2008

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Publication details
Article available on Open Access with the published version made available in ePublications@scu with the kind permission of the publisher.  
Publisher version available from:  
http://dx.doi.org/10.3727/108354208785664238

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AIRCRAFT CONTRAILS CONTRIBUTE TO CLIMATE CHANGE: WHOLE TOURISM SYSTEMS ARE APPROPRIATE CONTEXTS FOR RESEARCH ON SUSTAINABLE TOURISM

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Environmental activists and concerned scientists have suggested since the 1970s that jet aircrafts’ contrails, also known as vapor trails, might be having undesirable effects on the environment. In 2001, an unusual but scientifically rigorous research project, testing this hypothesis, found that contrails do have an environment impact. On busy routes the effects are significant and serious, similar to the effects of greenhouse gases, resulting in climate change. The present article discusses implications of this for sustainable tourism and ecotourism. Almost all research to date on these linked topics has focused exclusively on destinations. Knowledge about the effects of contrails adds weight to the evidence and belief that sustainable tourism and ecotourism cannot be achieved by attempts to sustain destinations if other elements in whole tourism systems are being damaged by tourism. A comprehensive understanding of tourism’s environmental impacts and research on sustainability requires, as the unit of analysis, whole tourism systems.

Key words: Aircraft pollution; Contrails; Whole tourism systems; Environmental impacts; Sustainable tourism; Ecotourism

Introduction

In recent decades a body of research has grown on tourism’s environmental impacts. Following Brundtland (1987), many researchers took up the cause of sustainability and many publications have appeared under the rubric of sustainable tourism. Much of the research is interesting and useful in advancing the cause. However, most of it has focused on destinations and ignored tourism’s impacts elsewhere. Research on the allied topic of ecotourism has had the same concentrated perspective. Implicit in that conventional view is an assumption that the geographical scope of tourism begins and ends in places visited, in tourist destinations. If destinations can be sustained, so the assumption goes, then tourism will be sustainable.

For a number of reasons, the assumption is misleading. The present article aims to demonstrate that impacts in transit routes should be included in any generic assessment of tourism’s environmental impacts. This aim is pursued via a discussion of
aircraft pollution, placed into the context of whole tourism systems. A second aim is to demonstrate that, to date, research on the impacts of tourism and the allied topic of sustainable tourism—and its public face, ecotourism—has been excessively concerned with tourist destinations, because almost all researchers who have published on these topics have ignored the relevance of transit routes.

Ultimately, the article’s third aim and main purpose is to encourage researchers interested in sustainable tourism to consider adopting whole tourism systems as a conceptual context, as a broad unit of analysis, especially in generic discussions of the topic and also where projects focus on sustainability within a particular place, such as a town or district in its role as a tourist destination.

The discussion below begins by noting various forms of pollution stemming from jet aircraft. Research by Travis, Carleton, and Lauritsen (2002) on the environmental effects of jet aircrafts’ vapor trails, also known as contrails, is described. Implications for the aerospace industry are suggested, followed by an overview of implications for environments in whole tourism systems. Against that background, the discussion reviews the literature on sustainable tourism and ecotourism. What emerges is that the overwhelming focus of research to date has been on destinations, with most researchers totally ignoring sustainability issues in transit routes. The discussion concludes that research on sustainable tourism and ecotourism can be improved, for systemic comprehensiveness, by adopting whole tourism systems as the unit of analysis.

Forms of Aircraft Pollution

While a theme in this article involves one form of pollutant stemming from aircraft, to provide background various forms are identified. There have been repeated allegations that jet aircraft cause various kinds of environmental problems (Government Accounting Office [GAO], 2000). However, excepting localized problems such as noise near airports, doubts have existed as to whether other sorts of environmental damage are substantial and serious. Before 2001, the effect of contrails was one of these doubtful issues.

Pollution occurs at local, regional, and global levels. “Local” refers to effects near the land surface and is mainly restricted to airport areas. Aircraft cruising at higher altitudes have different effects, some more global than others depending on the gasses in question and some more concentrated in particular regions depending on the number of flights passing through a region. In describing pollutants, references will be cited for certain points but for many, which are well-established scientific facts, no references will be cited.

Aircraft Noise

For people near airports, loud noise heard during take offs and landings can be a form of pollution, disturbing, and often spoiling an otherwise peaceful environment, especially for those under flight paths. Noise can trigger opposition to the siting of new airports and to the routing of flights near airports. Noise pollution is, for many people, the most obvious form of pollution associated with aircraft. It has resulted, in some countries, in the imposition of airport curfews and the introduction of government-funded noise insulation for houses under busy flight paths. There is also growing concern about the intrusion of light aircraft and helicopters in wilderness areas where the noise can destroy the ambience for those on the ground.

