Project Acronym:	**LIFE GAIA Sense**
Grant Agreement number:	**LIFE17 ENV/GR/000220**
Project Title:	**LIFE GAIA Sense: Innovative Smart Farming services supporting Circular Economy in Agriculture**

DELIVERABLE

Documentation of Use Case Existing Agricultural Practices and Restraints, Requirements, Needed Interventions and KPIs

Type of Document	Deliverable
Contractual date of delivery	12/2018
Deliverable Leader	NP
Status – version, date	Revised version – v.1.1, 28/06/2019
Action	A1

Project co-funded by the European Commission within the LIFE 2014-2020 programme		
Dissemination Level		
P	**Public**	
C	**Confidential, only for members of the consortium and the Commission Services**	**X**

As this report is confidential, the uploaded document does not contain all the information/ content and all the chapters that were included at the "original" report.

This deliverable was produced under the co-finance of the European financial instrument for the Environment (LIFE) programme during the implementation of the project "LIFE GAIA Sense" (LIFE17 ENV/GR/000220).

Executive Summary

The purpose of the deliverable Documentation of Use Case Existing Agricultural Practices and Restrains, Requirements, Needed Interventions and KPIs is to provide all the information about the 13 Use Cases that participate in the project from the first year.

The information concern the profiling of the organization, the main characteristics of the crops, the agricultural practices, the irrigation, fertilization and pest management challenges and needs as well as some information about the marketing of the products. The information was obtained during the Informative Meetings in a face2face manner (see also deliverable "Informative meetings report, including list of demonstration parcels and telemetric stations network deployment plan").

Additionally, the deliverable describes the methodology developed by NP for defining the final location of the telemetric stations (gaiatrons) for each Use Case based on climate/soil conditions and presents the final list of selected farmers and parcels participating in the project.

Role	Name (Organisation)
Deliverable Leader:	K. Michos (NP)
Contributors:	A. Baglatzi, K. Michos, N. Marianos (NP)
Reviewers:	V. Tsafaraki, I. Kalyva (GAIA)
Approved by:	A. Baglatzi (NP)

Version	Date	Contributor(s)	Description
0.1	07/12/2018	K. Michos, A. Baglatzi, N. Marianos	Initial version for internal review
0.2	12/12/2018	A. Baglatzi, N. Marianos, K. Michos	Draft version for review
0.9	20/12/2018	V.Tsafaraki, I. Kalyva	Reviewed version
1.0	31/12/2018	A. Baglatzi	Final version
1.1	28/06/2019	A. Baglatzi	Revised version
1.1.S	15/09/2020	V. Pyrgiotis (NP)	Summary

Table of Contents

List of Figures

List of Tables

Definitions, Acronyms and Abbreviations

Acronym	Title
GAIA	GAIA EPICHEIREIN ANONYMI ETAIREIA PSIFIAKON YPIRESION
NP	NEUROPUBLIC AE PLIROFORIKIS & EPIKOINONION
SF	Smart Farming
CE	Circular Economy
COSTEIRA	VIÑA COSTEIRA SCG
MIRABELLO	Agricultural Cooperative Partnership Mirabello Union S.A.
VELVENTOS	Agrotikos Synetairismos Epexergasias kai Poliseos Oporokipeftikon Proionton (ASEPOP) Velventou SYN.P.E
CONFAGRI	Confederação Nacional das Cooperativas Agrícolas e do Crédito Agrícola de Portugal CCRL
ORESTIADA	Enosi Agrotikon Synetairismon Orestiadas
AIGINA	Omada Pagagogon Kelyfotou Fistikiou Aiginas
ELASSONA	Agrotikos Synetairismos Fytikis kai Zoikis Paragogis – Enosi Elassonas
KOMOTINI	Thrakika Ekokkistiria
DRAMA	Enosi Agrotikon Synetairismon Dramas
SPEKO-PESKO	Koinopraksia Agrotikon Synetairismon –SPEKO-PESKO
KIATO	Geoponiki Kiatou
STYLIDA	Stylis Olive Producers Cooperative
THESTO	Agricultural Cooperative of Thessalian Tomato Producers
THESGI	Farmers' Cooperative of Thessaly
NATURA	Network of nature protection areas in the territory of the European Union
NITROPOLLUTION	Areas vulnerable to Nitropollution usually, due to intense agriculture activity were nitrate ions may leach from the soil to surface and underground aquatic bodies (such as sea gulfs, rivers, underground waters) leading to increased levels of nitrate salts concentration.
LASITHI	Enosi Agrotikon Synetairismon Oropediou Lasithiou
gaiatrons	NP's telemetric stations

