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Assessing the impact of global warming on the sport, tourism, and recreation industries in western Norway

Summary

Sport, tourism, and recreation, like many other areas of life, are influenced by environmental factors, including climate. Climate is one of the major factors determining the living conditions on our planet, which determine the functioning and behavior of all organisms. Therefore, this poses the question: Are global climate changes seen by ordinary people? If so, how are they seen and how do they affect the various domains of life, in particular, sport, tourism, and recreation? The aim of the pilot research was to determine the impact of global climate changes (observed in the public media as well as being in the public consciousness) in the area of western Norway (WN) on sport, tourism, and recreation. Pilot research was conducted in the summer and autumn of 2015 using a diagnostic survey on the internet. The research tool was a questionnaire survey. Respondents came from two groups: 61 employees and entrepreneurs in the industries of sport, tourism, and recreation in WN and 32 people either actively partaking in sport and recreational activities or visiting the region as tourists. Interviewees noted that climate changes have already occurred in the nature of western Norway. However most of them are not prepared for these changes even though they believe that the majority of the changes will only grow and intensify. For example, some of the researched companies have already been forced to take certain steps in relation to the companies functioning e.g., company

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reorganizations. The expected transformation in nature caused by global climate changes are changing the behavior of athletes, tourists, residents, representatives of the authorities, and economic entrepreneurs who make their living from tourism, recreation, and sport. In the future, Norway may turn out to be no longer as attractive as it is now for these people.

Key words: climate change, sports, recreation, tourism, western Norway

1. Introduction

Sport, tourism and recreation, like many other activities, are influenced by environmental factors, including climate. Climate is one of the major factors determining the living conditions on our planet, which influences the functioning and behavior of all organisms. Fundamentally it has an effect on the shape of the world economy and on the populations of individual countries and their access to water and food.

Global climate change is a fact of life and, as shown by numerous studies, can proceed rapidly (Kundzewicz 2008). To combat the currently observed symptoms of global warming radical steps are being taken. For example international arrangements are now in place in relation to basic economic and political decisions, among other initiatives, in order to inhibit these processes. On 12 December 2015 the "historic agreement, the turning point and a great step of humanity" was signed according to the French President Francois Hollande. This was a reaction to the climate agreement signed in Paris by 195 delegations from around the world (Web-01).

So the question arises, are global climate changes seen by ordinary people? If so, how are these changes seen and how do they affect the various domains of life, in particular, sport, tourism, and recreation?

The task of trying to assess the various aspects of this impact have already been undertaken by some research institutions (Research Council of Norway – project NORKLIMA; Norwegian Meteorological Institute together with Bergen University, local authorities and other entities – project BERGENSCENARIER 2020; Meteorology, Hydrology and Water Management Research Institute in

Warsaw – project KLIMAT; Arctic Council from 2004 – project ACIA; Norwegian authorities, in cooperation with the research units – project "White Winter").

One effort to assess the various aspects of this impact was, for example, the conference "Tourism to climate change" organized in 2014 by The University of Physical Education in Krakow and Meteorology, Hydrology and Water Management Research Institute in Warsaw. The conference was focused on the winter sports, the issues related to climate change, such as drilling length and the quality of the snow cover (in the Tatra mountains and the Alps) and their impact on tourism and recreation in the winter. According to research (Bultot *et al*. 1994, Whetton *et al*. 1996), it is very likely that some of the ski resorts will suffer losses (number of users, pecuniary loss) due to the decrease in the thickness of the snow cover, if the warming continues. The studied ski resorts are located mainly in the lower altitude than resorts built in a later period. Examples of resorts which are exposed to these changes are Garmisch-Partenkirchen in Germany and Kitzbühel in Austria. Snow accumulation models for regional scenarios of climate change for this area show a decrease in the number of days with snow cover, in particular, in resorts located at altitudes lower than 1400 m above sea level (Bultot *et al*. 1994, Whetton *et al*. 1996). Forecasts predict that the ski resorts located at higher altitudes will experience a growth in visitor numbers if their competitors located at lower altitudes become less profitable as a result of climate change.

However, as shown by observations and forecasts, the area which is most vulnerable to climate change, and will probably continue to be, is the Arctic (Arctic Climate Impact Science, 2008). It is seen, for example, in the melting of the polar ice cap there. The polar ice cap has significantly decreased in the past three decades (approx. 50% during 2008-2012) and this is absolute proof that climate change is already taking place in reality (Arctic Climate Impact Assessment, 2005). Temperatures there are extremely low, insolation and precipitation limited, and the growing season is short. Sea ice, snow cover, tundra, and permafrost are more sensitive to subtle changes in sunlight, temperature, and precipitation than temperate or tropical

ecosystems. Minor temperature change, like the average rising above the freezing point of water, may completely change the character of this region. The temperature in the Arctic is increasing twice as fast as anywhere else in the world (Jeffries *et al.* 2014). Ironically enough, warming could lead to a blocking of the Gulf Stream carrying warm water to the North. In this case, the effect of global warming may be cooling, for example, as it was in Scandinavia (Sala 2009). It can be assumed that these changes will be clearly felt in the sport, tourism, and recreation industries.

