New Tillage Detection functionality in the L4C Processor

sen4cap
common agricultural policy

Introduction

- Terminology - tilling and ploughing

  o Tilling: agricultural preparation of the soil by breaking the soil apart mechanically (preparing the soil for planting)

  o Ploughing: overturning and mashing of the soil to reveal the soil underneath the topsoil (refreshing the planting field)

  o Tilling happens in the spring season and Ploughing in fall

- Sen4CAP implementation (EO data response)

  o No difference is considered at a physical level (i.e. the land is lying undisturbed and then is suddenly disturbed)

  o Tillage is used as a single term that covers all the physical and temporal variability of tilling & ploughing practices

Preparatory activities

- Agreement with two pilot countries interested in collaboration during tillage processor development:
  1) Lithuania
  2) Spain (Castilla y Leon)

- Assessment of farming practices relevant to tillage:
  o when the tillage is usually applied
  o at which frequency
  o what is the parcel cover before and after the tillage (bare soil vs. vegetation cover)?
  o do parcels stay unmanaged for some time before and after the tillage?
  o etc.

European Space Agency

Tillage detection processor - concept

- Same approach as agricultural practices monitoring (automated analysis of EO-based temporal profiles through **"harvest" markers**)

- Focus on **tillage applied after the harvest** of the main crop

- The implementation will follow **continuous monitoring** concept (similarly as harvest detection: weekly evaluation)

- The goal is to provide **generic solution** that could be applied in any EU country (no country specific tailoring)

European Space Agency

Tillage detection processor - methodology

- Use of „harvest" markers (M1 – M5) + detection of harvest as pre-condition

- At a purely theoretical-level:

  (1) NDVI should remain low throughout this process

  (2) The backscatter ratio should remain high/increasing throughout this process

  (3) Coherence should increase during/after harvest and decrease after ploughing/tilling

| MARKERS FOR HARVEST		
M1	Presence of vegetation in the main vegetation season	High values of NDVI
M2	Loss of vegetation	Break in NDVI (decrease)
M3	Loss of vegetation	Break in backscatter ratio (increase)
M4	Low/no vegetation	High values of backscatter ratio
M5	Low/no vegetation (stable conditions)	Break in VV Coherence (increase) or high values of VV Coherence

Tillage detection - example

id: 49452, orig_id = 1011868272-044513-1518-2,   practice: 2020-09-01 - 2020-10-15,   harvest: 2020-07-27 - 2020-08-02
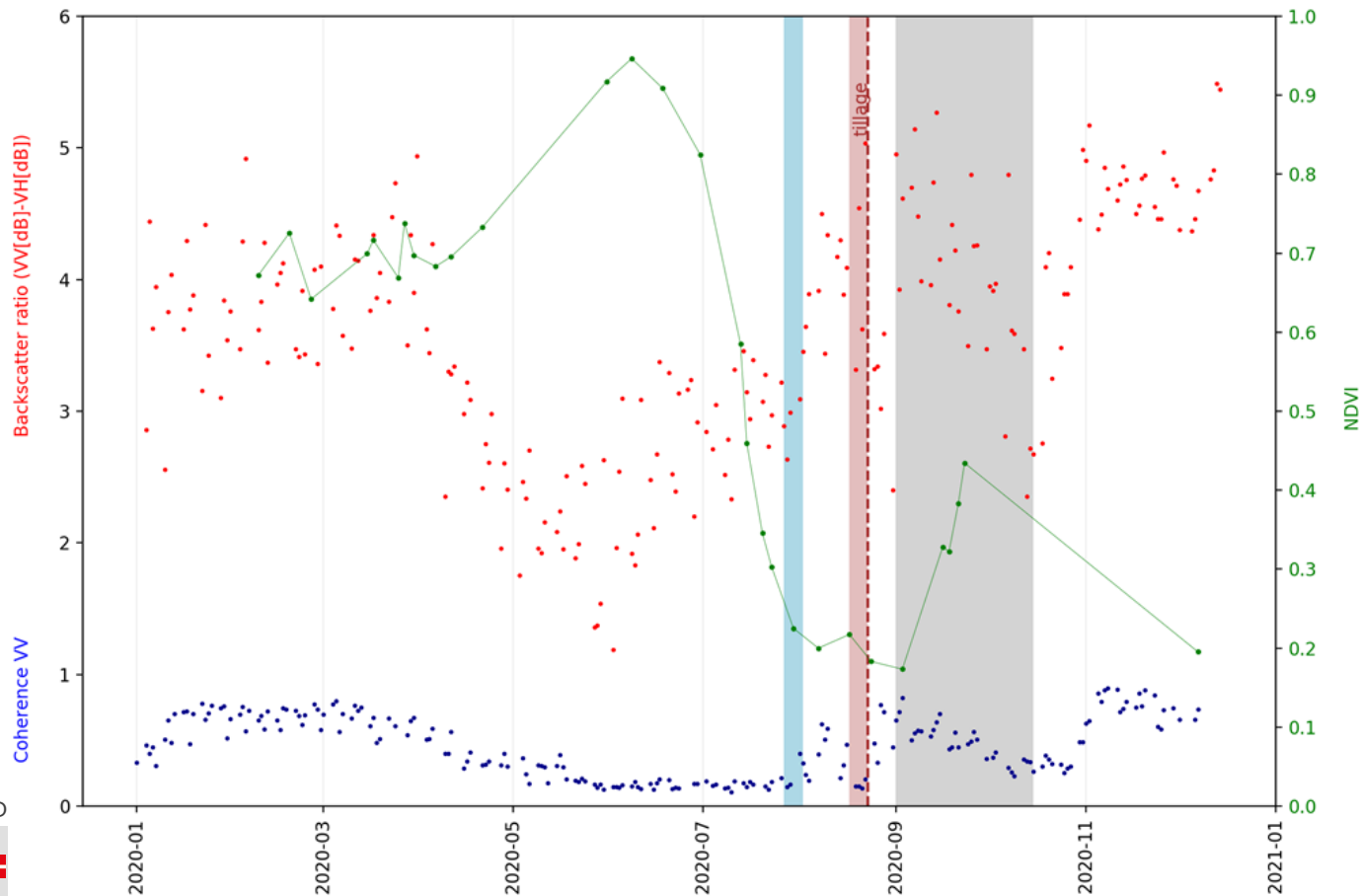
European Space Agency

