Bachelor thesis in Human Geography
Perceptions of climate change at ski resorts in mid-south of Sweden.
Abstract

Climate change as a phenomenon will imply new risks for the ski industry. Intergovernmental Panel on Climate Change presents three future scenarios, during the periods between 1990-2100, in forms of increased temperatures, a rise in the sea level and seasonal variations, variables out of which two have direct impacts on the ski industry. The aim for this study was to explore and compare attitudes towards climate change between five ski resorts located in mid-south of Sweden. This was done through in depth interviews in both face to face and by telephone. The result of the study was that all the chosen ski resorts were aware of climate change as a phenomenon but have not yet recognized its consequences. All ski resorts use methods to maintain skiing i.e. artificial snow production though not because of climate change.

Sammanfattning

Klimatförändringar som ett fenomen, kommer att innebära nya risker för skidindustrin. Intergovernmental Panel on Climate Change presenterar tre framtida scenarion, under perioden mellan 1990-2100, i form av ökade temperaturer, ökning av havsnivån och förändrade säsongsmönster, variabler av vilka två har direkta effekter på skidindustrin. Syftet med den här studien var att undersöka och jämföra attityder mot klimatförändringar mellan fem skiddestinationer lokalisera i mellersta och södra Sverige. Det var gjort med djupgående intervjuer både på plats och per telefon. Resultatet av den här studien var att alla valda skiddestinationer var medvetna om klimatförändringar som ett fenomen, men är inte än helt övertygade om dess konsekvenser. Alla skiddestinationer använder sig av metoder för att bibehålla skidåkandet som produktion av konstsnö men detta görs inte på grund av klimatförändringar.
4.2 Strategies ........................................................................................................22

4.3 Ski resorts perception of tourist attitudes concerning climate change ....25

5 Analysis..................................................................................................................27

5.1 Climate change ..................................................................................................27

5.2 Strategies ..........................................................................................................27

5.3 Perceptions ........................................................................................................29

6 Discussion..............................................................................................................31

7 Conclusion .............................................................................................................33

8 References.............................................................................................................35
1 Introduction

A possibility of climate change with increasing temperature all over the world presents new risks for the tourism industry. Climate change is a contemporary debate and perhaps a future problem. ‘In my view, climate change is the most severe problem we are facing today, more serious even than the threat of terrorism’ (King, 2004:176). The tourism industry is especially vulnerable because of its dependence on weather as well as natural features and scenery, variables which could be heavily affected by climate change, specifically ski tourism which like many other types of tourism is dependent on natural features. This industry is dependent on cold weather and snow cover which reasonably would suffer from temperature rises. Climate change therefore bears crucial relevance in the context of ski-tourism and its future existence which has to be taken seriously. Especially in the tourism industry since it is an important part of the regional economy (Hall, Müller and Saarinen, 2009).

Becken and Hay (2007:40) present a dark future for ski-resorts at lower altitudes when snow cover decreases and temperature rises. They stress the risk of total termination of operation in the future for ski-resorts in alpine Europe at lower altitudes. Elsasser and Burki (2002) argue that ski resorts above 2000 masl (meters above sea level) have a brighter future ahead in forms of snow covered areas. Decreased natural snowfall and increased temperatures will definitely create the need for adaptation in order to prevail. SEPA, the Swedish Environmental Protection Agency (2011), has identified ski tourism in Sweden as vulnerable to climate change which risk economic losses. Since many ski resorts in Sweden range from about 250masl to 1000masl with the highest slope in Abisko at 2000masl (Ski Info; Allt om skidresor, 2012), this is of importance to explore further and why this research will focus on adaptation strategies and perceptions at ski resorts in mid south of Sweden. The study area, mid south of Sweden became Dalarna where all ski resorts are located and illustrated in the map (fig.2).
1.1 Research problem

Alpine Europe has been extensively researched on ski tourism and climate change as well as adaptation strategies for climate change. This is one of the major areas for skiing in the world (Becken and Hay, 2007; Climatic research unit, 1999) and an area of origin for these studies. Elsasser and Burki (2007) mention that diminishing snow cover was given major attention in the Alps especially the years between 1987-1990 when the tourism industry had grown substantially to a level where its economical loss became significant. Some studies in the mountain areas in Scandinavia have been conducted on the effects of climate change (Moen and Fredman, 2007) which also argued potential substantial economic loss because of climate change.

Moen and Fredman (2007) pointed out that impacts of climate change on downhill skiing have been given relatively little attention in Scandinavia. This study have recognized the need to research smaller ski-resorts in mid-south of Sweden which because of lower altitudes as well as less recourses available could be more vulnerable and have different attitudes and perceptions.

1.2 Aim, objectives and research questions

Because tourism has integral economic impacts on the regional economy and climate change is a major threat to tourism activities, the aim of this study is to explore and compare attitudes towards climate change between five ski resorts located in mid south of Sweden. In addition, the use of strategies to mitigate the effects of climate change will also be explored at the cases. The objective of this study is to exemplify perceptions from the selected ski resorts towards climate change, their strategies to mitigate its effects and a theoretical perspective on climate change, its effects and adaptation strategies. Additionally the ski resorts perception of their customers’ attitudes concerning climate change will be attempted to explore, as the customers are a vital aspect for any business, how their attitudes are perceived is important. These perceptions will consist of informants at the ski resorts, Bjursås SkiCenter, Kläppen Resort AB, Rättviksbacken AB, Säfsen Resort AB and Grönklittsgruppen AB. In order to fulfill the aim and objectives of this research, these research questions will be answered:
1. Do the ski resorts perceive climate change as a threat to their winter activities?

2. How can they engage consequences of climate change i.e. warmer climate, changes in snowfall and seasonal changing patterns?

