Dartmoor 2022 Carbon Baseline and Targets

Small World Consulting

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Introduction

This report presents the results of the 2022 carbon footprint baseline and decarbonisation trajectory carried out by Small World Consulting (SWC) for Dartmoor National Park. Along with the 14 other National Parks in the UK, Dartmoor has committed to halve carbon emissions within the landscape by 2030 and become a significant carbon sink by 2050. To meet the Paris Agreement target of limiting global warming to 1.5° C, we need to drastically reduce global greenhouse gas emissions within the next decade, reaching "net zero" emissions as soon as possible. While the UK government has set a date of 2050 as a target for reaching net zero, the most crucial time for emissions cuts is on a much shorter timescale.

What is Net Zero?

Net Zero means that the same amount of greenhouse gases is being emitted as are being absorbed, so that the total amount in the atmosphere does not increase. Only at that point will the rise in global temperatures above pre-industrial levels slow down and stop. This could be reached by reducing emissions completely to zero, or by reducing emissions to very low levels and absorbing the remainder.

For short-lived greenhouse gases, such as methane, annual emissions need to stabilise, but a reduction of emissions levels would help stop global temperature rise more quickly, lessening the damages from the climate emergency.

For CO_2 removals from the atmosphere to contribute to net zero they must permanently sequester (store and lock away) carbon, and the best way of achieving this is restoring the biosphere, since humans have heavily deforested the planet and released the carbon which was previously locked into the Earth's natural carbon cycle. Increasing the levels of natural sequestration is also important for restoring lost biodiversity.

Unfortunately, the climate change we have already caused will likely subject trees and peatlands to new stresses such as wildfires, droughts and pests, threatening to release

the carbon that we think is locked up forever. Therefore, it is always much safer to reduce emissions levels as much as possible as quickly as possible, rather than rely on the arithmetic of net-zero and potentially at-risk sinks.

Where are we now?

Dartmoor National Park's emissions in 2022

Small World uses a consumption-based approach to calculating the emissions for residents and visitors, which means that we include the emissions associated with the manufacture and distribution of goods, wherever that happens, as well as their endpoint of use. For example, we include the emissions associated with extracting, refining and distributing a litre of petrol, as well as the emissions which come directly from burning it in a car's engine. We also include the emissions due to manufacturing the car itself.

By contrast, a territorial-based measurement would only include the emissions which happen within the National Park itself, without considering the impact of the global supply chain and infrastructure which sits behind all the emissions within the park.

Residents

The total footprint of the **37,252** residents of the National Park was **502,976** tonnes CO_2e in 2022. The table below shows the breakdown of this figure into broad contributing categories, ordered from largest to smallest. Goods and services make up the largest proportion of the footprint, closely followed by food and drink. The rural nature of the park entails high reliance on car use, so although the footprint from private cars isn't the highest individual category, it shows the largest difference between an average resident of the National Park and an average UK resident. Overall, the annual per capita footprint of a Dartmoor resident is **12**% larger than an average UK resident.

(See Table 1 for residents' footprint breakdown)

Visitors

The total visitor's footprint was **135,491** tonnes CO_2e in 2022, from an average of nearly 8,000 visitors per day, with 81% of the footprint coming from visitor travel to and from the park. Of this, 85% is due to the reliance on driving, making it by far the main contributor to the overall visitor footprint. The footprint due to train travel and other public transport is very low, but the footprint from visitors flying to the park is not insignificant, contributing more to the total visitor footprint than the food and drink consumed during the stay.

(See Table 2 for breakdown of visitor emissions)

Figure 1 shows the residents' and visitors' footprints, while Figure 2 shows the breakdown of the visitors' footprint while they are in the park.

Land use and agriculture

The land use and agriculture footprint is made up of emissions (gross emissions **187,710** tonnes CO_2e) and sequestration (**84,963** tonnes CO_2e), leading to overall net emissions

of **102,747** tonnes CO_2e. The largest contributor to this footprint is the emissions associated with livestock farming, and agriculture as a whole dominates the sources of emissions. The sinks are provided by forests, with wetlands being the largest non-agricultural source of emissions.

What does this mean for Dartmoor going forward?