2. Location of the study

Although the Arctic is a sparsely populated area, there are in Arctic some urban areas, and areas subjected to intensive sport, leisure, and recreation activities. These areas include Norway. About 30% of the country is located above the Arctic Circle. Norway is ecotonal in its location positioned at the interface between climate zones and large geographical ecoregions (biomes, tundra, and taiga). The boundaries of these zones are relatively sharp so the displacement of climate zones caused by global climate change in these areas is particularly clear. Additionally, there should also be noticeable changes in nature caused by climate change (Botkin *et al*. 2007). Many scientists claim that ecotones can be sensitive regions to the impact of climate change (Kimball and Weihrauch 2000). Because of this the climate change should have a well observed impact on sport, recreation, and tourism, as they are implemented in the same environment.

Norway therefore seems particularly suitable to carry out studies on the problem in this article. It is a significant fact that the area occupied by today's Norway is unique on a global scale due to its natural values and characteristics. In addition, it was subjected to strong climate modifications during the last ice age. These changes have been very clearly etched into Norway's landscape and residents and visitors to this region are aware of this

The studies were conducted in western Norway, one of the most popular tourist destinations in Norway. It is estimated that there will

be a growing influx of visitors to this part of Norway in the coming years due to the nature of this region. In 2011, the sea wall was visited by a record number of visitors 869,686 (Web-02). By comparing the number of overnight stays in hotels in Bergen city in 2014 and 2015, a 7.2% increase can be noted with a total of 1,739,447 accommodations in 2015 (Web-03). The data indicate the huge economic potential of the tourism industry, which plays an increasingly important role in the economy of the country.

In addition to this, there has been a clear enlargement of the number of tourists (both domestic and foreign) practicing physical activity outdoors (such data has been established from a study conducted between May and August 2014, by the Statistics Norway – SSB for Innovasjon Norge). Due to the terrain and the location of Norway, the most popular activities are winter sports. The most popular winter sports in Norway are cross country skiing, ice hockey, Alpine skiing, ski jumping, skiing, biathlon, and bobsleigh. Walking, hiking, jogging, biking, fishing, swimming, and boating are popular in the summer (Web-04).

Some of the largest winter sporting events take place in Norway (Ski Jumping World Cup, FIS Nordic World Ski Championships, Olympic Winter Games). In addition, the King of Norway Harald V established 2015 as The Year of Outdoor Life. Norway, due to the qualities of its nature, is one of the few countries in Europe also suitable for organizing extreme sports competitions. The biggest sports event in the extreme sports arena takes place in western Norway, in the little town of Voss (Web-05).

In Hordaland (one of west county in Norway), which has about 512 000 inhabitants (Web-06) there are approximately 2300 unions and sports associations (Web-07). The data confirms the involvement of residents in matters related to the activity of recreational and outdoor sporting practices.

One can surmise that western Norway is a particularly good place to find answers to the question of whether climate change is perceived. Furthermore, it can give us answers about whether climate change is taken into account in the sport, travel, and leisure industry and in the activities and plans of the people involved in this area of the

economy. Tourists, recreational activities, and sport mainly depend on the natural environment and should therefore be particularly sensitive to climate change.

The research was focused in and around the city of Bergen, the capital and center of tourism in western Norway. This region is significant on a national scale in the field of sport (home to many associations of sports and outdoor activities) and at the same time is a place with a deep academic culture with several universities and the modern meteorological department – The Bjerknes Centre for Climate Research (University of Bergen). It is there where such concepts as "polar" or "the polar front" were born (Chisholm 1922). Therefore, the subject of climate change should be very much alive and well and actively monitored in this location.

3. The aim of the study

The purpose of the research was to determine the impact of global climate change in western Norway (observed, as well as being in the public consciousness by way of the mass media) on sport, tourism, and recreation on the basis of the diagnostic survey among local businesses, residents, and visitors, interested in those forms of activity.

In order to effectively carry out the research the following research questions were asked:

For entrepreneurs:

1. Does climate change currently have an impact, or may it have an impact in the future on the business and activities of companies dealing with sport, tourism and recreation in western Norway?
2. What are the effects now, along with the predicted effects in the future, of climate change on the sectors of sport, tourism, and recreation in western Norway?

For athletes, tourists, and coaches:

1. Whether athletes, tourists, and people practicing recreation in western Norway have noted the impact of climate change on sports practiced there by themselves or on the tourism or

recreation industries? What is the character of this impact and what are or may be the effects?

4. Material and methods

The studies were conducted in the summer-autumn season of 2015 using a diagnostic survey method by internet (by e-mail and on Facebook fan pages for sport and tourism in Western Norway). The chosen research tool was a copyrighted survey consisting of more than a dozen closed questions and multiple choice questions. The questionnaires were developed in Norwegian and English. Documents from the University of Bergen's Meteorological Institute Bjerknes have also been analyzed. The study involved two groups of respondents:

1. 61 employees and entrepreneurs in the sport, tourism, and leisure industries in western Norway,
2. 32 athletes, tourists, and people practicing recreation in western Norway.

