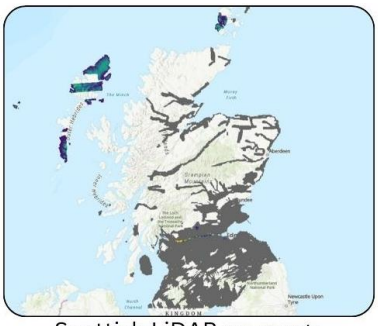
BRIEFING

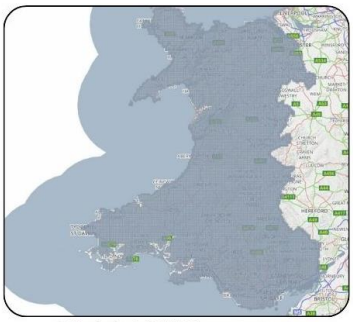
SRUC

Scotland: lowest LiDAR coverage in Britain. How remote sensing can help with re-forestation & biodiversity gains



Scottish LiDAR coverage

English LiDAR coverage



Welsh LiDAR coverage

Summary

Scotland's LiDAR coverage has fallen well behind the 2 other countries that make up Great Britain. In 15 years, over 6 phases, LiDAR is low resolution, old and data barely covers one-third of the Scottish mainland and islands, with coverage being incredibly fragmented and typically central-belt focused.

This compares to England who achieved near 100% 1m resolution LiDAR coverage in 3 years. The Welsh government have also achieved near 100% LiDAR coverage of their country, further demonstrating how far behind Scotland has fallen with regards to LiDAR and remote sensing technologies.

With Scotland's shameful position of being in the bottom 15% in the UN's Biological Intactness Index, it needs every tool available in its arsenal to try and improve on the 56% of Scotland's biodiversity that remains intact, and this includes proven remote sensing technologies such as LiDAR, which would be able to provide the Scottish Government, regional councils, Forestry and Land Scotland, conservation groups and landowners with invaluable information on woodland structure and composition including tree height and tree density amongst other uses.

Such information would assist the Scottish Government and partners towards reaching their target of woodland expansion to cover 21% of Scotland by 2032, which would directly benefit and increase Scotland's biodiversity.

Recommendations

- Scottish Government and SEPA to commit to full airborne LiDAR coverage of Scotland (mainland and all islands), with 1m resolution (minimum) with full programme funding ringfenced
- Achieved by dividing areas of Scotland into around 120 grid squares of around 600-700km^2
- 4 year flying programme (flying and capturing between November and March) with timeframe allowing an extra year for remote areas and harsher weather conditions
- Rolling data releases – once data of grid squares has been collected and processed, data to be published and open to all
- Hardware, software and training available to government and regional departments for the monitoring, management and expansion of Scotland's woodland areas
- Commit to re-run the programme in 3-5 years' time to allow comparison and progress of re-forestation projects
- Taskforce creation for monitoring technology advances and opportunities of satellite LiDAR in future
- Reverse and protect SEPA budgets, with budgets rising in-line with inflation

Background

Position of shame in B.I.I

Scotland currently sits in the bottom 15% of countries in the Biological Intactness Index [1] with 56% of our biodiversity has been assessed to be intact [2].

History

While the current state of Scotland's biodiversity can't be down to one thing, one driver of biodiversity loss has been de-forestation. In a report by the Scottish Government, it found that Forestry sector was worth just under £1b (GVA) to the Scottish economy and employed over 25,000 people, so a key economic contributor and employer, particularly in rural areas [3].

Today

Scotland's woodland cover is over 18.5%, a substantial increase from 5% cover little over 100 years ago. While good progress has been made, and while Scotland's woodland cover percentages are the highest amongst the British Isles, they still fall well short of most European countries as Figure 1 demonstrates [4].