For Dartmoor National Park to reach net zero emissions, we have set decarbonisation targets until 2050 for 6 footprint categories. Due to constraints on the ability of the National Park Authority to directly influence some of the emissions from residents and visitors presented above, not all those categories are carried forward to the target-setting categories. Additionally, since some sectors are treated quite differently from others in the target-setting exercise, some results which were presented together above have been separated – for example agriculture and other land use. The 6 resulting categories are:

- Energy use – the emissions from direct energy (electricity, gas and other fuels) used for running and heating homes, shops and factories, petrol and diesel burnt in cars, vans, lorries and buses, and fuel used for industrial processes. The category also includes the emissions generated by the extraction, refining and transporting the fuels themselves.
- Food and drink – the emissions from the food and drink bought by residents and visitors from shops and supermarkets, and from eating out at cafes and restaurants.
- Other shopping – the embodied emissions of most goods bought from shops (except food and drink), for example clothes, furniture and electronics. It also includes the embodied footprint of residents' cars.
- Visitor travel – the emissions from travelling to and from the national park via car or public transport, as well as the embodied emissions of the cars.
- Land use (excluding agriculture) – the emissions and sequestration from current land use and recent changes in land use, for example carbon sequestration by forests and grasslands.
- Agriculture – the emissions from farming activities on the land such as ploughing, applying fertiliser, the methane emissions from cows and sheep, and the emissions from burning fuels in tractors and machinery.

The total footprint across these categories for Dartmoor National Park is **633,439** tonnes CO_2e in 2022, and we use this figure as the starting point for the emissions reduction target-setting.

The table below shows the baseline footprint by category in 2022, with the largest being energy, agriculture, and food and drink. The baseline footprint is also shown in Figure 3.

Category	tonnes CO2e	% of emission sources	Targeted % decrease per year
Energy (incl supply chain)	229,627	33%	8%
Agriculture	162,004	23%	3%
Food & Drink	143,597	21%	3%
Visitor travel to/from	99,006	14%	11%
Other Shopping	58,462	8%	13%
Sources	**692,697**	100%	**6%**
Land use excl. agriculture	- 59,258		
Total	**633,439**		

Energy

The energy category makes up **33**% of the total baseline footprint emissions, and we propose an **8**% reduction in these emissions each year to 2050. The energy emissions are mainly made up of residents' vehicle fuel use (nearly 40%) and household fuel use (nearly 20%), highly influenced by the rural nature of the National Park and therefore the dependence on private car use for transport, and a higher proportion of homes using solid fuel or oil for heating.
To tackle these emissions, the ambitious yet achievable target would be reached through:

- **Energy Efficiency in Homes**: Replacing oil and gas boilers with electric heat pumps, improving insulation, and setting thermostats to lower temperatures can make homes both more sustainable and energy efficient.
- **Low-Carbon Transportation Options**: An overhaul of the transport system away from private cars and towards active travel and public transport is required, which will also involve changes to how settlements and services are placed and planned. Where it is unavoidable to use cars, they must be switched to electric vehicles, along with the rest of the vehicle fleet.
- **Transition to Renewables**: Shifting to renewable energy sources like solar, wind, tidal, and hydroelectric power is essential, with solar and wind the most relevant to Dartmoor. Verified green energy tariffs can provide access to clean energy backed by Power Purchase Agreements, ensuring a sustainable energy supply.
- **Building and Infrastructure Enhancements**: Increasing demand from electric heat pumps and electric vehicles will require better grid connections and local renewable energy production to ensure reliability.

Additional activities include building new structures with lower-carbon materials, like timber instead of conventional concrete and steel.

Energy category	Footprint (tonnes)	% of energy footprint
Resident vehicle fuel	86,735	38%
Resident household fuel	41,302	18%
Industry fuel and processes	32,456	14%

Resident public transport, coaches and ferries	20,311	9%
Industry vehicle fuel	18,594	8%
Resident household electricity	17,883	8%
Visitor vehicle fuel	8,563	4%
Industry electricity	2,608	1%
Visitor public transport, coaches and ferries	565	0%
Visitor household fuel	419	0%
Visitor household electricity	191	0%
Total	**229,627**	100%

Agriculture

The agriculture category makes up **23**% of the total baseline footprint emissions, and we propose a **3**% reduction in these emissions each year to 2050. The activities leading to these emissions include livestock rearing, fertilisation, and machinery use. This is primarily due to methane emissions from livestock, which have a higher global warming potential than carbon dioxide. Other contributors include emissions from soil management and machinery fuel, though these represent a smaller share.

