

IMPACTS OF CLIMATE CHANGE ON TOURISM AREAS IN GERMANY: AN OVERVIEW OF RECOMMENDED ADAPTATION MEASURES AND THEIR COMMUNICATION

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ABSTRACT

The climate in Germany will change due to human-induced climate change. Therefore, the German Environment Agency is continuously monitoring and evaluating these changes on behalf of the Federal Government in order to advise it on the necessary measures. Climate change will also affect the tourism industry and travel regions in Germany. Hence, temporary or permanent restrictions on business activities may occur, endangering jobs and incomes. The changes are much more visible on the level of the travel regions than on the national level. In a research project, measures for Germany that can be taken on the regional level to counter the consequences were identified through communication with stakeholders in the tourism industry and tourism destinations. Additionally, data on climate change are made available via a climate information system. This serves to raise awareness of climate change among stakeholders.

Keywords: sustainable tourism, climate adaptation, travel region, policy advice, communication, adaptation measure.

1 INTRODUCTION

It is known that the findings on possible climate change and its causes date back to around 1965. It was already recognised by scientists at that time that carbon dioxide emissions were responsible for climate changes. Thereafter, the first climate models were developed in the 1970s and experts pointed out the need for changes in economic and consumer behaviour in the media or advisory bodies. In 1958, the German poet Hans Magnus Enzensberger pointed out in an essay that tourism, and especially mass tourism, has a great destructive potential [1]. Since then, tourism has grown many times over and with it the pressure on the environment and nature. If you read scientific papers or political concepts on sustainable tourism, many different topics are addressed, for example energy use, waste and water management, fair working conditions, inclusion or economic success. Daniel Scott argues the following in 2010: “Tourism is currently considered among the economic sectors least prepared for the risks and opportunities posed by climate change and is only now developing the capacity to advance knowledge necessary to inform businesses, communities and government about the issues and potential ways forward” [2]. The concern with climate change and adaptation to its consequences is continuing to this day [3].

The economic contribution of the German tourism industry amounts to 3.9% of the gross domestic product and secures a total of 2.9 million jobs [4]. Both the economic and recreational factors of tourism are influenced by the effects of global climate change. The tourism sector itself also contributes to climate change: Globally, the World Tourism Organization (UNWTO) and the United Nations Environment Programme estimated tourism’s contribution to climate change at between 4.6% and 7.8% [5]. Similar values are also included in the report of the Intergovernmental Panel on Climate Change [6]. In addition,

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the current findings of the IPCC show that with the climate-damaging emissions we are already emitting, we can expect global warming of 1.5 or 2 degrees, and even more without a change in our consumption and economic practices. This article is not about analysing who would have to contribute what amount to reduce tourism's contribution to climate change. There are already a number of agreements and recommendations on this. However, there is a lack of comprehensive and ambitious implementation of measures to achieve climate protection goals in the tourism industry [7]. Therefore, the purpose of this article is to address the problem that climate changes will occur in all regions of the world. These will have an influence on the economy and thus also on the tourism industry. In the following, the article will look at the situation in Germany.

2 THE SITUATION IN GERMANY

The vulnerability analysis of Germany to climate change published in 2015 deals with the tourism industry as an area for action. The study identifies three main impacts of climate change on the tourism industry through an impact chain analysis. These are (1) business interruptions; (2) seasonal and regional shifts in demand; and (3) climate-related demands on tourism infrastructures. Overall, the impact on the tourism industry is classified as low in relation to other fields of action. In the event of a strong change in the climate, a change would most likely occur in the area of tourism infrastructures, according to the study's findings. At the same time, the tourism industry is considered to have a high capacity for adaptation. However, the affectedness and adaptation needs of individual tourism segments differ greatly. The climate signals of river floods, storm surges, flash floods, temperature, humidity, heat, precipitation, snowfall and changes in radiation were identified by the study as particularly relevant for the tourism industry [8]. Questions of changing conditions for travel are addressed in the context of ski tourism in the Alps and low mountain ranges and partly in connection with coastal regions [9]–[11].

