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COMMENT

Tourism – sustainable development option?

In the 1990s, tourism received increasing attention as a low-impact, non-consumptive development option, in particular for developing countries. It is argued that tourism allows for the use of areas which are otherwise of low value, such as remote beaches, but perfectly meet the demands of the growing travel industry (e.g. WWF [World Wide Fund for Nature] 1995; World Bank 1998). In line with the concept of sustainable tourism, it is believed that negative social and environmental impacts can be avoided or minimized if tourism development is thoroughly well planned and controlled. This view can be contrasted with the fact that what may be considered sustainable forms of tourism still represent an extremely small share of all tourism, presumably less than 5%, and that some impacts like the use of energy and its global consequences have virtually been excluded from the discussion on sustainability.

Worldwide, a range of successful projects have shown that it is possible to reduce the negative impacts of tourism. Sustainable concepts have remained the exception, however, because the social and environmental costs of tourism are shared by all suppliers, while profits from each tourist accrue to the individual. This leads to the rejection of more cost-intensive, sustainable solutions, especially in developing countries, where, for example, environmental legislation is often not enforced or does not even exist. A precondition for sustainable tourism will therefore be to overcome the shortcomings of the present development and to establish concrete, binding targets in favour of socio-economically and ecologically viable solutions. Ultimately, sustainable tourism development will remain a question of scale. This becomes very obvious if you look at the global consequences of energy use in tourism. The combustion of fossil fuels has now reached a magnitude that must be sufficient to contribute to the alteration of biogeochemical cycles and to global warming.

Fossil fuels are needed for travel to destinations, for cooking, heating, cooling, cleaning, transport, the import of foods and products, and services such as the additional demand of tour guides and other staff. There is little information in the scientific literature on energy consumption in these sectors, but there is some evidence that the demand for fossil fuels can easily exceed 100 kg per tourist during a two week vacation in a resort hotel (S. Gössling, unpublished data 2000). Air traffic, however, is the major energy-consuming process.

Since the 1960s, civil aviation has become an ever more important means of transport in international tourism. In 1996, 413.1 million passengers were transported by air globally (excluding domestic flights). Out of these, about 57% (235.7 million) were tourists (WTO 1998). The proportion of fuels used for tourists in international air travel might even be higher, because tourists are more frequently involved in long-haul travel. Knisch and Reichmuth (1996) indicate mean distances that are 30% greater for German tourists than business travellers. Long-distance flights are responsible for most of the passenger kilometres. In Germany, the marginal 15% of flights that were longer than 5000 km accounted for more than 57% of the total passenger kilometres in 1992.

Global air traffic consumed aviation fuels at a rate of 130–180 Mt yr^{-1} during 1992–95 which was 5–6% of consumption of all petrol products, the latter including a military fraction of about 10–20% (Brasseur *et al*. 1998). Thus, civil aviation consumed 104–162 Mt of fuel in 1995. The share of tourism-related fuel use is difficult to estimate, because tourists seem more frequently to be involved in long-distance flights and may thus use a higher proportion of the total. On the other hand, freight also accounts for a significant proportion of fuel consumption. If we take these considerations into account, a conservative conclusion is that tourism might be responsible for about 50% of the fuel consumption in civil aviation, or 52–81 Mt of fuel in 1995.

When fossil fuels are burnt, they result in emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), water vapour (H_2O), hydrocarbons (HC), carbon monoxide (CO), soot (C), and sulphur compounds (mainly SO_2). The contribution of trace-gas emissions to global warming is usually measured in terms of radiative forcing, which in turn can be translated into an increase in global mean temperature. Since 1850, all anthropogenic emissions of CO_2 have, on the basis of elaborate

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model calculations, been estimated to cause a radiative forcing of 1.6 Wm^{-2}, with a corresponding temperature increase of about 0.6 K. Aircraft-related emissions of CO_2 have contributed 0.02 Wm^{-2} to this increase (Schumann 1997). This seems to be a minor fraction, but aviation emissions need special consideration, because they are released at altitudes of 10–12 km in the upper troposphere and lower stratosphere; this is a region with relatively large residence times, low temperature, low background concentrations and large radiative sensitivity. Emissions of NO_x and H_2O in particular have a larger impact on ozone, cloudiness, and radiative forcing at this level than they do at the level of the Earth's surface. If added, they are estimated to cause a radiative forcing of approximately 0.05 Wm^{-2}. The warming caused by pollutants emitted by aircraft may thus be up to three times that exerted by CO_2 alone (Prather & Sausen 1999).

As only 5% of humanity participate in air travel, emissions should be calculated on a per caput basis to understand their importance. Return flights entail energy demands of 120 kg for 2000 passenger kilometres and up to 2000 kg for 36 000 passenger kilometres. To give an example, a two week package tour covering a typical return-flight distance of 7000 passenger kilometres is based on the use of 325 kg of fuel for air travel, including a national connecting flight, and another 100 kg of fuel for different purposes at the destination. This translates into a CO_2-equivalent of about 3385 kg, including the effects of NO_x and H_2O, which is not far short of the global average of 4000 kg of CO_2 emitted annually per caput. The contribution of tourism to climate change must be substantial. Air traffic should also be considered in light of its expected large growth rate in fuel consumption, which may be approximately 3.9% yr^{-1} until 2015 (Schmitt & Brunner 1997).

With respect to energy use, present air travel-related tourism is here suggested to not be sustainable and limited options to compensate for its impact may make it an activity which needs to be limited. In view of the increasing dependency of developing countries in particular on the tourist industry, tourism-based approaches to development should thus be advocated only with caution.

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