Estonian Presidency of the Council of the European Union
Satellite based grassland mowing detection

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Tallinn, Estonia
Outline

• Agricultural Registers and Information Board
• Background of the project ‘Automated satellite based mowing detection’
• Main outcome – a new system SATIKAS
• State of play, figures
• Challenges and issues
• Future plans
• Conclusions

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Agricultural Registers and Information Board (ARIB)

• State authority in the area of the Ministry of Rural Affairs.
• Established in the summer of 2000 in Tartu.
• Main duties:
  • Maintenance of agricultural registers
  • Administration of agricultural, fishery and rural development support schemes
  • Implementation of EU agricultural market regulation measures
ARIB is a paying agency (PA)

Common Agricultural Policy Funds

![EU flag]

National budget EU2017.EE

- Land Parcel register (LPIS)
- Animals register
- Clients register

Requirements (!)
BACKGROUND - PROBLEM

• Mowing or grazing of grassland by certain date is one of the most common requirements for all area based supports in Estonia.

• Mowing requirement is quite often violated. This is keeping error rate high.

• On the spot checks are done only for 5-6% of applicants.

• Cost of on the spot checks is rising every year.

• There is a need to reduce number of on the spot checks and to have better targeted field inspections.

• Preventing errors is better than sanctioning.
BACKGROUND – Pilot Project

• Research and preparatory projects started in 2011 (Tartu Observatory.).
• Optical data projects: 2012 and 2013, using VHR and HR satellite data from WorldView, QuickBird and Spot.
• Encouraging satellite based results, well in line with field inspection results!
• Sentinel data became available.
• Funding from EU Structural Funds (2016)

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Project: ‘Automated satellite based mowing detection’

- **Goal:** an integrated system that uses Sentinel 1 and 2 images (timeseries) to make country level mowing controls and reports the mowing detection results (mowing dates) to the farmers and paying agency officials.

- **Scope:**
  - Additional functionality to existing systems (IACS, e-ARIB, GIS)
  - A new system SATIKAS

- Development period: 06.2016 - 01.2018
- Fully operational starting from 2018.
SYSTEM OPERATING PRINCIPLE

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New system “SATIKAS“

• General name: SATellendi andmete KAsutamise Süsteem - ‘A system that uses satellite data’. Mowing detection is the first task.

• System uses as input data:
  • Agricultural parcel (grasslands) geometries from aid applications (E-ARIB/IACS/GIS)
  • Sentinel-1 and Sentinel-2 time series (ESA scihub)
  • Meteorological (rainfall) data (Estonian Weather service)

• Observation period set in 2017: 01.05 - 31.10

• Stand alone system with user interface (UI) for administrator and API for exchanging data.

• Cloudy weather independence thanks to Sentinel-1 radar data.

• Input data temporal density: new S1 or S2 image every 2 days.

• Update of “mowing layer“ at least every week

• Due to input (Sentinel) data resolution constraints, system covers fields greater than 0.38 ha
VALIDATION OF PARCEL GEOMETRIES

Buffer area (mixed pixels) 15 m
Min 140 ‘clean’ pixels needed
Min area for calculating 0,38 ha.
Examples of skipped parcels

Narrow ditches
Figures

• Agricultural parcels claimed in 2017 (in total) – 170,672 (965,629.88 ha)
• Agricultural parcels (grasslands) processed by SATIKAS – 100,366 (440,093.64 ha)
• Skipped due to small area or complex shape – 40,669 (~40%) (43,480.03 ha (~10%))
• Mowing detection error rate by number of parcels – 15% (of 59,697)
• Validation sample size – 1,791 mowing events
RESULTS IN EAGIS (LPIS)
RESULTS IN IACS
RESULTS IN FARMERS PORTAL (e-ARIB)

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RESULTS ON PUBLIC WEBMAP
https://kls.pria.ee/kaart/

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CHALLENGES

• Local Sentinel data distribution center (EstHUB) is not there yet.
• Weather data services (API) where not there.
• IT development and science has to be done simultaneously.
• BIG(est) DATA amount a single system needs (15 TB per environment) – performance is a key factor
• Every single step of the process is timeconsuming - >testing takes time (a lot).
• SATIKAS has no permanent host yet – mobility.
FUTURE PLANS for SATIKAS

• **Final results** published by the end of 2017.
• Other possible functionalities (and other possible image/data providers) will be assessed:
  1. Crop (crop group) detection
  2. Detection of nitrogen fixing crops
  3. Detection of cultivation of fallow land
  4. Hints for changes in LPIS.
• Notification of farmers before deadline of mowing.
• System will be hosted on top of/next to the EstHUB (at KeMIT)
Sentinel data distribution - EstHub

Weather Service
Rainfall

Estonian Collaborative ground segment - EstHub

SATIKAS

S1/S2

S1/S2

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Conclusions

• The results of automated mowing detection can be used in risk analysis and targeted controls, BUT …

• … 100% mowing control is not possible using only S1 and S2 images (because of the pixel size and error rate of the system)

• Sentinel images can possibly be used in combination with other datasets (LIDAR, VHR, aerial photos, geotagged photos) and methods as alternatives for OTSC.

• A benefit already achieved: farmers know that PA knows (ie PA is monitoring)
Mowing before 07.05.2017
Mowing before 14.05.2017
Mowing before 21.05.2017
Mowing before 28.05.2017
Mowing before 04.06.2017

EU2017.EE
Mowing before 11.06.2017
Mowing before 18.06.2017
Mowing before 25.06.2017
Mowing before 02.07.2017

EU2017.EE
Mowing before 09.07.2017
Mowing before 16.07.2017
Mowing before 23.07.2017
Mowing before 30.07.2017

EU2017.EE
Mowing before 06.08.2017
Mowing before 13.08.2017 (10.08!)
Mowing before 20.08.2017
Mowing before 27.08.2017
Mowing before 03.09.2017 (01.09!)
Mowing before 10.09.2017
THANK YOU FOR YOUR ATTENTION!

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