

Cave Expedition Carbon Offsetting

Background

The UK will have used its carbon budget for 1.5C (the amount we can emit from now until *forever*) in **9** years at current emissions levels, so things have to change, and fast. That means, amongst other things, people like us changing what we do and how we do it, *now*, not in 5, 10 or 30 years time. If this is news to you, see anything by Kevin Anderson, of the Tyndall Centre:

8min summary: https://www.youtube.com/watch?v=ty_entt1MCU

half-hour talk: <https://www.youtube.com/watch?v=Z5OV1TPEQoY>

The least we can possibly do is start offsetting emissions for expeditions. I would argue that we should go significantly further than that.

Caving expeditions' carbon footprints relate almost entirely to their travel emissions. There is a small footprint from equipment but it is normally dwarfed by travel.

A set of personal caving gear works out at about 11Kg/yr. 100m of rope 3Kg/yr
(from <http://wookware.org/talks/eurospeleoclimate/>)

So, as an example, take an annual 6 person expedition with 600m of rope plus rigging gear and camping gear, totalling maybe 100Kg of CO₂e for kit.

Now compare with the transport emissions:

Europe (flights):	3600Kg	(97% transport)
Europe (cars, 3up):	780Kg	(89% transport)
Europe (trains):	420Kg	(81% transport)
Europe (bus):	324Kg	(76% transport)
Mulu:	24000Kg	(99% transport)

So transport is typically 95% or more, if flying, Or about 80% by less carbon-intensive means.

Given this, choosing to only consider/offset travel is reasonable, especially as it is fairly easy to calculate and most offset providers are set up this way.

I am extremely pleased that the GPF is considering offsetting transport emissions for expeditions. Caving expeditions beyond Europe, and even within Europe if care is not taken with travel, are a very high-carbon activity. We have glorified the people doing this repeatedly for far too long. The GPF needs to take a long hard look at what it encourages and why. Rich westerners dashing around the world bagging all the best caves is a very colonial attitude. There is no need to get into all the caves before the locals have the time, money and expertise to do so. The caves will still be there in 20 years time, when long-distance transport emissions may have been solved; and leaving some for the locals should be seen as a good thing.

This is an uncomfortable message for the GPF, but given the really scary numbers of the climate crisis, and that behaviour change is 4 times as fast as infrastructure change, I think the GPF should be strongly discouraging intercontinental caving until the situation improves. Offsetting is better than nothing but it's very important to understand that it doesn't actually reduce emissions at all. It just allows (generally rich, white) cavers to pay someone (generally poor and brown with a much lower carbon footprint already) to do their emissions reductions for them, so they can carry on as before. Again, quite colonial. You can go to Austria by train **50** times for the same emissions as going to Mulu once.

Some trips can be justified on scientific grounds, and of course a case can be made that all new exploration is science so this is all justified. Again I would point out that where the science is mere exploration, there is no hurry - the caves aren't going anywhere. We can leave it to others, or wait for better ways. Only where it is time-limited climate science does the 'but science' argument hold much water.

With Europe we should be strongly encouraging low-carbon transport. Flying is 6-8 times the effective emissions of train, coach or 3-up driving so should not be done lightly. Anywhere you can get to in <24hr should be done without flights, and preferably anywhere in Europe, whilst recognising that it is 2-3 days to the furthest corners. We should have a good think about what travel rules we wish to set.

Offsetting

Offsetting is a very weak measure, and some offsets are pure bullshit so we need to choose carefully. It's difficult to be certain that offsets are real, and have longevity (it's no good if your new forest goes up in flames in 10 year's time). Another offset type with a poor historical record is HFC23 destruction. (This was UN CDM approved in the early days, and people started making more of it to destroy to get the credits!). Offsetting only has value if issue like these are avoided.

The only unquestionably solid project, that takes carbon straight out of the atmosphere and sequesters it permanently in rock underground, is Climeworks <https://www.climeworks.com/> However they have an individual monthly subscription model which doesn't fit expeditions at all well, and the price is very high at 1000€/t, which would double or triple the cost of flights.

Then there is a huge gap and everyone else prices offsets in the £6-£40 range. This illustrates the difference between the costs of avoiding emitting in the first place and taking it back out of the atmosphere afterwards. For offsetting to be meaningful it needs to cost more than about £10/t. The current EU ETS price is 44€/t (£34/t). The UK carbon floor price is £22 (from 2021, previously £18). As noted above, extracting and sequestering an already-emitted tonne mechanically costs £860. Very low offset prices add less than a fiver to a European flight which isn't going to change anyone's behaviour. On the other hand it does mean that there is no excuse for not doing it. It seems to us that a price in the £20-40/t range is most appropriate, but most offsetters charge less than that: £5-£10/t.

