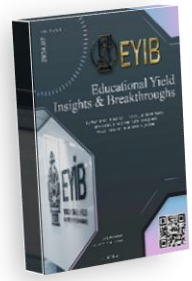
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The Impact of Climate Change on Global Tourism

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Annotatsiya

Background. Tourism is one of the fastest growing parts of the world economy. Tourism reacts strongly to climate. Studies that look at how tourism and climate change're related have split into separate branches. These branches use methods and sometimes give results that seem to conflict.

Kalit so‘zlar: climate change; tourism demand; Tourism Climatic Index; seasonality; vulnerability; adaptation; sustainable development

1. Introduction

Tourism has become an integral part of the global economy. Since 1950, the number of international tourist arrivals has increased from an estimated 25 million to approximately 940 million in 2010. This has grown at an average of around 6.5% annually. The World Tourism Organisation have predicted that international tourist arrivals will exceed 1.8 billion by 2030. International tourist trips account for a small amount of overall tourist trips (around 15%). In 2015, worldwide tourism contributed US$7.2 trillion (9.8% of the world’s GDP), and employed 284 million people (9.1% of overall employment) (World Travel and Tourism Council). Over 90 countries depend on tourism for more than 10% of their GDP. Tourism is strongly associated with climate. Tourism tends to be attracted to destinations offering pleasant climates during the traditional tourism season. Some are dependent on snow, coral reefs and beaches/glaciers. All of these destinations will be impacted by climate change and policy as it will affect the cost of travel, safety and natural environment. However, the association between tourism and climate change did not become widespread until the mid-1980s. The role of climate in tourism research has generally been overlooked and vice versa when examining climate impact (Hamilton, Maddison & Tol, 2005; Scott et al., 2012). There has been two conferences held by the UN on climate change and tourism. The first was in Djerba in 2003. The second was in Davos in 2007 concluding that climate change should be considered as the biggest threat to sustainable tourism in the 21 st Century. Although there has been an increase in research, there is variation in evidence. This is because research has been carried out using numerous methods. Research has used a global model with one equation system to predict tourist flows,

calculated climate comfort indices for specific locations, focused on specific tourism products (e.g. skiing) within one area or created complicated indicators to predict national vulnerability. All of these answer different questions and therefore can lead to contradictory summaries. Research into modelling has shown that climate change will not cause a huge impact to the overall level of international arrivals but only effects a few percent. However, research into specific areas has shown that ski areas, beaches and reef attractions may be lost. This gives a confusing message to the reader about whether there will be little relevance to climate change or it will completely impact tourism. Early research has tended to focus on one aspect of the tourism system (usually one destination or market segment) (Scott et al., 2012). Tourism is a competitive and complex system globally. To truly understand any impacts this needs to be compared to the impacts on competing destinations and tourist origins. Bringing the evidence together will increase understanding of how the main aspects of research will impact tourism. This article aims to bring together the main aspects of research literature to produce an integrated summary of how climate change is likely to impact global tourism. This will be achieved by addressing the following research questions:

RQ1: How will climate change impact total volume and distribution of international tourism demand?

RQ2: How will climate change impact climate comfort and seasonality of current destinations?

RQ3: Which tourism products and environments will be most impacted by climate change?

RQ4: How will vulnerability to climate change be distributed globally? How does this relate to the economic importance and anticipated growth of tourism?

RQ5: What role will mitigation policies and adaptations take? What areas are lacking in knowledge?

This article will follow the IMRAD format. Section 2 provides a brief overview of the literature and explains the conceptual framework which includes 4 pathways. Section 3 demonstrates the methodology used to create the integrated synthesis. Section 4 provides a brief summary of the results by addressing the 5 research questions. Section 5 discusses the findings, implications for policy and practice, limitations of the study and areas for future research. Finally, the main conclusions are given. References

