

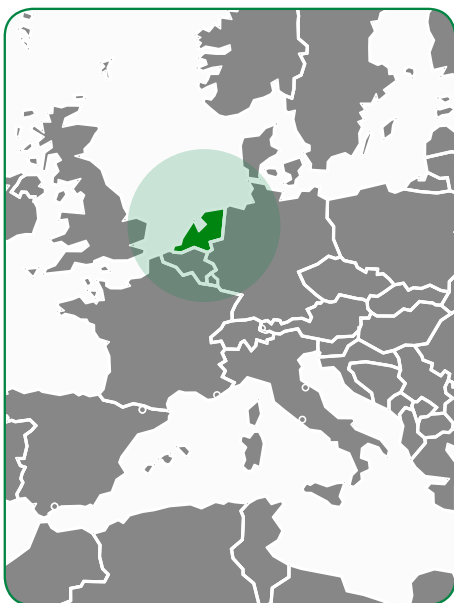
ASSESSING GEESE DAMAGE IN THE NETHERLANDS

Copernicus Sentinel data is being used by the Province of Fryslân in the Netherlands to improve the management of geese damage compensation through the Fauna Fund, leading to more efficient appraisals by saving time and cost.



THE CHALLENGE

Over the last few decades, the Netherlands has become a winter paradise for geese, as modern agriculture created an abundance of winter food on the Dutch fields. Causing much distress to the Dutch farmers, increasingly more geese are staying during spring in the Netherlands as well to breed. Some geese species have even recovered from an endangered nature conservation status to healthy populations. The swarm of birds can be quite a spectacle for nature lovers, however for Dutch farmers it can be a nuisance, with their pastures and winter wheat crops being destroyed and stripped bare by the geese. According to researchers at SOVON and WEnR, the growing geese populations (**some 2.3 million in winter and 150,000 in summer**) result from the rich yields on Dutch farming lands: the growing season has become longer, while the yields per hectare have increased. It thus makes it more attractive for geese to feed no longer on the traditional grounds but move instead to agricultural fields with richer crops. Regions with many waters and lakes such as the southwest of Fryslân and North-Holland are the geese' preferred habitats.



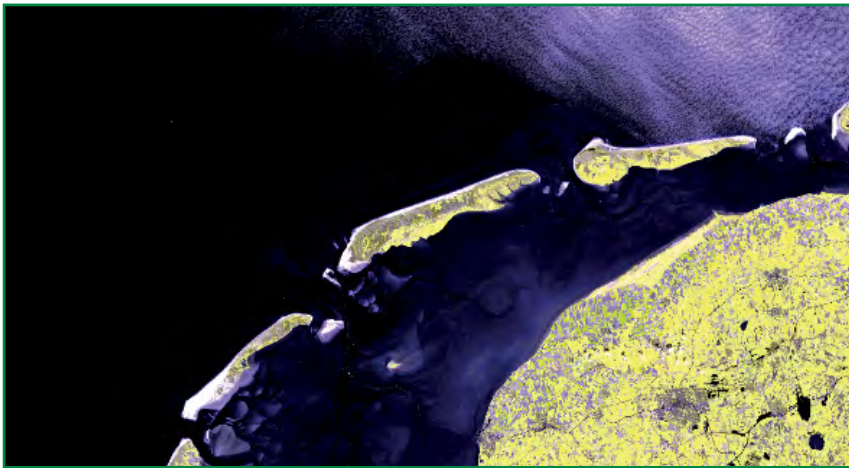
In light of this development, the government started compensating farmers for the damage of geese-grazing through the dedicated Fauna Fund in 1999. Since then, the damage, and consequently the compensation, has steadily increased: while in 2008 the government paid out about 8 million Euros, this amount has almost doubled **in 2015 to about 17 million Euros**, causing more than 1 Euro of damage per person in the Netherlands alone. As a fauna damage hotspot, farmers from the southwest of Fryslân have thus been compensated many million Euros in recent years. Between 2012 and 2017, a total of 23,000 damage cases were reported by farmers, each requiring an appraisal by the Fauna Fund on the spot. Naturally, this is time-consuming and prevents the appraiser from handling more urgent and serious cases without any form of prioritisation.

HOW SATELLITES CAN HELP

ilionX, a Netherlands-based remote sensing consultancy, has developed a specific predictive model for agriculture using free high-quality satellite images from **Sentinel-2** and Landsat-8 data to monitor geese damage. Thanks to analysing the pixel colour of satellite imagery through time and by making use of significant developments in artificial intelligence and machine learning in recent years, ilionX was able to develop a tool for damage detection and assessment. The model is able to give a global overview over a farmer's fields, appraise the field "remotely" and assess whether or not geese damage has occurred on a field.

