Tourism and climate change

K. Smith

In a higher CO_2 world, the overall volume of tourism, the pattern of outdoor pursuits, the degree of customer satisfaction and even the levels of safety in some environments are all likely to change. For example, key ecosystems offering winter sport and beach holiday facilities will be directly threatened by global warming and sea level rise. Enhanced temperatures in the mid-latitudes may well reduce the relative attraction of some Mediterranean and longer-haul destinations, especially if areas like the Caribbean become more prone to hurricanes. The tourist industry should be more aware of these sensitivities and should be planning now for climate change.

The author is with the Department of Environmental Science, University of Stirling, Stirling, FK9 4LA, UK.

Tourism and outdoor recreation represents one of the most important and rapidly growing service industries throughout the world. Its continued success is intimately associated with the quality of the environment and the development of land use policies which preserve and enhance the renewable biophysical resources on which it rests. The state of these resources is climate dependent, and in some cases climate itself is the resource which has directly promoted tourism. Despite this, the leisure industry has shown little interest in exploring its atmospheric sensitivity. In particular, with few exceptions, there has been a lack of planning for climate variation on any timescale. Equally, tourism and its land use implications have so far been largely neglected by the climate impact researchers, and at present there appears to be no real awareness of the social, economic and managerial challenges posed by climatic change.

In the absence of reliable model-based regional predictions of climate change, any consideration of the effects of greenhouse warming on tourism is highly speculative. Also, as with most other affected sectors, tourism will experience a complex mix of winners and losers in most areas. For example, the conclusion from a series of studies undertaken in Ontario, Canada, has been that, although the ski season would be reduced, the opportunities for summer recreation would be enhanced by a longer season provided that the predicted decline of water levels did not adversely affect wetland-based activities.[1]

Climate and tourist activity

Weather and climate conditions can firstly be shown to influence the total extent of tourist activity in any area. Thus, mass tourism around the Mediterranean over recent years has not only been driven by the perceived attraction of its normal summer climate to visitors from northern Europe, but has also been sensitive to seasonal weather variations nearer home. Figure 1A draws on data compiled for the UK International Passenger Survey[2] and shows the number of UK residents travelling by air to Portugal for holiday purposes in the third quarter of the year, ie in July, August and September. Clearly, the progressive upward trend over the past decade has been promoted by broad socioeconomic forces which continue the expansion of tourism in the developed world and there appears to be little climatic dependency in the linear growth over time. However, if the annual residuals from the fitted regression line are plotted against a crude measure of rainfall over Britain in the *previous* summer (July and August totals at London, Manchester and Glasgow) another remarkably good statistical relationship emerges (Figure 1B). This result is significant at the 1% level with explained variance (r^2) of 74%.

Figure 1B suggests that a poor summer in the UK persuades more residents to take a holiday in Portugal

[1] G. Wall *et al*, 'Recreation and climatic change: an Ontario case study', *Ontario Geography*, Vol 28, 1986, pp 51–68; G. Wall *et al*, 'Implications of climatic change for camping in Ontario', *Recreation Research Review*, Vol 13, No 1, 1986, pp 50–60; G. Wall, 'Implications of climatic change for tourism and recreation in Ontario', *Climate Change Digest*, CCD 88-05, 1988.

[2] The International Passenger Survey was started in 1961 and has since been progressively developed to cover all the ports of exit/entrance of the UK. The Office of Population Censuses and Surveys is responsible for sampling and interviewing travellers. The Department of Employment is responsible for processing the sample data and producing the published estimates on overseas travel and tourism.

