



NIVA Use Cases

Jesús Estrada (TRAGSATEC)

NIVA State of play – 23/06/2020



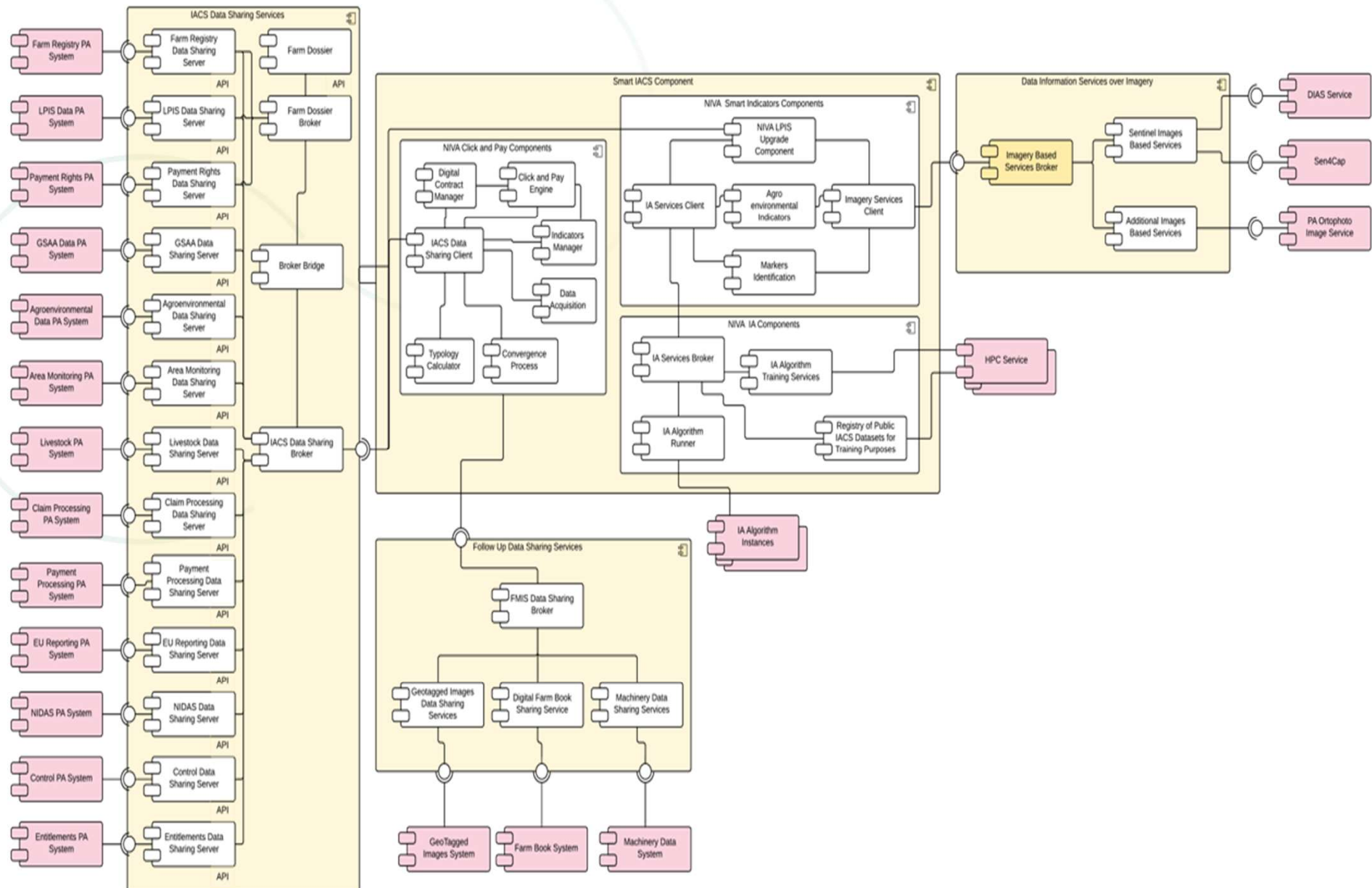
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 842009



WP2: General Overview

- Under WP2, they will be designed, deployed, tested and validated ICT tools and services for a modern Common Agricultural Policy (CAP): The NIVA USE CASES
- They will provide significant reduction costs across member states, administrative burdens and they will address farmer's needs, EU demands, and other stakeholder's requests
- 12 months of trials in real conditions in the nine countries
- Sharing of harmonized data and services for farmers and further stakeholders
- Creation of a permanent exchange platform for discussion and exchange

WP2: NIVA Simplified Architecture





WP2: Use Cases

- General Status and Overview
- What they have produced so far
- Final Product
- How they can be used by others PAs



U C 1a: Earth Observation Monitoring & Traffic Lights OPEKEPE (Greece)



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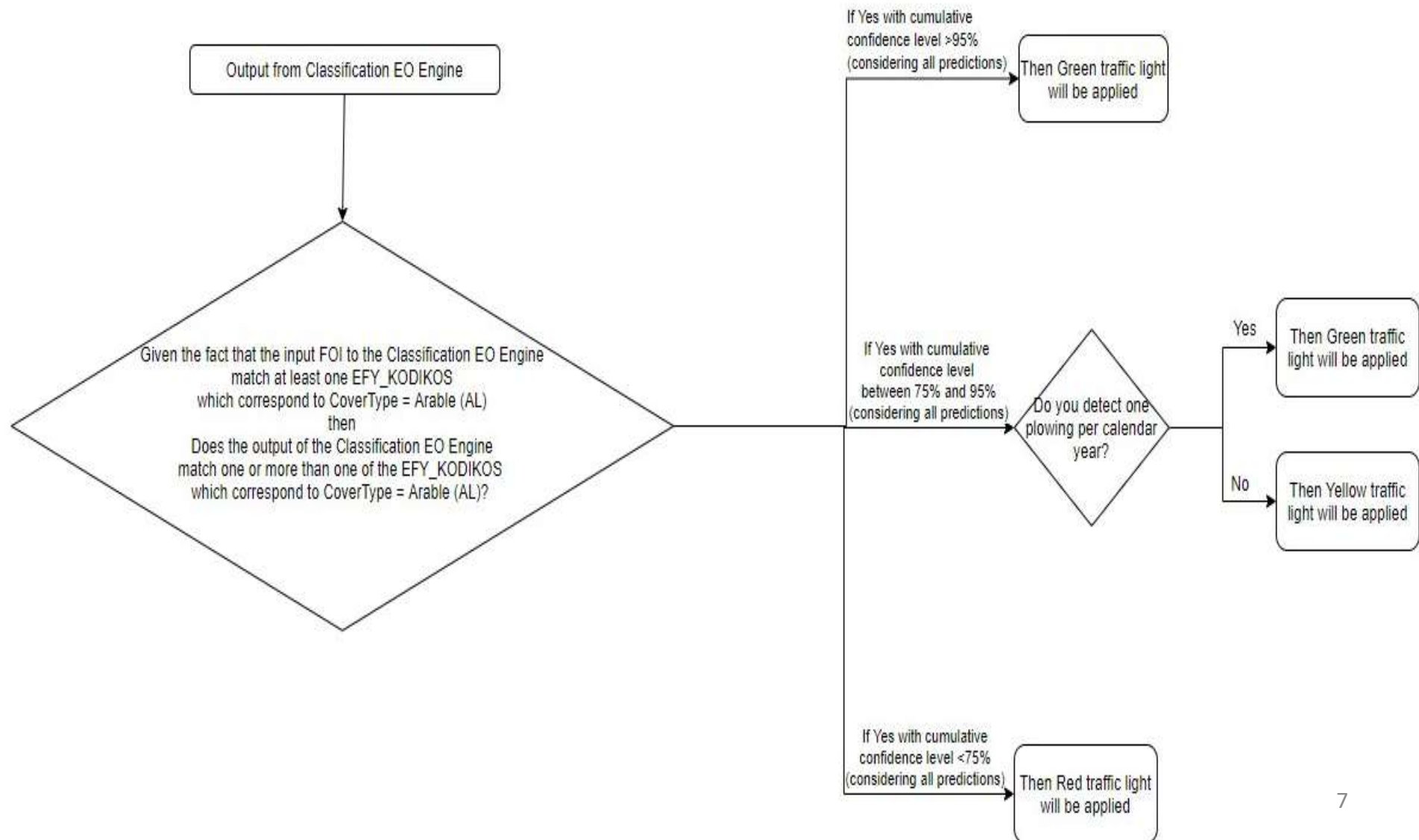