With a few changes in the current appraisal methods to further train the model, ilionX is able **to monitor geese damage on agricultural fields on the basis of satellite imagery**. Using only Landsat-8 imagery of geese damage, ilionX was able to receive quite satisfactory results – using Sentinel-2 images with 9 times more data, the model's reliability will increase even further. Another benefit of the model is the possibility to monitor the evolution of damage in space and time, and thus to keep track of the geese, providing new and valuable information in the months before the final appraisal. This information in turn is of great value to the farmer who can put in place some **mitigation measures**.

The key advantages of using satellite data are that remote and/or extensive areas as is the case with agricultural fields may be accessed efficiently and in the case of Sentinel imagery free of charge and that both historical and up-to-date information on the fields can be provided. Therefore, it is ideal to monitor seasonal and long-term trends.



Sentinel-2 Image of Fryslân
© ilionX

The satellite data:



Sentinel-2 carries an innovative wide swath (290km) high-resolution (10m) multi-spectral imager with 13 spectral bands, providing unprecedented views of the Earth with frequent revisit times.

The mission is mainly intended to support land monitoring: its images can be used to determine various indices related to the status of vegetation that are useful for e.g. agriculture and forestry. When imaging over crisis areas, Sentinel-2 contributes to disaster mapping, helping humanitarian relief efforts. Sentinel-2 imagery is also useful to monitor glaciers, lakes and coastal waters.

Copernicus Sentinels data are available under an open and free data policy.

Sentinel-2 data can be accessed at <https://scihub.copernicus.eu>

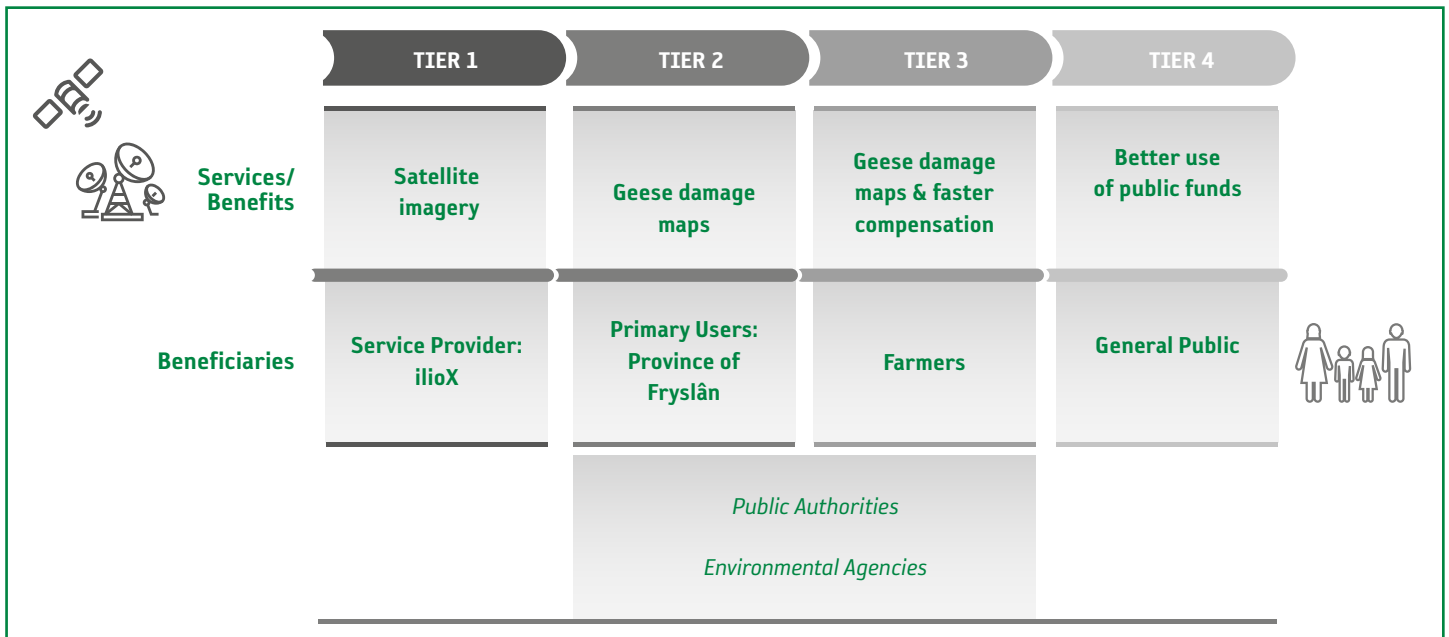
More info: <https://sentinels.copernicus.eu>

