innovation and have a proven track record in this regard. Top Farms Głubczyce has for many years been a well-recognised regional trend-setter in agronomy, while OHZZ Chodeczek has vigorously engaged with new approaches to agronomy since the change in management a few years ago.

Third, the two cases represent significant potential for scale-up, as they are parts of their respective networks of farms, managed by the before mentioned Spearhead International in the case of Top Farms Głubczyce, and Krajowy Ośrodek Wsparcia Rolnictwa (National Support Centre for Agriculture) in the case of OHZZ Chodeczek. Altogether the size, visibility and networks of these entities hold a promise of a potentially large impact as a climate mitigation measure.

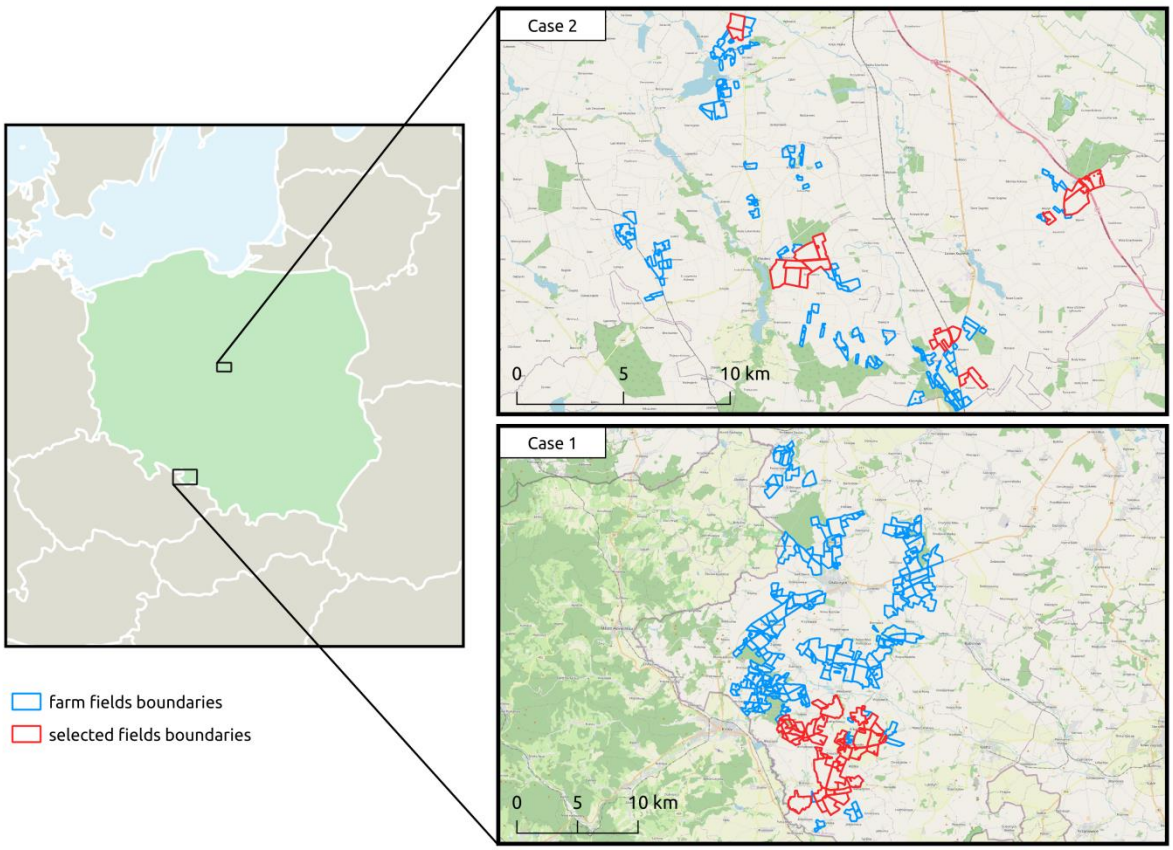

Figure 1. Localisation of the two farms which form the AgricaptureCO2 Case Study in Poland. Case 1: Top Farms Głubczyce (2 830 ha out of 10 620 ha earmarked for the study), Case 2: OHZZ Chodeczek (760 out of 1 800 ha earmarked for the study)

Top Farms Głubczyce is located in southern Poland (Opolskie voivodship), near the border with Czechia. This region has some of the best arable land in Poland. The company focuses on the production of cereals, rape, potatoes, sugar beets and milk. Every year TFG

produces *circa* 40 thousand tonnes of cereal, 6 thousand tonnes of rape, 10 thousand tonnes of sweet corn, 50 thousand tonnes of sugar beets and 35 thousand tonnes of potatoes for sale. The company is also one of the largest milk producers in Poland, with a herd of 2 500 milk cows, producing more than 22 million litres of milk per year.

TFG adheres to the Code of Good Agricultural Practices and its vegetable production is certified with GlobalGAP (the former EurepGAP). Since a few years TFG has been increasingly adopting different regenerative agriculture practices, recognising both the opportunity for better food and environment quality, and for gaining advantage in markets driven by increasingly environment-aware consumers. These efforts have been assisted by the TerraNostra Foundation, an entity closely linked with all Top Farms' operations (*circa* 30 000 ha), whose mission is to promote and certify so called "biologisation of the soil" which in a large part overlap with regenerative agriculture. In particular, Terra Nostra created the "Code 5C", the components of which are described in the table below. SatAgro Sp. z oo, and other Agricapture partners, intend to support TFG in originating a regenerative agriculture project through integration of the specific requirements of this challenge with the ongoing implementation of the Terra Nostra's Code 5C.

Table 5. Components of the "Code 5C" promoted by the Terra Nostra Foundation

Calcium
Calcium is a key soil nutrient for building soil fertility. It improves pH and in turn also assimilability of nutrients. It also enhances soil structure. For these reasons liming is an important part of soil "biologisation".
Carbon
Carbon, or organic matter, is essential in soil, also enhancing its structure, and in addition increasing water holding capacity, retention of minerals for plants, and protection against pathogens. The major premise of "biologisation" is to increase the amount of organic matter and carbon in the soil.
Cover crops
Covering the soil all year round prevents soil erosion (while the longer roots loosen the soil), inhibits the growth of weeds, and revitalises microorganisms and soil metabolism.
Cultivation
Here the principle "cultivate as little as possible, but as much as necessary" is promoted. The soil is loosened deeply without turning it over and mixed shallowly, which promotes formation of humus rather than oxidation, improves permeability, and preserves living organisms.
Culture
The culture component is about a wider context of crop cultivation. In general, the goal is to promote biodiversity, e.g. through revitalising of ponds, building water retention

reservoirs, maintaining mid-field shelterbelts, using rich crop rotations and mixed-species cover crops. Collaboration with naturalists clubs facilitates interventions critical for the survival of protected species, e.g. Montagu's harrier which nests within crop fields.

OHZZ (Breeding Centre for Pedigree Animals) Chodeczek is located in central Poland, on the south-eastern edge of the Kujawsko-Pomorskie Voivodship (see the map above). The company is focused on animal breeding and rearing, intensive crop production and agricultural processing. Additionally, it sells services in trade and agrotechnology. Crop production takes place on the area of 1978 ha and it is largely shaped by the needs of the animal production. Approximately 70% of the sown area is used for cereal crops with a predominance of maize and wheat. The company also grows industrial crops for sale: rapeseed - about 15%, and sugar beet - 10% of the area. Since 1995 OHZZ Chodeczek has been operating as a limited liability company under control of the Agricultural Property Agency.

Since the change in management in 2017 there has been a shift towards improved sustainability of production, with the main focus on precision agriculture. Vantage Polska Sp. z oo, a company specialising in various aspects of agronomy, from soil sampling to plant nutrition to machinery retrofitting for Variable Rate Application, has been assisting OHZZ Chodeczek in this transition. Vantage Polska has also been a partner company of SatAgro, especially in the area of satellite-assisted soil and nutrition management. It is this partnership, the fact that the three parties have already embarked on collaboration through the SatAgro platform, and the common interest in regenerative agriculture, which positioned OHZZ Chodeczek as a good candidate for a pilot study.

2.2.1. Overall Objective and Specific Aims

The overall objective of this case study is to demonstrate implementation of a regenerative agriculture project in a large-scale crop cultivation case, supported by services implemented in the SatAgro platform.

To deliver this objective, the specific objectives are:

- To provide the necessary inputs for the establishment of the AgriCapture project and platform.
- To create the AgriCapture platform as an extension of the SatAgro platform.
- To demonstrate the benefits of the AgriCapture platform.

- To apply appropriate actions in order to promote regenerative agricultural practices.