5. Results

In the group of 32 persons practicing sport, recreation, and tourism in western Norway 50% (16) were inhabitants of the region, and 50% (16) were tourists of which 50% (8) had previously visited the western Norway area at least 4 times (tourists from the UK, Ireland, Poland, United States). 62% of the (20) subjects were men and 38% (12) were women. Age of the respondents is presented in Tab. 1.

Table 1. Age of respondents.

Age	N	%
18-25	5	16
26-35	11	34
36-45	10	31
46-55	2	6
55+	4	13
Total	32	100

There were most respondents (11) in the age group 26-35 with 34% of the total surveyed. 6% (2) were in the age group 46-55. 31% (10) of respondents did hiking, walking, Nordic walking, and trekking, 13% (4) did cycling, 16% (5) water sports, 9% (3) running, 19% (6) winter sports, 6% (2) sightseeing and 3% (1) extreme sports and the same number of people did fishing or hunting. 22% (7) of those surveyed practiced some form of sport, recreation or tourism daily, 19% (6) every few days, 31% (10) several times a week, 13% (4) once a week, 6% (2) once a month, and 9% (3) once a month or less. They noted the following changes in climate in this region: a warmer climate – 53% (17), increased rainfall – 44% (14) noted stronger winds, 31% (10) worse snow conditions, and 25% (8) noted the deterioration of the paths, trails and routes. Respondents maintain the desire to train or visit western Norway if the following climate changes are going to deepen (Tab. 2): a warmer climate 81% (26) was the most popular effect. Worse conditions for paths or routes/trails and worse conditions for water sports, both with 44% (14), were the least chosen effects.

Table 2. Summary of the frequency of elections to answer the question about willingness to train or visit western Norway, despite deepening climate change in the region.

Change	N	%
Warmer climate	26	81
Colder climate	23	72
Decreased rainfalls	22	69
Better conditions for doing winter sports	22	69
Better conditions for hiking trails/routes	21	66
Better conditions for doing water sports	19	59
Increased rainfall	18	56
Worse conditions for doing winter sports	18	56
Better conditions for fishing/hunting	17	53
Increased strong winds	16	50
Worse snow conditions	16	50
Worse conditions of trails/routes	14	44
Worse conditions for doing water sports	14	44

22% of respondents (7) do not intend to train in or visit western Norway if snow conditions are going to deteriorate and the same number of respondents are not going to train in or visit western Norway if performance declines in the conditions along paths and trails or if strong winds will become more frequent. 16% (5) surveyed do not intend to train and visit western Norway if there will be worsening in the conditions for water sports or an increase in the frequency of precipitation. 44% (14) surveyed do not see an alternative to visit or to train in western Norway if the above effects of climate change deepen. 22% (7) would choose another region in Norway (northern Norway) and the same number of respondents would choose a different country in Europe (Spain, Scotland, Ireland, Greece, Finland, Italy). According to 74% (24) of respondents, the climate changes now seen in western Norway will not lead them to choose a different place for their next training or travel. However, 13% (4) of respondents believe that the already observed climate changes in the area will result in a change in the choice of location for their next training or travel. 13% of (4) respondents have no opinion on the subject.

The climate change effect of "an increase in the number of athletes or tourists in the region" was noted by 50% of respondents (31% (10) among the athletes, 19% (6) among the tourists). 94% (30) of interviewees did not see a decrease in the number of athletes or tourists in the region (among the athletes 53% (17), among the tourists 41% (13)). 41% (13) of respondents noted changes in training and tourist routes (among athletes 22% (7), tourists 19% (6)) but 59% (19) of respondents did not note any changes to these routes (among the athletes 34% (11), tourists 25% (8)). 19% (6) noted an improvement in their athletic performance (only athletes) and 22% (7) of respondents noted the additional costs (among athletes 9% (3), tourists 13% (4)). 41% (13) of the respondents have no opinion on whether they see a need for changing (declared in the survey) their discipline of sport or tourism or recreation to another. 6% (2) are able to change their declared discipline of sport or form of tourism or recreation to another, but 53% (17) of respondents are not able to do that.

According to the respondents, the following constituents of the sport, tourism, and leisure industries in western Norway gain (they are more attractive for them) (Fig. 1) as a result of climate changes. The largest number of respondents chose waterfalls and streams (22%), and the smallest amount chose glaciers (2%).

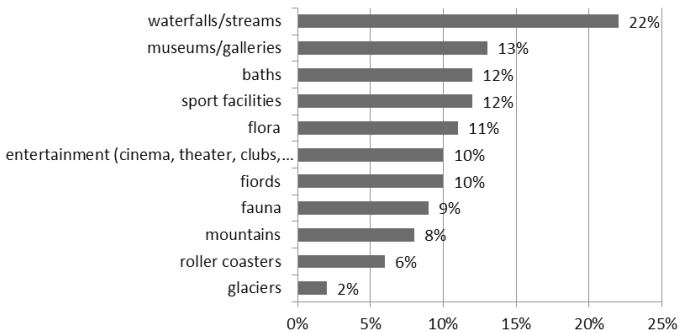

Figure 1. Constituents of sport, tourism and leisure industries in western Norway rising in attractiveness as a result of climate change – according to respondents (results do not add up to 100% due to multiple choice question).