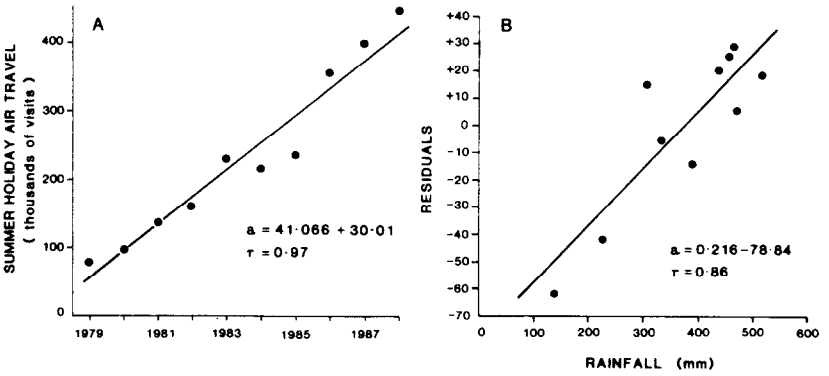

Figure 1. (A) The number of UK residents visiting Portugal by air for summer holidays between 1979 and 1988, with fitted regression line; (B) The annual residuals from the 1(A) regression line fitted to a linear relationship with a measure of average summer rainfall over Britain in the previous summer.

the following year and demonstrates the wider point that vacation travel decisions are influenced by conditions at home, as well as in the holiday destination. In a warmer world, therefore, many winter vacations currently taken in Florida or Mexico by residents from the colder parts of the USA and Canada may become less compelling under the relatively large increment of winter warming predicted for these latitudes. Similarly, within northern Europe, any greenhouse trend towards warmer summers, especially if it significantly improves the temperature of bathing waters and is not accompanied by higher rainfall, might well encourage more holidaymakers to stay at home in future.

Participation types

Once on vacation, the actual pattern of activities pursued by tourists is strongly weather-dependent. The most fundamental effects concern the presence, or otherwise, of direct climatic resources such as snow cover for winter sports. Low-level ski resorts are especially sensitive to variations in winter temperature and snowfall. During the 1988/89 winter a persistent anticyclone over western Europe created what was probably the warmest December–March period for some 300 years. It produced a disastrous ski season in the Alps and Scotland. In both these areas temporary diversification into other activities, such as hill walking in the Alps and the use of indoor facilities in Scotland, could prove to be an indication of the longer-term adaptation which will be required in a high CO_2 world.

Latitude and altitude are likely to be crucial determinants of the future implications for winter snow.[3] In winter sports areas as far apart as eastern Canada, the European Alps and the Snowy Mountains of Australia there is concern that the most vulnerable resorts may no longer have a viable length of season within a period of 20–30 years.[4] The extent to which the season will remain reliable over the critical Christmas–New Year holiday is likely to be a key factor in strategic planning and there are already signs of caution with regard to the investment in new facilities in some areas. In Scotland, where skiing occupies small areas of low mountains, winter snow (and good weather on the slopes with which to enjoy it) is far from a seasonal certainty under the present climatic conditions. But pressure for increased facilities has already led to the development of a new £8 million investment due to open in 1989/90 winter at Aonach Mor near Fort William on the west coast. In addition businessmen, planners and environmentalists continue to debate the merits of a further extension of skiing into Lurchers' Gully, in the eastern corries of the Cairngorms, seemingly oblivious to any threat from climate change.

Global warming can threaten many other ecosystems on which outdoor recreationalists depend. The 1988 drought in North America, also hailed by some commentators as a taste of things to come, created severe problems for water, land and wildlife management. The size of duck breeding populations was severely limited in the northern prairies and many sport fisheries on intermittent streams, small rivers and impoundments were

[3]G. McBoyle and G. Wall, 'Impact of CO_2-induced warming on downhill skiing in the Laurentians', *Cahiers de Géographie de Québec*, Vol 31, 1987, pp 39–50.
[4]See, for example, R.W. Galloway, 'The potential impact of climate changes on Australian ski fields', in G.I. Pearman, ed, *Greenhouse: Planning for Climate Change*, CSIRO Publications, Melbourne, Australia, 1988, pp 428–437.

badly depleted.[5] The US Forest Service and Park Service had to deal with a large number of forest fires which adversely affected ongoing campground rehabilitation, timber salvage and reforestation operations. Emergency measures, such as seeding and erosion control to prevent damage from fall and winter storms, as well as longer-term recovery programmes were necessary in the Yellowstone Park together with parts of the national forests within the Greater Yellowstone area. Any persistent change to warmer, drier conditions, with an increased risk of forest and heathland fires, may well result in large areas being closed to summer visitors. At best, some activities – such as camping – may be restricted.

