WikiCAP

CTS Covid19

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Technical proposals to substitute impossible RFVs due to "COVID19" confinement rules

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Pre-amble

This webpages, which have been prepared by the European Commission (Joint Research Centre, JRC) in close collaboration with DG AGRI, describe technical proposals to substitute, specifically, impossible Rapid Filed Visits (RFV) due to "COVID19" confinement rules but also to substitute, in general, RFV to be done in the frame of On-The-Spot Checks (OTSC). Due to 'COVID19 outbreak' decisions, in some MSs or Regions it could be forbidden to physically go on the field. In such case there is a need to find alternative solutions to substitute "Rapid Field Visits" (https://marswiki.jrc.ec.europa.eu/ wikicap/index.php/Guidance_CTS#Rapid_Field_Visits). This Common Technical Specification (CTS) addendum provides RFV alternative for Member States to use (or not) and to combine according to their own situations.

ACRONYMS

CAPI: Computer Assisted Photo-Interpretation (CwRS)

CwRS: Control with Remote Sensing

HHR: High High Resolution sensors (enhanced spatial resolution compared to HR)

LPIS: Land Parcel Identification System

NDVI: Normalised Difference Vegetation Index

OTSC: On-The-Spot Checks

RFV: Rapid Field Visit

VHR: Very High Resolution sensors

Proposed alternative solutions

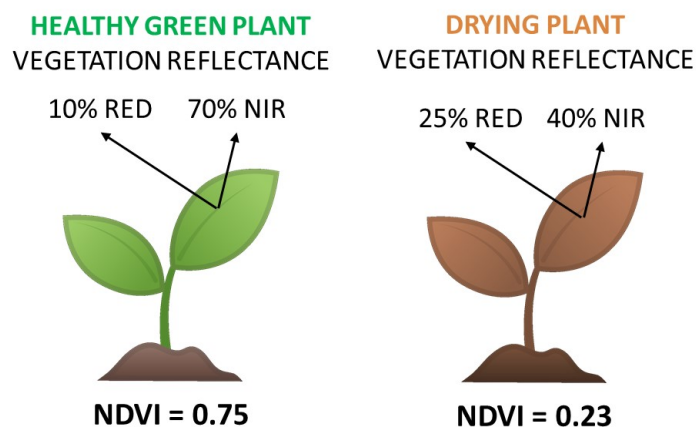## Using reduction of OTSC sample from 5% to 3%

For MS using CwRS, the Commission Implementing Regulation (EU) No 2020/532 allows to reduce the OTSC sample from 5 to 3% (or 3% to 1%). This reduction can offer the opportunity to remove, from the original 5% sample, part or all the holdings that were having some parcels outside of CwRS zones and that would have requested RFV to finalise the dossier processing.

The MSs that only perform part of their OTSC with CwRS, could eliminate from the sample farms selected for physical checks and/or replace some by a check with remote sensing (increasing thus the % of dossier checked by RS over the total OTSC in the remaining 3%).

In both approaches, the MS should ensure that the reduced rate of checks of individual schemes are respected.

Use of Sentinel information

For parcels found as doubtful during CAPI and that typically are flagged for RFV, the CAPI doubt may be removed using Sentinel data temporal extracts (optical and/or SAR). Principles to photo-interpret Sentinel 2 (optical) data are the same as the one used for 'traditional' CAPI using 2 to 5 dates of combined VHR/HHR data. Spectral resolution of Sentinel-2 still allows reliable visual discrimination of the major agricultural land cover types on several well-positional images, if the appropriate spectral bands are selected. The spatial resolution is, however, inferior compared to HHR, which means that the physiognomic and structural aspect of the vegetation would be less apparent (prominent mostly in the case of permanent grasslands and permanent crops). Nevertheless, it is somehow compensated by the increased Sentinel 2 temporal resolution, which allows to obtain much more observation dates and to build temporal profiles that can be very much associated with crop/plant phenology. As a reminder, as a plant is growing, its reflectance will change in time at different spectral wavelengths. In particular, photosynthetic active chlorophyll pigments absorb light in the red part of the spectrum. Also, in the near-infrared (NIR) part of spectrum, light is highly reflected by the turgor of healthy leaves. Combination of reflectance from these two wavelengths as form of vegetation indices like the NDVI (NIR-red/NIR+red) allow to evidence the crop/plant abundance and vigor.


