LIFE FROSTDEFEND

LIFE20 CCA/GR/001747

DC3.1 Report on the training workshop (Aeghion) incl. training material

Dec 2025

NATIONAL CENTRE FOR SCIENTIFIC RESEARCH "DEMOKRITOS"
ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ AGRICULTURAL UNIVERSITY OF ATHENS
INRAE la science pour la vie, l'humain, la terre
AGRICULTURAL COOPERATIVES' UNION AEGHION S.A.
msensis

Project Number	**LIFE20 CCA/GR/001747**
Project Title	**Forecasting and protecting fruit crops from frost damage**
Project Acronym	**LIFE FROSTDEFEND**
Action	**C3 Pilot implementation of the LIFE-FROSTDEFEND IoT system**
Deliverable	**Report on the training workshop (Aeghion) incl. training material**
Beneficiary	**ACUA, AUA**
Date	**12/2025**

Table of Contents

Summary		4
1	Introduction	5
2	Presentations	7
3	Closing Remarks	12
ANNEX I: Agenda		13
ANNEX II: Training Material		14

Summary

The LIFE FROSTDEFEND consortium organized an on-site technical workshop for farmers, agronomists, and local agricultural stakeholders in Aegion, Greece, focusing on the implementation and practical application of the FROSTDEFEND decision-support tool in the pilot area of Aegialia. The workshop was held on 22 October 2025 as part of the project's info-day activities and was jointly organized by the Agricultural Cooperatives Union of Aegion (ACUA) and the Agricultural University of Athens (AUA).

The event took place at the premises of ACUA and was attended by local stakeholders actively involved in agricultural production, advisory services, and cooperative activities. The workshop contributed to capacity building and stakeholder engagement in the framework of the LIFE FROSTDEFEND project, supporting the uptake of innovative tools for frost risk prediction and mitigation in agricultural systems.

This document is delivered in the context of Action C3 "Pilot implementation of the LIFE-FROSTDEFEND IoT system" of the LIFE FROSTDEFEND project.

1 Introduction

As part of the dissemination, communication, and stakeholder engagement activities of the LIFE FROSTDEFEND project, the consortium organized a technical workshop addressed to farmers, agronomists, and local agricultural stakeholders in Aegion, Greece. The workshop focused on the implementation and operational use of the FROSTDEFEND decision-support tool in the pilot area of Aegialia and was conducted within the framework of an info-day event aimed at enhancing awareness and uptake of innovative climate adaptation solutions in agriculture.

The workshop took place on 22 October 2025 and was jointly organized by the Agricultural Cooperatives Union of Aegion (ACUA) and the Agricultural University of Athens (AUA). The event was hosted at the premises of ACUA and brought together farmers, advisors, and cooperative representatives.

The main objective of the workshop was to present the FROSTDEFEND tool and its core functionalities, highlighting its role as an advanced decision-support system for frost risk prediction and management. Unlike conventional frost warning systems that rely exclusively on short-term meteorological forecasts, the FROSTDEFEND tool integrates weather data with crop-specific parameters affecting frost hardiness and vulnerability. This integrated approach enables more accurate, site-specific, and actionable frost risk assessments, thereby supporting timely and informed decision-making by farmers and agronomists.

Furthermore, the workshop aimed to demonstrate the applicability and transferability of the FROSTDEFEND tool across different crop varieties and agro-climatic conditions. While the primary focus was placed on citrus crops, reflecting their high economic importance in the pilot region, the potential use of the tool for other crops (i.e. grapes, apricots, pears), was also presented and discussed. This aspect underlined the tool's adaptability and its potential for replication in other regions facing increasing frost risks due to climate variability.

Through technical presentations, practical demonstrations, and interactive discussions, participants were informed about the benefits of integrating the FROSTDEFEND tool into routine farm management practices. The workshop contributed to strengthening local capacity for climate change adaptation, fostering stakeholder engagement, and supporting the broader LIFE FROSTDEFEND objectives of reducing frost-related crop losses and enhancing the resilience and sustainability of agricultural systems.