Overview & Final Product

- Eligibility Criteria for: **BP Scheme, VC Schemes & Crop Specific Payment for Cotton** based on EO Classification
- Decision Support System (NIVA-DSS) based on inputs from:
 - 2 EO Classification engines: a) Sen4CAP and b) A subcontracted EO
 - Secondary sources to deal with yellows (FMIS and Geo-tagged)
- Easy-to-use tool customised to the needs of every PA and will easily adjust to test countries (only training of the algorithms and parametrization of Eligibility Criteria and the DSS will be needed)
- Open-source and well-defined interfaces (not locked-in to a specific platform), enabling post-project further modifications/adaptations and improvement.
- Enables other EO monitoring engines and platforms to plug-in and further use it for their purposes
- Supports all external data sources

Eligibility Criteria: Decision Trees

(indicative based on Sen4CAP output in Greece for Eligibility Criterion 1)





More Information

- Information sources registry: responsible for maintaining a registry of the information sources (EO based classification systems, FMISs, Apps, IACS) that are registered with the NIVA-DSS
- Data Import: This component provides the core functionality for managing the imported and exported information items that is utilised by NIVA-DSS.
- Security & Access Control: This component enforces the required security mechanisms that ensure confidentiality, integrity and access control on information items.
- Decision Engine: This component operates logical algorithms that are customised to each eligibility criterion (EC) and assess claims based on the processing of the collected evidences. Based on predetermined threshold levels each score will qualify to a traffic light colour for each eligibility criterion that will be the final outcome of the NIVA-DSS.
- Inference Algorithms: repository of implemented knowledge inference algorithms (e.g. Bayesian statistical libraries) that will be utilised by the decision engine in order to process the data and infer the outcome.
- Front-end: This component will provide a user-friendly GUI that will visualise the outcomes of the NIVA-DSS.



UC1b: Agro environmental indicators ASP (FRANCE)



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Overview & Final Product

- List of agro-environmental indicators and Functional analysis on Carbon storage
- The final product will be the computing tools of the 3 selected indicators.
- Testing phase in Denmark, Netherlands and Spain