Surveys on Airport-Related Environmental Issues

In a survey of officials working at the 50 busiest commercial service airports in the US, respondents were asked their views on environmental issues affecting airports’ current operations and future growth (GAO, 2000). They rated noise as the most serious problem currently in 29 cases and in the future in 22 cases. While aircraft engines are quieter now compared to 20 years ago, the number of flights continues to grow while human dwellings increasingly encroach on most airports. The suggested impacts include: interference with communication, sleep disturbance, annoyance, hearing loss, disturbance to students’ learning, performance effects, and cardiovascular and physiological effects.

Surprisingly, runoff from aircraft on the ground was the primary current concern in 12 of the 50 US airports surveyed by the GAO (2000), ranking second to noise and ahead of air pollution. In air-
ports that receive large amounts of snow, the chemicals used for deicing and anti-icing of airstrips and aircraft are a major concern. These glycol-based products are highly soluble and they threaten aquatic life. Eleven airports reported fuel spills as their primary concern.

*Pollutants From Jet Engines*

Jet-propelled aircraft use aviation kerosene. The exhaust contains a cocktail of gases. With changes to engine designs since the 1970s, fuel efficiency has improved and emission factors for all pollutants except oxides of nitrogen (NO and N₂O) have decreased. Nitrogenous pollutants are highest; CO and volatile organic compounds (VOCs) are very low at full throttle; however, when idling CO and VOCs are much higher. Successive reactions of VOCs, sunlight, and oxides of nitrogen give rise to photochemical smog. NOₓ (mainly nitric oxide, NO) reacts in the atmosphere to give nitrogen dioxide (NO₂), which further reacts to give ozone (O₃). Sunlight is necessary for this to occur. In parallel with ozone formation, a proportion of the NO₂ (nitrogen dioxide) reacts with water and other species to give acid aerosol nitrates, a component of brown haze. The rate of smog formation is proportional to VOC concentration, but is higher in sunny hot conditions (Australian Academy of Technological Sciences and Engineering [AATSE], 1997).

Aircraft emit gases and particles directly into the upper troposphere and lower stratosphere where they have an impact on atmospheric composition. These emissions alter the concentration of atmospheric greenhouse gases, including carbon dioxide (CO₂), ozone (O₃), and methane (CH₄). They also trigger the formation of condensation trails (also known as contrails or vapor trails, referred to below as contrails), which appears to increase cirrus cloudiness (Intergovernmental Panel on Climate Change [IPCC], 2002). All this contributes to climate change but whether the change is significant has been uncertain. During recent decades, although much research has been carried out attempting to measure the effects of contrails, the collection of meaningful data is difficult if not impossible when air traffic is busy.

Because carbon dioxide and methane have long atmospheric residence times, they become well mixed throughout the atmosphere and so become an indistinguishable part of the atmosphere. Emissions of carbon dioxide by aircraft were estimated to be 2% of the total anthropogenic carbon dioxide emissions or about 13% of carbon dioxide emissions from all transportation sources (IPCC, 1992). However, this is not the most important impact of aircraft pollution. The other gases (e.g., NOₓ, SO₂, O water vapor) and particles have shorter atmospheric residence times and remain concentrated near flight paths, particularly in the mid-northern latitudes where most aircraft activity occurs. The increase in the aircraft NOₓ emissions is expected to decrease the concentration of methane, which is also a greenhouse gas (IPCC, 2002). However, aircraft sulphur and water emissions in the stratosphere tend to deplete ozone, partially offsetting the NOₓ-induced ozone increases.

Ozone is a greenhouse gas but it also shields the surface of the Earth from harmful ultraviolet radiation. Subsonic aircraft fly in the upper troposphere and lower stratosphere (altitudes of 9–13 km), while supersonic aircraft cruise higher in the stratosphere (17–20 km). Ozone in the upper troposphere and lower stratosphere is expected to increase in response to increases in NOₓ, and methane is expected to decrease. In contrast, at higher altitudes, increased NOₓ leads to decreases in the stratospheric ozone layer. Clearly future impacts will be strongly influenced by whether there is development of a second generation of supersonic, high-speed civil transport aircraft. Flying higher leads to greater decreases in stratospheric ozone (IPCC, 2002).

Water vapor, SO₂, and soot play both direct and indirect roles in climate change and ozone chemistry. Large numbers of small (1–10 nm) volatile particles are formed in the exhaust plumes of cruising aircraft. These particles form from sulfuric acid, chemical ions, and water vapor, and freeze under appropriate temperature and humidity conditions. These trails of ice are the contrails.