Report in the training workshop

2 Presentations

The speakers at the workshop were:

- Professor Dimitrios Georgakopoulos, AUA
- Professor Ioannis Papadakis, AUA
- Dr. Prodromos Fetfatzis, NCRS-Demokritos
- Dr. Stavros Markantonis, MSensis
- Dr. George Sarigiannidis, MSensis

Professor Dimitrios Georgakopoulos (AUA) presented the rationale for implementing the LIFE FROSTDEFEND project, with particular reference to citrus frost damage statistics in Greece and their impact on reductions in citrus cultivation areas. Local agronomists complemented the presentation with region-specific information on past frost damage events in Argolida and Aegialia.

Professor Ioannis Papadakis (AUA) presented the latest scientific knowledge on citrus sensitivity to frost, focusing on the influence of cultivar–rootstock combinations. He also reviewed passive and active frost damage mitigation measures, including crop establishment strategies in frost-prone fields, windbreak establishment, and the proper use of wind

machines, heaters, surface irrigation, and misting systems, supported by data on their effectiveness for different citrus crops.

Professor Georgakopoulos further explained the role of epiphytic ice nucleation-active (INA) bacteria, commonly present on crop surfaces, in initiating frost damage. He stressed the importance of controlling INA bacterial populations and their ice nucleation activity as part of an integrated frost mitigation strategy. He then presented the scientific rationale behind the design of the FROSTDEFEND forecasting tool, which aims to predict INA bacterial abundance and activity 48 hours ahead of an anticipated frost event. This prediction is achieved indirectly by correlating atmospheric and meteorological parameters measured in real time by the AirSensis instrument, developed within the project.

Evidence on the effectiveness of copper sprays for controlling INA bacteria was presented, drawing on studies from California and Australia, as well as pilot experiments conducted at high-altitude project orchards during winter 2025 and at commercial orchards in Aegion during the 2024–2025 growing season. Finally, Professor Georgakopoulos encouraged participants to contribute feedback by completing questionnaires distributed both in physical and electronic formats.

Report in the training workshop

The LIFE FROSTDEFEND consortium recognizes local stakeholders (including representatives of agricultural cooperatives and farm supply businesses) and agronomists as key intermediaries and potential advisors supporting farmers interested in investing in the AirSensis instrument and subscribing to the FROSTDEFEND warning services. Consequently, the workshop placed particular emphasis on presenting both the AirSensis instrument and the FROSTDEFEND smartphone application to these target groups.

Dr. Prodromos Fetfatzis (NCSR-Demokritos) provided a demonstration of two monitoring devices for real-time measurement of key aerosol and meteorological parameters in the plots. He explained their installation in orchards and their operational principles. The presentation covered the installation of the photovoltaic panel and battery, sensor array configuration, calibration procedures, data transmission via SIM card, and basic troubleshooting actions, such as system restart.

Dr. Stavros Markantonis (MSensis) presented the structure and functionality of the FROSTDEFEND smartphone application. He demonstrated how users can search for private and public stations, enter user and crop information (including location, crop species, and rootstock), select available frost protection methods, and record mitigation actions taken following frost warnings through hands-on practice. He also emphasized the role of agronomists as consultants supporting farmers in the effective use of the application.

Report in the training workshop

Report in the training workshop

Dr. George Sarigiannidis (msensis), Head of msensis, explained the financial aspects related to the purchase of the monitoring devices and subscription fees to the FROSTDEFEND application, clarifying the obligations and options available to end-users.

3 Closing Remarks

During the concluding session, participants engaged in an open discussion with the LIFE FROSTDEFEND scientific team, raising questions related to frost damage events experienced in recent years, locally applied mitigation measures, and their perceived effectiveness. Particular interest was expressed in the use of timely copper sprays as a frost damage mitigation strategy, including practical considerations regarding application timing and regulatory constraints related to harvest intervals.

Professor Georgakopoulos emphasized the importance of the FROSTDEFEND application and targeted copper spray recommendations as frost mitigation approaches associated with significantly lower carbon emissions compared to conventional methods commonly used in the region. He highlighted that forthcoming revisions of the Common Agricultural Policy may include carbon emissions as a factor influencing agricultural subsidies. In this context, the FROSTDEFEND tool provides an opportunity not only to reduce frost damage but also to demonstrate measurable reductions in greenhouse gas emissions.