2. Literature Review

For much of the twentieth century climate change and tourism were studied separately. Climate change focused on the impact on agriculture, water resources and ecosystems, whilst tourism focused on marketing, management and motivation. This led to a large body of literature regarding climate change and tourism with climate seen as an external factor for tourism (Hamilton et al, 2005; Scott et al, 2012). A key turning point was climate change becoming a key discussion within international organisations during conferences in Djerba (2003) and Davos (2007). There are three key studies which have been carried out. Gössling and Hall have conducted a multi disciplinary study looking at how tourism is both impacted by climate change and can contribute to global environmental change (Gössling and Hall, 2006). This study looked at how tourism is impacted in polar regions, fresh water environments, extreme weather, disease and water. A detailed review was undertaken by Scott et al (2012) looking at

the impacts on different market segments and pathways. The most recent study undertaken is by Scott et al (2019) looking at the vulnerability of countries. Alongside the two quantitative studies looking at global flows and climatic comfort (Hamilton et al, 2005; Amelung, Nicholls and Viner, 2007), these have formed the evidence base for this article. However most studies in the early literature focused on only one element of the tourism system (Scott et al, 2012). Tourism is a highly competitive and interconnected industry globally, therefore if any significant part of the market is impacted tourists will change their choices. This can create opportunities for other areas if the destination is put at a disadvantage compared to other competitors or businesses. For example if half the snow falls in Switzerland but all the snow falls in Europe then Switzerland could benefit (Hamilton et al, 2005). It depends on how the destination is impacted and changed compared to competitor destinations and the climate of the tourists home location. Four general pathways have been identified (Scott et al, 2012) which have been used to create a vulnerability index (Scott et al, 2019). These are outlined below in table 1.

Table 1: Effect pathways of climate change and climate change policy on international tourism

Effect Pathway Mechanism Effects

1. Direct climate effects Temperature, Rainfall, Seasonality and extremes impacting the length and quality of climate sensitive tourism. Shorter ski season, longer high latitude summer, higher costs of cooling and snow making, damage to infrastructure and disruption.

2. Indirect environmental effects Changes to natural resources that make up the destination image. Coral bleaching, glacial melt, beach erosion, changing biodiversity and wildlife, lack of water.

3. Indirect socio-economic effects Changes to economic factors, discretionary incomes, political stability and attitude towards travel. Lower Income from source area, security issues, health issues, changing perceptions.

4. External policies Cost and traveller changes due to mitigation and adaptation policies in other sectors. Carbon taxes on airlines, emission trading, changes to water rights and insurance costs.

Note: Adapted from Scott et al (2012) and Scott et al (2019).

There are many macro drivers to tourism such as economic growth/recession, travelling costs, political stability, currency and natural disasters and major events. The interactions between factors have not been explored in much detail so there are still uncertainties to how tourism will develop in the future in relation to climate change (Scott et al, 2012).

When researching the motivations of tourists ‘push’ and ‘pull’ factors are usually looked at. ‘Push’ factors relate to the tourists origin and what they want. ‘Pull’ factors relate to the destination and natural resources, culture and climate (Amelung et al, 2007). Climate can be seen as both a ‘push’ and ‘pull’ factor. Cold, dark and rainy days can encourage travelling whilst warm and sunny climates can attract tourists to certain areas. It has been found that the majority (70-80%) of British tourists’ main reason for travelling is improved climate conditions (Amelung et al, 2007). In Germany weather is the third most important factor to tourists after landscape and price. However it is

not always an important factor and was not even one of the most important pull factors in some surveys (Hamilton et al, 2005).

Climate can be quite complicated within tourism. Climate sensitive tourism relates to tourists being attracted to the climate, for example holidays in the Mediterranean. Weather sensitive tourism relates to tourists being impacted by the weather when wanting to do specific activities (Amelung et al, 2007). Scott et al (2012) also mention tourists will be impacted by levels of heat, moisture and wind. These vary depending on market segments and cultures. The early literature suffered from only looking at the annual average temperatures for each individual country. Four different categories of literature were found. The first was a simulation on global tourism flows. This looked at how demand for tourism changed based on income, population and temperature. It looked at how different climate scenarios would impact arrivals and departure (Hamilton et al, 2005). The advantage of this is it covers the whole globe and can show competitiveness between countries. However it has a weak evidence base and only uses annual average temperatures. The second category was climate indices. The most well known is the Tourism Climatic Index (TCI) (Mieczkowski, 1985). This looked at climate variables and created a comfort index for general sightseeing. It can be mapped spatially and temporally (Amelung et al, 2007). This shows how good a climate resource a place has but cannot predict how many tourists will visit. The third category was product/destination based. This included ski, coastal and nature based tourism (Scott et al, 2012). Many studies have been included in this (Gössling and Hall, 2006). This provided the most tangible evidence but suffered from an uneven spread. Whilst skiing had been looked at in depth coastal tourism, the biggest segment of tourism globally, has been looked at very little in a systematic manner (Scott et al, 2012). The fourth category was Vulnerability Indices. This looked at how vulnerable each country was based on exposures, sensitivity and adaptive capacity (Scott et al, 2019). This can show how different countries compare but is very subjective as it depends on what indicators are chosen and weighted. Gössling and Hall (2006) also highlight tourism can become a contributor to environmental change rather than just a victim. This is mostly due to emissions from transport. The book finishes with a study looking at tourism to the Seychelles. This found over 97% of the energy footprint was from air travel. They argue if studies only look at tourism from the destination perspective then most of the environmental impact is not looked at (Gössling and Hall, 2006). Tourism contributes to around 5% of global carbon dioxide emissions (Scott et al, 2012). Later estimates have shown tourism can contribute between 5.2% and 12.5% of radiative forcing. This shows tourism can be seen as a victim but also an emitter which links to mitigation policies. This was a common theme through out the sources. Each source made a unique contribution but none fully answered the questions faced by policy makers and destination managers. The simulation did not look at specific products, TCI did not look at arrivals, review did not show global ranking, vulnerability index used indicators from other studies and the edited book was broad but old. An integrated synthesis can help show the links between the findings and where they agree/disagree. This can help identify which conclusions are strong.