HEALTHY GREEN PLANT
VEGETATION REFLECTANCE
10% RED   70% NIR
NDVI = 0.75

DRYING PLANT
VEGETATION REFLECTANCE
25% RED   40% NIR
NDVI = 0.23

Reflectance in RED and NIR domains of healthy and stressed vegetation and the corresponding NDVI values
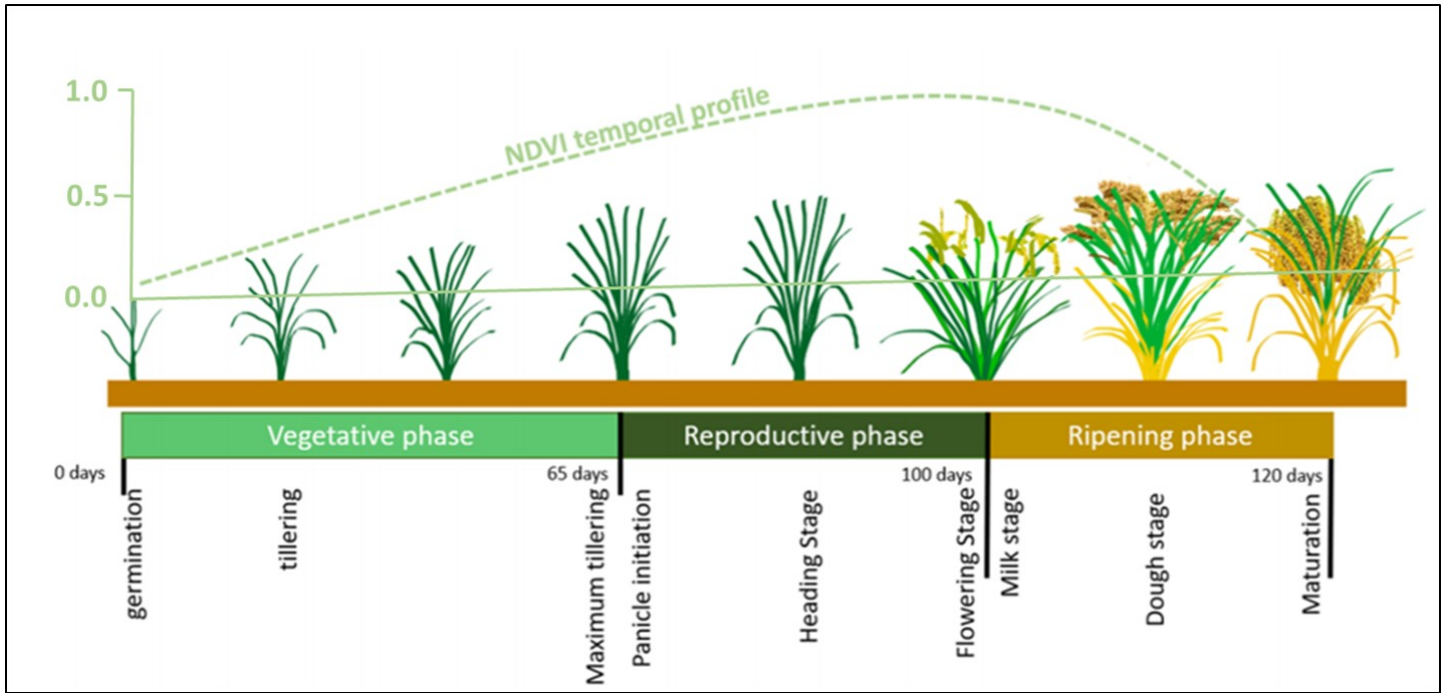
Rice plant development phases and corresponding NDVI evolution. (Based on illustration from: Aguilar, Andres. (2019). Machine learning and big data techniques for satellite-based rice phenology monitoring. 10.13140/RG.2.2.27404.26245)

