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University of the Witwatersrand

School of Geography, Archaeology and Environmental Sciences

Investigating tourism and climate change: the case ofSt Francis Bay and Cape St Francis

Dissertation submitted to the Faculty of Science in fulfilment of the requirements for the degree Master of Science.

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Johannesburg, August 2015

DECLARATION

I, Bronwyn Caroline Grant (377680), declare that this thesis is my own, unaided work. It is being submitted for the degree of Master of Science at the University of the Witwatersrand, Johannesburg, South Africa. It has not been submitted previously for any other degree or examination in any other university.

_____

Bronwyn Grant

_____ day of _____ 2015

ABSTRACT

Climate change literature is growing rapidly, with increasing literature being produced on the relationship between climate change and tourism. Globally, tourism is very dependent on the climate and the impacts of climate change may alter tourism flow and demand. Developing countries are likely to be the most affected by climate change and its effects on tourism which is worrying as this sector is a huge contributor to their economy. South African tourism relies heavily on its environment to attract tourists and give a satisfactory travel experience; climate change is a threat to the environment and thus a major concern for South Africa. This thesis investigates the perceptions of climate change threats within the tourism sector by exploring how perceptions may influence behaviour and how the tourism sector will respond to a changing climate. Research was carried out in two coastal towns, St Francis Bay and Cape St Francis in the Eastern Cape Province. These towns are dependent on their tourism sectors to drive their economies. These towns are dependent on their local tourism sector to drive their economy. The results indicate that while both the tourists and tourist accommodation establishments are aware of the threat of climate change and are concerned about its impacts, there is very little adaptation being implemented. While the level of concern varies among the accommodation establishments, there appears to be no perceived significant relationship between the threat of sea level rise and their distance from the coastline. Tourism Climate Index calculations for the two towns suggest that the climate is worsening in terms of tourist comfort, and project that the towns will become less attractive for tourism based on their climate. A Digital Elevation Model developed for the towns however shows that the projected sea level rise for 2050 and 2100 will result in parts of the beaches and a protective artificial spit being washed away. The lack of climate change planning to deal with these impacts is directly linked to their perception. The tourist accommodation establishments do not believe they need to take major action and rather feel the government should respond to climate change. Overall, the results indicate that there is a need for further research into bottom-up approaches to climate change, to better plan and implement successful climate change mitigation and adaptation which can be done through educating individuals and businesses within the tourism sector.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
CFCs	Chlorofluorocarbons
CIA	Daily comfort index
CID	Daytime comfort index
CLT	Construal Level Theory
COP	Conference of the Parties
DEM	Digital Elevation Model
DSTV	Digital Satellite TV
EIA	Environmental Impact Assessment
ENSO	El Niño Southern Oscillation
FDLP	Florida Green Lodging Program
FOSTER	Friends of St Francis nature reserves
GDEM	Global Digital Elevation Model
IPCC	Intergovernmental Panel on Climate Change's
J-Space Systems	Japan Space Systems
METI	Ministry of Economy, Trade and Industry
NAPA	National Adaptation Plans of Action
NASA	National Aeronautics and Space Administration
SCOSS	St Francis Coastal Open Space System
TCI	Tourism Climate Index
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNWTO	United Nations World Tourism Organisation
WMO	World Meteorological Organization

1
INTRODUCTION

1.1. Background to the Research

Climate change is one of the most significant issues that the global society will have to deal with in the 21st century (Jamal & Watt, 2011). The impacts of climate change are already affecting ecosystems and communities on a global scale, and these impacts are expected to continue into the future (Parmesan, 2006;Mackendrick, 2009). Governments globally have attempted to develop a regulatory system, the Kyoto Protocol, which is both comprehensive and integrated for managing climate change (Keohane & Victor, 2011). However, these regulatory systems have been created by many different countries at different times, which means they are neither integrated nor comprehensive and thus make up a loosely connected management system as opposed to a one main international system of managing climate change (Osofsky, 2009).South Africa has different developmental priorities to other countries and formed the National Climate Change Response White Paper to address these (South African Government, 1996).

Academic literature on climate change has identified it as major threat to many economic sectors, in particular tourism, which has been confirmed by the tourism sector (Gössling et al., 2012; Buckley, 2012; Kaján & Saarinen, 2013; Morrison & Pickering, 2013; Su et al., 2013). Climate is often used as a descriptive factor when marketing a destination and therefore tourists will know what to expect of the climate conditions when booking a holiday (Berritella et al., 2006). The climate impacts the planning of holiday calendars as it affects tourists' satisfaction and well-being through influencing the recreational activities on offer and feeling of safety among tourists in relation to health risks (Valls & Sarda, 2009). Therefore climate is often advertised as a destination's most important tourist attraction (Saarinen & Tervo, 2006). The tourism sector has begun to recognise the potential changes to this attraction and the dependence that tourist activities have on climate (Gössling et al., 2005; Gössling & Hall, 2006; Patterson et al., 2006; Bigano et al., 2007).Climate

change plays a role in the economic value of the tourism sector and this sector is therefore climate-sensitive (Gössling et al., 2009; Law et al., 2012; Peeters & Eijgelaar, 2014; Hall et al., 2015).

