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

Traps placement study

Type of Document	Deliverable
Contractual date of delivery	12/2018
Deliverable Leader	NP
Status – version, date	Summary - v.1.3.S, 30/12/2021
Action	B2

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 aim of the deliverable is to provide all necessary information related to the traps used for monitoring enemies within the scope of the LIFE GAIA Sense project. To start with, a theoretical background about the type, use and placement of traps is provided. Following, for each Use Cases, a detailed analysis of the type of enemies, their main characteristics, the rationale behind defining the location of the traps as well as the kind of traps and how they are monitored, is presented.

Role	Name (Organisation)
Deliverable Leader:	A. Baglatzi (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	12/12/2018	A. Baglatzi, K. Michos (NP),	Initial version
0.3	14/12/2018	A. Baglatzi, N. Marianos (NP),	Draft version for per review
0.5	23/12/2018	V. Tsafaraki, I. Kalyva (GAIA)	Reviewed version
1.0	31/12/2018	A. Baglatzi (NP)	Final version
1.1	28/06/2019	A. Baglatzi (NP)	Revised version
1.2	30/12/2020	V.Pyrgiotis, N. Marianos (NP)	Revised version
1.3	30/12/2021	V.Pyrgiotis	Revised version
1.3.S	30/12/2021	V.Pyrgiotis	Summaray

Table of Contents

List of Figures

List of Tables

Definitions, Acronyms and Abbreviations

Acronym	Title
CE	Circular Economy
GAIA	GAIA EPICHEIREIN ANONYMI ETAIREIA PSIFIAKON YPIRESION
NP	NEUROPUBLIC AE PLIROFORIKIS & EPIKOINONION
SF	Smart Farming
ORESTIADA	Enosi Agrotikon Synetairismon Orestiadas
VELVENTOS	Agrotikos Synetairismos Epexergasias kai Poliseos Oporokipeftikon Proionton (ASEPOP) Velventou SYN.P.E
AIGINA	Omada Pagagogon Kelyfotou Fistikiou Aiginas
ELASSONA	Agrotikos Synetairismos Fytikis kai Zoikis Paragogis – Enosi Elassonas
LASITHI	Enosi Agrotikon Synetairismon Oropediou Lasithiou
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
MIRABELLO	Agricultural Cooperative Partnership Mirabello Union S.A.
COSTEIRA	Viña Costeira SCG
CONFAGRI	Confederação Nacional das Cooperativas Agrícolas e do Crédito Agrícola de Portugal CCRL
MESSINIA	Agrotikos Sineterismos Messinias "Enosi Messinias"
ARTA	Apostolidis AE
FARSALA	Agrotikos Synetairismos "Farsalon Gis"
EUBOEA	Atypi Omada Paragogon Tomatas Dystou
PELLA	NOVAPLAN IKE
KASTORIA	Rodopoulos D. Ltd

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, peaches, cotton, pistachio, potatoes, 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

It is generally accepted that both the costs and the quality are the most important elements in the production of agricultural products. One of the main goals of the project is to introduce smart farming practices to support farmers maintaining these at desired levels (reduced cost, increased quality) through the proper crop management.

One of the many aspect of the project is pest management and particularly the implementation of an intelligent smart farming system that will inform the farmer about the danger of the appearance of the enemies and diseases.

For each Use Case, a number of targeted enemies[1] has been identified through the cooperation of the farmers and NP. In order to monitor the population of the enemies and combine it with data from the telemetric stations a traps placement study is completed for each Use Case. The study includes a brief description of the targeted enemies, the type of traps and the methodology for deploying the traps.

[1] The terms pest and enemy are synonymous and are used interchangeably in this document

2. Traps placement study - Summary

The traps placement study is part of a wider design of the way of dealing with enemies in different crops which basic principle is the definition and use of Tolerance Density Limits (POPs) of populations of the harmful enemies, at which control measures have to be taken.

Placement and monitoring of traps is a very valuable source of information for developing the scientific models for pest management.

