

«Title» «Christian» «Name»
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Dear «Christian»

Editor's introduction: The Broads and other wetlands are extremely important in Norfolk and can help us all to reduce our carbon footprint. These wetlands can even help with carbon capture. So, we are extremely pleased to have Harry Mach, an acknowledged expert in this field, to give us the benefit of his wisdom in the first of a series of articles.

What does a 600 tonne Carbon Footprint Actually mean?

By Guest Author Harry Mach



Harry Mach leads work at the Broads Authority on Climate Mitigation, working on the Broads Net-zero ambition. Additionally, he manages the Broads led CANAPE Partnership, an international partnership focused on better managing peatlands to reduce CO₂ emissions. He holds a law degree from the University of East Anglia, and a certificate in Business Sustainability Management from the Cambridge Institute for Sustainability Leadership. Outside interested include cycling, walking, and aerial acrobatics.

Whenever we discuss climate change, we hit a series of numbers. I can tell you that the Broads Authority operational footprint is around 630 tonnes of CO₂e. The National Atmospheric Emissions Inventory puts the emissions for the Broads Area at about 400,000 tonnes of CO₂e. I can tell you that Norfolk has CO₂e emissions of around 5 million tonnes a year, or the soil carbon in the Norfolk and Suffolk Broads is equivalent to 39 million tonnes of CO₂e.

We are also told we must reduce our own footprints, but with these numbers thrown around it is hard to get a grasp of what that means in practice.

My aim with this article is to try to put these figures into something of a more understandable context, to help demystify the GHG (Greenhouse Gas Emissions) we are talking about each and every day.

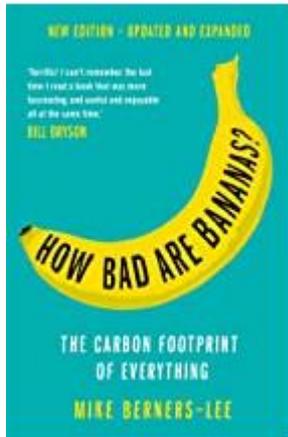
For this task, I am aided by some invaluable tools for anyone who wants to get to grips with their carbon footprint.

If you want to calculate how different aspects of your own life add up as a GHG equivalent, the website www.giki.earth has an accessible footprint calculator tailored to life in the UK. Accounts are free for individuals, and it proposes simple steps to reduce your personal footprint.

For a more detailed (but more complicated tool), I have referred to the governments "greenhouse gas reporting: conversion Factors 2020."

<https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020>

Produced each year by the Department for Business, these provide a standard set of calculations for converting items such as fuel use into Greenhouse Gas Emissions.



Finally, the work Mike Berners-Lee has done to create a "carbon footprint of everything," is an exceptionally good introduction to carbon footprinting. More information can be found in this article in the Guardian.

<https://www.theguardian.com/profile/mike-berners-lee>

Alternatively, his book "How bad are bananas" is a very useful read (with a revised edition published earlier this month).

Some Terminology.

CO_{2e} or CO₂ equivalent or Greenhouse Gas?

"Carbon Dioxide Emissions" and "Greenhouse Gas Emissions" are often used interchangeably. They are not however completely interchangeable. There are various gases which cause Climate Change, of which the three main ones are Carbon Dioxide (CO₂), Methane (CH₄), and Nitrous Oxide

(N₂O).

These are converted to "Carbon Dioxide Equivalent" based on Global Warming Potential. In most cases, this is the impact measured over 100 years.

Roughly speaking, 1kg of Methane has 34 times the impact of Carbon Dioxide, and 1kg of Nitrous Oxide has 296 times the impact. Unless specified otherwise, all figures in this article are in CO_{2e}

But what does a tonne of CO₂ look like?

There are various attempts to try and get this message across. Roughly, 1 tonne of CO₂ gas has a volume of 550 cubic metres. According to the Office of National Statistics (ONS), the UK footprint for 2019 was around 784 million tonnes of CO_{2e},¹ or 12 tonnes per person. Each year, you could fill 2 Olympic swimming pools with your CO₂ emissions. The "sustainable" level of emissions is considered to be 2 tonnes per person.

If you want to convert this CO₂ to solid form, assuming a tree is about 50% carbon would mean around 6 cubic metres of oak. If you carefully nurse an English Oak tree to adulthood, then you will have offset two years of an average UK resident's emissions.

Assuming I live as long as my Grandfather, that would require me to find space to plant, grow, and care for 47 oak trees, or about one and a bit football pitches of oak forest.

But what does that mean in a practical sense?!!

Again, the above is very abstract and not helpful for trying to cut your day-to-day emissions, or working out how to target reductions in an organisation.

Like remembering that the rule of thumb is that the top half of your thumb is about an inch, to navigate the age of carbon reduction we need to start developing a sense of what a kilogramme, or a tonne of CO₂ means.

To aid your journey, I have pulled together a brief table of different CO₂ amounts, comparing

- daily life,
- the Broads Authority,
- the County of Norfolk.

