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RESEARCH ARTICLE

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Behavioural change or "business as usual"? Characterising the reaction behaviour of winter (sport) tourists to climate change in two German destinations

Maximilian Witting[1] | Michael Bischof[2] | Jürgen Schmude[1]

[1]Department of Geography, Ludwig-Maximilians-University Munich, Munich, Germany

[2]Institute of Ecomedicine, Paracelsus Private Medical University of Salzburg, Salzburg, Austria

Correspondence
Maximilian Witting Department of Geography Ludwig-Maximilians-University Munich Luisenstrasse 37 80333 Munich, Germany.
Email: m.witting@lmu.de

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Abstract

Climate change affects both the supply and the demand side of winter tourism. So far, few demand-side studies exist in the field of climate change impact research. Those investigating the tourists' behavioural response to climate change concentrated exclusively on ski tourists in various countries, except for the highly vulnerable German market. This study conducted a survey (n = 751) in two German destinations to investigate the reaction behaviour of winter tourists to climate change, differentiated according to day and overnight guests. Findings show that not only weather, snow and operating conditions determine the reaction behaviour, but also lifestyle or sociodemographic aspects.

KEYWORDS

climate change, explorative study, logistic mixed models, optimal ski day, reaction behaviour, winter (sport) tourism

1 | INTRODUCTION

Research on the effects of climate change on tourism has existed since the mid-1980s (Scott, Gössling, & Hall, 2012). As of today, different publications determined that climate change leads to an alteration in tourism demand and a redistribution of tourist flows between destinations, resulting in winning and losing regions (e.g., Amelung, Nicholls, & Viner, 2007; Hamilton, Maddison, & Tol, 2005; Wall, 1992). Beside these global scale studies, national studies (e.g., Matzerakis & Lohmann, 2017) also conclude that this applies in principle to all tourism market segments, although the extent to which the individual segments are affected varies.

Winter (sport) tourism is an important economic factor for many European alpine destinations (Bätzing, 2017), particularly for low mountain range and alpine destinations in Germany (e.g., Soboll, Klier, & Heumann, 2012). The destinations' economic success depends on the quantity and quality of operating days of alpine and cross-country ski slopes (e.g., Landauer, Pröbstl, & Haider, 2012; Steiger & Abegg, 2015). Climate change has a significant impact on these parameters specific to winter (sport) tourism. Results of recent research estimate a decreasing snow reliability (e.g., Abegg & Steiger, 2016; Mayer & Steiger, 2013), a reduced number of operating days (e.g., Soboll & Dingeldey, 2012; Steiger, 2011a), as well as an increase in operating costs (e.g., snowmaking costs) (e.g., Müller, Steiger, Peters, & Veulliet, 2013) for many, particularly low-lying, German winter sport destinations in the future.

This particularly high vulnerability to climate change is also reflected in the large number of research projects on this topic that have been comprehensively reviewed by Steiger, Scott, Abegg, Pons, and Aall (2019). A distinction is made between climate change impact studies for the supply- and demand-side as well as analyses that examine possible supply-side adaptation strategies. The latter include,

among others, the expansion of snowmaking systems, the diversification of supply or improved communication between suppliers and tourists (e.g., Gössling, Scott, Hall, Ceron, & Dubois, 2012; Hoffmann, Sprengel, Ziegler, Kolb, & Abegg, 2009; Pickering, Castley, & Burtt, 2010; Scott & McBoyle, 2007). Most of the analyses conducted in this field focused on the supply-side, using climate change impact assessments as well as modelling-based and climate change analogue approaches in particular (Scott et al., 2012), whereas research on demand-side issues (e.g., tourists' behavioural response) has been given relatively little attention (Steiger et al., 2019). Consequently, Scott et al. (2012) and Steiger et al. (2019) call for further research to understand the reaction behaviour of ski tourists to climate change in order to identify destinations or regional markets where a contraction or an increasing market share may occur.

1.1 | Literature review

Survey studies on the reaction behaviour of ski tourists have been conducted in various countries (e.g., Australia, Austria, Canada, Norway, Switzerland and United States). Some of them (e.g., Cocolas, Walters, & Ruhanen, 2015; Dawson, Scott, & Havitz, 2013; Demiroglu, Dannevig, & Aall, 2018; Rutty et al., 2015a, 2015b) based their work on the theory of substitutability of leisure behaviour (Iso-Ahola, 1986). According to Iso-Ahola (1986, p 369), "substitution means that the originally intended or desired [leisure] behavio[u]r is no longer possible [(e.g. due to bad snow or weather conditions)] and must therefore be replaced by another behaviour". Studies using this theoretical basis differentiate between ski tourists who substitute the activity with another (activity substitution) and those who change the time (temporal substitution) or the destination (spatial substitution) of the leisure activity. The other studies in this field (e.g., Behringer, Bürki, & Fuhrer, 2000; Bürki, 2000; Dawson, Havitz, & Scott, 2011; König, 1998; Pickering et al., 2010; Unbehaun, Pröbstl, & Haider, 2008) worked with more differentiated response options (e.g., "stop skiing for part of the season", "stop skiing for a full season", "ski more often"). In all of the studies—Steiger et al. (2019) categorised most of the survey results within the three groups of Iso-Ahola's (1986) theory of leisure substitution—it becomes evident that skiers change their participation behaviour in the face of adverse conditions. In this context, most of the studies (e.g., Behringer et al., 2000; Bürki, 2000; Dawson et al., 2011; Demiroglu et al., 2018; König, 1998; Pickering et al., 2010; Unbehaun et al., 2008) base their results on very general scenarios (e.g., several future winters with marginal snow conditions). Rutty et al. (2015a and 2015b), in contrast, used scenarios on the operability of the ski areas (e.g., "if the in-situ resort was closed today, closed until mid-season or closed permanently due to lack of snow"), and Dawson et al. (2013) as well as Cocolas et al. (2015) concretise their scenarios. Conditions that are also relevant for winter sport, such as a fully operating alpine or cross-country ski area or a snow-covered landscape did not play any role in previous studies. According to Berghammer and Schmude (2014), these parameters represent an essential aspect in the skiers' decision whether to practise winter sport or not. With regard to this, they defined the "optimal ski day" (OSD) based on the experience and expertise of different ski lift operators. OSDs are weekends and (legal) holidays which are characterised by good weather conditions (no precipitation, low wind velocity, sufficient sunshine and suitable temperature), a snow-covered landscape, a fully operating ski area as well as a sufficient snow depth on slopes (Berghammer & Schmude, 2014). By means of these eight indicators, Berghammer and Schmude (2014) investigated the future impact of climate change on OSDs for individual winter sport destinations in the Upper Danube catchment area. They state that the number of profitable operating days will generally decrease in the future and that, in addition, there will be a shift of OSDs from Christmas towards the end of the season (Christmas-Easter shift).