*Contrails*

Conversion of fuel sulfur to sulfuric acid in the young plume is from 0.4% to 20%. Increasing fuel sulphur content results in more and smaller ice
particles. In the future, more fuel efficient engines will produce lower exhaust temperatures for the same concentration of emitted water vapor, and therefore will cause contrails at higher ambient temperatures and over a larger altitudinal range. Persistent contrails often develop into more extensive contrail cirrus in ice-saturated air masses. Ice particles in such persistent contrails grow by uptake of water vapor of the surrounding air. The area of the Earth covered by persistent contrails is controlled by the global extent of ice-supersaturated air masses and the number of aircraft flights in those air masses. While the regions of ice-supersaturated air shift over time, an average of 10–20% of the Earth’s mid-latitudes surface will be so covered at any particular time. Ice supersaturation is often too small in those regions to allow cirrus cloud to form naturally.

Contrails form a positive radiative forcing at the top of the atmosphere. They reduce both the solar radiation reaching the surface and the amount of longwave radiation leaving the Earth. Indirect radiative forcing is also caused by aviation-induced cirrus cloud that is produced in addition to line-shaped contrail cirrus. This forcing is positive and may be larger than that produced by line-shaped contrails. Observations suggest that cirrus cloud cover has increased by up to 0.2% of the Earth’s surface since the beginning of jet aviation, in addition to the 0.1% covered by line-shaped contrails.

Cirrus clouds form naturally at the high altitudes where jet aircraft fly. These thin, wispy clouds block sunlight to a small degree, thus having a cooling effect on the Earth, but they also have an opposite effect, keeping the lower atmosphere warmer by trapping some of Earth’s outbound infrared radiation. For some years, scientists have debated to what extent the same effects are caused by jet aircrafts’ vapor trails. According to a study reported by IPCC (2002), the largest area of scientific uncertainty in predicting aircraft-induced climate effects lie with persistent contrails, with stratospheric ozone increases and consequent changes in methane, with potential particle impacts on natural clouds, and with water vapor and ozone perturbations in the lower stratosphere, especially for supersonic aircraft.

The Contrails Study in 2001

Although many experiments have been carried out by researchers attempting to measure environmental effects of contrails, precise and meaningful data that compare the effects under different conditions cannot be collected during normal routines, when air traffic never stops. In the US this routine was interrupted immediately after the terrorist attacks on September 11, 2001 when, fearing more incidents involving hijacked aircraft, the Federal Aviation Administration shut down all commercial air traffic throughout the country for the next 3 days.

While most persons would have regarded the shut down as merely a necessary precaution in the interests of security, a small group of academics saw an extra dimension—a unique opportunity for scientific research. David J. Travis at the University of Wisconsin-Whitewater assembled a team to monitor the environment in the skies above the US over the 3 days when no commercial aircraft were flying and, by drawing on historic records, compared the data from 2001 with the same dates, and also the six adjacent dates, in 30 previous years. The design and findings of the study were reported by the researchers (Travis, Carleton, & Lauritsen, 2002).

The Contrails Data and the Findings

Data were collected from approximately 4,000 weather stations in 48 states of the US (excluded were Hawaii and Alaska). The data were the minimum and maximum daily temperatures over certain dates (September 8–17) for each of the 31 years from 1971 to 2001. The researchers made adjustments to allow for the fact that, “the grounding period commenced after the minimum temperatures had been reached on the morning of 11 September and ended before maximum temperatures were attained on 14 September” (Travis et al., 2002, p. 601). They then calculated the average diurnal temperature range (DTR), the difference between daytime maximum and nighttime minimum, for the periods under review and found that:

DTRs for 11–14 September 2001 measured at stations across the United States show an increase of about 1.1°C over normal 1971–2000 values.
This is in contrast to the adjacent periods (8–11 and 14–17 September) when DTR values were near or below the mean. DTR departures from the norm for the grounding period are, on average, 1.8°C greater than DTR departures for the two adjacent three day periods. This increase in DTR is larger than any during the 11–14 September period for the previous 30 years, and is the only increase greater than 2 standard deviations away from the mean DTR (s.d. 0.85°C). Moreover, the 11–14 September increase was more than twice the national average for regions in the United States where contrail coverage has previously been reported to be most abundant, such as the midwest, northeast, and northwest regions. (p. 601)

What this means is that during the day, the increased contrail cirrus cloud cover results in cooler days, yet the nights are warmer as the daytime heat cannot escape as readily. In other words, the temperature ranges less than it would do naturally. While the skies were free of air traffic during September 11–14, 2001, the days were warmer and the nights were cooler, giving a greater range.

The researchers concluded that the absence of contrails during 3 days in September 2001 was responsible for the statistically significant environmental impact. Contrails act like artificial cirrus clouds. Scientists at NASA were reported as saying that the findings, “are difficult to argue with” (Perkins, 2002, p. 291). Another independent view came from Stan Chagnon, an atmospheric scientist at the University of Illinois, who said the study was, “irrefutable proof of the effect of contrails on climate” (Perkins, 2002, p. 291).