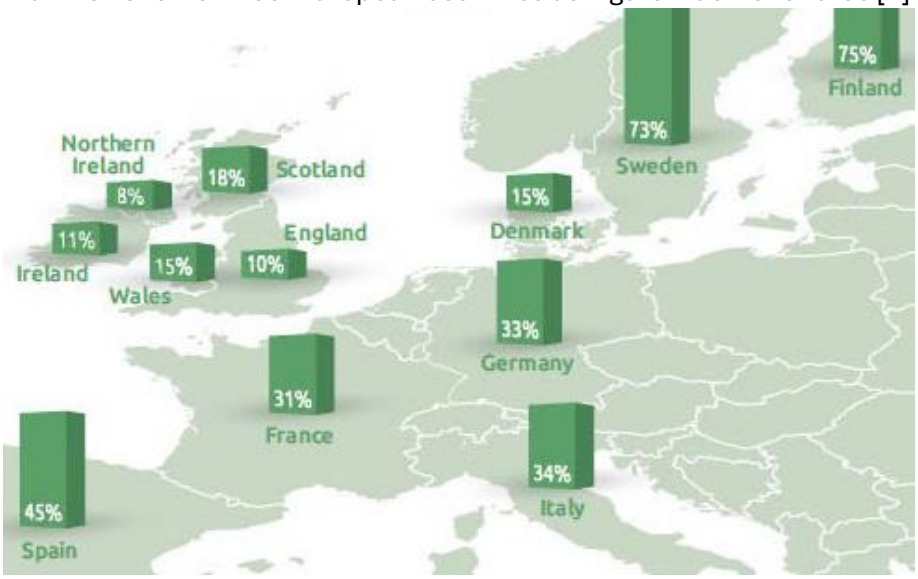


Figure 1 – Scotland's woodland cover compared to other UK and European countries

De-forestation and Biodiversity

Loss of woodland directly affects our biodiversity. Loss of woodland is a loss of habitat removing shelter and food sources[5]. Loss of woodland leads to further collapse of biodiversity in the remaining fragmented forest sections. This is because the remaining fragmented sections have reduced in quality which can therefore drive impoverishment of biological communities that reside there [6]. De-forestation has also contributed to global climate change which has the potential to decimate both global and local biodiversity further [7].

LiDAR – Current State

Scotland hasn't had a dedicated national wide coverage LiDAR programme. Current data is 5 separate phases (2011-2021) that has been collected for different projects [8]. There have been no published case studies from the Scottish Government that has used remote sensing technologies and data, such as LiDAR, on improving biodiversity in the country [20].

In 2023, Scottish Government allegedly considered annual LiDAR scans to monitor forest and peatland health, however there has been no further mention or progress with this [21]. Since then, SEPA has had budget cuts imposed upon them by the Scottish Government [16].

What is LiDAR

LiDAR (Light Detection and Ranging) is a technological way of creating high-resolution models of ground elevation and has an accuracy of 10cm. A laser, typically attached to light aircraft transmits pulses of light to the ground. The pulses are then reflected/scattered back and the travel time is used to calculate the distance between the

ground and laser scanner which Figure 2 demonstrates [9].

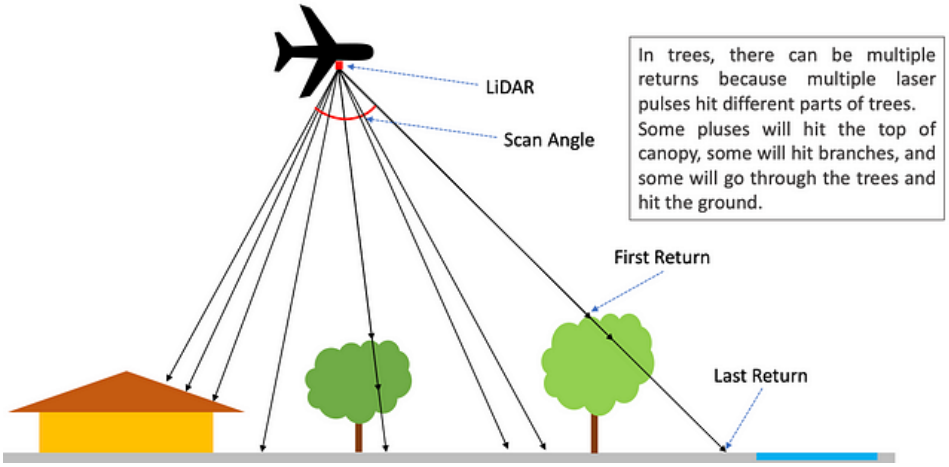


Figure 2- How LiDAR works (https://medium.com/@namratadutt2/a-quick-guide-to-lidar-part-1-theory-7c8ff48af0b9)