Possible identification/discrimination of crops/land cover/land use will depend on the phenological development and time when different developing phases occur. (cf. illustration below).
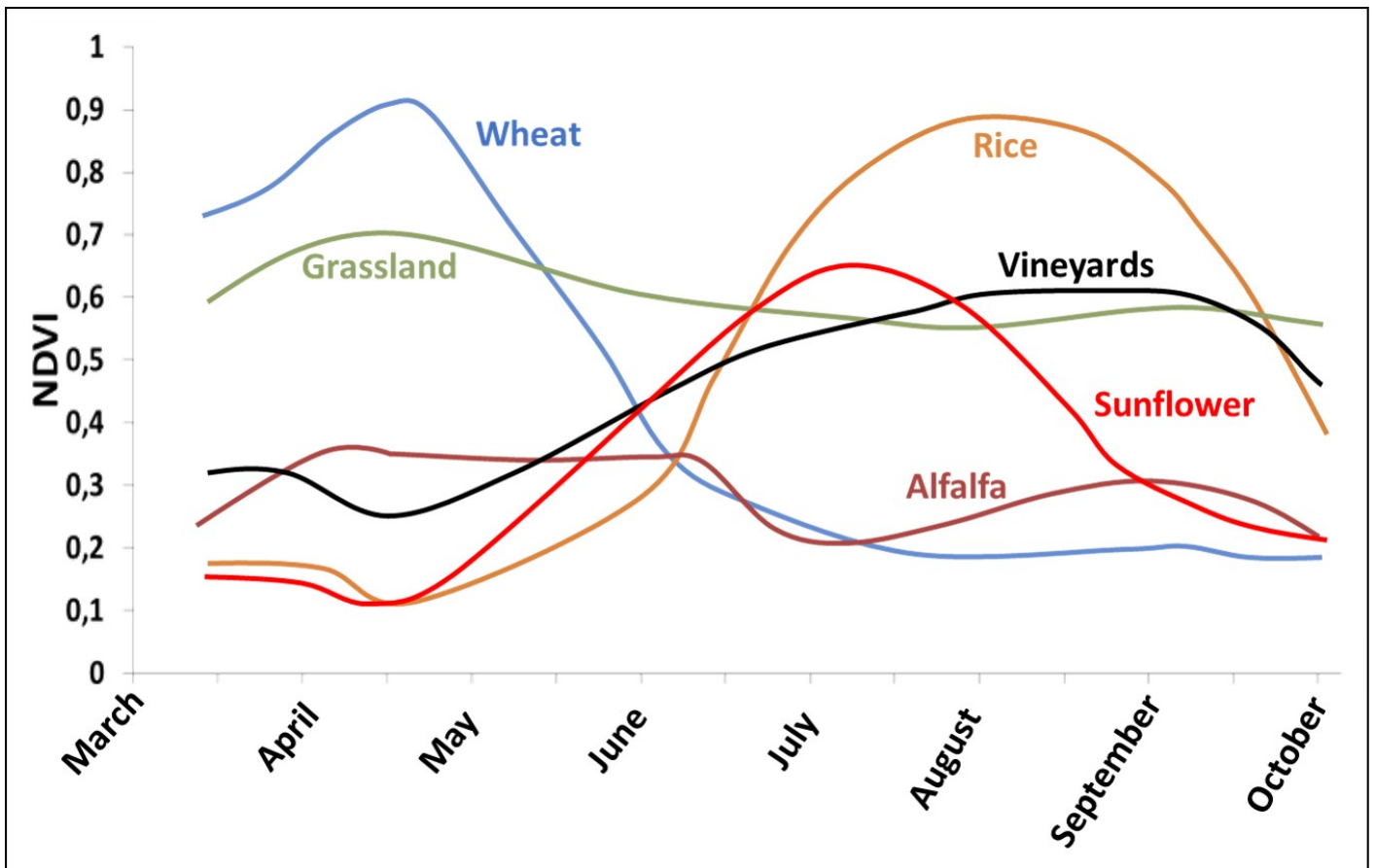
Generic NDVI temporal profiles of different type of crops

Identification will then depend on the good knowledge of regional/local phenological calendars (e.g. figure below). This knowledge is available from operational CwRS methodology.
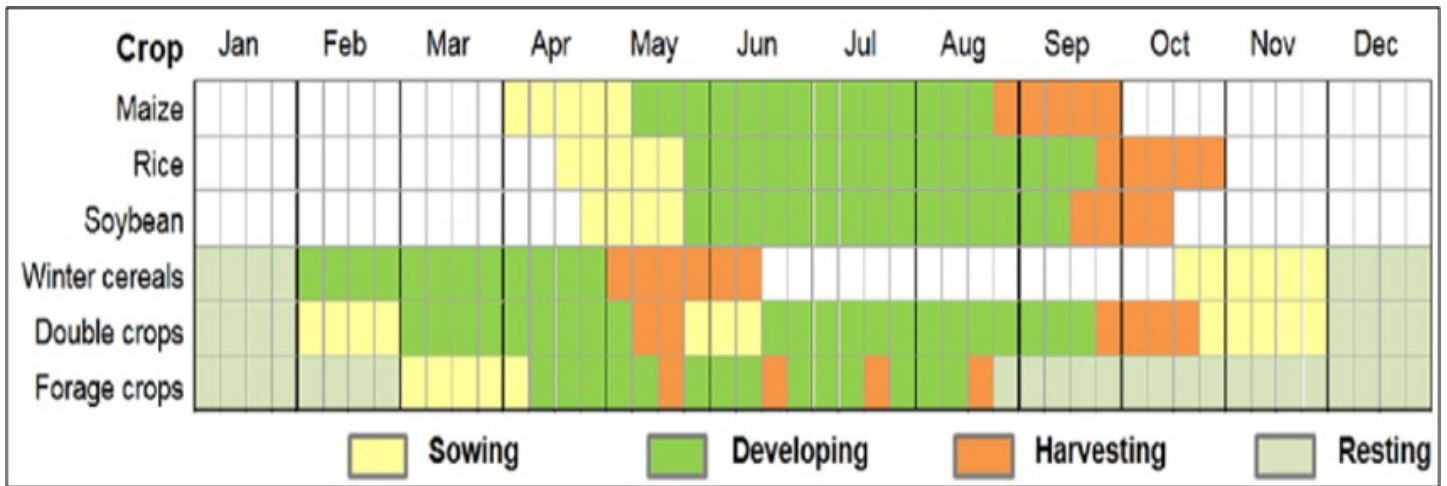
Typical crop calendar of major crops in Lombardy (Northern Italy). (From Ramin et al., (2016) Assessing in-season crop classification performance using satellite data: a test case in Northern Italy, European Journal of Remote Sensing, 49:1, 361-380)

