Air travel or a stable climate?

To fulfill the Paris Agreement and keep the climate safe, we need to reduce our carbon emissions drastically. For many, flights are a significant post and something that relatively easily can be avoided, often with synergies. Here we can take big strides toward climate stability, health and a more equitable world.

According to WRI, Americans emit about 20 tons of carbon dioxide per person per year (Europeans about half). At www.carbonindependent.org you can easily calculate your emissions for home, food, car, travel, etc. This calculator counts air emissions at **250 kg per flight hour** based on UK authority DEFRA's data. For example, if you fly 40 hours a year (say a long journey and two medium), emissions will be about 10 tons, a large addition. Flying is thus a big post, and for many, the largest of our private emissions (WashPost, NYTimes, Newsweek). Universities, industry, civil society and government also have significant air travel emissions (Wilde, Balmford, World Bank). Air travel thus offers potential for major, and quick, reductions (Wynes).

The Earth's capacity to absorb carbon dioxide is about 1 ton per inhabitant per year. We need to come under this level in order to meet the 2°C Paris agreement goal. Americans, Europeans and Chinese take more than their fair share of world resources. Many of the world's people live far below 1 ton per capita and strive to increase their "carbon budgets" for food, energy, housing and social services (Anderson:1, Diamond, Peters).

More on flight emissions: Along with carbon dioxide, water vapor and nitrogen dioxide are also released and at high altitude add to global warming. According to IPCC:RFI, this **high altitude effect** is accounted for by multiplying CO2 emissions with the **Radiative Forcing Index (RFI)**, a factor between 2 and 4. The precautionary principle would suggest taking RFI=4. Some calculators, however, set RFI=1 completely ignoring the high altitude effect, or use low CO2 values, thus seriously underestimating emissions. See Air Calculator Comparison and What the heck is radiative forcing?.

Using RFI = 2 (IPCC's minimum value), emissions are at least **250 kilograms per flight hour**, a rule of thumb you can use to estimate a flight (knowing it could be even higher). In concrete terms, this means hundreds of kilos of matter (several times your own weight) are released every hour of flight, forming an ever thicker, ever warmer greenhouse cupola over us. That cupola will remain there for thousands of years—it doesn't go away.

So how do we solve the climate problem? The aviation industry's potential for technical reductions is in the short term small (Peeters, TE) and in the long run requires major investment (as with electric cars, wind farms, etc.). We have limited resources and time is short, so we need to quickly reduce carbon emissions where we can, for example, by refraining from climate-intensive activities like flying and simultaneously invest in projects that reduce carbon over time. The goal is zero emissions, the earlier the better.

Example: Suppose a typical American has a carbon footprint of 20 tons a year. Say she considers a holiday in Paris, a flight with round-trip emissions of say 5 tons. She considers offseting with tree planting, in which case emissions will be +5 tons for the flight and -5 tons for the trees, her net unchanged at 20 tons for the year. No reduction in the climate threat! However, if she both refrains from flying and invests in forest planting or solar cells that reduce carbon dioxide by 5 tons, her year's emissions will be 20-5 = 15 tons, a substantial decrease and a big step toward the zero emissions goal.

Many companies as well as individuals are today opting for a safe climate and resource efficiency by avoiding harmful air travel in their work and lives. See, for example, Yes, #Flyingless, Anderson:2, Monbiot:1. If the savings and freed up capital are invested in climate mitigation or other UN Development Goals (SDGs), it also step by step builds a more stable, secure, healthier and more equitable future for us all.

A system perspective. The Earth as a whole is overexploited as a result of human activity (Overdevelpment). According to WWF, total resource use is 1.6 planets, ie, we use/break down 0.6 planets more resources than regenerate each year (footprintnetwork.org). Ecosystem limits are exceeded and all available resources are consigned to use (except perhaps sunlight, wind and similar energy sources). Several planetary boundaries are overrun (including climate stability), threatening our health, lives and livelihoods (see Club of Rome). There are no resources available for further human activity, neither for more flying nor for offsets. To **offset**, we would need an extra planet that could absorb our excess CO2, provide more farmland for food and biofuels, more land for forest, etc.

One consequence is that a person who offsets for a flight takes resources (land, water, forest, etc.) that are already in use. Specifically, it may mean that poor farmers' land is taken from them by the state (eg in China

or Africa) to build dams or plant forests with foreign capital in an offset program. This exchange of ownership and land use is dubious both ecologically and morally: we live life as usual, the poor lose their land and CO2 remains unchanged (reductions are offset by emissions). See Wikipedia, Anderson:3, Friends of the Earth.

Limited as we are to one planet, we need to reduce resource-intensive activities and restore natural ecosystems such as forests, the atmosphere and marine life in the oceans. This means shifting labor and investment from environmentally harmful activities to restorative and regenerative (WWF).