3. Methodology

An integrative literature review was undertaken to collect qualitative data. As multiple methods were used, this would not be quantifiable. This means that secondary

data was being used meaning the research would be descriptive. This means the conclusions will be based off current knowledge and not future predictions. Specific criteria was used to find the articles. The criteria were; (a) Discusses the impacts of climate change on tourism. Either globally or across multiple regions. (b) Peer reviewed or published by reputable academic publishers. (c) Looks at complementary factors of the topic. Including demand, supply, spatial, temporal and vulnerability. (d) Often cited. This gave a total of 5 sources which can be seen below in table 2.

Table 2: Source description

Source Type Research Focus

Hamilton, Maddison & Tol (2005) Simulation Global Demand Bilateral tourism flows between 207 countries. Simulated using 1995 calibration data. Destination attractiveness based on income and average annual temperature. Scenarios looked at include population, income and climate.

Amelung, Nicholls & Viner (2007) Index Comfort & seasonality An index to calculate the tourism climate index (TCI). HadCM3 scenarios used for 1970's baseline, 2020's, 2050's and 2080's. Using A1F and B1.

Scott, Gössling & Hall (2012) Advanced Review Impact pathways & Market segments Review of studies looking at impacts of climate change on skiing, coastal, nature based and other tourism. Includes mitigation policy.

Scott, Hall & Gössling (2019) Composite Index Vulnerability (National) The creation of a vulnerability index to understand climate change impacts (CVIT). Looking at 181 countries using 27 indicators from 16 different data sources. 6 dimensions.

Gössling & Hall (2006) Edited Book Tourism & Global Environmental Change Chapters look at the impacts of climate change on polar areas, freshwater, extreme weather, disease, water, emission from transport and sustainability. Interdisciplinary look at these factors.

[Note: Table made using 5 sources]

Information from each source was collected. This included research question, spatial scale, methodology, data, scenarios, quantitative findings, qualitative findings and any limitations mentioned by the authors. Then this was analysed by coding the statements (Deductive coding using the 4 pathways from table 1). Inductive coding was also used to group similar topics together. This was then grouped into 5 themes based around the research question. (a) Demand & Global Flows. (b) Comfort, Zoning & Seasonality. (c) Impacts on specific tourism products & environments. (d) Vulnerability variability. (e) Mitigation policy, adaptations & Knowledge gaps. The results from each source were then compared. All data was directly from the sources. Scenario and year identified. Not grouped as data is from different sources, different bases, scenarios and years. Validity was based on clarity of synthesis and quality of sources. Limitations were taken from the sources. More reliability given to results that have been found from various sources and methods. All claims can be linked back to the source. The sources were purposefully sampled meaning results won't be comprehensive. Some sources may have been missed relating to specific regions/sectors. Sources were published between 2005-2019 meaning the most up to date information on emissions, climate policy and how tourism have recovered from recent shocks may not be included. Some sources have overlap as later sources use

previous sources. For example, the vulnerability index uses findings from the simulation and TCI study. Due to this results should not be assumed to be completely independent. This has been considered when interpreting results (Section 5).