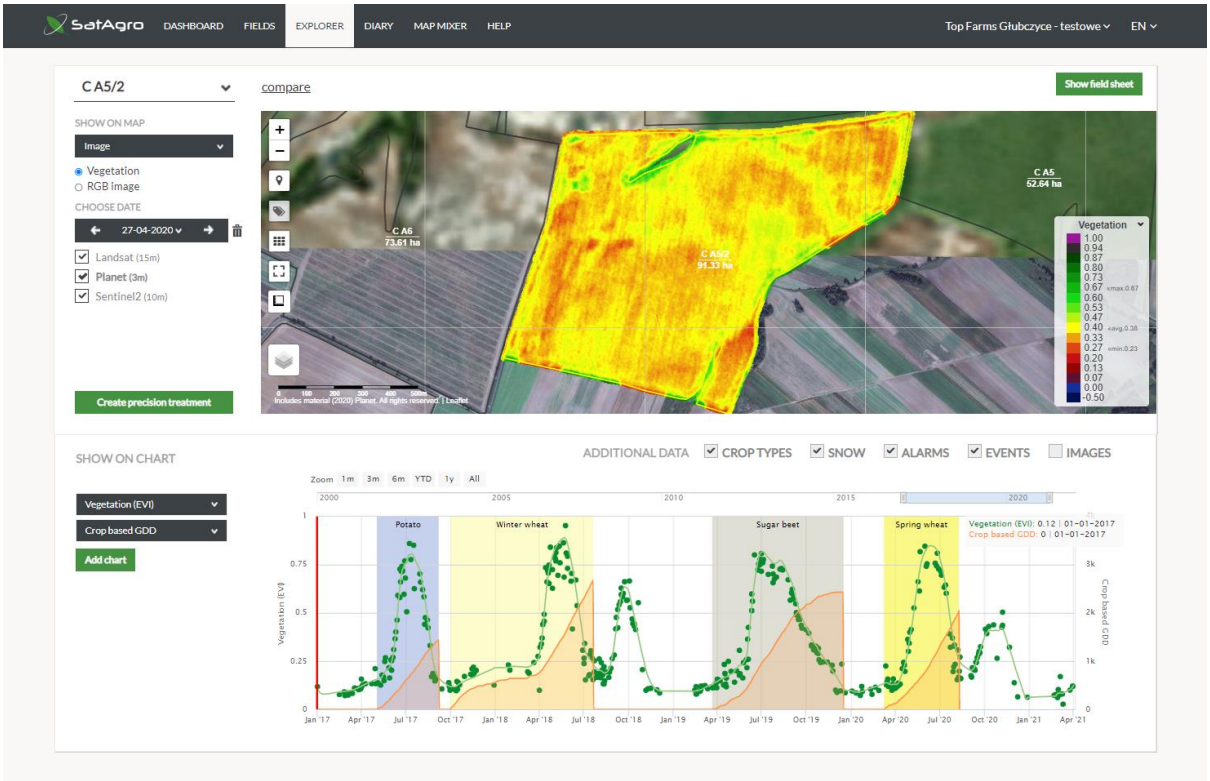

Figure 2. Screenshot of the SatAgro platform and within it a map of the state of the crop on one of the fields (top), as well as of crop phenology and agro-meteorological indices in the last three seasons (bottom). Peaks made of green dots denote individual crops. Non-labeled crops are cover crops, the handling of which needs to be expanded in the context of Agricapture.

2.2.2. AgriCapture partners involved

The lead partner of the use case is SatAgro.

Other AgriCapture partners currently involved in the use case are OCW (introduction to carbon markets, conceptualisation of Reg Agri activities) and Gilab (introduction to Agricapture, setting up the legal framework).

More involvement at the later stage is expected from Environmetrix and Agricultural University of Athens (soil sampling and soil pool estimation), Planet (provision of novel satellite data streams, enabling smaller farms), Farrington Oils ltd. and Game and Wildlife Conservation Trust (agronomy consulting).

2.2.3. AgriCapture Services to be used

The use case will include deployment and testing the following AgriCapture services:

Explore	Support	Validate	Quantify
Tools to assess how sustainable practices affect fields, farms and income	*Digital agricultural advisory services tailored to sustainable farming*	*Remote assessment of whether sustainable practices are being implemented*	*Cost-effective & accurate estimates for changes in soil carbon overtime*
✓	✓	✓	✓
- Mapping of the current profitability of each hectare - Assessing the potential carbon sequestration in a given scenario - Assessing how engagement with carbon markets will affect per ha profitability	- Soil sampling - VRA - Liming / ERW - Crop Rotation (incl. cover and inter crops) - IoT - Nature strips	- Crop rotation - Cover crops - Leaving residues - Nature strips - Precision treatments evidence	- Satellite-assisted carbon mapping - VRA-related reductions - ERW-based mitigation

2.2.4. End users involved

The use case includes the following end-users in testing AgriCapture services:

Farmers	Farmer coops/ groups	3rd party auditors	Agri-service providers	Public bodies	Sust. agri. certifier	Zero emissions certifier
✓	✓	✓	✓	TBD	TBD	✓
Top Farms Głubczyce OHZZ Chodeczek Possibly others	Spearhead Inter-national farms Farms overseen by KOWR (National Support Centre for Agri.)	Reg Agri project auditors (not defined)	Vantage Polska Grupa Azoty S.A. BNP Paribas	KOWR (National Support Centre for Agri.)	Terra Nostra	OCW

2.2.5. Characterisation of test farms

Table 6. Key characteristics of the farms involved in Use Case 2

Feature	Top Farms Głubczyce	OHZZ Chodeczek
Location	Głubczyce, Opolskie voivodship (Southern Poland)	Chodeczko, Kujawsko-Pomorskie voivodship (central Poland)
Farmed land area	10 620 ha	1 800 ha
Are earmarked for the Reg Agri project	2 830 ha	710 ha
Number of crop fields (size range)	40 (10-230 ha)	19 (10-90 ha)
Ownership	Land lease from the State	State (Agricultural Property Agency)
Crop types	Cereals with corn, oil rape, sugar beets, potatoes, soya	Cereals with corn, oil rape, sugar beets, grasses
Regenerative practices • No/minimum tillage • Cover crops • Leaving crop residues • Wide crop rotation • Intercropping (companion crops) • Variable Rate Application • Organic amendments application • ERW (basalt application) • Precision irrigation • Buffer/nature strips	 yes yes yes yes ? yes yes open to getting ready yes	 yes ? ? ? ? yes yes ? no ?

2.2.6. Use case activities

Table 7. Activities in Use Case 2

Activities		Frequency				
		Once	Several times	Monthly	Annually	Cont-inuous
1	Use case kick-off	●				
1.1	Prepare required materials	●				
2	Establish a baseline	●			●	
2.1	Create shape file and send to WP3 partners	●				
2.2	Provide data to OCW to measure footprint of farm/value chain operations				●	
2.3	Soil samples taken and analysed				●	
3	Supporting farmers		●	●		
3.1	Training/ Support workshops			●		

3.2	Publishing online support materials			●		
3.3	Collecting data and feedback from farmers		●			
3.4	Integration of farmers' data in the SatAgro platform		●			
4	Promote and liaise with new end-users	●				●
4.1	Promoting AgriCapture at national/regional opportunities					●
4.2	Organise final demo day	●				
4.3	Recruit new farmers					●
5	Buildilng AgriCaptureCO2 online tools				●	●
5.1	Conceptualise & design				●	
5.2	Implement with SatAgro platform					●
5.3	Integration with CropLab					●
5.4	New SatAgro release				●	
6	Manage use case				●	●
6.1	Maintain financial records					●
6.2	Maintain contact list of farmers					●
6.3	Implement & maintain GDPR best practices					●
6.4	Internal review				●	

2.2.7. Steps for implementation – Methodology

The steps for implementing Use Case 2 are:

- Data collection (annual)
- Data analysis and generating baseline (annual)
- Calculation of the carbon footprint and the size of natural assets
- Documentation of the regenerative agriculture activities and integration with the SatAgro platform (continuous)
- Official registration of the regenerative agriculture project
- Expansion of the SatAgro platform for routine support of regenerative agriculture projects
- Demonstration of the use of the Agricapture/SatAgro platform
- AgriCaptureCO2 support/promotion

2.2.8. Milestones

The major milestones of the use case are:

Table 8. Major milestones of Use Case 2

#	Name	Month	How you know you reached it
1	Use case kick-off	5	All local authorities have audits and priorities identified by OCW. All trial site parcels defined, shapefiles provided to WP3, historical data provided to OCW
2	Establish a baseline	4	Agreement on an operation site plans
3	Supporting farmers	13, 25, 34	Training workshops based on the content and tools available online
4	Promote and liaise with new end-users	32	Final demo day
5	Building AgriCaptureCO2 online tools	13, 25, 34	Release of new integration of AgricaptureCO2 tools with SatAgro
6	Manage use case	11, 23, 35	Agricapture platform review

2.2.9. The timeline

The activities, steps and major milestones cover the following:

Table 9. Gantt chart of Use Case 2.

