

U C 1a: Earth Observation Monitoring & Traffic Lights

Use Case 1a Leader:



PAYMENT AND CONTROL AGENCY FOR GUIDANCE AND GUARANTEE COMMUNITY AIDS (O.P.E.K.E.P.E)

UC1a IT Partner:



NIVA meeting - 11/05/2020



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

Main Concept

To develop Smart Monitoring approach of the CAP, at parcel level that will:

- Provide Eligibility Criteria for: BP Scheme, VC Schemes & Crop Specific Payment for Cotton based on EO Classification Engines Output
- Provide Decision Support System (NIVA-DSS) based on these Schemes that will conclude in a traffic light system at parcel level.

This DSS will incorporate input from:

At least 2 EO Classification engines:

a) Sen4CAP and b) the new Subcontracting EO Classification.

- Secondary sources to deal with yellows (FMIS and Geo-tagged)
- Ensure that the NIVA-DSS will be open and generic so as to incorporate information from multiple sources avoiding the lock-in to specific technologies
- Give input to other UCs concerning Parcel Level Traffic Light with diminished yellows and a system which can handle remaining yellows
- Be 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 postproject 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 with predefined formats ("everything plugs in if it has the right fuse")

From Copenhagen till now

- Restructuring of the UC1a (shift of UC1a towards SEN4CAP instead of its own Algorithms that was initially planned)
- New description of Use Case, new workflow
- Finalization of Eligibility Criteria
- Finalization of New Architecture
- The DSS is under development
- Learning curve and Tests in Classification with in SEN4CAP EO Engine. More training still needed

Eligibility Criteria

- <u>Eligibility criterion 1:</u> Distinction/classification between arable land (AL), permanent crops (PC) and permanent grassland (PG) (three types of land cover).
- *Objective:* To assess eligibility at parcel level for BPS.
- □ <u>Eligibility criterion 2:</u> Crop classification by categorizing Cotton.
- <u>Objective:</u> To assess eligibility at parcel level for Crop Specific Payment for Cotton.
- Eligibility criterion 3: Crop classification by categorizing main permanent crops and main arable crops.
- Objective: To assess eligibility at parcel level for VCS schemes.

Eligibility Criteria – Expected assessed output

ТҮРЕ	USING:	USING:	COMMENTS
	SEN4CAP	EO CLASSIFICATION ENGINE PRODUCED	
		BY SUBCONTRACTING	
Arable Land (AL)	Yes (to be checked)	Yes (higher confidence /to be checked)	Also fallow land & green
			houses - BPS
Perm. Crops (PC)	Yes (to be checked)	Yes (higher confidence /to be checked)	BPS
Perm. Grassland (PG)	Not possible	Yes (to be checked)	BPS
Cotton	Yes (to be checked)	Yes (higher confidence /to be checked)	Cotton Scheme
Oranges	Yes (to be checked)	Yes (higher confidence /to be checked)	Permanent Crops - VCS
Peaches	Yes (to be checked)	Yes (higher confidence /to be checked)	Permanent Crops- VCS
Nuts	Yes (to be checked)	Yes (higher confidence /to be checked)	Permanent Crops- VCS
Grapes	Yes (to be checked)	Yes (higher confidence /to be checked)	Permanent Crops- VCS
Apples	Yes (to be checked)	Yes (higher confidence /to be checked)	Permanent Crops- VCS
Rice	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Durum Wheat	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Industrial Tomatoe	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Pulses	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Protein/Legum LSto	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Seeds	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Asparagus	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Sugar beets	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS
Protein/Legum Hay	Yes (to be checked)	Yes (higher confidence /to be checked)	Arable Land- VCS

Eligibility Criteria – Decision Trees

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



NIVA – DSS process

- The NIVA-DSS is composed of the following process:
 - Primary input phase:
 - EO Classification engines (SEN4CAP and Subcontracting) output. Primarily, UC1a will utilize products from Sen4CAP as NIVA consortium considered it as the dominant approach in EO data processing systems
 - defined eligibility criteria
 - Decision-making using traffic light system based on registered EO outcomes concerning the eligibility criteria.
 - Secondary input phase: In case of inconclusive evidence: incorporation of additional data from secondary sources.