4. Results

Overall there were consistent results in the synthesis. There were 5 overall key findings. Overall climate change will have a secondary impact on the amount of tourism globally however it will have a primary impact on the geographical and seasonal distribution. It will also play a critical role in certain types of tourism and countries. Below are the results from the research questions. The most comprehensive model looking at how climate change could affect the global tourism pattern is Hamilton et al (2005). This looked at the two-way movement between 207 origin and destination countries. The model was calibrated using 1995 arrival and departure data. Tourists from each country were distributed according to general attractiveness of the destinations and distance between the capital cities. Attractiveness and propensity to travel was dependant on per capita income and annual average temperature. Income elasticity of attractiveness was found to be 0.80 and income elasticity of departure was 0.86. Temperature had a quadratic relationship with attractiveness. Cool countries will be more attractive with increasing temperature up to an optimum temperature of around 14°C. Cool countries will suffer from less international tourists with increasing temperature up to around 18°C however they will become more attractive for domestic tourism. Overall climate change will have a minimal impact on growth in tourism. It will however have a much smaller impact than population and income. Taking the average income elasticity, the average growth in international travellers between 1995 and 2075 under the A1B scenario will only be 3.24% annually. However if a higher income elasticity is used of 1.86 (taken from a meta-analysis of tourism demand studies) growth will be 7.46%. Even with this high income elasticity climate change will have a maximum impact of 7% on total arrivals. It should also be noted that this model was designed to look at sensitivity not forecasting. Whilst climate change will have a minimal impact overall there will be significant impacts geographically. Under a 1°C global warming in 2025, Canada, Russian Federation, Mongolia, Nordic countries and highland tourism in Zambia and Zimbabwe will see significant increases in arrivals. Hot destinations will suffer, such as Gulf states and many Sahelian countries. Table 3 shows some of the changes in market share. Canada will see an increase of 1.96% to 2.90%, Russian Federation will increase to 3.11% from 2.20%. Mexico will see a decrease of 3.71% to 3.16%. Spain will decrease to 4.84% from 5.09%. However due to increased attractiveness Canada and Russian Federation will see less tourists traveling internationally resulting in decreased market share to 2.21% from 2.86% and 4.61% from 5.75%.

Table 3: Simulated market shares (%) for 2025 with population and income growth (P+E) and under 1°C global warming (P+E+C).

Country Arrivals P+E Arrivals P+E+C Departures P+E Departure P+E+C
Canada 1.96 2.90 2.86 2.21
Russian Federation 2.20 3.11 5.75 4.61
China 7.25 8.17 2.10 1.99
Mexico 3.71 3.16 2.54 2.81
Spain 5.09 4.84 1.85 1.90

Italy 4.10 3.89 2.34 2.41
Germany 2.01 2.09 10.94 10.59
United Kingdom 3.07 3.17 6.14 5.96

[Note: Adapted from Hamilton et al (2005) Table 1 and Table 3. SRES A1B population and income. Global warming of 1°C. Average of 14 climate models.]

The simulations show that traditionally the biggest group of international tourists (Sun and beach lovers in North Western Europe) are not traveling as far. International tourists will generally travel less far with climate change. There is a reduction of between 4-7% in 2075. However this is a small amount. Some countries will see increases of up to 14% (Singapore). Other countries will see a reduction of up to 36% (Canada).

