Alliance for Internet of Things Innovation

Workshop

Role of IoT in addressing the agroecological focus of the Green Deal

Online • 6 April 2022

Agenda

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Agenda

15.00h Opening and Introduction (10')
Luis Perez Freire, AIOTI WG Agriculture Chair

15.10h Examples (40')

15.50h Summary of recommendations and open discussions (30')

16.20h Wrap up and end of webinar (10')

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Opening and Welcome

AI TI

AIOTI WG Agriculture at glance

77
members

107
contributors

ICT/agtech companies (large and small)
R&D organisations
2 of the largest agricultural machine manufacturers
Consultants
Representatives of farmers and cooperatives

Vision: unlock the full potential of IoT (technologies, solutions, services, ecosystem, and infrastructure) for supporting future-proof, sustainable agri-food and forestry value chains in the Green Deal era.

Scope: EU policies and standards, collaborative research and innovation, key technological developments and gaps

Chair
Luis Pérez-Freire
Gradiant

Co-Chair
Max Schulman
COPA-COGECA

Domains of interest: agrifood (agriculture, livestock, fisheries), forestry, food chain, environmental and biodiversity protection in agrifood and forestry

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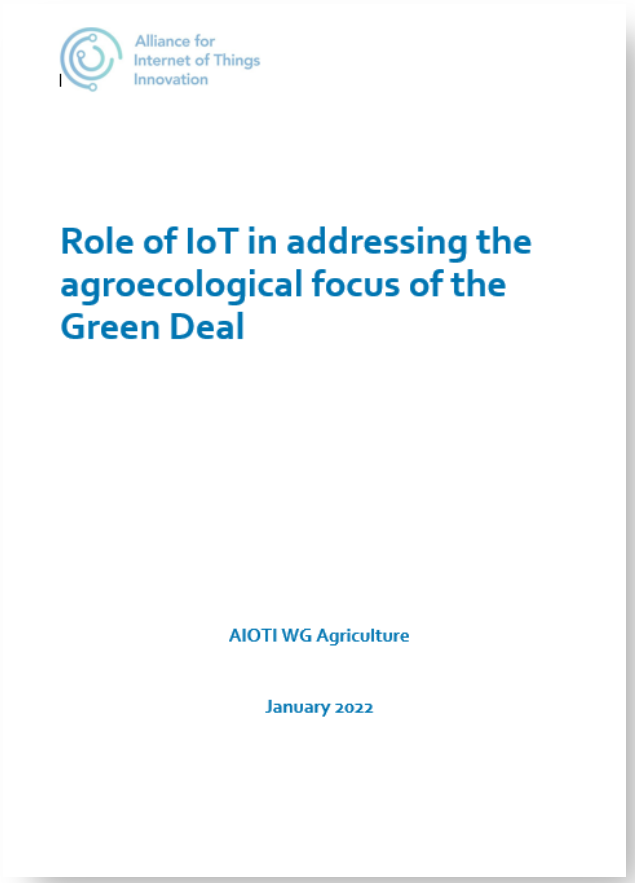
Introduction: AIOTI Deliverable


Alliance for Internet of Things Innovation

Role of IoT in addressing the agroecological focus of the Green Deal

AIOTI WG Agriculture

January 2022

https://aioti.eu/wp-content/uploads/2022/02/AIOTI-Role-of-IoT-in-addressing-agroecological-focus-of-Green-Deal-Final.pdf

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Introduction: Policy Context

The EU Green Deal → Farm to Fork Strategy, Biodiversity Strategy → Future CAP 23-27

Measureable objectives

1. **Reduce the loss of soil nutrients by at least 50%** while ensuring no deterioration of soil fertility, resulting in a **reduction of fertilisers of at least 20%**.
2. **Reduce the overall EU sales of antimicrobials** for farmed animals and in aquaculture by **at least 50%**.
3. **Reduce by 50% the overall use of chemical pesticides** and of more hazardous pesticides.
4. Achieve at least 25% of the EU's agricultural land under organic farming.
5. Ensure that at least 10% of agricultural area is transformed into high-biodiversity landscape features.

Shared objectives

1. Increase the contribution of EU agriculture to climate change mitigation and adaptation.
2. **Improve the management of natural resources** used by agriculture, such as water, soil and air.
3. Reinforce the **protection of biodiversity and ecosystem** services within agrarian and forest systems
4. Achieve effective **sustainability of food systems** in accordance with societal concerns regarding food and health on e.g. animal welfare, use of pesticides and antimicrobial resistance;
5. Ensure a fair economic return and improving the position of farmers in the food supply chain.

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Introduction: Agroecology and IoT Tech