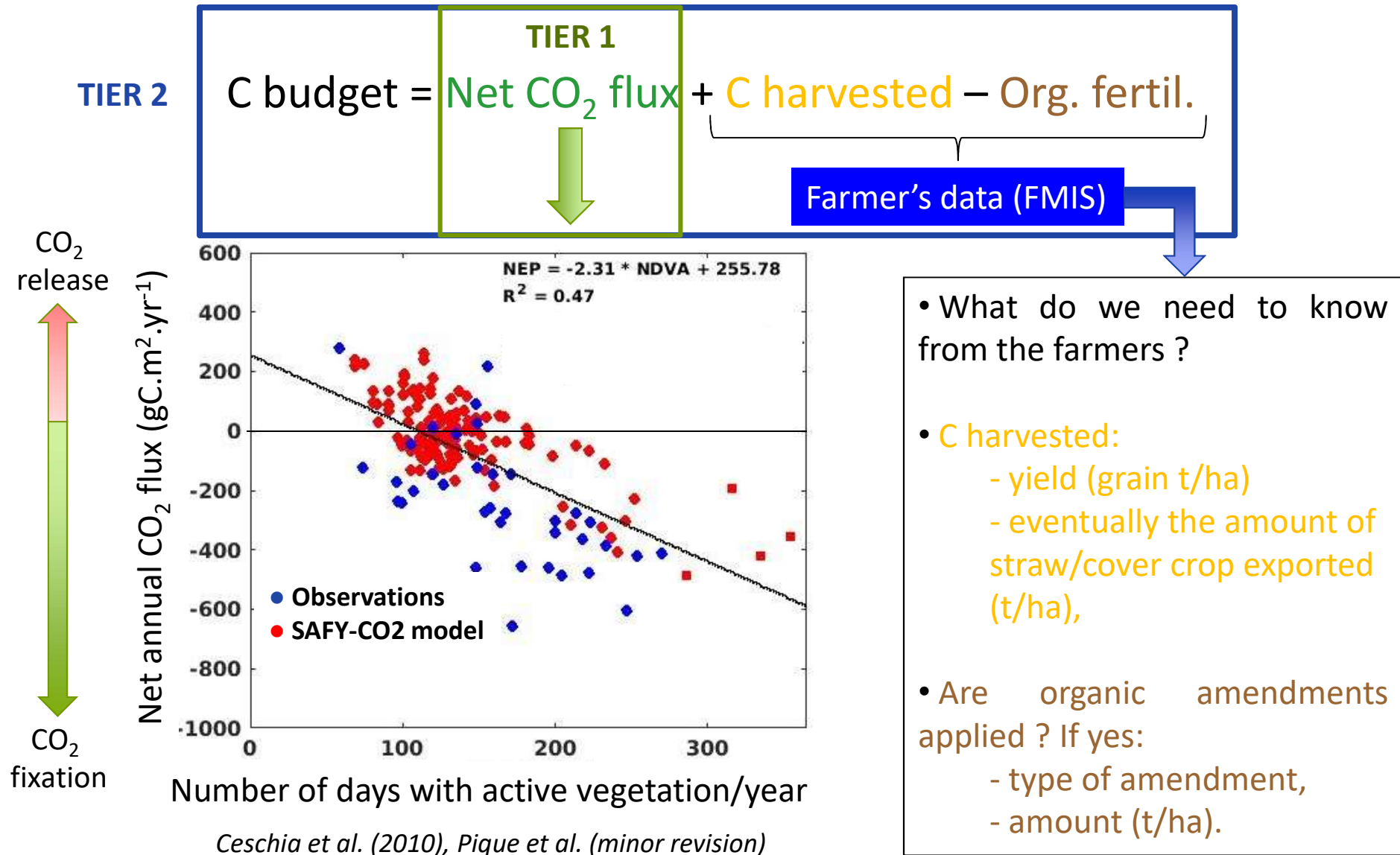
List of Agro-Environmental Indicators

- 11 A.E. indicators addressing 3 CAP objectives and 5 categories of environmental issues related to:
 - **Climate mitigation**: C budget, reduction of N fertilisers
 - **Water quality**: nitrates, pesticides, herbicides, fungicides
 - **Biodiversity**: biodiv. conservation, biological control, pollination
 - **Soils**: quality, erosion
 - **Landscapes**: aesthetic value
- 4 Calculation evidence-based methods (TIER 1 to 4)



Carbon budget Indicators

➤ Empirical approaches: plot level/annual



Nitrate leaching indicators

➤ Are calculated for **each couple previous/current cropping year** at plot level, but can be summed at rotation scale

➤ **2 TIERS:**

➤ **TIER 1:**

➤ Scoring method (between 0 and 1)

Crop rotation

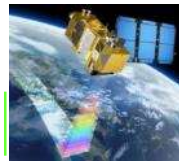
Previous crop



IACS data

Mineralisation
crop residue
soil after
previous crop (X2)

Catch crop



Sentinel data 1 & 2

Crop



IACS data

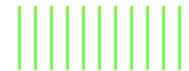
N uptake
Crop
Catch crop

Presence of CC
Development intensity
F factor

➤ **TIER 2:**

➤ Weighting factor
(between 0 and 1)

Type of catch
Crop (FMIS)



Soil climate



External data
Weather-soil
map

Data
needed

Biodiversity indicator

➤ **Specificity**

- Concerns the neighbouring area of each parcel

➤ **4 main components**

- Crop diversity : Shannon index (IACS)
- Plot structure : average size of the parcels (IACS)
- Semi-natural elements - Landscape features (IACS or Sentinel)
- Agricultural practices : tillage, fertilizers, Pesticides (FMIS)

➤ **Still to be done**

- Scope of the different tiers
- Allocation rules to each parcel
- Contribution rules of each parcel



REPUBLIC OF ESTONIA
AGRICULTURAL REGISTERS
AND INFORMATION BOARD



UC1c: Farmer Performance

ARIB (Estonia)



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Overview & Final Product

- Measure farmer performance and calculate indicators from IACS Data
 - Other sources: Farm Management Information System (FMIS)
- Prototype service with FMIS (eAgronom) and defining a data standard based on eCrop






Tools & components – prototype scope

- Semantic mapping:
 - IACS dataset vs eCROP (Estonia/ARIB)
 - FMIS dataset vs eCROP (Estonia/eAgronom)
 - Creating prototype: REST API component, enabling data exchange in JSON format
 - Message content based on eCROP standard
 - Defining some sample indicators which can be calculated based on additional data received from FMIS
- 



Tools & components – outcomes

- Microservice to convert a limited set of IACS and FMIS sample data to eCROP format
 - Prototype of service will be country-specific. Reusable components are recommended standards and data structure of APIs to exchange data between different systems
- 



UC2: Prefilled Application NPA (Lithuania)



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Overview & Final Product

- **Crop type integration model and methodology**

with harvested data from other use cases/ land cover classification, crop classification and activity monitoring provided by Sen4CAP;

- **Preliminary parcel boundary automatic delineation component**

using the eligible area detection algorithm and using the data from other use cases dealing with LPIS boundaries;

- **Tool selection and methodology for robotized tools**

for automatic data harvesting from external registers.



Results example



Crop type	Activity	Harvested data	Detected boundary	New ineligible object
Grassland	Mowed	Organic farming certified	Yes	No



Preliminary parcel boundary automatic delineation

- Use Sentinel data to detect parcels borders.
- Try and compare the results of two different approaches:
 - Unsupervised (LSMS) and
 - Supervised machine learning (eo-learn&eo-flow)
- Input data:
 - EO data (Sentinel-2 data through DIAS APIs)
 - GSAA parcels in shapefile format
- Output data:
 - shapefile with parcel boundaries



UC3: Farm Registry FEGA (Spain)