The sensitivity analysis shows there are sensitive results. If there are becoming cheaper to travel then distance will not be an issue. Places such as Pacific Island nations will see huge increases in arrivals of over 50%. New Zealand will see an increase of over 60%. European and Middle Eastern countries will suffer with up to a 12% reduction. The model is also sensitive to assumptions on tourist preferences. Using different parameters from an independent study looking at Italian tourists (who have a strong preference for temperature) climate change dominates the socio-economic scenario. This can result in some countries having a near complete reduction. However as this is a sensitivity test it is not representative as Italians are not representative. Amelung et al (2007) used the Tourism Climatic Index (Mieczkowski, 1985) which takes 5 sub-indices (Daytime comfort index, Daily comfort index, Rainfall, Sunshine and Wind) and combines them into a single score out of 100. The formula used is TCI= 4CID + CIA + 2R + 2S + W. Anything with a score of 70 or above will be considered attractive for general sight seeing tourism. The index was calculated for a baseline period centred around the 1970s, 2020s, 2050s and 2080s. Scenarios were run for two emission scenarios. A high emission (A1F) fossil fuel intensive scenario and a more environmentally friendly (B1) scenario. There seems to be a large shift towards polar regions. During the baseline period the most comfortable summer conditions will be in the Northern Mediterranean (Spain-Turkey), Western and Central United States, Southern Africa and Northern Australia. During the 2080s under the A1F scenario the most ideal summer conditions for the Northern Hemisphere have moved to Northern Europe and Canada. Even under the B1 scenario the most ideal conditions have moved to Northern France, Southern England, Germany, Low Countries and Southern Scandinavia. During the Southern Hemisphere the band of comfortable conditions have moved further south. The band of uncomfortable conditions around the equator have increased. This means very few places in Central America, Northern South America, Central Africa and South-East Asia will have even one month of comfortable conditions. Only Central Asia (Tajikistan) will have ideal conditions. The number of good months will also change. Currently the Mediterranean coast will have up to 7 months with a TCI of over 70. However Northern Europe will only have 1-4 months. Due to increasing temperatures during the summer months the Mediterranean could reduce to 4-7 months. However Northern Europe could increase by several months. This could mean that they lose the peak of summer and gain two peaks in Spring and Autumn. However as 54% of international arrivals and 52% of receipts were from Europe in 2004 and approximately 1/6 of international tourism trips were made by

Northerners to the Northern Mediterranean in 2000 there are global implications. Whether it will be an issue depends on how flexible institutions are. If institutions (such as schools) are flexible tourists will be able to spread their travelling time and climate change will not affect seasonality. However if institutions are not flexible then adaptation will only be spatial. Popular destinations will see a large loss of summer tourists. Northern destinations will see large increases in tourists which cannot be spread throughout the year. Seasonality will increase. Scott et al (2012) highlight that claims that the Mediterranean will be too hot for tourism (as early as the 2020s) rarely had any definition of what was too hot. When re-evaluating using surveys it was found that parts of the Mediterranean already experience temperatures similar to what tourists would consider too hot. However only under the hottest scenarios in the mid to late century would exceedance occur. Aggregated models and indices do not give much indication of what tourism products will be affected by certain climatic conditions. Evidence from Scott et al (2012) and contributors to Gössling and Hall (2006) are summarised below .

Skiing was the most researched area. The review showed that early studies tended to overestimate impacts due to incorrect indicators and failure to take into account snow making. Studies taking into account snow making (Canada, United States, Australia, Austria-Italy) showed much smaller impacts. However in mid century there will still be less reliable natural snowfall, increased snow making with less favourable hours and shorter and more variable seasons. There will be a reduction in the number of ski areas. Lower altitude areas and early season christmas period are most at risk (Scott et al, 2012). However in North America slight temperature increases (as projected for 2020s) could have positive impacts on mountain tourism due to longer and better summers. However in the European Alps where there is less investment into snow making a 2°C increase is projected to threaten a significant number of ski areas (Gössling & Hall, 2006). Overall the ski industry will not disappear however individual businesses and communities will shrink. Coastal tourism is the biggest segment globally however there has been very little systematic analysis of the impact of sea level rise (Scott et al, 2012). Assuming no impact on relative attractiveness of destinations computable general equilibrium analysis showed that a rise in sea level of 0.25m by 2050 would have hardly any impact on global tourism. However in specific areas the impact would be much greater. Large parts of the historical city of Alexandria are at risk from a 0.5m rise. In North Carolina 1.2 Billion USD of vacation properties are at risk from a 0.5m rise. Adaptability will vary. Infrastructure such as airports, cruise ports and high density urban resorts can be protected. However resorts relying on sea views and access to the beach are difficult to protect. The least adaptable are small island developing states and least developed countries in Africa and Asia. Overall rising sea levels will have a marginal impact on steep fiord coasts however could be fatal to low lying atolls. It could also lead to a shift in global tourism towards higher latitudes (Gössling & Hall, 2006). In Barbados a majority of tourists said they would not return at the same price if erosion increased. Nature-based tourism is reliant on climate sensitive environmental resources. Evidence was mixed (Scott et al, 2012). Studies looking at National Park visitors in the Rocky Mountains showed a significant proportion would stop visiting or visit less frequently under major environmental change scenarios. Loss of glaciers was the most important reason. However coral