Planning and decision making by stakeholders in the tourism sector will most likely be influenced more frequently by the perceptions of climate change (Scott et al., 2008). This focus on tourism perceptions' of climate change is essential as the tourism sector plays a vital role in global economy (Valls & Sarda, 2009) as perceptions have the ability to contribute to either problems and solutions of climate change (Weber, 2010). It has been found that environmental issues are perceived by individuals to be more severe the farther away they are (Shakeela & Becken, 2013).This can be explained by Construal Level Theory (CLT) which suggests that psychological distance of an event affects the way in which people mentally visualise and understand it (Spence et al., 2012). This has also been shown to be true for climate change perceptions (Spence et al., 2012). Perceptions are shaped by the way an individual experiences their immediate environment and their interactions with it (Middendorf et al., 2009).These general perceptions of climate change influence public behaviour (Shao, 2012) as perceptions can influence adaptation in whether climate change events are seen as a risk and if they should be responded to or not (Adger et al., 2008).

In the last few decades there have been two key responses in managing climate, that of mitigation and adaptation (Wardekker, 2011). Mitigation involves limiting climate change by reducing greenhouse gas emissions or by enhancing greenhouse gas sinks, and this process has been the focal point of developed country's policies while national policies in developing countries tend to focus more on adaptation (Allwood et al., 2014). Adaptation involves making changes to behaviour in order to adjust and respond to changes in the climate so as not to be negatively affected by it such as communities being relocated (Adger et al., 2009). Adaptation is important in addressing vulnerability to climate change as this process can greatly prevent damage, and assist in maintaining the attractiveness and thus competitiveness of a destination (Wardekker, 2011). While mitigation receives a high level of attention from governments in developed countries, literature on climate change is identifying

an increased incorporation of adaptation into policy making and planning (Mukheibir & Ziervogel, 2007).

Approaches to adaptation can be characterized by several elements. The first element is comprised of intent which can be considered either autonomous or planned. The timing in response to a stimulus is important as adaptation can occur in a reactive, anticipatory or concurrent form. The temporal scopedescribes the length of the period in which adaptation will occur which can be short term or long-term.The spatial and institutional scope describes whether the adaptation will occur locally or be widespread. Theform in which the adaptation occurs can be behavioural, financial, technological or informational adaptation. The last element is the function of adaptation which may be to protect, prevent, retreat, accommodate, tolerate or restore (Smit and Wandel, 2006, p.288). The spatial and institutional scope can also involve the issue of responsibility, to identify who should take charge of certain climate adaptation actions (Wardekker, 2011). It is of interest then to explore this issue of ownership further by addressing the perceptions of the communities in which these actions and adaption plans are needed. A reason for this is the idea that there is equal ownership over the Earth but not over the responsibilities of dealing with problems such as climate change (Risse, 2009).

In order to gain insight into local perceptions and the impacts that climate change will have it is necessary to understand the community's environmental knowledge and their societal norms (Wilson, 2011). The focus of planning has gradually shifted from top-down to bottom-up, whereby the importance of understanding how individuals and communities will adapt to changes in climate (Wicht, 2012). Therefore a need for policies to integrate top-down and bottom-up approaches has been identified which will better enable the public to accept policies while encouraging pro-environmental behaviour (Milfont, 2012).It is necessary that the perceptions of the public associated with climate change are better understood as it has been found that public attitudes and beliefs can greatly influence behaviour (Shao, 2012). This is due to a difference in response identified between perceptions developed from experience and perceptions developed from learning (Weber, 2010). With reference to tourism, the amount of literature on the relationship between climate and tourism has increased

(Lohmann & Hübner, 2012) butthere has only recently been some research that focused upon tourism operators' perceptions of climate change (Valls & Sarda, 2009). There is also a lack of research on the tourists' climate perceptions observedat the location (Lohmann & Hübner, 2012).

The relationship discussed between the changing climate and the tourism sector can be further understood in that climate change impacts on tourism whilst tourism impacts on climate change (Hall et al., 2015). Moreover, tourists choose destinations that they consider to have a good climate, whilst tourism uses environmental resources and contribute to climate change (Gössling et al., 2010). As a result of climate change being recognised as a growing problem, increased attention is being focused on how particular tourist destinations can adapt in order to minimise the risks whilst maximising opportunities particularly for the economy (Becken, 2010). However, many coastal environments suffer from tourism development and this has led to both the environment and the community having increased vulnerability (Mustelin et al., 2010). This vulnerability arises from increased tourism development as more tourist resorts, roads and recreational spaces are built (Davenport & Davenport, 2006). Coastal tourism encompasses all the tourism, leisure and recreational activities that are available in the coastal zone as well as offshore such as tourism development amenities (accommodation and restaurants) and the coastal infrastructure which supports this (retail businesses, marinas, ocean activities like deep-sea fishing) (Moreno, 2010, p.40). Thus high levels of environmental consumption are being indulged in, this is also evidenced through large amounts of water, energy and other resources consumed at the tourist destinations (Williams & Ponsford, 2009). Thus, while the tourism sector is thriving, natural resources are being over-exploited (Kotios et al., 2009).