Implications for the Aerospace Industry

For many years, the aerospace industry has been making progress towards improved environmental standards. Subsonic aircraft being produced today are about 70% more fuel efficient per passenger-km than 40 years ago, mainly through engine improvements, and to a lesser extent through airframe design. By 2015 further improvements of 20% in fuel efficiency and by 2050, of 40–50%, relative to today are projected, according to many informed commentators. However, while these improvements could reduce most types of emissions, contrail formation and NOx emissions are likely to increase. Reduction of sulfur content of kerosene will reduce SO2 emissions and sulfate particle formation, but its removal reduces lubricity of the fuel. The development of hydrogen fuel would eliminate carbon dioxide emission from aircraft but would increase water vapor emissions (IPCC, 2002).

Confirmation of long-held suspicions about contrails, as a result of research by Travis et al. (2002), should be providing extra impetus and direction for the aerospace industry to continuing research and development towards environmental sustainability. Will this occur? The answer might depend in part on future research on greenhouse gas and climate change and, more crucially, an increased sense of responsibility in the aerospace industry, and policy changes by governments. If concerns about climate change become critical, will political pressure build and lead to actions for reducing all pollutants that contribute to climate change, such as contrails? If this occurs before technological developments contain the contrail problem, how will airlines respond?

Implications in Whole Tourism Systems

The term “whole tourism system” (WTS) was coined by Getz (1986) to describe the combination of elements that form systemic wholes when tourists go on trips. The term refers to real WTS and also to models, representations of reality, devised and applied by researchers and educators. Examples of WTS models are noted below. While they differ in detail, and in their degree of detail—Stear’s (2002) is by far the most detailed of those noted below—the models are broadly similar in composition. Their elementary components are humans (tourists), various places (in different roles in itineraries), and organizations (one or more tourism industries, each comprising a collection of suppliers of services or facilities). Tourism industries are elements in the process but they are not totally dominant: models of WTS help researchers and students recognize that tourism is not “an industry.” Tourism is better understood as the theories and practices of tourists, shaped and supported to varying degrees by tourism industries.

Models of WTS emphasize for researchers and
students what is normally obvious to lay tourists: as a process, tourism begins (and ends) not in destinations but in places where tourists have their normal residences, the places where they are motivated, where they plan trips, from where they set off on trips and to where they return. Linking generating regions and destination regions (and a series of destinations in the case of multistation tourism) are transit routes. That is reflected in definitions viewing tourism as involving travel and visits, an idea first proposed by Burkart and Medlik (1974) and endorsed by many subsequent writers. The principal travel component occurs in transit routes; the main visit component is in destinations. Accordingly, the geographical scope of whole tourism systems can be described as containing three types of spatial elements: (i) generating regions—where trips begin and normally end, where tourism is generated in several ways; (ii) transit routes; and (iii) destination regions—places that tourists choose to visit (Cooper, Fletcher, Gilbert, & Fyall, 2006; Leiper, 1979, 1985, 1998, 2004; Henshall & Roberts, 1985; Hing & Dimmock, 2000; Page, 2003). Jafari’s (1987) model, a “springboard metaphor,” has a similar geographical construct. Slightly different is Stear’s (2002) model, which has four rather than three geographical elements, along with the human and organizational elements.

In the following discussion, implications from the contrails research are considered in relation to sustainability of the five types of elements in WTS. The approach, analytical and systemic, has the potential for being more comprehensive than approaching sustainable tourism and ecotourism from the perspective of just one or two of these elements.

Tourists

Increasing numbers of people are becoming sensitive to environmental issues. For example, behaviors have changed following widespread dissemination of scientific knowledge about greenhouse gases. Would knowledge that jet aircraft harm the environment in a similar way lead to changed behavior? Would many persons, as tourists, then feel uneasy and environmentally irresponsible if they continued to use airlines for discretionary activities that do not necessarily require flying to other locations? These are speculative questions. Certainly there are individuals who believe that flying is environmentally detrimental in various respects and who therefore avoid it, so it is true to some extent at least, but how many persons are now in this category, and how many more would be, in the light of the research on contrails? These are questions for proposing, not for answering here.

Traveling by jet aircraft induces tourists to ignore the environmental effects of their activity on transit routes. Little is seen from the windows but distractions and opportunities for entertainment inside aircraft gain passengers’ attention. These facets of the psychology of jet-propelled tourism tend to inhibit tourists from thinking about environmental effects on transit routes.