The emissions reduction target aims to bring emissions down to **50**% of current levels. Achieving this will require further shifts toward sustainable farming practices. Key strategies include:

- **Reducing Livestock Numbers**: As part of a broader dietary shift, a reduction in livestock numbers will reduce emissions, aligning agricultural practices with evolving consumer demands.
- **Adopting Regenerative Farming Practices**: These practices prioritise soil health and biodiversity, reducing the need for synthetic fertilisers and cutting down on emissions from intensive soil and crop management.

This transition to climate- and nature-friendly farming requires collaboration and support, allowing farmers to lead in conservation while maintaining sustainable productivity in Dartmoor's agricultural landscape.

Agriculture category	Footprint (tonnes)	% of agriculture footprint
Livestock	119,868	74%
Other	20,406	13%
Soils	18,066	11%
Energy	3,664	2%
Total	**162,004**	100%

Food and drink

The food and drink category makes up **21**% of the total baseline footprint emissions, and we propose a **3**% reduction in these emissions each year to 2050. Emissions from food and drink reflect the full impact of what residents and visitors consume across Dartmoor, whether bought in shops, enjoyed in restaurants, pubs, and as takeaway, or served in

hotels and B&Bs. This includes the environmental toll of producing, processing, and transporting these items. Notably, nearly 90% of these emissions come from the food residents buy in grocery stores and other shops, while the emissions from eating out and visitor food purchases represent a much smaller fraction.

The targeted emissions reduction aims for a **50**% decrease in 2050 compared to current levels. This goal breaks down into three primary approaches:

- **Shifting to Lower-Carbon Diets**: Shifting diets to include more plant-based foods such as fruits, vegetables, nuts, and legumes, and consuming less meat, could greatly reduce emissions. Plants mostly require far fewer resources and generate lower emissions compared to animal products. This gradual dietary shift supports both environmental goals and health.
- **Reducing Emissions from Food Production and Transportation**: Focusing on sustainable practices in food production and sourcing items closer to Dartmoor, can cut emissions tied to long-distance transport and high-intensity farming methods.
- **Cutting Food Waste**: Reducing food waste offers emission reductions, p votentially lowering an individual's food-related carbon footprint by up to 12%. This can be achieved through better storage, portion management, and creative meal planning.

Navigating food choices that balance climate, biodiversity, local livelihoods, health, and affordability is complex. Achieving these reductions will require collaboration among policymakers, farmers, food producers, public health organisations, and Dartmoor's residents and visitors.

Food and drink category	Footprint (tonnes)	% of food and drink footprint
Resident food and drink, shops	127,680	89%
Resident food and drink, eating out	12,878	9%
Visitor food and drink, eating out	1,689	1%
Visitor food and drink, shops	1,350	1%
Total	**143,597**	100%

Visitor travel

The visitor travel category makes up **14**% of the total baseline footprint emissions, and we propose an **11**% reduction in these emissions each year to 2050. Visitor travel emissions account for both how people reach the park and how they get around once they are there. Most of these emissions come from fuel used in personal vehicles, along with a smaller portion from vehicle manufacturing and maintenance. Travel by bus, coach, and train contributes a relatively small share of these emissions.

The emissions reduction target is based on stable visitor numbers. Achieving this goal involves several strategies that will rely on engaging visitors and travel agencies:

- **Promoting Public Transport:** providing the infrastructure to allow visitors to travel more easily to the park via public transport will significantly reduce travel-related emissions. Enhancing bus or shuttle services within the park will then allow visitors to enjoy the park without relying on cars.
- **Promoting Active Transport**: Tying into the changes mentioned in the Energy use section, converting infrastructure from car-oriented to walking- and cycling-oriented will allow visitors to explore the park in the cleanest ways possible. This would include providing secure and sheltered cycle parking at the most popular destinations.
- **Encouraging Electric Vehicles:** For any trips which cannot be made by public transport or active travel, EV charging points must be available to encourage the switch to electric vehicles.
- **Encouraging Longer Stays**: By promoting longer visits, the park can help lower the relative emissions per trip, as each visit would involve fewer individual travel journeys.