1.2. Rationale of research

In a competitive marketplace, it is important to retain an advantage whilst avoiding risk and thus most tourism operators, particularly accommodation establishments, are hesitant to make significant changes to their operations and infrastructure that could compromise their competitiveness (Williams & Ponsford, 2009). However, by not making changes the operators risk greater impacts from factors such as climate

change and therefore will lose their competitive edge regardless (Holden, 2005). Uncertainty exists regarding the long-term consequences of a changing environment on tourism, and only recently have such consequences been researched within an African context (Rogerson & Sims, 2012). The tourism sector is vulnerable to many impacts of climate change, and as this sector is also increasingly contributing to climate change through greenhouse emissions and use of valuable resources it is important that the stakeholders and tourism operators take action in adapting to climate change. The topic of climate change and tourism is especially important in South Africa where much of the tourism is driven by the country's environmental resources. These resources are most significantly threatened by climate change and damage to the environment could result in a large loss of revenue through the tourism sector.

One of the major climate change threats to South Africa is sea level rise, indicating that coastal areas are at the most risk from direct and indirect impacts. In order to contribute to the knowledge on coastal areas, this research will focus on the towns of St Francis Bay and Cape St Francis, located in the Eastern Cape Province of South Africa. These towns were selected for the research due to the risks posed to them from climate change as they are situated at alow altitude and close proximity to the sea. There are also additional factors which may exacerbate the impact of climate change on the towns, such asthe Kromme estuary, coastal dune field and the artificial spit. The research will be looking at the tourists' and the tourist accommodation establishments' perceptions of climate change threats in order to determine their knowledge of it and their level of concern regarding potential impacts. Whether they are planning to implement any form of climate change mitigation or adaptation will be discussed, as this will be affected by their current perceptions and behaviour.

St Francis Bay and Cape St Francis are both low lying towns and therefore susceptible to many climate change threats including sea level rise and flooding, thus these towns would act as good examples for perception based research in South Africa for tourist accommodation establishments relating to climate change impacts. The research on these towns is important as it can indicate inferred impacts

on other coastal towns, therefore contributing to the knowledge of a changing climate on coastal areas, specifically within a South African context. There are many tourist accommodation establishments in St Francis Bay and Cape St Francis that would potentially be threatened by climate change, making it important need for the town to set up well-defined adaptation strategies. Very little research has been done regarding climate change impacts on the Eastern Cape Province (Carter et al.,2011) and the results of the research will contribute to the limited knowledge on the province. The findings of this research may also be beneficial in providing appropriate information for tourist accommodation establishments, by assisting with climate change adaptation and coastal protection decision-making by the tourism sector.

1.3. Research Aims

The primary aim of the research is to explore the perceptions of tourists and tourist accommodation establishments of the threats of climate change. The research will therefore address issues linked with climate change such as awareness and potential for adaptation strategies that can be implemented. The perceptions will be compared to scientific findings through calculating the climate suitability using a TCI and modelling projected sea level rise using a DEM.In doing so, the research will aim to contribute to the knowledge on climate change and its effects on coastal towns relying on tourism as its main economic base. The research will investigate the effects whilst taking in to consideration the nearby geomorphological features such as the coastal dune field and Kromme estuary.

1.4. Research questions

This dissertation will attempt to provide answers to the following questions:

1. What are the tourists' and tourist accommodation establishments' understanding of climate change?
2. What is the perception of short-term weather threats?
3. What is the perception of the long-term climate threats?
4. What adaptation action are the accommodation establishments considering implementing?

1.5. Structure of thesis chapters

Chapter 2: Literature review. This chapter discusses the global relationship between climate change and the tourism sector. It discusses the increasing attention that climate change has gained in academic research. The literature describes the issue of climate change from the developed and developing world contexts. It also explores perceptions from each of these contexts and how they are formed. A method to measure climate suitability is discussed and explains why analysing the climate of an area is important to tourism. This chapter then focuses on climate change in Africa and the projected effects of climate change on coastal cities and their planned response is examined.

Chapter 3: Study site and methodology. The chapter describes the chosen study sites. The geography and history of the study sites provide a background into the reason the towns were selected. It provides information on their development and factors that may exacerbate the impacts of climate change. The tourism sector within the towns is explained as well as the changing climate of the area. The methodology makes up the remainder of the chapter. The research followed a mixed-methods approach with the sample selection and data analysis taking into account aspects of both the qualitative and quantitative approaches.

Chapter 4: Results. The findings of the research are presented in this chapter. As the research was both qualitative and quantitative, this chapter has been divided into two main sections with the results of each approach discussed. The qualitative research addresses the perceptions of the tourist accommodation establishments located in St Francis Bay and Cape St Francis, as well as the tourists that were visiting the towns. The chapter then describes then quantitative research that is made up of the Tourism Climate Index to measure climatic suitability as well as a Digital Elevation Model that is used to model projected sea level rise that would affect the study sites.

Chapter 5: Discussion. The results of the thesis are discussed in depth in this chapter.The findings of the literature are compared with the results of this research.