The Service Provider

ilionX is a Netherlands-based IT company, founded in 2002. It helps organisations to improve and adjust the course of its operational management. It combines new technologies with existing ones by optimising the provision of information, implementing and managing IT architectures and applications. Among its IT solutions are geospatial products for agriculture, environment, nature conservation, law enforcement and infrastructure.

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Schematic representation of the main beneficiaries along the value chain, including the corresponding services and benefits provided.

WHO IS CONCERNED?

Geese damage maps produced by ilionX are used by the appraisers from the **Fryslân authorities** to help them in their geese damage assessments. For each case where a farmer makes a claim for compensation due to geese damage, the Fryslân authorities used to send out an appraiser who examines the source of the damage, evaluates the extent of the damage and assesses potential monetary compensation towards the farmer. For this procedure, the appraiser is required to go to the farmer's damaged field(s) and assess its dimension. With a few thousand cases per year, this can be a tedious and resource-demanding work. The province of Fryslân decided to go novel ways and has recently started cooperating with ilionX, building upon satellite images and machine learning to ultimately improve the efficiency of appraisals of geese damage. The service by ilionX automates this process and provides appraisers with a useful and time-saving tool to monitor fields, detect and assess geese damage.

Until very recently, it had been unclear for **farmers** where and when exactly the damage occurred on their fields. The geese stay on the Dutch fields between September and April which is exactly the time when fields are not mowed, and farmers rarely visit all of their fields. Thus, farmers do not have a good global overview over the state of their fields and cannot tell when and where the damage occurred. Knowing the state of their fields and potential damage is important for farmers. Damage from geese can run into the thousands of Euros and hence having an up-to-date and accurate map of their fields enables farmers to be more aware of the risks and take mitigation measures before the growing season starts and hence protect their fields from consequential damages.

The Primary Users

The Province of Fryslân is one of the 12 provinces of the Netherlands located in the northern part of the country whose economy is dominated by agriculture. The province's wide agricultural lands make it a prime destination for geese. Protecting these geese results from the EU Birds Directive.

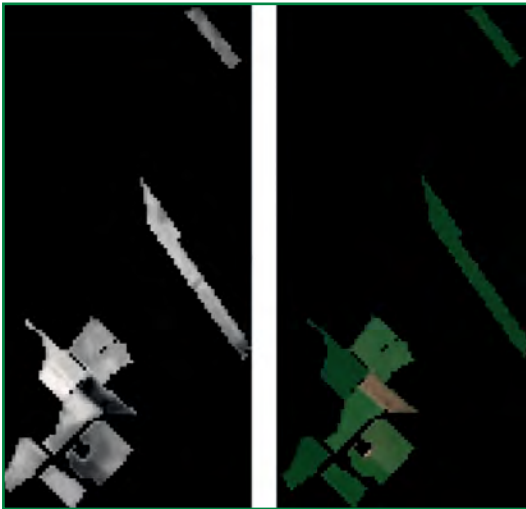
In return for damage that geese have caused on farmers' fields, the Fauna Fund has been set up to compensate farmers. The Fryslân authorities are responsible for managing claims to the fund by Fryslân farmers.

The appraisers have to work according to specific guidelines established by BIJ12-Fauna Fund. The Fund is a compensation scheme by the 12 Dutch provinces in cases of damage caused by protected native animal species to commercially grown agricultural crops or farm animals.

provinsje fryslân
provincie fryslân

www.fryslan.frl

The **Province of Fryslân as a whole and local citizens** have an interest to ensure that farmers' fields are safe from geese damage and that damage is kept to a minimum given that compensation has increased heavily over the last 10 years reaching around €17m – public money that could have been spent more effectively without the damage.



ilionX-processed S-2 image detecting geese damage
© ilionX

WHAT ARE THE BENEFITS?