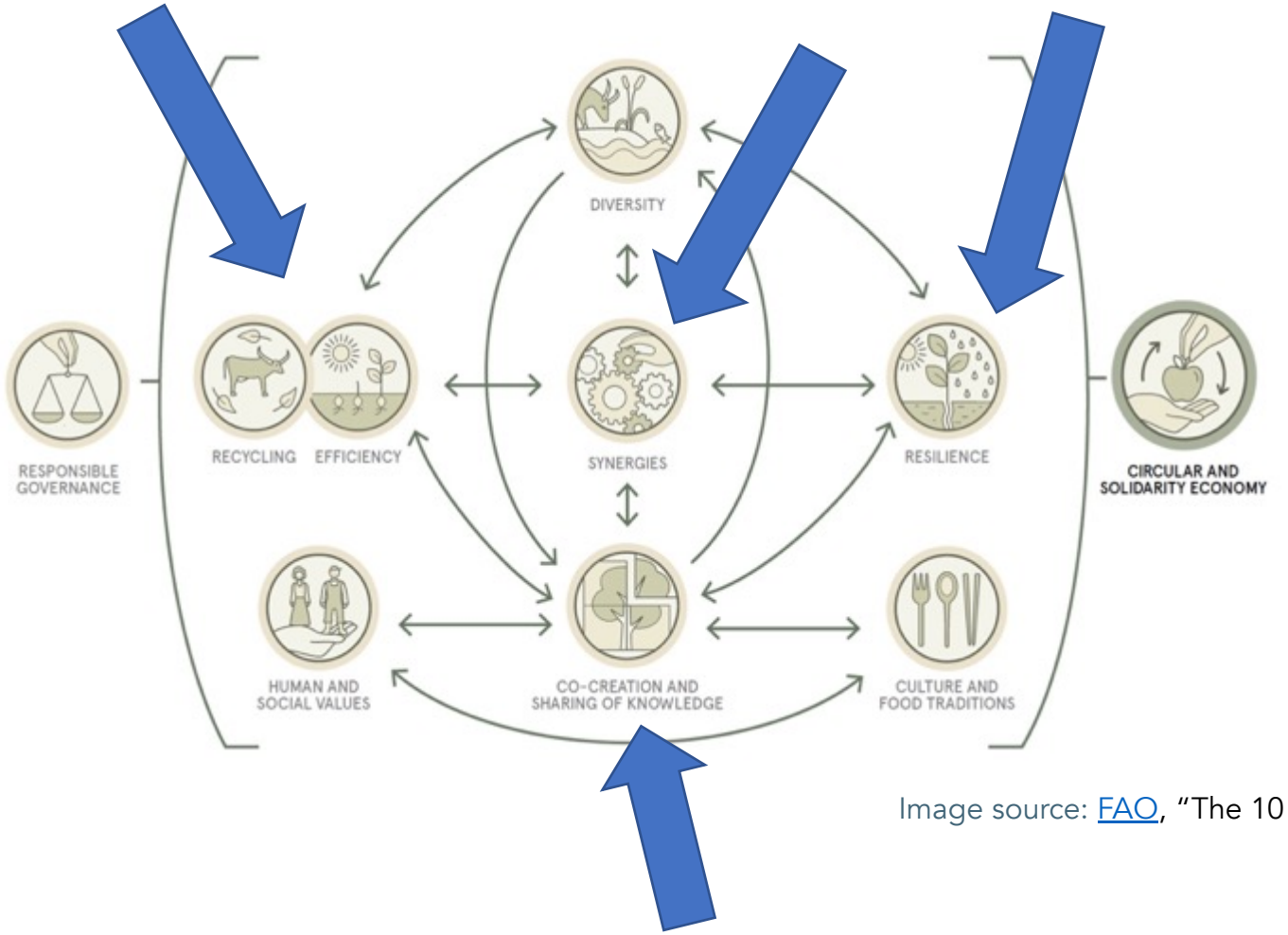

Image source: FAO, "The 10 elements of agroecology"

Use Cases: Five examples

Example 1: Disease prediction and supply chain transparency for orchards/vineyards	Lars T. Berger – Pulverizadores FEDE
Example 2: Integrated Plant Protection and decision support systems	Marcin Plociennik – Poznan Supercomputing Centre
Example 3: Digitalising the smart agrifood sector in the Balearic Islands	Dolorez Ordóñez - AnySolution
Example 4: CAP indicators landscape monitoring	Nikos Kalatzis - Neuropublic
Example 5: Smart Farming Techniques for Climate Change Adaptation in Cyprus	Nikos Marianos - Neuropublic


Lars T. Berger


Marcin Plociennik


Dolores Ordóñez


Nikos Kalatzis


Nikos Marianos

Example 1:
Disease prediction and supply chain transparency for orchards/vineyards – a DEMETER pilot

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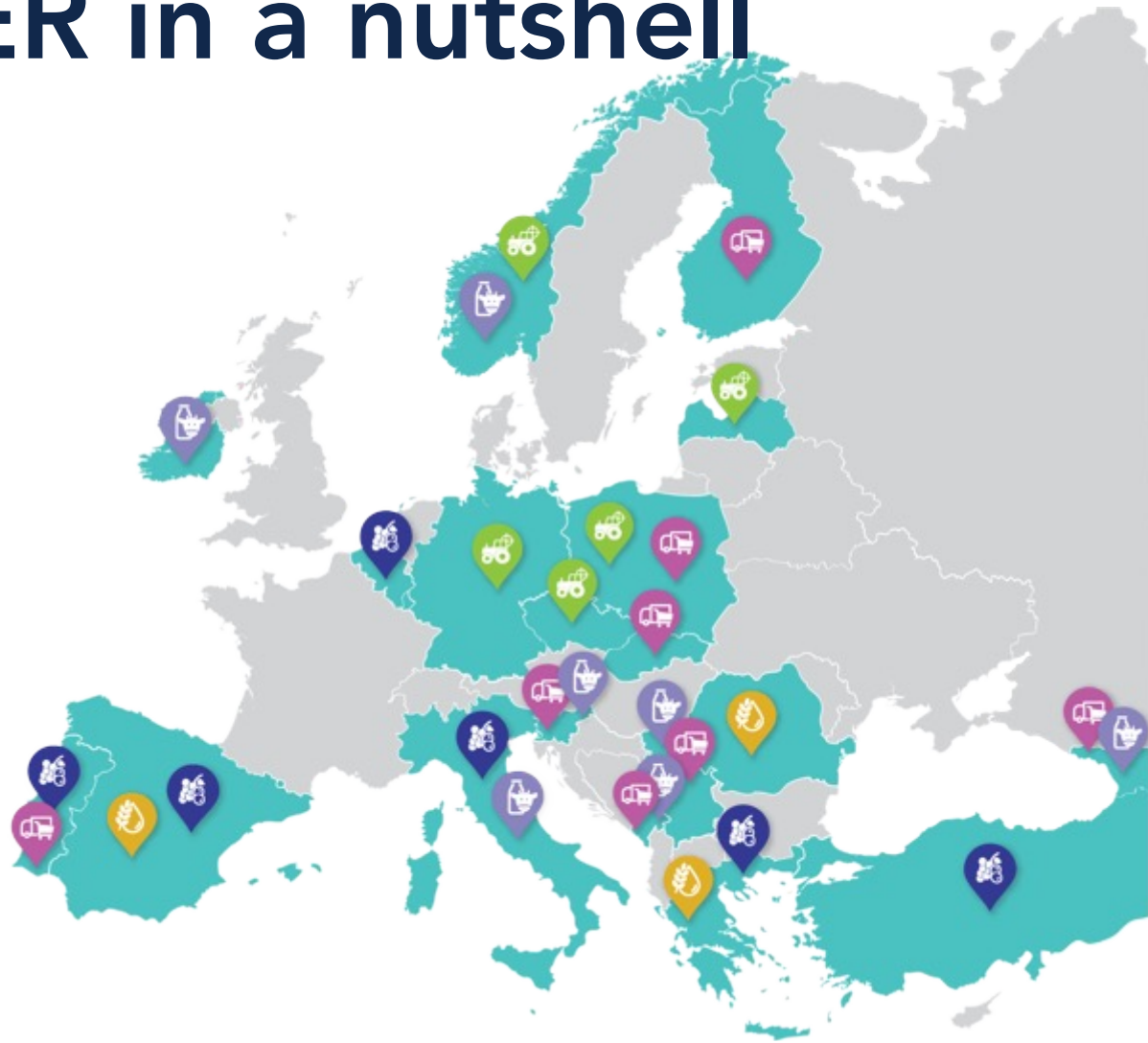
The EU project DEMETER in a nutshell