Activities		Duration		2021												2022												2023											
		Start	End	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Use case kick-off**																																						
1.1	Prepare required materials																																						
2	**Establish a baseline**																																						
2.1	Create shape file and send to WP3 partners																																						
2.2	Provide data to OCW to measure footprint of farm/value chain operations																																						
2.3	Soil samples taken and analysed																																						
3	**Supporting farmers**																																						
3.1	Training/ Support workshops																																						
3.2	Publishing online support mat.																																						
3.3	Collecting data and feedback from farmers																																						
3.4	Integration of farmers' data in SatAgro platform																																						

4	**Promote to and liaise with end-users**	**M3**	**M36**
4.1	Promoting AgriCapture at national/regional opportunities (e.g. farmer events)	M3	M36
4.2	Organise final demo day	M33	M33
4.3	Recruit new farmers	M3	M36
5	**Building AgriCaptureCO2 online tools**	**M3**	**M36**
5.1	Conceptualise & design	M5	M34
5.2	Implement with SatAgro platform	M7	M34
5.3	Integration with CropLab	M7	M34
5.4	New SatAgro release	M12	M24
6	**Manage use case**	**M1**	**M36**
6.1	Maintain financial records	M1	M36
6.2	Maintain farmer contact list	M1	M36
6.3	Implement & maintain GDPR best practices	M1	M36
6.4	Internal review	M11	M35

2.2.1. Business case in brief

When AgriCapture becomes fully operational, the services developed will be integrated with SatAgro as easy to use tools (soil management, profitability analysis) and information layers, thereby reaching a larger audience already familiar with the rest of the platform. The support for soil care and C sequestration will be one of the selling points for SatAgro when approaching new users.

Implementing a subset of practices aimed at C sequestration is firmly in the farmer's interest due to improved soil quality. In line with the company's experience with adoption of satellite-informed precision agriculture support, it can be expected that with time the target market will be increasingly educated which, together with increasing number of companies and offerings, the psychological barriers to entry will dwindle. Extending SatAgro service to include AgriCapture services will help farmers access actionable information on the results of planned and past interventions. The key will be to clearly demonstrate that high SOM content enables farmers to better withstand drought and use less fertilizer and other agrochemicals.

External schemes, such as C offset credits and consumer/corporate facing certification are an important extension of the inherent business advantages of Reg Agri practices, and are key for farmers to engage in the more effort-intensive practices. Assuming an offset price of €10 per ton of C, and a rate of 1 ton sequestered per hectare per year, the quantification service could lead to per unit of area revenue of the order contributing noticeably to Nitrogen fertilizer purchases, and exceeding the current cost of farmer's subscription to the SatAgro service which in itself enables significant cuts in agrichemical use.

2.2.2. Expected results

1. Deployment of a Agricapture regenerative agriculture project in Poland

2. Expansion of the SatAgro platform onto tools which support origination and running of a carbon sequestration project

3. Operational availability of Agricapture-linked services in Poland and the wider region, enabled by a partnership between Agricapture partners and locally operating companies.

2.2.3. Key performance indicators

Table 10. Key performance indicators for Use Case 2

Result	Indicator	Target
1	Case study is registered as an official VCS project	An audit successfully passed
2	Case study is functional	C sequestration per >2t ha/yr, Total C sequestered 600 t
3	Case study is able to offer certified carbon credits	Carbon credits verified and eligible
4	SatAgro platform is able to report on all aspects of the Reg Agri project (activities)	15 farmers participating in early stage R&D
		Support and verification offered for 7 activities
6	Partnership in place between AgricaptureCO2 and local actors	An offering is publically available and 200 of farmers reached
7	AgricaptureCO2 services sold beyond the case study	First sale of services accomplished
		2.5% value added to products
		5 private entities engaged for C offsets

2.3. The Case of the UK (#1) Meeting public climate commitments: Informing public land management for climate action

Lancashire County has 1.4 million inhabitants and covers 3,000 km2 in the Western UK. The County is locally administered by 12 district, and 2 unitary authorities.

Like many local, regional and national governments in Europe, the County has committed to Carbon neutrality, aiming to achieve this feat by 2030. To achieve this, the County plans to:

- Establish the baseline Carbon footprint of the individual district and unitary authorities.
- Make use of the significant land under its ownership, exploring various options to maximise C sequestration, and their associated costs. This includes the restoration of wetlands and assessing the conversion of grazing pastures into various agri-options, (agro-)sylvo-pastoral systems, or forests.

- Assess the effect of policies/initiatives that promote certain Reg Agri practices in the county, among farmers and other major landowners (large private estates, Forestry England, Church of England, Ministry of Defence)

Lancashire County Council is responsible for the monitoring and maintenance of 22 closed land fill sites (258ha) used for the disposal of refuse collected from the residents and businesses in the county. Once full, these sites were primarily restored to a pastural after use, often with some marginal areas of tree planting. The sites are generally managed by local farmers on short-term grazing licences. In addition to the closed land fill sites there are a smaller number of areas of former collieries and other areas of derelict land, that have been reclaimed and are similarly managed through grazing.

The 14 district and unitary authorities are responsible for the collection of garden waste arising from private households which represents a major component of the biodegradable municipal waste stream. In addition, the authorities will, over the coming years, be felling and removing tens of thousands of Ash (*Fraxinus excelsior*) which have succumbed to Ash Dieback (*Hymenoscyphus fraxineus*) and are posing a threat to the county's infrastructure or public safety.

As part of its work to achieve Carbon neutrality the County wish to investigate the opportunities to utilise this green waste to create PAS 100 compost and utilise this in a manner that will enhance longer-term Carbon capture. In this respect the County Council is also interested in the potential to utilise green waste for the production of BioChar, a more stable form of Carbon which has the potential for longer-term Carbon storage which is currently being utilised by the Stockholm BioChar Project.

2.3.1. Overall Objective and Specific Aims

The overall objective of this case study is to use AgriCapture to assess various management options for public lands, and inform an actionable plan to achieve climate neutrality of Lancashire County by 2030.

To deliver this objective, the specific objectives are:

- To undertake baseline Carbon audits of the 14 district and unitary authorities in Lancashire.
- To identify options for each local authority to achieve carbon neutrality.
- To identify opportunities for the AgriCapture Platform to deliver these options on public land, or through the actions of public authorities.

- To investigate the opportunities for green waste and the arisings from arboricultural and forestry works collected by public authorities to be utilised to increase the carbon content of soils on public sector land, and to apply these at a site level.
- To provide the necessary inputs, at site level, for the establishment of the AgriCapture Platform and also, demonstrate actions regarding the benefits and the use of the AgriCapture Platform under different management regimes.

2.3.2. AgriCapture partners involved

The lead partner of the use case is Lancashire County Council on behalf of the 14 district and unitary authorities in Lancashire.

The use case will spark cross-Borough cooperation through the Lancashire Environment and Climate Change Working Group to develop a roadmap to achieve climate neutrality. 7 out of 14 district and unitary councils in the county have already completed an assessment of their climate footprint, conducted by OCW, which will be expanded during the use case to cover the remaining 7. In turn, AgriCapture will be deployed to help assess the various options for the Borough's green assets, the C capture potential, and the entailing costs. Due to differences in urbanisation, natural landscape and land area ownership between Boroughs, the cross-Borough approach is instrumental to meet climate neutrality commitments.

Additionally, public authorities have significant engagement with the wider farming community through their roles in the management of the Public Rights of Way Network and through area-based landscape-scale work in the UK network of National Parks, Areas of Outstanding Beauty, and other landscape designations. Where possible we will utilise these roles to identify opportunities and promote the AgriCapture approach to the farmers and agri-environment advisors we work with. If feasible, AgriCapture may be used to assess the effect of various regenerative agricultural practices on privately-held lands, and examine which agricultural/land management programmes would have the highest climate impact as well as the synergy with the County's environment and potentially enable the Lancashire authorities to offset Carbon while supporting the local rural economy.

Where relevant, land use changes and management choices should also take into account the assessments of and cooperate with the UK Environment Agency to boost resilience to floods and fires.

