


Generational approaches to climate change with special regard to tourism and recreational habits - Results of a Hungarian survey

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Received: June 29, 2020 • Revised manuscript received: September 29, 2021 • Accepted: October 14, 2021

Published online: November 18, 2021

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ABSTRACT

Although the issue of the coronavirus pandemic has temporarily overridden discussions on the impacts of climate change on tourism, they have not lost their relevance at all. The exposure of the tourism industry to these effects is indisputable. This study, conducted in 2019–2020, examined the perceptible impacts of climate change that generate further changes, and the issue of climate adaptation involving certain supply-side players in the tourism sector at the local and regional levels. In the questionnaire used to explore the topic, questions were asked about a number of perceptible phenomena and their effects on everyday life, recreational habits, and adaptation. The quantitative surveys involved 1,615 respondents from the Transdanubian region of Hungary (NUTS1/HU2). The results of the research clearly confirm that the problem of climate change is no longer a concern only for scientists, and although the different generations perceive and evaluate the phenomenon differently in many cases, it increasingly affects people's everyday lives and recreational habits. The perceived effects experienced by the respondents clearly influence the enjoyment of certain tourism product groups (beach holidays, hiking, attending open-air events) and the comfort and satisfaction experienced by individuals.

KEYWORDS

climate impacts, tourism, climate change adaptation, survey, generation

JEL CLASSIFICATION CODES

Q54, L83

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1. INTRODUCTION

Today's scientific forums and discussions are no longer about the reality of climate change but its causes, ways to mitigate its effects and adaptation. Based on the scientific results known and widely accepted today, the phenomenon will test the adaptability of the entire world, including humans, in the next decades. Both the direct (e.g. heatwaves, rising sea levels) and the indirect (e.g. challenges of water and food supply; 'climate refugees'; the vulnerability of infrastructure) effects prophesy dramatic changes and the need to adapt for successive generations.

According to Nemes (2019), the 21st century will be the 'age of chameleons', characterized by adaptation, social inequalities, climate change and widely spreading modern technologies (robotics, artificial intelligence). The actors of society have no choice but to constantly change and adapt, and each generation must do so with different experience, knowledge and tools.

This study, presenting some of the results of the research project titled 'You feel it, see it or just hear about it', launched in 2019, examines the issue of climate change in a generational approach, highlighting people's knowledge of climate change, its perceived effects and the impacts of the phenomenon on everyday life and recreational habits. The hypothesis was that the feedback and insights of individual age groups concerning the topics would help understand the social aspects of the issue: the perceptions and reactions of individuals and society often overawed by the deluge of expert opinions, and random images from cyberspace and the media. Although the Coronavirus pandemic has temporarily overshadowed the climate issue, it has not lost its significance at all. On the contrary, humanity's vulnerability and the importance of adaptation and prevention have been dramatically exposed by the recent events.

The literature review section of the paper introduces the challenges caused by climate change and their social aspects. The subsequent sections present the research, based on stratified sampling with independent strata and personal interviews, and its results. The population's knowledge related to climate change, the perceived effects of the phenomenon and the related patterns of behavior, with special regard to recreational habits, are presented in a generational approach. By analytically assessing each particular age group's attitudes to the examined issues, their experiences and reactions, the concluding section highlights how important it is for the topics of prevention and climate adaptation to be gradually integrated into people's everyday lives, as well as the activities of the affected actors of the economy, including those of the tourism sector.

2. LITERATURE REVIEW

2.1. Climate change, climate adaptation and prevention - challenges of our age

The problem of climate change has been researched for decades, and by the turn of the millennium it had become a widely accepted and scientifically proven fact. The reports of the Intergovernmental Panel on Climate Change (IPCC) have provided an appropriate international scientific framework for research and debate on the subject since 1988. According to the organization's most recent interim short assessment (not the one traditionally published every 6-7 years), the Earth had already warmed by 1 °C compared to pre-industrial levels, and is expected to exceed 1.5 °C between 2030 and 2052 if current trends continue (IPCC 2018). As stated in the scientific literature, this can trigger a series of mutually reinforcing consequences, which can only be prevented by a long, worldwide transformation process starting now.



By now, the harsh opinions of many climate sceptics have also softened; instead of denying climate change, the issue has shifted to the question of human responsibility. According to [Piazza \(2021\)](#), mitigating the effects of climate change is one of the biggest ethical and political challenges facing our society today. [Kingsley \(2011\)](#) points out the overvaluation of human activity, however, he argues that this does not mean that we can remain disengaged. [Giddens \(2009\)](#) and [Green \(2001\)](#) draw attention to the need for continuous monitoring, understanding the causes and effects of the phenomenon, its thorough exploration and doing everything possible to mitigate the consequences.

Accepting natural changes and adapting to them is a much greater challenge for some countries and regions, both in terms of everyday predictability and security risks. Referring to the results of international and Hungarian research, [Pálvölgyi et al. \(2016\)](#) made a series of observations regarding Hungary. As the greenhouse effect intensifies in the region, the rise in the average temperature in the next decades is expected to be higher than the assumed rate of global warming. Moreover, the Hungarian climate will be characterized by extreme precipitation conditions; severe droughts and devastating floods can be expected even within the same year. The Carpathian Basin is characterized by territorial inequalities of various kinds and origins, which may become even greater as a result of climate change and other global changes. The above points all call for the strategic integration of ‘climate security’ and ‘climate proofing’ for the future.

The options for activities tackling the challenges posed by climate change fall into three main categories: emission reduction (mitigation), adaptation and shaping public opinion. Hungary’s Second National Climate Change Strategy ([Ministry for Innovation and Technology, Hungary 2018](#)) also identified these three main directions for action in terms of medium-term climate policy. A study of the [National Adaptation Center of the Institute of Geological and Geophysical Institute of Hungary \(2017\)](#) points out that the joint application of the above areas of intervention is necessary in all cases.

2.2. The social aspects of climate change

The transition to decarbonization requires the harmonization of complex social, technical and ecological systems, which is only attainable by the interplay of natural ecosystems, institutional regulations, private markets, infrastructures, technological innovations and user practices ([Geels et al. 2017](#); [Geels – Schot 2007](#)). Related to the above, [van de Poel et al. \(2015\)](#) highlights a phenomenon known as the ‘problem of many hands’: in the case of the involvement of many actors, it is difficult to determine who is responsible morally and why. Discussing this topic, several authors emphasize the gratifying fact that climate-conscious morality has finally got into the mainstream of public discourse, politics and mass communication. Over the years, the issue has clearly outgrown the scientific community ([Mackenthun 2021](#); [Ostheimer – Blanc 2021](#)). More and more factors, interests and phenomena are related to it, including political discourses, economic considerations and the involvement and responsiveness of certain social cultures to the issue ([Wieding et al. 2020](#); [Kriston 2018](#); [Bereczki 2012](#)).