Innovative aspects of NIVA-DSS

The main key and innovative aspects of UC1a:

- The NIVA-DSS will be open and capable to receive and plug-in other 'engines' aiming to enhance the assessment procedure of parcel declarations. This re-usability characteristics of the NIVA-DSS will also contribute significantly to the sustainability of the developed tool beyond the project end date.
- The NIVA-DSS will deploy and put into practice for the first time the interoperability mechanisms developed during NIVA project based on the EO engine (i.e. Sen4CAP) but also incorporating outcomes from different UCs (i.e. geotagged images).
- The NIVA-DSS engine will incorporate data fusion techniques aiming to enhance the capability of such systems to receive large volume of different datasets and from diverse sources of information, improving the reliability and accuracy of the generated traffic lights with minimum human intervention.
- The NIVA-DSS will give input to other UCs concerning Parcel Level Traffic Light with diminished yellows and a system which can handle remaining yellows

High-level architecture of NIVA-DSS



NIVA-DSS architecture

- <u>Information sources registry</u>: responsible for maintaining a registry of the information sources (EO based classification systems, FMISs, Apps, IACS) that are registered with the NIVA-DSS
- <u>Data Import</u>: This component provides the core functionality for managing the imported and exported information items that is utilised by NIVA-DSS.
- <u>Security & Access Control</u>: This component enforces the required security mechanisms that ensure confidentiality, integrity and access control on information items.
- <u>Decision Engine</u>: 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.
- <u>Inference Algorithms</u>: 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.
- <u>Front-end</u>: This component will provide a user-friendly GUI that will visualise the outcomes of the NIVA-DSS.

DSS: Time Schedule

- Set up GeoServer instance
 Configuration of GeoServer security
 Database and filesystem configuration
 Defining the process of importing parcel declarations
 Building data model for supporting crop classification results
 User management implementation
 Development of decision engine system- create decision/rule models for each EC
 - Development export functionality
 - Create/adjust graphical user interface (GUI) for data visualization
 - Extra web-gis functionality (search tools, extra layers, etc.)
 - Configuration of GeoServer exchange system
 - UI, Testing, refinement and debugging

M14 - M16

Ongoing – M12

M13 - M15

UC1a: Time Schedule

- Eligibility Criteria / Decision Trees check with other PAs
- UC1a final Description
- DSS development



- DSS development
- Test User involvement
- UC1a internal Testing
- Debugging, ready for piloting with users in Greece
- Pilot in Greece
- Ready to start Pilot in other MS (IE, FR, EE, IT)



Missing component: Subcontracting

- a)SEN4CAP is focusing on Sentinel 1 & 2 but not to other higher resolution satellite data available such as Planet,
- b) The crop classifier developed by Sen4CAP is based on Random Forest while other types of algorithms could be envisaged (e.g. deep neural networks),
- c) Sen4CAP has developed EO processes and growing indicators which implement standard indices. We miss assessment on the performance of the other indicators
- d) The detection, mapping and monitoring of other features like other type of pastures e.g. Pastures of southern countries which are much different than the "grassland mowing" product of SEN4CAP, is also missing.
- e) Also missing: Change detection algorithms with Sentinel + Planet or similar

Risks- Lessons Learned

 dependency of UC1a on another WPs/tasks (e.g. T4.2). we miss : interoperability enablers for EO engines, FMIS, Geo-tagged.

... IN PARTNERS WE TRUST | TIMESCHEDULE PLEASE!! ...

- delay in the UC due to Sen4CAP developments (2 months internal delay to decide about Sen4CAP + ? month(s) to hear from Sen4CAP)
 ...BEING OPEN AND FLEXIBLE HAS ITS PRICE...
- uncertainty about support from SEN4CAP after their project ends (Feb 2021)
- ...REUSE OF OPENSOURCE THIRD'S APP NEEDS CAREFULL PLANNING...
- Excessive effort put to SEN4CAP learning curve and effort spent for future modification

... SHIFT OF COMPONENTS AND IMPLEMENTATION METHODOLOGY ...



THANK YOU!





This project has received funding from the european union's horizon 2020 research and innovation programme under grant agreement no. 842009