

Agricultural Crop Monitoring from Space

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In agriculture, remote sensing images provide information of damaged crop, crop extent, crop productivity. These images can be also used to distinguish crops from other land classes, evaluate the effects of rainfall, irrigation systems, droughts, floods, fertilizer, pesticide, and The provided information would be useful to farmers, governments, and agricultural insurance companies.

In order to provide the state of agricultural fields, we need to multi-temporal remote sensing images. Here, the script is based on the time series of Sentinel-1 radar data. Using multi-temporal information from radar images makes it possible to improve the outputs of optical images. A time series of nine Sentinel-1 IW GRD images with VV and VH polarizations in a selected timeline is used as an input and the outputs are shown in Fig. 1.

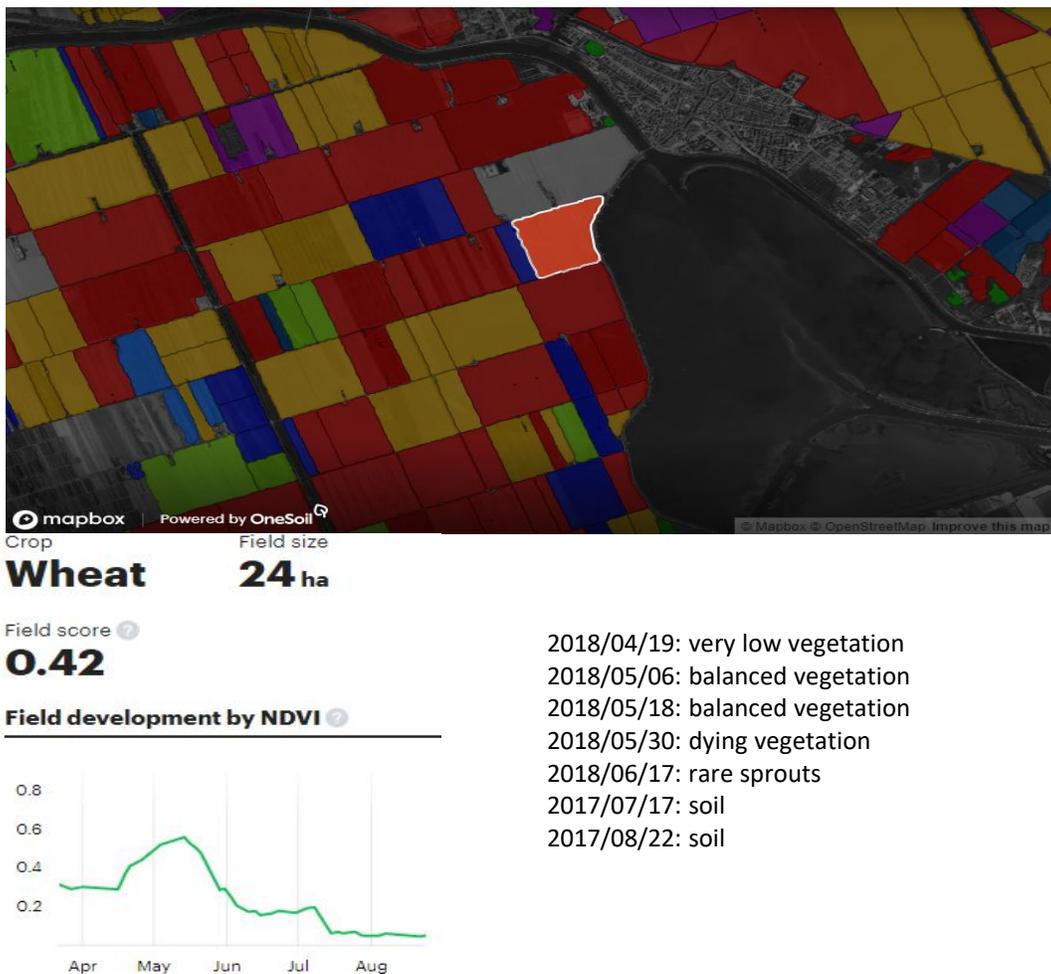






Fig. 1. The acquired images during the period from 2018/04/20 to 2018/08/22, in the region of Ferrara, Italy. The image of 2018/04/20 was used as the master image. $R=1.5 \times VV_{\text{slave}}$, $G=8 \times (VH_{\text{slave}} - VH_{\text{master}})$, $B=0.5 \times VV_{\text{slave}}$.

The output of the script gives a good view of where crops are growing well, or where crops are not growing, and identifies the surrounding water bodies and urban areas. The different colours in the crop fields display the growth stage variations between the crops. The plots below show the Normalized Difference Vegetation Index (NDVI) for three fields. The results of Fig. 1 are consistent with this index.





Crop **Soybea...** Field size **45.3 ha**

Field score **0.42**

Field development by NDVI



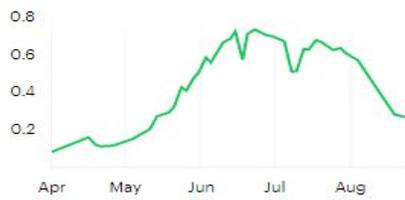
- 2018/04/20: rare sprouts
- 2018/05/18: very low vegetation
- 2018/06/05: balanced vegetation
- 2018/06/15: dying vegetation
- 2018/07/17: low vegetation
- 2018/08/04: dying vegetation



Crop **Maize** Field size **13.9 ha**

Field score **0.6**

Field development by NDVI



2018/04/20: rare sprouts
 2018/05/18: dying vegetation
 2018/05/24: low vegetation
 2018/06/05: balanced vegetation
 2018/06/10: high vegetation
 2018/06/23: very high vegetation
 2018/07/18: high vegetation
 2018/08/19: dying vegetation

Fig. 2. NDVI for three fields in Comacchio, Ferrara, Italy derived from <https://map.onesoil.ai>.