In order to provide the complementary Sentinel-based information to decide on a doubtful parcel, flagged for RFV, visual tools could be made available (Cloud solutions). They could be useful to extract and display the relevant Sentinel data in the dedicated visual environment for CAPI inspection. (cf. figures below). This eliminates the needs to download and process Sentinel data. Two main visual modalities are envisaged:

(1) Temporal profile – It is a graph showing the evolution in time of a given signal parameter (individual image band or derived indices), extracted from each Sentinel observation. It is usually calculated from all image pixels found within the declared parcel.

(2) "Imagettes" – these are consecutive series of image chips extracted from each Sentinel observation. The image chip usually encompasses the declared parcel together with a buffer zone around it. It could represent the raw image data (band combination used for visualization is normally 8, 11, 4) or derived indices (for example NDVI calculated at pixel level).

Example of Sentinel2 NDVI temporal profile extracted for a parcel declared as Alfalfa is given below. The blue line represents the NDVI mean value calculated from the pixels within the parcel, while the vertical orange bars show the NDVI standard deviation from the same pixels.
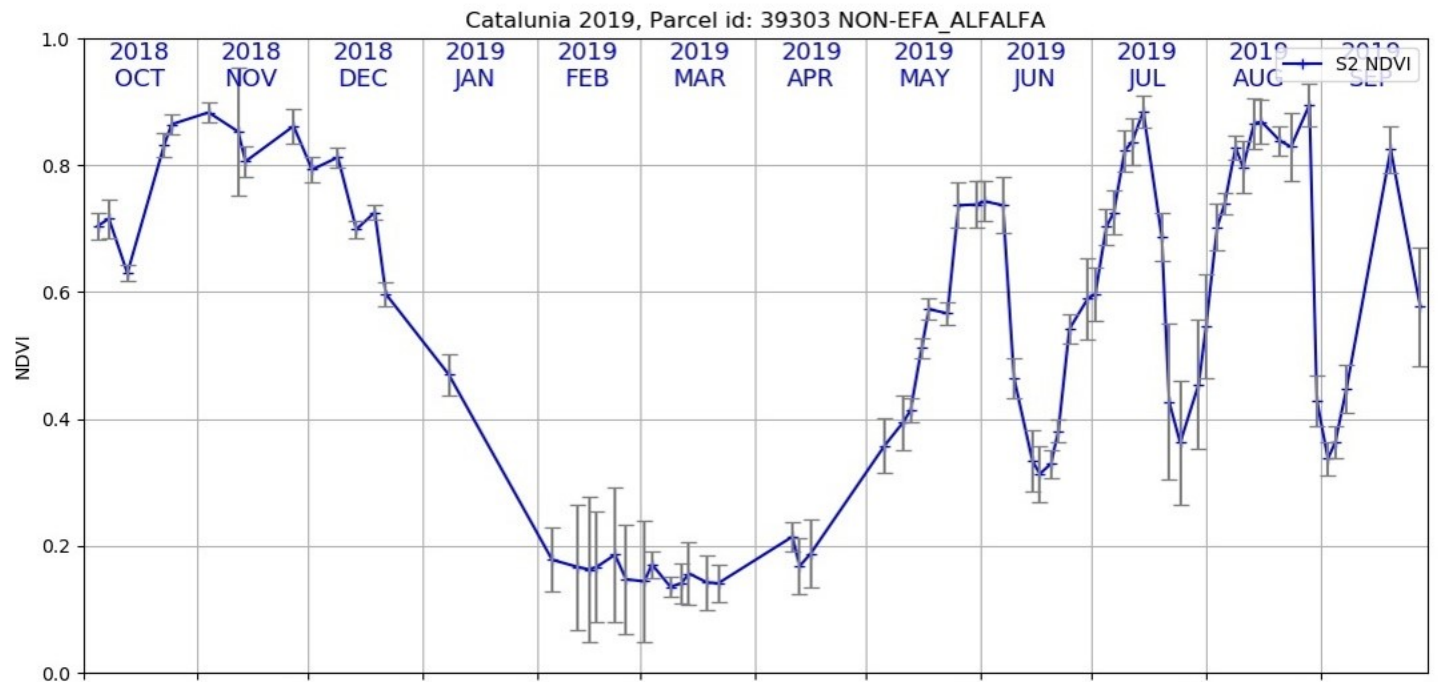

Similar temporal profiles (backscatter, coherence ...) could be extracted and generated from the SAR data, acquired by the corresponding Sentinel-1 (see example below). SAR-derived profiles (or series of "Imagettes") have the advantages of being not influenced by clouds and haze; however, their visual interpretation is not so intuitive, and requires some specific knowledge on SAR technology and the nature of the signal.