The research questions are answered with an explanation of how the findings related to the aims. The chapter also considers the methodology that was used, identifying how the results were interpreted. Some additional information that was acquired outside of the interviews on the issue of climate change in the towns is presented. This thesis noted limitations during the research process and these are outlined.

Chapter 6: Conclusion. The final chapter provides a summary of the thesis outlining the key findings of the research. It draws out the significant points observed from the climate change and tourism literature and explains how the research has compared. The chapter discusses how the findings from St Francis Bay and Cape St Francis relate to the research aims and research questions that were posed. The knowledge gaps that were identified are addressed through some recommendations for future research.

2
LITERATURE REVIEW

2.1. Introduction

Whilst the global climate has undergone numerous changes throughout the earth's history, the current rate of change, and consequences thereof, has resulted in growing global concern for climate change (Leiserowitz, 2006; Kellstedt et al., 2008; Smith et al., 2009). The climatic changes that are taking place, as well as modelled projections,suggest that the global community may experience the changes for decades regardless of efforts made to mitigate the effects due to time lags and a slow global biosphere response (Simpson, 2011). It is useful then to analyse these changes alongside the interaction they will have with humans, which provides a framework for the sciences to extend research into sustainability by considering vulnerability (Mertz et al., 2009). The vulnerability of countries to climate change may differ based upon their particular economic and geographical features, as these factors will determine how sensitive the country is to climate change impacts and the level of exposure to these impacts (Smit & Wandel, 2006). The changes in climate are regionally unique, and therefore will diversely influence the communities and businesses there, with significant effects on tourism businesses (Perch-Nielsen, 2008).

The relationship between tourism and climate change is an intricate one (Perch-Nielsen, 2008) as tourism is highly dependent on and vulnerable to climatic conditions (Hernandez & Ryan, 2011). One of the conclusions drawn from the Stern Report on the Economics of Climate Change (2006) is that although minimal temperature increases may initially benefit the economy, by the end of the century it could bring about a 20% decrease in per capita consumption (Stern, 2006). Tourism is the driver of many environmental problems as this sector has an impact on the natural surroundings; these include the polluting of air, water and soil (Mustafa *et al.,* 2012). As a means of escaping the severity of daily life, tourists tend to indulge in higher levels of consumption than they would at home, this is evidenced through

large amounts of water, energy and other resources consumed at the tourist destinations (Williams & Ponsford, 2009). The tourism sector is a large contributor to harmful impacts on the natural environment as the tourism operators, especially those in the accommodation industry, want to provide their guests with comfort and luxury which leads to the overuse of water resources for tourists (Cole, 2012). While tourism is evidently beneficial for an area economically it also brings with it many undesirable environmental consequences (Graci & Dodds, 2008).

An analysis of the existing literature demonstrates the significance of climate to tourism, as climate can affect the seasonality of tourism, where tourists choose to go and what activities they participate in as well as their overall experience of a tourist destination by means of how satisfied and safe they feel (Morabito et al., 2004; Becken, 2005; Kyriakidis & Felton, 2008; Richins et al., 2009; Gössling et al., 2012). As tourists seek destinations with a more favourable climate, current popular destinations may become less attractive (Rosselló & Waqas, 2015). The ability of tourism destinations to mitigate or adapt to climate change is prevented by the inequality between the concern given to developing the tourism sector, and planning for the consequences of climate change (Mohan & Morton, 2009). In order to adapt to climate change, all societies and economic sectors will need to get involved in the years to come, despite this however many sectors, including the tourism sector, have already begun to adapt (Simpson et al., 2008). The tourism sector has the ability to make a huge contribution in tackling climate change due to its rapid growth and being a core driver of global economic development (Mukogo, 2014). This allows for the sector to lead the way by adopting green practices and emphasising sustainability while educating their guests by using environmental management initiatives (Mukogo, 2014). However this would require innovation and resources from the sector being targeted at this problem (Scott et al., 2008). By putting forward a strong and sufficient response to climate change, the better the chances are that tourism will develop into a highly sustainable sector (Pollock, 2008).

This chapter will discuss the existing literature on the global changes in climate and the tourism relevant to this research. Thus, the chapter will develop by investigating the relationship that exists between climate change and tourism. First, by

considering the developed and developing world contexts of how climate change will impact upon these countries, and their ability to cope with the consequences. Next, the perspectives of the public is discussed and how various factors may influence the people's perspectives thereby affecting their ability to identify what climate change is and how to perceive risk from it. Finally, a review of the literature in terms of how climate change and tourism are linked by considering how climate change may impact upon tourism in various areas and how tourism operators can effectively cope, with a focus on coastal towns and their adaptive capacity.