Through these measures, Dartmoor can offer visitors a more sustainable way to experience the park, preserving its natural beauty while reducing the environmental impact of travel.

Visitor travel category	Footprint (tonnes)	% of visitor travel footprint
Vehicle fuel	73,225	74%
Car manufacture and maintenance	20,263	20%
Buses and coaches	4,139	4%
Trains	1,380	1%
Total	**99,006**	100%

Other shopping

The other shopping category makes up **8**% of the total baseline footprint emissions, and we propose an **13**% reduction in these emissions each year to 2050. Beyond food and drink, spending on goods like clothing, furniture, electronics, and vehicles also generates emissions—from production and transport to eventual disposal.

Other shopping emissions can be targeted through two main measures:

- **Adopting a Circular Economy**: Moving toward a circular economy is essential to achieving this goal. This approach emphasises sharing, leasing, reusing, repairing, refurbishing, and recycling materials and products to extend their life cycle. By rethinking consumption patterns and reducing raw material use, residents and visitors can minimise waste and save money.
- **Greener Supply Chains**: Encouraging manufacturers and retailers to reduce emissions across the supply chain, from production methods to logistics, will lower the footprint of goods purchased by residents and visitors.

Building a more circular economy not only cuts emissions but also reduces resource use and waste, supporting Dartmoor's wider environmental and sustainability goals.

Other shopping category	Footprint (tonnes)	% of other shopping footprint
Resident other shopping	34,673	59%
Resident car manufacture and maintenance	16,493	28%
Visitor other shopping	5,264	9%
Visitor car manufacture and maintenance	2,031	3%
Total	**58,462**	100%

Land use (excluding agriculture)

While farming presents one of the key challenges in addressing Dartmoor's emissions impact, land management is also part of the solution, since carbon can be sequestered by trees, hedgerows, grasslands and other healthy soils. Increasing sequestration is essential not only for mitigating climate impacts but also for enhancing biodiversity and creating valuable habitats for wildlife.

After excluding agriculture, the net effect of land use on Dartmoor is carbon sequestration, of **59,258** tonnes CO_2e per year. This is due to the overwhelming effects of forests, since all the other types of land use emit carbon rather than sequester it.

The amount of sequestration will have to increase to reach net zero. Actions that can help to boost carbon sequestration and support climate resilience include:

- **Woodland Expansion**: Increasing forest cover by planting 300 hectares of new woodland annually is one of the most impactful ways to boost sequestration. This could enhance habitat quality and resilience while absorbing significant amounts of CO_2 over the years. Planting native broadleaf trees like oak and beech, which absorb more carbon over time and benefit wildlife, is a priority.
- **Restoring Degraded Peat**: Restoring nearly 300 hectares of degraded peat a year will prevent further emissions from peat which has been drained or modified in some way.
- **New Hedgerows and Agroforestry**: Expanding hedgerow networks and adopting agroforestry, where trees are integrated into farmland, contribute additional carbon storage and soil health benefits. Cover crops and legume planting can further improve soil carbon and reduce the need for artificial nitrogen, supporting regenerative agriculture practices.
- **Climate-Resilient Planting**: Choosing species that can withstand future climate conditions is essential as rising temperatures and variable rainfall patterns will impact tree survival and carbon uptake over the long term.

Land-use changes must consider local livelihoods, particularly where fields used for grazing might transition to woodland or agroforestry. Farmers' roles in shaping

Dartmoor's landscapes and economies are integral and shifts toward carbon sequestration will need financial support.

Acting swiftly to plant and manage new woodlands, hedgerows, and soil-friendly crops will help Dartmoor reach its carbon sequestration goals while ensuring a sustainable, food-secure, vibrant landscape for future generations.