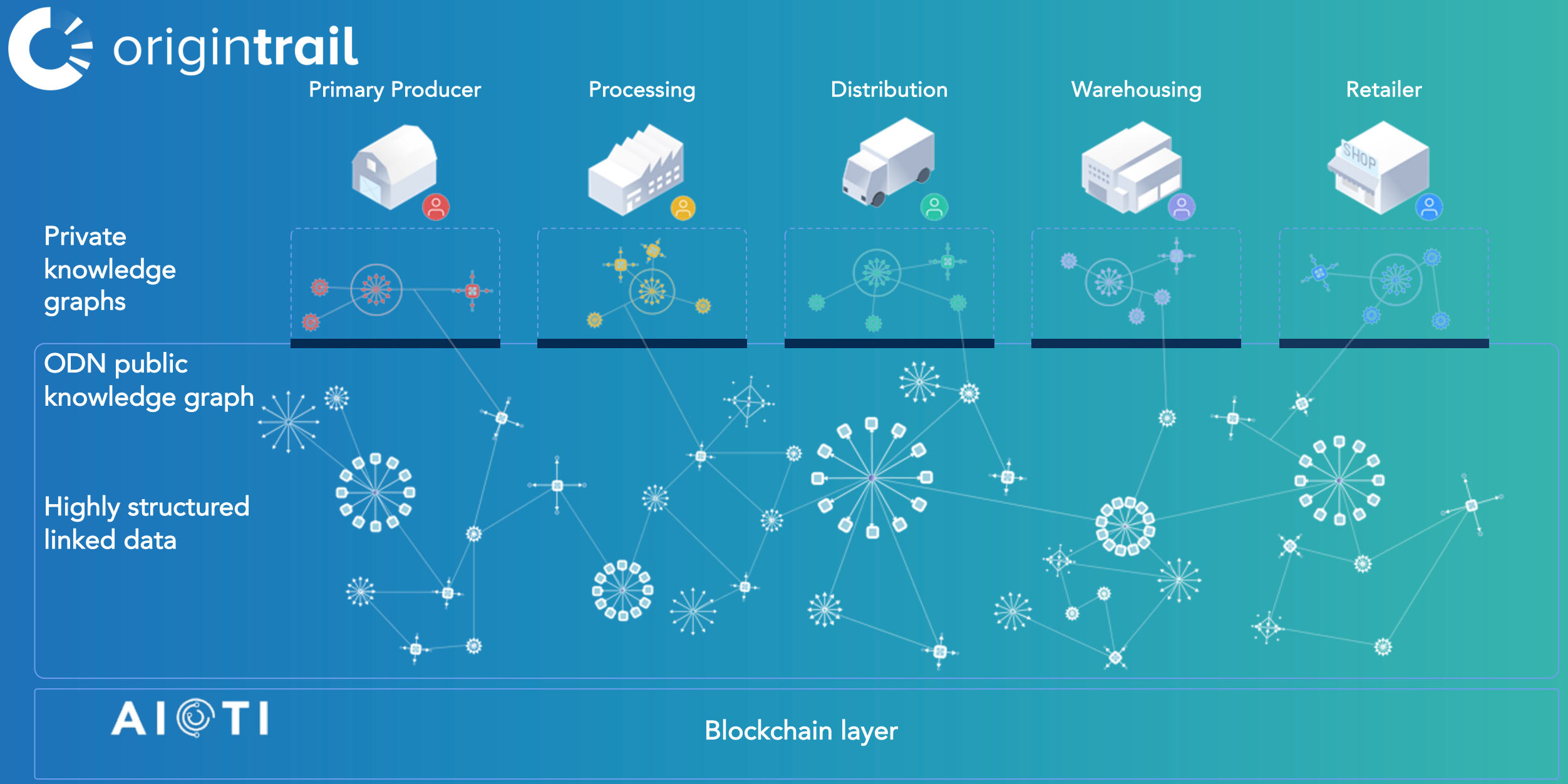


DEMETER's goal is to lead the digital transformation of Europe's agri-food sector through the rapid adoption of advanced IoT technologies, data science and smart farming, ensuring its long-term viability and sustainability.

Pilot: Disease prediction and supply chain transparency for orchards / vineyards


Disease prediction
Home
Overview
Show data
Table data
Botrytis Cinerea, Guignardia Bidwellii, Uncinula Necator
Botrytis Cinerea: 100
Guignardia Bidwellii: 100
Risk of grape black rot is 100%! A) No action is required - if spraying was already done (with fungicides that are efficient enough for grape black rot) in the last five days. B) If the treatment (with fungicides that are eficient enough for grape black rot) wasn't done in last five days, spray as soon as possible. Use curative fungicides. C) Do/Repeat the treatment with fungicides if 30 mm of precipitation has fallen. Use curative fungicides.
Uncinula Necator: 0
Órdenes de Trabajo

Global Knowledge Graph



IoT enables:

- Precise information on **when and how to spray** (from *DunavNET*)
- **Communication with sprayers** in the field and **precise spray application** as well as **application traceability** (from *Pulverizadores Fede*)
- **Traceability** along the supply chain (from *Origin Trail)*
- **Up to 30% pesticide savings**

DEMETER has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857202.

Example 2:
Integrated Plant Protection and decision support systems

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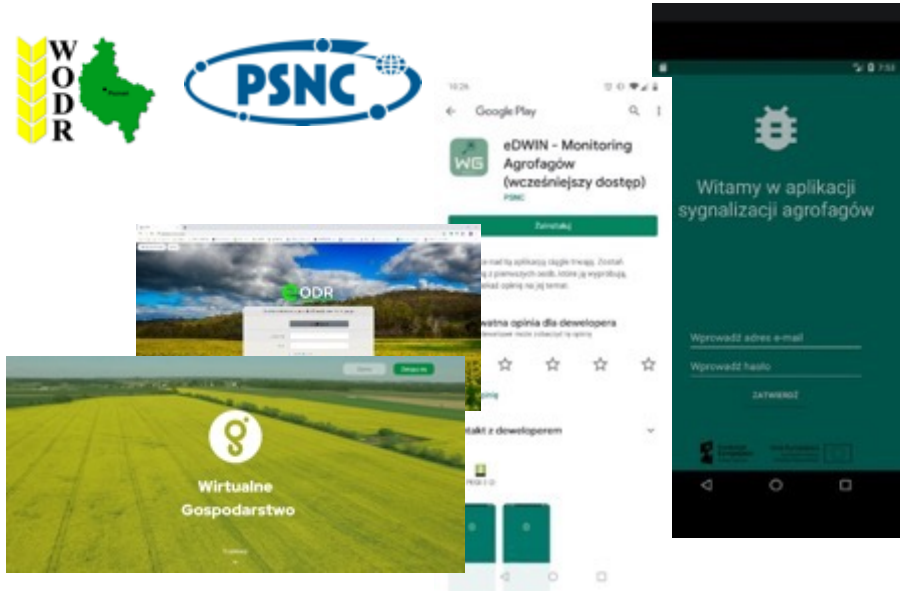
Integrated Plant Protection and decision support system