OCW will measure the climate footprint of the 14 Lancashire district and unitary authorities and identify opportunities to reduce or offset Carbon emissions. Close liaison with WP3 tech partners is also envisioned with regards to co-development activities.

2.3.3. AgriCapture Services to be used

The use case will include deployment and testing the following AgriCapture services:

Explore	Support	Validate	Quantify
Tools to assess how sustainable practices affect fields, farms and income	*Digital agricultural advisory services tailored to sustainable farming*	*Remote assessment of whether sustainable practices are being implemented*	*Cost-effective & accurate estimates for changes in soil carbon overtime*
✓	✓	✓	✓

Often the only land under active agricultural management which is in public authority ownership will occupy sites which were used for landfill of refuse, or previously derelict land which has been ameliorated. The soils on these sites will typically be man-made, shallow, poorly developed, and overly potentially environmentally hazardous materials. AgriCapture Support services will be tailored to identify the optimum pathway for improving soil structure and maximising soil Carbon sequestration on such sites utilising a range of management strategies including pastural agriculture, forestry, and recreation/biodiversity.

2.3.4. End users involved

The use case includes the following end-users in testing AgriCapture services:

Farmers	Farmer coops/ groups	3rd party auditors	Agri-service providers	Public bodies	Sust. agri. certifier	Zero emissions certifier
✓				✓		✓
Tenant farmers on public authority land				15 Lancashire 1st & 2nd tier public authorities		

Other end-users include:

- UK Environment Agency
- Local Farmer Networks
- Lancashire Rivers Trusts
- Agri-environment advisors

2.3.5. Characterisation of test farms

Midgeland Road Landfill Site (53.779269, -2.9980695. UK NGR SD343319).

This former landfill site covers 45 Hectares and straddles the boundary between Blackpool Borough Council and Fylde Borough Council.

Midgeland Farm landfill site received various types of waste, including industrial and household between 1973 and 1984. Following its closure as a landfill facility it was restored to open grassland. Further restoration works were undertaken in 2008 and completed in October 2011. There is no public access.

The majority of the site is now used for agriculture and comprises 8 fields managed as sileage/pasture. The fields are divided by tracks and hedgerows, there are some peripheral areas of tree planting around the site margins.

Chisnall Hall (53.608902, -2.6831140. UK NGR SD549127)

The location of the former Chisnall Hall Colliery this site covers 80 Hectares on the Southern boundary of Chorley Borough. The site is bisected by the M6 Motorway, the main North-South road connection in the West of the UK.

There is some uncertainty about exactly when the Chisnall Hall Colliery first opened but it appeared on historic maps in 1908 as an established coal mine with two mineshafts and railway sidings connecting to the mineral railway. At it's height over 1,000 people were employed at the colliery with over 300,000 tonnes of coal being produced annually. It is believed that the colliery ceased coal production in 1967. A restoration plan for the site was prepared in 1977. The site was mostly restored between 1981 and 1983. There is public access with a number of footpaths running through the site, these follow field boundaries with access to the main areas of the site currently restricted.

The site is used for grazing and has been split into 10 fields with woodland planting around most field boundaries. The highest point of the site is in the central area at the top of 3 mounds, formed from the remains of spoil heaps from previous coal mining activities.

Although some woodland has been established around the field boundaries, the nature of the topsoil, only 0.1m to 0.2m in depth, above compacted colliery shale has restricted root growth and means the trees have not reached a height to be expected of their age. Many of them show signs of poor health and form as well as instability. Due to their shallow root systems many trees have been blown over on. The shallow layer of topsoil with compacted shale underneath means that drainage is impeded causing issues across the site.

Between 2012 and 2016 a composted organic product was added to the colliery shales across 6.6 ha to enhance soil conditions and support viable woodland establishment. This increased soil permeability, with the added benefit of reducing surface water run-off and the leaching of oxidised mineral content into neighbouring riparian zones and watercourses.

2.3.6. Use case activities

Table 11. Activities in Use Case 3

Activities		Frequency				
		Once	Several times	Monthly	Annually	Cont-inuous
1	Use case kick-off	●	●			
1.1	Prepare required materials		●			
1.2	Meetings to introduce AgriCapture to 14 local authorities	●				
2	Establish a baseline	●			●	
2.1	Provide data to OCW to measure footprint of farm/value chain operations	●				
2.2	Identify options for each local authority to achieve carbon neutrality	●				
2.3	Define land parcels to be used for different management approaches within each site and development site management plans.	●				
2.4	Meetings to introduce AgriCapture trial site grazing licence holders	●				
2.5	Create shape files and send to WP3 partners				●	
2.6	Soil samples taken and analysed				●	
3	Implement management schemes	●	●			
3.1	Implement remedial land management in each of the selected parcels		●			
3.2	Amend grazing licences to reflect desired management regime	●				
3.3	Meetings with grazing licence holders to explain revised land management practices.		●			
4	Support/liaise with new end-users		●			●
4.1	Provide help and technical support in reaction to end-user requests		●			
4.2	Collect and provide data to OCW, WP3, etc.		●			
5	Promote		●			
5.1	Promote AgriCapture at regional opportunities		●			
6	Manage use case					●

6.1	Maintain financial records					●
6.2	Maintain contact list of farmers					●
6.3	Implement & maintain GDPR best practices					●

2.3.7. Steps for implementation – Methodology

The activities above will have the general sequence:

Step 1.
Baseline Carbon audits of 14 district and unitary authorities

OCW will undertake baseline Carbon audits of the 14 Lancashire district and unitary authorities and identify options for individual authorities to achieve carbon neutrality.

Step 2.
Defining the relevant monitoring parameters from the studied parcels that are needed to establish the Agricapture platform

Monitoring parameter or procedure in parcels	Number of samples/monitoring parameters per time	Parameters per sample
Soil depth	Depth of existing /Frequency: once	Depth mm
PAS 100/BioChar imported per ha	Total amount of medium imported into each management unit	amount
Soil nutrient content and soil organic matter	Soil sampling at specific locations/ Frequency: Every year	Soil basic properties and mineral nutrient content
Fuel use per ha	Collecting data and feedback from farmers and contractors/Frequency: Continuous	amount
Fertiliser application rates	Collecting data on organic and inorganic fertiliser applied to trial areas under agricultural management/ Frequency: Every year	amount
Average annual tree growth	Collecting data on annual tree growth from trial planting plots/Frequency: Every year	Fruit yield
Multi-spectral UAV imagery	One demonstration survey at the end of the project	Images

Step 3. Reference points 1, 2 and 3 (Baseline)	Based on the historical data of the parcels, OCW will count emissions for each trial area regarding the already applied practices - (Reference point 1). Based on the historical data of the parcels, KPIs will be counted for each trial area - (Reference point 2).
Step 4. Farm level under the proposed practices – comparison with Reference points 1 and 2.	Within in each site, management will be redesigned around a series of trial plots which will be designed to investigate the relative benefits of a series of management approaches to achieve lower emissions and promote regenerative agriculture, eg: • Apply PAS100/BioChar and woodland/hedgerow establishment; • Apply PAS100/BioChar and return to agriculture; • Apply PAS100/BioChar and no or limited conservation grazing; • Woodland/hedgerow establishment without PAS100/BioChar application • Continued existing management (Control). In turn, based on the proposed changes in the applied practices, the emissions and the KPIs will be recounted and recorded in each year and for each studied parcel, compared to the Reference point 1 and 2 and Control, respectively.

2.3.8. Milestones

The major milestones of the use case are:

Table 12. Major milestones of Use Case 3

#	Name	Month	How you know you reached it
1	Baseline definition	5	All local authorities have audits and priorities identified by OCW. All trial site parcels defined, shapefiles provided to WP3, historical data provided to OCW
2	Use case operation plan & evaluation methodology	10	Agreement on an operation site plans
3	Informative session with farmers	10	Meetings
4	Workshop	32	Final event
5	Evaluation processes of the Agricapture platform	15, 27	Agricapture platform validation

2.3.9. The timeline

The activities, steps and major milestones cover the following:

Table 13. Gantt chart of Use Case 3.