3. How do the ski resorts perceive tourist’s attitudes towards climate change?
2 Literature review

2.1 Background

2.1.1 Tourism

Today, the industry of tourism exists in various forms whether the demand is for sun, sea and sand, alpine activities or adventure tourism, there is something for everyone. People’s different perspectives and desires force the tourism industry to develop new alternatives to satisfy tourist’s different needs. The alpine industry itself dates back before the 18th century and it was during the middle of 19th century as the mass tourism in the Alps begun (Godde, Price and Zimmerman, 2000). As demand for alpine activities increased among the tourists, railways were built to improve the accessibility in the mountains. Nowadays, around 100 million tourists visit the Alps each year (Becken and Hay, 2007:26). Among the destinations in the Alpine Europe, many are solely or almost exclusively dependent on winter tourism. Their source of income is dependent on the tourism flows which in this turn are directly affected by snow reliability (Bürki, Elsasser and Abegg, 2003). In Sweden the skiing is the major tourism activity in the mountain regions. (Moen and Fredman, 2007). Domestic tourism in general in Sweden is often an integral part of the regional economy. Expenditure by tourists generate income and employment opportunities to the region which in turn multiply into other regions (Hall, Müller and Saarinen, 2009; Archer, 1982 cited in Saarinen 2003). Additionally tourism, is often used as a tool for rural development. Since rural areas began to experience decreased opportunities, tourism has been a way of maintaining rural areas concerning economical growth and work opportunities (Wilson, Fesenmaier, Fesenmaier and Van Es, 2001).

2.1.2 Climate change and its effects

Climate change, also called global warming has started to affect the earth more and more in forms of an increase in the temperature, extreme weather and a rising sea level (European Union, 2006). The earth’s atmosphere filters some of the heat from going back out into space and is comparable to a greenhouse. Natural greenhouse gas emissions exist on the earth but since the industrialization, the concentration of the gases has increased substantially. Carbon dioxide stands for 75% of all the emissions
being released in the world by the burning of fossil fuels like oil, coal, woods etc. by the humans (European Union, 2006). The tourism industry is a big user of these fossil fuels especially in transportation e.g. one mode of transport responsible for the fastest growing of greenhouse gas emission is air planes (Becken and Hay, 2007:119).

The mean temperature has increased by 1°C during the 20th century in Europe and scientist of climate predicts that the temperature will increase further by 2°C and 6.3°C in Europe by the year of 2100 (European Commission, 2006). An increased in the temperature affects the season but also the snowfall. In some areas in the European Alps, the amount of snow can reduces by as much as 30% in the year of 2020 and in the year of 2050, by 50%. The winter tourism industry in the Alps has declined the last five years and especially the Swiss Alps has suffered consistent economical losses for several years. (Climatic research unit, 1999)

Intergovernmental Panel on Climate Change has listed three future scenarios during the periods between 1990-2100 (IPCC, 1999,2001 cited in Hall and Higham, 2005:64). These three scenarios will affect both economic and social factors in many sectors, including the tourism industry:

- Global temperature will increase by 1,4°C to 5,8°C
- Sea levels will rise by 9 cm to 88 cm by 2100
- Regional and seasonal variations

Hall and Higham (2005:67) continue to argue the consequences for the Alpine regions considering these scenarios. The ski season will be shorter while the season providing non-ski activities will be longer than before. The demand for ski resorts located at higher altitude will increase but the overall demand for skiing could also decrease consider the uncertainty of snow covered areas. The ski resorts that will be most affected by climate change are the ski resorts located on an altitude beneath 2000 masl (Elsasser and Burki, 2002). Ski resorts in such areas must adapt to climate change or perish eventually.
Research by Moen and Fredman (2007) has attempted to project the regional effects of climate change on a ski resort in the southern parts of the Swedish mountain range. The snowfall is argued to decrease in number of days but increase cumulatively. The season regarding snowfall will therefore become shorter but during that time the snowfall will be larger in total (millimeters).

Inland northern and southern parts of Sweden is said to account for a smaller part of ski-ticket sales. Sales in the mountain regions accounts for the majority +80%. According to the projections, the specific ski resort risk a reduction of skiable days by 40-60% out of 162 that was skiable in 2007. In addition, the reduced expenditure in Sweden at ski resorts because of less skiable days could amount to between 900-1755 million SEK, a significant but rough amount caused by differences of impact by either cumulative snowfall or mean daily temperature. The research argues that it is necessary to develop alternative activities to skiing that do not rely on the existence of snow coverage. (Moen and Fredman, 2007)

Studies have shown that both the length on the season and the snow amount has decreased significantly since mid-1980s. (Becken and Hay, 2007:37) Due to shorter seasons, the demand for snow covered areas increases on the ski resorts which become especially important on occasions like Christmas or winter sports holidays (Bürki, Elsasser and Abegg, 2003). Not surprisingly since most of the tourists activities in the Alps involve snow. In the planning stage of a ski trip, an evaluation of whether the ski resorts has the ability to offer snow or not becomes a crucial aspect in the final choice of ski resort. The fact that tourists are very dependent on the snow is further confirmed in research. When ski resorts has suffered from poor snow conditions over a period of time, 49% of the skiers would choose another snow reliable ski resort and 32% would ski less often (Bürki, Elsasser and Abegg, 2003). It is interesting in this research that almost half of that sample would choose another ski resort with more reliable conditions, because it states the dependency on good snow conditions.
2.2 Adaptation strategies

The projected impact concerns the ski resorts snow reliability. There are definitions on the concept e.g. ‘a ski resort could be considered as snow reliable if, in 7/10 winters, a sufficient snow cover of at least 30 to 50 cm is available for ski sport on at least 100 days between December 1 and April 15.’ (Bürki, Elsasser and Abegg, 2003) This however is based on the condition of the alps and not Sweden, but the principle is the same, that snow reliability is a measurement or appreciation of the conditions i.e. snow depth and temperature at ski resorts and the “ski ability” in those conditions.

A model of adaptation strategies for climate change was developed by Elasser and Bürki (2002) (Fig. 1). It depicts the general strategies available to a ski resort facing the effects of climate change. The strategies for maintaining ski tourism are in direct concern with snow reliability. Maintaining ski tourism is mostly a matter of maintaining snow reliability.

Figure 1 Adaptation strategies in the ski tourism industry
Development of higher terrain is not considered relevant to this study, the possibilities to do this in Sweden are slim. The strategy is developed with the natural features of the Alps as a prerequisite, the Swedish ski resorts are often at the highest possible terrain under the available conditions.