How many providers are there?

A lot.

Resellers:

Pachama <https://pachama.com/>
Wren <https://projectwren.com/>
Compensate <https://compensate.com/>
ReduceApp <https://www.reduceapp.com/>
BuyWithImpact <https://buywithimpact.com/>
Zeeco <https://zeeco.io/>
Docomy <https://doconomy.com/en>
Carbon Trim <https://www.carbontrim.app/>
Puro <https://puro.earth/about-us/>
Carbonfund <https://carbonfund.org/>

Consensus <https://www.co2nsensus.com/>
Clear offset <https://clear-offset.com/>
Chooose <https://chooosetoday.com/>
Offsetra <https://www.offsetra.com/>
Nori <https://nori.com/>

Specialized

Cloverly <https://www.cloverly.com/>
Carbon Checkout <https://www.carboncheckout.com/>
Carbon Click <https://carbonclick.com/>
Trip to carbon <https://triptocarbon.xyz/>
Atmosfair <https://www.atmosfair.de/en/about-us/what-is-atmosfair/>
Jet Set offset <https://jetsetoffset.com/>
Suttinable Travel International <https://sustainabletravel.org/our-work/carbon-offsets/>
Cooleffect <https://www.cooleffect.org/>
Offcents <https://offcents.com/>
Website Carbon calculator <https://www.websitecarbon.com/>
Carbon Trust <https://www.carbontrust.com/home/>
Threedegrees <https://3degreesinc.com/>
Plana <https://plana.earth/>
BRC https://businessrenewables.org/brc_marketplace/

Developers and operators

SouthPole
Terrapass
Native Energy
Clearsky
Natural Carbon
EcoAct
Green Mountain
Nature Bank
NewForest
WeAct
EraEcosystem
GreenTrees
Carbon Engineering
Climeworks
Global Thermostat
Climatecare

How did we investigate?

Investigating all of those was too much work. Many are not providing the sort of service we want (e.g they make an app to estimate your footprint from movement tracking), so could be excluded quickly. We picked a fairly arbitrary subset that did the right sort of thing, tending to ones that had been around a while. If you are interested <https://blog.memohub.io/carbon-offset-industry-stack/> is a great overview of the sector.

Significant research was done on Atmosfair, Carbonfootprint.com, Terrapass, South Pole, Co2nsensus, and lesser on Offcents, Pachama, clear-offset.com

We looked at:

- Reliability of offsets chosen
- Cost of offsets
- Accuracy of carbon calculators
- Ease of use for applicants

Reliability of offsets

Numerous schemes have appeared to certify offsets.

- The Gold Standard (CER)
- CDM CER (Clean Development s
- Voluntary Gold Standard (VER)
- Verified Carbon Standard (aka Verra)
- QAS (Quality Assurance Standard) <https://qasaudit.com/>
- Climate Action Reserve
- American Carbon Registry
- PAS 2060 (UK BSI) ('Publically Available Standard' except it costs £150 to read!)
- Carbon Footprint Standard: <https://www.carbonfootprint.com/cfpstandard.html>
- REDD: <http://www.fao.org/redd/en/>
- Plan Vivo
- e-green

All of the top 5 are good standards for our purposes. And probably some others too, but I lost the will to live at that point. Some providers (e.g Atmosfair) exclude forestry-based offsets entirely because they are intrinsically uncertain in the future. If you are using forestry-based offsets then choose those with REDD certification, as it is good assurance of real offsets.

Some providers give you choice of specific offsets. Others choose them for you. In general the latter makes more sense as they have the relevant expertise, not us or our users. We should chose a provider or a standard, not specific projects.

Accuracy of provided calculators?

They produce quite variable results. We used an example European journey by train and and an example long-distance flight for test purposes.

1st Comparison: Train StPancras to Bad Aussee (CUCC Austria expo):

ecopassenger:	39.5Kg
carbonfootprint:	10 Kg (1400km, international rail)
southpole:	30.2Kg (1400km, international rail)
clearoffset:	20 Kg (1400km, international rail)

It's reliably known that Eurostar to Brussels or Paris is 10-13Kg so 10Kg to Bad Ausee has to be bollocks, so Southpole is the only one I found giving plausible numbers, but you laboriously have to look up the journey length. (many calculators don't even have international trains)

Recommendation: For trains in Europe tell people to use the numbers from ecopassenger.org, which works on stations, and real routes, and knows about country variations. Otherwise they are likely to be off by a factor of 3 or 4.