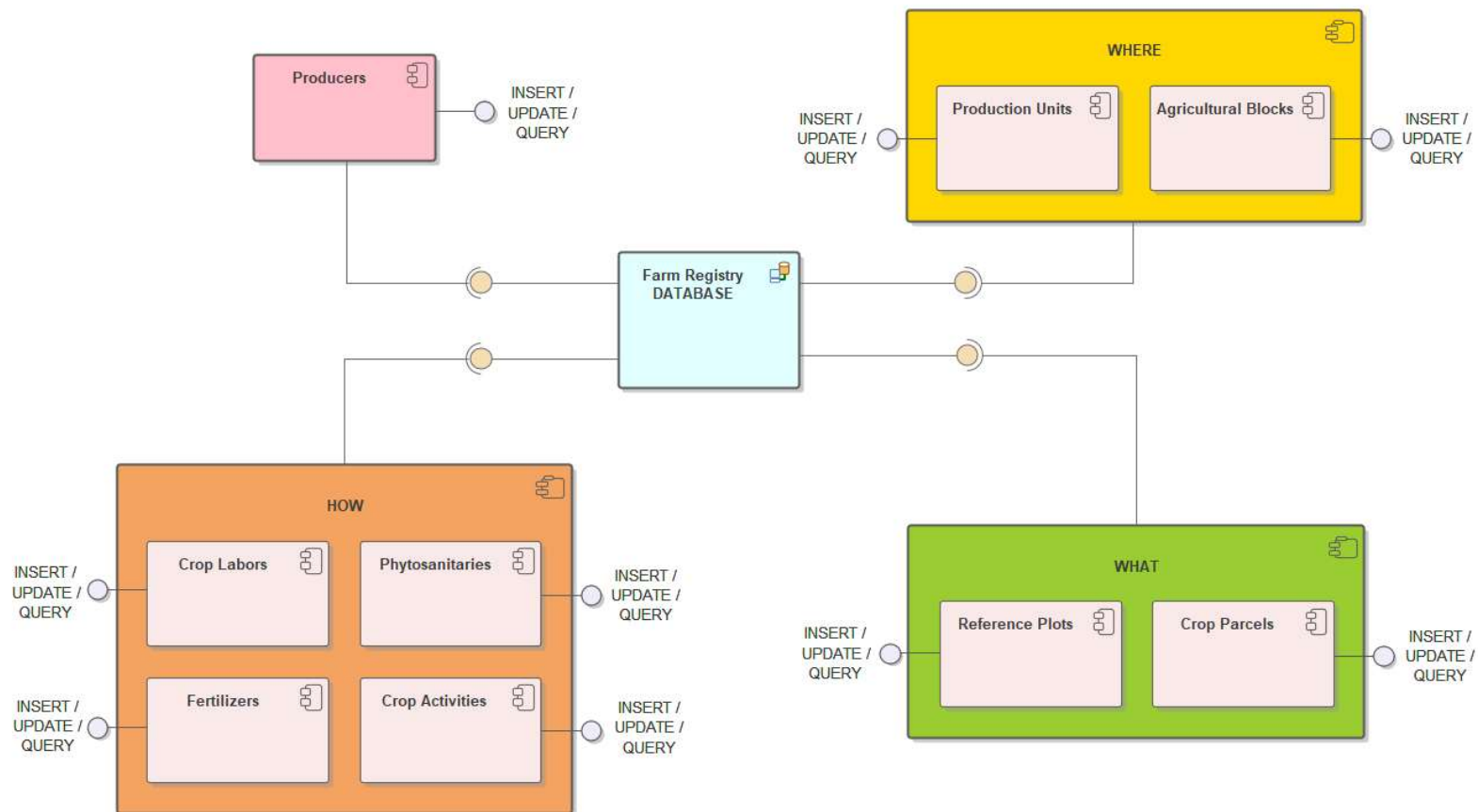


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Overview & Final Product

- Centralized Farm and exploitations registry
 - Harmonized data model (partially based on JRC, INSPIRE and eCROP)
 - Scripts to create DataBase model (tables, master data, ...)
 - WebServices (insert / update / query data into/from DataBase)
 - All the necessary documentation to install/deploy UC3 components

Components and Interfaces





More Information

- Foundations for a common agricultural Farm Registry
- Crossborder vocabulary
- Unified data and standard information:
 - Definitions aligned with EU CAP regulations
 - A unique farm identification code that could be used in all MS
 - Common code lists
 - Information exchange between participants and with external systems



UC3- Significant ideas (II)

✓ We propose:

- **Definitions** aligned with EU CAP regulations
- A **unique farm identification code** that could be used in all MS
- **Common code lists in NIVA** that will enable us to easily exchange information between participants and with external systems



UC4a: Geotagged Photos

DAFM (Ireland)

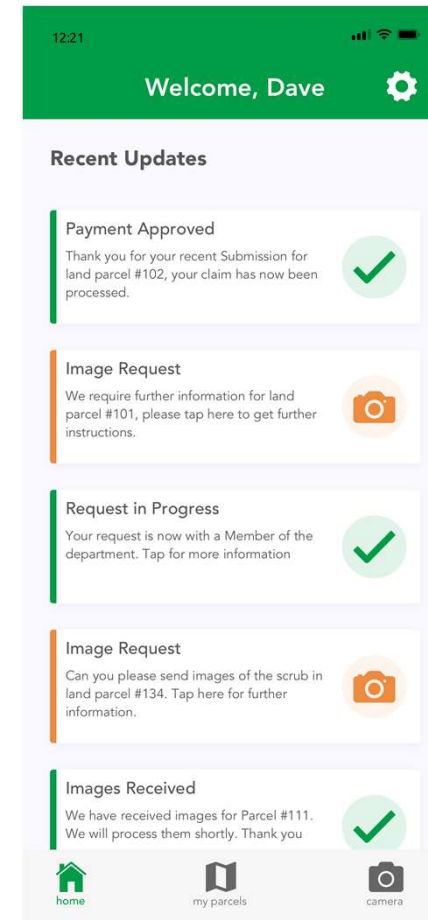


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Overview & Final Product

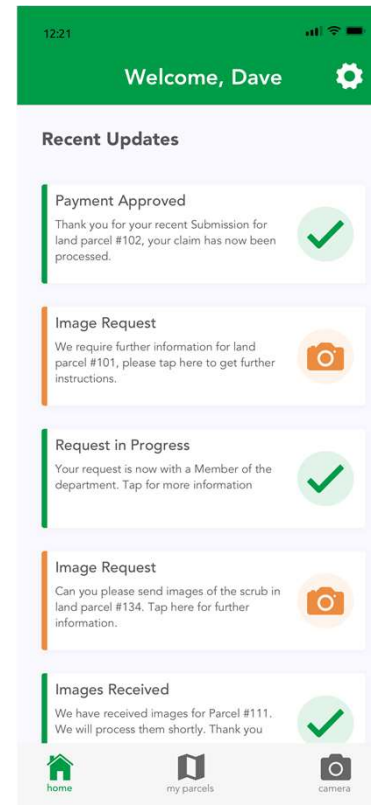
Design

- Click Through Prototype complete:
<https://www.sketch.com/s/1e27d1b8-0a2d-4655-b494-19290ec10469/a/8ZkAQR/play>



Development

- Components:
 - Main components for layout completed
 - Camera integration
 - Native maps (Apple and Google tested)
 - GPS location
 - Gyroscopic information
 - Security Plugins available
 - Hybrid & Offline



Augmented Reality

- Adding information to the camera
 - Placeholder
 - Compass
 - GPS coordinates
- Research ongoing with AR/VR team in TSSG

Object Recognition (research in progress)

- Identify what is in an image
 - Using Google Vision API
 - Identify people / person , number plates etc.
 - Deny upload based on information
- Can be used in future for training AI models





UC4b: Machine data RVO (The Netherlands)



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The rationale behind the use case

Movement in CAP from compliance to performance

-> Monitoring

-> Seamless claim

Fear for sharing data
will turn into an
interest in sharing data

Different data sources can contribute to 'prove' performance

Field data is closely linked to certain for CAP interesting activities.