Fatalism strategies *Cancel ski tourism* and *Business as usual* are not supposed to be interpreted as real strategies (Elsasser and Bürki, 2002). Instead these are the different outcomes if a business fails to adapt to climate change, either by disregarding the threat or adapting unsuccessfully.

Subsidies are a measure of maintaining ski resorts which are of economical importance to the region. Subsiding minor resorts are sometimes argued to have further significance in promotion of the industry as a whole. New generations are often introduced to skiing in the slopes at these minor resorts, so subsidies of these could act as a preemptive investment in the industry’s future. However, the significance is a debated issue (Bürki, Elsasser and Abegg, 2003). Additionally, because of the tourism industry’s importance to the rural economy and tool for development in rural areas (Wilson, Fesenmaier, Fesenmaier and Van Es, 2001).

Another strategy is to develop alternatives to skiing at the resorts. This strategy was also addressed as revenue diversification by Scott and Mcboyle (2007:1421). Their revenue diversification contained spa and sports facilities, retail stores, rafting, mountain biking. Generally they are similar activities but with more than one purpose, both one that would attract non skiers in the winter season, but also activities that expanded in to other seasons. Diversification could compensate for a diminishing winter season and from a business’s survival point of view, alternatives to ski tourism could be developed. (Scott and Mcboyle, 2007)

### 2.2.1 Artificial snowmaking

Artificial snowmaking is one of the most common and contemporary strategies, a snowmaking method which is used to mitigate the effects of diminishing snow fall as
well as to prolong the season (Elsasser and Bürki, 2002; Scott and McBoyle, 2007). It is a procedure that uses snow guns or canons which discharge compressed air and cold water into the air that freezes on impact resulting in ice particles (Vijay, 2011:62). Besides technological advances in snow canons and energy efficiency, new methods for producing snow have been developed which are operational in up to +20°C. (Vijay, 2011)

Scott, McBoyle and Minogue (2006) argued that artificial snowmaking is commonly used in North America which is why the skiing there is less pervious to climate change. Further, they argued that it is general practice to use artificial snowmaking in many resorts today, a fact that have not been taken into account in research and which is why the industry might not be as vulnerable after all. Hall and Higham (2005:214) mentioned that Norway as a case does not use artificial snowmaking due to climate change at all but instead, as a method to prolonging the season. This had become a market trend which the ski facilities had to adapt to in order to remain competitive.

However, artificial snowmaking is investment intensive and not every ski resort has the resources to sustain its large energy consumption. Besides energy, large amounts of water are also necessary in the process, this is sometimes opposed by local communities and environmental organizations. However, more sustainable approaches are being developed i.e. construction of water reservoirs to mitigate the mitigation of climate change effects. (Scott and McBoyle, 2007)

2.2.2 Ski slope design

The depth of snow which is necessary to maintain downhill skiing varies on the shape of the terrain. A smooth terrain made up of soil or grass would only require minor snowfall to prevent skiers carving into the ground when skiing. If the terrain is uneven with large rocks, the snow cover would have to extend above those rocks with a margin. Consequently, contouring the slopes and removing any obstacles or rocks can be done to sustain the activities in event of less natural snow fall or a reduction in artificial snow production, this is also a method in the development of new ski slopes. Additionally, development of new ski areas can be done on a higher altitude, in a favorable cardinal direction or simply in snow reliable regions. (Scott and McBoyle, 2007)
2.3 Perceptions

Bürki (2000) conducted focus group interviews of representatives from the tourism industry perceptions of climate change. The major view was that climate change and its effects had been given disproportional attention in media and politics compared to how they experienced it, they did however agreed in that climate change was present. Strategies for climate adaptation had begun taking its form but they were not necessarily labeled climate change adaptation strategies.

The Swedish Environmental Protection agency (2009) investigated the Swedes perceptions of climate change and concluded that they perceive themselves as aware of climate change, conscious about their actions concerning climate change and making at least some changes in order to mitigate its effects. Additionally their positive attitudes towards companies which actively participate in climate change mitigation have increased. But they have begun to demand more and better labeling of these kinds of companies in order to identify them.

A survey of winter tourism entrepreneur’s perception about climate change in northern Sweden revealed consistent results in that their business would not suffer any significant effects the next 10 years. It was suggested that entrepreneurs in a continental climate would worry less over climate change than costal climate situated entrepreneurs. The differences in continental and costal climate are unfavorable to costal situated entrepreneurs which therefore would have a larger incentive to consider climate change. (Brouder and Lundmark, 2011)

Scott and Mcboyle (2007) stressed that there is a knowledge gap when it comes to demand adaptation to climate change from tourists, in contrast to the supply side that have been more researched. Hence, the tourist’s role in winter tourism and choice of destinations has not been given enough attention (Unbehain, Pröbstl and Haider, 2008). They conducted a survey on 538 skiers in Vienna, Austria on theirs perceptions and attitudes on the ski destinations. The results revealed that climate change is not a new phenomenon for the skiers, 73% are aware of the problem and 70% of the informants had experienced problems concerning poor snow conditions during previous vacations (Unbehain, Pröbstl and Haider, 2008). If a ski resorts would
suffer from poor snow conditions repeatedly, 68% of the skiers would choose another ski resort with more reliable snow conditions. The loyalty towards a ski resort is not enough for the skiers if the ski resort does not have the ability to guarantee snow during the visit. Ski resorts are trying to develop new activities not involving snow due to the uncertainty of snow covered areas, like spa facilities. Though, this kind of new activities is not relevant for the skiers in this survey where *sureness of snow* and *winter experience* is the top two determinations in the choosing of ski resorts. At the bottom of the list comes shopping and also activities not involving snow. (Unbehain, Pröbstl and Haider, 2008)

The researchers of the survey stress the need to avoid marketing a ski resort as snow reliable because of artificial snow production. Even though artificial snow production is a climate change adaptation strategy to maintain the season and provide snow coverage, artificial snow is perceived to be less favourable to ski on than natural snow. (Unbehain, Pröbstl and Haider, 2008)