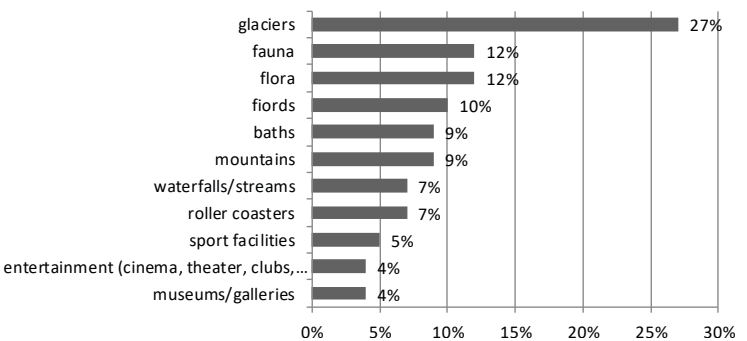

Figure 2. Constituents of sport, leisure and tourism industries in western Norway decreasing in attractiveness as a result of climate change – according to the respondents (results do not add up to 100% due to multiple choice question).

Fig. 2 shows a decline in the attractiveness of some constituents of the sport, tourism, and leisure industries in western Norway. The largest number of respondents (27%) believe that glaciers are set to lose the most as a result of climate change. The smallest number of respondents (4%) chose entertainment (clubs, theatres, cinemas, etc.) and museums or galleries as being least affected.

Tab. 3 shows the forms of sport, recreation, and tourism which will become, as a result of ongoing climate change in western Norway, easier or harder to practice than now in the opinion of the respondents. According to the interviewees it will be easier to practice water sports and running – 28% (9), and harder to practice winter sports – 66% (21).

Table 3. Evaluation of the possibilities for practicing forms of sport, recreation and tourism as a result of ongoing climate change in western Norway (results do not add up to 100% due to multiple choice question) Respondents: employees and entrepreneurs in the sport, tourism, and leisure industries in western Norway.

Easy	N	%	Difficult	N	%
Running	9	28	Running	3	9
Riding a bicycle	7	22	Riding a bicycle	7	22
Extreme sports (other than air sport)	8	25	Extreme sports (other than air)	11	34
Air sports	7	22	Air sports	14	44
Water sports	9	28	Water sports	9	28
Winter sports	5	16	Winter sports	21	66
Fishing/hunting	5	16	Fishing/hunting	10	31
Hiking/Nordic walking/ trekking	7	22	Hiking/Nordic walking/ trekking	7	22
Sightseeing	10	31	Sightseeing	4	13

In a group of 61 entrepreneurs and employees in the sport, tourism, and leisure industries 56% (34) were male and 44% (27) female. Age is in Tab. 4 below. 30% (18) of respondents are in the age group 26-35, and 8% (5) in the group 18-25.

Table 4. The age of the interviewees.

Age	N	%
18-25	5	8
26-35	18	30
36-45	14	23
46-55	10	16
55+	14	23
Total	61	100

62% (38) of them observed changes in the environment which they attribute to climate changes. Some of the most common changes they noted are shown in Tab. 5. 61% (37) of respondents chose increasing rainfall and the least number of them chose extending the winter season (8% (5)).

Table 5. Noticed changes in environment of western Norway, which respondents attribute to climate changes (results do not add up to 100% due to multiple choice question).

Change	N	%
Increased rainfalls	37	61
Increased strong winds	29	48
Worse snow conditions	28	46
Glaciers melting	23	38
Shorter winter season	18	30
Higher temperature	13	21
Composition of species of animals and plants on land and in the waters	9	15
Have not noticed any changes	8	13
Lower temperatures	7	11
Longer winter season	5	8

74% (45) surveyed believe that there has been an increase in rainfall in the region. 67% (41) of respondents believe that the problem of melting glaciers has become worse in the region, and 8% (5) of them deny that. According to them, there has been an increase in the frequency of strong winds (66% (40)) and inferior snow related conditions (milder and wet

winters (67% (41)), shortening of the winter season (61% (37)) and higher temperature (48% (29)), however, the 10% (6) has the opposite opinion. Furthermore, in the opinion of the respondents, changes have occurred in the composition of species of animals and plants on land and in the waters (38% (23)) and an increase in the sea level (28% (17)). According to the interviewees, these changes will have a negative effect on the businesses declared at the beginning of the survey. Tab. 6 shows the answers of respondents to the question of what they think will change the most, in the sport, tourism or recreation sectors in western Norway in the coming years, due to climate change. Most of respondents do not predict any changes (34% (21)), and the least amount of them predict changes to trade from tourism, recreation or sport to a different field (3% (2)).

Table 6. The main expected effect of climate change on the sport, tourism and recreation sectors of western Norway in the coming years by respondents.