Sentinel-1 time series for parcel 39303 (Alfalfa)
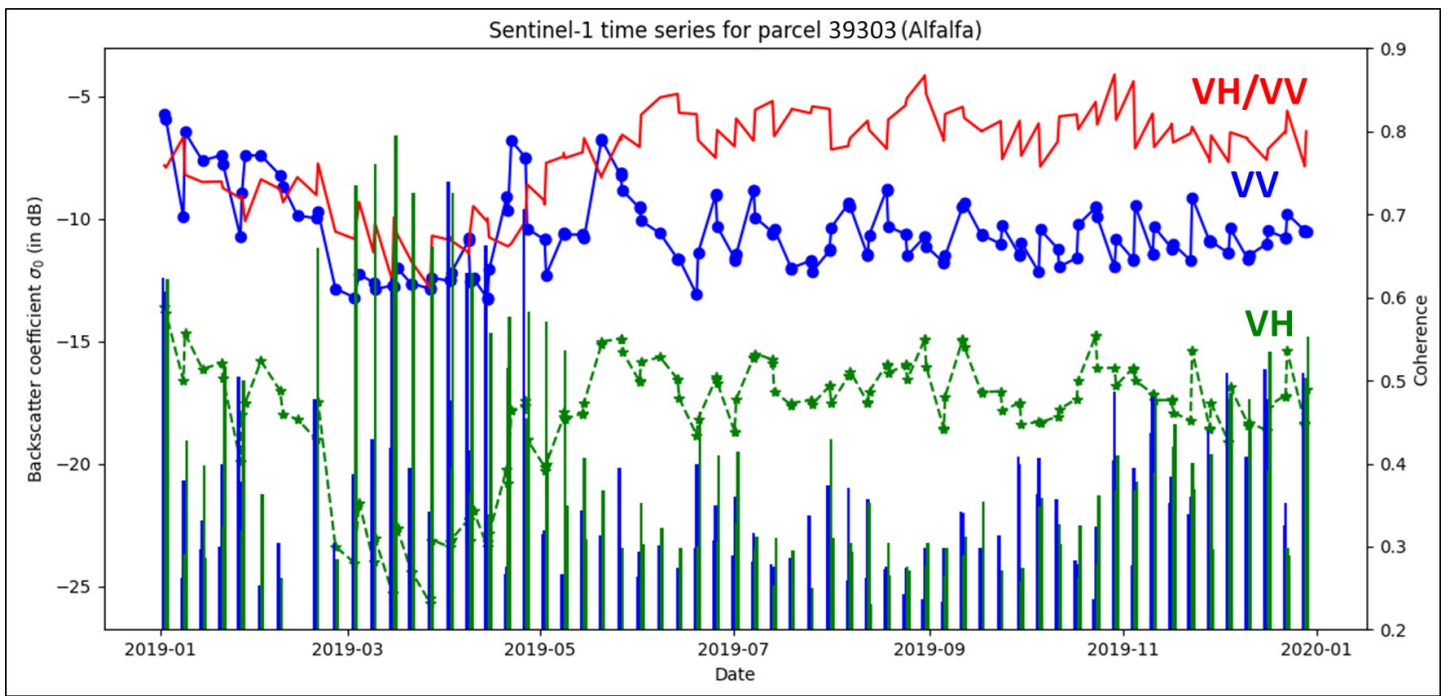
The series of image chips "Imagette" are the closest to what the CAPI operators are used to work with in the current CwRS setup. They can be organized in an array with rows being the months in the year and the columns being the half-weeks within the month. The example below lists