2.2. International concern for climate change

Global climate change is the alteration of the earth's climate over time (Marshak, 2008). The world's climate has shown to be both cooler and warmer than it is now due to the constant change in climate, nevertheless the average global temperature is presently increasing and at an unprecedented rate (Allaby, Twist & Megonigal, 2008). Academic research has most recently placed a high level of focus on global warming and climate change (Higham & Hall, 2005; Ehmer & Heymann, 2008; Nickerson, Becerra & Zumstein, 2011; Ramasamy, 2012). There is a vast amount of evidence to support that the climate is changing (Berrang-Ford, Ford & Paterson, 2011). Despite this, the key issue is why such pressing issues today such as climate change and environmental problems are not dealt with the same enthusiasm and ideals as disasters of the past like war and tyranny (Beck, 2010). While the climate change debate has continued for several decades raising increased concern and awareness, it remains a low priority in respect to other social, environmental and political issues (Leiserowitz, 2006).

The international level of awareness and concern for climate change has risen exceptionally as a response to events of Al Gore's documentary 'An Inconvenient Truth', the Intergovernmental Panel on Climate Change's (IPCC) fourth and fifth assessment report on climate change, and both the Al Gore and the IPCC being awarded the Nobel Peace Prize in 2007 (Mertz et al., 2009). The IPCC, established in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO), released scientific evidence in the first IPCC Assessment Report of 1990 which highlighted the challenge of climate change and

emphasised the significance of international cooperation to deal with its consequences, which in turn lead to the formation of the United Nations Framework Convention on Climate Change (UNFCCC) (IPCC, 2014). The international response to climate change is represented by the UNFCCC and its Kyoto Protocol (Lambrou & Piana, 2006). However the Kyoto Protocol is generally viewed as a failure (Wiley & Gostin, 2009) with it being argued to be a result of its design which made enforcing the Protocol difficult if not impossible (Barrett, 2008). The need for newer and faster technology to be implemented has been expressed, in order to decrease greenhouse gas levels to avoid detrimental outcomes (Thomas, et al., 2004). Several studies suggest that there is a need for greater action by governments with both national and international regulation (Leiserowitz, 2006; Lorenzoni, Nicholson-Cole & Whitmarsh, 2007). There is no world government, there is however nearly 200 governments and each is given sovereign equality within international law (Barrett, 2008). With multiple actors at different levels of government, often approaches to climate change are not aligned and thus the ability to get governments to interact within international laws is limited (Osofsky, 2009). For instance, countries such as China, India, Brazil and certain countries in Africa, refuse to agree to any international approach that will limit the economic abilities of their citizens (Beck, 2010).

Due to the uncertainty regarding the exact processes of climate, dangerous decision making is taking place and policies based on these decisions can result in negative anthropogenic interference with the climate system through carbon taxing (Mastrandrea & Schneider, 2004). Even though uncertainty exists, some consensus does occur between scientists by acknowledging anthropogenic drivers is the main cause of climate change due to the burning of fossil fuels and therefore the release of greenhouse gases, thus calling for carbon taxing (Oreskes, 2004). It has been observed that due to large climate change contributing countries such as the United States delaying adoption of climate change policies has had a domino effect on other countries thus promoting inaction (Nordhaus, 2010). This is because while global concern due to extreme climate events hasgrown, the world's super power, the United States, has unfortunately failed to address the issue of climate change significantly (King, 2004). Despite this many climate change polices and agreements

have been considered with the international community seemingly focused primarily on mitigation (Wiley & Gostin, 2009). An in depth look at the Copenhagen Accord, an agreement to act as a successor to the Kyoto Protocol, reveals that while many developing countries have joined the Accord, this positive move is overshadowed by the fact that they have actually agreed to very little (Nordhaus, 2010).

Climate change is a major challenge that needs to be considered from a multitude of perspectives, which requires various approaches (Barrett, 2008). Due to the general failure of creating an international framework which would be able to stabilize emissions, there has been a realization that climate change is unavoidable, which has given a boost to research (Berrang-Ford et al., 2011). While climate change policy is essentially driven by research, they remain separate fields so while frameworks for international agreements are important it is necessary to understand what climate change research is focused on and what consequences can be expected as such if these agreements are not met (O'Brien, Eriksen, Schjolden & Nygaard, 2004). It has been identified that globally at least 136 major cities are located in low lying areas (Sherbinin et al., 2006), and thus are vulnerable to a rise in sea level (Nicholls &Lowe, 2004). Therefore a large amount of climate change research has concentrated on individual issues with particular attention to sea level rise (McGranahan et al., 2007). The second most widespread focus considers heat extremes and the impacts that it will have in future climate particularly with regards to heat stress (Hunt & Watkiss, 2011). These topics are of a research interest as the condition of the environment is changing rapidly and while the cause of this change is debated there is no doubt that there is a change taking place (Steyn, 2012).

Global studies on coastal regions have shown that proper development and land use planning needs to take place making use of reliable scientific tools to perform vulnerability assessments that determine which coastal areas are under threat (Mcleod et al., 2010). The density of human populations in coastal areas is extremely high and in many cities these populations will be affected by sea level rise and its secondary effects (Mustelin, 2010). Such effects have been identified in a study done on major cities by Hunt and Watkiss (2011) which found that a city such as Mumbai in India would experience structural instability as a result of coastal shifting

and many informal communities would not be fit to live in due to sea level rise. The study also looked at climate change in Rio de Janeiro in Brazil with increased concern over coastal erosion and a decreased ability of wetlands to buffer storm surges as these issues are predicted to enhance the impacts of sea level rise (Sherbinin et al., 2006). These increased occurrences of heat waves, floods and storms will all result in secondary impacts from climate change such as diseases (Agrawala et al., 2011).