bleaching suggests diving tourism may be more resilient than expected. A survey looking at tourists in Churchill Canada showed only half would visit if they could not guarantee seeing bears. A strong majority said they would go elsewhere to see bears. This may create opportunities for other destinations. Overall global environmental change in fresh water systems will have negative impacts on recreation and tourism due to changing water levels, temperatures, pollution, biodiversity loss and competition for water (Gössling & Hall, 2006). Last chance tourism is not well documented. Ethical issues arise due to increased emissions through travelling to exacerbate the issue (Scott et al, 2012). Extreme weather can have immediate impacts on infrastructure. This can deter tourists. Tropical storms pose the greatest threat to tourists and tourism infrastructure. This is due to a large amount of coastal tourism in tropical areas prone to hurricanes. However trends in storm frequency are unclear and projections from models are speculative. Some indicators suggest they may increase in intensity. Increasing average temperature and variance means heatwaves are more likely. Climate sensitive health risks (spread of vector borne diseases) may detour tourists. Water is also an issue. Tourism is a high user of water in dry destinations and the sector is vulnerable to water shortages and increased costs. Scott et al (2019) developed the Climate Change Vulnerability Index for Tourism (CVIT) to provide a consistent comparison between national tourism vulnerabilities. The index covers 181 countries and uses 27 indicators from 16 sources. The definition was taken from the Intergovernmental Panel on Climate Change which defines vulnerability as a function of exposure, sensitivity and adaptive capacity. The indicators were split into 6 categories. Tourism assets, tourism costs, tourism demand, deterrence factors in host country (Weather disasters, Health, Security), Adaptive capacity in tourism sector and Adaptive capacity in host country. The tourism demand indicator was directly taken from the simulations of Hamilton et al (2005). The tourism assets indicator was taken from climate suitability indicators of Amelung et al (2007). Two weighting systems were tried. The correlation between the two indicators was very high (0.97).

There are clear geographical impacts. The least vulnerable countries are Western Europe, Northern Europe, Central Asia, Canada and New Zealand. The most vulnerable are Africa, Middle East, South Asia and small island developing states in the Caribbean, Indian and Pacific Oceans. Many of the top 25 most vulnerable countries include Eritrea, Djibouti, Somalia, Yemen, Solomon Islands, Haiti, Kiribati, Bangladesh. The least vulnerable countries include Liechtenstein, Denmark, Finland, Austria, Sweden and Norway. Despite many Northern countries expecting to lose winter tourism they are considered to be low vulnerability due to high adaptive capacity and likely opportunities in other sectors.

Comparing the vulnerability with economic importance the most vulnerable are almost exclusively small island developing states where tourism contributes over 15% of GDP. These include the Maldives, Seychelles, Mauritius, Antigua and Barbuda, Bahamas, Saint Lucia, Grenada, Barbados, Jamaica, Vanuatu, Fiji, Kiribati. Non island countries include Costa Rica, Belize, Honduras, Laos, Thailand, Cambodia, Vietnam, Namibia and Gambia. The largest tourism economy is Mexico. Comparing this to growth projections there is cause for concern. The most vulnerable regions tend to be those with the largest growth projections (Table 5).

This is seen as a headwind to tourism in regions where it is most needed (Scott et al, 2019). There is also concern that it could create a vicious cycle with increased tourism growth causing more emissions and therefore making them more vulnerable. A sectoral index was previously created which showed small island states to be most vulnerable due to exposure to coral reefs. Another was created however the methods used were unclear and small island states were not included giving very different results to the CVIT.

Mitigation

Tourism is impacted by climate policy through increased travel costs. It is reported that transport accounts for around 20% of carbon emissions. Air travel accounts for around 12% of transport energy usage. It is also one of the fastest growing forms of transport (Gössling & Hall, 2006). Mitigation policies have focused almost entirely on aviation. Taxes on international flights and aviation joining the European Union emissions trading scheme have caused concern in long haul destinations such as the Caribbean, Australia, New Zealand and Indonesia. Studies consistently show that policies as they stand would only result in a reduction in international arrivals of typically less than 5%. Air travel and international tourism will continue to increase (Scott et al, 2012). More stringent global policies could have larger impacts, especially on small island developing states. Overall attitudes are unlikely to help as many people state they would pay a tax or offset however typically less than 5% buy offsets.