Land use category	Footprint (tonnes)
Wetlands	18,443
Croplands	2,678
Grasslands	2,627
Settlements	1,842
Other	115
Forests	- 84,963
Total	**- 59,258**

Decarbonisation trajectory

The resulting decarbonisation trajectory from the target-setting exercise is shown below, and shows a rapid decrease in most sectors, although emissions from agriculture and food remain significant. By 2050, Dartmoor's residual emissions are estimated at **147,520** tonnes of CO_2e, while sequestration efforts aim to absorb around **231,552** tonnes of CO_2e. The carbon footprint assessment can be re-calculated every year to monitor progress against these targets. The trajectory is shown in Figure 4.

Near-term rises in energy and visitor travel emissions are anticipated as part of post-COVID recovery, a trend largely outside the direct control of the National Park Authority. However, this should not be seen as "allowable" growth but rather as an anticipated outcome given current conditions.

The decreases in the emissions targeted here will require fundamental changes to our provisioning systems and current way of life, but the nature of the crisis we face demands action at this scale. We should also bear in mind that the interventions which will affect these emissions reductions will also improve our well-being in other ways, as well as the well-being of the natural world.

The projected path aims for "net zero" by 2044, but it's essential to stay realistic about the limits of this goal. Rising temperatures could damage forests or dry out peatlands, which would release stored carbon back into the atmosphere, potentially negating any progress. This is why it is crucial to focus on cutting emissions quickly and significantly, while also boosting carbon capture through methods like tree planting and peatland restoration. The sequestration methods come with the added benefit of supporting biodiversity, meaning they contribute to both tackling the climate crisis and protecting ecosystems.

Figures and Tables

FIGURE 1: RESIDENTS' AND VISITORS' FOOTPRINTS BY CATEGORY.

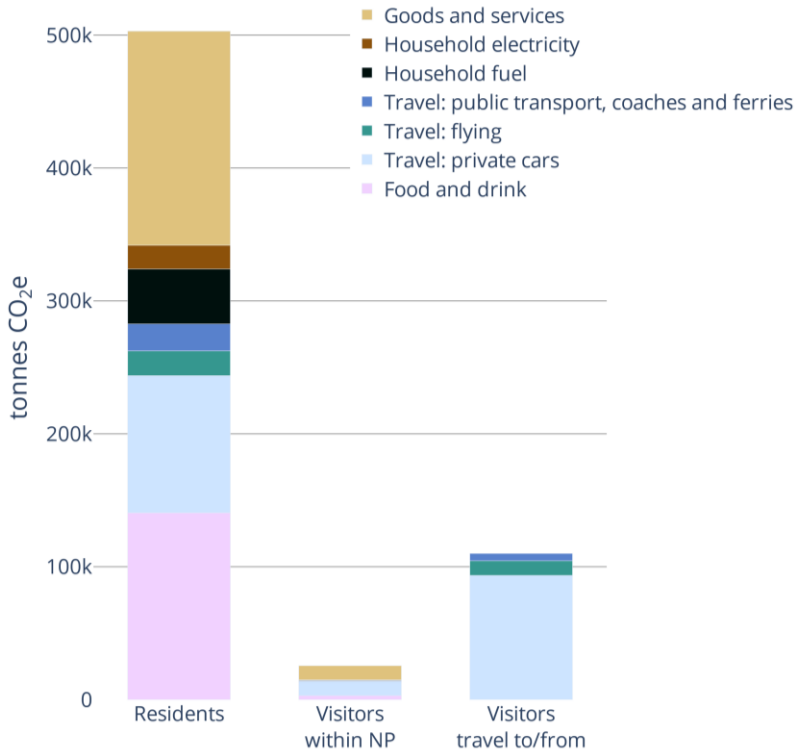

FIGURE 2: BREAKDOWN OF VISITORS' FOOTPRINT WHILE STAYING WITHIN THE NATIONAL PARK.