Effect	N	%
No changes	21	34
I do not know	13	21
Influx of tourists, visitors, athletes into western Norway	11	18
Change in the profiles of companies within the sport, tourism and leisure sectors	6	10
Emergence of many new companies within the sport, tourism and leisure sectors	6	10
Changes of trade from tourism, recreation or sport to a different field	2	3
Other	2	3
Total	61	100

According to interviewees, changes, such as the influx of tourists, visitors, athletes and changes in the profile of businesses inside the sport, tourism, and leisure sectors (each 10% (6)) and the emergence of many new companies in the industry of tourism, recreation, or sports (20% (12)) will proceed the fastest. The changes predicted to proceed most slowly according to them are changes of the profile of companies within the sport, tourism, and leisure (62% (38)), changes in trade from tourism, recreation, or sport to a different field (67% (41)), the collapse or

bankruptcy of many companies within the sport, tourism, and leisure sectors (73% (45)), but also the emergence of many new companies within the sport, tourism, and leisure sectors (48% (29)), the influx of tourists, visitors, athletes (64% (39)) with the same number of responses for a reduction in the number of athletes or visitors to the region.

The respondents also answered the question about whether they should change the profile of the company they own or work for in the context of climate change. Their answers are presented in Fig. 3.

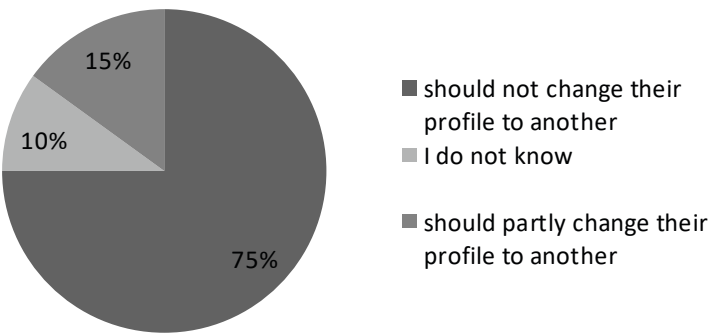

Figure 3. Response rates to the question: in the context of climate change should the company, you own or work for, change its profile to another.

Most of respondents (75%) believe that the company, business, or establishment in which they are working should partly change their profile to another and the lowest number of respondents (10%) have no opinion on the subject. Some of respondents linked the changes in the functioning of the company, in which they are employed with climate change: the additional costs (22% (13)), reorganizations (24% (11)), the loss (24% (14)), changes of the routes for visitors or athletes (24% (14)), a decrease in the number of athletes or visitors (24% (14)). 13% (7) saw an increase in the number of customers.

To the question, what would you do as a (potential) owner of a company inside the sport, tourism, and leisure sectors if the climate in western Norway will be warmer or colder than today, the subjects responded as follows (Tab. 7).

Table 7. The answers to the question: what would you do as a (potential) owner of a company inside the sport, tourism and leisure sectors, if the climate in western Norway will be warmer or colder than today.

Change	Warmer climate		Colder climate	
	N	%	N	%
Remain in the industry without any changes	33	55	25	41
Have not thought about it	20	33	24	39
Remain in the industry but change the profile	6	10	9	15
Move to another industry	0	0	1	2
Other	2	3	2	3
Total	61	100	61	100

54% of respondents, in the case of warmer climate, and 41%, in the case of colder climate, are willing to remain in the industry without any changes. 0% of respondents, in the case of warmer climate, and 2%, in the case of colder climate, would move to another industry.

The degree of preparedness of the respondents (scale: 1–unprepared, 5 – prepared) to the effects of climate change in question are as follows: 57% (34) surveyed are prepared for a change in the seasonality, 59% (29) for higher temperatures, 44% (26) for lower temperatures, 51% (30) for more sunny days in the year, 46% (27) for less frequent rainfall, 45% (26) for snow conditions to deteriorate (milder and wet winters), 41% (24) for increased humidity. Respondents are not prepared for the following changes in relation to their business: for the increase in sea level (37% (22)), for fewer sunny days (33% (20)), 35% (21) for more frequent rainfall, for melting glaciers (24% (14)), for increased humidity (28% (17)), (for increased frequency of strong winds (33% (20)) and 20% (12) for changes of natural/leisure values.

According to the respondents the number of people engaged in the following forms of sport, tourism, and leisure will increase or decrease (Tab. 8). Most of respondents (40% (24)) believe that there will be an increase the number of people doing hiking, walking, Nordic walking or trekking, and the lowest number of respondents (10% (6)) believe that the number of people doing aviation sports will increase.

Table 8. Expected changes to the number of people doing sport, tourism, and leisure activities in western Norway, in mentioned forms of sport, tourism, or recreation, due to climate change (results do not add up to 100% due to multiple choice question).

Activity	Increase		Activity	Decrease	
	N	%		N	%
Running	15	25	Running	2	3
Riding a bicycle	18	30	Riding a bicycle	4	7
Extreme sports (other than air sport)	9	15	Extreme sports (other than air sport)	11	19
Air sports	6	10	Air sports	10	17
Water sports	12	20	Water sports	2	3
Winter sports	7	12	Winter sports	20	33
Fishing/hunting	11	18	Fishing/hunting	5	8
Hiking/Nordic walking/ trekking	24	40	Hiking/Nordic walking/ trekking	5	8
Sightseeing	15	25	Sightseeing	6	10

According to those surveyed climate change will reduce the attractiveness of the following constituents of the sport, tourism, and leisure industries in western Norway (Fig. 4). The highest number of respondents (43%) marked glaciers, and the lowest (5%) number marked trails, tourist paths, museums or galleries and waterfalls or streams.