This placement study for each Use Case includes:

- information about the targeted enemies
- Information about the types of traps to be used
- Information about the methodology of deploying and monitoring the traps

The use of traps facilitates the monitoring of insect or arthropods /enemies population in different crops. In some cases, traps are also used as an environmental friendly alternative to pesticides when it comes to pest management. Their main use though is to examine the distribution of enemies' occurrences during the cultivation period.

Different kind of enemies are lured by different attractants. For instance, flies and wasps are attracted by proteins, tephritis flies are attracted by methyl eugenol, other insects by colors, fragrances, pheromones, lactic acid etc. That has resulted in a great number of different types of traps with the most commonly used attractants being:

- Food (non-specific using attractive liquids)
- Light (affecting vision on some species)
- Colour (water and adhesive)
- Sound (effect on hearing)
- Mechanical (e.g. soil Pitfall)
- Suction (with the influence of wind non-selective)
- Shelter traps (eg tape with arcades around logs for captive larval arrests)
- Egg traps (using attractive nesting)

Within the scope of the project, the most commonly used traps are

McPhail traps

The McPhail traps (**Error! Reference source not found.**) are marketed in many variations and are usually plastic with a yellow bottom and transparent top. In some cases i.e. when used by governmental agencies for monitoring Dacus in Greece (olive fruit fly), McPhail glass traps are used.

An aqueous 2% phosphate or ammonium sulfate solution is used and in some experimental cases hydrolyzed protein solution of 4% and 1.5% borax. Certain formulations such as NuLure have proven to be particularly attractive for the olive fruit fly although they are not widely used.

Figure 1: Trap type McPhail

Delta

Delta traps (Figure 1) are named after their Delta-form shape. An adhesive surface is placed at the base of each trap and is replaced according to the number and frequency of insect trapping. On each trap stand, a sex pheromone evaporator is placed attracting certain sex of the enemies. The pheromone is replaced about every 3 weeks, except in cases of high temperatures when there is a need to replace them earlier.

Figure 2: Delta type Pheromone Adhesive Trap

Figure 2: Funnel pheromone trap

Funnel trap

Funnel traps (Figure 2) are using a sex pheromone evaporator for attracting the enemies, i.e green worm. Impregnated sheets of paper with the active insecticide transfluthrin (0.4% w / w), each weighing 0.325 g, are placed inside the trap in order to extinguish the captured enemies. The impregnated sheets have to be replaced twice a month.

Depending on the type of traps, their use, the insect to be monitored, and the crop, traps are placed in accordance with the following common instructions:

1. The installation usually takes place at the beginning of the growing season.
2. The traps have to be assembled carefully and in accordance with the manufacturer's instructions.
3. In pheromone traps the change of pheromone should be done every 3 weeks except in cases of very high temperatures or rainfall when it may be needed to replace them earlier.
4. In cases where new trapped insects are counted, if the trap type allows it, trapped insects should be removed after each measurement.
5. Adhesive traps should be checked regularly so that there is a sufficient "adhesive" surface to ensure high trapping efficiency. Whenever necessary they should be replaced with new ones.

6. In traps using an attractive solution (e.g. McPhail type for trapping) the proportions of the solution have to be kept at a stable level and the attractant should be renewed at regular intervals.

2.1. Traps placement study – ORESTIADA

2.1.1. Targeted enemies

In ORESTIADA, four enemies have been identified for cotton that are targeted at this project (Table 1).

Table 1: Enemies identified for ORESTIADA

Crop	Type of pest/disease	Name
Cotton	Enemy	*Helicoverpa armigera*
		Pectinophora gossypiella
		Eurygaster maura
		Lygus hesperus

In VELVENTOS, one enemy has been identified for peach that is targeted at this project (Table 2).

Table 2: Enemy identified for VELVENTOS

Crop	Type of pest/disease	Name
Peach	Enemy	*Grapholita molesta*

In ELASSONA, one enemy has been identified for walnut (Table 3)

Table 3: Enemy identified for ELASSONA

Crop	Type of pest/disease	Name
Walnut	Enemy	*Cydia pomonella*

In LASITHI, two enemies have been identified for potato that are targeted in this project (Table 4)

Table 4: Enemies identified for LASITHI

Crop	Type of pest/disease	Name
Potato	Enemy	Leptinotarsa decemlineata
		Phthorimaea operculella

In Pieria, two enemies have been identified for kiwi (Table 5).