all corresponding Sentinel 2 (cloud free) Imagettes available for the parcel with Alfalfa shown above.
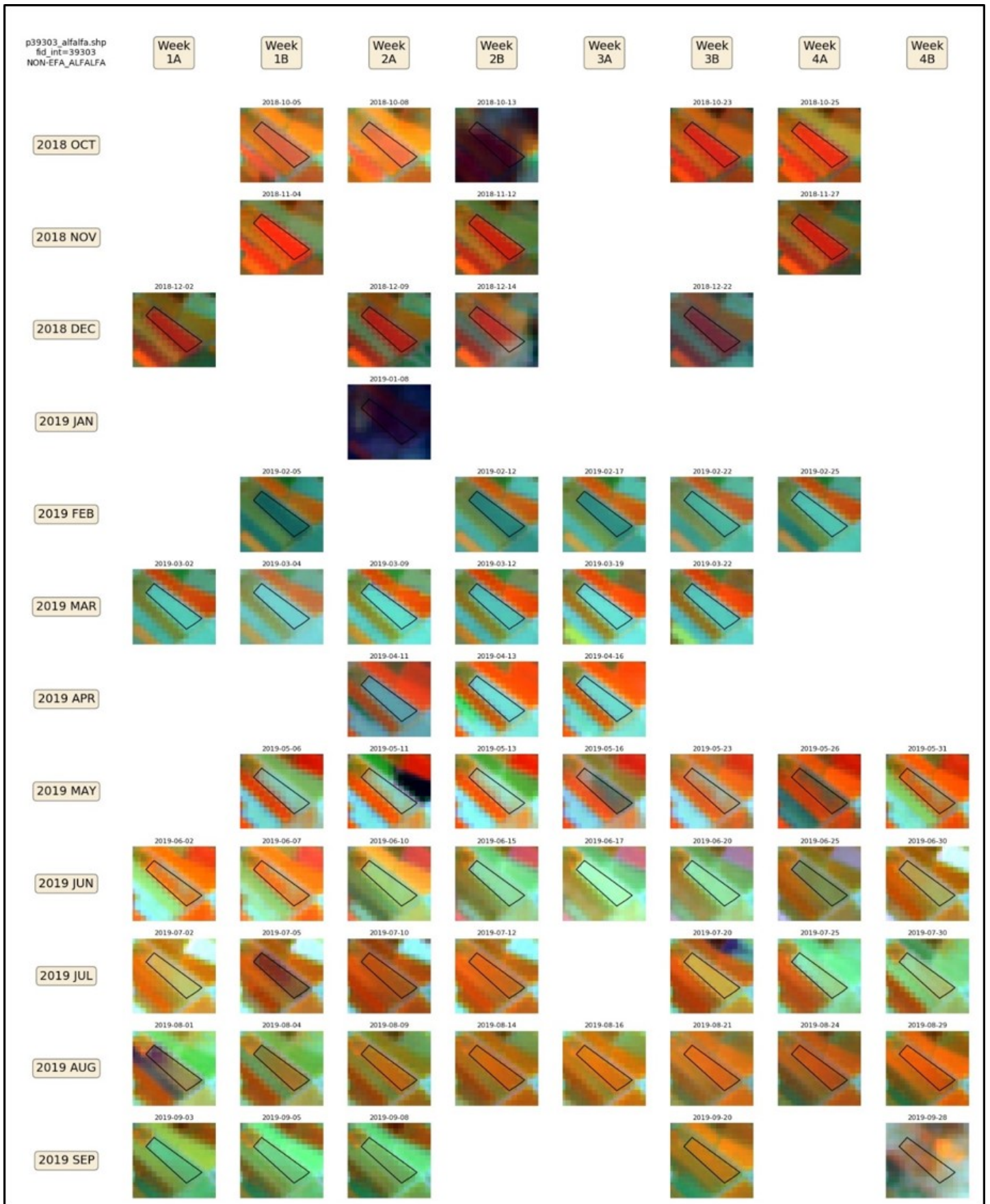
Tools to extract information, for a specific parcel, have been developed by the JRC. (Please contact JRC for information). Another supporting tool of interest is one allowing to display temporal profiles of parcels declared