According to [Kulcsár \(2013\)](#), climate change can be increasingly classified as one of the factors whose effects contribute to the transformation of the economic and social structure. The challenges of food production and water supply, for example, project a new type of migration wave that is larger than anything before. [Padányi and Halász \(2012\)](#) stress the concept of environmental sensitivity, which means that different natural, ecological, physical or social systems react differently to external impacts depending on their sensitivity.



Environmental concerns, commitment, pro-environmental behavior and related development opportunities and motivations are in the focus of much of the literature (Singh et al. 2018; Gkargkavouzi et al. 2018; Maichum et al. 2017, Keshavarz – Karami 2016). Studies focusing on the sensitivity of certain demographics to environmental problems have come to the fore (Kahan et al. 2007; Hersch – Viscusi 2006). Several authors (Baranyai – Varjú 2017; Agg – Csapó 2015) specifically investigate issues and attitudes related to climate change. Regarding this cross-generational issue, the individual generations' responsibilities, motivations and willingness to act are often in the focus of attention. However, the wider exploration of the topic and the practical application of the results still pose a significant challenge; geographical, economic, cultural and other factors also influence their assessment.

As discussed above, climate change in Hungary is expected to be accompanied by—among other things—warming, dry periods and an increase in the frequency and intensity of extreme weather events. They will appear differently in time, space and society (and in several economic sectors), and may have various effects (negative or positive) depending on sensitivity, tolerance and vulnerability. The imminent changes clearly require individual and societal adaptation.

2.3. The impact of climate change on everyday life and recreational habits

Every region faces constant changes in the economic, environmental and social conditions, which are influenced by many factors. In terms of impacts on society, the effects of climate change may also affect everyday life and recreational habits. The effects on tourism have been the subject of numerous international studies around the turn of the millennium and in the years that followed (Rutty – Scott 2014; Sauri et al. 2013; Scott et al. 2012; de Freitas et al. 2008; de Freitas 2003; Huybers 2003). These contributions draw attention to the fact that a significant proportion of tourism products and recreational habits depend on weather, and with its changes, some products may lose some of their popularity and even the image of certain destinations may be damaged. Under extreme conditions, they may even lose their entire ability to attract visitors. Previous research has now been complemented by studies on overtourism and its possible solutions. The extremely negative effects on the host communities and/or the natural environment at constantly or periodically popular destinations are cause for concern (Benner 2019). In Hungary, research on the effects of climate change on tourism has intensified since 2010. The works of Michalkó et al. (2020), Kajner et al. (2017), Lőrincz et al. (2014), Aubert et al. (2014), Csete et al. (2013) highlight the local aspects and peculiarities of the issue and the importance of related research.

2017 was the International Year of Sustainable Tourism for Development, drawing even more attention to studying the environmental impacts of tourism. Prevention and adaptation are now widely discussed. In her research, Karakasné (2017) examined the food waste present in the hotel industry and its minimization possibilities. Németh et al. (2018) and Ásványi et al. (2017) investigated the role and potential of renewable energy sources in the tourism sector. The impact of the transport sector on tourism has also come into focus (Peeters 2019; Jebli – Hadhri 2018). The above points highlight the complexity of the issue and call for the strategic integration of 'climate security' and 'climate proofing' in the future.

3. METHODOLOGICAL APPROACH

Following the turn of the millennium, research in connection with climate change and its societal and economic effects has appeared in large numbers and great diversity. The examination



of the climate adaptation of the tourism sector has become the focus of the literature mainly in the past few years. Exploring the related knowledge on the consumers' side, understanding the reactions and decisions is an important and indispensable element in moving towards responsible travel and recreation. This research examines the population's knowledge regarding the issue of climate change, its perceptible effects, and the related forms of behavior in a generational approach. In the questionnaire used to explore this topic, everyday phenomena, their effects and related adaptation responses were asked about. The scope of the investigation also included the effects of the perceptible phenomena of climate change on travel, recreational habits and the changes in related decisions.

The survey involved stratified sampling with independent strata and personal interviews. Thanks to the proportional stratification, results were obtained for each demographic, furthermore, representativeness was also achieved according to demographic characteristics. The questionnaire contained mostly closed-ended questions with some mixed ones too.

The research, which involved respondents from the Transdanubian region of Hungary (NUTS1/HU2) lasted from September 2019 to November 2020. To explore the whole context, a generational approach was applied, assuming that each isolated age group views and experiences the problems differently. Each generation was delimited according to Kulcsár's (2014) study based on the attitude of each group to the digital world (Generation Alpha, born after 2010, was not included in the research due to their young age). The representative survey was based on the age and territorial delimitation of the 2011 census of the Hungarian Central Statistical Office. In the study, the proportions of respondents by age group in the region show significant agreement with the results of the census. Table 1 summarizes the composition of the representative sample

Table 1. Generational distribution in the surveyed Transdanubian area (NUTS1/HU2), composition of the sample

Age groups (according to year of birth)*	Number of population in the examined area (N)	Percentage of population (%)	Size of sample in the examined area (n)	Percentage of sample (%)
1996–2009 (Generation Z)	781,224	26.01	420	26.01
1980–1995 (Generation Y)	648,878	21.61	349	21.61
1965–1979 (Generation X)	617,004	20.54	331	20.50
1946–1964 (Baby Boomers)	737,331	24.55	397	24.58
in or before 1945 (Veterans)	218,778	7.28	118	7.31
The five generations in total	N = 3 003 215	100%	n = 1615	100%

Source: authors.



by age group and the distribution by age group of the 3,003,215 people living in the area. 1,850 people were asked in the survey and the sample population was 1,615 people.

Correlation analyses were performed by association calculation using SPSS 26 software. The analysis of the relationship between two criteria measured on a nominal scale is the association analysis, during which it is determined with the help of Cramer's V-index how close a relationship is between the two criteria ($P = 5\%$). The index ranges from 0 to 1, with a value of 0 indicating a lack of relationship and a value of 1 indicating that the relationship is functional (Foster et al., 2018).

