Earth Observation for Environment and Forestry

Earth Observation has been used successfully for a variety of environmental monitoring purposes. This document presents case studies on bare peat monitoring, illegal waste site detection and the mapping of tree species distribution.

Complexity

- Clear method and straightforward
- Clear method but complex
- Possible; needs research

Resource

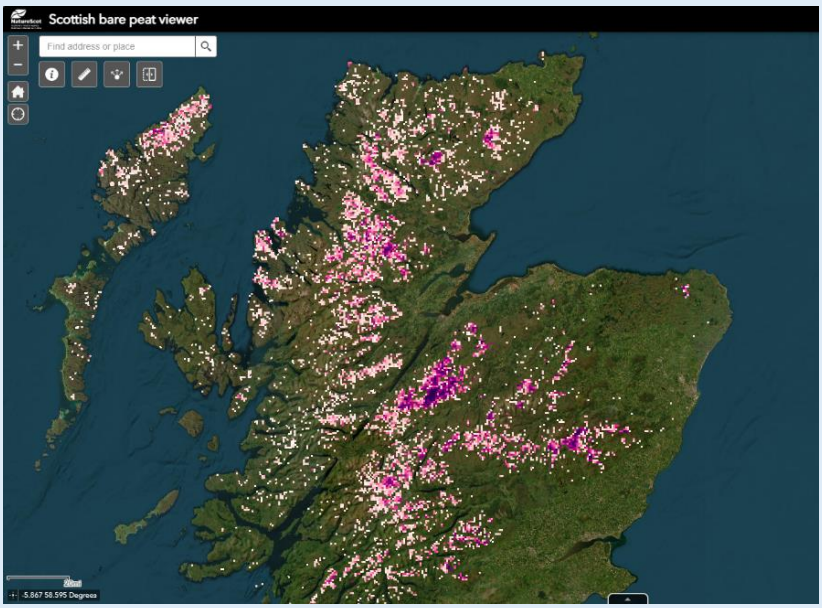
- £ Low
- ££ Medium
- £££ High

Case Study I: Peatland monitoring

NatureScot use data from Sentinel-2 to map large extents of bare peat. The dataset is part of the Peatland Action project which, for the first time, produced a bare peat map that covers all of Scotland with a spatial resolution of 10 m. The map is made available in a dashboard and aims to help targe site visits and more detailed analysis of an area. Currently, only a 2018 map exists with no information on future updates available.

The method is based on a machine learning classification of summer imagery to map patches of bare peat. Due to the limited resolution of Sentinel-2 imagery, only larger patches of bare peat can be identified. However, the approach is well understood and easily transferrable to other types of data. Smaller areas of bare peat could therefore be mapped with the same method if commercial, high-resolution satellite data is used. To assess the quality of the produced classification and make improvements to the method, a quantitative analysis of the outputs and error rates would be required.

A workflow for processing the required data is already in place but would need a small expert team to improve and maintain, especially when outputs are to be produced more frequently. Data storage and processing is already taking place in the JASMIN cloud environment which comes with a small annual charge. Further charges occur from the ESRI license which is used to make the outputs available to users in an online dashboard. Costs would increase if data with very high spatial resolution is purchased for this work only or if more complex data processing (e.g. Sentinel-1 coherence) is required to further improve the method.



Case study I: Bare peat viewer for Scotland

Further products and applications

Fly-tipping / Landscape Evaluation / Peatland restoration / Afforestation suitability / Biomass change / Invasive species

Case Study II: Tree species mapping

Rezatec

Rezatec use optical and synthetic-aperture radar satellite data alongside ground information to generate species distribution maps and estimate stand height and volume by species. The commercial product is available from a dashboard or as integration into customers' GIS systems. Products are updated annually and are available on a subscription type basis.

The method is based on machine learning methods and is owned and maintained by Rezatec. The success rate of the service across different scales is uncertain e.g. it is likely to work best for mature large stands of single species and unlikely to work for small areas of mixed saplings or seedlings. Some effort and in house testing would be required to determine accuracy at regional and national scale against intended use.

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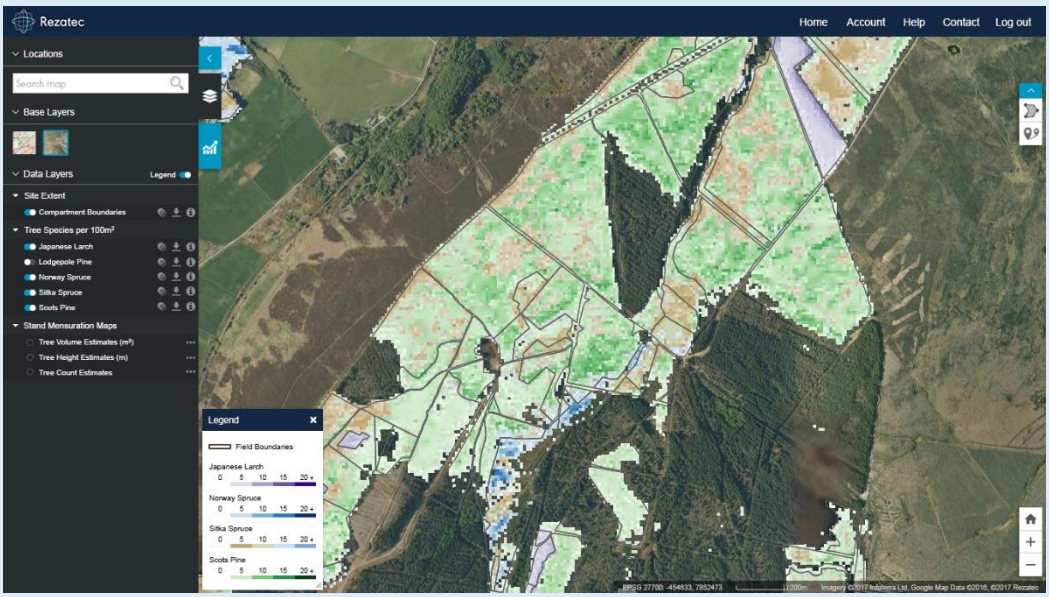
The service is available as an annual subscription which provides access to the data platform and more in-depth analysis functions. Costs vary depending on area of coverage and data volume used. Staff training might be required to access and interpret the provided products.



Case study II: Forest inventory by Rezatec

Case Study III: Managing Waste

sepa

SEPA are using Sentinel-1 and 2 data for large scale monitoring of waste management. Random forest algorithms are used to detect tyre and plastic waste and to locate illegal waste disposal sites. The work is still in development, but a pilot study has been published in a scientific journal. SEPA are working on improvements to further improve and automate the method for operational use and have plans to expand the mapping to marine plastics.

The method is based on random forest classification which is well understood but the generation of input data is complex and in parts resource intensive. Cloud free conditions are required for optical imagery and Sentinel-1 data is processed interferometrically which is computationally expensive and currently not produced routinely. Further development of data processing platforms is required to automate and scale the method. Outputs would need further validation against ground data which is limited by the sensitive nature of the data. The integration of high-resolution commercial data could help to improve the method further and is already being explored by SEPA.

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A prototype workflow for processing the required data is already in place but would need upscaling for routine data processing and a small expert team to improve and maintain. Data storage and processing is already taking place in cloud environments which comes with a small annual charge. Costs of the method would increase if data with very high spatial resolution is purchased more regularly for this work only.

Published: 2024-03. Reference to any specific product or entity does not constitute an endorsement or recommendation by JNCC or Scottish Government. Other products may be available.