



**A Carbon Baseline and
Decarbonisation Transition Assessment for
Gloucestershire County and Districts**

**Small World Consulting
January 2025**

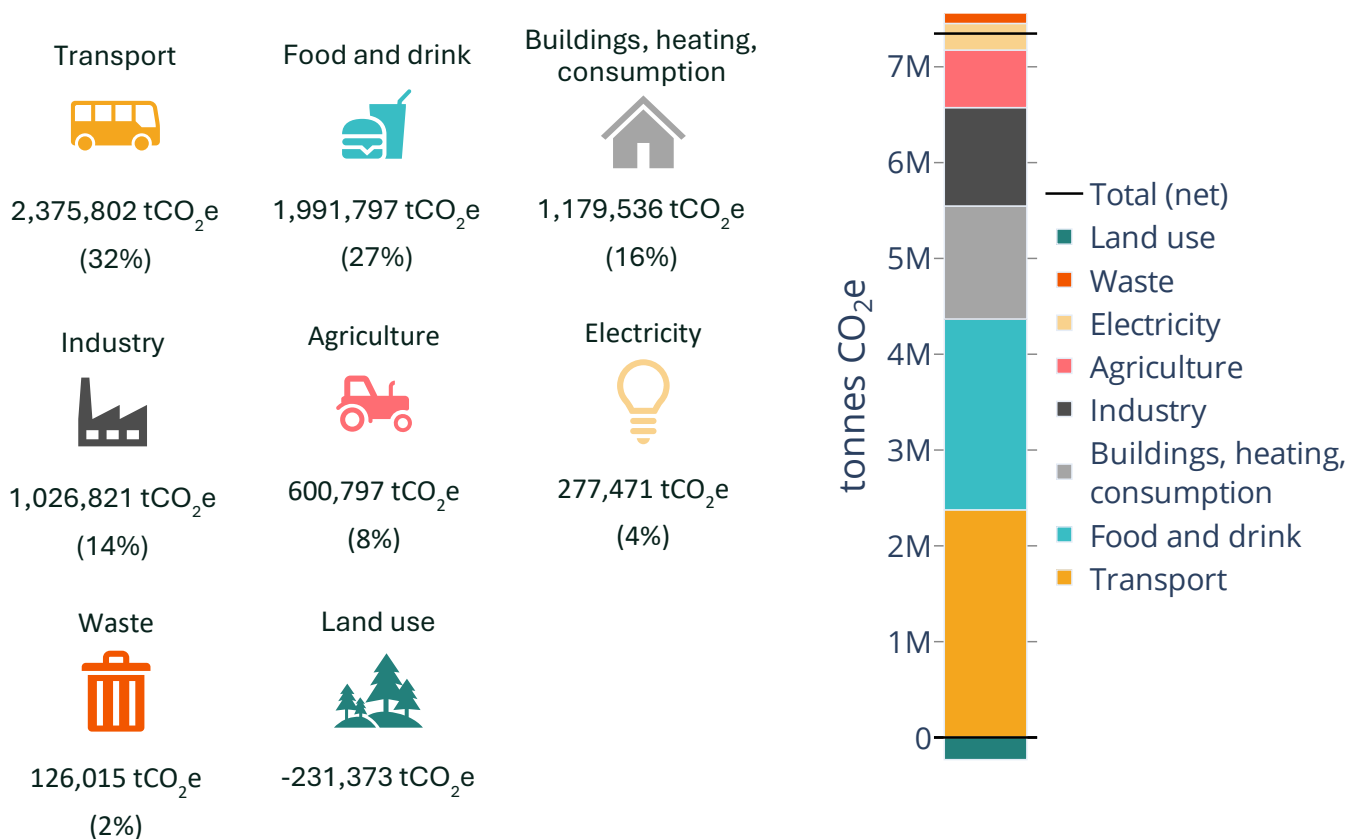
Executive Summary

In 2024, Gloucestershire County Council commissioned Small World Consulting (SWC) to calculate the carbon footprint of the county and its districts: Cheltenham, Cotswold, Forest of Dean, Gloucester, Stroud, and Tewkesbury. This summary presents the results of our analysis of the climate impacts linked to the products and services that residents, visitors and businesses consume, and to the way land is used in Gloucestershire. Following this analysis, we used the carbon footprint as a baseline to calculate science-based targets for emissions reduction and carbon sequestration. Finally, we used the results from these exercises to identify priority policy interventions, which incorporate considerations of the potential to reduce emissions along with the ability of the councils to act, given their authority and role within a wider legislative context.