Tourist-Generating Regions

Tourist-generating regions are where tourists have their normal residences, where trips begin and end, and where the principal economic, socio-cultural, and psychological generators of tourism are located. This is where individuals and families become motivated, make decisions about going on trips, and accordingly where crucial promotional messages from tourism industries are placed.

There are some local environmental effects in the tourist-generating regions. Airport effects discussed earlier, specifically noise and air and sometimes water pollution, are a more or less equal issue at both the departure airport and arrival airport.

For a number of reasons that do not require spelling out here, during pretrip and posttrip phases of tourism (i.e., while in generating regions) tourists in general are mostly interested in destinations and experiences there, more than in places passed through (or over) while getting to and from destinations. Thus, the psychology of pre- and posttrip tourism also tends to inhibit tourists from thinking about transit routes.

Transit Routes

Aircraft contrails have environmental effects in many transit routes of whole tourism systems, notably the busy routes used by large numbers of jet
The world’s busiest air routes span much of Europe, the North Atlantic, widespread regions of the US, and a strip through East Asia between Japan and Singapore. These are the routes followed by most of the world’s tourists when they travel from their homes to and from one or more destinations.

Collectively the countries of the world recorded 764 million arrivals of international tourists in 2004, with almost half, 330 million or 43%, traveling by air (World Tourism Organization [WTO], 2007). Also traveling by air, within many countries, are large numbers of domestic tourists. Moreover, there is a direct link between the recent increase in tourism and air travel, both growing at about twice the rate of growth of world GDP between 1970 and 1990 (Wheatcroft, 1994).

While there are variations in different countries, of the total energy consumed by tourists in Australia for example in 1995–1996, an estimated 36% was for air travel and this accounted for 23% of the country’s total greenhouse gas emissions (Benghezal, Foran, & Baker, 2000). A direct and substantial link exists between tourism and the environmental consequences of air travel.

With air traffic expected to increase by about 5% per year on the global scale (T. Clarke, 2002, p. 1), and more rapidly in some parts of the world, especially Asia (Pan, Chon, & Haiyan, 2007), the contrails’ effect on climate will, presumably, amplify unless some ameliorative change occurs. As noted above, this might not be possible via technological developments in the design of jet engines. Regardless of that possibility, without tourists in the skies the contrails effect would be insignificant.

Tourist Destination Regions

Tourist destinations can be conceptualized as places that tourists choose to visit, in order to personally experience features and/or characteristics of a place in ways that are personally pleasurable or satisfying in some other respect. Tourist destination regions, as elements in WTS, can be thought of as areas bounded by a normal day-tripping range around the location of each tourist’s accommodation. Thus, a large city constitutes a single region, medium-sized countries (e.g., England, New Zealand) contain dozens, and large countries (e.g., Canada, China) have hundreds.

A necessary condition for a place to function as a destination region is that some other place functions as a generating region while a third place or sequence of places serves as a transit route. Accordingly, because every WTS contains destination regions systemically linked with transit routes, environmental damage in transit routes is systemically damaging—for all parts of the systems including destinations. Persons and organizations with interests in particular destinations do not always recognize that principle. Instead, they can be easily preoccupied with issues of many kinds (business, social, environmental, etc.) in the region where they reside or, if they are environmental activists, become involved in the general issues of environmental movements in the world at large.

Tourism Industries

Tourism industries can be described broadly as collections of organizations whose businesses involve supplying services, facilities, and goods for tourists. While most commentators refer to “the tourism industry” as a generic, implying that one large entity supplies everything consumed by all tourists in all places, a more realistic practice for researchers recognizes multiple tourism industries, which can overlap geographically (Leiper, 2008). In the geography of WTS, the dispersal of organizations in tourism industries is concentrated in destination regions where larger numbers and a greater range of types are located (e.g., inbound tour services, accommodation, entertainment, local tours, theme parks, and so on). In contrast, fewer are located in generating regions and along transit routes. In generating regions are travel agents specializing in outbound travel and also luggage stores and on transit routes are transport services such as airlines and coachlines, road side attractions, and transit accommodation such as airport hotels and highway motels.

Environmental issues are typically taken up by organizations in particular domains. What is the scope of such domains? It depends on the mindset and vision of individuals. The Chairman of one airline might investigate new ways to conserve en-
ergy and reduce aircraft pollution: Richard Branson has been notable in this regard, active in many projects and allocating large sums of money in the process (Friend, 2007) while other airlines do not appear to be so proactive. The manager of one hotel might initiate what they think are sufficient environmental policies by arranging to plant trees in the grounds of the hotel and by suggesting to guests that water and energy can be conserved by not washing towels every day. The manager of another hotel might join a community action group concerned with broader environmental issues in the region. Relatively few hotel managers would engage with environmental issues stemming from the aircraft and coaches coming into the region to deliver guests to the hotels.