Extreme climatic events as well as natural hazards are expected to become more frequent and severe (Faling, 2012). As a result there are many issues within climate change, these include: temperature and precipitation changes, sea level rise, changing storm patterns, and the effects that these issues have on human settlements and the biota (Mather et al., 2009; James & Hermes, 2011; Tandross et al.,2011). Climate change also poses a huge risk for extinction of various flora and fauna globally with an expected 15-37% of species being resolved to extinction by 2050 in the sample regions modelled by Thomas et al. (2004). Research done by Parmesan (2006) on the ecological and evolutionary responses to recent climate change, show the biological variation linked with climate change. It is explained that species will become restricted in range, and as a result will ultimately experience a decrease in population size, with those in polar or mountain top areas predicted to be the first to undergo extinction (Wilson et al., 2005). The ranges are shifting significantly suggesting an average shift of about 6.1 km per decade towards the poles (Parmesan & Yohe, 2003). It has also been considered that interactions between species such as that of the predator-prey relationship will change as has been observed in the past and this has resulted in genetic shifts in species (Bradshaw &Holzapfel, 2006). This genetic shift can allow the species to adjust to local effects of climate change, however very minimal evidence exists to suggest that this will assist in mitigation towards negative effects at the species level (Nussey et al., 2005).

To deal with the possible effects it is suggested that building resilience to climate change is imperative to assisting humans in effectively coping with the environmental impacts (Adger, Arnell & Tompkins, 2005). The ability to adapt and be resilient would

lie in our understanding of climate change and its processes, such as how factors such as water vapour, lapse rate, clouds, snow, and sea ice are associated with the radiative feedbacks and these can affect the estimates of climate sensitivity (Bony et al., 2006). Research by Brown and Southworth (2006) discussed the possibility for each city to individually address climate change through infrastructure and development that is green. Similar research has used cities in the U.K. as case studies, to show that green space within a city can assist in adaptation to climate change with temperature difference (Gill, et al., 2007). Trinidad and Tobago has an effective community-based coastal management system in place, and this is used as an efficient example to substantiate the argument that adaptation will be possible by immediate action building resilience (Adger, et al., 2005). Despite these developments though, it is important to realise that climate science is highly uncertain (Bony, et al., 2006). It is also important to note that the availability of resources to become resilient and the risk from climate change will be different at spatial and societal scales (Tompkins & Adger, 2004).

Building resilience may also be derived from governmental action but also support from the public (Semenza et al., 2008). The public social context can aid in either increasing or weakening perceptions of climate change risk (Lorenzoni & Pidgeon, 2006). It is no surprise that the public's perceptions and understanding of climate change is being increasingly considered in research and policy (Wolf & Moser, 2011). In the last few years it has been observed that the degree of reported concern for climate change has decreased to some extent, and this has been accompanied by a rise in people voicing their uncertainty regarding whether a human influence on climate is real (Leiserowitz et al., 2010; Whitmarsh, 2011). A decrease in concern can be attributed to numerous reasons, such as more pressing issues of economic status, crime and job security, as all these issues have tended to dominate the mass media over the last few years thus drawing attention away from climate change (Hamilton, 2011). Yet, despite this the fall in public opinion that has been suggested is not quite as severe as believed (Spence et al, 2010). It seems though that due to more urgent concerns that the public is being tested on their capacity to care about climate change (Nielson, 2011). More recently studies have aimed to probe deeper into public perceptions of climate

change, and thus look further than focus on levels of concern and awareness (Poortinga et al, 2011; Devine-Wright et al., 2015). A study done in the UK determined that a large number of people would support the use of public taxes to finance low-carbon policies to deal with climate change (Spence et al, 2010).

There is a considerable amount of support for climate change policies despite the level of certainty about climate change by scientists and the public alike (Lorenzoni et al., 2007). It is possible though that the volume of attention paid is not continuous at all times due to the lack of continuous coverage by the media and thus from time to time it may fade from the collective public conscience (Nielson, 2011). Studying the perceptions people have of climate change can be difficult as the concept of climate is not one which people normally think extensively about (Wilson, 2011). This is problem is explained by Hulme (2008,p. 2-3):

> "Climate cannot be experienced directly through our senses. Unlike the wind which we feel on our face or a raindrop that wets our hair, climate is a constructed idea that takes these sensory encounters and builds them into something more abstract"

As a result significant knowledge gaps remain on public perception, particularly tourist perceptions and their behavioural responses to a climate or environmental change (Moreno, 2010).

A large knowledge gap of public perception considers why public opinions may differ and three main fields of research exist that aim to explain this: socio- demographic effects, cognitive effects and geographic effects (Shao, 2012). Socio-demographic such as age, race, gender and education have all been identified to have an influence on perceptions of climate change (Leiserowitz, 2006; Dunlap & McCright, 2008; Hamilton & Keim, 2009; van der Linden, 2015). However, overall these studies portray an unclear picture of how socio-demographic factors affect perceptions (Shao, 2012). Cognitive effects include attitudes, beliefs and worldviews which are shown to influence environmental concern determined by information put out in the public domain (McCombs, 2013).