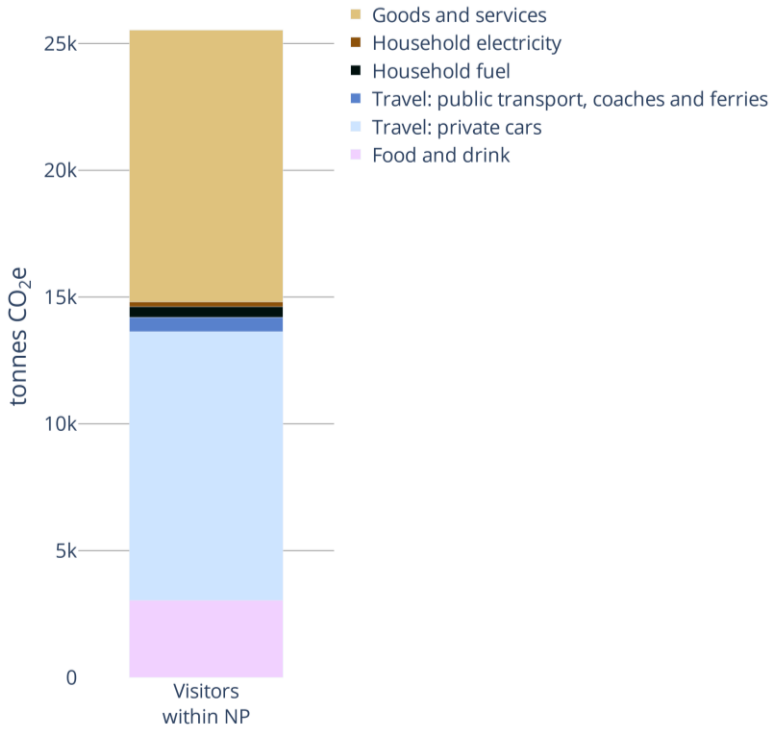

Figure 3: The 2022 baseline footprint for Dartmoor National Park. This is the footprint from which the decarbonisation trajectory is calculated.

