

INTERACTIONS BETWEEN TOURISM, BIODIVERSITY AND CLIMATE CHANGE IN THE COASTAL ZONE

E. G. Coombes¹, A. P. Jones¹, W. J. Sutherland², I. J. Bateman¹

1. School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, UK

2. School of Biological Sciences, University of East Anglia, Norwich, NR4 7TJ, UK

E-mail address: emma.coombes@uea.ac.uk (E. G. Coombes)

ABSTRACT

As climate plays a significant role in influencing tourism and recreation behaviour, it is important to consider the effect that climate change may have on visitors to the coastal zone. In terms of coastal environments such change may hold implications for patterns of tourist distribution, including the numbers and types of visitors to the coast, as well as the locations they visit. It may also affect the behaviour of tourists at specific beaches, influencing their activities, their habitats, and the lengths of their visits. This study, not yet complete, investigates the impacts that climate change may have on tourism and recreation on the coast of Norfolk, UK. At the regional scale, Geographical Information Systems (GIS) are being employed to assess the time and distance that visitors travel from population centres to reach the coast. At the local scale, surveys are being undertaken at Holkham beach, Norfolk, to assess visitor behaviour, and to determine how this behaviour relates to weather conditions. The results will be used to assess how changes in climate may influence the frequency and spatial distribution of visitors, and how such changes may impact coastal biodiversity. These coastal impacts will be studied via the development of models, and will be used to determine the implications of policy and management options for the coastal zone.

KEYWORDS: *Coastal tourism, Coastal biodiversity, Climate change*

INTRODUCTION

Coastal tourism is one of the fastest growing areas of contemporary tourism. It includes leisure and recreational activities that take place in the coastal zone and the offshore coastal waters, such as swimming, boating, snorkelling and diving. It also includes coastal tourism development and supporting infrastructure, for example accommodation, restaurants, retail businesses and activity suppliers (1).

The consequences that climate change may have on tourism are likely to be particularly marked at the coast, as this environment is highly susceptible to change. Climate change is likely to influence local weather patterns, affecting average and extreme conditions. It may also affect the structure of beaches, and the type and extent of habitats available (2). Changes to local weather patterns and beach structure hold implications for tourist distribution at the regional scale. They are also likely to affect the behaviour of visitors at specific beaches. It is important to understand these two possible changes because the intensity and type of recreational use influences the impact that tourism may have on biodiversity. Thus the type of habitat to which the use is being applied is particularly important.

Tourism and recreational activities have significant impacts on biodiversity. These may be negative. For example recreational use of the intertidal zone can result in losses of flora and fauna due to trampling, the overturning of rocks and the collection and disturbance of certain species (3). Tourism may also have positive impacts. Beach users with high environmental awareness value the natural environment and prefer to visit undeveloped beaches. This may raise conservation awareness with local bodies and promote the protection of such areas (4).

The coastal zone provides an excellent environment to study the interactions between tourism, biodiversity and climate change because many coastal areas receive a large number of visitors annually, which results in a high impact upon a relatively small area. Furthermore, coastlines are very sensitive to disturbance. In particular, stabilised sand dunes that carry climax vegetation have been found to respond more strongly to disruption than shifting and semi-stabilised dunes (5). It is therefore important to understand the interactions between tourism, biodiversity and climate change so that we can manage the coast appropriately. The results of this study and similar studies may be useful in conserving coastal habitats, providing appropriate tourist facilities, aiding coastline protection decisions and adapting to climate change.

PREVIOUS STUDIES

A number of investigations have been undertaken to assess the behaviour of visitors at specific locations (6-9). These studies have focused on determining the influence of visitors' socio-economic background on their behaviour, including the activities they undertake. Relatively little is known, other than in very general terms, about the effects of climate on tourism (10). Some investigations have considered visitors' preferences for 'highly developed', 'less-highly developed' or 'undeveloped' environments (4), but the manner in which visitors interact within these environments has not been greatly explored (11). Furthermore, studies have tended to focus on landscapes as a whole (8) and have not considered individual habitats. Information concerning the manner in which visitors interact with habitats, including the activities they undertake and the

length of their stay in relation to weather conditions, is required to provide insight into the interactions between tourism, biodiversity and climate change.