Precision Ag data
has high quality
characteristics



FMIS



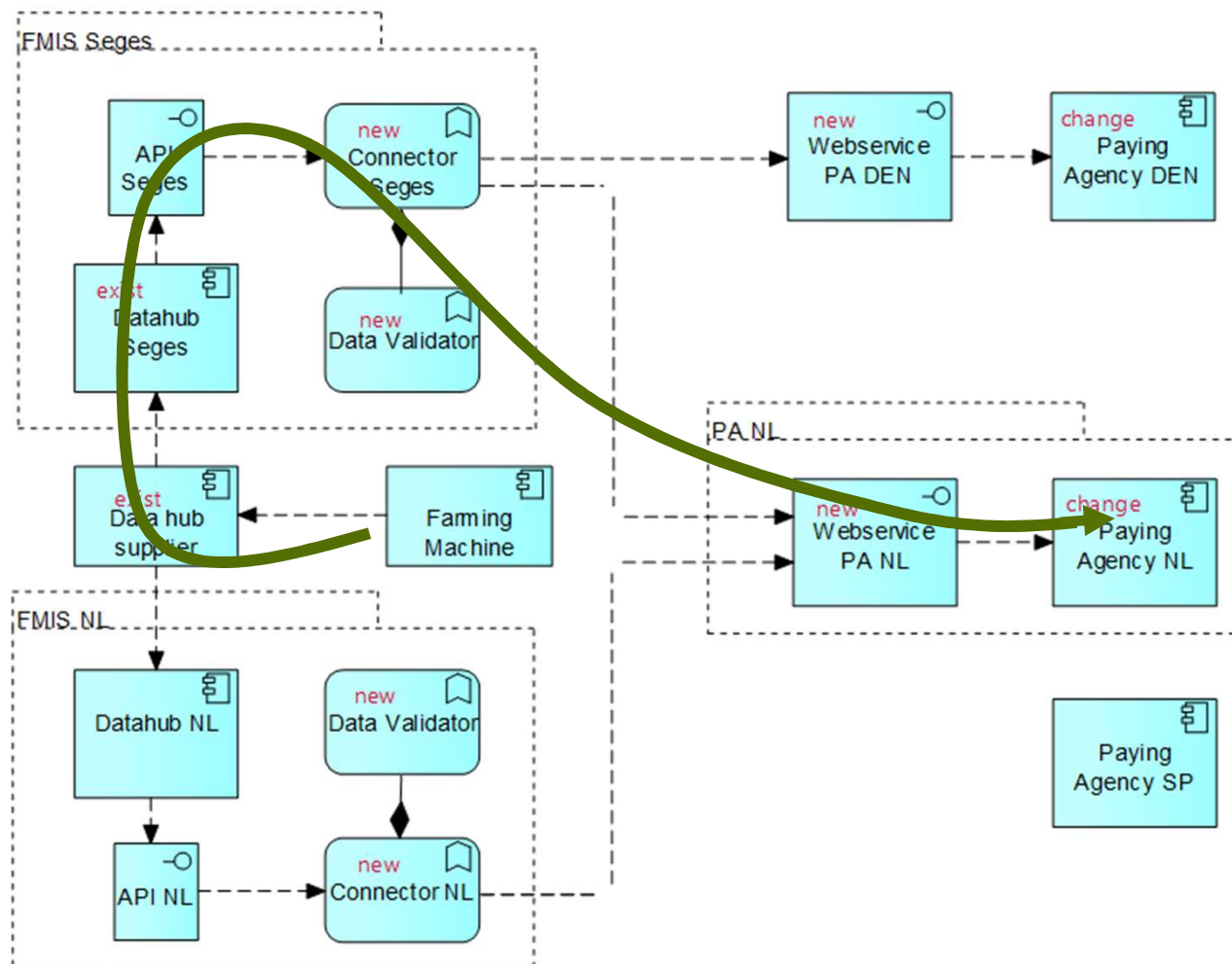
Paying agency

Can fill the monitoring void for small elements
strip cultivation and buffer strips

Overview & Final Product:

Create a system for data flow from machine to Paying Agency

Selected Use case focusses on **catch crop**



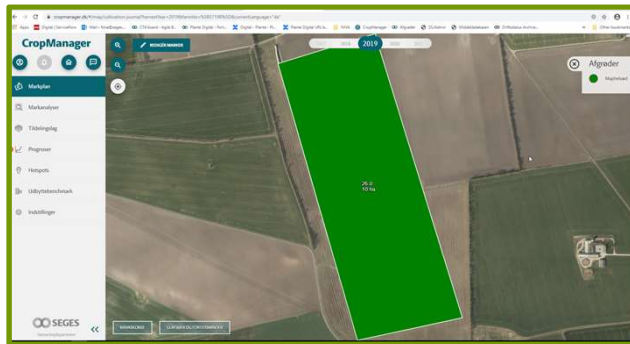


Components

Name	Description	Supplier (brand) + Model	Number of units	Deployment Site(s)
NIVA front end farmer	Connection to datahub	Open source	1	Gitlab
NIVA Connector	Sends data to validate and put through to PA	Open source	1	Gitlab
NIVA Validator	Elementary data check	Open source	1	Gitlab
Web service PA NL	Webservices to pull in the data.	Open source	1	Gitlab
Database scripts PA	Storage at the Payment agency	Open source	1	Gitlab