Public perception based studies on climate change show that often people understand the issue of climate change and are interested in being active in mitigation processes (Semenza et al., 2008). Nevertheless, it has been found that the problem is not willingness to participate but rather taking an actual active role and this could be linked to a lack of experiencing the consequences of climate change first-hand (Weber, 2010; Spence et al., 2011). The way in which people contextualise climate change may not necessarily be environmentally based and instead may be based on their consideration of their health and livelihoods (Wolf & Moser, 2011). Public perception can also be related to their individual surroundings thus those who live in areas considered vulnerable to climate change impacts, such as low-lying coastal areas, are shown to have an increased sense of personal risk (Spence et al., 2011). It has been noted that there has been a recent decline in the level of public attention and concern regarding climate change as a result of extensive media coverage causing information fatigue and the influence of recent weather conditions such as cool or warm conditions (Ratter, 2012). This level of concern needs to be addressed as the perceptions of the public are crucial in determining the socio-political context in how the policy makers' function as the perception of risk can either significantly encourage or limit the political, economic and social action that is necessary to deal with the risks (Leiserowitz, 2006).

This event of information fatigue by extensive media coverage demonstrates how large a role mass media plays in providing information to the public and there has been a number of studies considering this (Boykoff & Boykoff, 2004; Boykoff, 2008). Examples of media coverage include an online article which focuses on the aftermath of Hurricane Sandy notes the importance of the public understanding scientific assessments and therefore suggests the potential for these assessments to be written in a way that can be understood at a public level (Clark, 2013). Another article discussed a meeting between 200 nations to reduce greenhouse gas emissions from the year 2020 and this is considered a negative means of combating climate change, because the longer action is withheld the worse the level of effects to address as well as the higher the costs of doing so (Doyle, 2012). Many mass media articles discuss scepticism towards climate change, such as viewing climate change as an Armageddon story which is being fed to the public, and those in denial

suffer from the “Armageddon Complex” (Marom, 2013). It understands the public as reluctant to take action because of the belief that climate change cannot really be so harmful or that it is not their responsibility to take action but rather that of the climate experts (Wheeler, 2008). The topic of climate scepticism is also popular within politics as the sceptics believe that the medieval warming period is evidence for global climate change to be considered part of a natural cycle (Alfreds, 2013). The vulnerability of Africa is observed in the article by Taggart (2015) in which the area of St Louis in Senegal is flooding due to a rise in sea level and the Atlantic Ocean advancing while the city is protected by a thin 17km sand spit, the village of Doun Baba Dieye has completely disappeared and it is expected that the rest of the city will follow.

Mass media would ultimately fall into the category of cognitive effects as mentioned previously, however it is not the only cognitive factor that needs to be considered (Boykoff, 2008). Cognitive effects can also involve how people make decisions when faced with risk and this is dine through personal experience and statistical information (Weber, 2006). Nevertheless, it has been determined that people favour personal experience over statistical information (Marx, Weber, Orlove, Leiserowitz, Krantz, Roncoli & Phillips, 2007). The last field of perception research focuses on geographic effects with the public’s views of the environment found to differ with location (Hamilton, Colocousis & Duncan, 2010; van der Linden, 2015). The perceptions can have a few core issues that are globally shared among people anywhere in the world (Crona et al., 2013). In regards to a climate change study done by Brody, Zahran, Vedlitz & Grover (2008) showed that geographic variables such as elevation, distance to the coastline and proximity to sea level rise rely on certain physical experiences and can therefore affect the relationship between real risk and perceived risk.

2.3. Climate change from a developing world context

Climate change impacts will have many effects on the global economy and also the global quality of life, however it is important to understand the distribution of those impacts on developed and developing countries (Mendelsohn, Dinar & Williams,

2006). Investigations into climate change impacts show that developing countries are at far greater risk than developed countries (Amelung, Blazejczyk & Matzarakis, 2007; Bigano, Bosello, Roson & Tol, 2008; Beck, 2010). Climate change will hinder the developing countries' ability for development (Simpson, 2007). Countries with economies in transition will experience the most harmful effects as their populations are extremely vulnerable and thus will be less likely to adapt (Amelung et al., 2007). Developing countries often have large regions dedicated to agriculture, this is due to agriculture contributing a high level of income to the economy and also because land is more valuable, as a result these areas will experience higher levels of direct losses as opposed to developed countries (Bigano et al., 2008). Therefore developing countries such as the Asian, African and Latin American countries, with the exception of China, will experience more GDP loss as opposed to most developed countries (Bigano et al., 2008).

Through the creation of sectoral agreements, developing countries should also be offered financial assistance considered as 'incremental cost' whereby these countries are assisted financially for complying with agreement to meet climate change mitigation standards (Barrett, 2008). A potential problem to implementing sectoral agreements is that various developing countries will not agree to meet mitigation standards, such as restricting their emissions, because if they did then they would not stand the possibility of developing (Olausson, 2009). This could be addressed by making use of trade-sensitive sectoral agreements which enforce restrictions and due to developing countries being financially compensated for participating it would standardize the restrictions thereby having more legitimacy (Buob & Stephan, 2013).