The use of satellite data to appraise and track geese damage benefits a limited number of actors along the value chain. First and foremost, the Dutch provinces and the Fauna Fund's administration are able to conduct the procedure of appraisals much **more efficiently**, as appraisals can partially be automated through the model, and a more targeted approach can be followed, **saving time and cost**. The model can detect actual geese damage meaning that the appraiser has to visit the field only in cases of uncertainty and for measuring the extent of the damage in more detail if needed. Moreover, in the period between the last mowing and the first mowing of the new season, there is often great uncertainty about the state of the fields. Satellite images can bring light into this darkness and give some indication about the development of the field and consequently potential geese damage.

Satellite imagery also supports the **farmers** in that they can take **mitigation measures** against the geese. It enables the farmers to act in time and the right place to prevent or at least curtail agricultural damage. As a result, the farmers suffer from less damage and thus economic loss, as they benefit from an increased yield. Furthermore, the automated appraisal speeds up the process and thus compensation is paid out more quickly, providing the farmer with more financial security.

Ultimately, it is also the **general public** that benefits. Should the precautionary measures against the geese be 'fruitful', then the societal loss of 1 Euro of geese damage per person, or 17 million Euros as a whole per year, could be spent more meaningfully elsewhere. Finally, it should be noted that **fraudulent claims** have been raised by farmers towards compensation in the past, undermining the system of compensation. With the geese damage model by ilionX, such wrongful claims can be detected more efficiently without the need of appraising the field on the spot.

The key benefits are:

- **Financial:** faster payment of damage compensation and less damage thanks to mitigation measures.
- **Efficiency:** faster and improved appraisals due to automation. Appraisers visit fields only in cases of uncertainty and can use their time more productively.
- **Societal:** improved detection of fraudulent claims undermining the system of compensation.
- **Awareness:** improved knowledge about the state of the fields between September and April.
- **Societal:** if fair and well-implemented, the compensation scheme can contribute to striking a balance between the farmers' needs (social) and environmental needs in the long-run.

EXTENDED IMPACT

Geese damage is not only a nuisance to farmers in the Netherlands. **Other parts of the world** such as neighbouring Germany, the Scandinavian countries, the UK, Canada and the US have faced the human-geese problem and suffered from agricultural – and thus unnecessary financial – losses, occupying policy-makers and farmers with finding effective solutions. In Bavaria (Germany) for instance, the number of wild geese has increased eightfold over the last 10 years, posing not only a problem to farmers' yields, but also to the health of farm animals such as cows due to feculent meadows. In light of this development, the predictive models such as the one developed by ilionX should be considered a viable option for taking mitigation measures where geese cause agricultural damage.

In addition, it might be worthwhile to check the possibility of extending the model to **other animal-caused agricultural damages**. For instance, many parts in Europe such as Bavaria in Germany or the Basilicata region in southern Italy have seen a stark increase in wild boars in the past two decades, which can, among others, be traced back to the heavy cultivation of maize. In a similar vein to the Frisian geese, the boars have left many agricultural fields grazed, leaving significant (financial) damage to farmers and increasingly a danger to the public. Here, a similar model could provide more data and information on the phenomenon as to support more expedient policy-making as well as put in place more effective mitigation measures. Given this context, models such as the one developed by ilionX has great potential to be both marketed in other geographical regions of the world facing similar problems with geese and applied to other animal-caused cases of agricultural damage.



ABOUT THE PROJECT

The Sentinel Benefits Study (SeBS) is conducted by EARSC (European Association of Remote Sensing Companies) with partners The Greenland, IIASA (International Institute for Applied Systems Analysis) and Evenflow on behalf of the European Space Agency (ESA). It has the goal to study 20+ full cases by analysing the impact of the use of Sentinel data along a value-chain. This short-case has been prepared where there has been an interesting use made of Sentinel data, but it has not (yet) been possible to conduct a full case. It tells the story of the use of Sentinel data without going deeply into the economic or environmental benefits.



We acknowledge that the understanding of the case was supported by interactions with the following stakeholders: Mr Jakko Pieter de Jong from ilionX and Gerard Kema from the Province of Fryslân. We thank them warmly for their availability.



The combination of remote sensing and AI is a very promising method for the Province of Fryslân to monitor the development of geese damage in a cost-effective, uniform and standardized way.

Gerard Kema, Digital Innovation Manager, Province of Fryslân



Do you know an interesting case demonstrating the benefits derived from the use of Sentinels data?

Email info@earsc.org

More Information on Sentinels Benefits Studies:

www.earsc.org/sebs



European Union



European Space Agency

The Sentinels Benefits Study is funded by the EU and ESA. The views expressed in this study cannot be taken to reflect the official position of the EU or of ESA.