

Agricultural Control Using Sentinel



The Danish Agricultural Agency uses time series of Sentinel satellite images to detect agricultural activities in all fields in Denmark. In this way, agricultural checks can be carried out without a physical inspection on the farm. This provides increased flexibility for both parties.

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The challenge

Every year, the Danish Agricultural Agency carries out checks on whether Danish farmers comply with conditions for receiving agricultural subsidies. This has traditionally been done by physical inspections in the field for a percentage of applicants – a process that is costly and time-consuming for both the Agricultural Agency and the applicant. Often, a single visit will not suffice, as different farming activities can take place throughout the year. In order to reduce the number of inspection visits, the Agricultural Agency has established periods when different agricultural activities must take place.

Since many of the subsidy conditions can be confirmed based on advanced satellite image analysis, more work is being done on using this data as part of the check. This is expected to lead to fewer inspection visits and more flexible deadlines for farmers.

The space-based solution

By means of nationwide time series of Sentinel-1 and Sentinel-2, all fields in Denmark can be monitored. Particular activities that result in a marked change in the surface of the field, such as plowing or mowing, will be registered as a change in the time series of satellite-based observations. In this way, it is not a single picture, but a time series of

satellite images of a field that most often brings value.

Time series of Sentinel-1 and Sentinel-2 data are processed and analyzed based on advanced 'machine learning' techniques and time series analyses to identify the specific times of events, such as plowing, mowing and harvesting, and mapping of crops.

” I think it is a good help that you can follow your fields possibly go from yellow to green, as I have done.

Anders Gade, Part-time farmer

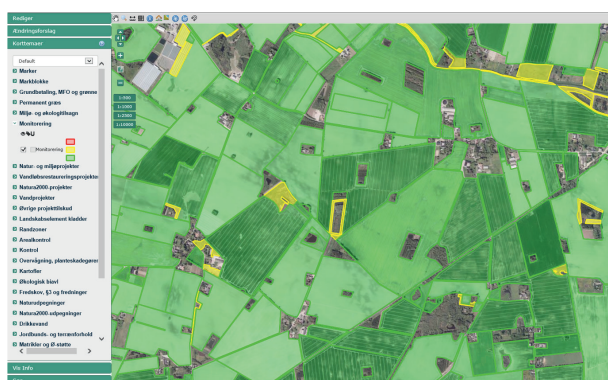
The processing is based on an advanced preprocessing system developed by DHI GRAS where all time series of Sentinel-1 and Sentinel-2 data are downloaded and processed for national coverage of Denmark. For all agricultural fields in Denmark, all satellite data and results are stored in a huge database. Finally, the results of the specific analysis and applications are visualized in a user-friendly web viewer where the Agricultural Agency can view time series of data for specific fields, view satellite images and evaluate results for specific fields.



Crop type mapping, example from Horsens. Source: Sentinel-2

Benefits to citizens

Up to now, these satellite observations have been used to guide the Agricultural Agency's inspectors to potential holdings where subsidy conditions have not been met. An initiative by the European Commission has now made it possible to use Sentinel observations more as a basis for inspection. This will allow the Agricultural Agency to carry out future inspections using Sentinel observations.



Traffic light map for monitored fields from the Danish Agricultural Agency's web GIS "IMK".

For farmers to keep track of whether their fields have registered an activity, results are displayed for all fields on the Agricultural Agency's website. These appear as a map layer, with approved fields colored green and fields where the requirement has not been fulfilled colored red. Yellow indicates that there is no clear result for the field. If the sat-

ellite-based determination is incorrect, the farmer will have the opportunity to take a georeferenced picture of the field and send it to the Agricultural Agency via an app.

Outlook to the future

Under the current legislation, there are still subsidy preconditions that cannot be monitored using satellite images. With the new Common Agricultural Policy, it will be possible to further develop satellite-based monitoring by allowing future inspections to be targeted on large-scale systematic violations, as opposed to using resources on measuring small ineligible areas that may not have great financial impact. A further expected benefit is that use of the traffic light map will have a "nudging effect", by allowing farmers to choose to withdraw applications for fields once they can see that they do not meet requirements.

Acknowledgements

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