In terms of management theory (and practice), it is a question of the managers’ perceptions of boundaries of the systems being managed as against the external environments of the system which, by definition, cannot be managed. In the history of management there is a trend for managers to attempt to extend the scope of managed systems, pushing outwards into environmental issues. This occurred in the 20th century with a trend of managers in large corporations attempting to manage conditions beyond the obvious scope of each corporation. The seminal study on the topic is Chandler’s (1977) *The Visible Hands*. Chandler showed how Adam Smith’s 18th century theory of “invisible hands” working as market forces was being replaced in the 20th century world of large business organizations, whose markets were coming under the influence of managers’ hands—visible forces if one looks closely at how powerful industries function. Perrow (1986) and other organization theorists and political scientists have shown how business managers, notably those in large corporations, have extended their managed systems into various kinds of environments, notably the realm of government policy. There are, however, limits to how far managed systems can take over and shape external environments. Studies in strategic management emphasize that principle, and recent research has been even more emphatic, stressing the uncertain, unknowable, and dynamic characteristics of business environments. A recent book summed up this situation as follows:

the inescapable conclusion is that randomness—the lack of order or pattern—is a necessary component of every system we might want to understand and control. We are doomed to either draw our boundaries too narrow,...or to under-specify the initial conditions... Either way, it is uncertainty, not predictability, that best characterizes out future. (Raynor, 2007, p. 99)

**Cause and Effect in Whole Systems and Their Environments**

Whole tourism systems are useful units of analysis for research because they are contexts where the causes and the effects (or impacts) of tourism can be studied and understood in a scientific way—at least with hindsight if not as accurate predictions. Tourism is not caused by events or phenomena in destination regions: so-called “attractions” do not literally have a “magnetic effect” on tourists, and describing destinations as “the heart of tourism” with the implication that they are a life-sustaining pump is to seriously misunderstand reality. Some researchers seem to have been misled on these points. For example, Australia’s Cooperative Research Center for Sustainable Tourism appears to have followed a prescription from its chief executive officer that “destinations are the heart of tourism” to the an extent that almost all of the hundreds of projects it has supported are focused on destinations. A contrary view was advanced by one of the Center’s researchers who suggested that the prescription was a feral metaphor that could discourage a scientific approach to understanding tourism; the view was not taken up by the Center’s leaders (Leiper, 2000). What actually causes tourism, functioning as the main “pump” in the system, if one were to use that metaphor, is a sufficiency of necessary conditions in generating regions, resulting in tourists setting off on trips. Included in these conditions are individuals with sufficient leisure time, motivation, and money, and a lack of constraints that might keep them at home.

Impacts or effects of tourism occur in all five elements of whole tourism systems and are perceptible in the environments of all five elements. This article is not the occasion for a discussion of diverse environmental impacts across all elements, but two examples will be noted, to indicate that these impacts are not confined to destinations.
First, the crucial theme of the present article, jet contrails, represents an environmental impact of tourism that occurs mainly in transit routes. Second, tourists return to their homes personally changed to some extent by their experiences, and this has impacts on the generating regions where their trips began.

Sustainable Tourism

The growing influence of environmental activists in recent decades, reinforced by institutional reports (Brundtland, 1987), alongside the realization that various activities of tourists and tourism industries do cause environmental damage, has been accompanied by a growing movement aiming for sustainable tourism. While there are differences regarding details and policies, the bond of that movement, linking concerned persons among tourists and in tourism industries, governmental agencies, community groups, and academe, is that responses to environmental challenges are worthy and can potentially achieve, or at least strive towards, sustainability.

While few individuals would assume that sustainability can be perfectly or fully attained, there seems to be a widespread opinion that progress towards that aim is necessary and possible. Many programs are under way, often labeled as “environment friendly,” in hotels, tour operators, and many other kinds of organizations in tourist-related lines of business. The movement is encouraged by various schemes such as Green Globe, is promoted and assisted by governmental policies, and is assisted in various ways by academic researchers and educators. However, as noted earlier in this article, the sustainable tourism movement to date has very largely focused on what happens in destinations, ignoring what happens to environments of transit routes used by tourists traveling to and from destinations. This fact emerged from a wide-ranging literature review. Further, in general, environmental standards are higher in tourist-generating regions (most often First-World countries). This has lead to NGOs like Tourism Concern blowing the whistle on undesirable environmental and social practices by First-World-based companies. Such activities and others have probably contributed to an emphasis by tourism industries on the environmental impacts in the tourist destination regions.

Although the seminal research that inspired the present discussion (i.e., the contrails study) was published in 2002, 5 years later there is no known mention of it in the research literature on tourism. A search found several articles published between 2002 and early 2007 on contrails issues, but all are in journals devoted to science or aircraft engineering and their themes do not extend to implications for tourism.