There is a scientific consensus that tourism is influenced by the climate, as many tourism activities take place in nature or in front of the landscape. At the same time, the exact influence of climate change is hardly quantifiable for Germany due to the lack of data: which is mostly available on a monthly basis. Quantification would require trip or turnover data on a daily basis. A case study for an Alpine destination can already establish a connection by analysing a combination of weather data and overnight stay data [12].

In 2008, the Federal Government launched the German Strategy for Adaptation to Climate Change [13]. This strategy identifies the need for change and adaptation in tourism, particularly in coastal areas and mountain regions. The adaptation strategy is accompanied by a reporting and monitoring process [14]. The monitoring system is regularly evaluated and improved [15]. For this purpose, indicators were developed that show both the influence of the changes caused by climate change on the tourism industry ("impact indicators") and its reactions ("response indicators").

The Climate Impact and Risk Assessment 2021 for Germany specifies the risks for the tourism field of action in the case that no adaptation takes place (Fig. 1).

The report points out that the impact of climate change varies from region to region. It can be seen that most of the tourism sectors under consideration are currently only slightly affected. It is expected that this will increase as climate change progresses. Due to the multicausality of regional differences in geography, climate and tourism offerings, it is hard to describe impacts and adaptation capacities more precisely on the national level.

"Official statistics distinguish 143 travel areas in Germany, which usually correspond to a district in terms of their spatial layout" [17]. The German Environment Agency has



Climate impact		Present	Middle of the century		End of the century		Adaptation period
			optimistic	pessimistic	optimistic	pessimistic	
Restriction of tourism options: effects of a lack of guaranteed snow on winter tourism	Climate risk	low	medium	medium	high	high	< 10 years
	Certainty		medium		medium		
Restriction of tourism options: effects of heat on health-based tourism	Climate risk	low	low	medium	medium	medium	< 10 years
	Certainty		low		low		
Damage to tourist infrastructure and business interruptions	Climate risk	low	medium	medium	medium	high	< 10 years
	Certainty		medium		low		
Shift in demand	Climate risk	low	low	medium	low	medium	< 10 years
	Certainty		low		low		
Economic opportunities and risks for tourism	Climate risk	medium	medium	medium	high	high	< 10 years
	Certainty		medium		low		

Figure 1: Climate risks without adaptation in the tourism action field [16].

launched an investigation with the title Impacts of climate change on tourism in 2017. The study aimed to show how tourism regions are and will be affected by changes in climate. By providing information, data and suggestions for measures, destination management organizations should be enabled to implement adaptation measures themselves. The research was implemented jointly by several institutes and was completed in 2021 [17].

3 ANALYSIS ON THE LEVEL OF TOURISM DESTINATIONS

In relation to the difficulties of accurately describing the consequences of climate change on the national level, it is useful to look at the regional level. The following results are available in the research project “Impacts of climate change on tourism in the German alpine and low mountain ranges and coastal regions as well as on bathing tourism and river-related forms of tourism (e.g. cycle and water tourism)” [17]. The key question is which changes in the climate will bring about the need for adaptation for the tourism industry. Both extreme weather events and changes in the general conditions that occur gradually and then remain are relevant to consider. Extreme events in Germany are storms, floods, heavy rain, forest fires, low water and drought. The general conditions are influenced by changes in temperature or the amount of precipitation. Depending on the region, this leads to further consequences, especially with regard to nature or people’s health and well-being. “Since weather records began in 1880, the air temperature in Germany has increased by 1.4°C, with a particularly sharp rise since the 1960s. Extreme values are also increasing, with heat days occurring twice as often today as in the climate reference period 1961–1990. This particularly affects the regions of Rhineland and Spreewald. Heavy rainfall events are occurring with increasing frequency, especially in northern and central Germany. Ice days, which occur most frequently in the high and low mountain regions, decrease significantly. On average across Germany, the number of ice days decreases by about 1 day per 10 years” [17].