### 2.3.1 Climate change scepticism

A study by König (1998 cited in Bicknell and McManus, 2006:5) investigated managers’ perceptions about climate change in Australian ski resorts. The results revealed that nine out of ten managers were unaffected by the concerns of climate change in the process of planning the resorts. Three reasons why the managers felt like this was suggested, there is lack of evidence about the impacts of climate change, that the projections could be too far in the future for a resort which plan only a few years ahead and finally that the development in the technology will mitigate the presumed reduced snow fall. (König, 1998 cited in Bicknell and McManus, 2006:5)

Norgaard (2011) found signs of climate change scepticism in Norway when the snowfall decreased significantly in 2001 in the community Bygdaby. The snow usually comes in November but this particularly year, it did not fall until mid-January. Even though Norway has a fairly high public support concerning climate change and an awareness of the phenomenon, no actions were taken. People lived as usual even though many got affected by the reduced season. Norgard argued that public response
is quite low when it comes to behavioural changes or movement activities, not just in Bygdaby but worldwide. (Norgard, 2011)

Consistently, Saarinen (2006) investigated perceptions from nature based tourism entrepreneurs in Finland and found that half of the sample was unconvinced or sceptic of the existence of climate change as a phenomenon. Additionally it was found that the entrepreneurs had adapted to new conditions described as ‘market changes and weather variations’ (Saarinen, 2006).

Hall and Higham (2005:305) claimed that the response from the tourism industry concerning climate change has been in denial. Small medium enterprises have barriers to respond to the impacts of climate change compared to tourists and a few tour operators which could respond at once. Even though there is consensus concerning climate change articulated in organizations i.e. IPCC (Oreskes, 2004) there are simultaneously signs of climate change denial evident with entrepreneurs in the tourism industry. More seriously it could be said, this perception is not uncommon in the local government and planning bodies (SEPA, 2012)

2.4 Literature review summary

The first part of the literature review presented a brief introduction on the tourism industry and its importance to the regional economy. The alpine tourism was also given attention followed by relevant literature on climate change. Effects on the alpine tourism industry are explained e.g. increased temperatures, shorter seasons and a decrease in the snowfall. Three future scenarios from IPPC; increased temperatures, rising sea level and shortened length of seasons are used to illustrate the effects that climate change could have.

Adaptation strategies are one of the most integral concepts used in the research. In order to maintain snow reliable ski resorts, a set of strategies exist. These are described both in general and detail according to their relevance and focus in the literature. The major focus has been on artificial snow making and ski slope design.
Artificial snow making is one of the most common strategies to prolong the season though it is an investment intensive strategy which not every ski resorts has the resources to apply. Ski slope design is used to smoothen the terrain to use as little snow as needed compared to uneven terrains with rocks requiring large amount of snow to cover up.

Perceptions’ concerning climate change is the latter part where research on perceptions in the tourism industry is presented i.e. Burki (2000) about climate change and its effects, how it was perceived to have been given disproportional attention in media. Tourists’ perceptions are also used to illustrate how customers perceive the phenomenon, that over 70% of the sample is aware of climate change and considering the snow reliability, almost 70% would choose another ski resorts over a ski resorts suffering from poor snow conditions repeatedly. The fact that climate change despite its recognition and consensus is perceived differently has been given attention.
3 Methodology

3.1 Data collection

The research method for this study is qualitative in order to answer how and why small scale operators perceive and adapt to climate change. This study will rely on both empirical primary and secondary data. Semi-structured interviewing as a method of data collection is considered to be suitable to this study since it provides access to privileged information. It is also a method which is reasonably easy to arrange. It can also provide depth in the information and opportunities for further exploration in single instances which could become necessary (Denscombe, 2007:183).

Since it is explorative, it is necessary to both be able to explore the issue and to answer specific questions. Therefore an interview guide has been used to structure the interview and keep track of the key issues. The interviews were semi-structured and conducted in Swedish, both face to face in a comfortable environment for the informant, often their workplace as well as by telephone in order to overcome the distances. The interview guide was constructed with an introductory part containing some basic warm up questions for the informant to become comfortable in speaking and get as much valuable information as possible.

The interviews were recorded with a dictaphone when conducted in person in order for the interviewer to be able to direct his/her whole focus on the interviewee. The telephone interviews were recorded via applications in the telephone. All interviews were recorded with the full knowledge and authorization of the interviewees. Since the interviews were recorded, they could therefore be listened to repeatedly and thoroughly to check for ambiguity in the answers. The recorded interviews were later transcribed as truthful as possible with pauses, coughing and words indicating uncertainty.

3.2 Limitations

As with most other qualitative research this process involves interpretation of the data which is a non-objective approach, however measures have been taken to strengthen
the reliability i.e. detailed interview transcripts. The study was conducted over an
eight weeks period as well with very limited financial resources. It would of course be
in the interest of science to conduct a more extensive study but the intentions of the
authors are that this still will be contributive despite its limitations.

3.3 Reliability and Validity

According to Bell (2010:119) reliability ensures consistency in the measurement of a
phenomenon, that the same method could be applied again under the same conditions
and produce similar results. This is a particular issue in interviews as a data collection
method due to the interviewer affect (Denscombe, 2007:203). Denscombe explains
that it is hard to achieve similar results several times because we are different
individuals with individual perceptions. Which is why, all the interviews in this study
have been recorded and completely transcribed to as a large extent as possible
maintain the objectivity of the data.

Validity on the other hand is instrumental accuracy, that the data that has been
collected reflect the reality (Bell, 2012:120). To illustrate: In this research, validity is
influenced by the data collection method. It is crucial to find the “right” informants
which possess relevant knowledge and which can express themselves on behalf of the
business. Validity of interviews as a research method is particularly difficult to assess.
The problem lies in whether the informant is honest or not, however, there are
methods to assess validity in interview data. In this research the interview transcript
has been sent to the informant for confirmation to avoid misunderstandings. Common
themes as a method have been applied to find consistent themes in the different
transcripts which further improve the validity of the data. (Denscombe 2007:201)

3.4 Presentation of cases

The ski resorts Säfsen Resort AB, Rättviksbacken AB, Kläppen Resort AB, Bjursås
SkiCenter and Grönklitt are all part of the study area mid south of Sweden (fig.2). The
area was selected because of the author’s interest in the geographical area in their
proximity and that it is an area with both high and low average temperatures
compared to northern parts of Sweden (SMHI). It is intended that these destinations
could vary in size and in turn capacity to adapt their business. Additionally the study area account for 43% of all ski ticket sales in Sweden which makes it an important area to research (SLAO, 2011). All information concerning the business turnover, number of employees etc. has been collected at (Ratsit.se), data which originally come from (Swedish Companies Registration Office) and (Swedish tax agency). Beside these resorts, contact has been taken with ski resorts which either have failed to respond or declined to participate.