AIMS AND OBJECTIVES

This investigation will be conducted in five stages to assess the interactions between tourism, biodiversity and climate change. Stage 1 will study the regional distribution of visitors and explore the factors that influence which locations tourists visit. Stage 2 will study visitor behaviour at a specific beach. The activities that visitors undertake, the habitats they use and the length of time they stay will be monitored. This will allow the intensity of use the beach receives to be investigated. Stage 3 will assess the sensitivity of this beach to visitor impacts. It will be examined in terms of the types of coastal habitats it comprises, the extent of area these habitats cover, the maturity of the habitats and the species they support. Stage 4 will investigate the relationships between tourism and biodiversity by combining the results from Stages 2 and 3. At Stage 5 these relationships will be extrapolated for several climate change scenarios, to explore how they may develop. Stages 1 and 2 of the investigation are currently being undertaken and this paper focuses on their methods.

METHODS

STUDY AREA

The distribution of visitors to the coast will be assessed for the entire Norfolk coastline, which is approximately 200km in length. In addition, surveys will be undertaken at Holkham beach to obtain information about visitor behaviour.

The coastline of Norfolk, UK, (Figure 1) is an interesting location to examine the interactions between tourism, biodiversity and climate change for three reasons. Firstly, tourism is important to the local economy and a significant proportion of the tourist activity in Norfolk is related to the coast. Secondly, it comprises a wide range of coastal habitats including mudflats, sandflats, shingle beaches, saltmarsh, sand dunes and cliffs. Finally, it is anticipated that climate change may have significant impacts on the Norfolk coastline because it is low-lying, so a relatively small increase in sea level rise could significantly alter coast morphology. It is also geologically soft and consequently very susceptible to change.

Holkham National Nature Reserve (NNR), where the visitor surveys are being undertaken, is situated on the North Norfolk coastline and covers an area of 3,850ha. It was identified as a suitable location to examine visitor behaviour because it receives 500,000 visitors annually. In addition, a variety of habitats exist within the reserve including sandflats, saltmarsh, dunes and wooded areas towards the back of the beach. The area is important in terms of the vegetation it supports, including

rare species such as shrubby seablite (*Suaeda fruticosa*) and Jersey cudweed (*Gnaphalium luteoalbum*). It is one of only three dune systems in the UK where the natterjack toad (*Bufo calamita*) is present.



Figure 1: The coastline of Norfolk, UK. Holkham is situated in North Norfolk

STUDY APPROACHES

GIS will be used to examine the time and distance that visitors travel from populations centres to reach the coast. The assessment will be based on three data sets. Firstly, aerial video footage of visitors along the Norfolk coastline is available from a recent study undertaken at the Tyndall Centre for Climate Change, University of East Anglia, UK. This investigation examined the effect of tourists on the distribution of ringed plover (*Charadrius hiaticula*) and oystercatcher (*Haematopus ostralegus*) territories, and the impacts of climate change on this interaction. The coastline was filmed in April, June and August 2002 from an aeroplane. The locations of the visitors who were filmed have been entered into a GIS to allow their distribution to be examined. Secondly, National Census (2001) data will provide information on the populations of urban areas in Norfolk. Finally, Ordnance Survey data of the transport network will allow the time and distance from population centres to beach access points to be investigated. The time and distance that visitors travel to reach the coast will be compared to the distribution of visitors illustrated by the videos.

ON-SITE SURVEYS

Surveys are being undertaken at Holkham NNR to examine visitor behaviour. Surveys are conducted at the main access point to the beach, and surveying commenced in January 2004. They are undertaken one day a week and will continue for 12 months. The surveys include recording weather conditions and pedestrian counts, and undertaking interviews with visitors. Weather conditions are recorded hourly. Pedestrian counts are also undertaken hourly. The results from the weather conditions and pedestrian counts will be compared to examine the influence of weather on the numbers of people entering and leaving the beach. Questionnaires are undertaken with visitors as they leave the beach. The questionnaire examines three levels of use. Firstly, visitors are asked about their use of the coast in general, including how often they visit and their preferences regarding different types of beach characteristics. Secondly, they are asked about their use of Holkham beach, including the number of visits they have made in the last 12 months, and what they like and dislike about the beach. Thirdly, they are asked about their visit on that particular day. This includes why they chose to visit, the activities they have undertaken and how long they have stayed. They are shown a map of Holkham NNR (Figure 2) and are asked to draw a line showing the route they took and mark any points where they stopped, and write what activities they participated in and estimate the length of time they stopped. The results from the visitor maps are being entered into a GIS so that a grid of the intensities of use each habitat receives can be created.