A lot of outdoor recreation takes place along the shorelines of freshwater lakes. Global warming, plus associated changes to the hydrological regime, may well change the tourist potential of such shorelines. For example, any fixed waterfront facilities, such as marinas, will be vulnerable to either positive or negative changes in water level. For the Great Lakes of North America the greenhouse scenario is for reduced water levels over the next few decades.[6] Tourist potential may well decline as some wetlands disappear, with a loss of ecological diversity, and colder water species of game fish are replaced by other varieties. More generally, a decrease in lake water content, combined with higher temperatures, is likely to result in higher levels of near-shore pollution. This will arise not only from the reduced dilution offered to effluent but also due to the warmer water temperatures, which will encourage higher rates of production of algal blooms and bacteria.

Rising sea levels are likely to have profound effects for recreation along all marine shorelines. Boorman, Goss-Custard and McGrorty have documented the anticipated changes to the British coast resulting from rising sea levels.[7] For a beach backed by a sea wall, as in many resort towns, the prediction is that increased erosion would lead to a lowering of the beach. Depending on the supply of sand, the beach facility could be totally lost with subsequent underming of the stability of the sea wall. Other coastal habitats used for recreation such as sand dunes, shingle banks and even soft earth cliffs would also be affected, as would built recreational facilities along the shore.

Although tourists are likely to be increasingly mobile and adaptable in the future, travel to long-haul beach destinations is unlikely to be the answer to this global problem. Indeed, several groups of small, low-lying tropical islands, such as the Republic of Maldives in the Indian Ocean and the atoll chain of Tuvalu in the south Pacific, may even be facing extinction from rising sea levels according to some greenhouse commentators. The highest point on Tuvalu is only 4.5 m above mean sea level and according to some greenhouse scenarios most of the nation could be inundated by the end of the 21st century.[8]

Tourist satisfaction

Even if climate-related tourist facilities are present, the degree of satisfaction achieved by the users is critically weather dependent. As far as possible, outdoor leisure is concentrated within the appropriate 'tourist seasons', the definition of which has been the major contribution to date in the field of recreation climatology.[9] Such definition relies on the identification of key weather thresholds or combinations which are required before most people are willing to participate in mainstream outdoor activities such as swimming, beach use, camping, golf, tennis, visiting parks and other outdoor sites. This aspect of recreation climatology has been most systematically developed in Canada where the Atmospheric Environment Service has produced tourism and outdoor recreation handbooks for each region.[10] These volumes identify the start and end dates for various activity seasons and indicate the elements of climate which affect tourism with special regard for human comfort and convenience. For example, the winter season is defined as the first and last dates with a snow cover of at least 2.5

[5]N.D. Strommen, 'Monitoring the United States drought of 1988', in *The Drought of 1988 and Beyond*, Proceedings of a Strategic Planning Seminar, 18 October 1988, National Climate Program Office/ NOAA, Rockville, MD, USA, pp 89–99.

[6]US National Climate Program Office and the Canadian Climate Center, *Impacts of Climate Change on the Great Lakes Basin*, Report of the First US–Canada Symposium, NCPO/CCC, 1989.

[7]L.A. Boorman, J.D. Goss-Custard and S. McGrorty, *Climatic Change, Rising Sea Level and the British Coast*, Institute of Terrestrial Ecology Research Publication No 1, HMSO, London, UK, 1989.

[8]J. Lewis, 'Sea-level rise: some implications for Tuvalu', *Newsletter of the International Hazards Panel*, No 4, July 1989, pp 13–19.

[9]See, for example, A.H. Paul, 'Weather and daily use of outdoor recreation areas in Canada', in J.A. Taylor, ed, *Weather Forecasting for Agriculture and Industry*, David & Charles, Newton Abbot, UK, 1972, pp 132–146.

[10]These baseline studies were produced in the 1970s and 1980s. Examples include A.D. Gates, *The Tourism and Outdoor Recreation Climatology of the Maritime Provinces*, Publications in Applied Meteorology REC-3-73, Atmospheric Environment Service, Environment Canada, Toronto, 1975; and J.M. Masterton and D.W. McNichol, *A Recreation Climatology of the National Capital Region*, Climatological Studies No 34, Atmospheric Environment Service, Environment Canada, Toronto, 1981.

cm whilst high summer is the period during which the mean daily maximum temperature is 18°C or greater.