Carbon Footprint Analysis

The landscape-level carbon footprint analysis uses Small World Consulting's (SWC) industry-leading model to assess landscape-level Scope 1, Scope 2, and Scope 3 greenhouse gas (GHG) emissions for Gloucestershire County and its constituent districts. This model integrates over 20 national and local datasets, capturing emissions from residents, visitors, and industry across various sectors, including land use.

Based on a breakdown of the total footprint (7.3 million tonnes of CO₂e) across slightly modified UK government reporting categories, the footprints of each sector in order of size are:



The total footprint per resident is **12.6 tCO₂e** based on 2022 data. The largest components are goods and services (consumption), and food and drink (3.8 and 3.2 tCO₂e respectively).

Comparison to UK average footprint

The resident population in Gloucestershire numbers nearly 600,000 people. Of the 7.3 MtCO₂e (million tonnes) footprint described above, 70% is due to residents and 11% due to visitors, with the rest arising from industrial energy use, land use emissions and agriculture.

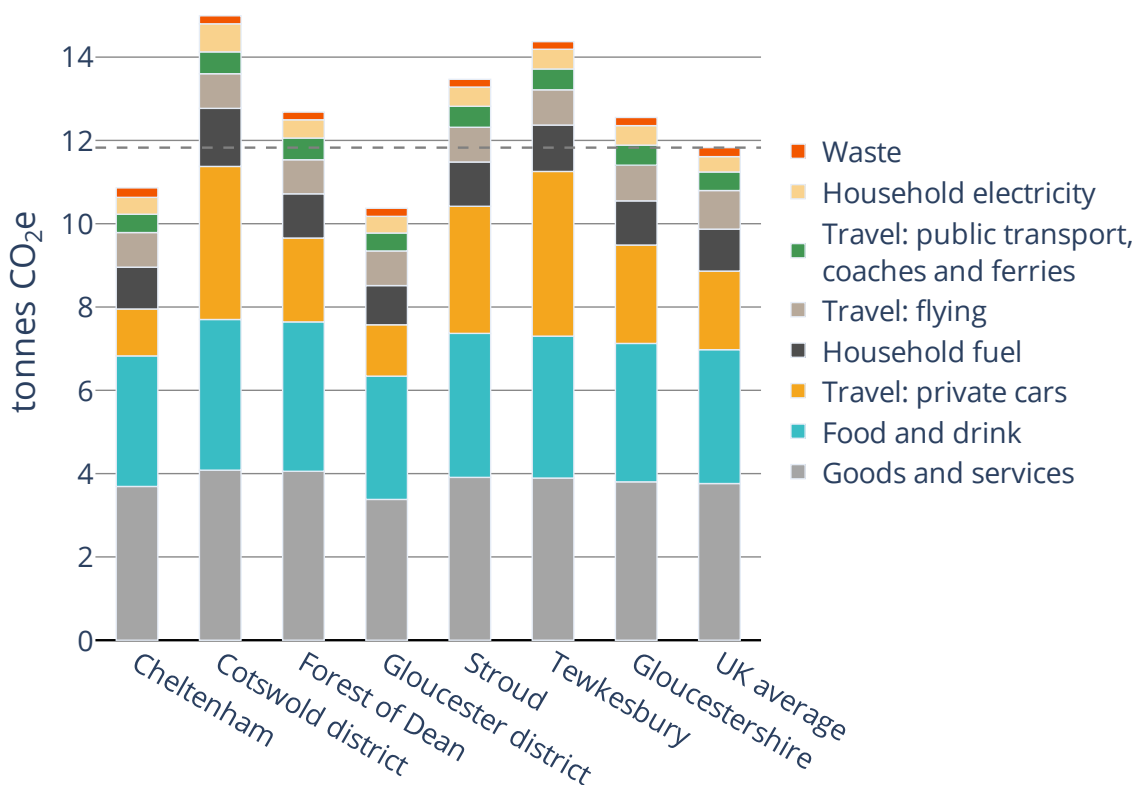
Gloucestershire residents' footprint is **6% larger** per capita than the UK average.

The largest difference is due to household electricity consumption, **21% higher** for a Gloucestershire resident than the UK average.

The rural nature of several districts also influences vehicle fuel use (2.4 tCO₂e per resident): **20% higher** than the UK average.