Since there are people who make decisions in organizations, it is their perceptions that are worth while exploring in this study (Bell, 2010:12). The primary data collection is done through interviews of managers at micro and small scale skiing resorts which are considered to provide both a general insight in their activities and planning as well as an in depth perspective of how they perceive climate change. The managers will further on be referred to as informants in order to ensure their anonymity. The participating resorts have a maximum employee count of about 50 and a yearly turnover less than 7 million € according to the European Union’s definition of small and medium enterprices SMEs (European Union, 2012), most resorts within the study area fit this description.
Bjursås SkiCenter

Bjursås SkiCenter is a family-owned company which is located between Falun and Rättvik in Dalarna County. They have 7 ski lifts and 21 slopes at a maximum height of about 400m (Bjursås SkiCenter). Their turnover in 2011 was about 8.5 million SEK and the number of employees about 50 persons during season. Bjursås offers activities during winter, summer and fall. Miniature golf, four wheeler, skiing, pedal
boat and sauna float are a few of the activities available. In addition they offer facilities in order to hold conferences.

**Orsa Grönklitt**

Grönklitt is a part of Grönklittsgruppen AB, a parent company to several tourism oriented business e.g. Orsa Björnpark, Grönklitt, Tomteland. They are situated in Dalarna close to Mora and have 8 ski lifts and 23 ski slopes at a maximum height of 165m. Turnover in 2011 for Grönklittsgruppen was accounted to about 100 million SEK and 100 employees in the organization, conditions which deviate from the small enterprise definition but is inclusive of several other facilities. Grönklitt alone is assumed to fit de general conditions set up in this study. They offer activities during the winters and summers i.e. hiking in the mountains, mountain biking, fishing, skiing, canoeing etc.

**Kläppen Ski Resort AB**

Kläppen Ski Resort is located in Transtrand in Dalarna County. They have 15 ski lifts and 32 slopes and a maximum height of 315m (Slalombackar). Their turnover in 2011 was accounted to about 88.8 million SEK with approximately 100 employees. Kläppen offers activities during the winters and summers. Some of the activities are skiing, camping, beaver safari, paddling, cross country, hiking, fishing etc.

**Rättviksbacken AB**

Rättviksbacken is located in Rättvik in Dalarna County. Their facility concerns 1 ski lift and 4 slopes at a maximum height of 372m (Rättviksbacken). The turnover in 2011 was accounted to about 3.1 million SEK with 2 employees registered in the company. Rättviksbacken offers activities during both winters and summers. The activities are paintball, luging, camping, skiing and walk on nature trails. Conference facilities are also available for rental.
**Säfsen Resort AB**

Säfsen is located in Fredriksberg in Dalarna County. Their facilities include 5 ski lifts and 11 slopes at a maximum height of 270m (Åka Skidor). Their turnover is about 70 million SEK in with 50 employees. Säfsen offers activities all year around besides skiing in the winters. Among the activities are skiing, hunting, golf, hiking, riding, mountain climbing etc. Along with conference facilities.
4 Result

4.1 Perception of climate change by the ski resorts

*Bjursås SkiCenter – Climate change*

According to the informant from Bjursås, they have definitely notice that the climate has become more unstable, but they cannot say whether they perceive a trend of warmer or colder climate, or if it is just irregularities in the weather. Climate change is not directly perceived as a threat, however it is realized that shorter seasonal pattern would have negative effects. And if the climate would become extremely unfavorable it would of course become a more pressing matter, but today they feel they could manage a temperature increase of 2°C. The informant feels that an awareness concerning the phenomena exists in the company but that the specific knowledge that is available is vague concerning effects of climate change. A cornerstone in their business is weather on which they stressed their dependency on and mentioned an ambition to become more independent.

*Kläppen – Climate change*

There is definitely an awareness of climate change at Kläppen; they are familiar with what is happening on a global level i.e. melting of the glaciers. However, on a local level they are ambiguous concerning the future since recent winter’s temperatures are have been quite irregular without any definite pattern to rely on or address as a changing climate. If a change were to become evident, their goal would be to adapt if possible in order to still be able to offer their product to the customers.

*Rättviksbacken – Climate change*

The informant from Rättviksbacken is aware of the debate about climate change but believe that it is perhaps not as bad as predicted. The interviewee recalls back at the previous winters with extreme cold besides this winter, with a lot of cold providing good conditions for snowmaking. They were very surprised to get such cold winters due to the debate that winters will get worse. The informant believe that nothing will happen during the following years but in about hundreds of years there could perhaps
be a change in the climate. The informant definitely hope to try to keep skiing as a sport and is very engage on how to lower the energy consumption, primary from snow making. The informant encourage and hope to see future “green” labelling opportunities of the slopes which would motivate Rättviksbacken to work even harder to become more ecologically aware. Such an opportunity would also help to motivate decisions concerning energy efficiency, both in the business itself but also in communication to their customers. The interviewee feels that an awareness of energy consumption or climate change has not yet reached the consumers.

The informant described the skiing activities as in a breakeven financial state and the summer activities more profitable. Today climate change was not concretely considered as a threat by the informant, but it was said that if future conditions would imply more stress on the snow production, a termination of the winter activities would have to be considered.

**Säfsen Ski Resort – Climate change**

The informant at Säfsen is sure of that change is coming; however, they expressed that it would be difficult to answer how and when. The informant could not with certainty say that a change had been observed and referred to historic documents and occurring warm winters the past 200 years. The informant think that media is partly responsible for a confusion of this debate. That the debate concerning climate change is very active when the winters are warm with less snow but goes in to hiding when cold and snowy winters return. Therefore an absence of a more nuanced debate was experienced, where different voices could be expressed and listened to.