Scott et al. (2012) and Steiger et al. (2019) identified three main limitations of the studies on ski tourists' response that need to be addressed in future research. In Section 2.2, it is further explained how this study attempts to overcome the following limitations. First, many studies used hypothetical scenarios that could be interpreted very differently between respondents. Thus, scenarios should be defined more precisely in order to prevent misunderstanding. A further limitation refers to the lack of segmentation of the sample in many previous studies, although Cocolas et al. (2015), Dawson et al. (2011 and 2013), König (1998) and Rutty et al. (2015b) agree that the tourists' reaction behaviour very much depends on sociodemographic features, personal traits and characteristics related to skiing (e.g., skiing skills, place loyalty). Further insight into the factors influencing the very complex process of the tourists' destination choice in general is provided by Karl and Reintinger (2017). Finally, the gap between stated and real behaviour is mentioned as a main limitation of previous studies. This gap can be further analysed by either using skier visit data that helps to understand prior behaviour or conducting climate change analogue studies that show how demand changes during anomalously warm winters compared to current average winter seasons. Analogue study results in Canada (Rutty et al., 2017), Austria (Steiger, 2011a) and Italy (Steiger, 2011b), except for the study of Pickering (2011) in Australia, show a considerably lower reduction in skier visits (2 to almost 12%) compared to surveys on skiers' reaction behaviour (summarised in Steiger et al., 2019). This further confirms that climate change is not the only factor influencing tourists' reaction behaviour.

In addition to climate change analogue studies, a further non-survey-based approach (agent-based models) is used in winter tourism research. Several approaches aim to analyse the impact of climate change on ski tourism for different regions (e.g., Pons, Johnson, Rosas-Casals, & Jover, 2014; Soboll et al., 2012; Soboll & Dingeldey, 2012), considering supply-side (e.g., changes in operating conditions) as well as demand-side aspects (e.g., tourists' reaction behaviour to adverse conditions). Model results in each of the studies underline a regionally differentiated view on climate change impact. Thus, a redistribution of tourism flows among winter sport destinations is to be expected due to the skiers' behavioural response to marginal winter sport conditions. This is in line with the analogue study results of Pickering (2011), Rutty et al. (2017) and Steiger (2011b),

who reinforce that especially low lying and rather small winter sport destinations may face severe impact. How this affects key actors involved in winter tourism economically has been analysed for a ski area in Germany (Witting & Schmude, 2019). Winter sport destinations with favourable conditions (e.g., due to higher mean altitude or high snowmaking coverage), in contrast, may gain market share and thus create higher turnover (e.g., Pons et al., 2014; Soboll & Dingeldey, 2012).

1.2 | Aim of the study

The synchronous investigation of demand-side response to supply-side impact remains a research need, as previous studies only concentrated on the reaction behaviour of ski tourists. Furthermore, these studies lack differentiation of the reaction types with regard to day and overnight guests. This seems to be relevant, as the destination choice (due to the different travel distance) (e.g., Rutty et al., 2015a; Unbehaun et al., 2008) as well as the booking process and thus, the reaction behaviour, differs between day and overnight guests. Day guests, who plan their trips spontaneously, tend to show other reactions compared to overnight guests, who generally book their stay well in advance. Thus, the main purpose of this study is to expand previous approaches by considering winter (sport) tourists (alpine skiers, cross-country skiers as well as tourists who practise alternative winter sports or no winter sport) to better reflect the multiplicity of supply in destinations. To do so, the study investigates how winter (sport) tourists may change their participation behaviour due to adverse weather, snow and operating conditions in the future—differentiated according to day and overnight guests. For this purpose, the study uses the OSD parameters, as they play a significant role in the decision process of winter (sport) tourists (e.g., Berghammer & Schmude, 2014; Demiroglu et al., 2018). With regard to the behavioural response, the theory of substitutability of leisure behaviour (Iso-Ahola, 1986) presents the theoretical basis of the study. In contrast to previous studies on the reaction behaviour of ski tourists (e.g., Cocolas et al., 2015; Dawson et al., 2011, 2013; Rutty et al., 2015a, 2015b), this study introduces two further reaction types ("stop winter sport" and "business as usual") in addition to those already identified (spatial, temporal and activity substitution). This is necessary, as this study considers not only winter sport tourists but also winter tourists, which in turn results in additional reaction options:

- **destination switchers:** winter (sport) tourists who change their destination as they, for example, search for higher snow reliability to practise their preferred winter sport.
- **activity switchers:** winter (sport) tourists who change their activity (e.g., to winter hiking or mountain biking) while visiting the same destination.
- **time switchers:** winter (sport) tourists who postpone their winter day trip/holiday, but still visit the same destination.
- **stop winter sport:** winter (sport) tourists who no longer practise any winter sport.
- **business as usual:** winter (sport) tourists who do not change their behaviour at all.