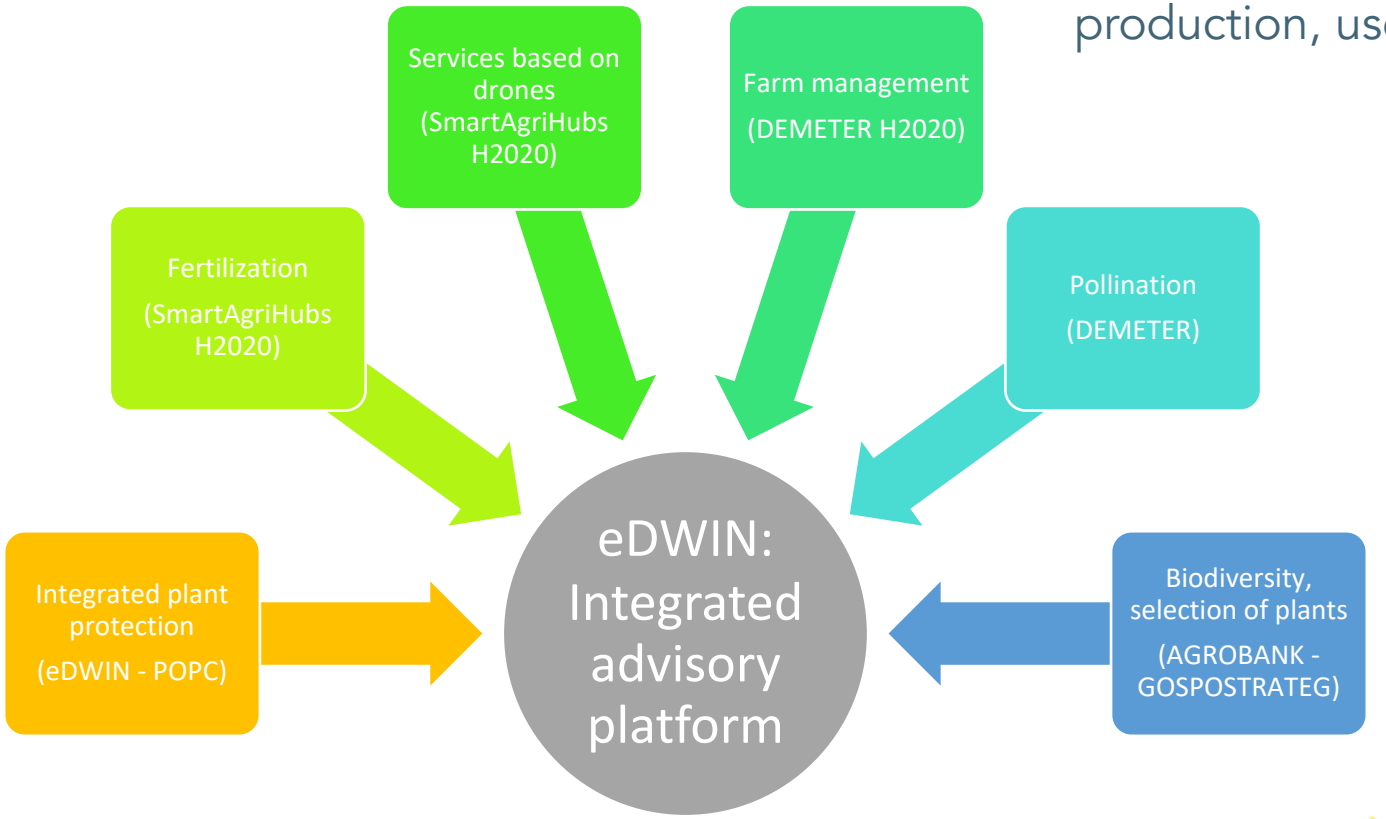
- Coordinated by WODR (Wielkopolska Agriculture Advisory Center), main IT partner: PSNC
- The primary outcome is to **rationalize the use of pesticides** in agriculture
- Platform will provide four e-services for polish farmers, agriculture advisors and administration units:
  - Virtual Farm Dashboard
  - Tracing the origin of agricultural products and plant protection products used
  - Risk reporting
  - Sharing of meteorological data
- Decision support systems
  - deployment of 20 models for **integrated plant protection**
  - **pest signaling**

The eDWIN project (Case 2) has been implemented under the Operational Program Digital Poland for 2014-2020.



Agriculture integrated advisory platform

WODR network of 100 demonstration farms – all kind of the agriculture production, used in pilots and projects

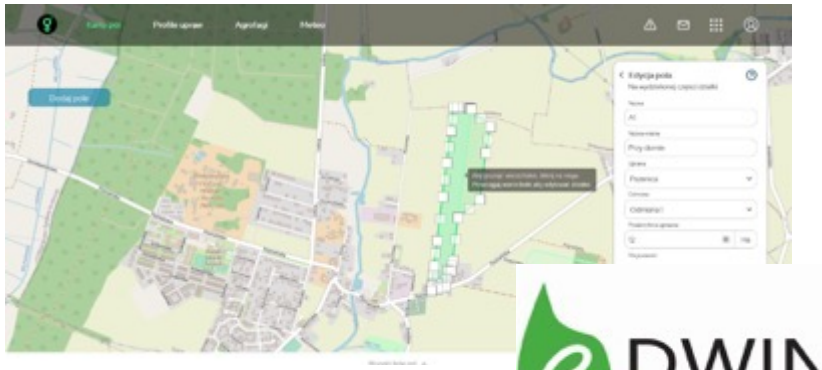


Agriculture integrated advisory platform

- Apart from the application layer, eDWIN expand the physical network of meteorological stations
- System integrates approx. 200 existing stations from project partners and installs additional 300 units, creating a regular network throughout the country
- A set of 20 dedicated phenology observation stations are also installed within the project – to be used for AI based analysis

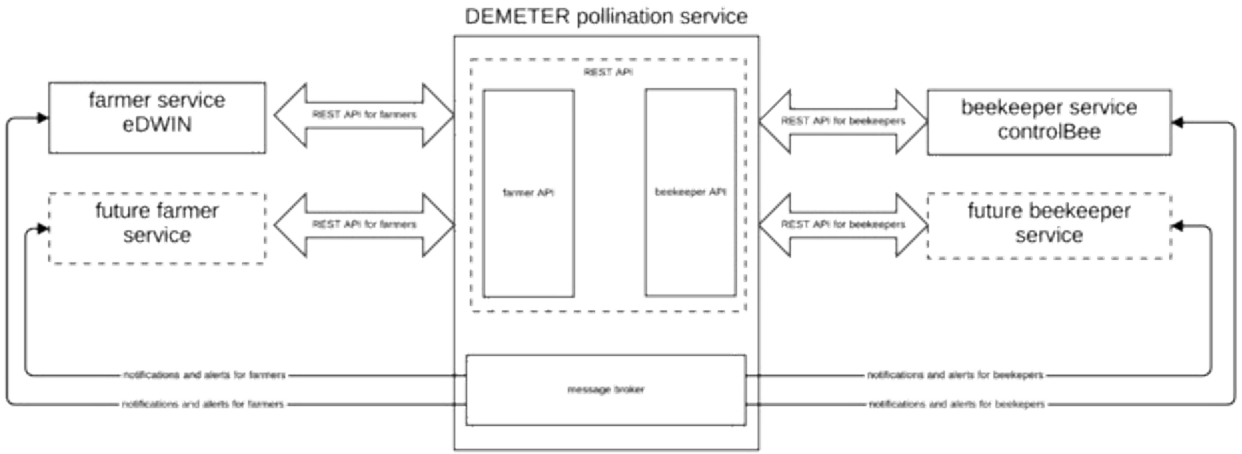
Virtual farm

- Entry application for largest group of users
- Support farm management based on spatial information
- Tracks lifetime of plants, types and amount of plant protection products used
- Provides results of mathematical models – calculating threat of pest occurrence
  - for plants such as wheat, barley, potatoes or beetroot)
- Knowledge about pests and pesticides, contact with advisors
- Both web portal and mobile applications available



Pollination Optimization Service

- Calculating pollination needs for field
  - size and shape of field
  - type of crop
  - Region



- Communication between farmers and beekeepers
  - farmer creates invites specifying pollination needs
  - beekeepers browse and accepts invites
  - specify apiaries deployment timeline
  - **send alerts between systems in case of pest threat and pesticides usage**

demeter

H2020 DEMETER project (Grant Agreement No 857202) that is funded by the European Commission under H2020-EU.2.1.1

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WODR

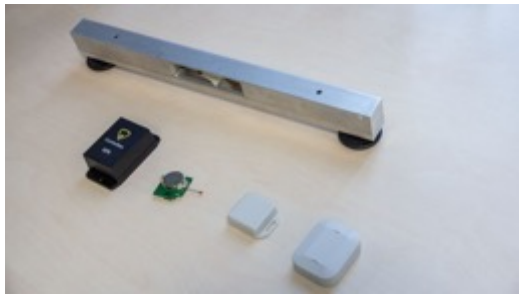
eDWIN

PSNC

Integration of the Pollination Optimization System

- Hardware deployment
  - ControlBee units
    - Temperature, humidity and acoustic sensors
    - Theft alert
    - Knock-over alert
    - Colony development – comparison with other colonies
    - Queen mating and status
  - Several beekeepers/apiaries
- Software deployment
  - Pollination Service utilizing DEMETER
  - ControlBee service with new functionalities
  - Dedicated connector within eDWIN platform