Visitor Footprint

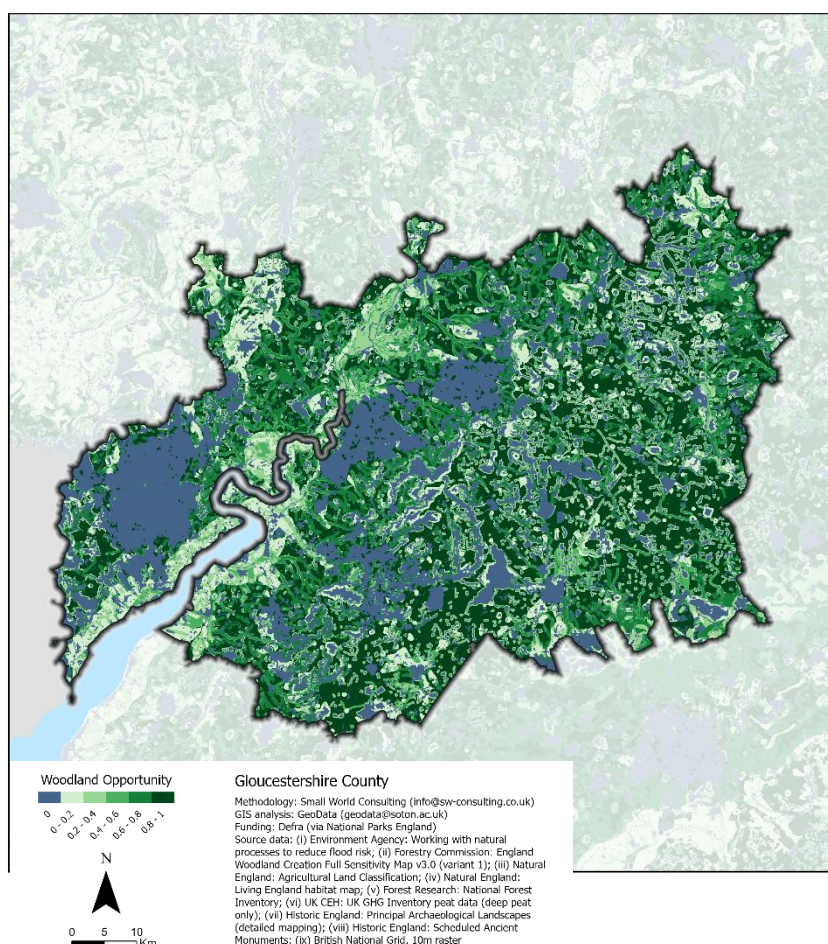
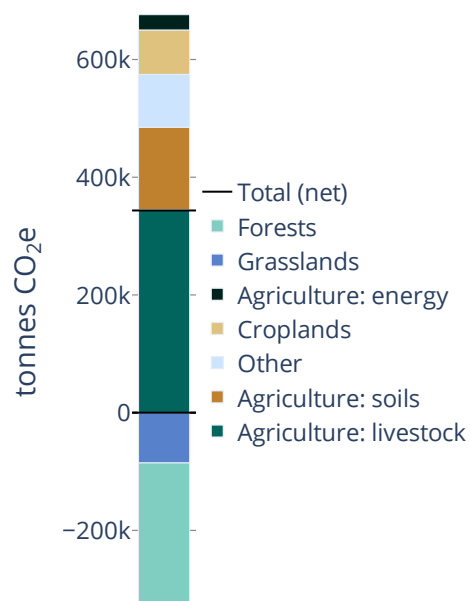
Visitors' emissions make up only 11% of the total area footprint, with the vast majority of this arising from their travel to and from their visit destination (927,718 tCO₂e, 78% of the visitors' total) and 9% due to goods and services consumption emissions within the county during their visit.



Land-Based Emissions and Carbon Sequestration

The land use emissions (and emissions from energy used for farming) in Gloucestershire contribute over 300,000 tCO₂e to the total footprint, even after factoring in the carbon sequestration from existing forests and grasslands (-332,755 tCO₂e). The single biggest contributor to the gross emissions is livestock farming (344,847 tCO₂e, 49%). Despite being a net emitter, Gloucestershire has the potential to use nature-based solutions to reduce its footprint with the right management techniques and stakeholder engagement, while sequestering carbon via the creation of new woodland and a transition to regenerative agricultural practices.

Using the Small World's Woodland Opportunity Map (results shown in the map below) a fair share woodland target (965,000 m²) was calculated for Gloucestershire in line with the UK's 6th Carbon Budget, with further adjustment to reflect what is required to tackle the UK's consumption-based footprint. Over 50% of the target woodland areas are within Cotswold district, with the next largest district allocation being Tewkesbury (17%).