- 2018: farmers reports about the dates of applied practices:

harvest/tillage/sowing

  Parcels to be checked on Planet imagery.

- 2020: recorded data from GPS tracking of agro machinery in the period of 25.-30.9.

  No information about the type of activity (harvest/tillage/sowing).

- The PA provided the photographs acquired by farmers to document parcel status at the date of acquisition of the photograph

- We have interpreted photographs to record the parcel status

- If the parcel was interpreted as plowed it means the tillage had to be applied before the acquisition date of the photograph

Tillage detection – Validation results

Lithuania – geotagged photos

Category [reference - detected]	No of parcels	Category	Cummulative
0 - 1 week	251	71,7%	
2 weeks	50	14,3%	86,0%
3 weeks	12	3,4%	89,4%
> 3 weeks	14	4,0%	93,4%
Not detected	23	6,6%	100,0%
Total	350	100,0%	

Lithuania – no tillage regime

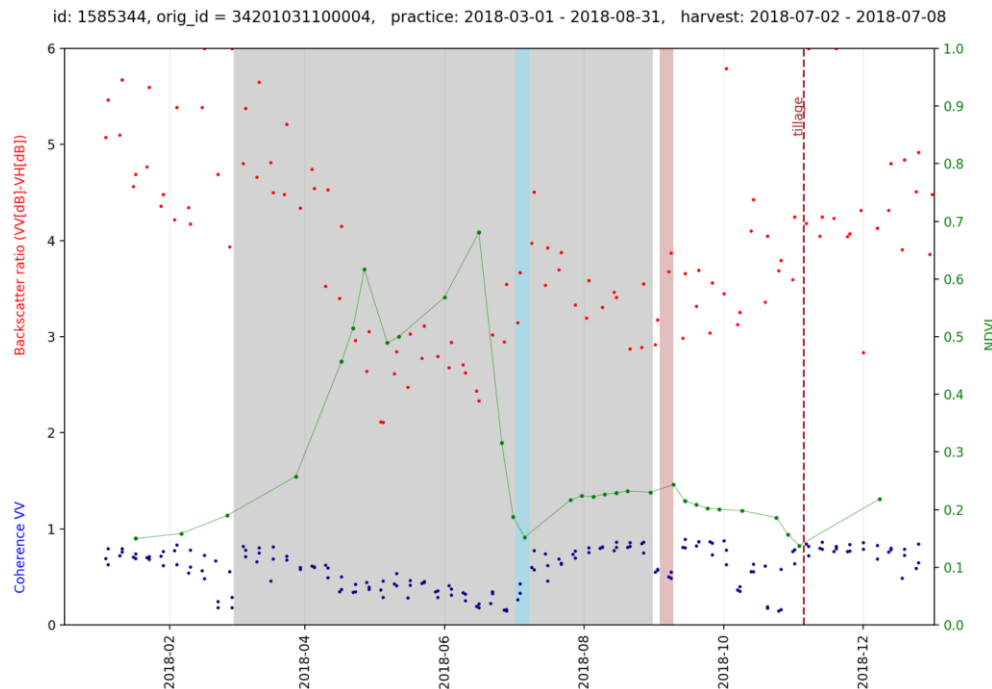| Parcels under no tillage regime		
Category	No of parcels	Share
Tillage not detected	1662	32,0%
Tillage detected	3529	68,0%
Total	5191	100,0%

Castilla y Leon – farmers reports

Category [reference - detected]	No of parcels	Category	Cummulative
0 - 1 week	11	33,3%	
2 weeks	8	24,2%	57,6%
3 weeks	2	6,1%	63,6%
> 3 weeks	12	36,4%	100,0%
Not detected	0	0,0%	
Total	33	100,0%	

Castilla y Leon – GPS tracking of agro machinery

Category [harvest or tillage detected]	No of parcels	Category	Cummulative
0 - 1 week	193	38,0%	
2 weeks	76	15,0%	53,0%
> 2 weeks	16	3,1%	56,1%
Harvest or tillage not detected	223	43,9%	100,0%
Total	508	100,0%	

European Space Agency

Tillage detection – Validation comments

- Multiple drops for coherence marker - more activities occur after the harvest (e.g. harvest residuals management) –> the detector likely detects the first one as tillage application *

- High rate of tillage detection (see *)

- Poor results for no tillage parcels (false detections - see *)

- Consistency and reliability of reference data

- Two coherence thresholds introduced in the system – may be adjusted by the user to reflect local conditions (sensitivity to coherence drops)

id: 1585344, orig_id = 34201031100004, practice: 2018-03-01 - 2018-08-31, harvest: 2018-07-02 - 2018-07-08

Tillage detection – live demo