ControlBee
Twój bezpieczny ul



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demeter

H2020 DEMETER project (Grant Agreement No 857202) that is funded by the European Commission under H2020-EU.2.1.1

WODR

eDWIN

PSNC

Example 3:
Digitalising the smart agrifood sector in the Balearic Islands

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IoT and Agrifood in the Balearic Islands

- 85%
- Digitalisation based on IoT deployment
- Introduction of innovative technologies could increase the competitiveness of agri-food companies as well as generate synergies between the agri-food and tourism sectors

CPS4AGRI

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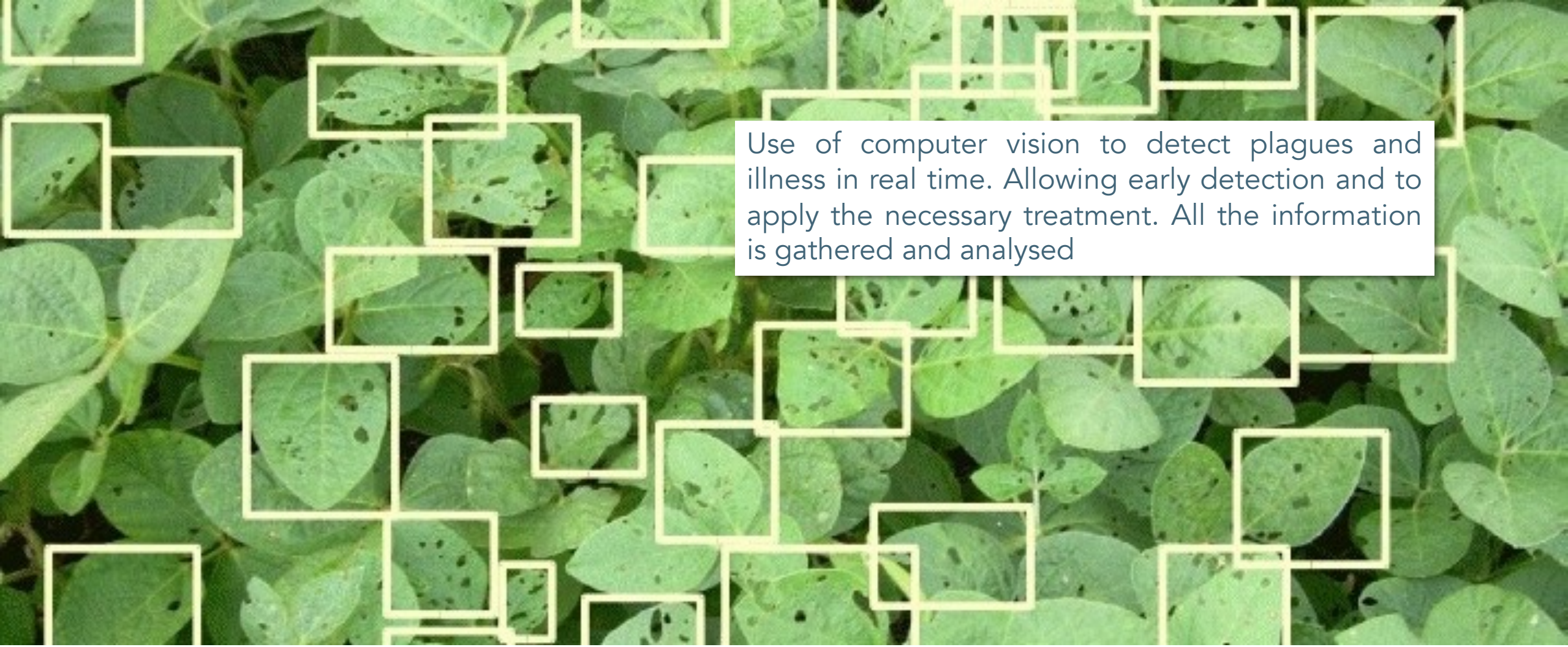
Sensors deployed in different sites to gather data:

- Soil humidity
- Air humidity
- Temperature
- Par radiation
- Rain
- CO2

All this information is gathered by NADIA for its storage and analysis

Real time monitoring



Use of computer vision to detect plagues and illness in real time. Allowing early detection and to apply the necessary treatment. All the information is gathered and analysed

Computer Vision

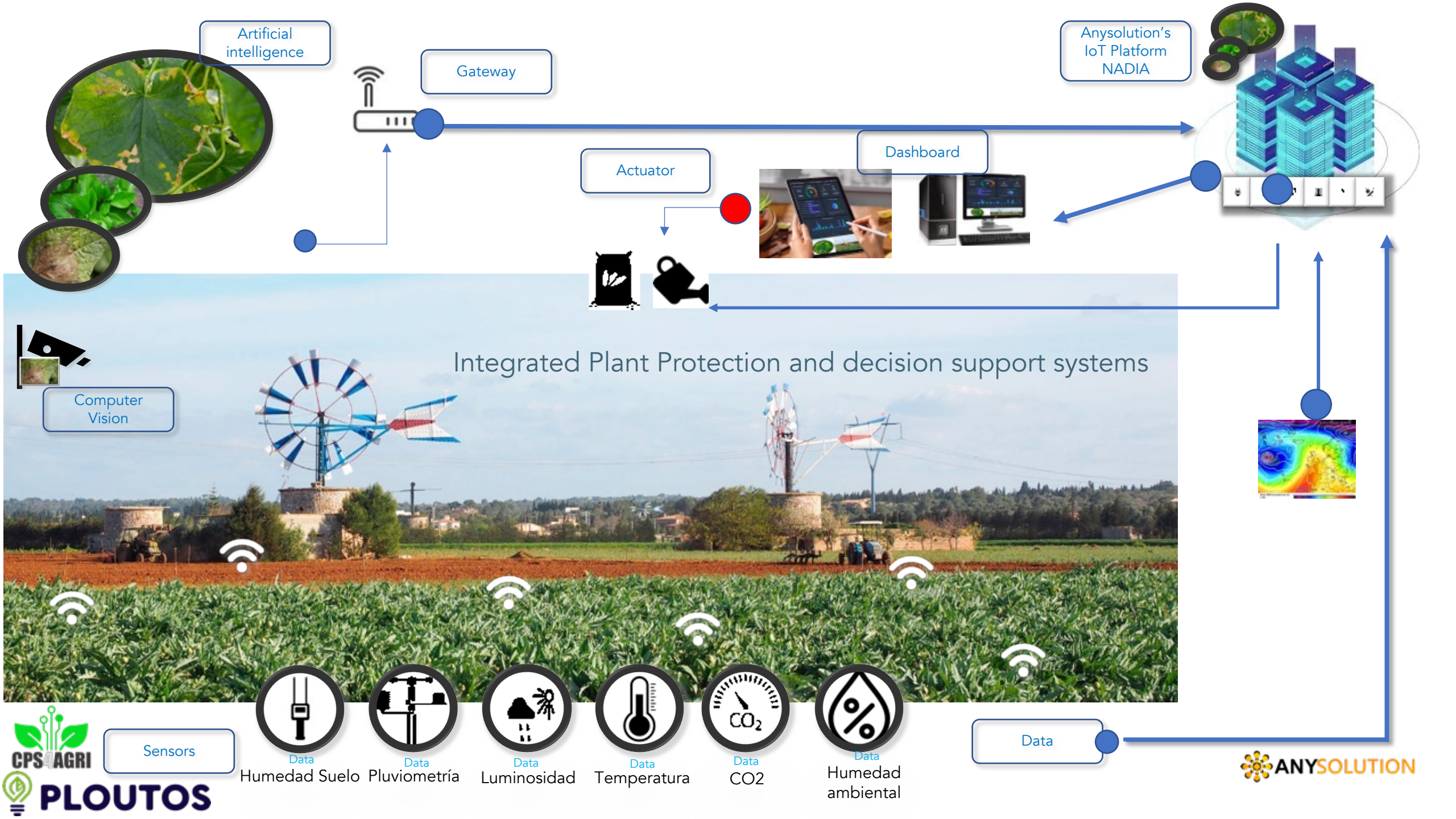
The sensors send the data to the cloud where it is analysed so that the system takes autonomously the decision to irrigate, to open the windows for airing, etc