**Orsa Grönklitt – Climate change**

Today climate change is not perceived as a threat to Grönklitt, however that is because they perceive the debate or information concerning climate change as vague and inconsequent. The informant from Grönklitt said that what they know of climate change is what’s being communicated in the media e.g. a future scenario of temperature increase by 5°C which would be perceived as a threat, but weather the threat is real or not is yet to early for them to say.
4.2 Strategies

Bjursås SkiCenter - Strategies

Artificial snow was described as essential in order to maintain a full season and to skiing facilities in general on their latitude. An on going discussion and planning is in the technology, different artificial snow production systems and how they are used. In the production of snow, before it is distributed over the slopes, they store it in shadier areas. Since the development of the slopes it has been realized that slopes in a southern direction are more vulnerable because of faster melting. Today they have recognized a major difference on the snow dependent on which direction the slope is facing in terms of amount and quality in critical situations when the weather is warmer. They perceive that their geographical location as an advantage and that it provides favorable conditions in terms of natural snowfall and lower temperatures because of its altitude.

In the winter they offer e.g. snowmobile safaris as alternatives to the skiing. Year round they offer e.g. spa facilities which are intended to increase the service of the destination as a whole but also as a mean to become more weather independent.

Kläppen - Strategies

Kläppen’s ambition, long-term, is to be totally self sustaining on energy. They are currently researching means of energy production i.e. hydroelectricity, wind turbines and solar energy which could be implemented to sustain their activities. In addition they are continually optimizing energy efficiency of their current systems. The largest consumer of energy is their snow production which is operating during the first and fourth quarter of the year. By producing electricity all year round they would be able to at least compensate for the energy intensive season.

Artificial snowmaking is Kläppen’s primary mean to maintain the season as it is today. Without artificial snowmaking, a resort like Kläppen would not manage:
No...No ski resort in Sweden would manage that... To maintain a full season everyone must use a foundation of artificial snow... We would perhaps be able to manage a few weeks entirely on natural snow, but not for certain...

Besides artificial snowmaking, it was said that they have investigated complements to the current snow production in order to maintain the season and that these could possibly be used in a more unfavorable climate. An interest was expressed in a new technique that could produce snow in temperatures above 0°C. Additionally, the informant at Kläppen mentioned that they have considered plastic or artificial slopes as complement to maintain or prolong the season.

*Rättviksbacken - Strategies*

This year, Rättviksbacken is preparing the terrain of the slope until next season, contouring it to be able to use less snow depth. With this method they believe to reduce almost half of the amount of snow necessary to cover the slopes. Some of the slopes use artificial snow whilst other slopes rely exclusively on natural snow, despite that, they could never guarantee snow covered areas for the customers. The informant said that limiting snow production has also become a question of resources apart from striving to ease the environmental impact of its energy consumption.

*It is not solely of financial reasons; there is this concern for the environment as well... Unfortunately that is not the decisive aspect... Had it been free to produce snow, then we would have done it in plenty.*

The informant presented a vision in order to loosen the strain on the pumps to the snow production and save energy. The idea is to pump water up to a water reservoir on top of the slope from Lake Siljan. By doing so, gravity would complement the pressure from the pumps to their snow production systems in the slope. Cutting energy cost is an ongoing issue at Rättviksbacken but the largest cost is still their artificial snow production. The informant had an additional idea of how to become more efficient in the use of artificial snow. In their slopes during season they construct “jumps” of snow in which skiers can jump high into the air. This requires a significant amount of snow depending on the size of the jump. The informant believe
that it would be possible to create a foundation of e.g. used car tires and cover it with up with snow less snow but get the same result.

Rättviksbacken is in the construction process of a downhill biking track that can be run as an activity during summertime. Beside these plans and the skiing, the business was described to be operational during other seasons as well.

**Säfsen Ski Resort - Strategies**

The informant said that Säfsen like most other have artificial snow production systems to sustain the downhill skiing. The planning and investments of new snow canons are important processes for Säfsen. An interest in this was expressed e.g. the informant described a comparison between different snow production systems that had been made in Falun. The “winner” of that comparison was one of Säfsens major suppliers, which was satisfying news for them. They are currently investing in snow production systems and that can produces snow at -1 to 0°C.

Säfsen offers activities all year round, i.e. downhill cycling where both the slopes and the lifts are being used during the summers as well. Fishing, hiking and conferences are also activities that can be engaged in. By contouring the terrain of their cross country tracks they can rely on the natural snowfall, with some minor preparation of the snow cover.

The informant stressed a concern for environmental issues and how they are involved in different collaborations on this matter. Säfsen is a svanen-branded ski resort as well as member of organisations i.e. Eco tourism (Ekoturism) and Natures Best’s (Naturens bästa). In an attempt towards more sustainable activities they have been investigating possibilities to offer consumers more control over their energy consumption and costs i.e. a future scenario they had considered, guest could stay for a lower cost exclusive of electricity, then guests would have an incentive to consume less energy.
**Orsa Grönklitt – Strategies**

The informant from Grönklitt described their measures to maintain snow cover as primarily by snow production but also preemptive work i.e. preparing and contouring the terrain to require less snow depth.

**4.3 Ski resorts perception of tourist attitudes concerning climate change**

**Rättviksbacken**

The informant believes that tourists skiing at Rättviksbacken are very unaware of environmental issues. They had received complaints from skiers concerning the snow depth in the slopes, this was expressed at different meetings, discussions and in the newspapers. When the informant made an effort in cutting cost in artificial snowmaking, it resulted in some dissatisfaction by the skiers. A lack of knowledge about energy and its cost is the main issue among skiers according to the informant. Development and awareness concerning environmental issues has not yet reached the skiers, instead, the informant believe that these issues are more evident in the technology of snow production and the preparation of slopes.