1. Introduction

1.1. Project Summary

The main objective of the LIFE GAIA Sense project is to demonstrate gaiasense, an innovative "Smart Farming" (SF) solution that aims at reducing the consumption of natural resources, as a way to protect the environment and support Circular Economy (CE) models.

More specifically, this project will launch 18 demonstrators across Greece, Spain and Portugal covering 9 crops (olives, peach, cotton, pistachio, potato, table tomatoes, industrial tomatoes, grapes, kiwi, walnut) in various terrain and microclimatic conditions. They will demonstrate an innovative method, based on high-end technology, which is suitable for being replicated and will be accessible and affordable to Farmers either as individuals or collectively through Agricultural Cooperatives.

Moreover, LIFE GAIA Sense aims to promote resource efficiency practices in SMEs of the agricultural sector and eventually, contribute to the implementation of the Roadmap to a Resource Efficient Europe. This project will demonstrate a method on how the farmer will be able to decide either to use or avoid inputs (irrigation, fertilizers, pesticides etc.) in a most efficient way, without risking the annual production. The focus is on the resource consumption reduction side of CE, and the results will be both qualitatively and quantitatively, considering the resources' efficiency in agricultural sector.

1.2. Document Scope

The main scope of this deliverable is to describe the Use Cases and their related demonstrators. The Use Cases and their demonstrators can be regarded as the "heart" of the project as they will provide the parcels to place the telemetric stations (gaiatrons) and all the necessary data to develop, implement and test the smart farming solutions described in the project. Participants of each Use Case work hand-in hand with the consortium and the scientific experts.

For the first year of the project, 13 Use Cases have been identified, 11 of them located in Greece, 1 in Spain and 1 in Portugal. During the Informative Meetings (deliverable "Informative meetings report, including list of demonstration parcels and telemetric stations network deployment plan"), awareness was raised and a common communication language was established among the farmers, agronomists, farming advisors and consortium members regarding the goals of the project, the methodology that will be followed and the role of each member of the Use Cases.

With a combination of face2face discussions and questionnaires, the profile of each Use Case was obtained containing information about the current agricultural practices, the constraints and the difficulties the producers face. To ease the process and organize the information, a template was designed and used for each Use Case.

Moreover, in this deliverable the methodology for defining the location of the gaiatrons is being described by exhibiting the data sources, the spatial analysis for defining the climate/soil zones and the placement study which output is the final list of selected farmers and parcels.

The deliverable was revised to include the information about the Use Case LASITHI, which replaced the Use Case DRAMA.

2. Documentation of Use Case Existing Agricultural Practices and Restrains, Requirements, Needed Interventions and KPIs – Summary

In order to achieve the main objective of the project which is to demonstrate the gaiasense solution as a SF solution that helps farmers to decide either to use or avoid inputs (i.e. irrigation, fertilizers, pesticides etc.) in a more efficient way, 18 demonstration areas (13 for the first year and 5 for the second year of the project) across Greece, Spain and Portugal, covering 9 crops (olive, peache, cotton, pistachio, potato, table tomato, industrial tomato, kiwi, grape and walnut) have been chosen. For each Use Case one demonstrator is set up consisting of a number of parcels and gaiatrons (telemetric stations).