The research literature on tourism does contain discussions and brief references to environmental issues arising from transport used by tourists, but these discussions and references are few. Becken’s (2002) research projects are noteworthy. Introducing her article, she observed that, “a systematic inclusion of environmental impacts of air travel, in particular energy use and greenhouse gas emissions, in discussions about sustainable tourism is lacking or virtually excluded” (p. 115). Drawing on data related to international travel to New Zealand, she examined, “the neglected relationship between tourism and aviation with regard to global environmental impacts, including energy use and greenhouse gas emissions” (p. 114). In another project, she investigated sustainable tourism from the perspective of energy use by coach tours in New Zealand (Becken, 2005).

Also noteworthy is a finding from research in Australia by Benghezel, Foran, and Baker (2000), summarized earlier. In Germany, Bohler, Grischkat, Haustein, and Hunecke (2006) surveyed almost 2,000 residents, to identify choices of transport mode used for holiday travel (e.g., private vehicle, coach, rail, air) and distances traveled—within Germany, to and from other countries in Europe, and to and from destinations further away. From the survey and other sources, the researchers estimated the greenhouse gas emissions produced. The smallest of four groups in the survey, the long-haul tourists using jet aircraft, produced 80% of the emissions for the entire sample.

Gossling (2005) is another researcher whose publications have addressed, or noted, the topic of tourists’ consumption of energy in getting to and from destinations, regarding this as one of the issues in sustainable tourism. Peeters, Gossling, and Becken (2006) summed up several projects by as-
serting that, "the tourism sector is increasingly environmentally unsustainable. This is mainly caused by the contribution of aviation to a large and growing amount of greenhouse gas emissions by tourism... Only a small number of tourist trips causes the main impact" (p. 184).

In contrast to the small number of researchers who have linked transport issues to sustainable tourism, a huge number have written at length on the theme of sustainable tourism without mentioning transport and other environmental issues in tourism's transit routes.

While this can be regarded as a deficiency, there are good and sensible reasons for focusing on destinations when conducting research on the impacts of tourism. It is where the dramatic impacts occur, where the drama of tourism is played out, where a wide range of environments are affected (physical, sociocultural, economic, and so on), and where, in many places, beneficial as well as damaging impacts can be observed. It is where governments become most actively involved, seeking to develop and therefore protect their constituency’s performance as a destination. It is where there are complex and controversial issues. It is where academics can conduct research as quasitourists, a role that combines work and pleasure.

Hundreds of publications espousing sustainable tourism could be listed where the focus is exclusively on destinations, despite the fact that the publications are discussing sustainability in a generic sense, without reference to a particular place. Examples include: J. Clarke (2002); Edgell (2006); Hardy, Beeton, and Pearson (2002); Herrimans (2006); Inskeep (1987); Johnson and Tyrrell (2005); Ko (2005); Liu (2003); McIntyre (1993); McRandle (2006); Middleton (1998); Mowforth and Munt (1998); Pigram (2001); Swarbrooke (1999); Wahab and Pigram (1997); Wall (2001); World Tourism Organization (2000). There are, in addition, countless publications on sustainable tourism in particular destinations. Here too, an argument can be made for a wider view.

If a district’s "flagship attraction" such as the Alnwick Garden in England is to be sustainable, what must be sustainable is not merely the Alnwick Garden per se, but one or more whole tourism systems. This principle seems to be lacking in Sharpley’s (2007) research on the case. Similarly, for wildlife tourism in Australia to be sustainable, sustaining the wildlife is merely the most obvious requirement; also vital is sustaining the whole tourism systems involved. This acknowledgement seems to be lacking in the research by Rodger, Moore, and Newsome (2007). Many similar cases can be found in the literature. Obviously in such cases, what is desirable is not a detailed study of all elements in relevant whole systems but, alongside the details on sustainability issues in a garden or a certain type of wildlife, sustainability issues in relevant whole systems should be noted at least, if not discussed.

Ecotourism

Although ecotourism is where the focus on environmental issues is most pronounced, ecotourism ignores, more than any other form of tourism, what happens in transit routes. Researchers seem to assume that environmental issues occurring while ecotourists travel to and from destinations are of no concern. This conclusion emerges from perusing the literature: Allcock, Jones, Lane, and Grant (1994); Beaumont (1998); Beeton (1998); Butcher (2005); Dowling (2000); Honey (1999); Hunter and Shaw (2007); Khan (2003); Prideaux and Cooper (2002); Weaver (2002, 2005); Wight (1993); Zogfragos and Allcroft (2007).