Furthermore, the study examines potential differences in the reaction behaviour of winter (sport) tourists and describes the personal traits of each reaction type in detail. At this point, the relatively small share of tourists practising "alternative winter sports" (see Table 1) should be considered during interpretation. With the results, destinations gain an understanding of the effects of climate change as well as of prospective changes in demand, enabling them to identify specific adaptation measures.

2 | RESEARCH DESIGN

The study was conducted in two selected German winter sport destinations (Bayrischzell in the Bavarian Alps and St. Englmar in the Bavarian Forest), for various reasons. Winter tourism is one of the main economic factors for many low mountain and alpine destinations in Germany (e.g., BMWI, 2013). Compared to other alpine countries, the German winter tourism market includes a relatively large share of low-lying destinations (Bätzing, 2017). This is one reason why present publications demonstrate that several destinations in Germany may have to cope with serious consequences of climate change—also taking into account existing adaptation strategies (e.g., snowmaking infrastructure). According to Steiger and Abegg (2015), only 44% of ski areas in the Bavarian Alps can be seen as snow-reliable with an average temperature increase of 2°C. With regard to the selected case studies, Mayer and Steiger (2013) show that Bayrischzell has to deal with a declining reliability of snow in the future. This is particularly the case during the Christmas season, which is still of great economic importance. This will lead to high turnover losses in the next decades (Witting & Schmude, 2019). For St. Englmar, declining operating days and OSDs have been estimated until the 2050s seasons (Berghammer & Schmude, 2014; Soboll & Dingeldey, 2012). The tourists' behavioural response triggered by these effects already affects winter sport destinations in Germany, but has not been investigated so far (Steiger et al., 2019). This is crucial in order to understand the consequences for the regional winter tourism market (e.g., severe economic structural changes). In addition, the two case studies reflect the heterogeneous nature of the winter (sport) tourism industry in the German Alps (e.g., with regard to winter touristic offers, facilities, sociodemographic aspects of winter tourists, snow reliability and altitude of the winter sport area) (e.g., Abegg & Elsasser, 2007).

2.1 | Research areas

The Sudelfeld ski area (870–1,563 m) is located in the municipalities of Bayrischzell (1,606 inhabitants) and Oberaudorf, (5,250 inhabitants), which are part of the regional tourism association Alpenregion Tegernsee Schliersee (ATS) in the Bavarian Alps (LfStat, 2018). According to BayLfU (2006), the Sudelfeld ski area (588.36 acres) is

the second-largest ski area in Germany after the Zugspitze (615.54 acres) and its average altitude (1,216 m) lies within the average altitude of German ski areas (1,325 m). In an alpine-wide comparison, the Sudelfeld ski area can be characterised as rather small and low-lying (Bätzing, 2017). Bayrischzell is one of the most important destinations for ski day trips for over 4 million inhabitants residing in the catchment area of Munich (one-hour drive), Ingolstadt and Rosenheim (LfStat, 2018) (Figure 1). The winter sport offers also include cross-country skiing, winter hiking as well as ski touring and snowshoeing (ATS, 2019).

The winter sport destination St. Englmar in the Bavarian Forest (1,898 inhabitants) differs greatly from Bayrischzell (LfStat, 2018). There is no connected ski area, but three small ski areas (Pröller 660–1,030 m and 85.25 acres; Predigtstuhl 848–1,023 m and 49.42 acres; Grün-Maibrunn 726–825 m and 10.87 acres) and one little practise slope for kids and beginners (Kapellenberg 835–877 m and 4.2 acres) (BayLfU, 2006; USE, 2019). The average altitude is significantly below the average altitude of German ski areas. Winter sport offers also include cross-country skiing, winter hiking as well as tobogganing (USE, 2019). St. Englmar is one among several small winter sport destinations in the Bavarian Forest that generates a constantly high share of year-round tourism, with peaks in January and February as well as July and August (TIStE, 2018). The catchment area for winter sport day trips comprises several districts in the north-eastern part of Bavaria, including the cities of Nuremberg, Regensburg and Landshut (around 1.8 million inhabitants) (LfStat, 2018) (Figure 1).

2.2 | Survey instrument

Data for this explorative study was collected through standardised quantitative face-to-face interviews in the two case studies. A questionnaire was developed that comprises the following three sections:

The questionnaire starts with an open question where respondents indicate the three most important conditions that make their day optimal for winter sport activities. This individual perception is used to characterise the different reaction types. With the second question, respondents assign a value to each of the eight OSD parameters developed by Berghammer and Schmude (2014) using a five-point Likert scale (from "1 = not important" to "5 = very important"). This aims to determine which OSD parameters are most important to the respondents and to investigate the individual reaction behaviour (section two of the questionnaire) if these parameters are not fulfilled.

Section two includes three questions on how respondents' visitation behaviour in the case of day visits would change contingent upon adverse weather, snow and operating conditions in the future due to climate change. Each question refers to one of the OSD parameters, which was valued as being "very important" or "important" by the respondent in the question before. For example, respondents are asked to state their reaction behaviour if the OSD parameter "alpine or cross-country ski area is operating fully" is not fulfilled on the next day trip—taking realistic account of their time and budget limits. Analogous to this, respondents are asked about their reaction behaviour for the next multi-day visit (three questions). This way of asking about behavioural reaction takes into account the limitations of previous demand-side studies identified by Scott et al. (2012) and Steiger et al. (2019). Although the questions are prospective (referring to the next day or multi-day trip), they are not based on future scenarios, but refer to the very clear definition of each OSD parameter (Berghammer & Schmude, 2014), which minimises the probability of misinterpretation. Each answer only allows a single response. Two further questions with multiple answers investigate the desired offers in the destination (differentiated according to day and multi-day visits). Specific offers are queried that may serve as an incentive to visit the destination even though the three OSD parameters dealt with before are not fulfilled.