The methodology chosen for the research presented in this study provides a good basis for showing how much the perceived phenomena of climate change concerns the respondents and encourage them to take action. The examination allowed a comprehensive and credible presentation of the relationships observable between the generations. These investigations can contribute to the exploration and understanding of certain consumer side climate adaptation issues in the tourism sector, as well as to the definition of areas of intervention necessary for achieving sustainable tourism.

4. EVALUATION AND DISCUSSION

4.1. General approaches: knowledge and associations related to the topic

On the basis of the respondents' answers, it can be stated that everyone has heard of the problem of climate change regardless of age group, and they are mostly aware of the phenomenon in the general sense. The survey sought to identify what those few facts were that came to people's minds if the issue of climate change was mentioned, so a classical association survey was done related to this. The answers to the open-ended questions that were related to the same notions were grouped in categories (e.g. changing/extreme/changeable weather; melting ice, glaciers, polar region). There was no difference between the demographics regarding the most common mentions: the association of 'warming/global warming/warm' was at the first place in every age group. Among the second most common mentions, two categories 'changing/extreme/changeable weather' and 'melting ice, glaciers, polar region' appeared in the answers. The latter appeared in the group of those born in 1996 and after. Among the third most common answers the associations of 'change/shift/transformation of seasons' (born 1946–1964 and 1965–1979) and 'environment/environmental pollution/environmental protection' (born 1980–1995) were added. From the above, an absolute order, independent of age groups, can be determined, which characterizes the associations related to the topic:

- Warming/global warming/warm (473 mentions);
- Changing/extreme/changeable weather (258 mentions);
- Melting ice, glaciers, polar region (80 mentions);
- Change/shift/transformation of seasons (65 mentions);
- Environment/environmental pollution/environmental protection (36 mentions).

There are several interesting things to observe regarding the thoughts appearing in each age group. For example, the polar bear seems to be a kind of a symbol of the phenomenon in every group. Mentioning names multiple times appears in the age groups who were born between 1980 and 1995 and after 1996: multiple mentions of David Attenborough, Greta Thunberg,



Donald Trump, Arnold Schwarzenegger, Leonardo DiCaprio are an interesting part of the examination of this subtopic. Among company names, Tesla, which specializes in the production of electric cars, and the British-Dutch Shell oil company appeared in the associations connected to climate change. This highlights the phenomenon when globally known companies, brands or personalities show environmental engagement. Statements by ‘opinion leaders’, popular videos, photos and memes in the online space can go viral globally within hours and can affect the appreciation of any issue. Based on our studies, these (negative or positive) associations were primarily found in the case of those born after 1980.

Among the general questions exploring the issue of climate change, the knowledge and awareness of the phenomenon were also probed. The answers to the closed-ended questions revealed that more than half of the respondents (59.3%, 958 people) felt that they had average knowledge of the topic (know and have heard of several things). Nearly a third of the respondents (28.7%, 464 people) considered their knowledge to be incomplete (have heard about it but do not know the details). These two categories covered most of the answers (88%, 1,422 people). Nearly one tenth of the respondents (8.4%, 136 people) considered their knowledge to be thorough (comprehensive knowledge). The category of having no knowledge about it (has not heard of it) represented only a few percent (3.5%, 57 people).

The analysis of the responses of the age groups (Fig. 1) shows that the above (cumulative) ratios were also very similar within each group. In the thorough knowledge category, the generation born between 1980 and 1995 achieved a value of more than 10%. The answer revealing a lack of knowledge only preceded the average-knowledge category in the group born in 1945 or before.

The results of the correlation analysis show that there is a weak correlation between belonging to an age group and the respondents’ assessment of their knowledge related to climate change ($V = 0.139, P = 0.000$). However, it is worth mentioning that the selection of the ‘I have average knowledge’ category may also be a routine reply, characteristic of similar questions. To

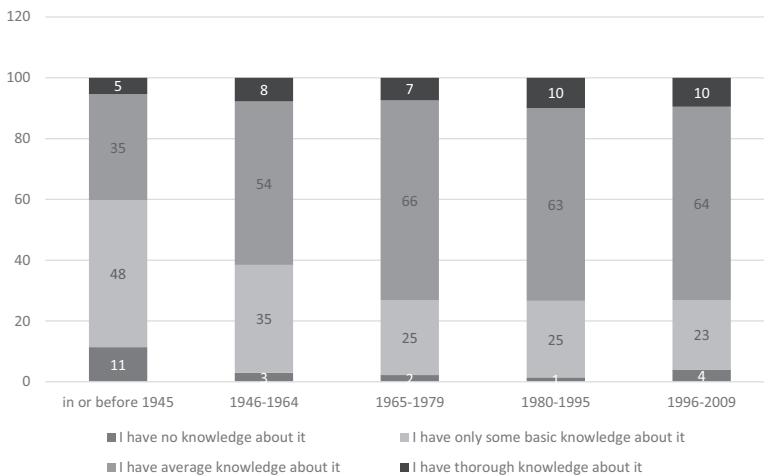


Fig. 1. The assessment of knowledge related to climate by age group (%)

Source: authors.



compensate for this, it is worth examining the two positive (average and thorough) categories together. In connection with the results obtained in this way, it is certainly encouraging that in the responses of those born between 1946 and 1964, the 'top' two categories exceed 60% (61.6%, 205 persons) and 70% for all age groups born after 1965. It is the highest among those who were born between 1980 and 1995 (73.3%, 256 people). This cannot, of course, be generalized in terms of actual, specific knowledge of the subject, but it can certainly indicate the kind of openness and interest that can form the basis of active engagement concerning the issue, which is becoming urgent for all social groups and generations.

4.2. Novel phenomena previously not experienced or only to a lesser degree

An important element of the research was the examination of what kind of novel, previously not, or less experienced phenomena related to weather and climate change were perceived by the respondents (Table 2). The table summarizing the frequency of each answer to the closed question is color-coded, darker shades indicating more frequent answers.

Considering the aggregate responses of the respondents, the temperature sub-topic is the most prominent. Here, in connection with the 'lack of winter snow' and the 'lack of long-lasting snow cover', 'shifting seasons', 'shorter transitional seasons (fall, spring)' the most common answers were 'it occurs more and more often' and 'it has become a fact of life nowadays'. The response selected by the most respondents (657) was 'it occurs but not often' referring to 'long cold periods', which is in agreement with the (most noticeable) changes related to the winter season, as experienced by the respondents.