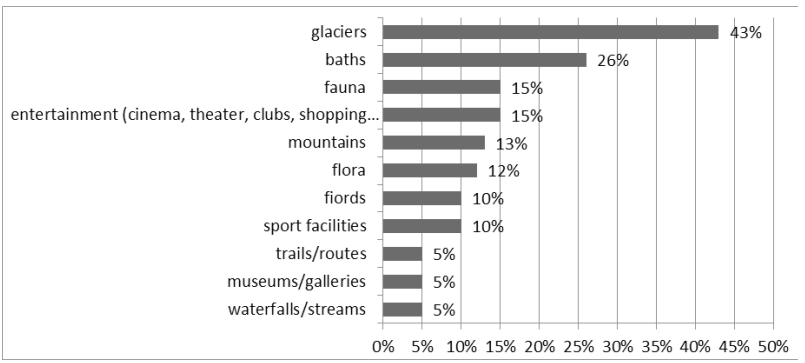

Figure 4. Constituents of sport, tourism or leisure industries in western Norway in which attractiveness will be reduced as a result of climate changes according to those surveyed (results do not add up to 100% due to multiple choice question).

It is worth mentioning that respondents believe that climate change will increase the attractiveness of the following constituents (Fig. 5): the highest number of respondents (38%) marked waterfalls or streams, and the lowest number (2%) marked fauna.

The respondents predict that there will be a decrease in attractiveness for doing winter sports (36% (22)), air sports (18% (11)), extreme sports other than air sports (16% (10)), cycling (15% (9)), hiking, walking, Nordic walking or trekking (10% (6)), sightseeing (12% (7)), running and fishing each (8% (5)), and there will be increase in attractiveness for doing winter sports and air sports each (12% (7)), extreme sports (other than air sports), cycling and water sports each (15% (9)), fishing and running (10% (6)), hiking, walking, Nordic walking or trekking (25% (15)), and sightseeing (16% (10)).

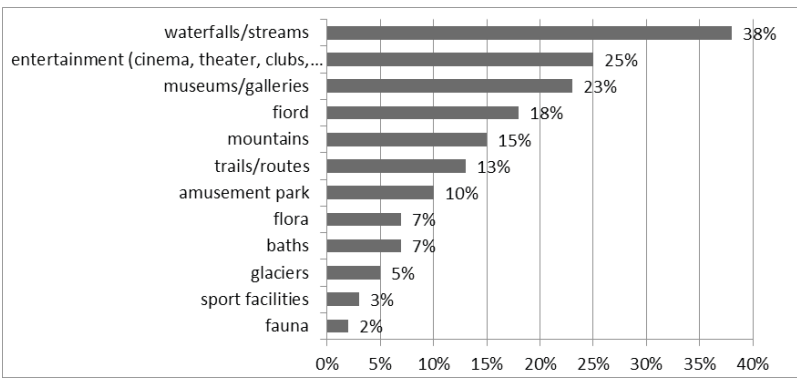

Figure 5. Constituents of sport, tourism or leisure industries in western Norway in which attractiveness will be increased as a result of climate change according to those surveyed (results do not add up to 100% due to multiple choice question).

6. Summary, discussion and conclusions

The research was focused on trying to determine the impact and scale of global climate change on the sport, tourism and recreation sectors in western Norway. Pilot studies presented in this paper and analysis

of the literature confirms that climate change will have consequences for tourism, recreation, and outdoor sports not only for tourists and athletes, but also for the inhabitants of this area.

It should be clarified that the research was carried out on a small sample, and there was a lack of division of the respondents in terms of tourists, athletes, and residents. Alterations here can, of course, slightly change the results. The full analysis will be made after the statistical analysis of the main research. The expected and observed impacts of global climate change on nature in western Norway change the behavior of athletes, tourists, residents, representatives of the business sector of the economy, who make their living from tourism, recreation, and sport. This has been partially shown in the results, divided into two surveyed groups. Norway may turn out to be less attractive in the future than it currently is, for the surveyed groups. Some of the surveyed athletes and tourists have experienced the real effects of climate change and for example, have been forced to change their existing place of training or travel arrangements (12.5%). Some of the companies have also been forced to take some operational restructuring measures, resulting in changes of routes, hiking trails or paths, reorganizations, a reduction in income (24%) and incurred extra investment costs (22.5%).