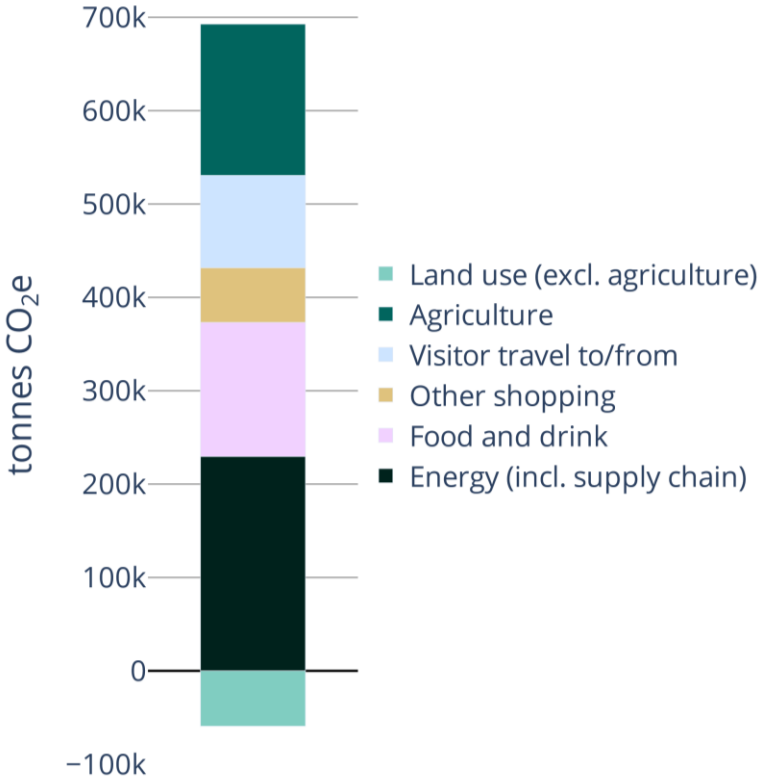

Figure 4: Decarbonisation trajectory for Dartmoor National Park

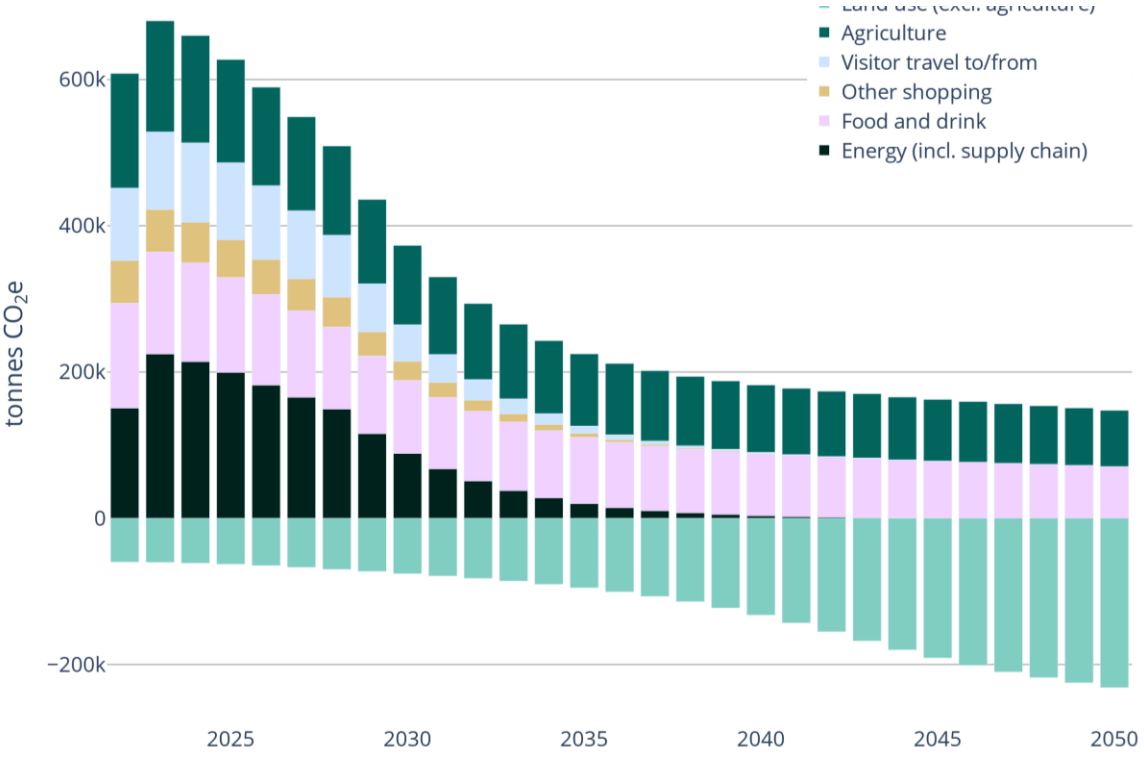

TABLE 1: RESIDENTS' FOOTPRINT BY CATEGORY

Resident footprint category	Dartmoor NP total (tonnes)	% of total	Dartmoor NP per cap (tonnes)	UK average per cap (tonnes)	% difference
Goods and services	161,100	32%	4.3	4.0	8%
Food and drink	140,558	28%	3.8	3.2	15%
Travel: private cars	103,229	21%	2.8	1.9	32%
Household fuel	41,302	8%	1.1	1.0	9%
Travel: public transport, coaches and ferries	20,311	4%	0.5	0.4	18%
Travel: flying	18,594	4%	0.5	0.9	-86%
Household electricity	17,883	4%	0.5	0.4	23%
Total	**502,976**	100%	**13.5**	**11.8**	**12%**

TABLE 2: VISITORS' FOOTPRINT BY CATEGORY; AND EMISSIONS WHILE STAYING WITHIN THE NATIONAL PARK, AND THOSE WHILE TRAVELLING TO/FROM THE PARK.

	Within NP			Travel to/from			Sector total	
Visitor footprint category	Footprint	% of within	% of visitor total	Footprint	% of to/from	% of visitor total	Footprint	Sector % of visitor total
Travel: private cars	10,594	42%	8%	93,488	85%	69%	104,083	77%
Travel: flying				10,957	10%	8%	10,957	8%
Goods and services	10,719	42%	8%				10,719	8%
Travel: public transport, coaches and ferries	565	2%	0%	5,518	5%	4%	6,083	4%
Food and drink	3,040	12%	2%				3,040	2%
Household fuel	419	2%	0%				419	0%
Household electricity	191	1%	0%				191	0%
Total	**25,528**	100%	**19%**	**109,963**	100%	**81%**	**135,491**	**100%**