In the other two sub-topics (precipitation, other factors), the responses were much more evenly distributed. Only in connection with the phenomenon of strong UV radiation is there a clear shift towards the 'it occurs more and more often' and 'it has become a fact of life nowadays' responses. In terms of the sub-topic of precipitation, the perception of annual precipitation presents an interesting contradiction. The similarity of the responses regarding 'increase of annual precipitation in total' and 'decrease of annual precipitation in total' can probably be attributed to changes in the temporal distribution of annual precipitation (and its perceptibility depending on place of residence, daily activities and the nature of work). Frequent droughts also occur as a phenomenon perceived by the respondents (experienced more often than before). Contrary to our expectations, the experience related to flash floods caused by sudden and large amounts of precipitation mostly appeared in the 'it occurs but not often' and 'it does not happen' categories. In the future, it may be interesting to examine this phenomenon by settlement type, as this problem is much more palpable where the proportion of built-up areas is high.

Examining each age group, it can be stated that the category most significant from the perspective of the research, i.e. 'it has become a fact of life nowadays' appeared in the oldest group (born before 1945) regarding the 'lack of long-lasting snow cover', 'shorter transitional seasons (fall, spring)', 'weather earlier not typical for the given season' and 'strong UV radiation'. This answer was not selected for any of the sub-topics among those born 1946–1964 and 1965–1979. Among those born 1980–1995 and after 1996, the 'lack of long-lasting snow cover' appears the most often in the category of 'it has become a fact of life nowadays'.

Concerning the results above and perceived phenomena, it is important to stress that with increased emphasis on the aspects of comfort and people's heightened need for comfort,



Table 2. Novel, previously not or less experienced phenomena (answers in percentage)*

	Groups of phenomena related to climate change	It does not happen.	It occurs but not often.	It occasionally happens.	It occurs more and more often.	It has become a fact of life nowadays.	Total %/n
Precipitation	Intensive rain events	10.2	36.4	27.1	21.7	4.5	100/1615
	Frequent storms with strong wind, precipitation	8.0	34.6	29.5	22.6	5.3	100/1615
	Flash floods – from short heavy rain	27.9	34.2	19.6	14.6	3.6	100/1615
	Inundations - permanent surface water mass	29.8	36.8	19.8	10.4	3.1	100/1615
	Decrease of annual precipitation in total	25.1	25.4	24.1	17.9	7.4	100/1615
	Increase of annual precipitation in total	36.0	28.4	19.4	12.5	3.7	100/1615
	Drought - lack of precipitation accompanied by great heat	12.1	27.0	28.7	23.5	8.7	100/1615
Temperature	Long, unusually strong heat waves	4.6	17.1	29.8	33.9	14.6	100/1615
	Long cold periods	25.3	40.7	18.6	10.0	5.4	100/1615
	Lack of winter snow	3.8	14.4	20.2	36.3	25.3	100/1615
	Lack of long-lasting snow cover	4.2	11.3	19.0	33.1	32.4	100/1615
	Shifting seasons	3.3	11.1	20.4	35.5	29.7	100/1615
	Shorter transitional seasons (fall, spring)	4.4	13.9	22.2	34.1	25.4	100/1615
Other factors	Weather earlier not typical for the given season	4.6	15.7	28.9	33.6	17.2	100/1615
	Unpredictable weather	4.9	14.1	27.0	33.3	20.7	100/1615
	Changes in flora	11.7	25.5	30.6	22.7	9.5	100/1615
	Changes in fauna	15.7	26.8	29.0	19.0	9.5	100/1615
	Spread of diseases affecting human health	10.9	23.5	24.3	26.9	14.4	100/1615
	Increasing weather sensitivity	7.6	14.9	24.4	35.2	18.0	100/1615
	Strong UV radiation	5.5	11.9	23.2	33.7	25.8	100/1615

* Color-coding: the more frequent the answer, the darker the shade. Single-choice questions.

Source: authors.



tolerance levels are changing; needs (desires) shift towards ‘ideal office temperatures’ and ‘ideal holiday or hiking weather’. Deviations from these often make lasting impressions on people.

4.3. The impacts of weather phenomena related to climate change on everyday life and recreational habits

In addition to the individual perceptible phenomena, their effects on everyday life and recreational habits were also examined by the questionnaire. Exploring the topic, a number of perspectives and approaches were encountered, and those of them related to the examined sub-topic are highlighted here. Regarding the activities listed in Table 3, the recreational habits of the respondents were affected differently by the weather.

The answer ‘made impossible on numerous occasions’ did not stand out for any of the listed activities in terms of the number of responses. It appeared in the highest proportion (9.6% of the respondents) in connection with ‘Holiday, recreation by/near water’. The ‘strongly affected’ or ‘partly affected’ categories appeared with more weight concerning ‘Walking, hiking’ (69.3%); ‘Attending open-air events’ (69.8%) and ‘Holiday, recreation by/near water’ (67.5%).

Examining the ‘strongly affected’ category independently, it was conspicuous in connection with ‘Holiday, recreation by/near water’ (36.5%). Thus, deducing from the respondents’ opinions, the exposure of the activities listed above can be considered high or partially high. The assessment of winter sports is not so clear, after the ‘not affected’ category (49.6%) the ‘strongly affected’ category (21.4%) is at the second place.

Table 3. The role of unpleasant/unusual weather phenomena resulting from climate change and their influence on recreational habits (answers in percentage)*

Activities	Not affected	Partly affected	Strongly affected	Made impossible on numerous occasions	Correlation between belonging to age group and climate change as influencing factor V/p (5%)
Relaxing, spending free time at home	34.1	43.3	18.7	3.8	0.045/0.622
Walking, hiking	23.5	39.4	29.9	7.2	0.123/0.000
Cultural tourism (sightseeing, tours)	29.2	41.2	25.0	4.6	0.116/0.000
Attending open-air events	22.0	35.6	34.2	8.2	0.165/0.000
Holiday, recreation by/near water	22.9	31.0	36.5	9.6	0.168/0.000
Wellness- and health services	64.8	24.9	8.7	1.6	0.064/0.072
Religious tourism	80.2	12.6	5.6	1.7	0.075/0.007
Business tourism (incl. MICE)	78.1	14.7	5.6	1.6	0.52/0.380
Shopping tourism	62.7	26.4	9.4	1.5	0.06/0.139
Sport tourism	52.8	27.2	15.7	4.3	0.128/0.000
Winter sport	49.6	20.1	21.4	8.9	0.125/0.000
Adventure tourism	50.5	28.0	16.3	5.2	0.147/0.000

* Color-coding: the more frequent the answer, the darker the shade. Single-choice questions.