Adaptation

The tourism industry has shown to be very adaptable to shocks such as terrorism, disease outbreaks and the global financial crisis (2008-2009). Overall showing high adaptive capacity (Scott et al, 2012; Scott et al, 2019). Stakeholders are reasonably aware of climate change however are not overly concerned it will have a large impact on their businesses. Nearly half of Austrian ski managers believed additional snow making would keep their business viable for at least another 75 years. However stakeholders may be over estimating their capacity under mid to high emission scenarios (Scott et al, 2012). Little is known about the effectiveness of current adaptations. Uncertainty around climate science, long timeframes not fitting with business planning and lack of technical, human and financial capacity are consistently cited as barriers. SMEs are particularly limited. An assessment of 18 leading tourism countries showed that most governments had not carried out a strategic review of vulnerabilities in the sector. Only around a quarter had considered adaptation strategies for tourism, 2 concluding that no strategies were needed. 82 of the 182 Nationally Determined Contributions under the Paris process mention tourism. This shows increasing awareness however not consistent action (Scott et al, 2019).

5. Discussion

Overall this synthesis has demonstrated that the apparent paradox of climate change leading to a small or severe impact can be explained by looking at the scale the impact is being measured on. It has been identified that at a global scale climate change will only have a small impact on the total number of tourists due to income, population and travel costs being the drivers of tourism (Hamilton et al., 2005). However at a destination/product/country scale climate change can have a significant impact. A small change to the distribution of tourists globally does not have an impact on the total number of tourists globally but a small island economy that relies on tourism

contributing over 15% of its GDP can have a large impact (Scott et al., 2019). This means the results of aggregate and localised studies are not contradictory as they are answering different questions. Secondly the impact of climate change on tourism is not negative but a shift in where tourists go. Comfortable temperatures are shifting North and higher (Amelung et al., 2007) simulations show colder countries will benefit but hotter ones won't (Hamilton et al., 2005). The Mediterranean may lose its summer peak. The TCI study demonstrates Central Asia, specifically Tajikistan will still have ideal conditions throughout the century and the vulnerability index shows it will be one of the least vulnerable areas (Amelung et al., 2007). This doesn't indicate the number of tourists going but the climate resource may increase. Finally this synthesis has demonstrated that human adaptation can play a big part in the outcome. Looking at the flexible and inflexible scenarios (Amelung et al., 2007) opposite conclusions can be reached. Snow making can help reduce the severity of the impact on skiing. Analogue studies have shown intentions and actual actions may not match and certain areas of diving have shown a relatively high resilience to climate change (Scott et al., 2012). Predictions do not consider adaptation and tend to be quite negative. However there is little evidence as to how effective adaptation can be.

Table 6 shows the main conclusions from this synthesis along with the evidence to support them and strength. This is my own interpretation of the evidence and considers how many sources and different methods are used to support each conclusion. The authors have also considered how limited their studies are.

Conclusion Evidence Strength

Climate is a secondary factor affecting total international arrivals. Hamilton et al. (2005) Scott et al. (2012) Moderate - Mainly one method of simulation. Limitations acknowledged.

Comfortable temperatures are shifting North/Higher. Seasonality may change in the Mediterranean. Amelung et al. (2007) Hamilton et al. (2005) Scott et al. (2012) Moderate - Consistent results between both methods. Cannot confirm impact on arrivals.

Low altitude ski, coastal and reef tourism is most vulnerable. Scott et al. (2012) Gössling & Hall (2006) Strong - Skiing only. Low for coastal and reef.

Small islands, Africa, South Asia and Middle East are most vulnerable. Scott et al. (2019) Hamilton et al. (2005) Amelung et al. (2007) Moderate - Vulnerability depends on the indicator. Some results are using similar inputs.

Mitigation will reduce but not prevent growth. Adaptation is poor. Scott et al. (2012) Scott et al. (2019) Gössling & Hall (2006) Moderate - Little empirical evidence to show how effective mitigation/adaptation will be.