In order to find the most appropriate candidate Use Cases, following factors have been considered:

- To cover a wide range of crops
- To find Use Cases that have a significant economic impact
- To cover a great variety of terrain and microclimatic conditions.

The success of the project depends a lot on the willingness of the local producers and agronomists to actively participate in the project. Therefore, their level of interest has been also taken into account when choosing the Use Cases.

The 11 Use Cases in Greece, 1 in Spain and 1 in Portugal are shown in Table 1:

Table 1: Use Cases of the 1st year of the LIFE GAIA Sense project

Country	Region	Organization	Acronym	Crop
Greece	Eastern Macedonia and Thrace	Enosi Agrotikon Synetairismon Orestiadas	ORESTIADA	cotton
	Western Macedonia	Agrotikos Synetairismos Epexergasias kai Poliseos Oporokipeftikon Proionton (ASEPOP) Velventou SYN.P.E	VELVENTOS	table peach
	Attica	Omada Paragogon Kelyfotou Fistikiou Aiginas	AIGINA	pistachio
	Thessaly	Agrotikos Synetairismos Fytikis kai Zoikis Paragogis – Enosi Elassonas	ELASSONA	walnut
	Crete	Enosi Agrotikon Synetairismon Oropediou Lasithiou	LASITHI	potato
	Central Macedonia	Kinopraxia Agrotikon Synetairismon SPEKO-PESKO	SPEKO-PESKO	kiwi
	Peloponnese	Geoponiki Kiatou	KIATO	table tomato
	Central Greece	Stylis Olive Producers Cooperative	STYLIDA	table olives

	Thessaly	Agricultural Cooperative of Thessalian Tomato Producers	THESTO	industrial tomato
	Thessaly	Farmers' Cooperative of Thessaly	THESGI	cotton
	Crete	Agricultural Cooperative Partnership Mirabello Union S.A.	MIRABELLO	olive
Spain	Galicia	VIÑA COSTEIRA SCG	COSTEIRA	grape
Portugal	Alentejo	Confederação Nacional das Cooperativas Agrícolas e do Crédito Agrícola de Portugal CCRL	CONFAGRI	olive