Activities		Duration		2021												2022												2023									
		Start	End	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Use case kick-off**	**M1**	**M28**																																			
1.1	Prepare required materials	M1	M27																																			
1.2	Meetings to introduce AgriCapture to 14 local auth.	M4	M28																																			
2	**Establish a baseline**	**M4**	**M30**																																			
2.1	Provide data to OCW to measure footprint of 14 district and unitary authorities and test sites	M4	M28																																			
2.2	Identify options for each local authority to achieve carbon neutrality	M28	M28																																			
2.3	Define land parcels to be used for different management approaches within each site and development site management plans.	M10	M10																																			
2.4	Meetings to introduce AgriCapture trial site grazing licence holders	M10	M10																																			
2.5	Provide data to OCW to measure footprint of 14 district and unitary authorities and test sites	M6	M30																																			

2.6	Soil samples taken and analysed	M10	M30	
3	**Implement management schemes**	**M10**	**M30**	
3.1	Implement remedial land management in each of the selected parcels	M16	M30	
3.2	Amend grazing licences to reflect desired management regime	M14	M26	
3.3	Meetings with grazing licence holders to explain revised land management practices.	M10	M22	
4	**Support/liaise with end-users**	**M33**	**M35**	
4.1	Provide help and technical support in reaction to end-user requests	M33	M35	
4.2	Collect and provide data to OCW, WP3, etc.	M33	M35	
5	**Promote**	**M33**	**M35**	
5.1	Promoting AgriCapture at regional opportunities	M33	M35	
6	**Manage use case**	**M33**	**M35**	
6.1	Maintain financial records	M33	M35	
6.2	Maintain farmer contact list	M33	M35	
6.3	Implement & maintain GDPR best practices	M33	M35	

2.3.10. Business case in brief

The case study is representative of AgriCapture use by large landholders in general and public authorities in specific. Given various public body commitments to climate neutrality (e.g. UK and EU by 2050, Finland by 2030, etc.), AgriCapture provides a flexible and robust tool to assess C capture from various management options across large expanses of public land. Similarly, it can assess C capture from various Reg Agri practices on private land, and thus provide input for informed policy making. Such a decision support tool to measure potential capture is currently not available.

2.3.11. Expected results

The expected results of the project are to use AgriCapture to assess various management options for public lands, and inform an actionable plan to achieve climate neutrality of Lancashire County by 2030.

2.3.12. Key performance indicators

Table 14. Key performance indicators for Use Case 3

Result	Indicator	Target
1	Cost of Action plan measures per inhabitant	<€10
2	Planned total C capture t/yr	7.2M
3	Net climate balance	0

2.4. The Case of the UK (#2) Scaling certified Regenerative Agriculture businesses: concerning reward and support for regenerative agriculture conversions

Sustainable farming requires a site-specific farming system that integrates farm economic viability with the environment and society over the long-term. Promoting this approach has been LEAF's mission for 30 years. As one its activities, LEAF certifies "sustainable farms" implementing LEAF's Integrated Farm Management (IFM) programme with the LEAF Marque, currently covering 375.679 ha in Europe. The programme includes 9 sections: soil management & fertility, organisation & planning, crop health & protection, pollution control & by-product management, animal husbandry, energy efficiency, water management, landscape & nature conservation, and community engagement.

There are many opinions on what regenerative agriculture is, however we believe it is not something that can be defined merely by the outcomes, nor the practices and tools used – it is a mindset that takes you on a journey and involves generation as well as regeneration. It involves:

- Regenerating the health of our soils
- Generating knowledge, collaboration, and relationships
- Generating healthy and resilient food and farming solutions
- Regenerating land and ecosystems
- Generating value
- Generating carbon and wider climate change solutions

The 5 core principles (as below) aim to exceed the goals of sustainable agriculture, by revitalising and regenerating the soil and wider environment, not just minimising the impact of production. The 5 core principles of regenerative agriculture:

- Keep the soil surface covered as much as possible
- Try to limit the amount of physical and chemical disturbance of the soil as much as possible
- A wide diversity of plants is encouraged to increase soil biodiversity
- Keep living roots in the soil for as much of the year as possible
- Integrate grazing livestock into the system

Farrington's Oils, a LEAF-certified business and LEAF demonstration farm in Northamptonshire, UK, implemented regenerative agriculture on its 290 ha in 2002 (no tillage, crop rotations, etc.). Between 2002 and 2016, soil organic matter (SOM) increased from 3.8% to 6.3% while nutrient availability, as measured by Cation Exchange Capacity, increased from 14 to 32 meq/100 g. As such, the farm has sequestered around 23.4 t C per ha in a little over a decade.

They cold press their rapeseeds to produce a high-quality and nutritious rapeseed oil (e.g. rich in vitamin E, rich in omega 3 oils, low saturated fat, etc.). It is marketed under the zero-plastics, zero-emissions certified Mellow-Yellow Rapeseed Oil brand. Their Reg Agri approach is representative of converted farmers, and seeks to:

- Produce food with the lowest environmental impact

- Increase SOM to increase the nutritious value of agricultural products
- Foster the potential of soil to contribute to climate solution by sequester C.

2.4.1. Overall Objective and Specific Aims

The overall objective of this case study is to addresses cultivation within a regenerative agriculture-related certification scheme. Ideally, the case study will operationalise the deployment of AgriCapture to empower certified regenerative agriculture production. The case study will define, promote, support, and monitor regenerative agricultural practices in rapeseed production that boost nutrient use efficiency, enhances soil health, and ensures productivity. Throughout this use case, peer-to-peer knowledge exchange and C-learning opportunities will be facilitated and encouraged.

To deliver this objective, the specific objectives are:

- To provide the necessary inputs for the establishment of the AgriCapture platform.
- To demonstrate the benefits of the AgriCapture platform.
- Deliver activities and opportunities to promote regenerative agricultural practices and/or reduce emissions on farm.
- Develop a portfolio of audio and visual resources to evidence and support the case study.
- Gap analysis of existing LMq standard in regards to regenerative agrcultural practices.

2.4.2. AgriCapture partners involved

The lead partner of the use case is Farrington Oils, working closely with LEAF.

OCW will seek to certify Duncan as reg agri and carbon credit certified – measure footprints of farms (baseline, +1), map current interventions using questionnaire and collect soil sample data (<5 years?), model UK interventions (LEAF/others support farmers in management/practice choice), develop compensation for practices (carbon credits).

Close liaison with WP2 engagement partners and WP3 tech partners is also envisioned with regards to co-development activities.

2.4.3. AgriCapture Services to be used

The use case will include deployment and testing the following AgriCapture services:

Explore	Support	Validate	Quantify
Tools to assess how sustainable practices affect fields, farms and income	*Digital agricultural advisory services tailored to sustainable farming*	*Remote assessment of whether sustainable practices are being implemented*	*Cost-effective & accurate estimates for changes in soil carbon overtime*
✓	✓	✓	✓

The use case will form part of the business case for use of the AgriCapture platform and tool as a digital support platform to

(i) "Explore" Reg Agri practices and potential new revenue streams for Reg Agri farmers,

(ii) Seek to verify the potential of the "Validate" services for remote inspections in line with LEAF Marque certification procedures,

(iii) Tailor "Support" tools to lower input use in this specific farm system.

Finally, the use case will also look to link the AgriCapture "Quantify" service to a farm to fork footprint, potentially providing a strong marketing tool for FrOils.

2.4.4. End users involved

The use case includes the following end-users in testing AgriCapture services:

Farmers	Farmer coops/ groups	3rd party auditors	Agri-service providers	Public bodies	Sust. agri. certifier	Zero emissions certifier
✓	✓	TBD	✓		✓	✓
LEAF Network + others	LEAF	NSF, SAI Global, others	LEAF, GWCT, other		LEAF Marque certifiers	OCW

2.4.5. Characterisation of test farms

- Northamptonshire UK
- 290 ha
- Highly engaged farmer (LEAF Demonstration Farm) and family owned
- Rapeseed
- Regenerative practices used:
    - No/minimum tillage

- No inputs (fertilizer/pesticides, applications of manure/compost)
- Cover crops
- Intercropping (companion crops)
- Crop rotation
- Buffer/nature strips (beetle banks, flower rich margins, winter food margins, grass margins), field ponds, and hedgerows
- Mulching

2.4.6. Use case activities

Table 15. Activities in Use Case 4

Activities		Frequency				
		Once	Several times	Monthly	Annually	Cont-inuous
1	Use case kick-off		●			
1.1	Prepare required materials		●			
2	Establish a baseline	●				
2.1	Create shape file and send to WP3 partners	●				
2.2	Provide data to OCW to measure footprint of farm/value chain operations				●	
2.3	Soil samples taken and analysed				●	
3	Supporting farmers (use app, agronomic practices, etc.)		●			
3.1	Training/ Support workshops		●			
3.2	Collecting data and feedback from farmers		●			
5	Promote	●	●			●
5.1	Promote					●
5.2	Promoting AgriCapture at national/regional opportunities (e.g. farmer events)		●			
5.3	Translate communication materials	●				
6	Manage use case					●
6.1	Maintain financial records					●
6.2	Maintain contact list of farmers					●
6.3	Implement & maintain GDPR best practices					●

2.4.7. Steps for implementation – Methodology

- Data collection (annual)
- Data analysis and generating baseline (annual)
- Workshops/podcasts/blogs/videos (continuous)
- LEAF Marque audit (prior = data collection and verification – potentially using AC services) (annual)
- UN Carbon Neutral audit(?) certification (annual)
- LEAF Marque Standard evaluation
- AgriCaptureCO2 support/promotion

2.4.1. Milestones

The major milestones of the use case are:

Table 16. Major milestones of Use Case 4

#	Name	Month	How you know you reached it
1	Baseline definition	5	Shapefiles provided to WP3 and historical data provided to OCW
2	Use case operation plan & evaluation methodology	5	Agreement on an operation plan
3	Assessment of interventions and gap analysis		
4	KE session with farmer(s) and LEAF Network	11, 16, 22, 28	Trainings
5	Workshop – sharing findings	14, 26	Event held

2.5. The Case of Serbia
Overcoming financial barriers to sustainable agriculture

As a consequence of burning residual crop stubble, the air quality in south-eastern Europe is significantly damaging to human health in October of every year. Indicatively, for several days in October 2019 Belgrade had the 3rd highest pollution of any city in the world.