Examining how visitor behaviour relates to weather conditions and coastal habitats will allow the impacts that climate change may have on behaviour to be explored, both directly (e.g. through changes in average temperatures), and indirectly (e.g. due to changes in beach structure).

RESULTS

To-date, 50 responses to the visitor survey have been obtained. Preliminary results suggest that many people visit Holkham for dog walking, other walking or bird watching. Table 1 illustrates the numbers of people who indicated that one of these activities was the main activity they came to undertake. The table also includes details of their preferences for various beach characteristics.

Table 1 demonstrates that all coastal user groups at Holkham may be influenced by the impacts of climate change. Dog walkers and other walkers, who account for 70% of the visitors interviewed, both stated they have a strong preference for a wide beach. Furthermore, all of the groups indicated that they have a strong preference for a quiet beach with wooded areas. Sea level rise may result in a reduction of the enjoyment that these groups experience from visiting Holkham. This may be directly due to a decrease in beach width. It may also occur indirectly, as a narrower beach may result in visitors spending a greater proportion of their visit in areas towards the back of the beach, such as the wooded dunes at Holkham. Increased use of such areas could lead to them becoming

degraded. Also, a narrower beach may result in visitors perceiving the beach to be busy, even if visitor numbers remain unchanged, which may influence tourists' behaviour. Bird watchers indicated that they have a strong preference for a beach with a saltmarsh. If the extent of this habitat was reduced by sea level rise, or it became degraded by increased storminess as a result of climate change, bird watchers may choose to visit alternative locations.

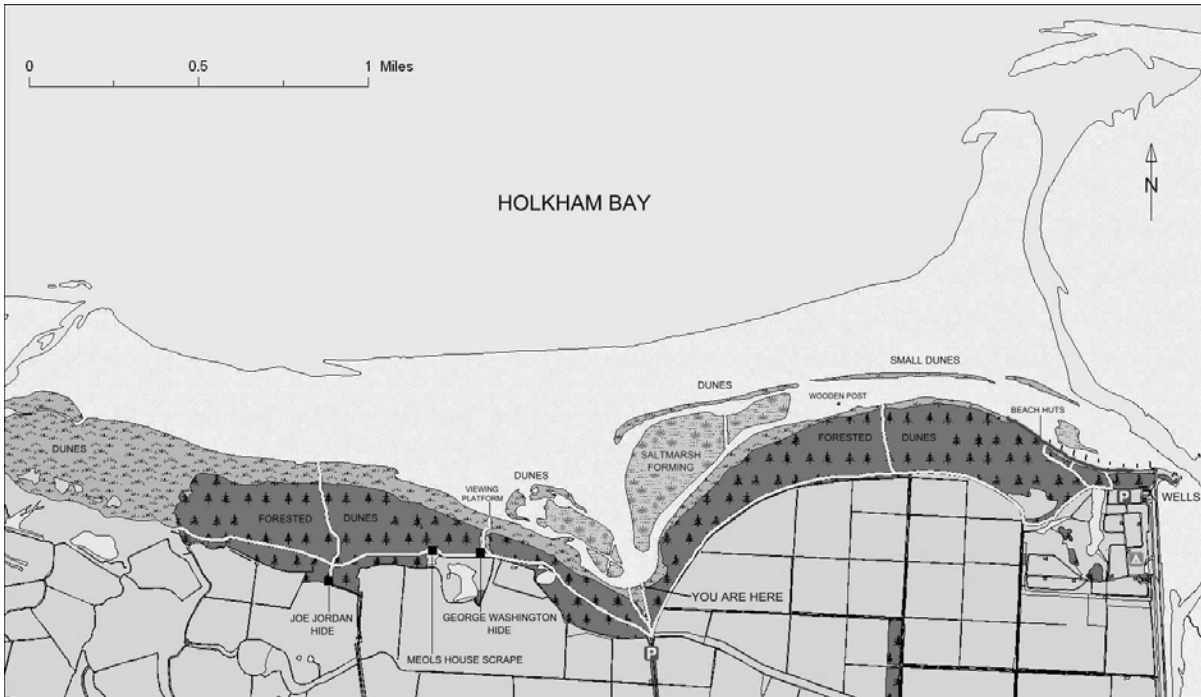


Figure 2: A monochrome reproduction of the map that is used with visitors at Holkham. The map is based on Ordnance Survey data