The spatial distribution of the Use Cases can be seen in Figure 1

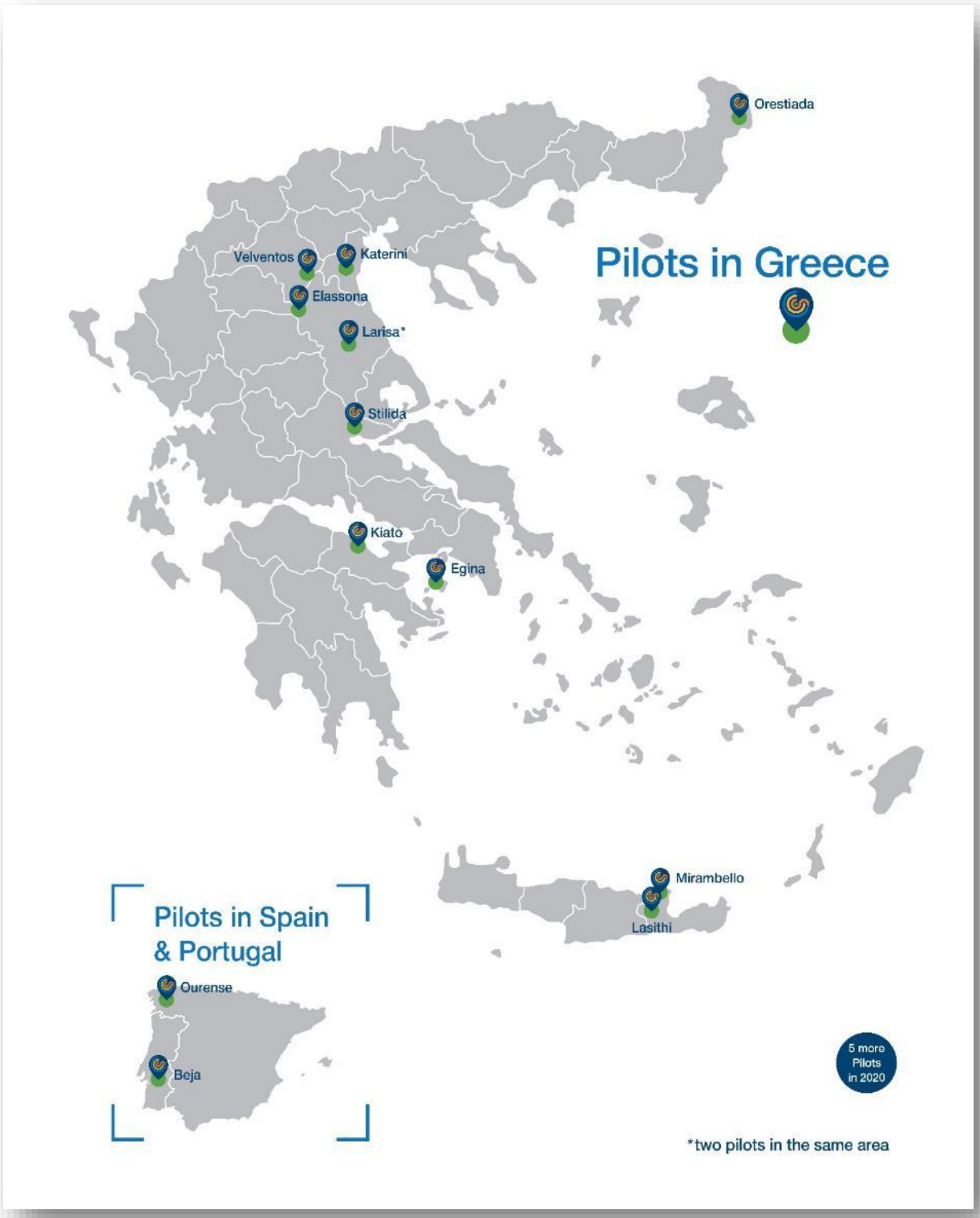

Figure 1: Spatial distribution of the Use Cases participating in the LIFE GAIA Sense project

During the Informative Meetings a wealth of information for each Use Case about the actors, the profile of the organizations as well as their needs and challenges has been obtained. Lean/co-creation approaches have been chosen as the most appropriate ones for raising awareness, retrieving information and establishing a common communication ground between the Use Case actors and the project. The main actors of each Use Case that could be identified, were producers/farmers and agronomists/farming advisors.

During the Informative Meetings, face2face interviews with the different actors have been held. The main goal was to obtain a better understanding of the current cultivation practices, as well as the current fertilization, irrigation and pest management processes and challenges.

As far as KPIs are concerned, LIFE Gaia Sense aims at introducing a SF solution for the better use of resources in the agricultural sector in line with the EC resource efficiency – related policy. It can be seen as a very efficient and realistic solution for implementing the EU policies in the areas of water, waste and air.

The results of former pilots, already implemented by NP, show very promising results, and depending on the crop type can reach up to:

- 30% improved nitrogen use efficiency
- 11-25% reduction of pesticides use
- 25% less water (power) consumption

Within the scope of the project, these indicators have been further analyzed and specified.

In order to reach the targets set for each Use Case all the needed interventions will be taken in each case, based on the produced smart farming advice. For the second cultivation period of the project starting in Spring 2020, all farmers will start applying the smart farming advice and further measurements will be taken to evaluate the impact of the proposed smart farming solution.

The information gathered during the interviews has been collected in a standardized form that provides a very comprehensible way of getting an overview of the Use Cases.

Once the Use Cases are defined, NP follows a standardized process for identifying the location of the gaiatrons to be placed. To start with, NP requests from each organization map data of the area depicting the parcels and their attribute data (i.e. Crop type, farmer/owner etc.). Particular emphasis is put on obtaining the cartographic data of the farmers who expressed their interest in participating in the project during the Informative Meetings. After receiving the map data, a certain methodology mainly via spatial analysis processes is followed in order to correlate the climate/soil zones with the location of the parcels and finally retrieve the suggested number and location of gaiatrons.