Table 5: Enemies identified for SPEKO-PESKO

Crop	Type of pest/disease	Name
Kiwi	Enemy	Pseudaulacapsis pentagona

		Metcalfa pruinosa

In KIATO, no enemies have been identified for table tomato.

In STYLIDA, two enemies have been identified for table olives (Table 6).

Table 6: Enemies identified for STYLIDA

Crop	Type of pest/disease	Name
Table olives	Enemy	*Bactrocera oleae*
		Prays oleae

In THESTO, one enemy has been identified for industrial tomato (Table 7).

Table 7: Enemy identified for THESTO

Crop	Type of pest/disease	Name
Industrial tomato	Enemy	*Helicoverpa armigera*

In THESGI, four enemies have been identified for cotton (Table 8).

Table 8: Identified enemies for THESGI

Crop	Type of pest/disease	Name
Cotton	Enemy	*Helicoverpa armigera*
		Pectinophora gossypiella
		Bemisia tabaci
		Lygus hesperus

In MIRABELLO, two enemies have been identified for olives (Table 9).

Table 9: Identified enemies for MIRABELLO

Crop	Type of pest/disease	Name
Olive	Enemy	*Bactrocera oleae*
		Prays oleae

In COSTEIRA, one enemy has been identified for grape (Table 10)

Table 10: Identified enemies for COSTEIRA

Crop	Type of pest/disease	Name
Grape	Enemy	*Lobesia botrana*

In CONFAGRI, one enemy has been identified for olives (Table 11)

Table 11: Identified enemies for CONFAGRI

Crop	Type of pest/disease	Name
Olive	Enemy	*Prays oleae*

In MESSINIA, one enemy has been identified for olives (Table 12)

Table 12: Identified enemies for MESSINIA

Crop	Type of pest/disease	Name
Olive	Enemy	*Bactrocera oleae*

In KASTORIA, one enemy has been identified for tomatoes (**Error! Reference source not found.**)

Table 13: Identified enemies for KASTORIA

Crop	Type of pest/disease	Name
Table tomato	Enemy	*Helicoverpa armigera*

In FARSALA, one enemy has been identified for olives (Table 14)

Table 14: Identified enemies for FARSALA

Crop	Type of pest/disease	Name
Cotton	Enemy	*Pectinophora gossypiella*
		Helicoverpa armigera

In ARTA, no enemies have been identified for kiwis.

In PELLA, two enemies have been identified for olives (Table 15)

Table 15: Identified enemies for PELLA

crop	Type of pest/disease	Name
Peach	Enemy	Grapholita molesta
		Anarsia lineatella

APPENDIX I

Pests for each Use Case

Use Case	Crop	Pests
ORESTIADA	cotton	Helicoverpa armigera
		Eurygaster maura
		Lygus hesperus
		Pectinophora gossypiella
VELVENTOS	peach	Grapholita molesta
ELASSONA	walnut	Cydia pomonella
LASITHI	potato	Leptinotarsa decemlineata
		Phthorimaea operculela
SPEKO-PESKO	kiwi	Pseudaulacapsis pentagona
		Metcalfa pruinosa
KIATO	table tomato	-
STYLIDA	olive	Bactrocera oleae
		Prays oleae
THESTO	Industrial tomato	Helicoverpa armigera
THESGI	cotton	Helicoverpa armigera
		Pectinophora gossypiella
		Bemisia tabaci
		Lygus hesperus
MIRABELLO	olive	Bactocera oleae
		Prays oleae
COSTEIRA	grape	Lobesia botrana
CONFAGRI	olive	Prays oleae
MESSINIA	olive	Bactrocera oleae
ARTA	kiwi	-
EUBOEA	table tomato	Helicoverpa armigera
KASTORIA	table tomato	Helicoverpa armigera
FARSALA	cotton	Pectinophora gossypiella
		Helicoverpa armigera
PELLA	peach	Grapholita molesta
		Anarsia lineatella