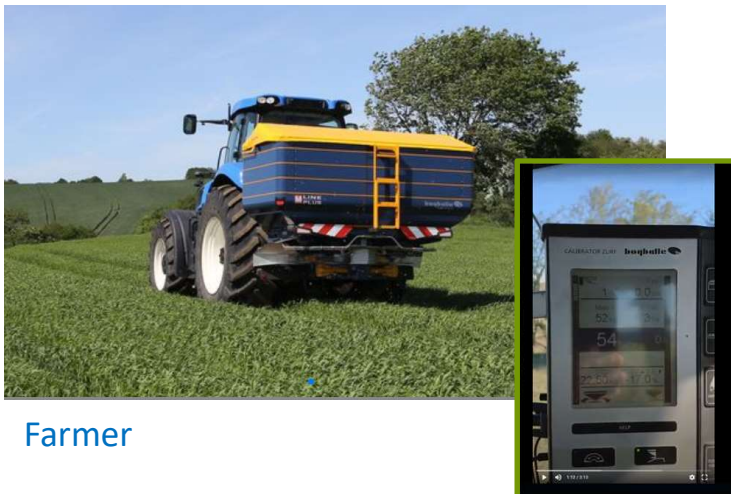
First demo end-to-end dataflow (1), May

1. Create Variable Rate Application map in Farm Management Information System



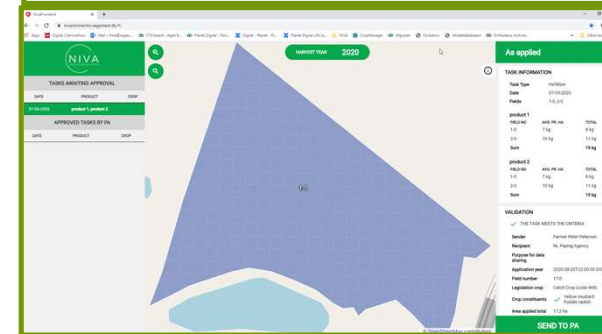
Farmer

2. Execute task with Bogballe device



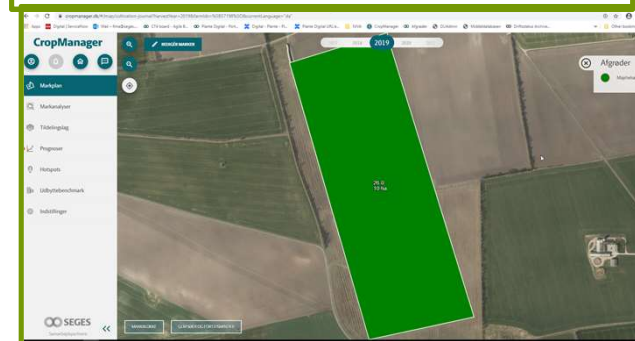
Farmer

4. Inspect As Applied Map in Connector frontend (EU-PL)



Farmer

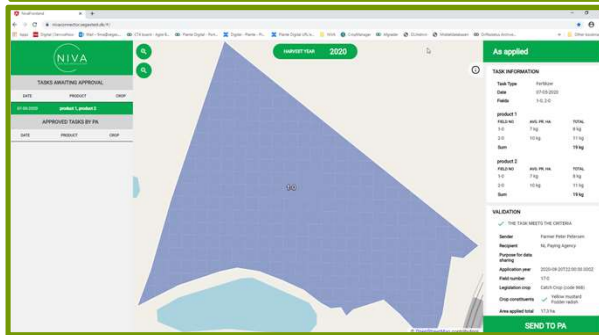
3. Inspect As Applied Map in FMIS



Farmer

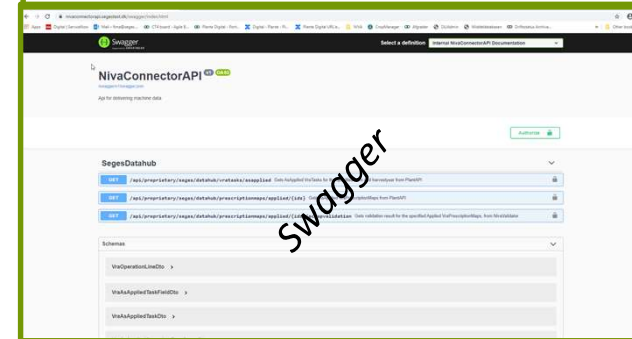
First demo end-to-end data flow (2), May

4. Inspect As Applied Map in Connector frontend (EU-PL)

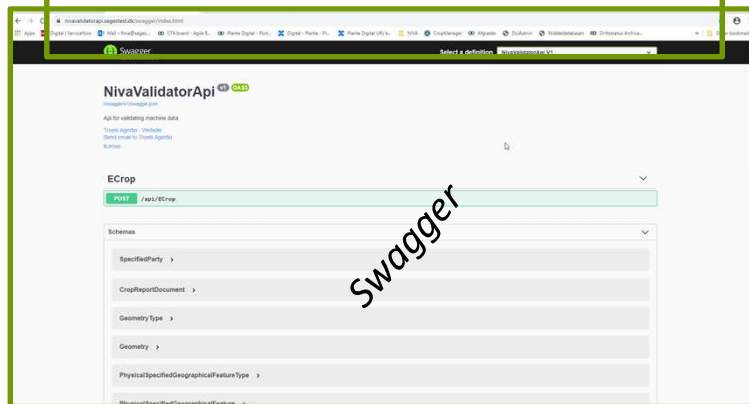


Farmer

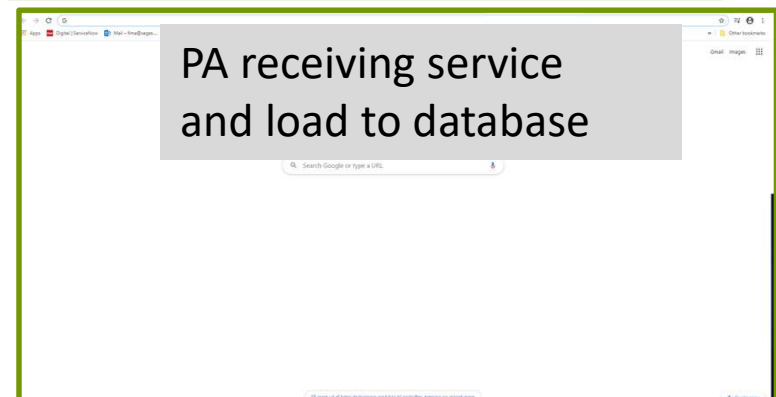
6. Expose As Applied Map from ConnectorAPI (EU-PL)



5/8. Evaluate with ValidatorAPI (EU-PL)



7. Receive As Applied Map in webservice (EU-PL)





UC5a: LPIS Update DAA (Denmark)



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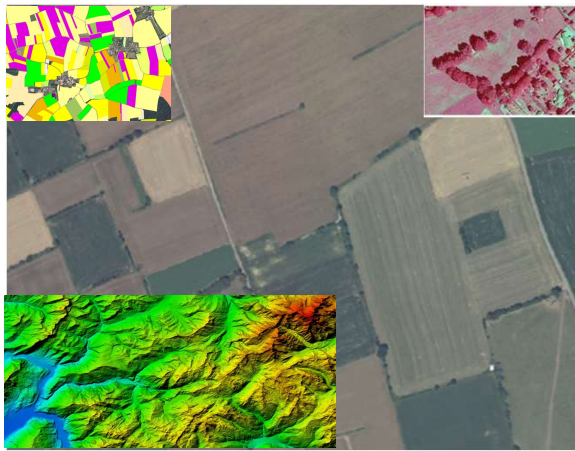