Due to the fact that the positive outcome of the project depends a lot on the willingness and the good cooperation with the farmers, the results of the placement study are first shown to the organizations. Based on their feedback and the communication with the farmers the final choice of locations to place the gaiatrons is made. After having defined the final list of participants and selected parcels, a closer cooperation between the farmer, agronomists and NP starts.

As far as climate/soil zones are concernced it should be mentioned that they are a very substantial source of information for the gaisense solution. They are used in order to obtain a better understanding of a certain place. They are incorporated in the models and used to define the position of the station to be deployed.

The main sources of climate data for the project are:

1. Climatic Research Unit (CRU)[1]
2. CHELSA[2]

Within the scope of the project, the two dataset are joint together in a new raster form.

Main data sources for the definition of the soil zones are openly available national soil datasets for Greece, Spain and Portugal. Additionally, Corine Land Cover[3] (CLC) data was used. Within the scope of this projects data refereeing to following categories are used: Arable Land, Permanent Crops, Pastures and heterogeneous agricultural areas. Based on field measurements, cartographic data and the different soil categories selected, vector representations/polygons of the soil zones have been produced. Each zone is accompanied with an attribute table providing information about the physical and chemical characteristics of the soil.

In order to define the main climate/soil zones, the above mentioned soil, Corine Land Cover and climate data are combined/intersect with the aid of spatial operation processes and algorithms. Based on the reference data, a methodology for the production of climate/soil zones was developed.

Initially, soil classes, climatic data and Corine Land Cover data are used to produce the polygons that will be used to define the climate/soil zones. Soil classes are categorized based on the mechanical characteristics. For the climate data, unsupervised classification algorithms for raster data are used. According to this methodology a large number of unknown pixels are turned into a cluster (group) based on channel values (climatic parameters) without the interference of human experts. The output of this phase is vector data depicting areas with similar climate characteristics.

For defining the final climate/soil zones, the two vector datasets are intersected. Initially, polygon intersection is applied to the soil and CLC polygons. In this process, the algorithm extracts the polygon segments from the two levels and produces new polygons with boundaries corresponding to the two-plane intersections. These new polygons retain the properties of the import data. So in this way we create the soil zones containing 5 plus 1 categories.

The soil and climate zones resulting from these processes are 523 unique (as non-polygonal) soil-climatic zones.

In order to define the number of gaiatrons to be placed in each area a new methodology has been developed by NP. This takes as input the climate/soil zones, the number of regions/counties and the different cultivations and provides as output the maximum number of gaiatrons needed for each climate/soil zone per region per cultivation.

By overlaying and oversetting the climate/soil zones and the number of gaiatrons per area, the location of gaiatrons per Use Case are defined

[1] https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_4.01/cruts.1709081022.v4.01/

[2] http://chelsa-climate.org/

[3] https://www.eea.europa.eu/publications/COR0-landcover

Following the methodology describedabove, the climate/soil zones as well as the suggested number and location of parcels is defined. The results of the placement study regarding the number of climate/soil zones and the gaiatrons for each Use Case is shown in Table 3.

Table 2: Results of the placement study for each Use Case

Use Case	Crop type	Number of climate/soil zones	Number of gaiatrons to be placed
ORESTIADA	cotton	14	5
VELVENTOS	peach	12	4
AIGINA	pistachio	2	2
ELASSONA	walnut	11	3
LASITHI	potato	3	2
SPEKO-PESKO	kiwi	20	5
KIATO	table tomato		3
STYLIDA	table olives	8	3
THESTO	industrial tomato	8	5
THESGI	cotton	21	3
MIRABELLO	olive	15	4
COSTEIRA	grape	3	2
CONFAGRI	olive	3	2
		SUM	43