Biofuels also a limited resource. Farmland is in short supply worldwide and subject to land grabbing. There is simply no unused land available for biofuel farming in large quantities for airplanes/cars/trucks/ships. IEA is unrealistic, ignoring WWF's 1.6 planets. On the contrary, were we to follow biologist E O Wilson's proposal in Half Earth, we would instead reduce the share of land in human use and allocate half of nature to reserves where biodiversity can flourish, ecosystems stabilize and carbon plus resilient buffers build up. See, e.g., Giampietro, MacKay (pg 42), Monbiot:2, Food or Fuel (Johansson), TE:Paris.

Biofuels are renewable and emit less carbon dioxide, but more than half of a flight's emissions, the high altitude effect, remain the same. Rather than using forest and farm residues for biofuels, we need to increase carbon storage by leaving forests undisturbed and cropland unplowed (IPCC scientists).

Carbon-free, low energy society: Rockström, Hansen, SDSN DDP, Univ.Calif, IEA 2015, McKinsey, Pollin, Anderson:4 and others sketch the road to the fossil free, electrified, low energy economy needed to meet the 2015 Paris Agreement goals. Keys are a price on **carbon** and tax on **natural resources**, so that these are used less, as well as the removal of subsidies to fossil fuels (TE:Paris, ODI). A necessarily ambitious **minimum** goal is halving emissions every decade (7% per annum) or fossil-free 2050 (Rockström:2, Mission2020). A 12% annual reduction and fossil free 2030-35 gives us greater climate security (Anderson:4).

Energy prices will likely double, with sharp increases in airfares and reduced demand. Today, aviation and shipping receive huge subsidies by their exclusion from fuel and carbon taxes (TE:Paris, Monbiot:2). Scientists can point the way, but in a democracy it is up to us to choose climate first, both in daily life and in the next election (Randers, Higham).

Not the time to expand airports. The fossil-fuel dependent airline industry is incompatible with the carbon-free, low energy economy we need to stabilize the climate (WWF:2). Airport expansion is being questioned in cities worldwide (Stern, Monbiot:3). Ongoing investment to double passenger capacity at London Heathrow or Stockholm Arlanda by 2040, is incompatible with the Paris 2015 agreement. Rather than airports, investment needs to go into public transport, rail, electricity infrastructure etc that are part of a resilient and sustainable low energy economy.

Alternatives to a flight: Whatever the purpose of travel, there are always options. For example: video conferencing replaces physical meetings, documentary films replace physical travel, domestic holiday replaces a foreign, etc. As late as the 1990's, we flew only half as much as today—fewer leisure trips—and had signifiantly lower climate footprints.

Europe's and America's vast landscapes offers local leisure which, like our local food, local economy and local democracy, are both resource-efficient, climate-friendly and healthy. Local nature is completely free and doesn't destroy Earth's resources. Protecting our nature serves also to secure our vital basic resources: agricultural land, forests, water, wetlands etc.

Summary: Aviation's CO2 emissions and its extensive resource needs (for airplanes, airports, fuels etc) do irreversible damage to the climate (Guardian, Chester). No one today knows how to remove the carbon dioxide, water vapor and nitrogen dioxide that a flight emits. Survival is obviously more important than holidays and meetings abroad. For a safe future—the Paris agreement goal—we need to reduce CO2 emissions by 7-12% annually. Avoiding air travel moves us quickly toward this goal, and also frees up capital and resources to invest in carbon-free energy, ecosystem restoration and developing countries. Giving up a holiday trip or finding an alternative could be this year's coolest thing.

Footprint calculators: carbonindependent.org, chooseclimate.org, coolclimate.berkeley.edu, footprintcalculator.org, Air Calculator Comparison **Aviation and climate:** Wikipedia, Peeters, Anderson, Flyingless, ICSA, TE, Corsia/EU ETS, Carbon offsets **System:** Overdevelopment, Overpopulation, Overshoot, Ecosystem diagram (Duncanson), Club of Rome, Earth Policy Institute, Potsdam Institute, Sustainable Energy (MacKay) **Economy:** Doughnut Economics (Raworth), Growth vs Sustainability, Enough Is Enough (Dietz, O'Neil)), Prosperity without Growth (Jackson), A Future Beyond Growth (Washington, Twomey) **Solutions**: World Resources Institute, Univ.Calif, SDSN, Plan B 4.0 (Brown), Drawdown (Hawken), Half Earth (Wilson), Green Gold (Liu, film), High seas reserve (Sumaila), Ensia **Personal action**: Being the Change, Yes Magazine, Ecology Begins at Home (pdf).