The informant felt strongly about the skiers’ responsiveness to differences in snow depth when deciding over a destination. Rättviksbacken (like many slopes and resort) report daily on their weather conditions and snow depth during the season to an organization which present the data through different medias. Though there is a limited depth required for skiing, the perception was that these reports have created competitiveness over the responsive customers resulting in over production of snow as a marketing tool.

**Säfsen ski resort**

The informant at Säfsen Resort believes that their customers in a way demand environmental perspectives by the destination. The image which is communicated to them is in a way the environment and the wild which is why these are of major concern.
**Kläppen**

The informant has not noticed any awareness about climate change among the customers at Kläppen but believes that it will increase in the future. Questions that have been raised by the customers concern alternative fuels for the cars. Since a personal vehicle is the main transport mode for skiers when travelling there, and the development suggest more alternative fuels in the future, the skiers have concerns about if they will be able to refuel (or recharge) their vehicle at the destination.

**Bjursås SkiCenter**

The informant from Bjursås SkiCenter has noticed awareness and demand among the customers lately. E.g. previously Bjursås SkiCenter tried to introduce a new garbage disposal system but were unsuccessful due to lack of commitment from customers. But lately the customers have become more aware and begun demanding more sophisticated garbage disposal system which made them try this one more time with success. The informant perceives that initiatives and demands from the customers concerning environmental issues are very positive and that it helps Bjursås SkiCenter develop their activities when it is possible.

**Orsa Grönklitt**

The informant has not noticed any awareness concerning climate change among the customers. Grönklitt conduct surveys where customers can comment their experience and express need for improvement but the informant from Grönklitt has never read anything about the concerns of the environment. As long as they maintain sufficient snow cover, the customers will are pleased.
5 Analysis

5.1 Climate change

The literatures suggest that entrepreneurs or tourism industry informants in the ski industry perceive climate change as being over exaggerated (Bürki, 2000). The perception of the cases in this study does not completely support this. The informant at Säfsen perceived media’s perspective of climate change as opportunistic and discouraging of dialogue. All cases are however aware of climate change as a phenomenon, but how and in what way differ between the cases. E.g. Säfsen agree that the change is real but have seen neither the change nor any problems specifically for their activities. While Bjursås SkiCenter perceive the recent winters as changes in the climate compared to earlier experiences but recognize an issue in whether it is just weather fluctuations or actual climate change. Rättviksbacken were unsure of the matter, they had acquired the general knowledge about climate change, and was surprised by recent winter’s fluctuations. But whether or not climate change would affect them in a foreseeable future was perceived as doubtful. The cases are partly consistent with climate change skepticism as described by Norgaard (2011) and König (1998 cited in Bicknell and McManus, 2006) and generally described by Hall and Higham (2005) as barriers to responsiveness. Though, essentially the scepticism towards climate change would imply a ‘business as usual’ strategy (fig.1) and eventually total termination of operation. The informants in this study are definitely aware of the phenomenon, just not as a threat to their activities, which implies a need for regional assessment of climate change.

5.2 Strategies

According to adaptation strategies (fig.1) and the result (table 1) it could be argued that artificial snowmaking is applied by all of the ski resorts. But as new perspectives on artificial snow making argues, it could be perceived differently than an adaptation strategy, as a general practice or a necessity in maintaining the skiing (Scott, Mcboyle and Minouge, 2006). This is confirmed in the findings of this research, especially in what the informants from Kläppen and Bjursås argued; simply that it is a necessity in order to maintain the length of the season for ski resorts on these latitudes.
Some informants expressed concerns over the energy consumption of the snow canons. The literature recognizes that this is an energy intensive method (Scott and McBoyle, 2007) indeed, this was a critical aspect in one of the cases. If climate were to change drastically and a maintained skiing would require additional snow production, they might not be able to sustain it. Then, a ‘cancel ski tourism’ approach would become necessary to consider. Logically, every ski resort would have to do so eventually if climate changed to the worse and energy costs increased to unsustainable levels. In this study two of the informants felt that if a trend of significant climate change became evident, snow production would become to resource demanding in their current situation and equipment. However, a majority of the informants perceived an ongoing development in new technology considering energy consumption, efficiency and operational temperature conditions. Indeed, a confidence in technological development were identified by König (1998 cited in Bicknell and McManus, 2006) as a contributor to climate change scepticism.

To reduce the necessary snow depth required, the terrain below the snow cover can be evened out. This has been done in most cases but in different time perspectives, e.g. Rättviksbacken were in the process of doing it, while Bjursås SkiCenter and Kläppen had done so during the initial development of the slopes.

Table 1 Adaptation strategies at the Ski resort

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Artificial snowmaking</th>
<th>Slope design</th>
<th>Non snow related activities in the winter</th>
<th>All-year tourism</th>
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</thead>
<tbody>
<tr>
<td>Bjursås SkiCenter</td>
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<td>Orsa Grönklitt</td>
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<td>Kläppen</td>
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<tr>
<td>Rättviksbacken</td>
<td>✓</td>
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<tr>
<td>Säfsen resort</td>
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</table>
The most occurring strategies and their use at the ski resorts respectively (table 1) are the result of the interviews and comparisons of the cases online information. This is also the perception of the informants, and not necessarily adaptation strategies to climate change but mere practice.

None of the informants in the study have accounted for any subsidies in the interviews, but because of the importance tourism can have on regional economy in the Nordic countries (Hall, Müller and Saarinen, 2009). It could prove to be a significant strategy to remember for regional planning bodies.