17% of the interviewees agree that in the case of worse conditions for water sports they will no longer train in or visit the studied area. In response to a question whether the influx of athletes and tourists will be larger or smaller, the respondents correspond that the number of visitors or athletes in western Norway will increase. At the same time, they consider these projections to be one of the major impacts of climate change occurring in the studied area. Another research question was to answer the question whether employees in sport, tourism, and recreation industry are prepared for climate change, and if so, how are they prepared? Studies were carried out on partial (relative to adopted in the survey scale) preparedness of interviewees. It transpires that the subjects are prepared for changes in seasonality, higher temperatures, lower temperatures, more sunny days during a year, less frequent rainfall, inferior snow conditions (milder and wet

winters), and more humidity. They are not prepared for the following changes in relation to, and directly involved with, their business/companies: an increase in the level of the sea, a smaller number of sunny days, more frequent rainfall, melting glaciers, higher air humidity, increased frequency of strong winds changes of natural and leisure values. However, none of the subjects identify how they are prepared to deepen the ongoing changes. So the question arises, do the respondents see the need for change in the functioning of their business to changing climatic conditions? More than half of those surveyed declared that due to the connection to climate change they would remain in the business without any changes and more than 30% of them have not even thought about any changes in this area. 74% of the interviewees also believe that the company in which they work should not change its profile due to the effects of climate change, while 15% of them are for this change. 31% of athletes, persons doing recreation or tourism are not prepared to change the discipline or form of recreation or tourism declared in the survey to another. If the observed changes are to significantly deepen a large group of respondents (28%) is prepared to choose a different sport. Respondents are aware that certain sports, tourism or recreation activities are closely associated with constituents of nature. Therefore, such changes will be a natural result of atmospheric transformations, which are the subject of research. From the respondents' answers (athletes, tourists, and inhabitants) it follows that the glaciers will become the least attractive value of western Norway as a result of climate changes (27%). In turn, the waterfalls and streams considered most attractive value of western Norway as a result of climate changes (22%). This may be due to the fact that the IPCC scenarios (IPCC 2007) and respondents foresee an increase in the frequency of rains and melting of glaciers, by what may be an increase in the volume of water in the above tracks and itineraries.

According to the results published in 2010 (The Norwegian Climate and Pollution Agency 2010) areas such as sport, recreation, and winter tourism (based on snow), in the context of climate changes will be forced to adapt to them through:

1. change in practice in existing offers (e.g. snow cannons, ski slopes),
2. change of services location (e.g. transfer of the snow properties to the places with more snow),
3. change of offers (e.g. from glacier hikes to the cruises, sailing on fiords),
4. searching for creative solutions and increasing cash outlays.

According to the present report, there is no more specific information about athletes changing their outdoor training routines in relation to climate change, but it is believed that such changes have occurred and continue to occur. Some forms of training may be more vulnerable to climate change, especially the more extreme trainings. Climate change, the consequences of the greenhouse effect and other forms of impact of these weather changes on the environment, may aggravate existing effects in the quality of doing sports and outdoor activities, for example, by increasing mobility, increase in consumption of equipment or excessive use of the site. Such changes also affect tourism, which is one of the most dynamically developing economic sectors in the world whilst at the same time having a direct impact on nature and the environment.

Respondents (a group of entrepreneurs and business owners in western Norway) have noticed climate changes that have occurred in the nature of western Norway in recent decades. However, most of them were not prepared for these changes and furthermore, in their opinion, most of these changes will deepen. According to the interviewees, as a consequence of these changes, there will be also many new companies associated with sport, tourism and recreation. Such forecasts and this position may prove to be unbeneficial to the functioning of the researched companies. Some sports and some of the forms of tourism and leisure may be at risk. According to the respondents these are winter sports, air sports, hiking, walking, Nordic walking and trekking and it will be more difficult to do these activities than is currently the case. Changes in the winter sports notes e.g. Hermann Weinbuch trainer of the German Nordic combined team, who says, "There is no doubt – the situation of the athletes in

winter disciplines is and will be more and more difficult. There is less and less snow, the weather becomes variable and unpredictable." He continues: "We had to wait for snow, in the uniquely associating with winter mountain resort Obersdorf, until the middle of December, for many weeks weather forecast gave the organizers of the inauguration of the Four Hills Tournament sleepless nights. For a few days before the competition thermometers showed several degrees in the shade." (Web-08).

Respondents also noted positive, in their opinion, effects of climate change: higher temperatures and extending of the summer season in the region. However, you can assume that these changes, along with a growing number of people doing sport, tourism, and recreation, may prove to be not necessarily positive. The natural environment in this area will, after all, be more crowded by end users, which can affect the natural values of the area and subsequently the most frequently chosen places for sports, tourism, and recreation. It also may be detrimental to the future of the surveyed business owners in this industry due to (according to the predictions of the respondents) the growing numbers of new businesses resulting in increased potential competition.

Most of people covered by the research (a group of tourists, athletes, coaches) notice climate change and its increasing effects in the region, and they declare their desire to continue training or visiting (tourism, recreation) in western Norway. Therefore, half of them do not see the need to change their place of training or visits in the context of global climate change. Those who see the need to change the locality can choose an alternative region in Norway (north) or another Scandinavian or European country (Austria, Spain, Italy, Scotland, Ireland). Due to the researched group not being very large, as well as a lack of division of respondents (on tourists or athletes), any change here could change the obtained results. With a bigger number of respondents there could be a split on different sports and once could look more precisely to identify alternative places for training or arrivals of respondents.

It can be concluded, that all the above mentioned changes in nature and the environment of Norway can consequently change decisions, choices, preferences of athletes, tourists, residents and entrepreneurs who make their living from the sport, tourism, and leisure industries. For some of these people Norway may no longer be so attractive. For others, it can be more attractive than today, for example, by the significant influx of athletes or tourists expected by respondents.