The research team first identified the geographical spread of the 143 tourism areas into which Germany is divided. For these regions, statistics are available on the number of guest arrivals and length of stay on a monthly basis. In the next step, recognised climate models were used to calculate the expected change in the number of visitors. The “observed climatic changes of the last decades (1961–2019) provide information on which developments we should expect in the near future and allow a classification of regional climate projections for medium time horizons beyond 2050. In order to gain insights into the future climatic development, 4 regional climate simulations were evaluated for the emission scenario RCP8.5 (‘business-as-usual’) (see chapter 3.2.2). A climate information system [...] was developed for the illustrative presentation of various climatic parameters, which describes past and possible future climatic development using interactive maps, tables, and time series” [17] (Fig. 2). The climate information system makes it possible to call up and display climate changes either for a selected travel region or in the overview for Germany with all regions.

Each of the climate changes will require tourism offers to be adapted. Regionally, it may also be that certain activities are temporarily or permanently not possible. In relation to increasing drought, this is associated with an increased risk of forest fires, impairment of biodiversity and water shortages. Water is used for various tourism activities, which can then be restricted. These include the production of artificial snow, but also canoeing and swimming. But also the use of streams for energy generation, e.g. in small hydroelectric power plants in mountain regions, may be limited. Impairment of the forest in turn affects activities that are carried out in the forest, such as hiking, geocaching or cycling.

4 ADAPTATION MEASURES

The German Environment Agency presents a number of adaptation measures on its website. However, there was a lack of specific recommendations for the tourism industry and related tourism activities. After the analysis of the changes on the regional level, the commissioned research team was able to start working on adaptation measures. “In order to identify possible adaptation measures, a scheme was developed to analyse changes due to climate change and impacts on tourism elements and forms. Based on a literature review and four expert workshops, 24 measures were selected for closer examination” [17].

The measures could be divided into the following six categories: (1) Leisure activities independent of weather conditions; (2) Technical measures in the event of changes in the general conditions; (3) Crisis management; (4) Crisis prevention; (5) Product and marketing adaptation; and (6) Guidance of visitor flow [17]. The measures described must be selected on the basis of the changes to be expected regionally and relate to the existing offers of the travel area.

Table 1 shows all climate change adaptation measures that were found for German travel areas. All measures are presented and assessed in detail to help local actors implement and integrate them into their own work. For each measure, a description is given of the climate impacts it can improve. A measure can address several changes, as it is complex. Furthermore, for each measure there is an indication of the steps that a person responsible for implementation or the team must undertake in order to implement it. In addition, obstacles and their solutions are already pointed out as far as foreseeable. Costs often play an important role in implementation, so what can be expected is discussed. This is described qualitatively, as it is not possible to make a quantitative statement, because too many factors are unknown, such as the size of the region, previous work that can be drawn upon, etc. Furthermore, almost none of these measures have been put into practice so far, so that no empirical values can be used. Moreover, there are estimates of the ecological and socio-economic impact of each