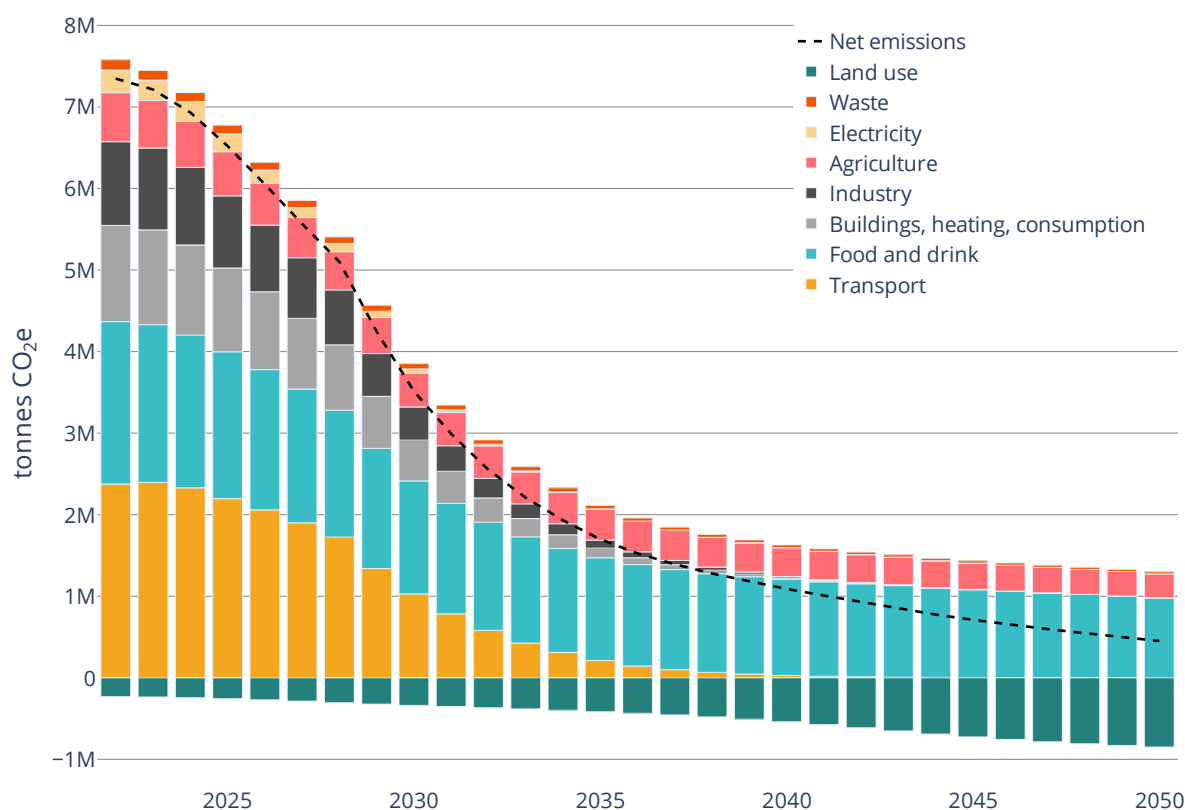
As well as creating new native, biodiverse woodland, the targets we set for the agriculture sector include four regenerative practices: planting and restoring hedgerows, agroforestry, species-rich grassland (including the use of legumes), and cover cropping.

The long-established use of hedgerows offers both carbon sequestration and valuable wildlife habitats without affecting agricultural land use. Moving to species-rich grassland with legumes and adding cover crops to crop rotations improves soil fertility and carbon storage, reduces erosion, and cuts emissions, balancing climate needs with those of farmers. Agroforestry – when properly implemented – enhances biodiversity, captures carbon, shelters livestock and improves soil stability, all without disrupting farming operations.

Fair Share Decarbonisation Trajectory

We use the results from the carbon footprinting exercise and the sequestration potential assessment to construct a science-based fair share decarbonisation trajectory. The trajectory is consistent with the global ambition to limit global temperature rise to 1.5°C. We combine the magnitude of the UK's fair share of a global 1.5°C carbon budget, calculated by the Tyndall Centre, with the feasible sector-specific decarbonisation pathways from the UK's 6th Carbon Budget. A separate adjustment is made to the food and agriculture sectors, which are dominated by methane and therefore have target rates of emissions instead of carbon budgets.

The resulting trajectory is shown below, broken down into the slightly modified UK government reporting categories, as used above. The trajectory starts from the baseline of **7.3 MtCO₂e in 2022**, which is then projected to decrease to **0.45 MtCO₂e in 2050**, with the residual emissions arising from the methane-dominated food & drink and agriculture sectors. It is worth noting that our analysis of the carbon sequestration potential does not take into account the possibility of carbon sinks being lost to wildfires, pests, flooding and so on (risks which will increase in a warming world), so the priority still ought to be on swift and comprehensive emissions reductions rather than the arithmetic of "net zero".