Action

An intelligent system designed to automatically act on the crops will be deployed: level 1 for analysis (at the Edge) and level 2 for prevention (through a remote platform)

All information gathered is analysed using AI algorithms to detect patterns. Increasing efficiencies, as well as productivity, optimising the water use and reducing fertilisers and chemicals

Artificial Intelligence algorithms


Artificial intelligence
Gateway
Anysolution's IoT Platform NADIA
Dashboard
Actuator
Integrated Plant Protection and decision support systems
Computer Vision
Sensors
Data
Humedad Suelo
Data
Pluviometría
Data
Luminosidad
Data
Temperatura
Data
CO2
Data
Humedad ambiental
Data
CPS AGRI
PLOUTOS
ANYSOLUTION

Example 4:
CAP indicators landscape monitoring

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Towards future CAP and Green Deal objectives

- Tools for assessing CAP performance
  Common Monitoring and Evaluation Framework (CMEF)
  1. Application by farmers for CAP payments (IACS)
  2. Data from national statistical agencies, Eurostat and the Farm Accountancy Data Network (FADN).
  3. Earth Observation Satellite/Aerial images/Geotagged photos (on the spot)

- Assessment of Future CAP
  Performance Monitoring and Evaluation Framework (PMEF)
  - National/Regional/Farm level performance evaluation
  - Need for additional data sources

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New data sources for future CAP monitoring and evaluation

Farm level data:

- Parcel/Polygon
- Crop type per cultivation period – growth stages
- Agriculture activities
- Applied pesticides, fertilizers (time of application, what type of active substance, dose)
- Irrigation (Dose)
- Geotagged photos of cultivated parcel




Start Date	End Date	Growth-Stage
20/4/2020	21/4/2020	Planting of tuber seed or "potato seed"
24/5/2020	27/5/2020	Stems growing towards soil surface, formation of scale leaves in the axils of which stolons will develop later
1/6/2020	15/6/2020	Emergence: stems break through soil surface
16/6/2020	20/6/2020	4th-6th basal side shoot visible (> 5 cm)
20/6/2020	21/6/2020	Crop cover complete: about 90% of plants meet between rows / First individual buds (1–2 mm) of first inflorescence visible (main stem) / Tuber initiation: swelling of first stolon tips to twice the diameter of subtending stolon
21/6/2020	1/7/2020	First flower petals of first inflorescence visible / First open flowers in population

Start Date	End Date	Type	Application method	Commercial Name	Dose	Unit
17/3/2020	17/3/2020	basal fertilisation	Broadcasting	Macro Speed Gren 25%MgO + 50%SO3	266	kg/hectare
4/4/2020	4/4/2020	basal fertilisation	Broadcasting	Wapno Nordkalk (Organic manure)	2600	kg/hectare
9/4/2020	9/4/2020	basal fertilisation	Broadcasting	Mega DAP 18-46	96	kg/hectare
18/4/2020	21/4/2020	basal fertilisation	Broadcasting	RSM (26%)	558	kg/hectare

Start Date	End Date	Commercial Name	Active Substance	Dose	Unit
18/4/2020	21/4/2020	MONCUT 46 SC	flutolanil 460g/lt	513	mL
21/5/2020	21/5/2020	Round-up FL-360	glyphosate 360 g/l	2	L
21/5/2020	21/5/2020	Boa 360 CS	clomazone 360 g/l	0.16	L
21/5/2020	21/5/2020	Bandur 600 SC	aclonifen 600 g/l	2	L
21/5/2020	21/5/2020	Citation 70 WG	metribuzin 700 g/kg	0.45	kg
21/5/2020	21/5/2020	Stomp 400 SC	pendimethalin 400 g/l	4	L
21/5/2020	21/5/2020	Tuberon 70 WG	metribuzin 700 g/kg	0.46	kg

New data sources for future CAP monitoring and evaluation

Environmental monitoring observatories

- EU **Soil** Observatory (EUSO) & European Soil Data Centre (ESDAC)
  - Dashboard containing soil-related indicators EU level
- **Biodiversity** Information System for Europe (BISE) platform and Digital Observatory for Protected Areas
  - Assess, monitor, report and possibly forecast the state of and the pressure on protected areas at multiple scales.
- Integrated **Carbon** Observation System (ICOS) **GHG**
  - Standardised and open data from more than 140 measurement stations across 14 European countries
- Knowledge Hub on **Water** and Agriculture (JRC)
  - Land cover and fertilization, Surface water quality – Nitrates, Groundwater quality - Nitrates Directive, Surface water quality – Phosphates, Ecological status of water bodies, Chemical status of water bodies, Irrigation
- **In most of the cases interoperable data provision**

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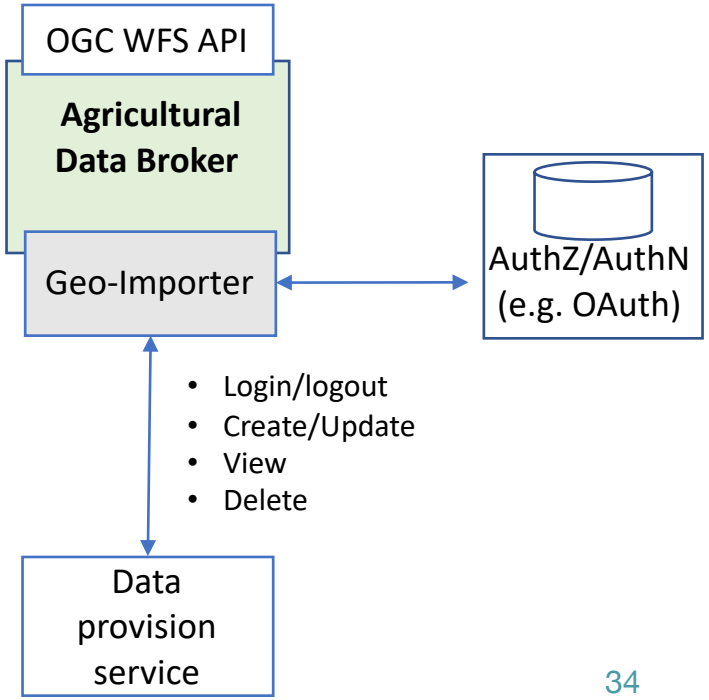
CAP indicators landscape monitoring component