In addition, productive agricultural areas use intensive practices, including deep tillage, blanket synthetic pesticides applications, large mineral fertiliser doses, etc., which have damaged waterways, biodiversity and air quality. Also, they lead to diminishing SOM, which lowers soil quality. Some of these practices are limited by law, but limits are ineffectual in practice. Nonetheless, Serbia and other Western Balkan countries must not

only adopt *Acquis Communautaire* of the EU, but it is increasingly likely they will have to demonstrate effective implementation under new proposals for reforms during the Accession process.

Without a change in the structure of public subsidy programmes and effective monitoring, there is little economic incentive for farmers to experiment with new management options that would address environmental issues. The project intends to make use of the AgriCapture platform and its potential to cost-effectively quantify and verify C offsets to create a project under the UN's CDM. Farmers belonging to UPOR, an agri-cooperative in an intensively farmed region within 50 km of Belgrade, will be used both as a test-users as well as demo farms to disseminate the approach and scale the approach after the project. Required exchanges with the Ministry for Environmental Protection, Climate Change Office is needed for CDM approval. Contact will also be established with the Ministry of Agriculture to discuss policy recommendations and inform future agricultural reforms in Serbia needed to match post-reform CAP and meet Accession criteria.

2.5.1. Overall Objective and Specific Aims

The overall objective is to promote, support and monitor regenerative agricultural practices in crop production in Serbia and West Balkans in order to enhance soil health, increase farmers' profit, decrease seasonal air-pollution before the heating season and improve biodiversity in agricultural landscapes. Thus, to create a model for wider adoption of regenerative agriculture that will be supported by digital decision tools and financial incentives.

To deliver this objective, the specific objectives are:

- To provide the necessary inputs, at farm level, for the establishment of the AgriCapture platform
- To demonstrate actions regarding the benefits and the use of the AgriCapture platform.

2.5.2. AgriCapture partners involved

The lead partner of the use case is UPOR. UPOR will be working closely with Gilab.

2.5.3. AgriCapture Services to be used

The use case will include deployment and testing the following AgriCapture services:

Explore	Support	Validate	Quantify
Tools to assess how sustainable practices affect fields, farms and income	*Digital agricultural advisory services tailored to sustainable farming*	*Remote assessment of whether sustainable practices are being implemented*	*Cost-effective & accurate estimates for changes in soil carbon overtime*
✓	✓	✓	✓

2.5.4. End users involved

The use case includes the following end-users in testing AgriCapture services:

Farmers	Farmer coops/ groups	3rd party auditors	Agri-service providers	Public bodies	Sust. agri. certifier	Zero emissions certifier
✓	✓		✓			✓
A number of farmers that have already applied reg. practices, as well as new farmers that have not	UPOR, others		State agriculture advisory services: -Institute Tamis Pancevo -Agri-support point Ruma			OCW

2.5.5. Characterisation of test farms

Number of selected farms are 15. One farm belongs to the State Agriculture Advisory Services with an experimental field, while others are family-owned farms.

They are located in north-east part of central Serbia near the river Danube and in the northern Autonomous Province of Vojvodina. The farms include all productive soil types.

Of the farms included, all except one have have been practicing regenerative agriculture for more than seven years (e.g. reduced or mulch tillage, no till with proper weed management and proper plant protection). One farm has not yet implemented any practices of regenerative agriculture. Only one farm is a diary production farm. Others are arable crops farms with winter wheat, corn, sunflower and soybean.

Only two farms established cover crops in the last two years. Farms covered parts with less precipitations in winter and summer period, wind and water erosion and reduction of organic matter in the soil during the last 65 years by 1.5-3%.

The selected farmers are divided in two groups:

- The first group includes four farmers which represent the Farmers association of Ruma Municipality (UPOR) with fields where they set on the basic principles of regenerative agricultural practices by comparing it with conventional production. This group is called *developing farms*.
- The second group includes farmers who have been practicing regenerative agriculture in production for more than seven years. This group is called *demonstration farms*.

2.5.6. Use case activities

Table 17. Activities in Use Case 5

Activities		Frequency				
		Once	Several times	Monthly	Annually	Cont-inuous
1	Use case kick-off		●		●	
1.1	Prepare required materials		●			
1.2	Workshops to introduce AgriCapture to new farmers (based on new farmers included in the process of the project)				●	
2	Establish a baseline				●	
2.1	Define parcels to be used				●	
2.2	Create shape file and send to WP3 partners				●	
2.3	Provide data to OCW to measure footprint of farm/value chain operations				●	
2.4	Soil samples taken and analysed				●	
3	Supporting farmers (use app, agronomic practices, etc.)		●			●
3.1	Training/ Support workshops		●			
3.2	Collecting data and feedback from farmers					●
4	Support/liaise with end-users		●		●	●
4.1	Recruit new farmers				●	
4.2	Provide help and technical support in reaction to end-user requests					●
4.3	Collect and provide data to OCW, WP3, etc.		●			

5	Promote	●	●			
5.1	Promoting AgriCapture at national/regional opportunities (e.g. farmer events)		●			
5.2	Translate communication materials		●			
5.3	Organise final demo day	●				
6	Manage use case					●
6.1	Maintain financial records					●
6.2	Maintain contact list of farmers					●
6.3	Implement & maintain GDPR best practices					●

2.5.7. Steps for implementation – Methodology

Implementation will have the following sequence:

Step 1.
Defining the relevant monitoring parameters from the studied parcels that are needed to establish the Agricapture platform

Monitoring parameter or procedure in parcels	Number of samples/monitoring parameters per time	Parameters per sample
Soil moisture monitoring	Soil samples taken on experimental field with long term 4 different tillage systems/ Frequency: Every 10 days through vegetation period of crop	soil moisture
Soil nutrient content	Soil sampling at specific locations, depth 0-5 cm; 5-10 cm; 10-20cm and 20-30 cm/	pH, CaCO3, available phosphorus and potassium (P2O5 and K2O)
Soil organic matter	Soil sampling at specific locations depth 0-5 cm; 5-10 cm; 10-20cm and 20-30 cm/	Organic matter in %, organic C
Efficiency of cover crop mix	Soil sampling at specific locations/ Frequency: Every year	Available N for next crop as $N\text{-}NO_3$, from 0-90 cm
Coverage harvest residues and management	Measuring for each registered field/ Frequency: Every year after harvest	Coverage in % and t/ha
Soil compaction	Measuring for each registered field/ Frequency: Every year before and after crop production	Using data from penetrometer
Yield	Measuring for each registered field/ Frequency: Every year in harvest	Yield in t/ha
Fuel use per ha	Collecting data and feedback from farmers/Frequency: Continuous	Amount in liters

Application of fertilizers	Records of types and quantities of applied fertilizers/ Frequency: Continuous	Type, amount, time and place
Meteorological data sets	Ground stations and local data estimation with DailyMeteo model / Frequency: Continuous	Temperature, precipitation

Step 2.
Reference points 1, 2 and 3 (Baseline)

Based on the historical data of the parcels, OCW will count emissions for each parcel regarding the already applied practices - (Reference point 1).

Based on the historical data of the parcels, KPIs will be counted for each studied parcel - (Reference point 2).

Step 3.
Farm level under the proposed practices – comparison with Reference points 1 and 2.