The Swedish Environmental Protection Agency (2009) identified perceptions of climate change of Swedes. A demand for labeling and more clearly communicated efforts in work concerning climate change was presented. A case in this study perceived that labeling would be an incentive for them to become more involved in the issue. The same informant expressed beliefs about an overproduction of snow by other ski resorts as a marketing tool to attract customers, which in his perception if it were so, was a serious issue. The informant explained that they did not possess the resources to do the same, but would probably do so if a demand for it was identified and snow production became more affordable. However, production of snow to market a unnecessarily deep snow depth could be very contra productive to those ski resorts (if any) considering Swedes demand for climate aware and sound companies as well the fact that it has been recommended to avoid artificial snow making in marketing (Unbehain, Pröbstl and Haider, 2008)

5.3 Perceptions

While literature suggests that climate change adaptation on the demand side is unattended in research (Scott and Mcboyle, 2007), the ski resorts in this study do not even perceive any climate change awareness of their visitors. The perceptions of tourist’s attitudes concerning climate change however vary between the ski resorts. Three of them have not noticed a awareness from the customers concerning climate change while two of them had. Out of the three, Kläppen expressed a belief that awareness of climate change will become greater in the future due to customers increasing awareness of environmental issues. Similarly Bjursås recognized a
increasing demand for environmental consciousness by ski resorts among customers nowadays compared to a few years before. Generally, the informants are not aware of any specific concerns regarding climate change among the customers.
6 Discussion

An issue for the ski resorts could be to identify climate change further in order to assess it. The concept of climate change seems to be very associated with environmental impacts in general. In this study it has been suggested that the concept of climate change is vague or used to commonly, e.g. in the survey by SEPA (2009) the general public is asked for their perceptions of companies which work to limit climate change. This suggests that climate change is a solitaire phenomenon rather than consequences of all our actions i.e. fossil fuel combustion. Additionally there is not always a clear difference made between naturally occurring climate change and the climate change that we can limit.

Many of the resorts have been eager to describe their ambitions to lower environmental impacts. The reason for this could be that the ski resorts are generally defensive in issues of environmental impact and climate, which is why they stress their energy efficiency. However, energy is also a major cost, which is why it would be very logical to try and limit that cost whether the purpose is ecological consciousness or cost efficiency. In one case; Kläppen, they had great ambitions of becoming self sustaining of energy. This seems admirable and might become an even more interesting case in the future if they manage to become self sustaining. The ambition however, could decrease their vulnerability to climate change considering natural snowfall and temperature. By compensating for the energy intensive consumption of artificial snowmaking they would be able to produce more snow at less cost to sustain or possibly prolong the length of their season. A majority of the informants expressed an ambition to become more efficient in their energy consumption especially considering snow production, as this could compensate for worsening climate conditions to some extent. It could also be a response to the increasing awareness and demand for climate sound companies by customers or at least prove to be beneficial in marketing. But it seems as questionable that the ski resorts could undergo any major changes in energy efficiency as adaptation towards climate change. Then, would the ski resorts prevail in a warmer climate using artificial snow production? The question has no obvious answer. Technology exists to
make it possible, however, it is very investment intensive and only major resorts have implemented it so far and merely as a complementary tool, not as a complete solution.

As it is partly the perceptions of the informants, the ski resorts could be implementing more methods than presented in the study. This means that the strategies identified in this study (table 1) are not necessarily considered as adaptation strategies for climate change by the ski resorts. Instead as suggested in the literature concerning Norway, the strategies are expressed more as general practice in the industry on these latitudes. That is why, researching climate change adaptation methods could benefit from the ski resorts to fully realize their vulnerability of climate change.

It could be argued with the support of the literature that the informants participating in this study are skeptic to the phenomenon climate change. This is a fairly common perception and has been argued to inhibit the industry’s response to climate change. However there is a knowledge gap in the regional assessment of climate change. This is why the consequences of these perceptions as well would be difficult to asses. And since all cases have snow making infrastructure, they are better prepared to engage climate change than those which does not. Artificial snow making as described, demands large quantities of water, and this could potentially become an issue. If the climate change and ski resorts have the financial and technological resources to compensate with a larger snow production, water supply would become an even larger issue than today. But, since the goal of the ski resorts in this study generally seems to be to maintain ski tourism, it might become necessary that climate change is perceived as a threat. If climate change would worsen, and ski resorts would fail to adapt, it would be in the interest of regional planners to attend to these issues as early as possible given their regional impact. Climate change has to be recognized on a level of regional planning, if these resorts have important economic impacts on the regional economy, the consequences of failed adaptation will become mutual. Because tourism’s importance both as a rural and regional development tool it could also become necessary to reevaluate the impacts of subsidies which could have more important impacts than simply nurturing the ski industry.
7 Conclusion

The aim and objectives of this study was to explore and compare attitudes towards climate change between five ski resorts located in mid south of Sweden, explore the strategies to mitigate the effects of climate change.

Do the ski resorts in perceive climate change as a threat to their winter activities?

No, currently, climate change is not perceived as a threat. The concept of climate change is still to a degree ambiguous concerning its regional impacts. However, the impacts of climate change, with increasing temperatures, could become a perceived threat. Though, some skepticism exists concerning how when and where those impacts will occur.

How can they engage consequences of climate change i.e. warmer climate, changes in snowfall and seasonal changing patterns?

Since climate change is not a perceived issue to the ski resorts, it is not something they consciously attempt to engage in. However, the consensual effects that climate change is projected to have on a global level i.e. higher temperature and shorter seasons could be managed. The adaptation strategies available are partly consistent with the practices at the ski resorts. They aim to maintain the ski tourism which is done primarily through artificial snow making but in some cases also ski slope design or contouring and diversification into other seasons or non snow reliant activities.

The literature suggests that the tourism industry will become less responsive to impacts of climate change unless the concept is realized. However, adaptation is occurring, just not labeled climate change. The ski resorts are adapting to market changes with measures easily confused with climate change adaptation. The ski resorts are keen on expressing the energy efficiency and development of the technology used. Their efforts could become more important in the future if energy efficiency becomes a measure to maintain skiing.
How do the ski resorts perceive tourist’s attitudes towards climate change?

Contradictory to that which has been found in the literature, some of the ski resorts in this study have not perceived any awareness or demand from their customers, while others have, and encourage that demand in order to better adapt themselves. Stronger communication and labeling of efforts in climate change adaptation could become beneficial in the future.

Conclusively, climate change is an issue that is given more and more attention. A trend of increasing demand for climate change aware companies could prove as beneficial if it is recognized in time by the ski resorts. And climate change, do require more attention in the industry. The attitudes and perceptions of climate change in this study generally recognize the phenomenon but fail to fully realize it. Given the history of the Alps 1987-1990, how effects of climate change was fully recognized when it became critical to the industry. It can serve as a lesson of survival to be prepared and realize the threat before the situation becomes critical again.
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