When considering agriculture and land use, there are two primary changes reflected in the net zero trajectory for Gloucestershire. Firstly, the emissions linked to agriculture will reduce as less carbon-intensive regenerative agricultural practices are adopted and the overall numbers of livestock fall thanks to a gradual transition toward a more plant-based diet. Secondly, the cumulative effects of county-wide woodland creation will result in significant amounts of carbon sequestration once trees begin reaching maturity. It is this delay in sequestration in trees that highlights the importance of taking immediate action if we want to stay within the carbon budget for 2050 aligned with the global 1.5°C target.

Priority Interventions Analysis

This analysis identifies and assesses the top five priority interventions to achieve Gloucestershire's "fair share" emissions targets. The priority interventions were determined through a mix of quantitative data on emissions hotspots and qualitative assessments.

Together, residential car travel, household fuel use, and food and drink make up more than half of Gloucestershire's total carbon footprint.

1. **Goods and services** (footprint for residents is 31% of the whole baseline) - Reducing consumption patterns, by buying less, repairing, reusing and repurposing goods, and favouring more local supply chains.
2. **Food and drink** (footprint for residents is 27% of total) – Dietary shift to more plant-based foods reduces emissions and allows more land to be used for nature recovery and carbon sequestration.
3. **Car use** (footprint for residents is 19% of total) – A shift to active travel and public transport, along with localisation to ensure rural communities are still well served without being locked in to car dependence.
4. **Visitor economy** (16% of total) – As much visitor travel by public transport as possible, as well as encouraging longer stays and more local visitors.
5. **Household fuel use** (footprint for residents is 9% of total) – A complete switch away from oil and gas for household heating, along with significant energy demand reduction measures.

While there are many more puzzle pieces needed to fully decarbonise Gloucestershire, these five interventions represent highly impactful areas to address. Through the combination of integrated and sustainable spatial planning, active travel and local service re-establishment, renewable energy technology, and carbon sequestration efforts, Gloucestershire can make meaningful progress toward its climate goals. This holistic approach will also help mitigate any negative socio-economic impacts on rural communities of localisation, changes to farming practices, and nature recovery programmes, ensuring a just transition and a prosperous future for all¹.

Cost:benefit analyses

Extending the work of the 6th Carbon Budget to cost intervention measures, Small World have undertaken cost:benefit analyses on transport and housing stock decarbonisation measures. These show that, assuming a carbon pricing mechanism is in place, rapid rollouts of home insulation, heat pump installations, active travel and public transport measures, and EV charging infrastructure will pay for themselves in reduced operating costs before 2050.

- **Buildings:** We modelled social housing and private housing separately, since councils will have more control over interventions in social housing. We found that investment in insulation and heat pump installation should be heavily weighted towards the short term. This saves money for the council and residents in the long term, as well as meeting climate goals. We have assumed that the price of gas stays constant to 2050, but further disruptions to supply in the future would make it even more cost-effective to invest sooner.
- **Transport:** Due to lower fuel and operating costs after switching to cleaner transport, and the high projected costs of carbon, the benefits for decarbonising transport already outweigh the costs. However, due to a heavy focus on cars and lorries in the 6th Carbon Budget the economic benefits could be even greater by focussing much more on reducing travel demand and investing in active travel and public transport measures which are much less energy-intensive and cost-effective.

¹ See our recent policy paper [UK Farming and Land Use: Addressing the Climate and Ecological Emergencies while Supporting Farmers](#) for a deeper discussion on this topic.

SMALL WORLD CONSULTING



This report was prepared by

Tom Higgs
Morgan Neilson
Mira Kracke

Small World Consulting are world-leading experts in measuring the environmental impact of organisations and landscapes. We help organisations see how they could become truly sustainable. We measure the carbon footprint of living landscapes and show how to reduce emissions from the land and the communities who live, work and visit there.

We work with clients across retail, telecoms, finance, manufacturing, food and hospitality, and landscapes. We look at the smallest details to the global big picture. We help you see yourself thriving in a low-carbon future.

A dedication to truth is at the heart of all our work.

Small World Consulting Ltd
Lancaster Environment Centre
Gordon Manley Building
Lancaster University, Lancaster LA1 4YQ

info@sw-consulting.co.uk | 01524 510272 | www.sw-consulting.co.uk