In the parcels where Reg Agri practices have already been applied, redesign of the practices will be done (if applicable) to further reduce emissions and increase C offsets. In the new Reg Agri parcels (where there is no history of Reg Agri), the practices will be designed and advised. The new Reg Agri parcels will be divided into 2-3 parts while one part will be done in the traditional way, and on the other part(s), a combination(s) of Reg Agri practices will be applied. This will facilitate the comparison of the KPIs.

The emissions and the KPIs will be recounted and recorded in each year and for each studied parcel, compared to the Reference point 1 and 2, respectively.

Agricultural Practices that will be advised to be applied in farm scale (recorded):

- Cover crops
- Minimum and no-tillage
- Soil mulching (leaving crop residues)
- Integrated crop protection management (IPM for crops)
- Avoid unnecessary passages in the field and less soil compaction
- Measuring the needs of plants for N and appropriate application

2.5.8. Milestones

The major milestones of the use case are:

Table 18. Major milestones of Use Case 5

#	Name	Month	How you know you reached it
1	Baseline definition	5	All parcels defined, shapefiles provided to WP3, historical data provided to OCW
2	Use case operation plan & evaluation methodology	5	Agreement on an operation plan
3	Informative session with farmers	7, 19, 30	Trainings
4	Workshop	32	Final event
5	Evaluation processes of the Agricapture platform	15, 27	Agricapture platform validation

2.5.9. The timeline

The activities, steps and major milestones cover the following:

Table 19. Gantt chart of Use Case 5

Activities		Duration		2021												2022												2023											
		Start	End	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Use case kick-off**	**M3**	**M28**																																				
1.1	Prepare required materials	M3	M27																																				
1.2	Workshops to introduce AgriCapture to new farmers	M4	M28																																				
2	**Establish a baseline**	**M3**	**M34**																																				
2.1	Define parcels to be used	M3	m27																																				
2.2	Create shape file and send to WP3 partners	M3	M27																																				
2.3	Provide data to OCW to measure footprint of farm/value chain operations	M6	M30																																				
2.4	Soil samples taken and analysed	M7	M34																																				
3	**Train farmers (use app, agronomic practices, etc.)**	**M5**	**M35**																																				
3.1	Training/ Support workshops	M6	M30																																				
3.2	Collecting data and feedback from farmers	M5	M35																																				
4	**Support/liaise with end-users**	**M3**	**M35**																																				
4.1	Recruit new farmers	M3	M27																																				

4.2	Provide help and techincal support in reaction to end-user requests	M3	M35
4.3	Collect and provide data to OCW, WP3, etc.	M3	M35
5	**Promote**	**M3**	**M35**
5.1	Promoting AgriCapture at national/regional opportunities	M3	M35
5.2	Translate communication materials	M3	M27
5.3	Organise final demo day	M33	M33
6	**Manage use case**	**M3**	**M35**
6.1	Maintain financial records	M3	M35
6.2	Maintain farmer contact list	M3	M35
6.3	Implement & maintain GDPR best practices	M3	M35

2.5.10. Business case in brief

There is large potential to deploy AgriCapture in the modality used in this use case for agri-environmental projects in Western Balkan countries and other EU Candidate/Potential Candidate countries, to address soil degradation as a result of intensive agriculture, seasonal air-pollution before the heating season, improve biodiversity in agricultural landscapes, and other measures that are likely to feature in the reformed CAP. In addition, this modality can also be used for Carbon offsetting projects including CDM project in developing countries (i.e. UNFCCC non-Annex I countries), for voluntary carbon credtt programmes, and regenerative certification that would generate incentives for farmers.

2.5.11. Expected results

The expected results of the project are to create a model that will motivate farmers to change the traditional agricultural practices and adopt regenerative agriculture and improve environmental profile of Serbian agriculture. The model will include the methodology for certification of Carbon credits and regenerative agriculture certification that will provide the incentives to farmers. Furthermore, the digital decision tools will support the optimization of the production process.

2.5.12. Key performance indicators

Table 20. Key performance indicators for Use Case 5

Result	Indicator	Target
1	C sequestration per ha	+10%
2	Application of fertilizers per ha	-20%
3	Fuel use per ha	-10%
4	Effects on soil quality (OM in top 10 cm, soil moisture)	+15%
5	Reducing soil compaction	-10%

2.6. The Case of Kenya
Creating a certified methodology for integrated sustainable flower cultivation supported by digital decision tools and financial incentives

The case study is in Kenya, positioned on the equator on Africa's east coast. The study focuses on the horticultural sector, specifically flower production, which is Kenya's second largest export after tea. Flower production contributes around 1% of the country's GDP

and is also one of the country's largest source of employment, with over 100,000 people working directly in the flower industry and an estimated two million indirectly.

Kenya has a complex and variable climate ranging from warm and humid in the coastal regions to arid and very arid in the interior. The Kenyan economy is very dependent on climate-sensitive sectors such as agriculture including horticulture, water, energy, tourism, wildlife, and health.

According to the World Bank Climate Country Adaptation Profiles[1] projections under the worst-case scenario (RCP 8.51) show that temperature is projected to increase by 1–2.8°C by 2060, with the western regions of Kenya experiencing the greatest warming. The reliance on rain-fed agriculture is a major risk of climate change, which is expected to negatively affect human health, reduced crop and livestock production, food security and increase poverty levels (Kabubo-Mariara and Kabara, 2018).

Horticultural crops, which are quite diverse, are particularly sensitive to the impacts of climate change due to their high water demand and strict temperature requirements. Climate change in the form of increased or decreased rainfall, increased temperature and drought, lack of water for irrigation, and vulnerability to pests and diseases can affect the suitability of areas for growing horticultural crops.

Climate change presents one of the greatest challenges to the productivity and sustainable growth of the horticultural sector in Kenya and climate change mitigation should consider the following core elements:

- better management of existing water resources
- higher soil water retention capacity through boosting Soil Organic Matter (SOM)
- higher soil water retention by lowering transpiration through timely pruning and cover crops
- reduced use of chemicals (pesticides, fertilizers etc.)
- promote biodiversity and ecosystem services, etc.

This project aims to bring together 3 core areas of regenerative agriculture practices, earth observation technology, and certified methodology to set out and demonstrate a clear path to building resilience, reducing emissions and increasing carbon credit yields for farmers in Kenya.

[1] https://climateknowledgeportal.worldbank.org)

A representative sample of cut flower producers have been selected. The proposed services will benefit farmers, processors, retailers, and end-users and is expected to cover the whole supply chain.

It is planned that this case study is scalable, presenting significant opportunities across Kenya.

2.6.1. Overall Objective and Specific Aims

The overall objective is to bring together regenerative interventions, Earth Observation technology and approved methodology to generate a robust and streamlined approach to reduced emissions and increased carbon credit yields for farmers that adopt "better agricultural practices". This will boost water use efficiency, enhance soil health, ensure productivity, and improve resilience against climate change. Thus, to create a certified methodology that applies an integrated model of sustainable flower cultivation supported by digital decision tools and financial incentives, to be disseminated across Kenya.

To deliver this objective, the specific objectives are:

- To provide the necessary inputs for the establishment of the AgriCapture platform.
- To demonstrate the benefits of the AgriCapture platform.
- Bring together 3 areas of regenerative farming interventions, earth observation and methodology that will enable access to the carbon markets by farmers.
- To apply appropriate actions to promote and achieve compensation for applied regenerative interventions and/or reduced emissions at farm level or in different parts of the whole production chain - Farm Level, processor and retailer.
- Methodology development and certification.

2.6.2. AgriCapture partners involved

The lead partner of the use case is OCW.

Close liaison with WP3 tech partners is also envisioned with regards to co-development activities.

2.6.3. AgriCapture Services to be used

The use case will include deployment and testing the following AgriCapture services:

Explore	Support	Validate	Quantify
Tools to assess how sustainable practices affect fields, farms and income	*Digital agricultural advisory services tailored to sustainable farming*	*Remote assessment of whether sustainable practices are being implemented*	*Cost-effective & accurate estimates for changes in soil carbon overtime*
✓	✓	✓	✓

2.6.4. End users involved

The use case includes the following end-users in testing AgriCapture services:

Farmers	Farmer coops/ groups	3rd party auditors	Agri-service providers	Public bodies	Sust. agri. certifier	Zero emissions certifier
✓	✓	✓				✓
Multiple flower farms		VERRA 3rd Party Verifiers				OCW

Other end-users include: retailers.

2.6.5. Characterisation of test farms

Flamingo Horticulture

Flamingo's world-class farms in Africa are situated in Kenya (near Mt Kenya and Lake Naivasha) and in South Africa (near Johannesburg).