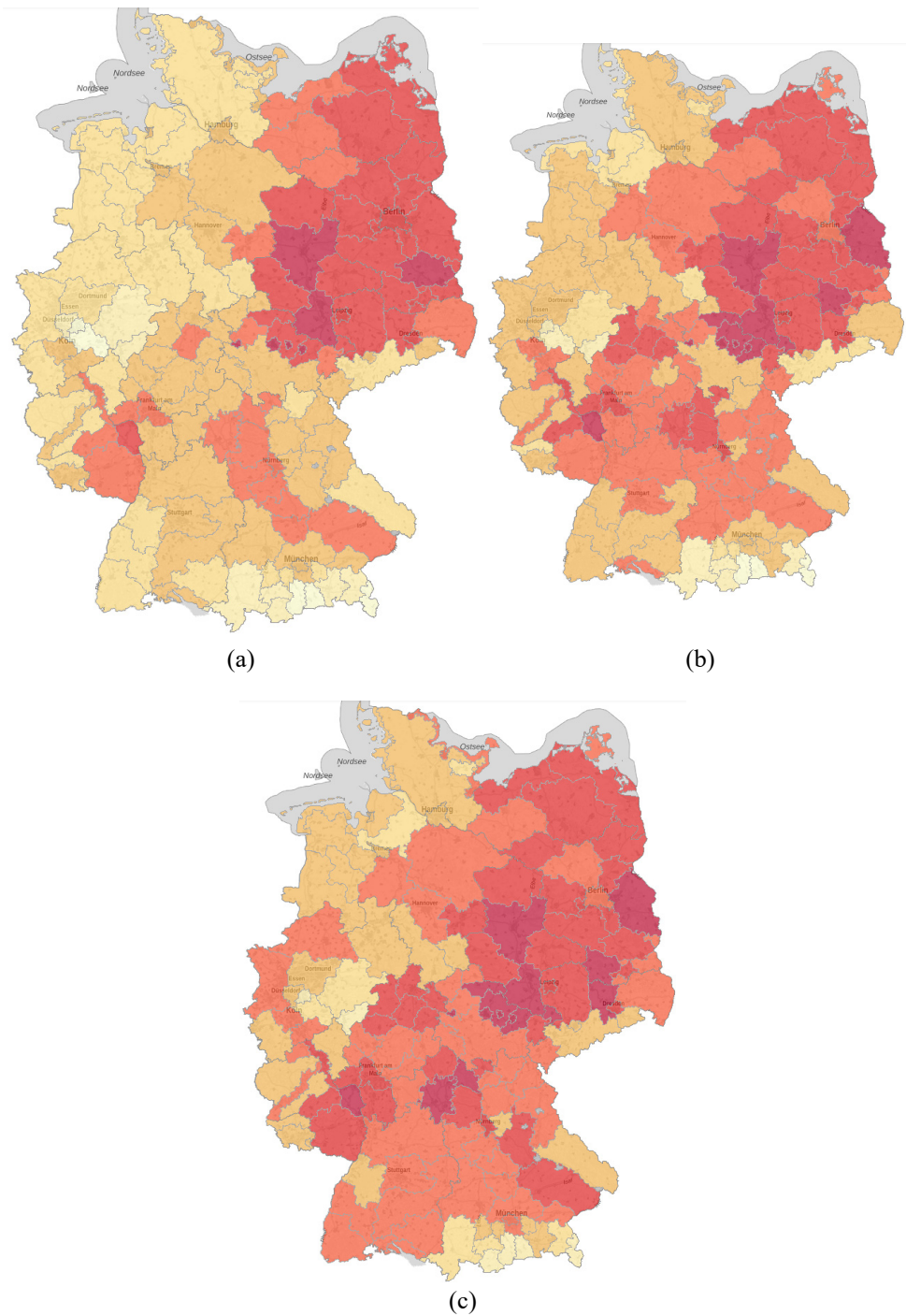


Figure 2: The number of dry days per year in comparison to three time periods. (a) 1990–2019; (b) 2031–2060; and (c) 2071–2100 [19].

Table 1: Overview of the selected measures [17].

Category of adaptation measure	Specific adaptation measure		
Leisure activities independent of weather conditions	Shading of paths against increasing heat		Footbridges that adapt to water levels
Technical measures in the event of changes in the general conditions	Creation of water areas	Measures to save water in tourist facilities	Water-saving outdoor facilities Creating more recreational facilities that are not dependent on weather conditions
Crisis management	Establish and refine crisis management		
Crisis prevention	Consistently and systematically monitor endangered areas that are considered tourist areas	Carry out risk analyses and natural hazard scenarios for tourism, continuously update risk mapping	Promote learning cooperation for mutual support in hazard prevention
	Raise awareness of climate change among tourism service providers and associations.	Educate the population about weather risks and natural hazards – Inform guests openly	Train staff to save water and energy Train staff on how to behave in crisis situations
Product and marketing adaptation	Modification/tightening of cancellation conditions	Risk minimisation for (large) events	Product adaptation
Guidance of visitor flow	Guidance through information and targeted offers		
	Guidance through bans and restrictions		

measure. Not all measures could be recommended from an ecological point of view, e.g. the use of artificial snow in skiing regions that can expect less and less snowfall [17].