Finally, it was suggested that the FROSTDEFEND Tool (incl. monitoring devices and the FROSTDEFEND application) could be incorporated into future proposal submissions by stakeholders to European Union funding programmes, supporting long-term strategies and infrastructure investments aimed at crop protection, climate resilience, and sustainable agricultural development.

ANNEX I: Agenda

ΕΝΗΜΕΡΩΤΙΚΗ ΕΚΔΗΛΩΣΗ

ΣΥΝΑΝΤΗΣΗ ΕΡΓΑΣΙΑΣ

Έργο LIFE20 CCA/GR/001747 "LIFE-FROSTDEFEND"

«Forecasting and protecting fruit crops from frost damage»

ΠαναΙγιάλειος Ενωση Συνεταιρισμών, Αίγιο, 22/10/2025

ΠΡΟΓΡΑΜΜΑ

ΕΝΗΜΕΡΩΤΙΚΗ ΕΚΔΗΛΩΣΗ για Παραγωγούς και Γεωπόνους	
18:00-18:30	Προσέλευση
18:30-18:35	Χαιρετισμός, κ. Α. Σωτηρόπουλος, Πρόεδρος Παναιγιαλείου ΕΣ Εισαγωγή, Καθ. Δ. Γεωργακόπουλος, ΓΠΑ
18:35-18:50	Παγετός και Εσπεριδοειδή
	Γενική κατάσταση στην Ελλάδα, Καθ. Δ. Γεωργακόπουλος
	Ευαισθησία ειδών, συνδυασμών ποικιλίας/υποκειμένου σε κάθε είδος, Καθ. Ι . Παπαδάκης, ΓΠΑ
18:50-19:15	Μέτρα προστασίας
	Συμβατικά μέτρα προστασίας, Καθ. Ι. Παπαδάκης
	Προληπτικά μέσα προστασίας - Ψεκασμοί με χαλκό/Έλεγχος του πληθυσμού των παγοποιητικών βακτηρίων, Καθ. Δ. Γεωργακόπουλος
19:15-19:30	Περιγραφή του έργου LIFE20 CCA/GR/001747 "FROSTDEFEND". Καθ. Δ. Γεωργακόπουλος
ΣΥΝΑΝΤΗΣΗ ΕΡΓΑΣΙΑΣ για Γεωπόνους	
19:30-19:45	Περιγραφή του αισθητήρα AirSensis: Σχεδιασμός, Εγκατάσταση, Βαθμονόμιση, Λειτουργία, Δρ. Π. Φετφατζής, ΕΚΕΦΕ Δημόκριτος
19:45-20:15	Περιγραφή, δυνατότητες, οδηγίες χρήσης της εφαρμογής FROSTDEFEND, Δρ. Σ. Μαρκαντώνης, MSENSIS
20:15-20:30	Συζήτηση, Περιγραφή & συμπλήρωση ερωτηματολογίου
20:30-21:30	Ελαφρύ Δείπνο

Το έργο συγχρηματοδοτείται από την Ευρωπαϊκή Ένωση

ANNEX II: Training Material

Calibration and operating procedures for the monitoring devices

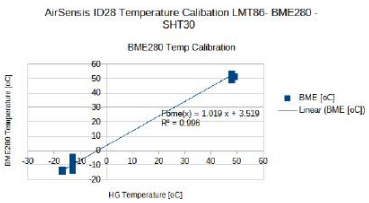
Ανανεωμένη και Αυτόνομη γενιά συστημάτων αισθητήρων

Χαρακτηριστικά αισθητήρων χαμηλού κόστους για προστασία από τον παγετό:

airsensis

- μετάδοση δεδομένων μέσω δικτύου κινητής τηλεφωνίας
- μετρήσεις με GPS σε ηλεκτρονική πλατφόρμα κάθε λεπτό
- παρακολούθηση μετρήσεων σε σχεδόν πραγματικό χρόνο
- Πιστοποίηση ακρίβειας με ιστορικό ποσοτικών μετρήσεων
- Ηλιακό πάνελ + μπαταρία ιόντων λιθίου, με ενισχυμένη διάρκεια μπαταρίας για μετρήσεις κατά τη διάρκεια παγετού.
- Έτοιμο περίβλημα για εξωτερική χρήση στους αγρούς
- Εξωτερικοί RHT αισθητήρες

Βαθμονόμηση θερμοκρασίας.