The last section comprises 12 questions on sociodemographic factors (e.g., age, gender, net household income, educational level), lifestyle as well as winter-sport-specific features (e.g., type of winter sport currently practised, type of lift ticket, spending behaviour), in order to characterise the different reaction types. This study aims to examine influencing aspects additional to those (e.g., skiing skills or place loyalty) identified by Dawson et al. (2011). Therefore, questions on the respondents "degree of activity in social media", "degree of activity as a member of a sports club", "sportiness", "amount of organic food consumed" or "leisure activities" were included in order to map the tourists' personal lifestyle. The variable "type of winter sport currently practised" is categorised into four groups: "alpine skiing", "cross-country skiing", "alternative winter sports" and "no winter sport". The group "alternative winter sports" includes tourists practising winter hiking, ski touring, snowshoeing, etc. Overall, this set of questions considers the limitations mentioned by Scott et al. (2012) and Steiger et al. (2019)—that most previous studies do not segment the sample, but assume the ski tourists to be a homogeneous group.

The questionnaire was directed at all German-speaking winter (sport) tourists in the two destinations, because the source market for both destinations is almost exclusively Germany (TIB, 2018; TIStE, 2018). Prior to the survey, a pre-test was conducted between December 2018 and January 2019 with 20 randomly selected respondents in Munich, resulting in minor changes to the questionnaire.

2.3 | Data collection

The survey was conducted by trained interviewers. The training aimed to minimise errors in filling out the questionnaire and to learn how to handle refusals. The survey was undertaken during the winter season 2018/2019 on 7 days from 11th until 22nd February 2019. In order to ensure a balanced ratio of weekdays, it was conducted on five weekdays and two weekend days. The respondents were selected randomly at 15 specific and frequently visited locations in the two destinations. The locations were selected in order to identify winter (sport) tourists. There were 1,032 attempts to conduct interviews and 278 were refused (response rate: 75.5%). A final number of 757 completed the face-to-face interviews, of which 751 were completed correctly. Table 1 shows selected characteristics of the sample.

TABLE 1 Respondents' profile (total sample and differentiated according to the research areas; in %)

Variable	Total sample (*n* = 751)	Bayrischzell (49.5%; *n* = 372)	St. Englmar (50.5%; *n* = 379)
Sex			
Male	54.5	55.9	53.0
Female	45.1	43.8	46.4
Age			
Under 25	11.2	16.1	6.3
25 until 44	40.5	39.2	41.7
45 until 64	39.7	38.4	40.9
65 and older	7.7	5.4	10.0
Type of winter sport currently practised			
Alpine skiing	65.9	77.2	54.9
Cross-country skiing	15.0	11.0	19.0
No winter sport	14.2	9.1	19.3
Alternative winter sports	4.8	2.7	6.9
Level of education			
Low	8.7	7.5	9.8
Medium	24.2	21.0	27.4
High	63.8	68.0	59.6
Number of children (>18) in the household			
No children	54.5	60.2	48.8
One child	16.4	18.0	14.8
Two children	22.1	15.9	28.2
Three and more children	6.8	5.6	7.9
State of residence (TOP 3)	65.1 (Bavaria)	74.7 (Bavaria)	55.7 (Bavaria)
	7.9 (Saxony)	4.8 (Hesse)	12.9 (Saxony)
	4.5 (Thuringia)	3.8 (North Rhine-Westphalia)	6.3 (Saxony-Anhalt)
Country of residence			
Germany	97.5	97.0	97.9
Other EU-states	2.5	3.0	2.1

Source: own table based on survey data

2.4 | Data analysis model

In order to accomplish the purpose of the study, statistical regression models (logistic mixed models) have been used (Fahrmeir, Kneib, Lang, & Marx, 2013). Each model comprises the same set of independent variables, but has different dependent variables (each reaction behaviour is a binary coded variable). A distinction is made between "destination switchers", "activity switchers", "time switchers" as well as those winter (sport) tourists who "stop winter sport" or continue "business as usual". These reaction types are characterised in Section 3. The Appendix S1 (supporting information) provides Table S1 with detailed information on all dependent and independent variables and respective categories. Furthermore, it includes a detailed explanation of the created metric score variable that aims to weight the number of parameters valued as being "very important" or "important" (Table S2 in the Appendix S1). For each respondent, the questionnaire captured up to three observations of a specific dependent variable (reaction behaviour). The number of observations depends on how many OSD parameters were regarded as being "very important" or "important" by the respondent.

The model estimation was performed with the function "gam" from package "mgcv" (Wood, 2011) in the statistical software R (R Core Team, 2018). To evaluate the performance of each model, the area under the curve (AUC) value was calculated on a test set (comprising 20% of the respondents) which was not used for model estimation. The final reported results were obtained by re-estimating each model on the whole dataset including the test set.

3 | RESULTS

During the case study selection, differences in the reaction behaviour on destination level were assumed. Figure 2, however, shows no significant difference between the destinations, as the overall structure