Source: authors.



The ‘not affected’ category appeared markedly in the wellness- and health services, religious tourism, business tourism, shopping tourism; Sport tourism, adventure tourism, and winter sports categories.

Disregarding religious and business tourism due to their more restricted nature and (classical) winter sports because of the uncertainties detailed in the previous chapters, the other activities listed above clearly belong to the ‘climate-proof’ category and offer a kind of alternative to activities that are more exposed to weather conditions. As the ‘classical big summer holiday’ in Hungary is concentrated in a shorter period, the consumer reactions examined herein may also be a warning to service providers that the actors on the supply-side of the tourism sector will have to face the challenges of having to offer unique and diverse products. In this respect, indoor wellness and medical services are a sure point for those who want to relax. Services ‘built’ around them (such as adventure parks, but also beaches in the vicinity, bike paths) appear to be a major advantage among services in rural areas. This may increase, depending on the previously mentioned comfort requirements and the evolution of tolerance limits. Added to this may be the issue of the rapid flow of information created by the internet and the consequent possibility of flexible changes in plans on the demand side.

There were no significant relationships, or even if there were, they were only weak ones, between belonging to an age group and judging the extent to which weather phenomena resulting from climate change affect tourism activities. Examining each age group in more detail, the most striking difference was regarding open-air events. It was observed that both the post-1980 and post-1996 age groups selected the exposure of outdoor events, clearly very popular among younger people, in a higher proportion. Most of the answers concerning the activity were in the category ‘strongly affected’ with 136 and 179 responses, i.e. 39% and 43% of the answers for these activities. Thus, besides holidays by/near water, open-air events showed this high level of exposure. Therefore, in the two above-mentioned age groups, festivals, open-air concerts, and also events involving families with small children, seem to be in the focus also in terms of the issues examined. The weather risk of these events on the organizers’ side is significant. From their perspective, this can be a significant cost-increasing factor, resulting in, for example, higher ticket prices on the demand side. Thus, climate adaptation issues in a broader sense also have effects that cannot be ignored on either the demand or supply side. The costs of adaptation are ultimately borne by consumers in the vast majority of cases.

4.4. Weather forecast information and its role in shaping recreational and travel habits

Regarding the wider issue, it was considered important to explore how those who intend to travel are informed about the expected weather and to what extent the forecasts influence their decisions.

Following the weather forecast appears in the answers of 90% (or similar) of the respondents born after 1965. 81% of those born 1946–1964 and 64% of those born before 1946 indicated that they were informed in advance about the expected weather when planning their leisure time and travel. It is assumed that the 90% share of younger people may be due to their constant presence in the online space, mentioned earlier, while the 81% rate of the seniors was thanks to television, still popular in their demographic, as the weather forecast is a permanent element of broadcasting, and it is one of the most popular programs.



The significance of the above becomes manifest when the respondents’ recreational and travel decisions related to weather forecast information are also analyzed. The responses of each age group are shown in Table 4.

The answers indicate that weather forecast information significantly influences respondents’ decisions about when they do a given activity: the total of 815 responses makes up about 50% of all the answers, the rest of which is distributed among the remaining three categories with proportions between 9% and 22%. It is an interesting result that the influenced decisions tended to prompt a change in the time rather than the location of the given activity. The difference between the ‘changing the location’ and the ‘They do not influence my related decision’ categories is less pronounced: the internal proportions are closer to each other (18% and 22%, respectively). The results of the correlation analysis also confirmed the above, i.e. that belonging to an age group is weakly related to recreational and travel decisions connected to weather forecast information ($V = 0.148, P = 0.000$).

Regarding the above, however, it is worth emphasizing that the separation of several days’ holidays involving substantial financial decisions and shorter trips may be justified and may point to a further research direction. In the case of longer, pre-booked holidays, both rescheduling and relocation are more difficult, as most service providers try to reduce customers’ possibilities of re-planning, for understandable reasons. In our view, another way of dealing with

Table 4. Recreational and travel decisions related to weather forecast information by degree of influence/demographic category (relative frequency of answers, %) *

Age groups	They significantly influence my decisions: I choose another time.		They significantly influence my decisions: I choose another location / destination.		They do not influence my related decisions.		The question is irrelevant.		Total	
	% of age group	% of total selecting above response	% of age group	% of total selecting above response	% of age group	% of total selecting above response	% of age group	% of total selecting above response	% of age group	% of total selecting above response
in or before 1945	47.7	8.7	9.4	4.7	16.8	7.0	26.2	26.5	100.0	9.2
1946-1964	42.3	17.3	18.6	20.9	23.4	21.9	15.6	35.4	100.0	20.6
1965-1979	53.8	24.0	21.4	26.3	19.5	19.9	5.2	12.9	100.0	22.5
1980-1995	52.7	22.6	20.6	24.2	21.5	21.1	5.2	12.2	100.0	21.6
1996-2009	53.1	27.4	16.9	23.9	25.5	30.1	4.5	12.9	100.0	26.0
Total	50.5	100.0	18.4	100.0	22.0	100.0	9.1	100.0	100.0	100.0

* Color-coding: the more frequent the answer, the darker the shade. Single-choice questions.

Source: authors.



this is to create possibilities for product diversification, combining less weather-dependent, climate-proof services with others, as mentioned in previous chapters.

4.5. Prevention, mitigating the risks of climate change, and environmentally conscious behavior during travel

The research also examined the possibilities related to climate change risk mitigation. In general, it can be said that preventing the negative effects of climate change and slowing down the process of climate change are of concern to the respondents. The survey sought to find out where respondents prioritized environmentally conscious behavior and paying attention to the environment: in their home environment, in other environments (during holiday/recreation) or everywhere. The issues in the background of this concerned the environmental effects of tourism as well as people's behavior depending on location. The participants' answers to this question are presented in Table 5.

Regarding all the answers, it is extremely encouraging that over two thirds of those surveyed (1,162 persons, 67%) consider themselves equally environmentally conscious at home and during holidays and recreation. The category is dominant for all generations. The following category in every age group was that of 'environmental awareness rather at home'. For the post-1965 age groups there was no meaningful difference between the categories of more conscious behavior at home and that during holiday and recreation.