5 ACCOMPANYING COMMUNICATION ON RESEARCH

The study “Impacts of climate change on tourism in the German alpine and low mountain ranges and coastal regions as well as on bathing tourism and river-related forms of tourism (e.g. cycle and water tourism)” [17] was commissioned with the aim of providing policy advice. It was important from the start that the results should be used for practical application. Another aspect to consider is that the awareness of the need for adaptation of the tourism industry to climate change was not very high at the beginning of the project. Furthermore, measures for future implementation were developed without being able to look back on an extensive evaluation of similar measures in the past, as climate change is occurring for the first time. These facts required extensive communication with local actors in the travel areas. The aim of the communication was firstly to include existing knowledge, secondly to identify needs, thirdly to prepare research results in a target group-oriented and practical manner, fourthly to raise awareness of the need for adaptation measures and fifthly to encourage implementation.

In the different phases of the research project, communication with local stakeholders of the tourism industry varied (Fig. 3). After the first analysis of available data, a workshop was offered. The aim was to narrow down which climate changes are particularly relevant for tourism and which are not. Furthermore, what support is needed for adaptation on the local level was identified and discussed. It became clear that a guide summarising the information would be helpful. It should present the impacts of climate change, provide guidance on how to start and implement an adaptation process, how to finance it and what measures can be taken. In addition, the preparation of data on the level of the tourism region was considered helpful by the stakeholders.

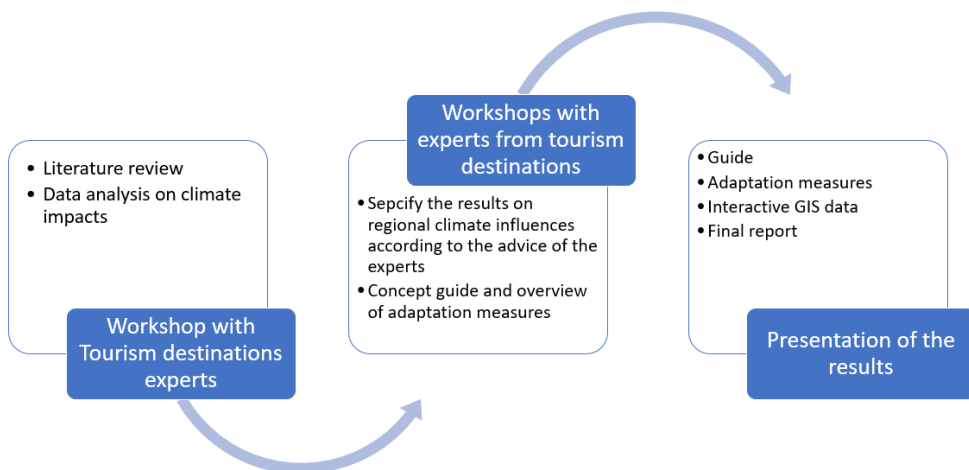


Figure 3: Process of the contracted research project and the accompanying communication on the topic with experts from the tourism regions.

In the next step, a guideline [18] was developed that responds to the indications. This results in the contents: Presentation of the necessity of adaptation to climate change,

description of the expected changes. It also describes how an adaptation process can be started. It then goes on to describe which adaptation measures are possible and recommended, and how financial resources can be found. After another round of region-specific workshops with stakeholders, the guide was finalised, the data was entered into a GIS climate information system [19] and the adaptation measures [20] were presented on the website of the German Environment Agency. While the guide is available free of charge in pdf and printed form, the pdf format can only be accessed online. The reason for this is that they can be updated quickly if new findings emerge. All results were presented to the interested expert public during the first lockdown in an online conference with almost 300 participants [21]. In addition, two brochures were produced on the topics of how to use the climate information system [22] and climate protection versus climate adaptation – where are the differences? [23]. Finally, the scientific report was published and a press release was issued.

6 OUTLOOK

Were the objectives of the project achieved? Yes, many of the objectives have been achieved, it is now clear that climate changes will occur in tourism regions that will require adaptation measures in the future. It is also clear what these changes will be in the individual tourism areas. Through the accompanying communication, many of the 143 travel regions have been able to achieve a raised awareness. The information materials provided have been adapted to their needs. One federal state have launched his own adaptation campaign [24] for their regions. The Excellence Initiative Sustainable Destinations in Germany has included the topic in its knowledge portal. Furthermore, the results have been noted in the scientific community.

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