with similar LU/LC in the considered parcel 'vicinity'. See example hereafter, this hugely facilitates the comparison between parcels with similar use in the period of interest.
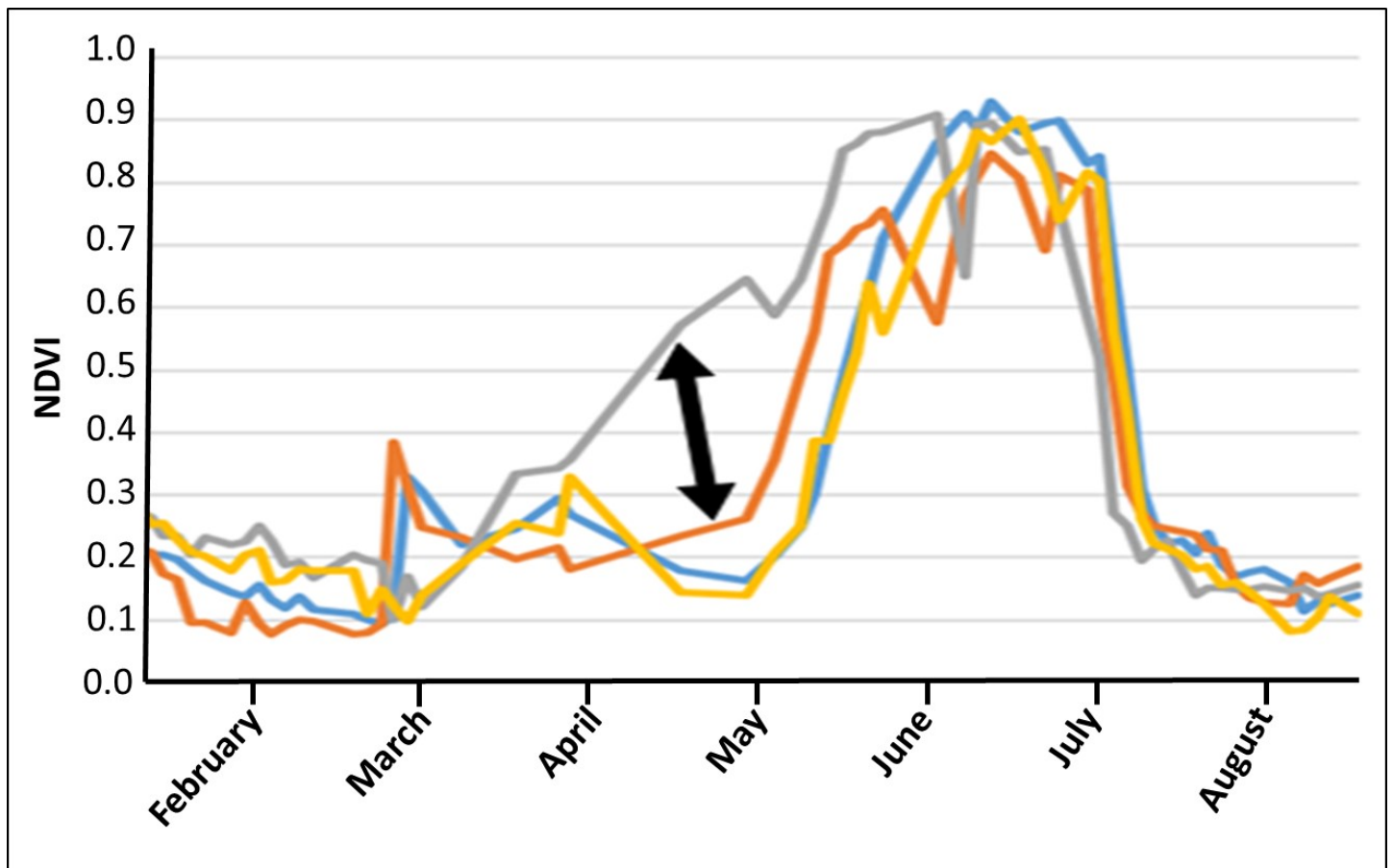
Displaying of NDVI temporal profiles of three parcels (blue, yellow, orange lines) declared with the same LU/LC of the parcel under check (grey line).

