Use of Sentinel images for the new CAP monitoring system: quality issues and potential solutions

Spatial Data Quality workshop
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Plan

• General context: CAP monitoring

• Short presentation of the NIVA project

• Quality issues of new CAP monitoring system

• Conclusions
Common Agricultural Policy (CAP) monitoring
In the context of Common Agricultural Policy, farmers may receive payments but they have to respect some conditions. Controls are conducted by Paying Agencies on declared areas: use of LPIS (Land Parcel Identification System) and LPIS provides the boundaries of agricultural areas. On activities.
Checking the activities: previous system (before 2023)

- By sampling: 5% of farmers

- Source of controls:
  - satellite images (1-2 dates)
  - controls of the spot

- Controls often considered as unfair by farmers
  - “tracking the last m²”
  - Exaggerated penalties
Checking the activities: new system (after 2023)

• Making advantage of Sentinel images
  – Good resolution (10 m for S-2)
  – High frequency
  – Free of charge

• To ensure continuous and exhaustive control of all parcels
Checking the activities: new system

Parcels with declared activities

EO monitoring

Traffic lights at parcel level
- Payment
- No payment

Sentinel images

Ask for secondary evidence (e.g. geotagged photos)
Checking the activities: new system

- Allowing farmers to change their declarations (done in May each year)

- General purpose is not to track red lights but to make them disappear

The new monitoring system mandated by the EU Commission is quite fairer than the old one.

What about practical implementation and quality issues?
NIVA project
The NIVA project

- NIVA: New IACS* Vision in Action
- H2020 project
- Objectives:
  - To develop e-tools to modernise the CAP
  - To broader reuse of IACS data
- Consortium
  - 9 Paying Agencies
  - technical partners
  - 27 partners
- 3 years project (June 2019 to May 2022)

IACS* : Integrated Administration and Control System (Information System of Paying Agencies)
The NIVA project

WP1 Coordination and Management

WP5 Innovation Ecosystem

WP6 Call for software components and pilot validations

WP2 Large Scale Pilot

WP3 Harmonisation and Interoperability

WP7 Ethics requirements

WP4 Knowledge Information System

(Main) source of today presentation

WP3 conducted some state-of-play about EO monitoring
Quality issues and potential solutions
Quality criteria

- Reliability
- Efficiency
- Transparency

- Reasonable control costs
- Acceptability by farmers
EO monitoring phases

Choice of satellite images

Pre-process of satellite images

Process of satellite images

Traffic lights

Get ARD (Analysis Ready Data)
Ex: georeferencing, atmospheric corrections

Guess farmer activities: crop type or event
(ploughing, mowing, harvesting, etc)

Compare parcels with declared activity with the activity “guessed” from satellite images
Choice of satellite images: quality issues

• S-2 images are the most adapted
  – Optic images easy to be interpreted
  – Rich semantic (13 bands)
  – High resolution (10 m)

• But optic images may be hidden by clouds

• 10 m resolution is not enough for small parcels
Choice of satellite images: potential solutions

- Against cloud issue, use of S-1 images
  - Radar data => weather regardless images
  - More difficult to process
  - Resolution: 30 m

- To deal with small parcels, use of better resolution images (e.g. SPOT, Planet ...)
  - Not free of charge
  - For **transparency** reasons, view to the images used in the monitoring process should be provided to farmers
Choice of satellite images: potential solutions

• Various approaches regarding definition of a “small parcel”

1 pixel S2
(Some countries)

3 pixels S2
(SEN4CAP project)

8 pixels S2
(JRC study)

Efficiency

Reliability
Pre-process of satellite images: quality issues

• Several options for cloud mask detection
• Choice of DTM may influence geo-referencing

Main issues:
  – selection of valid pixels (balance reliability/efficiency)
  – transparency:
    o Likely limited impact on decision-making process
    o But necessary to benchmark various methods
Process of satellite images: context

• Machine-learning processes often used to guess the farmer activities

• Training data is generally coming from farmer declaration
  – limited number of errors or frauds
  – The AI process is robust enough to detect the “divergent” parcels
Process of satellite images: quality issues and potential solutions

- Availability of training data
  - Depends on the condition to be checked
  - Not enough, e.g. for rare crop types
  - Not at all, e.g. for forbidden practices

- Strategy to choose training data is key => to be documented

- Making more robust models
  - sharing training data between countries
Process of satellite images: quality issues and potential solutions

- Lack of reference data
- No mean to measure the reliability of a method or to compare 2 methods
- JRC guidelines for quality control focus on the process part; visual controls mandated on sample set of parcels
Process of satellite images: quality issues and potential solutions

• Lack of transparency: IA results considered as not understandable by human beings

• At least, farmers should be given view to the images used in the EO monitoring
  – No issue with free Sentinel images
  – To be taken into account for higher resolution and not free of charge images
Decision on traffic lights: quality issues

- Very limited communication from Paying Agencies

- Likely, choice of thresholds to decide if results of EO monitoring confirm or not farmer declarations is seen as difficult and a bit arbitrary
Conclusions
Need for efficient EO monitoring

- In the new control system, the main limitation is the requirement of secondary evidences
  - It requires farmer contribution
  - Geotagged photos seem the most promising solution
  - More or less accepted by farmers: should not be too often
    - not too many “yellow lights” from EO monitoring
    - organisational issues
  - Process of geotagged photos
    - Need for automation
Need for EO monitoring benchmarking

• There have been lots of experimentations about EO monitoring

• But it is difficult to compare them

• It is important to document all the decisions that influence the quality of CAP payment decision
  – Transparency
  – Method benchmark => process improvement
Need for EO monitoring benchmarking

• Some NIVA deliverables may help for standardised documentation of EO monitoring process
Conclusion

• The new monitoring system looks quite fairer

• But it is raising lots of technical and organisational issues

• Need for consolidation
  – Should be implemented soon in EU
  – But still years of work to get strong quality ensured system?
Thank you for your attention!

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