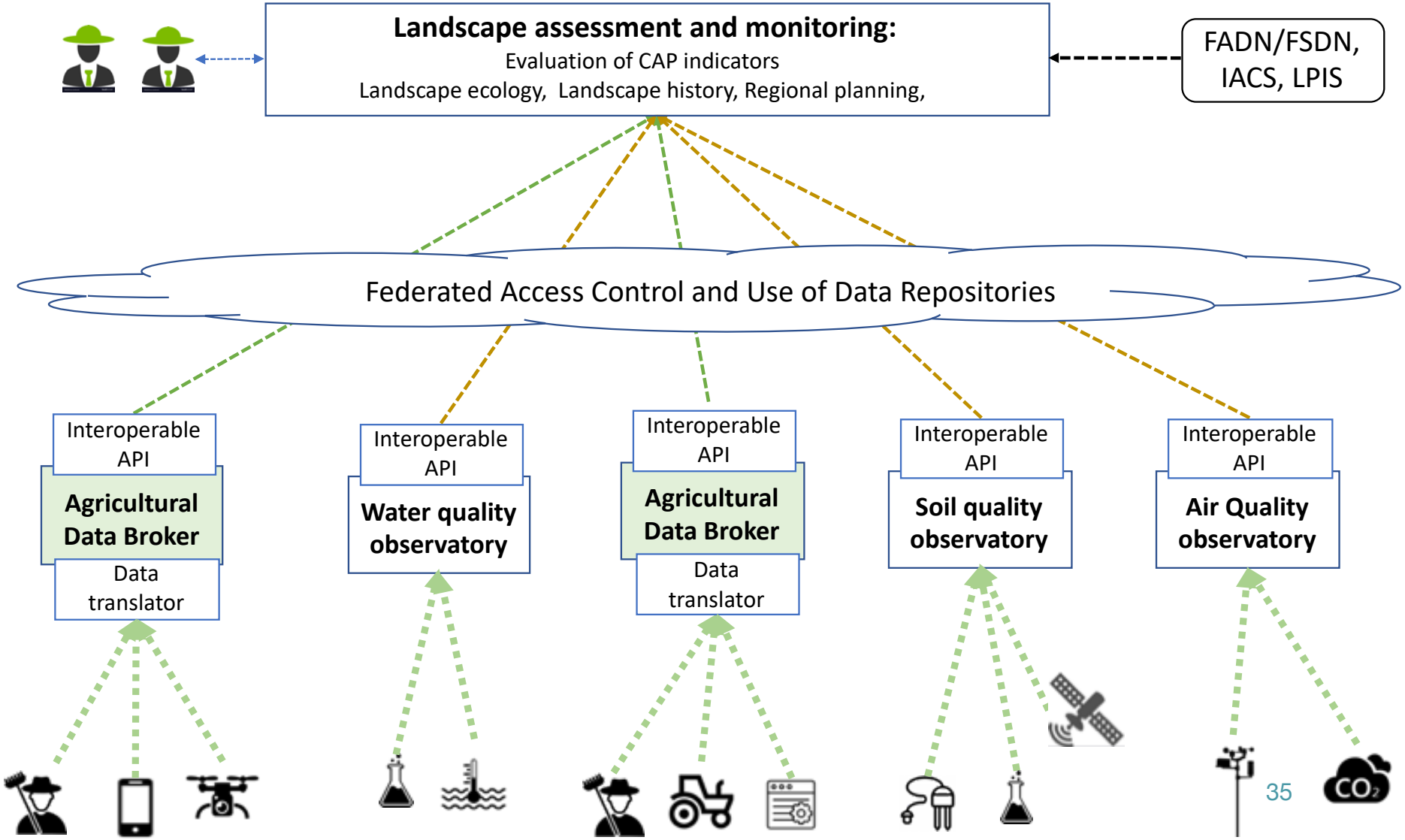
- A software component for heterogeneous agricultural data collection on regional level
- Information sources refer to multiple farms
- Administered by the farmer/farmer association/agriculture advisor.
- Builds on top of Geoserver - http://geoserver.org/
  Not re-implementing another data platform
- Data export/sharing of collected data OGC API
  Interoperability OGC-WMS/WFS
- Data Import
  Extending native RESTfull API



Towards a unified Agri-Environmental Observatory

Federated

Scale-dependent:
Local,
Sub-regional
Regional levels



Implementation

H2020-NIVA project

NIVA Code repository -

https://gitlab.com/nivaeu/WP4_cap-markers-data-signals_ogc_api

- GeoImporter live service

https://niva-eu.neuropublic.gr/importer/

- GeoImporter Swagger documentation

https://niva-eu.neuropublic.gr/importer/documentation#/

«CAP markers» setup - README with detailed instructions :

https://gitlab.com/nivaeu/WP4_cap-markers-data-signals_ogc_api

- Demo Video

https://www.youtube.com/watch?v=3dTbICGCXcU

https://www.youtube.com/watch?v=twpdFBHM6uE

Example 5:
Smart Farming Techniques for Climate Change Adaptation in Cyprus

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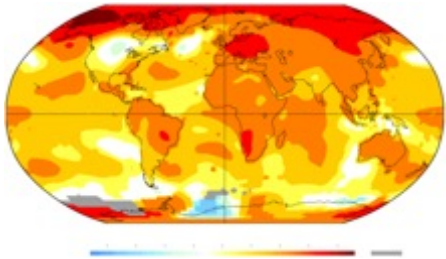
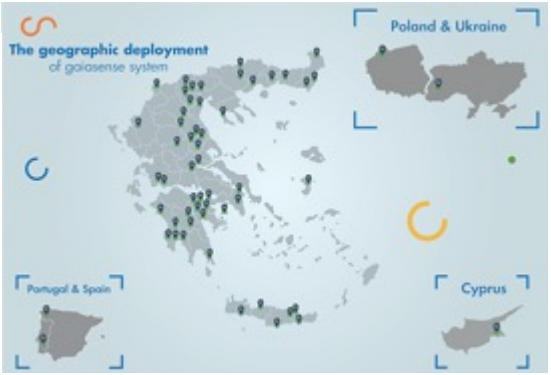
SF Techniques for Climate Change Adaptation in Cyprus

- Green Deal & CAP relation: Ability to reduce pesticides use
  - Also help smallholders cross the digital gap + leave no one behind
- Other benefits: Reduction of irrigation & farming ecological footprint
- Maturity level: gaiasense is TRL 9 (deployed in 5 countries)
- Cyprus highly affected by climate change: increased temperature, decreased precipitation
  - Leads to increased irrigation needs & soil degradation, decreased yields
- SF to help adapt to and mitigate climate change
  - SF = strategic goal for Cyprus