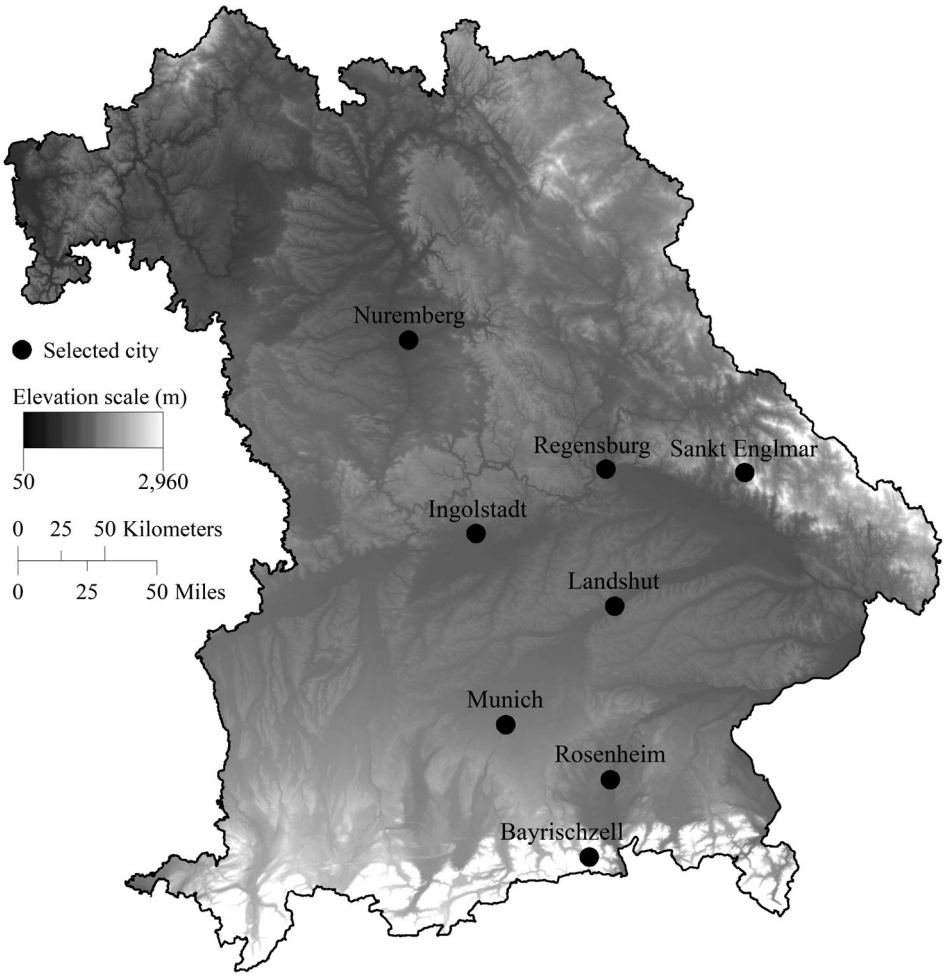

FIGURE 1 Map of the two case studies located in the German state of Bavaria. *Source:* own illustration based on EEA (2013)

and the ratio between day and overnight guests are similar. Only minor differences can be identified between the individual reaction types. In St. Englmar, winter (sport) tourists tend to switch the activity (e.g., to winter hiking or mountain biking), whereas in Bayrischzell, a bigger share changes the destination (e.g., due to low snow reliability). This can be explained by the destinations' structure and the tourists' preferences. Bayrischzell is primarily visited by alpine and cross-country skiers, who want to engage in one particular sport. In St. Englmar, in contrast, winter (sport) tourists are not bound by one specific sport, and the destination offers a wide range of activities. This may also be a reason why day guests in St. Englmar become activity switchers rather than time switchers, whereas in Bayrischzell, it is vice versa. With regard to the reaction behaviour, it becomes evident that in both destinations, around two-thirds of the winter (sport) tourists indicate a behavioural change. This is consistent with the findings of Behringer et al. (2000), Bürki (2000) and König (1998), who also considered "business as usual" as one response option in their surveys.

The following results concentrate on the reaction types among day guests, as both winter sport areas show a high share of day guests. However, within each reaction type, there are a few differences between day and overnight guests. Table 2 lists all explanatory variables for each reaction type among day guests. Relevant effects on the reaction decision and differences between the reaction types are presented by using a scale from "++ = very strong positive effect" to "– – = very strong negative effect". The row "research area" contains only one destination, provided that this destination shows a stronger effect on the reaction behaviour. As long as there is no difference, "both destinations" is listed. The Appendix S1 contains Table S3, which lists the respective statistical values: exponential regression coefficient "exp(b)" and the corresponding significance "*p*". Variables or categories that show significance at a given significance level (α = .05) are marked with "*". The *p*-values are listed for the sake of completeness, but should be interpreted depending on the models' AUC value. The adjustment of some models cannot clearly reproduce the correlation structures in the data, and thus the *p*-values should be interpreted with some care. All other variables and categories that are not listed in Table 2 but were used in the models (Table S1 in the Appendix S1) do not show an important effect on the reaction behaviour of winter (sport) tourists. For more detail, see the complete analysis results of all models in the Appendix S1. The number of respondents used in the models is *n* = 551, as logistic mixed models exclude all respondents who have missing values in one of the models' variables.

Destination switchers

Destination switchers primarily change to another destination when the alpine or cross-country ski area is not operating fully (e.g., due to

TABLE 2 Effects of explanatory variables for each reaction type among day guests (n = 551)

Explanatory variables	Reaction types (day guests)				
	Destination switchers	Activity switchers	Time switchers	Stop winter sport	Business as usual
Research area	Both destinations	St. Englmar +	Bayrischzell +	Bayrischzell +	Both destinations
Sunshine duration		+	+	+	
No precipitation				–	
No wind	–*	–	–	–	+
Snow-covered landscape	–*	–	–	++	+
Temperature (between −5 and + 5°C)	+	–	+		
Fully operating alpine and cross-country ski area	+		+		–
Sufficient snow depth on slopes	+			+	+
Perception: Winter sport conditions		–	+	++	+
Perception: Weather conditions					+
Perception: Expectations of the destination	–		–	++	+
Perception: Personal expectations	–	+			
Snowmaking infrastructure	+*	–	+	–	
Discount on ski ticket	–				+
Discount on overnight stay					
Events in the destination		++*	–	+	
Alternative, snow-independent, outdoor offers		++*	–	– –*	–
Complementary winter sport offers	–	–	+		+
Alternative indoor offers			+		–*
Type of winter sport currently practised	Alpine and cross-country skiing	Different winter sports	No winter sport and alternative winter sports	Cross-country skiing	No winter sport
Degree of activity in social media	+				
Degree of activity as a member of a sports club		+			
Sportiness	+*		–*	+	+
Amount of organic food consumed	–		+	+	–
Leisure activity: Sport			+	++	
Leisure activity: Work		+	–	+	–
Leisure activity: Culture				+	
Leisure activity: Personal framework		–*		++	+
Level of education			High education +	Low education ++	
Number of household members (< 18 years)	–*			+	+
Net household income	High*	Low to medium	Medium	Low to medium	Low to medium