Current Polices

Biodiversity

There are several global and local polices that aim to restore biodiversity and woodland cover, such as:

Scottish Government
Riaghaltas na h-Alba
gov.scot

Biodiversity Strategy [10]

› Halt biodiversity loss by 2030
› Restored & regenerated biodiversity by 2045

Kunming-Montreal
GLOBAL BIODIVERSITY FRAMEWORK

2030 Targets [13]

› Restore 30% of all Degraded Ecosystems
› Conserve 30% of Land, Waters and Seas

Scottish Government
Riaghaltas na h-Alba
gov.scot

Climate Change Plan [11]

› Woodland cover 21% of Scotland by 2032
› New afforestation (rise to 15,000 ha per year)

DESA Department of Economic and Social Affairs

6 Global Forest Goals [14]

› Goal 1: Global forest area increased 3%
› Goal 2: Large increases in designated protect forest areas

Scotland – LiDAR and Remote Sensing

While the Scottish Government, through Internationally legally binding targets or voluntary schemes has committed to halting biodiversity loss and increasing woodland cover and biodiversity gain, unfortunately there has been no firm commitments with regards to investment in remote sensing technologies, despite the Scottish Government considering annual LiDAR scans in 2023 [21].

Perhaps Scotland's lack of investment in remote sensing technologies is the result of Scottish Government funding cuts to SEPA [16].

UK and International Partners – LiDAR and Remote Sensing

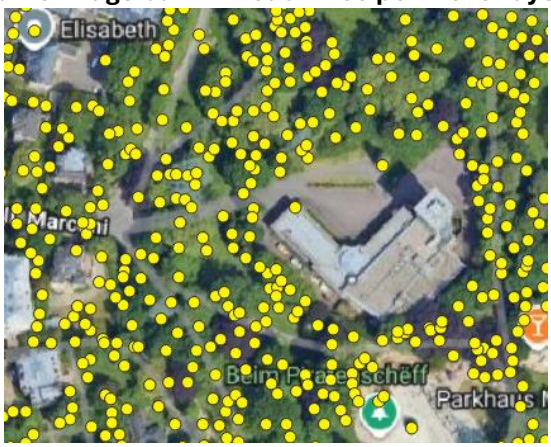
England's Environment Agency committed to a full airborne LiDAR coverage programme in 2017 and finished it in 2020 [14] with the aim of using the data for conservation purposes. The EU has invested in spaceborne LiDAR technologies to access the effectiveness of forest protected areas [15]. Denmark has used LiDAR for vegetation structure and local bird richness [22] while Canada has created a research branch "Canadian Wood Fibre Centre" within the Canadian Forest Service to balance the economic and biodiversity requirements of Canada's woodlands [23], by utilising remote sensing technologies such as aerial and ground-based LiDAR systems [24].

Case Study - Luxembourg

The Government of Luxembourg has produced a dataset that has every tree in the country mapped. The dataset is complete with every single tree having a unique tree ID, X&Y co-ordinates, tree height and crown diameter. The data was automatically extracted from 2019 airborne LiDAR data [17]. See below.

Satellite image of Luxembourg Park

Same image but with each tree point overlayed



This dataset has been used by the organisation Forestpaths, who have used this data for "biodiversity-smart forest management" [18]. Government of Luxembourg has embarked on re-forestation projects to restore natural ecosystems [25]. LiDAR can assist in the management and monitoring of existing and new woodland by providing invaluable information on forest density and tree height, helping track progress of re-forestation projects.

Conclusion

The Scottish Government has some made some great progress to re-forestation and halting biodiversity loss. However, it has some tough targets both locally and globally and legally binding.

To meet these targets on re-forestation which would directly increase biodiversity in Scotland by providing new habitat, food and shelter resources, the Scottish Government has to invest in remote sensing technologies such as LiDAR while reversing the cuts to SEPA's annual funding.

As has been demonstrated by the EU, Denmark, Canada, England, and Luxembourg, remote sensing and LiDAR can be a vital tool in any countries arsenal for monitoring and increasing biodiversity through re-forestation. Furthermore, with remote sensing and increasing capabilities and advancement of A.I, they can work in conjunction to further improve Scotland's biodiversity protection [19]. However, this needs dedicated funding and the political will to succeed.

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This briefing was created as an assessment for the Action for Biodiversity module.