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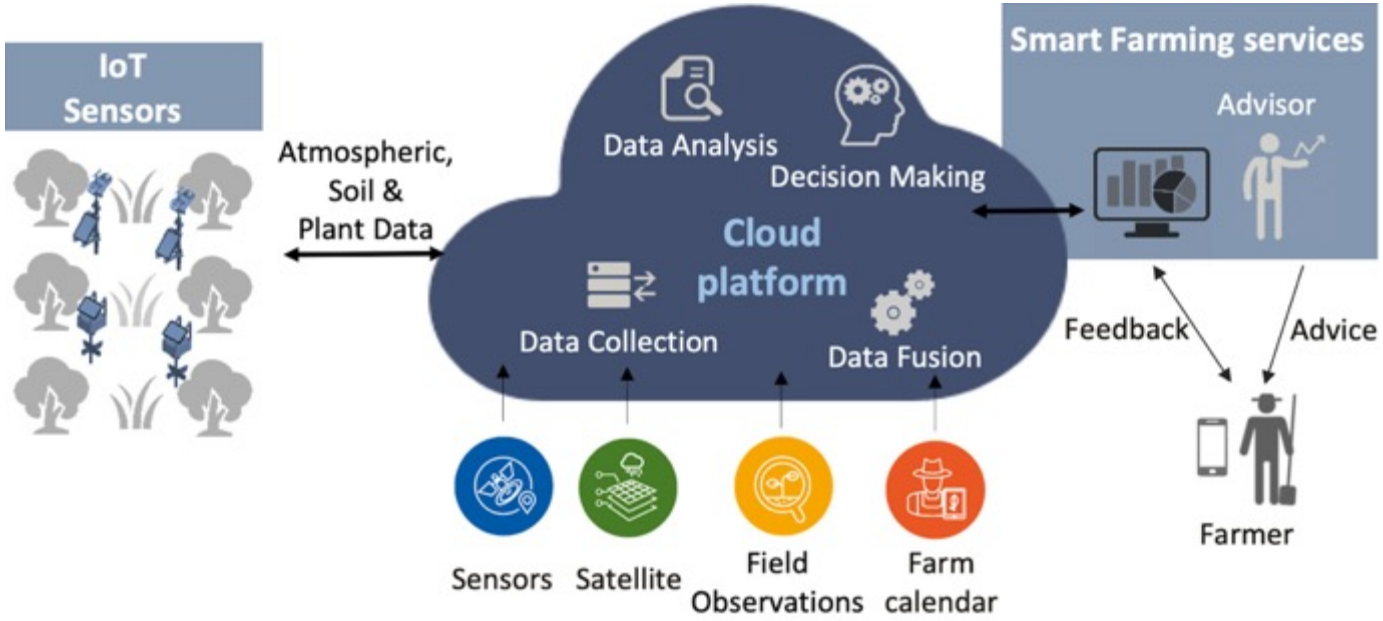
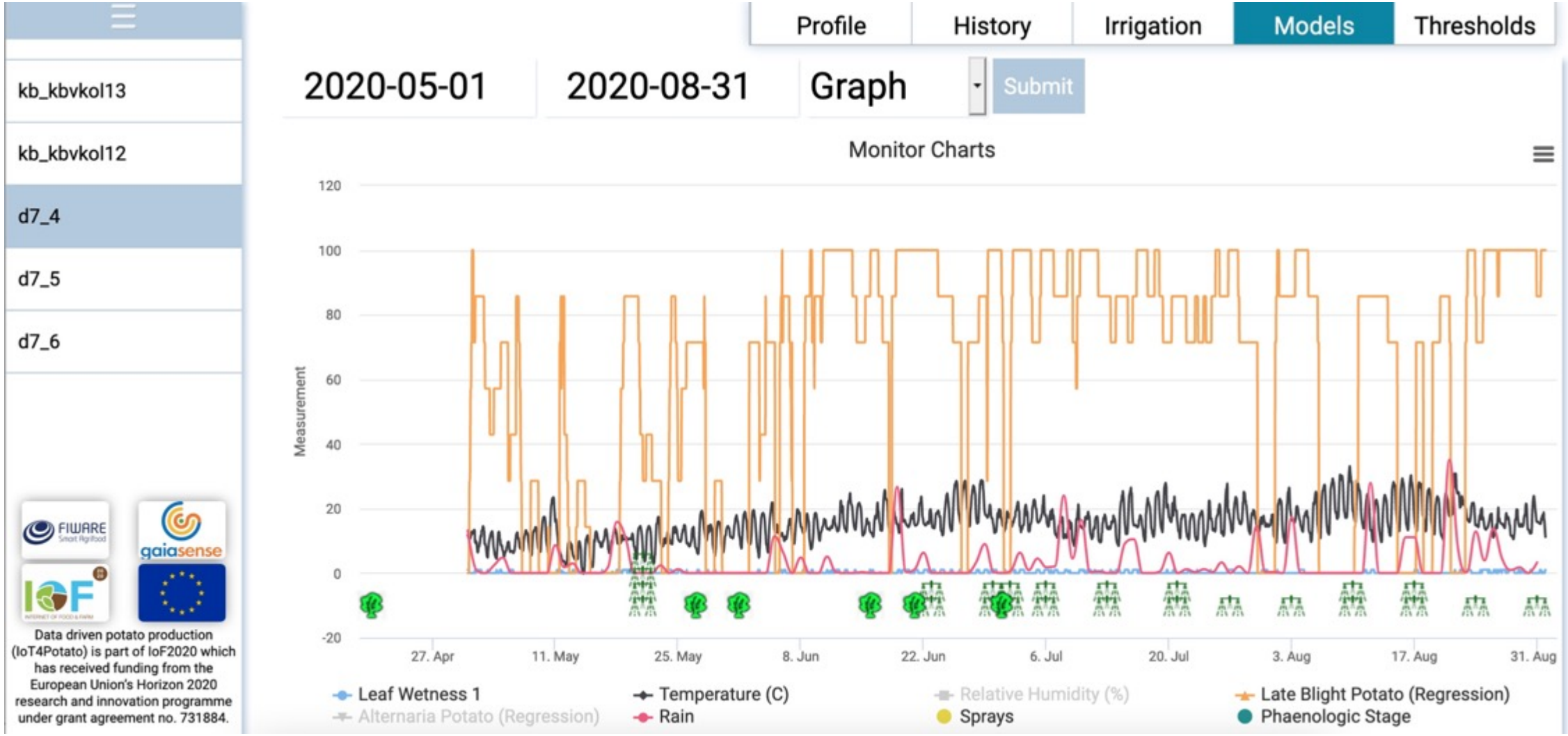
The "gaiasense" smart farming solution

- A technology solution offering SF services that provide advice to farmers based on field data
- Zero infrastructure investment for farmers, making it accessible even to smallholders – Smart-Farming As a Service
  - IoT sensors infrastructure owned and operated by the service provider.
  - Subscription based model – annual service per hectare

- What is the pests risk level and when do I have to spray?
- How much water and when?
- What is the precise type and the exact amount of fertilizers needed?



Pest Management Advise – Risk Prediction



Pilot and results

Results from pilot in Cyprus

- 6 fields in Cyprus
- 2 cultivation periods (2019-2020)
- Potential irrigation reduction of up to 22% AND important optimization
- Opportunities on pesticides use efficiency
- Significant potential for mitigating climate change effects and help farmers reduce their ecological footprint
- Inclusion of local actors and support for small farms

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Recommendations
+
Open Discussion

AI TI

AIOTI Recommendations

1. Quantification and benchmarking of the impact of IoT in the ecological footprint of (organic) farming → Roadmap for "replicable benchmarking"
2. Framework for quantifying full ecological footprint of IoT-based smart farming
3. Digital tools for reliable and certified measurement of environment indicators ("digital evidences") affected by agricultural activity, on a farm level
4. Interoperability and accessibility of data
5. Large-scale adoption: reach out agents of all sizes, ROI, testing and benchmarking

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Wrap-up and end of webinar

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AIOTI Signature Event 27 Sept Brussels

Please register here: https://aioti.eu/aioti-signature-event-2022/

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Internet of Things
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