Whilst the sources agree on the overall trend, different areas are being highlighted. Simulation studies and TCI show high latitude/high altitude countries will benefit. However the product studies show some areas in the North and Mountains will be negatively impacted. In particular low altitude ski industries. This is overcome by looking at the vulnerability index. Whilst countries in the North may be negatively impacted by certain products they may not be vulnerable overall due to having a high adaptive capacity (Scott et al., 2019). The edited book (Gössling and Hall, 2006) is more critical about the industry and researchers work towards sustainability as it focuses on tourism as an emitter and how it will adapt. The evidence suggests tourism

should be more explicitly included in National Adaptation plans, Nationally Determined Contributions and Official Development Assistance. Governments rarely consider how vulnerable this sector is (Scott et al., 2012)(Scott et al., 2019). Destinations with high vulnerability and dependency should be supported. The International air passenger levy has been frequently suggested to fund adaptation in highly vulnerable countries as these countries emit a lot of emissions from their key source markets (Scott et al., 2019). Tourism strategies should be looked at to identify climate risk. The areas with the highest projections for growth are the most vulnerable. Growth currently isn't taking climate change into account. The sector should also look to reduce their emissions as travel, particularly air travel, makes up the majority of their environmental impact (Gössling & Hall, 2006). Destination managers should be using an adaptive strategy and diversifying. Monitoring thresholds for certain tourism sectors, planning for longer/shifted seasons, investing in products that aren't as reliant on one climate sensitive asset and acknowledging stakeholders may over estimate their adaptive capacity (Scott et al., 2012). Countries in Central Asia, including those experiencing increased tourism have shown they do have an advantage with their climate but this isn't guaranteed as transport links, infrastructure, safety and culture will also affect visitation (Amelung et al., 2007).

There are limitations to be considered regarding the conclusions from this article. The synthesis was based on 5 intentionally selected sources so other studies may not have been considered. All sources were published between 2005 and 2019 meaning the projections are based on scenarios and baselines which have now changed. Many sources have similar inputs reducing the independence of the evidence. None of the models were re estimated using the figures given by the original authors. The strength of evidence in Table 6 is my own interpretation. Overall the data shows an overall trend but should be treated with caution when looking at specific numbers. Gaps in knowledge have been identified. Further research should be done looking at more regions, particularly Africa, Asia, Central/South America and small islands where there is the least evidence (Scott et al., 2012)(Scott et al., 2019). Global models should be more realistic looking at tourist behaviour and how they will actually respond to changes, differences within the market and future cohorts who won't have any memory of past environmental conditions. More sub-national analysis should be done and how climate interacts with other tourism drivers. Indicators like CVIT should be improved and monitored over time. Empirical investigation should be done to see how effective adaptation strategies, such as snow making, coastal protection and diversification, will be.

6 Conclusion

This article, drawing upon five different sources, has highlighted that whilst climate change will impact tourism globally, it will not affect everyone equally and for many countries the impacts will happen slowly. There will be growth in global tourism and climate change will not be the main factor. There will be a shift to high altitude and latitude areas to find more comfortable climates. Activities in low altitude environments (ski, low lying beaches and reefs) will feel significant pressure. Adaptation will take place and there will be areas that are more resilient therefore the impacts will not be as extreme. Overall the impacts will be unequal and areas that are most important to tourism will be hit hardest. Tourism will become more of a victim

and culprit, therefore there will be increased influence on the costs of tourism. Overall there is a lack of preparedness and knowledge. Evidence suggests that there will be some moderate but serious impacts. Tourism will not disappear but some areas will benefit so they cannot be complacent. Policy makers need to include tourism in adaptation and climate strategies. Support should be provided to the most vulnerable areas. Researchers should look at filling in the knowledge gaps in certain regions and behaviours. As stated in the title of the final chapter by Gössling and Hall (2006) 'it is time to wake up'. This is a serious issue.

References

1. Amelung, B., Nicholls, S., & Viner, D. (2007). Implications of global climate change for tourism flows and seasonality. Journal of Travel Research, 45(3), 285–296. https://doi.org/10.1177/0047287506295937

2. Gössling, S., & Hall, C. M. (Eds.). (2006). Tourism and global environmental change: Ecological, social, economic and political interrelationships. London: Routledge.

3. Hamilton, J. M., Maddison, D. J., & Tol, R. S. J. (2005). Climate change and international tourism: A simulation study. Global Environmental Change, 15(3), 253–266.

4. Scott, D., Gössling, S., & Hall, C. M. (2012). International tourism and climate change. WIREs Climate Change, 3(3), 213–232. https://doi.org/10.1002/wcc.165

5. Scott, D., Hall, C. M., & Gössling, S. (2019). Global tourism vulnerability to climate change. Annals of Tourism Research, 77, 49–61. https://doi.org/10.1016/j.annals.2019.05.007