TABLE 2 (Continued)

Explanatory variables	Reaction types (day guests)				
	Destination switchers	**Activity switchers**	**Time switchers**	**Stop winter sport**	**Business as usual**
Age	Young*	Middle-aged*	Young	Rather old	Middle-aged*
Gender	Predominantly female	Predominantly female	Male*	Female	
	AUC value 0.64	**AUC value** 0.74	**AUC value** 0.54	**AUC value** 0.60	**AUC value** 0.70

Source: own table based on analysis results

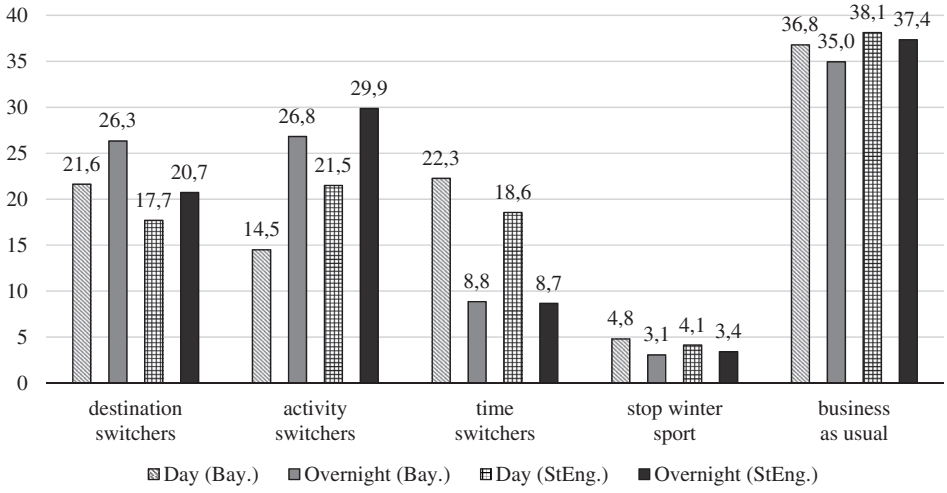

FIGURE 2 Reaction behaviour of winter (sport) tourists in the two destinations, differentiated according to day and overnight guests (in %; n = 751). *Source:* own figure based on survey data

bad snow conditions), whereas a snow-covered landscape (p = .0338*) does not play any role. This is consistent with their request for snowmaking infrastructure that guarantees open slopes (p = .0341*). Destination switchers can be described as young (p < .0001*) and sporty (p = .0006*) alpine and cross-country skiers that are similarly strongly represented in both destinations. They are more likely female, have fewer children (p = .0009*) and a high net household income (p = .0049*). Compared to the other reaction types, they show a higher activity rate in social media, but rather low organic food consumption. For overnight guests, in contrast, snowmaking infrastructure and a fully operating alpine and cross-country ski area are not important, whereas good weather and snow conditions do matter. This model is able to reproduce the correlation structures in the data (AUC value: 0.64).

Activity switchers

Activity switchers tend to change their activity in the case of unfavourable weather conditions. Due to their flexibility regarding winter sports, they do not require good snow conditions. This is also evident when looking at the additional destination offers that may serve as an incentive to visit the destination even though conditions are bad. They prefer music or cultural events (p = .0053*) and snow-independent outdoor offers (p < .0001*). Activity switchers are middle-aged (p = .0385*) and more likely female winter sport tourists in St. Englmar—practising alternative winter sports (p = .0117*) in particular—with a low to medium net household income. Furthermore, they describe themselves as active members of a sports club. Overnight guests only differ significantly regarding leisure activities. The model is clearly able to reproduce the correlation structures in the data (AUC value: 0.74).

Time switchers

Time switchers prefer to practise the initially intended winter sport instead of changing their activity. In particular, they postpone their trips in the case of bad weather or when the alpine and cross-country ski area is not operating fully. This can be countered by means of further winter sport and indoor offers (e.g., wellness, shopping). Time switchers are predominantly young and less sporty (p < .0001*) males (p = .0004*) with a high level of education and a medium net household income. They tend to practise alternative winter sports or no winter sport instead of cross-country skiing (p = .0238*) in Bayrischzell. Overnight guests prefer to travel with family and describe discounts on the overnight stay as an important incentive. The model is able to reproduce the correlation structures in the data. However, the results should be interpreted with care (AUC value: 0.54).

Stop winter sport

Respondents in this group stop practising winter sports when the landscape is not snow-covered or there is not a sufficient depth of snow on the slopes. Apart from good snow conditions, they express specific requirements with regard to the destination (e.g., good food, accessibility by train). These do not include snowmaking infrastructure or snow-independent outdoor offers (p = .0251*). They can be characterised as older, but sporty female cross-country skiers in Bayrischzell. They tend to have children, a lower level of education and a low to medium net household income, but show high organic food consumption. Leisure time activities are very diverse and range from sport and cultural activities to DIY. Overnight guests, in contrast, prefer snowmaking infrastructure. The model is able to reproduce the correlation structures in the data. However, the results should be interpreted with care (AUC value: 0.60).