Ευχαριστώ!

NATIONAL CENTRE FOR SCIENTIFIC RESEARCH "DEMOKRITOS"

ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
AGRICULTURAL UNIVERSITY OF ATHENS

INRAE
la science pour la vie, l'humain, la terre

AGRICULTURAL COOPERATIVES' UNION AEGHION S.A.

msensis

NATIONAL CENTRE FOR SCIENTIFIC RESEARCH "DEMOKRITOS"

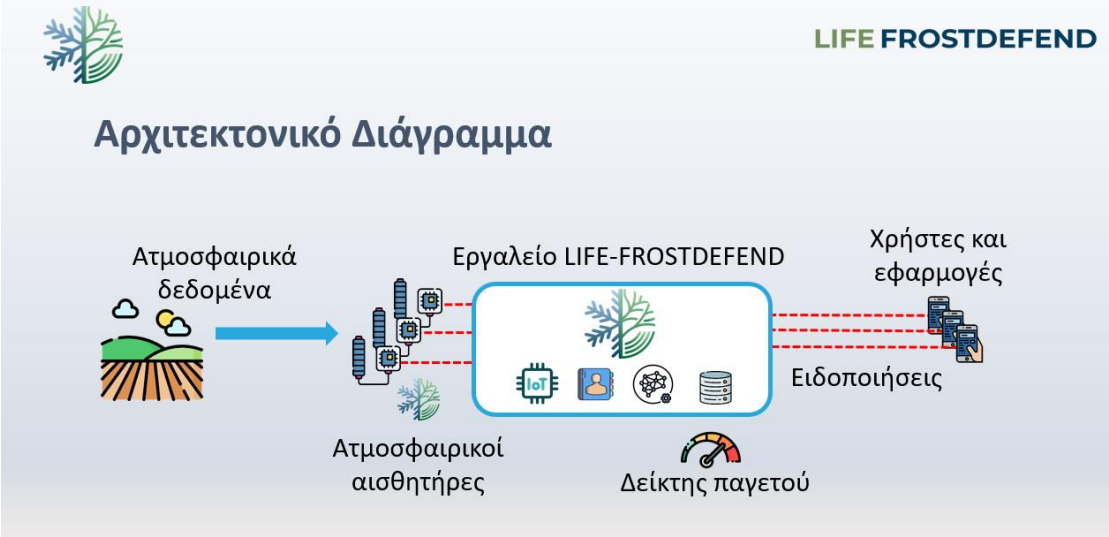
ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
AGRICULTURAL UNIVERSITY OF ATHENS

INRAE
la science pour la vie, l'humain, la terre

AGRICULTURAL COOPERATIVES' UNION AEGHION S.A.

msensis

The FROSTDEFEND app


LIFE FROSTDEFEND
Αρχιτεκτονικό Διάγραμμα
Ατμοσφαιρικά δεδομένα
Εργαλείο LIFE-FROSTDEFEND
Χρήστες και εφαρμογές
Ειδοποιήσεις
Ατμοσφαιρικοί αισθητήρες
Δείκτης παγετού


https://app.frostdefend.eu/stations
Εργαλείο LIFE-FROSTDEFEND


Εργαλείο LIFE-FROSTDEFEND
LIFE FROSTDEFEND
FrostDS
Καθόλου κίνδυνος
PM 2.5 μg/m3
Τύπος
Ανεμομείκτης
Ανεμοφράκτης
Επιφανειακή άρδευση
Υδρονέφωση
Ψεκασμός με φυτοπροστατευτικά προϊόντα
Τύπος Καυσίμου
Πετρέλαιο
Ηλεκτρική Ενέργεια
Βενζίνη-Λάδιού

Οδηγίες χρήσης για το εργαλείο LIFE-FROSTDEFEND

Σύστημα πρόβλεψης και προστασίας των καλλιεργειών φρούτων από ζημιές από παγετό

Μια καινοτόμος λύση για την πρόληψη του παγετού των καλλιεργειών

User instructions for the LIFE-FROSTDEFEND Tool

Prediction and protection system of fruit crops from frost damage

An innovative solution for crop frost prevention