Overview & Final Product

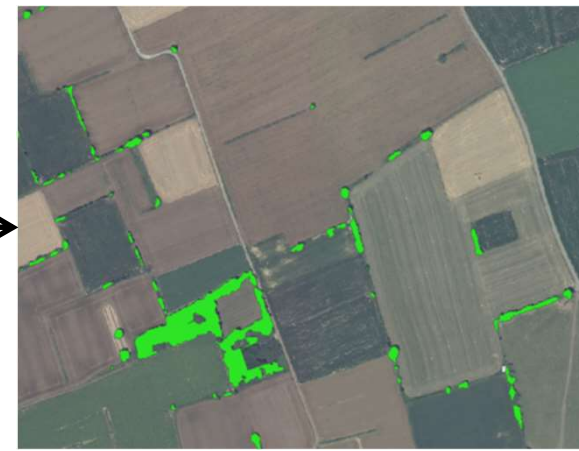
- Facilitate LPIS update by locating changes on non-agricultural elements (appeared or disappeared)
 - Develop algorithms (machine- and/or deep learning)
 - Basis for algorithms: Orthophoto and other relevant data
- Depending on quality, data from the algorithms can be used as
 - Fairly precise geo-located alerts
 - Fairly precise suggestions for changes
- The final product is an algorithm and a description on how use it : Each paying agency will run the algorithms on their data

Schematic process explanation of vegetation tool

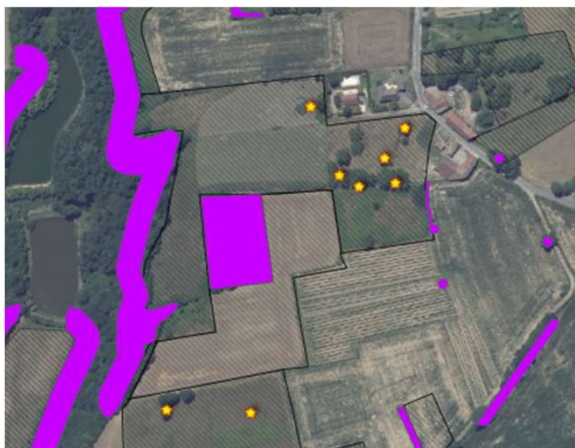
Objective => located by a punctual alert changes of tall vegetation corresponding to the land feature and/or EFA objects (trees, groves, hedges...)



1. Data preparation



2. Vegetation mask computation

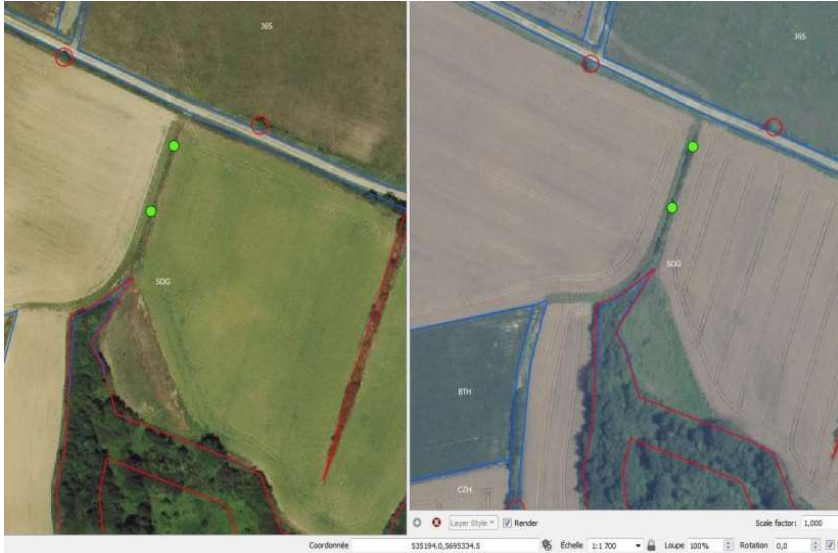


4. Punctual geolocated alerts



3. Segmentation and post-processing

Some results of the prototype (appeared alerts)