Table 5. Environmental awareness and attention to the environment depending on location (frequency of answers) *

Age groups	Environmental awareness, attention to environment				
	Only at home.	Only on holiday and during spending free time.	At home and on holiday and during spending free time, equally.	On holiday and during spending free time I pay much more attention to this than at other times.	I do not consider it important either at home or on holiday.
in or before 1945	44	6	74	12	24
1946-1964	59	13	233	21	28
1965-1979	43	14	293	34	10
1980-1995	44	16	264	38	14
1996-2009	56	24	308	49	17

* Color-coding: the more frequent the answer, the darker the shade. Multiple-choice questions.

Source: authors.



Overall, only 93 respondents (5%) did not consider the issue important. In terms of inter-generational proportions, more than half of those giving this answer (52 persons, 56%) belonged to the two age groups born before 1964. Having examined the background of this, it was concluded that according to the results regarding knowledge about the issue, these two generations had the highest proportion of people who had deficient knowledge (I have heard of it but do not know the details) and who had no knowledge of it (I have not heard of it).

Answering further multiple-choice questions concerning environmentally conscious behavior on holiday, respondents mentioned the 'pressure' to adapt to the clean, orderly environment. Obviously, the opposite of this may also occur, resulting in negative phenomena (e.g. litter may attract more litter). Another interesting notion appearing among the answers was that 'home routines' often do not work when one is on holiday; different signs, waste selecting and recycling customs may cause problems for travelers.

5. CONCLUSIONS

Recently, there has been an increase in the number of scientific research that focus on the unique features of the climatic changes experienced in smaller geographical units instead of whole continents and/or certain countries (Sachindra et al. 2016), as well as on the exposure of the various economic sectors (Moretti – Loprencipe 2018; Craiga – Feng 2018) or even individual demographic groups (Lutz – Striessnig 2015; Ergas – York 2012). In this study, the approaches of individual age groups to climate change and their effects on everyday life and recreational habits were examined.

The knowledge related to climate change is a key driver of reactions and patterns of behavior related to the issue and, as a consequence, the successful fight against climate change (Shi et al. 2016).

Based on this research, everyone in the studied region, regardless of age, has heard and is generally aware of the phenomenon. Examining the differences between the generations, it is encouraging that those with medium and thorough knowledge appeared in significant numbers in all age groups with the exception of the oldest generation, born before 1945, which clearly indicates general openness to the topic.

Regarding the main elements of climate change associations (warming, extreme weather, problems of the polar regions, seasonal shifts, environmental protection), there were general differences between age groups only concerning the individual subtopics. While in their research Frumkin et al. (2012) and Moody (2010) pointed out that the political and social views of especially older people could significantly influence their attitudes towards climate change, this study found that a similar phenomenon could be observed much more in the case of those born after 1980. Here, the influence of the activities of some political actors, 'opinion leaders' and multinational companies often seen in the media could be felt in people's assessment of the issue.

Examining the age groups together, the following were highlighted among the perceptible phenomena of climate change previously not or less experienced: shifting seasons, shorter transitional seasons (fall, spring), lack of long cold periods, lack of winter snow, lack of long-lasting snow cover and strong UV radiation. These phenomena were the most mentioned proportionally in the oldest age group. It is important to emphasize that the changes in the characters of the seasons and the changeable weather also appeared in another sub-topic of our



study, the one concerning associations. These perceptions are clearly in line with the aggregated data broken down to seasons of the [National Meteorological Service \(2021\)](#). According to the analysis, spring weather in Hungary changes the fastest: here the linear trend shows a warming of 1.5 °C in the period between 1901 and 2019. In addition, over the past few years, warming has become particularly spectacular in both summer and fall.

The perceived phenomena, including the ones highlighted above, also have an impact on certain tourism activities. There was no clear significant relationship between belonging to an age group and the assessment of the extent to which weather phenomena resulting from climate change affect respondents' tourism activities. However, about 90% of all those born after 1965 mentioned following weather forecast information. It is important to note that, in many cases, sensationalist headlines on the internet (e.g., 'storm of the year about to strike'; 'the hottest weekend of the summer coming') can significantly affect the movements of tourists and thus the revenue of destinations.

Respondents rated hiking, attending open-air events and 'holiday, recreation by/near water' among the activities most exposed to weather. The assessment of winter sports was not so clear, although several studies highlight the challenges of the ski industry related to climate change. Several activities (e.g., wellness and medical services, shopping tourism) clearly strengthen the more weather-independent, 'climate-proof' category and offer an alternative to more exposed activities. The exposure of open-air events, popular with the two younger age groups (born after 1980), stands out among the responses.

It is important to emphasize that one cannot talk only about negatives or positives regarding the climate issue. For example, the transformation of the seasons can have a positive effect on hiking, while winter sports (such as ice skating or ski tourism, mentioned earlier) can suffer. Consumers' reactions triggered by the changes are also indicative for service providers: the phenomenon of climate change is increasingly on the agenda for tourists. In connection with the preservation and development of their ability to attract visitors, individual destinations and service providers clearly face the challenges of diversification. In addition to air-conditioning and shading for comfort, the need to develop weather-independent attractions (such as covered terraces, covered events spaces, indoor and outdoor pools), requiring more investment, is becoming more and more important. The costs of these will have to be paid by the tourists, in the price of tickets or hotel rooms.

Besides the issue of climate adaptation, the prevention (mitigation) of climate change is obviously of concern to the respondents. It is encouraging that over two-thirds of them consider themselves environmentally conscious both at home and outside the home environment. Among the problems concerning this issue, the most often mentioned ones were the difficulties of disposing of or selecting waste.

While the effects of the COVID-19 pandemic shocked the world in a very short time and without warning, climate change is a slow, prolonged, process spanning generations. The issue of prevention and adaptation must be gradually integrated into people's everyday lives and the activities of economic actors. Location, cultural and economic factors, different life situations, and the experiences and personal involvement of the different age groups all affect attitudes towards the issue. The tourism industry is obviously exposed to the changes, both negative or positive. Learning about the attitudes, experiences, future visions and reactions of the age groups examined herein may help the industry with adaptation, mitigation and the exploration of the possibilities of awareness raising, and thusly the practical implementation of the necessary measures.