Climatic change will make necessary some revision of tourist seasons. Whilst temperature is one of the main weather elements to consider, optimum conditions for many activities depend on a much wider range of atmospheric conditions. For example, received opinion has it that a day is suitable for skiing if there are six hours during the period 0800–1800 hours when there are at least 2.5 cm of snow on the ground, the winds are less than 6.5 m/s, the temperature is in the range –20 to 5°C, the visibility is better than 0.8 km and there is no liquid precipitation. Clearly, it will be a very long time before even short-term climatic variability can be predicted with this degree of precision.

What does seem certain is that the quality of recreational experience will become more important in the future as tourists become more discriminating. This may soon start to have an economic effect. For example, tourism is already the number one industry in Scotland, attracting 12 million visitors per year, but surveys by the Scottish Tourist Board regularly reveal that the biggest single cause of visitor dissatisfaction is the weather. Typically over 10% of British, and nearly 20% of overseas, visitors complain about the weather. Any trend to wetter conditions, including more cloud and reduced visibility, would not be good news and would further invalidate the undue emphasis on brochures full of 'blue sky' illustrations.

The detailed recreational consequences of future climate change will be complex, especially in the high mid-latitudes where the models predict major swings. Warmer summer conditions may be generally welcome but changes in humidity/wind/temperature relationships may increase the concentrations of biting insects. Where snow cover remains reliable, warmer winters may lead to more downhill skiing and snowmobiling on calm clear days in those areas where it has been previously restricted due to high mean values of windchill.

Outdoor safety

For some outdoor sports and activities the level of safety experienced by participants is crucially dependent on the weather. Warmer winter conditions may bring more risk of snow avalanches which are already a growing hazard in many mountainous winter sports areas.[11] This may result in more frequent and costly closure of ski slopes and greater controls on activities like backpacking. As more recreation parks are developed in increasingly remote areas, there will be a need for better climatic information and more local weather forecasting designed to warn of these dangers.

Global warming may also bring risks to the more passive tourist. Long-haul tropical holidays are becoming very fashionable just now but several popular destinations are vulnerable to tropical storms and hurricanes similar to Hugo, which devastated the Caribbean in September 1989. Hurricanes are generated by the presence of high sea surface temperatures. As global warming develops, marine temperatures will increase and the areas of ocean capable of initiating a hurricane are likely to expand. The inference is that existing hurricane zones will experience more frequent events and that such storms will spread to other coastal areas. Apart from established resorts, it is possible that many newly developing tourist spots, such as Malaysia and northern Australia, might be avoided by more prudent holidaymakers in the hurricane season.

Conclusion

There is little doubt that climate should feature more prominently in the minds of planners and policy makers who have responsibility for tourism and recreation. A greater awareness of atmospheric variations is needed not only for long-term planning but also to deal with existing conditions. The climate is affecting the tourist industry now and, without a better understanding of (and adjustment to) present relationships, it seems unrealistic to expect an optimum adaptation to CO_2-induced climatic change in the future. If we

[11] K. Smith, 'Avalanche hazards: The rising death toll', *Geography*, No 73, 1988, pp 157–158.

simply wait for more definitive regional and seasonal scale predictions from the models, it will be too late. By then change is likely to be well underway and the potential range of adaptive strategies is likely to be curtailed. Even if climatic change could be reliably forecast now, it is doubtful if the industry has sufficient understanding of its atmospheric sensitivity to plan rationally for future conditions.

On the other hand, it is not likely to be productive to spend too much time trying to forecast in detail the nature and demand for tourism several decades ahead. The present generation of climate impact studies all carry the important health warning that 'other things are assumed to remain the same'. But just about the only thing that everyone can be fully confident about is that everything else will *not* remain the same over the next few decades. Tourism and recreation will react especially sharply to all the economic, social and technological changes which are likely to take place in the future. Many of these may override the consequences of climatic change. Therefore the best way forward is probably through a strategy which links a better understanding of the present weather and climate sensitivity of tourism with the improved predictions which will come over the next few years from the numerical models. By this means the industry could hope to adapt progressively, with maximum flexibility, to any changed climatic future.