A. Very sensitive hedge detection



B. Good detection on the parcel boundary

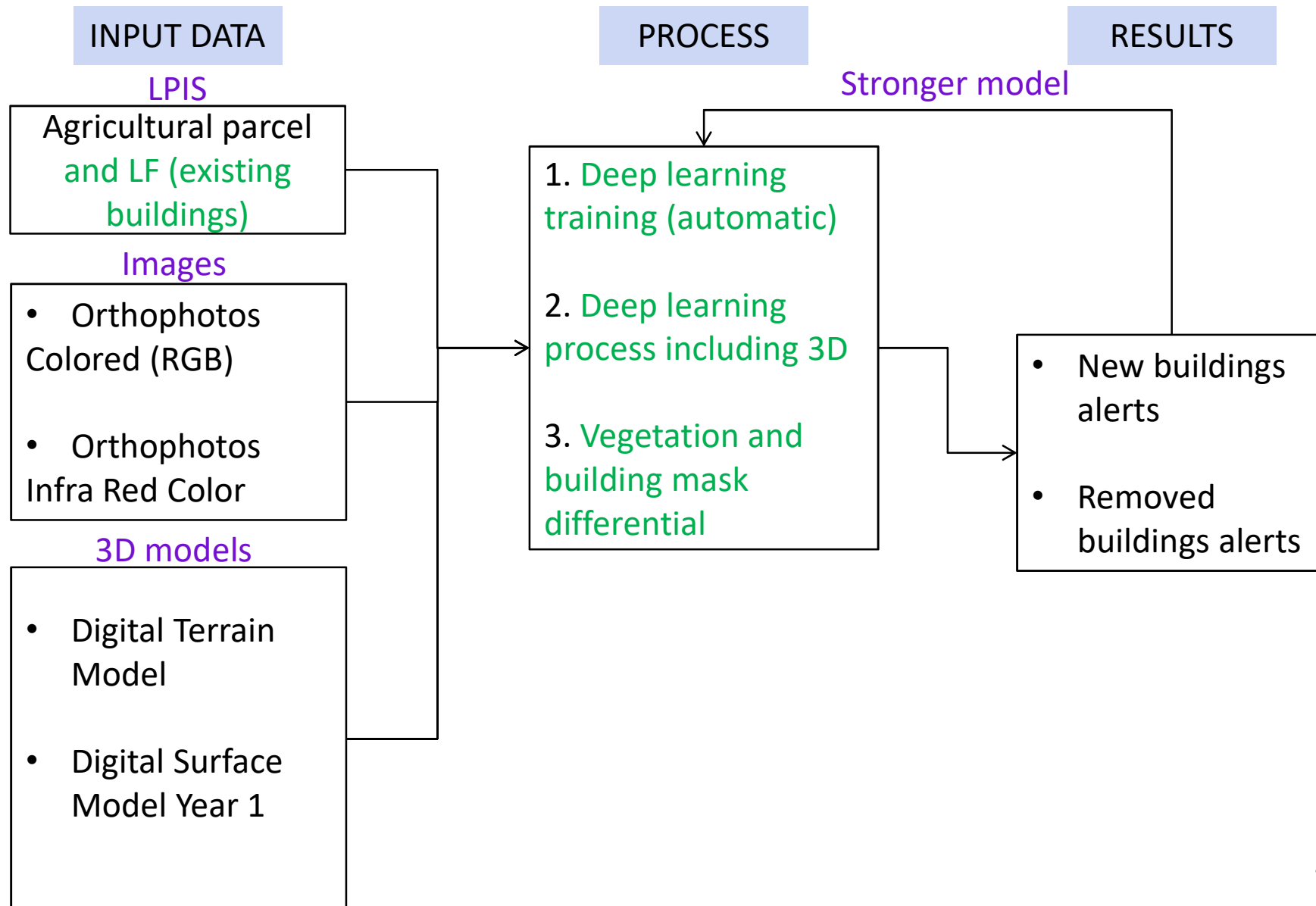


C. Fallow land and grasslands to be reinforced



D. Over-sensing on permanent crops

New method with deep learning





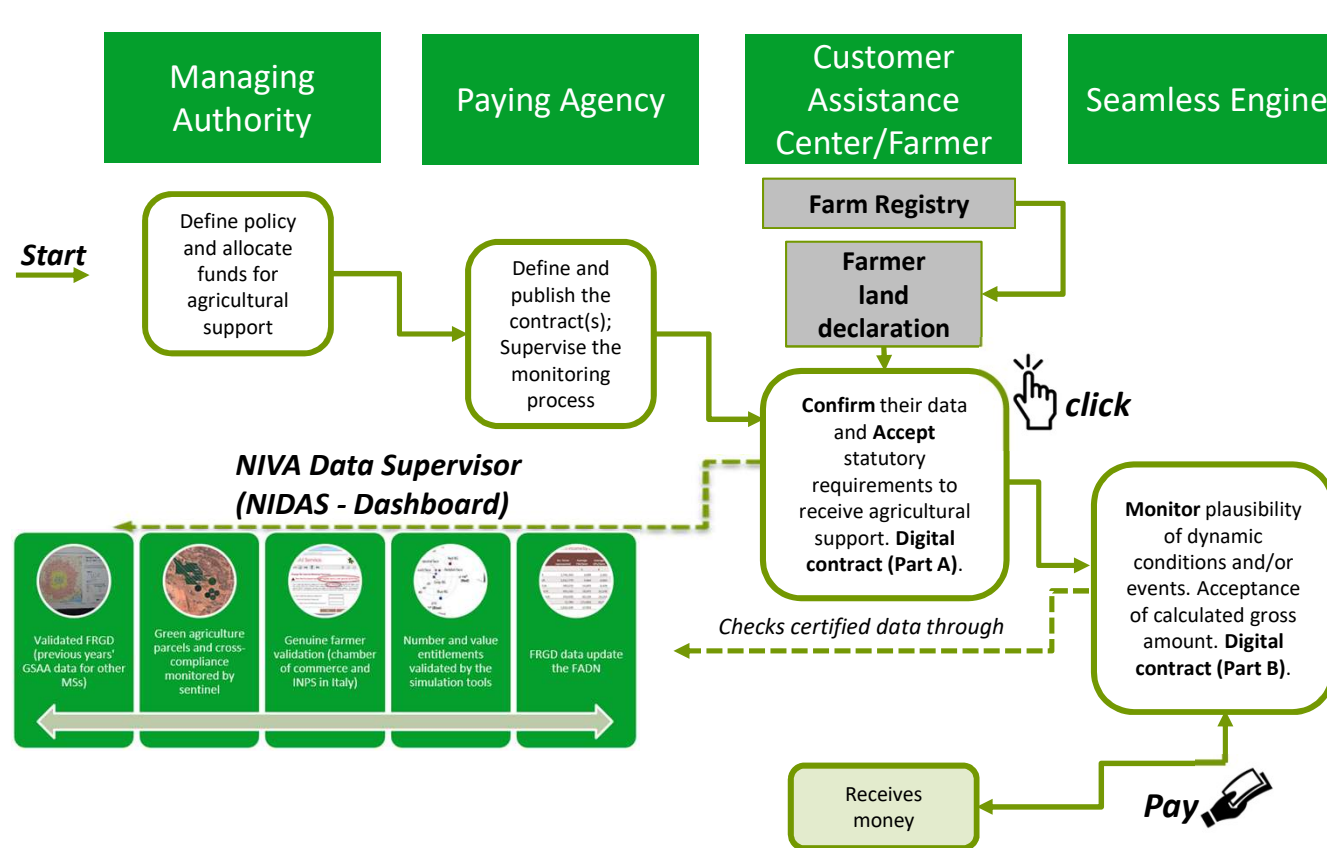
UC5b: Seamless Claim

AGEA (Italy)



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Overview



UC5b assists Farmer in complying with the conditions of **new CAP Reform** rules.

Main articles for digital contract:

- Art. 63.4(f) - Horizontal Regulation
- Art. 65.1 - CAP plan regulation
- Art. 65.6 - CAP plan regulation

Final Products



Digital contract

Contract performance enforced by digital protocols.



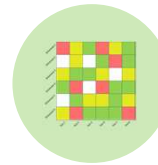
Click-and-pay engine

Digital Terms & Conditions semantic reasoner and payment calculation.



Entitlements simulation

Re-calculation or New-calculation of payment rights.



Indicators

Asserted facts from IACS distributed ledgers or other validated sources.



Farm classifier

Introduce EU standard monetary value to rank and typify farms.



NIVA Data Supervisor

Certifies data and its source.

Wireframe seamless claim: *click*

Browser

← → ↻ www.example.com

New Contract My Contracts

Go to contract Terms & Conditions, and SIGNATURE

	Sector	Contract Type	Open date	Close date	Eligibility
<input type="button" value="SELECT & ACCEPT"/>	Direct Pay	BISS	1/1/2021	31/12/2021	<input checked="" type="checkbox"/>
	<input type="checkbox"/> <input type="button" value="▶"/>
	<input type="checkbox"/> <input type="button" value="▶"/>

Suggest eligibility based on known facts, eventually providing instructions to complete or motivation to reject

Wireframe seamless claim: *pay*

Browser

← → ↻ www.example.com

×

☰

New Contract

My Contracts

Go to contract detail, which also provides a status report with instructions if any action is required

	Contract ID	Contract Type	Year	Status
<div>OPEN</div>	123xyz	BISS	2020	UNDER MONITORING
<div>OPEN</div>	546nfs	Eco-1 ponds	2019	CLOSED
<div>OPEN & AGREE</div>	Eco-1 hedges	2020	READY TO PAY



Conclusions

- NIVA is delivering common e-tools at EUPL basis
- Free and Open to any other Pas and partners in the IACS ecosystem
- Semantic and component Interoperability based on common vocabularies, common APIs and common approaches

THANK YOU!



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