Also included is a suggestion for what level of offset is required for each level.

Please note that all the figures provided below are estimates. Because of the inherent difficulty in calculating a carbon footprint, figures from different sources may vary.

	Transport	Daily Life	The Broads	Norfolk	Offset needed
1Kg CO ₂ e	Driving 3 miles in an average UK car	Half a cheeseburger	Running the Broads Authority for 1 minute	n/a	Choosing a local beer rather than an imported beer for your next pint.
5kg CO ₂ e	Driving Norwich to Wroxham and back in a typical UK Car	A whole Cheeseburger, and a pint of European imported lager	Running a typical household boiler, full power, for an hour	n/a	Drying 2 loads of laundry on the line rather than in a drier
20kg CO ₂ e	Driving from Norwich to Cambridge (one way)	Driving 5 miles in heavy traffic.	A day of cruising on a largish family cruiser.	n/a	Commuting 5 miles by bike, twice a week, for a month. ²
100kg	Taking a train to Scotland and back from Norfolk. Driving a typical UK car to Bristol from Norfolk.	Smashing your phone and buying a high end replacement	Operating the Broads Authority "Spirit of Breydon" rescue and patrol boat for a week.	n/a	Switching your home to a Green Energy Tariff for 2 months.
1 tonne	4 months use of average UK car (3,300 miles) ³	½ a year of the average UK household gas use ⁴	Lighting at Broads Authority HQ, 1 month	n/a	Replacing 1 Megawatt Hour (MWh) of coal power with 1 MWh of Wind
10 tonnes	First class flight to Hong Kong and back.	UK Resident average Footprint (12 tonnes)	Fuel used by 2 Broads Authority excavators, working on Hickling Broad, over six months.	n/a	Replacing 2 coal cooking stoves with efficient agricultural waste stoves ⁵ (in China)

² Or once, if your commute is normally very congested.

³ Average UK car is driven 10,000 miles per year. The average UK car emits 270gCO₂e per mile.

⁴ Based on 12,000kwh of gas usage, at 200gCO₂e per kwh. This works out at 2.4 tonnes per year.

⁵ <https://www.goldstandard.org/projects/more-efficient-cooking-and-heating-china>

100 tonnes	Flying a Boeing 747 Jumbo Jet from London to Cairo ⁶	Building a House	All Broads Authority cars, vans and trucks for 1 year.	1 hour of domestic heating across all of Norfolk. ⁷	Sheringham Shoals Wind Farm, running for 40 minutes ⁸
500 tonnes	Flying a Boeing 747 its full range (7,200 miles), London to Singapore.	Lifetime emissions of 1 person, assuming around 6t per year, 80 years of life.	Around 80% of the Broads Authority Carbon Footprint (600 tonnes)	Operating a typical municipal swimming pool for a year	Rewetting 0.5ha of deep drained arable peatlands.
10,000 tonnes	All cars driving along the Acle straight for 1 year	n/a	All use of boats on the Broads, for one year ⁹	n/a	30 ha of tropical forest restoration ¹⁰
20,000 tonnes	Approximate savings from Gatwick flight cancellations due to drone flights in 2018.	n/a	All domestic energy use within the Broads Area.	Diesel powered trains in Norfolk, 1 year ¹¹	
100,000 tonnes	All driving within Norwich City Council Area	n/a		Cantley Sugar Factory, operating for six months	CO ₂ removed from atmosphere by all of Breckland's Forests in one year
1,000,000 tonnes	All Driving on Norfolk's A roads, 1 year.	n/a	CO ₂ stored in vegetation (trees etc) in the Broads	All domestic energy use in Norfolk	CO ₂ removed from atmosphere in one year by all forests in Suffolk, Norfolk, Cambridgeshire, Essex, Hertfordshire and Lincolnshire combined (Around 900 thousand tonnes).
38,000,000 tonnes	All UK International Flight emissions	n/a	CO ₂ Stored in Broads Peat over the last 10,000 years	8 years of emissions from Norfolk (2018 levels of emission).	

⁶ Based on fuel consumption of 11kg per Kilometre

⁷ Domestic Oil and Gas produced 930 thousand tonnes Co₂ a year, a little over 8,000 hours in a year.

⁸ Based on replacing gas fired power at 500kgCO₂/Mwh, and Sheringham Shoals producing 316MW.

⁹ Based on a UEA survey of boatyards fuel sales.

¹⁰ <https://www.goldstandard.org/projects/ethiopian-forest-regeneration-cooperative>

¹¹ UK inventories are unable to separate the energy used by the electric trains on the Norwich-London and Kings Lynn-Cambridge Lines from general industrial use.

All numbers above are estimates and somewhat rounded. Offset figures are from a mixture of sources, including www.Goldstandard.org

Harry Mach – September 2020

With kind regards

John W Pennell

John W Pennell – Chairman: Norfolk ALC Well-being Task & Finish Group

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