2nd comparison: Flights to Mulu (LHR to MYY, via KUL if specifiable)

atmosfair: 6.62t (direct) CF=3
atmosfair: 7.57t (via KUL) CF=3
clear-offset: 5.65t (1 stop) CF=?
carbonfootprint: 3.48t (via KUL) CF=1.89
southpole: 4.08t (direct) CF=?
southpole: 4.32t (via KUL) CF=?
flightfootprint: 2.2t (only to KUL, not heard of MYY) CF=1
ICAO: 1.0t (via KUL, CO2 only) CF=1
CF=climate factor due to high-altitude emissions.

As you can see, a wide variation, both in CF and tonnage. Only 30% difference between Atmosfair and Carbonfootprint, allowing for CF. Both are plausible. Atmosfair has a good long-term reputation for accurate calcs from real-world airline databases, but possibly a bit out of date, and missing some recent improvements? Atmosfair's CF is more in line with the most recent studies (<https://phys.org/news/2020-09-aviation-contributes-drivers-climate-stem.html>). Any number between 2 and 3 is justifiable. Carbonfootprint's 1.89 is low, but better than the sites that ignore all non-CO2 effects.

Ease of use

Some calculators only did planes. Some only did internal flights or trains. Some were in US dollars or Euros, when we really want Pounds (a few let you choose). Providers that have an API as well (or instead, e.g <https://triptocarbon.com/>) could be interesting if we wanted to integrate the calculator more tightly into the application process. Some were aimed at individuals or businesses rather than trips, which can be confusing for users. Some let you pay without creating an account and logging on. Payment methods varied.

For now we just looked for a reasonably easy-to-use online calculator with realistic results that covers the relevant modes of international transport.

Conclusions

There are quite a lot of providers we could use, but none was perfect for one reason or another. We ended up whittling it down to two providers which had high quality standards-backed offsets, decent calculators, and an interface suited to cave expedition travel calculations: Atmosfair and Carbonfootprint.com

Atmosfair is European (non-profit based in Germany).

- It has a very long pedigree (founded 2005).
- Has what I believe to be the most accurate flight emissions calculator working from real airline data (if you know the airline you can choose it and get the emissions for that plane type)
- Has a realistic climate factor (3)
- Has a sufficient carbon pricing at about 23€/t (£20.5/t).
- Simple: just one price – project allocation is done by Atmosfair
- All projects are CDM & GS accredited (the two top standards).
- Forestry-based and HFC23 offsets are excluded on principle.
- Their calculator is only for flights. Can do vias. <https://www.atmosfair.de/en/offset/>
- You can offset Kg directly for other transport modes, calculated elsewhere. (same URL)
- Prices are in Euros.
- Payment methods are debit/credit cards, paypal, klarna and bank transfer. Conversion is automatic so the Euro pricing doesn't really matter.
- You don't need to create an account to pay.

- Minimum offset €5 (240Kg)

CarbonFootprint is UK based (7-person company)

- It is one of the first offset providers (going since 2004).
- Their offsets are all QAS approved (which uses CDM and Gold Standard and Verra).
- They exclude forestry, unless REDD approved and HFC-23 schemes.
- They do have some UK-based forestry which plants a tree here but also buys a 1t REDD-certified offset elsewhere. Nice if we want to specify a local benefit.
- Good calculator, covers, flights, cars (by distance), trains (by distance). Can do visas.
- lower climate factor (1.89)
- <https://www.carbonfootprint.com/calculator.aspx>
- Can offset by Kg, calculated elsewhere.
- They give a choice of offset methods/qualities and prices:
 - Global Portfolio: £6/t (solar, wind, hydro)
 - UK Tree planting: £12.90/t
 - Certified (CDM): £7.50/t
 - GS (Community): £8/t
- Minimum offset 0.333 tonnes (except UK tree-planting, minimum 1t)
- They also offer certification for expeditions/events.
- Need to set up account to pay
- Payment methods: credit/debit cards, apple pay, google pay, amex, UK cheques and postal orders

Neither of these providers calculates trains correctly, so we should recommend <http://ecopassenger.org> for car/train calculations to get a realistic number. That can be entered into sites to offset 'x Kg'

Offsetting individual emissions for things like European bus/train/car travel doesn't work very well as it's below the minimum transaction sizes. So they need to be done on a per-expedition basis. Not really a problem in our case. Both providers provide offset certificates, which we probably want to require to show it's been done. There are probably a selection of wrinkles like this to sort out for an actual implementation.

We recommend Atmosfair as the best overall provider with good-quality offsets, a cost per tonne that is not entirely trivial, accurate flight emissions numbers and convenient payment methods with no difficult choices. Carbonfootprint.com is also a reasonable provider except that its default offsets are too cheap to be meaningful. Its UK offsets are better but it might be tricky to get people to remember to choose those (we have no way to enforce it).