Promotional messages supporting ecotourism, messages aiming to shape tourists’ opinions and expenditures, also focus strongly on issues in places visited and thus, by implication, virtually invite tourists to ignore any ecological issues that might occur when getting to and from destinations. Consider, for example, an article titled “Go Eco” in a magazine published by an airline for its passengers. The message is similar to many others intended to promote ecotourism:

Ecotourism is... ecologically sustainable tourism with a primary focus on exploring nature or natural areas that incorporates and fosters environmental and cultural understanding, appreciation and conservation... A genuine ecotourism experience includes... leaving the lightest possible imprint when you depart. (Nelson, 2003, p. 27)

While ecotourism has admirable ideals, it also has been described as a strategic ploy of suppliers,
to encourage consumption by suggesting a form of tourism that is guilt free in relation to the environmental damage often associated with mass tourism (Leiper & Hunt, 1996). The strategic ploy can be inferred from the following remarks in a promotional message: “If you decide to plan a holiday using ecotourism as the determining factor, you’re choosing to be a responsible traveler. You’ll be using products and operators who are committed to sustainable tourism” (Nelson, 2003, p. 27).

Arthur (2004) claimed that because ecotourism is now a type of mass tourism in some locations, it is a threat to the natural world it supposedly aims to conserve; the title of Arthur’s article sums up his point. Lansing and De Vries (2007) questioned the ethics of the ecotourism movement. Wheeler (1993) called ecotourism “a ruse,” suggesting it is primarily a promotional device but seriously lacking in substance. He sees it as a ruse whereby tourists might have ecologically sustainable experiences in certain contexts but are subtly encouraged to ignore environmental issues in broader contexts. According to Wheeler, the rubric of ecotourism encourages consumers who can afford holiday trips to forget that they are privileged and that the wider world has serious and worsening problems. He has pointed out the anomaly that underlines the pretence of ecotourism to be ecologically sensitive, because it invites tourists to think only of what happens during their visits and ignore environmental impacts linked with their travels. Ecotourists might leave “the lightest possible imprint when they depart” from a pristine holiday venue but can leave a heavy footprint of environmental damage in their choice of transport going home:

The ecotourist and eco-firm, so concerned about ostentatiously behaving sensitively in the endangered destination environment, are not quite so concerned about the changes to the overall environment he/she causes in actively reaching the destination. Here convenience takes precedence over conscience. A car to the airport and a jumbo jet are hardly paradigms of virtue in the environment stakes yet are so often pre-requisites to that eco-safari or trek. (Wheeler, 1993, p. 124–125)

Very few researchers interested in ecotourism and actively supporting it have been candid on that issue. An exception is the observation that, “most ecotourism guidelines and projects focus on local impacts rather than global effects. Transport induces broader impacts on the environments that are often considered as being ‘beyond the scope’ of eco-tourism discussion” (Buckley, 2000, p. 379).

Conclusion

Most research studies and other forms of discussion on environmental issues associated with tourism have focused entirely on places visited, commonly referred to as tourists’ venues or destinations. There are good and sensible reasons for looking at places in those roles when considering tourism’s impacts but, if places with different roles in itineraries are ignored, the vision can become myopic and miss the full extent of tourism’s environmental effects.

Regardless of whether impacts are damaging, beneficial or benign, a wider geographical scope is necessary to recognize and understand the whole picture. This article has used the example of jet contrails, specifically the findings from research by Travis et al. (2002), to argue the case for including transit routes as an integral theme in any comprehensive discussion of tourism’s effects on environments, sustainable tourism, and ecotourism.

Contrails are not the only transport issue relevant to sustainable tourism. Other transport-related issues, such as those discussed by Becken (2002, 2005), may be more important. Nor are transit routes and destination regions the only topics where issues of tourism’s sustainability should be considered. As Saul (2004) remarked when discussing another theme, “the underlying questions have to do with our relationship to the whole. If you don’t ask those questions you end up acting irrationally” (p. 280).

Most of the existing research on sustainable tourism and ecotourism, while generally worthwhile, can be challenged because of its limited scope. It would be improved by a broader vision, a whole systems view. Tourism has direct effects on and around all elements of whole tourism systems. A comprehensive, systemic analysis of tourism’s environmental impacts, of sustainable tourism and ecotourism, would involve considering issues affecting not merely destination regions and
transit routes, but generating regions, tourists, and tourism industries. In other words, all the elements of whole tourism systems, and the environments of those elements, constitute a unit of analysis at the macrolevel. Challenging the mainstream of research on sustainable tourism and ecotourism in this way implies that existing knowledge on these linked fields is deficient but is capable of development. As J. S. Mill remarked, knowledge that does not meet the test of repeated challenge is not really knowledge (Mill, 1851, cited by Fish, 2005, p. 71).

References


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