The Kenyan farms cover a combined total of 1,856 ha. Situated on the equator at high altitude, Kenya offers ideal growing conditions for flowers and vegetables, with consistent temperatures and regular rainfall.

- Siraji – Mount Kenya (Spray Carnations, large headed roses)
- Kingfisher- Naivasha – (Roses, Spray Carnations, Fresh produce)
- Flamingo – Naivasha – (Roses and Fillers)

2.6.6. Use case activities

Table 21. Activities in Use Case 6

Activities		Frequency				
		Once	Several times	Monthly	Annually	Cont-inuous
1	Use case kick-off		●		●	
1.1	Prepare required materials		●			
1.2	Workshops to introduce AgriCapture to new farmers				●	
2	Establish a baseline				●	
2.1	Define parcels to be used				●	
2.2	Create shape file and send to WP3 partners				●	
2.3	Provide data to OCW to measure footprint of farm/value chain operations				●	
2.4	Soil samples taken and analysed				●	
3	Supporting farmers (use app, agronomic practices, etc.)		●			●
3.1	Training/ Support workshops		●			
3.2	Collecting data and feedback from farmers					●
4	Support/liaise with end-users		●		●	●
4.1	Recruit new farmers				●	
4.2	Provide help and technical support in reaction to end-user requests					●
4.3	Collect and provide data to key partners and other WPs, etc.		●			
5	Promote	●	●			
5.2	Promoting AgriCapture at national/regional opportunities (e.g. farmer events)		●			
6	Manage use case					●
6.1	Maintain financial records					●
6.2	Maintain contact list of farmers					●
6.3	Implement & maintain GDPR best practices					●

2.6.7. Steps for implementation – Methodology

Implementation will have the following sequence:

- Analyse the carbon footprint data
- Collect soil samples available
- Send Shape File to allow for monitoring and verification of intervention's
- Intervention's screening form and gap analysis

- Advice and support on implementing additional intervention practices
- Create a bespoke methodology bringing together 3 core areas of regenerative agriculture practices, earth observation technology, and certified methodology
- Register project with VERRA
- Verification of carbon credits (independent 3rd party verification is required)
- Compensation to farms through sale of carbon credits
- Continual improvement cycle (for example soil sequestration and water retention).

2.6.8. Milestones

The major milestones of the use case are:

Table 22. Major milestones of Use Case 6

#	Name	Month	How you know you reached it
1	Baseline definition	5	All parcels defined, shapefiles provided to WP3, and carbon footprint analysed.
2	Design bespoke methodology	18	V2 Methodology created.
3	Assess implemented interventions	18	Intervention's screening assessment complete.
4	Use Earth Observation to verify interventions	18	Satellite verification report.
5	Register project with VERRA	24	PDD and Monitoring Plan submitted to VERRA.

2.6.9. The timeline

The activities, steps and major milestones cover the following:

Table 23. Gantt chart of Use Case 6

Activities		Duration		2021												2022												2023											
		Start	End	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Use case kick-off**	**M3**	**M27**																																				
1.1	Prepare required materials	M3	M26																																				
1.1	Prepare required materials	M4	M27																																				
2	**Establish a baseline**	**M3**	**M29**																																				
2.1	Define parcels to be used	M3	M26																																				
2.2	Create shape file and send to WP3 partners	M5	M28																																				
2.3	Provide data to OCW to measure footprint of farm/value chain operations	M6	M29																																				
2.4	Soil samples taken and analysed	M6	M29																																				
3	**Train farmers (use app, agronomic practices, etc.)**	**M5**	**M35**																																				
3.1	Training/ Support workshops	M6	M29																																				
3.2	Collecting data and feedback from farmers	M5	M35																																				

4	**Support/liaise with end-users**	**M2**	**M35**																																			
4.1	Recruit new farmers	M15	M15																																			
4.2	Provide help and techincal support in reaction to end-user requests	M2	M35																																			
4.3	Collect and provide data	M2	M35																																			
5	**Promote**	**M15**	**M35**																																			
5.1	Promoting AgriCapture at national/regional opportunities	M15	M35																																			
6	**Manage use case**	**M3**	**M35**																																			
6.1	Maintain financial records	M3	M35																																			
6.2	Maintain farmer contact list	M3	M35																																			
6.3	Implement & maintain GDPR best practices	M3	M35																																			

2.6.10. Business case in brief

This use case deploys AgriCapture to empower a new added-value brand using better agricultural practices. As such, it represents AgriCapture use across a value chain, allowing for brands to capture added-value to the environment/climate from agronomic practices, and to transfer financial benefits to all actors (including higher prices for farmers). This is representative of the offer that AgriCapture has for agri-cooperatives (like those involved) and agri-corporates that seek to seize upon increasing consumer valorisation of (certified) zero-emissions/"climate-friendly" products.

In addition, the use case will tailor AgriCapture for flower production. The global flower trade is a €15bn business, cut flowers are Kenya's second largest export after tea, contributing around 1% of the country's GDP. Kenya is the world's 3rd largest exported of fresh cut-flowers, supplying ~40% of all flower sales in the EU. Annual growth of the flower and ornamental plants over the next 5 years is expected to be in the region of 6.3% reaching $57.4 Billion USD in 2024, up from $42.4 Billion USD in 2019.

Climate change has and will bring widespread challenges to rain-fed practices such as flower farming and threatens the industry particularly in equatorial regions such as Kenya. AgriCapture support to a new Reg Agri approach to flower farms is timely in this context in order to build future resilience.

2.6.11. Expected results

The expected results of the project are to create, streamline, certify and scale the methodology that will promote, support and monitor regenerative agriculture practices across the flower farming industry. This can be applied to generate validated compensation and an added-value brand for farmers and their supply chain. Thus, to create a model of sustainable flower cultivation supported by digital decision tools and financial incentives from C offsets, to be disseminated across Kenya.

2.6.12. Key performance indicators

Table 24. Key performance indicators for Use Case 6

Result	Indicator	Target
1	Added value to products	+5%
2	C sequestration per ha	+3%
3	Water efficiency	+3%
4	Carbon neutrality status	Achieved within project timeframe
5	Verified carbon credits	Achieved within project timeframe

3. Evaluation methodology

Use cases are essential to the AgriCapture project, as the focal point between technical development and the contextual reality in which these developments will be applied – as such they are key to the co-development approach of the project.

Fully realising the ambition of the use cases is instrumental to advancing the co-development process. AgriCapture has a diverse collection of use cases, representing both the heterogeneity of agriculture as well as the range of potential users of the platform and its service. Thus, shortcomings in one use case will have consequences for the ultimate goal of the project as a whole – to develop valuable services and to launch them operationally/commercially by the end of the project.

This calls for a management and oversight, on the one hand, and support on the other. This will be provided through two main mechanisms:

- *Informal*: regular bilateral use case progress meetings (starting monthly), between ELGO as WP leader and each use case leader. The Project Manager and/or Project Coordinator will support initial meetings, and may be summoned as required.
- *Formal*: an evaluation of progress of the use case on the basis of the plan provided in this deliverable.

The latter will be an annual exercise.

ELGO will prepare two evaluation templates, one for the evaluator and one for self-evaluation. The evaluator will be ELGO. For Use Case 1 which is led by ELGO, Gilab as coordinator will have the role of evaluator. In turn, self-evaluation will be completed by the use case lead.

The templates will assess the following points:

- *Timeliness*, on the basis of milestones met and the timing, and the progress of activities on the basis of the timelines for each use case.
- *Impact*, on the basis of progress in regards to the use case KPIs.
- *Responsiveness*, on the basis of action points discussed during regular informal meetings and how/when they were addressed.
- *Assessment*, providing a reflection on lessons-learned, room for improvement, best-practices identified, etc.

If needed, the evaluation will also involve structured interviews with other use case participants.

The results will be structured into a *flash report* format, and will in turn be reported in the annual PILOT reports (i.e. D5.3, D5.4, D5.5).

4. Conclusion

The document provides a structured plan for each use case to implement use cases in the context of the AgriCapture project.

This is the main basis on which evaluation of progress will be formally measured, in addition to regular coordination and support from the WP-leader and the Project Management Team.

However, these plans are based on the perception of the project as it is positioned now; it is possible that future developments will present both new challenges and opportunities. As such, the plans will be dynamic in situations that justify updates. Any such changes will be documented in the annual PILOT reports (i.e. D5.3, D5.4, D5.5).

5. References

Kabubo-Mariara, J. and Kabara, M., 2018. Climate change and food security in Kenya. In: Agricultural Adaptation to Climate Change in Africa, Routledge in Association with GSE Research, Abingdon-on-Thames: 55-80.

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