Table 1: The beach characteristic preferences of visitors at Holkham, for different types of coastal users (where SP = strong preference, WP = weak preference, NP = no preference). The results indicate the mode responses recorded in questionnaires undertaken at Holkham NNR, January – April 2004

Coastal User Type	Sample Size	Beach Characteristics					
		Beach width	Sand dunes	Saltmarsh	Woodland	Sea defences	Quietness
Dog walker	12	SP for wide	SP for dunes	NP	SP for wood	NP	SP for quiet
Other walker	23	SP for wide	SP for dunes	NP	SP for wood	NP	SP for quiet
Bird watcher	10	NP	SP for dunes	SP for marsh	SP for wood	NP	SP for quiet
Other	5	SP for wide	SP for dunes	SP for marsh	SP for wood	NP	SP for quiet
All users	50	SP for wide	SP for dunes	NP	SP for wood	NP	SP for quiet

DISCUSSION

The early results suggest that climate change may influence the behaviour and distribution of visitors to the Norfolk coastline, and that change is likely to have implications for biodiversity. Surveys provide an excellent method to obtain detailed information on visitor behaviour. They allow information to be collected regarding tourists' and recreational users' preferences for beaches, and socio-economic details, which could not be obtained from observations. Maps provide a cost-effective means of eliciting information concerning visitors' use of coastal habitats. Thus, both surveys and maps represent simple methods that may complement other, more traditional techniques for examining visitor behaviour, such as questionnaires. Finally, the use of GIS provides an effective tool for examining the spatial distribution of visitors.

The methods presented are also applicable to other environments. Such methods provide a means to understanding contemporary visitor distribution and behaviour at specific sites, and how this relates to weather conditions, so that the implications of climate change can be examined and the consequences for biodiversity may be explored.

ACKNOWLEDGEMENTS

This paper forms part of a Ph.D. that is jointly funded by the Economic and Social Research Council and the Natural Environment Research Council. Many thanks to Viola Kimmel for assisting with surveys at Holkham.

REFERENCES

1. Hall, C.M. 2001. Trends in ocean and coastal tourism: the end of the last frontier? Ocean and Coastal Man. 44:601-618.
2. Davis, R.A. and Fitzgerald, D.M. 2004. Beaches and Coasts. Blackwell Science Ltd. pp.419.
3. Alessa, L., Bennett, S.M. and Kliskey, A.D. 2003. Effects of knowledge, personal attribute and perception of ecosystem health on depreciative behaviours in the intertidal zone of Pacific Rim National Park and Reserve. J. of Env. Man. 68:207-218.
4. Tzatzanis, M. and Wrba, T. 2002. Sun beds vs. sand dunes: a conservation – tourism conflict. Coastal Env., Env. Problems in Coastal Regions IV, edited by Brebbia, C.A. (WIT Press, Southampton, Boston), 25-34.
5. Kutiel, P., Zhevelev, H. and Harrison, R. 1999. The effect of recreational impacts on soil and vegetation of stabilised Coastal Dunes in the Sharon Park, Israel. Ocean and Coastal Man. 42:1041-1060.
6. Obua, J. 1996. Visitor characteristics and attitudes towards Kibale National Park, Uganda. Tourism Man. 17(7):495-505.

7. Carr, N. 2002. A comparative analysis of the behaviour of domestic and international young tourists. Tourism Man. 23:321-325.
8. DeLucio, J.V. and Múgica, M. 1994. Landscape preferences and behaviour of visitors to Spanish national parks. Landscape and Urban Plan. 29:145-160.
9. Gimblett, H.R., Richards, M.T. and Itami, R.M. 2001. RBSim: Geographic Simulation of Wilderness Recreation Behaviour. J. of Forestry. 99(4):36-42.
10. de Freitas, C.R. 2001. Theory, Concepts and Methods in Tourism Climate Research. Proceedings of the First International Workshop on Climate, Tourism and Recreation, Porto Carras, Greece, Oct. 2001, edited by Matzarakis, A., and de Freitas, C.R. Commission on Climate Tourism and Recreation, 3-20.
11. Soini, K. 2001. Exploring human dimensions of multifunctional landscapes through mapping and map-making. Landscape and Urban Plan. 57:225-239.