Business as usual

Winter (sport) tourists in this group continue their travel behaviour (business as usual) even under unfavourable weather or snow conditions. They are similarly strongly represented in both destinations and tend to show a different reaction behaviour only when the alpine or cross-country ski area is not operating fully. They can be described as sporty and middle-aged (p = .0481*) with children, a low to medium net household income and low organic food consumption. They require an efficiently operating destination (e.g., good accommodation, enough parking spaces), but no indoor offers (p = .0185*). Furthermore, discount on ski tickets may serve as an incentive for them to keep on visiting the destination. Overnight guests tend to be young males without children who see no reason to change their behaviour. The model is clearly able to reproduce the correlation structures in the data (AUC value: 0.70).

The results clearly show that changes in the tourists' behaviour are not only due to unfavourable weather (e.g., lack of sunshine, precipitation), operating and climate-change-related decline in snow conditions (e.g., insufficient snow depth, lack of a snow-covered landscape), but also based on various influencing determinants (e.g., lifestyle, sociodemographic aspects). This confirms the studies of Bischof, Schmude, and Bauer (2017), Karl, Reintinger, and Schmude (2015) and Reintinger, Berghammer, and Schmude (2016) as well as the comparison of analogue study results with skier surveys (Steiger et al., 2019).

4 | DISCUSSION

This study investigates the response behaviour of winter (sport) tourists to adverse weather, snow and operating conditions in the future—differentiated according to day and overnight guests. Potential differences in the reaction behaviour of winter (sport) tourists are examined, and the personal traits of each reaction type are described in detail. Finally, these findings are discussed with regard to previous studies and their consequences for winter sport destinations. Moreover, further research needs and limitations of the approach are indicated.

Around two-thirds of the winter (sport) tourists intend a behavioural change (see Figure 2). The type of change varies widely and thus, causes diverse effects in the destination or the regional market. Previous studies (e.g., Rutty et al., 2015a; Scott et al., 2012; Steiger et al., 2019) described the effects of the tourists' reaction behaviour for the regional market, though not on the destination level. As this study includes winter (sport) tourists, local impact of the tourists' behaviour becomes more differentiated. On the destination level, destination switchers and those who stop practising winter sport will lead to a loss of winter (sport) tourists. Witting and Schmude (2019), for example, investigated how this affects key actors involved in winter tourism for a ski area in Germany economically. This loss of tourists especially concerns alpine and cross-country ski operators, as both reaction types primarily use their expensive infrastructure. But other stakeholders, such as food, shopping or accommodation, will also be affected by direct economic consequences (e.g., decline in turnover). This refers in particular to destination switchers, who are strong in economic terms (highest net household income) and represent a high share of overnight guests. Therefore, destinations need to think about how to compensate for these losses. In this context, it should be noted that these tourists cannot always be replaced one-to-one, since the expenses of a winter (sport) tourist differ significantly from those of other tourists (e.g., hiking, wellness) (Witting & Schmude, 2019). Furthermore, the reasons for the reaction behaviour as well as the personal traits of these two groups are completely different. Compared to all other reaction types, destination switchers make their decision particularly subject to the reliability of snow at a destination (e.g., existing snowmaking infrastructure and a fully operating ski area). Consequently, it can be assumed that those who change their destination (from low-lying to high-altitude destinations) in winters with little snow may return to their previous destination in winters with an abundance of snow (Töglhofer, Eigner, & Prettenthaler, 2011). This may apply for some German destinations with favourable conditions (e.g., good snowmaking infrastructure, altitude, exposure), but most destinations will have to cope with severe impact due to climate change and thus cannot rely on this effect. According to Steiger, Posch, Tappeiner, and Walde (2020), destinations with suboptimal snow conditions and lower snow reliability may introduce dynamic pricing (e.g., throughout the season and dependent on snow conditions) in order to partly compensate for potential losses. With regard to the personal traits, destinations will lose a young target group which is active in the social media. This in turn may negatively affect the destinations' digital visibility and image and thus influence the destination choice of future travellers (e.g., Lange-Faria & Elliot, 2012).

For the group "stop winter sport", it can be assumed that winter sport (especially cross-country skiing) will become uninteresting in the long run due to a climate-change-related lack of a winter experience (snow-covered landscape) in their destination. This aspect is very

important for this group compared to all other reaction types: this OSD parameter is crucial for the reaction behaviour of only 3–5% of the winter (sport) tourists (reaction type: "stop winter sport"). Compared to the study of Unbehaun et al. (2008) one decade ago, where 77% of the respondents stated that the winter experience is of great importance for their choice of destination, this aspect seemed to decline in significance. This confirms the results of Falk and Lin (2018), who found that the turnover of ski lift operators no longer depends on natural snow. Today, tourists might be more used to practising winter sports on white stripes of snow in snow-less, brown surroundings. Further reasons for the reaction behaviour can be the comparatively higher age or more environmentally oriented values. This reaction type is characterised by an above-average consumption of organic food compared to the rest of Germany (BLE, 2018). This can be seen as an indication for an orientation toward environmental values. In view of the current discussion about sustainability and new (ecological) values in Germany, it is to be expected that the share of those who stop practising winter sport may increase in the near future. Thus, destinations need to think about how to compensate for this further loss of winter (sport) tourists. Due to the environmental awareness of this group, for example, offers focussing on nature and health topics could be a possibility for destinations.

Other types, in contrast, have a stronger connection to the destination. This applies in particular to activity and time switchers, who are equally weather sensitive, but differ considerably with regard to the guest structure (see Figure 2). Time switchers show a high share of day guests, whereas overnight guests prefer to change the activity. This can be explained by the booking process, as overnight guests book in advance and cannot react as flexibly as day guests. Though all previous studies lack such a differentiation, it presents an important element in understanding the tourists' reaction behaviour. This results in a differentiated picture regarding the economic effects of activity switchers. While changing the activity may negatively affect particular actors (e.g., alpine and cross-country ski operators), this means predictable revenues for others (e.g., accommodation). Although this study did not inquire about the activity that substitutes the originally intended one, respondents in this group prefer additional snow-independent offers (e.g., expansion of events and alternative outdoor sport opportunities). Consequently, for some destinations it would be economically appropriate to change their investment strategy and to set up snow-independent offers instead of investing in new or better snowmaking facilities (Pütz et al., 2011). This would not only be an incentive for activity switchers to stay in the destination, but can also be seen as a pull factor for additional tourists.