REFERENCES

- Agg, Z. – Csapó, D. (2015): Mennyire vagyunk „képben” az éghajlatváltozás kérdéseiben? [How aware are we of the issues of climate change?]. *Comitatus: Önkormányzati Szemle* 25(218): 34–41.
- Ásványi, K. – Juhász-Dóra, K. – Jászberényi, M. – Michalkó, G. (2017): Literature Review of Renewable Energy in the Tourism Industry. *Journal of Environmental Management and Tourism* 8(2): 476–491.
- Aubert, A. – Jónás-Berki, M. – Csapó, J. – Gelányi, N. – Ginzer, M. – Gyuricza, L. (2014): A klímaváltozás hatása a turizmusra [The impact of climate change on tourism]. In: Aubert, A. – Csapó, J. (eds.) *Turisztikai szöveggyűjtemény* [An Anthology on Tourism]. Nyitra: Konstantin Filozófus Egyetem, Közép-Európai Tanulmányok Kara.
- Baranyai, N. – Varjú, V. (2017): A klímaváltozással kapcsolatos attitűdök területi sajátosságai [Regional characteristics of attitudes related to climate change]. *Területi Statisztika* 57(2): 160–182.
- Benner, M. (2019): From Overtourism to Sustainability: A Research Agenda for Qualitative Tourism Development in the Adriatic. *MPRA Paper* 92213.
- Berezcki, B. H. (2012): A klímaváltozás médiadiskurzusai [Media discourse on climate change]. *Korunk* 22(2): 15.
- Craig, A. C. – Feng, S. (2018): A Temporal and Spatial Analysis of Climate Change, Weather Events, and Tourism Businesses. *Tourism Management* 67: 351–361.
- Csete, M. – Pálvölgyi, T. – Szendrő, G. (2013): Assessment of Climate Change Vulnerability of Tourism in Hungary. *Regional Environmental Change* 13: 1043–1057.
- Ergas, C. – York, R. (2012): Women’s Status and Carbon Dioxide Emissions: A Quantitative Cross-national Analysis. *Social Science Research* 41(4): 965–976.
- de Freitas, C.R. – Scott, D. – Mcboyle, G. (2008): A Second Generation Climate Index for Tourism (Cit): Specification and Verification. *International Journal of Biometeorology* 52: 399–407.
- de Freitas, C.R. (2003): Tourism Climatology: Evaluating Environmental Information for Decision Making and Business Planning in the Recreation and Tourism Sector. *International Journal of Biometeorology* 48(1): 45–54.
- Foster, G. C. – Lane, D. – Scott, D. – Hebl, M. – Guerra, R. (2018): *An Introduction to Psychological Statistics*. Department of Psychological Sciences University of Missouri-St. Louis.
- Frumkin, H. – Fried, L. – Moody, R. (2012). Aging, Climate Change, and Legacy Thinking. *American Journal of Public Health* 102(8): 1434–1438.
- Geels, F. W. – Schot, J. (2007): Typology of Sociotechnical Transition Pathways. *Research Policy* 36(3): 399–417.
- Geels, F. W. – Sovacool, B. K. – Schwanen, T. – Sorrell, S. (2017): Sociotechnical Transitions for Deep Decarbonization. *Science* 357(6357): 1242–1244.
- Giddens, A. (2009): *The Politics of Climate Change*. Malden, MA: Polity Press.
- Gkargkavouzi, A. – Paraskevopoulos, S. – Matsiori, S. (2018): Assessing the Structure And Correlations of Connectedness to Nature, Environmental, Concerns and Environmental Behavior in a Greek Context. *Current Psychology* 40: 154–171.
- Green, P. K. – Env, D. (2001): *Plain English Guide to the Science of Climate Change*. Washington DC.
- Hersch, J. – Viscusi, W. K. (2006): The Generational Divide in Support for Environmental Policies: European Evidence. *Climatic Change* 77: 45–72.
- Huybers, T. (2003): Domestic Tourism Destination Choices– a Choice Modelling Analysis. *The International Journal of Tourism Research* 5(6): 445–459.



- Ministry of Innovation and Technology (2018): *A 2018-2030 közötti időszakra vonatkozó, 2050-ig tartó időszakra is kitekintést nyújtó második Nemzeti Éghajlatváltozási Stratégia* [Second National Climate Change Strategy for 2018-2030, Also Providing an Outlook for 2050]. Budapest: ITM. 62.
- IPCC (2018): Summary for Policymakers. In: Masson-Delmotte, V. – Zhai, P. – Pörtner, H.-O. – Roberts, D. – Skea, J. – Shukla, P.R. – Pirani, A. – Moufouma-Okia, W. – Péan, C. – Pidcock, R. – Connors, S. – Matthews, J.B.R. – Chen, Y. – Zhou, X. – Gomis, M.I. – Lonnoy, E. – Maycock, T. – Tignor, M. – Waterfield, T. (eds.): *Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*. In Press.
- Jebli, M. B. – Hadhri, W. (2018): The Dynamic Causal Links between CO2 Emissions from Transport, Real GDP, Energy Use and International Tourism. *International Journal of Sustainable Development & World Ecology* 25(6): 568–577.
- Kahan, D. – Braman, D. – Gastil, J. – Solvic, P. – Mertz, C. K. (2007): Culture and Identity-Protective Cognition: Explaining the White Male Effect in Risk Perception. *Journal of Empirical Legal Studies* 4(3): 465–505.
- Kajner, P. – Czira, T. – Selmecezi, P. – Sütő, A. (2017): National Adaptation Geo-information System in Climate Adaptation Planning. *Időjárás - Quarterly Journal of the Hungarian Meteorological Service (OMSZ)* 121(4): 329–477.
- Karakasné, M. K. (2017): Az élelmiszerpazarlás jelentősége és minimalizálási lehetőségei a szállodaiparban [The Importance of Food Waste in the Hotel Industry and the Possibilities of its Minimization]. *Jelenkori társadalmi és gazdasági folyamatok* 12(4): 233–245.
- Keshavarz, M. – Karami, E. (2016): Farmers' Pro-Environmental Behavior under Drought: Application of Protection Motivation Theory. *Journal of Arid Environments* 127: 128–136.
- Kingsley, L. D. (2011): *New Consciousness for a New World: How to Thrive in Transitional Times and Participate in the Coming Spiritual Renaissance*. Rochester, Vermont: Inner Traditions Publisher.
- Kriston, L. (2018): Ha rajtuk múlik a környezetvédelem, akkor nagy a baj [If Environmental Protection is up to Them, The Problem is Big]. <https://piacesprofit.hu/klimablog/ha-rajtuk-mulik-a-kornezetvedelem-akkor-nagy-a-baj>, accessed 21/10/2021.
- Kulcsár, L. (2013): A klímaváltozás társadalmigazdasági hatása [The social and economic impacts of climate change]. In: Karlovitz, J. T. (ed.): *Társadalomtudományi gondolatok a harmadik évezred elején* [Social Science Thoughts at the Beginning of the Third Millennium]. Komarno: International Research Institute s.r.o.
- Kulcsár, Zs. (2014): *Az integratív e-learning felé* [Towards integrative e-learning]. <https://crescendo.hu/files/konyvek/kulcsar-zsolt-az-integrativ-e-learning-fele.pdf>, accessed 21/10/2021.
- Lőrincz, K. – Raffay, Á. – Clarke, A. (2014): Knowing the Unknowable, Controlling the Uncontrollable: Climate change and tourism around the Balaton. In: *ATLAS Annual Conference 2014 Tourism, Travel and Leisure Sources of Wellbeing, Happiness and Quality of Life*. Budapest, Hungary, 22–24.
- Lutz, W. – Striessnig, E. (2015): Demographic Aspects of Climate Change Mitigation and Adaptation. *Population Studies* 9(1): 569–576.
- Mackenthun, G. (2021): Sustainable Stories: Managing Climate Change with Literature. *Sustainability* 13(7): 4049.
- National Adaptation Center of the Geological and Geophysical Institute of Hungary (2017): *Módszertani útmutató a megyei klímastratégiák kidolgozásához* [Methodological guide to the development of county