Such tool has been developed in the frame of the Sen4CAP project and also by JRC. (Please contact JRC for information).

Use of geotagged photographs

Another alternative for RFV to a doubtful parcel, would be to contact the farmer and ask him/her to take photographs of the parcel of concerned and send it to the administration. For what concerns the use of geotagged photographs, information on different technical and implementation-related aspects is already available in the WikiCAP article on "geotagged photos" (ht tps://marswiki.jrc.ec.europa.eu/wikicap/index.php/Guidance_CTS#Geo-tagged_photos) and also in the JRC report on the "use of Geotagged photos for the CAP checks" (https://marswiki.jrc.ec.europa.eu/wikicap/images/c/ce/Geotagged_JRC_Rep ort1.pdf).

Some solutions and Apps are available on the market.

Nevertheless, under these exceptional circumstances, and where no App is already made available for farmers, a 'normal' photograph could be taken and sent to the administration. Attention should be drown to farmers to include (when possible) some features in the picture allowing for its location on VHR imagery (see example below). The GeoSpatial Aid Application (GSAA) or Reference Parcel (RP) identification can serve the geolocation purposes.
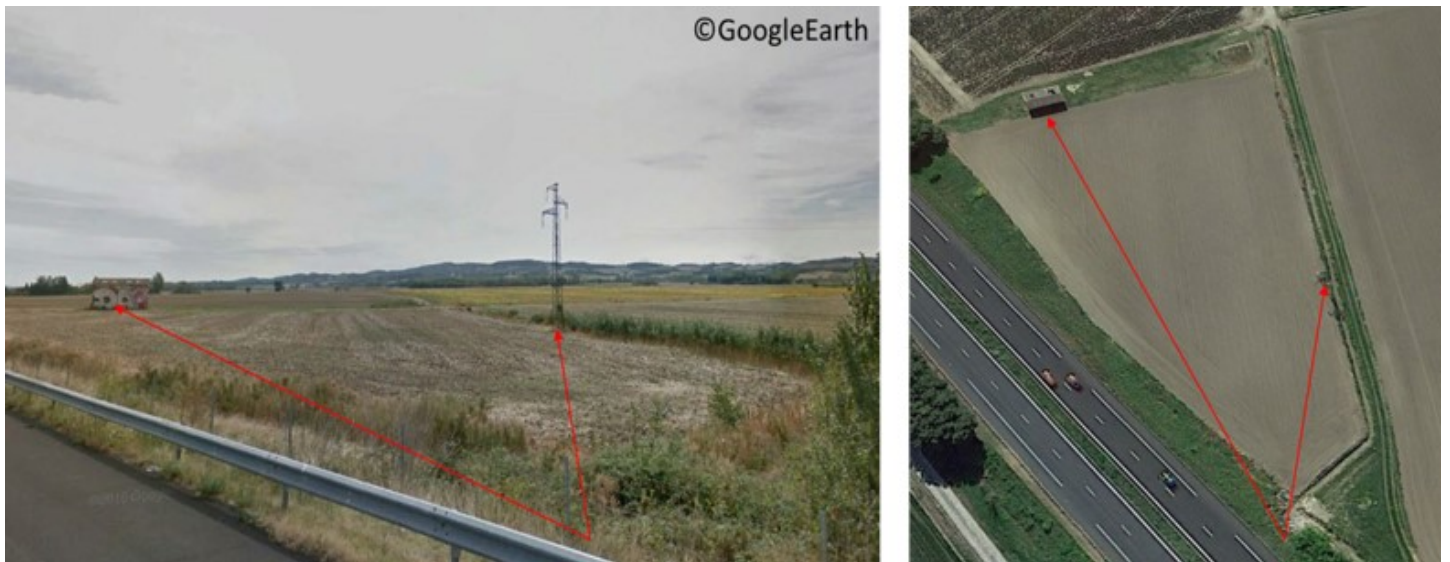
Example of photo with features in the field of view allowing to locate it on VHR imagery.

Also, as emergency and temporary solution, administrations may make use of the 'testing' App "EGNSS4CAP" developed for, and made available by the "European GNSS Agency (GSA)" (https://www.gsa.europa.eu/). Its embedded authentication system assures location and time of photos taken. Please note that this 'testing' App is available only for Android smartphones. For information and access to the EGNSS4CAP App please read that "Document" (https://marswiki.jrc.ec.europa.eu/wikicap/images/c/c4/Egnss4cap.pdf).

Use of other data

MSs may also make use of other information sources to help coming to a conclusion on a parcel with a doubt as regards the eligibility (on part) of it . This could be through a specific contract to receive HHR data like from Planetscope, Pléiades etc., or through access to the aerial VHR imagery taken by any administration during the current year campaign. Indeed, as a general rule, two images provide for better CAPI than a single image.

Need of RFV for area measurement check

In some cases, a request for RFV will be triggered not by the need to check the LU/LC of the parcel but by the need to check the parcel area. In such situations, mapping on Sentinel data will not be possible because Sentinels do not provide a sufficient spatial resolution that gives measurements the accuracy required by the legislation. Alternatives then are:

- Flag and postpone measurement for later in the season and optimize the delayed field campaign to cover only measurements.

There will be situations where the boundaries/area not visible on imagery may persist on the ground for a long period (e.g. permanent parcel limit on the ground hidden by tree canopy on imagery). In such case, it will be possible to postpone the measurement late in 2020 when visits are possible.

- Use of geotagged photographs

In some cases, the provision of a geotagged photo of the limit/area of doubt could allow to solve the interpretation problem on the VHR imagery and to finalise the measurement.

- Map the parcel on additionally available VHR imagery of suitable acquisition date

In some situations, MS may have access to other sources of VHR imagery than the one used for the CwRS. It can be for instance aerial VHR imagery taken in the frame of the LPIS update campaign or any other region/nationwide survey.

Inconclusive cases

As a last resort, when the possibilities cited above have been contemplated and when none of them allowed to come to a conclusion, (e.g. very small (<0.2 ha) irregular parcel), the farmer's declaration can be accepted as such this year. Here, we may have two different situations:

- the 'accepted' parcel corresponds to permanent crop/permanent grasslands. It is foreseeable that observation in 2021 (e.g. in the frame of a new OTSC or of LPIS update) will provide information to conclude on the 2020 situation (confirmation of declaration or evidence of non-conformity with retroactive financial recovery).

- 2020 LU/LC compliance on the ground will not be visible in the future (e.g. arable crop removed), the 2020 farmer declaration is definitely accepted. The considered farm may possibly be added to the risk population for the 2021 campaign.

End of pages on RFV substitution

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- This page was last edited on 5 June 2020, at 15:43.