For more than 20 years, research has been carried out identifying the impact of climate change on the sport sector, in particular, on winter sports in various parts of the world, emphasizing on North America (Smith 1990). The dual impact of climate on sports stands out: the intermediate factors (resources, i.e., water, snow) and the direct factors (quality and length of sport season, which affect the satisfaction of doing sports, outdoor recreation), on which the sport recreation and tourism sectors depend (Scott and Jones 2005). There are studies proving the impact of climate change, for example, on golf (McEvoy *et al*. 2001), where to be sure of organizational efficiency they apply different types of grasses and there is a special management of water resources in the field. In studies regarding the impact of climate change on another sport as tennis, there are mentioned positive effects, stressing in particular the possibility of doing summer sports longer. There were also conducted studies on the impact of climate changes on football in Poland (Choryński and Matczak 2011) and the necessity of adaptation of the infrastructure for this discipline to climate changes (synthetic surface). However, in the studies of a wide range of sports and recreation, the predominant indicator is a negative impact and the unexpected threat of weather as that result of climate change (Department of Sport and Recreation 2006). Researchers in the northeastern part of the United States estimate that four of the 14 major ski resorts will remain profitable until the year 2100 (Mote 2010). There will be no long-lasting snow as there is now and the possibilities for skiing will be much more limited, especially in the lowlands (European Environment Agency 2010). This can cause emphasis on the development of ski resorts, tours, and other objects in the mountains. It is also likely that Svalbard and other Arctic

regions will become more attractive places than now and there will be higher human impact on its environment. In the lowlands climate change may occur due to restrictions in public access to these places. Cultivated fields and farms are currently open for hikers and skiers in the winter, but only when the ground is frozen or snow-covered. As a result, many areas may become less attractive for sport, tourism and outdoor recreation (Ministry of the Environment of the Kingdom of Norway 2005). In the context of climate change a major concern becomes, among other things, instability and unpredictability of weather conditions. Therefore a very important fact was the signing of the global agreement in Paris in December 2015, whose key objective is to keep the increase in global average temperature at a level below 2 degrees Celsius above pre-industrial levels and continuing efforts to limit temperature increase to 1.5C. According to the Ban Ki-moon, the Secretary-General of the United Nations: "We have entered into a new era of global cooperation on one of the most complex issues, which humanity has never before faced with. It is the first time when each country in the world has taken the commitment to reduce greenhouse gas emissions, strengthen the resistance to the effects of climate change and join the common climate action. This is the spectacular success of multilateral cooperation." (Web-09).

The researched area of western Norway plays and can play a bigger role in the development and future of sport, tourism, and leisure activities in Norway. The continued increase in the number of tourists will require increased funding of the country for the protection of the unique natural habitat, which in the face of global climate change can be subject to further changes.

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Ocena wpływu globalnego ocieplenia na sport, turystykę i rekreację w Norwegii Zachodniej

Streszczenie

Sport, turystyka i rekreacja, jak wiele innych dziedzin życia, podlegają wpływom czynników środowiska, w tym klimatu. Klimat należy do głównych czynników określających warunki życia na naszej planecie, determinujących funkcjonowanie i zachowanie wszystkich zasiedlających ją organizmów. Pojawia się więc pytanie, czy i jak globalne zmiany klimatu postrzegane są przez ludzi oraz czy i jak oddziałują na różne domeny życia, a w szczególności na sport, turystykę i rekreację ruchową. Celem badań była ocena wpływu globalnych zmian klimatu (obserwowanych, a także kreowanych w świadomości społecznej przez środki masowego przekazu) na obszarze zachodniej Norwegii na sport, turystykę i rekreację. Badania przeprowadzono w sezonie letnio-jesiennym 2015 roku metodą sondażu diagnostycznego przez internet. Posługiwano się kwestionariuszem ankiety. Badaniami objęto dwie grupy respondentów: 61 pracowników i przedsiębiorców branży sportowej, turystycznej i rekreacyjnej w regionie zachodniej Norwegii oraz 32 osób uprawiających sport i rekreację oraz turystów odwiedzających ten region Badane osoby już zauważają zmiany klimatu, które zaszły w przyrodzie zachodniej Norwegii. Jednak większość z nich nie jest na nie przygotowana, mimo że ich zdaniem zmiany te będzie się pogłębiać. Niektóre z badanych przedsiębiorstw były już zmuszone do podjęcia pewnych kroków zmieniających ich funkcjonowanie, np. reorganizacje, co wiąże się z dodatkowymi kosztami. Spodziewane przekształcenia w przyrodzie Norwegii wywołane globalnymi zmianami klimatycznymi mogą zmienić zachowania sportowców, turystów, mieszkańców, przedstawicieli władz i przedsiębiorców sektora gospodarki, którzy utrzymują się z turystyki, rekreacji i sportu. Norwegia może okazać się dla nich już nie tak atrakcyjna jak obecnie.

Słowa kluczowe: zachodnia Norwegia, sport, rekreacja, turystyka, zmiany klimatyczne