Time switchers, on the other hand, can be described as regular guests who are emotionally linked to the destination—comparable with the "repeaters" in cruise tourism (Petrick, 2004). The temporal shift means increasing uncertainty for destinations, especially those with a high share of day guests, as this reaction behaviour primarily exists among day visitors (see Figure 2). Furthermore, this reaction behaviour can lead to a high concentration of demand on days with good weather, snow and operating conditions (e.g., Steiger et al., 2019). In the long term, this demand may exceed the carrying capacity of the local infrastructure or landscape and lead to further problems (e.g., crowding) (e.g., Dawson et al., 2011; Rutty et al., 2015a). For this reason, destinations should focus primarily on customer loyalty programmes or combining offers (e.g., sport and wellness). The low degree of sportiness illustrates that the winter activities among this group are not primarily about sport or physical fitness.

The greater proportion of winter (sport) tourists will remain in the destination without any behavioural change. At first glance, this group seems to be very uncomplicated for destinations. However, closer examination reveals that their decision very much depends on the destinations' snow reliability. As soon as snow conditions on alpine and cross-country slopes worsen, this group will show a different reaction. Due to the lack of similarities with the other reaction types (e.g., regarding personal traits), results give no indication of the type of response. In order to bind these tourists to the destination, a discount schedule on ski tickets could be implemented as a flexible short-term measure, whereas establishing complementary winter sport offers would be a more long-term measure.

It becomes evident that destinations need to actively adapt to the changes, taking into account the guest structure as well as the tourists' personal traits and individual expectations (e.g., desired offers). They will not be able to adapt to all of these very different demand-side requirements, but they should precisely understand both the demand-side and the supply-side effects of climate change in order to implement suitable measures (Dawson & Scott, 2013). In addition to the effects of the tourists' reaction behaviour, destinations must bear in mind that demographic change may also lead to declining demand in the future (e.g., Steiger, 2012; Witting & Schmude, 2019).

5 | CONCLUSION

This study follows an explorative approach that aims to test the developed statistical models and contributes to the current research. The results do not claim to be representative for all ski areas in the German Alps, but can be seen as an important contribution to the discussion, because previous studies did not include the German winter sport market, which is one of the most vulnerable to climate change in the European Alps (e.g., Mayer & Steiger, 2013; Steiger & Abegg, 2015). Furthermore, none of the previous studies on behavioural response considered different winter (sport) tourists or differentiated between the reaction behaviour of day and overnight guests. This study clearly demonstrates that both aspects together need to be included in future research in order to better display the heterogeneity of winter (sport) tourists. With regard to the different winter (sport) tourists under investigation, this study illustrates that alpine skiers prefer to change their destination or activity in particular. This is contrary to the results of Bürki (2000), Behringer et al. (2000), König (1998), Pickering et al. (2010) and Rutty et al. (2015b), where activity substitution is of comparatively low importance. Only Dawson et al. (2013) and Demiroglu et al. (2018) identified a similar tendency among alpine skiers. It needs to be considered that Demiroglu et al. (2018) investigated the response of summer (glacier) ski visitors

and in Dawson et al. (2013), activity substitution also included spending more time with family, participating in passive indoor activities (e.g., watching movies, playing video games) or working more. In contrast to previous studies, this survey used the very clearly defined OSD parameters to investigate reaction behaviour. The results emphasise that weather, snow and operating conditions are key factors in deciding whether and how winter (sport) tourists change their travel behaviour. Furthermore, the questionnaire included a set of questions on sociodemographic aspects, some of which (e.g., age, gender, net household income) revealed significant differences between the reaction types. Similar to the results of Cocolas et al. (2015) and Rutty et al. (2015b), young respondents are more likely to change their destination than older age groups. With regard to gender, males and females differ significantly in their response behaviour, which is consistent with (Dickson & Faulks, 2007). Furthermore, net household income emerged as an important aspect that may influence reaction behaviour. This is in line with the findings of Unbehaun et al. (2008), who stress that tourists are very sensitive to prices. As the price of ski tickets will most probably increase due to high snowmaking costs (e.g., Damm, Köberl, & Prettenthaler, 2014; Mayer & Steiger, 2013), this aspect will grow in significance. Finally, the survey included a small set of questions that aimed at querying the tourists' lifestyle. The results show that lifestyle is one of several aspects that influence the tourists' reaction behaviour. However, this, needs to be further investigated with a more comprehensive set of questions.

Apart from this, the study is subject to certain limitations. Data was collected on only 3 days in each winter sport destination. In this context, it needs to be considered that not only the season, but also certain weather conditions influence the respondents' answers (e.g., Gössling et al., 2012). Future research would need large scale quantitative surveys during the whole winter season in order to statistically validate the results. When interpreting the results, two aspects need to be borne in mind: (a) the questionnaire contains self-evaluation questions (e.g., amount of organic food consumption) that may support response bias, for example social desirability and; (b) respondents are asked about their intended and not their real-life behaviour (Abegg, Steiger, & Trawöger, 2017). With regard to the statistical analysis, the logistic mixed models "time switchers" and "stop winter sport" show rather low AUC values and thus need to be interpreted with care. This can, to some extent, be explained by a comparatively small number of respondents.

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ORCID

Maximilian Witting https://orcid.org/0000-0001-5944-5088

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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