- climate strategies]. http://klimabarat.hu/images/tudastar/8/kepek/KBTSZ_modszertanfejl_MEGYE_END_KIKULD.pdf, accessed 21/10/2021.
- Maichum, K. – Parichatnon, S. – Peng, K. C. (2017): The Influence of Environmental Concern and Environmental Attitude on Purchase Intention towards Green Products: A Case Study of Young Consumers in Thailand. *International Journal of Business Marketing and Management* 2(3): 1–8.
- Michalkó, G. – Németh, J. – Ritecz, G. (2020): *Turizmusbiztonság* [Tourism Safety and Security]. Budapest: Dialóg Campus Kiadó.
- Moody, H. R. (2010): Eco-elders: Legacy and Environmental Advocacy. *Generations: Journal of the American Society on Aging* 33(4): 70–74.
- Moretti, L. – Loprencipe, G. (2018): Climate Change and Transport Infrastructures: State of the Art. *Sustainability* 10(11): 4098.
- Nemes O. (2019): *Generációs mítoszok* [Generational myths]. Budapest: HVG könyvek.
- Németh, K. – Péter, E. – Pintér, G. (2018): Megújuló energiaforrások szerepe és jelentősége a hazai turisztikai szektorban – az energia, mint „helyi termék” [The role and importance of renewable energy sources in the domestic tourism sector – energy as a “local product”]. *Turizmus bulletin* 18(1): 37–44.
- National Meteorological Service (2021): *Elmúlt évszakok időjárása* [The Weather of the Past months]. MET.hu. https://www.met.hu/eghajlat/magyarorszag_eghajlata/eghajlati_visszatekinto/elmult_evszakok_idojarasa/, accessed 21/10/2021.
- Ostheimer, J. – Blanc, J. (2021): Challenging the Levels: The Catholic Church as a Multi-Level Actor in the Transition to a Climate-Compatible Society. *Sustainability* 13(7): 3770.
- Padányi, J. – Halász, L. (2012): *A klímaváltozás hatásai* [Impacts of the climate change]. https://www.uni-nke.hu/document/uni-nke-hu/padanyi_klimavaltoz_tanulm.pdf, accessed 21/10/2021.
- Pálvölgyi, T. – Czira, T. – Fancsik, T. (2016): Tudományos-alapú döntéselőkészítő információk alkalmazása a „klímabiztos” közpolitikai tervezésben [Applying science-based decision-making information in “climate-proof” public policy planning]. In: Pálvölgyi, T. – Selmeczi, P. (eds): *Tudásmegosztás, alkalmazkodás, éghajlatváltozás* [Knowledge Sharing, Adaptation, Climate Change]. Magyar Földtani és Geofizikai Intézet.
- Peeters, P. – Higham, J. – Cohen, S. – Eijgelaar, E. – Gössling, S. (2019): Desirable Tourism Transport Futures. *Journal of Sustainable Tourism* 27(2): 173–188.
- Piazza, A. (2021): Collective Responsibility in the Cooperative Governance of Climate Change. *Sustainability* 13(8): 4363.
- Poel, van de, I. R. – Royakkers, L. M. M. – Zwart, S. D. (eds.) (2015): *Moral Responsibility and the Problem of Many Hands*. London: Routledge.
- Rutty, M. – Scott, D. (2014): Thermal Range of Coastal Tourism Resort Microclimates. *Tourism Geographies* 16: 346–363.
- Sachindra, D. A. – Ng, A. W. M. – Muthukumar, S. – Perera, B. J. C. (2016): Impact of Climate Change on Urban Heat Island Effect and Extreme Temperatures: A Case-study. *Quarterly Journal of the Royal Meteorological Society* 142(694): 172–186.
- Sauri, D. – Olcina, J. – Vera, J. F. – Martin-Vide, J. (2013): Tourism, Climate Change and Water Resources: Coastal Mediterranean Spain as an Example. In: Schmidt-Thome, P. – Greiving, S. (eds.): *European Climate Vulnerabilities and Adaptation: A Spatial Planning Perspective*. John Wiley & Sons.
- Scott, D. – Hall, M. – Gössling, S. (2012): *Tourism and Climate Change. Impacts, Mitigation and Adaptation*. London: Routledge.



- Singh, M. P. – Chakraborty, A. – Roy, M. (2018): Developing an Extended Theory of Planned Behavior Model to Explore Circular Economy Readiness in Manufacturing Msmes, India. *Resources, Conservation and Recycling* 135: 313–322.
- Shi, J. – Visschers, V.H.M. – Siegrist, M. – Arvai, J. (2016): Knowledge as a Driver of Public Perceptions about Climate Change Reassessed. *Nature Climate Change* 6(8):759–762.
- Wieding, J. – Stubenrauch, J. – Ekardt, F. (2020): Human Rights and Precautionary Principle: Limits to Geoengineering, SRM, and IPCC Scenarios. *Sustainability* 12(21): 8858.

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