Developing countries will also need assistance from developed countries in order to build their human and technical capacities thus improving their adaptability (Smit & Wandel, 2006). A domain where this type of assistance would be really valuable is the coastal regions of developing countries (Agrawala, Moehner, El Raey, Conway, van Aalst, Hagenstad & Smith, 2004; Nicholls, Wong, Burkett, Codignotto & Hay, 2007). While developing countries have the political and societal will to protect or relocate populations in the coastal zones, they do not have the necessary capacity to

do so (Nicholls, 2007). These capacities can include the human, financial and technical capital needed to effectively deal with climate change problems, which is lessened in countries with a variety of socio-economic and environmental conditions (Amelung et al., 2007). As a result the various national and international stakeholders are reviewing their respective roles and responsibilities and are offering governmental support to countries facing the worst effects of climate change (Beck, 2010).

There is no simple means of assessing the vulnerability of developing countries to these effects, particularly as confusion exists over what constitutes vulnerability (Hinkel & Klein, 2009). Often climate may not be considered a process to which populations may be vulnerable due to it being a resource such as providing food and water; however it can frequently be a threat by causing various disorders in different societies (Agrawala & Crick, 2009). Such disorder is noted in developing countries such as those located in Sub-Saharan Africa, which will experience a higher level of warming than the global average with precipitation expected to decrease in many parts of the region and these changes put food and water security, public health, natural resources and biodiversity at risk (Bryan et al., 2009). Coastal regions such as in Kenya are also particularly vulnerable to climate change due to three factors: low altitude, high temperatures and high humidity levels (Awuor et al., 2008). As is the coast of Morocco, thus accelerated sea-level rise will affect these regions both physically and socio-economically, with most developing countries' coastal zones experiencing similar outcomes (Snoussi et al., 2007).

There is a recognised need to adapt to climate change, with the term adaptation being used in climate change literature to mean:

> "Adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities" (Adger et al., 2009,p. 337).

The objective of adaptation will be expected to be dependent on whom or what is adapting and their level of adaptive capacity (Adger et al., 2009). The higher the adaptive capacity the higher the ability to significantly decrease climate change

vulnerability while making beneficial changes (Juhola & Kruse, 2015). Developing countries have high levels of vulnerabilities and therefore will have specific adaptation needs (Mertz et al., 2009). As a result adaptation for developing countries can be considered more challenging than for developed countries due to limitations on adaptive capacity, because a shortage of adaptive capacity generates a hotspot of human vulnerability (Nicholls et al., 2007). Therefore countries, governments or societies of a wealthy and well developed standing may wish to merely maintain their current standard of living by means of adaptation whereas those in developing countries may wish to continue developing and improve the standard of living for their people (Adger et al., 2009). Although there has been valuable action taken to guarantee that there is adequate adaption in developing countries, there is still a large window for improvement in terms of the work being done into fully understanding the drivers of adaptation efforts of the past, future adaption needs and how to implement climate into overall development policies (Mertz et al., 2009).

Previous research on adaptation in developing countries has reported that these countries have an inadequate ability to comprehensively evaluate potential impacts and adaptation responses (Leary & Kulkarni, 2007). However, an exception is Egypt which has been found to be at the forefront of conducting thorough vulnerability and impact assessments, particularly in terms of coastal zones (Agrawala et al., 2004). The stability and effectiveness of political institutions as well as the accessibility of information, technology and resources will define the level of vulnerability of a region (Amelung et al., 2007). Ultimately the adaptive capacity of a country will therefore befundamentally determined by its development status with vulnerability differing between developing countries, although developed countries will not be protected from any harmful consequences as a result of extreme events (Nicholls et al., 2007).

The individuals and governments of developing countries often view climate change, and thus adapting to it, as less of a concern than current issues of poverty, diseases and war which are perceived as more urgent and noticeable (Reddy, 2011). Leiserowitz (2006) describes developed countries as having a higher level of awareness of climate change than developing countries. However, this has not been thoroughly researched as the majority of climate change perception studies have

been carried out in Europe and North America (Vignola, Klinsky, Tim & McDaniels, 2013). A study done by Ishaya and Abaja (2008) in Nigeria found that the level of awareness regarding climatic changes to be quite high amongst the indigenous people partly due to rising temperatures and decreased precipitation affecting their farming. The statement made by Leiserowitz is impartial to the indigenous perceptions in developing countries of climate change, which should be reconsidered as they have first-hand experience of any climatic changes that are occurring (Damgaard, 2013). Developed countries may possibly have a higher level of understanding but climate ultimately has very little practical significance in their everyday lives (Lorenzoni et al., 2007).

Leiserowitz (2006) also went on to describe developing countries to have an awareness of climate change that is beyond the framework of climate change science. There are many factors which can affect how individuals perceive climate change including: psychological, sociological and cultural influences (Weber, 2010). For instance, in some parts of Africa, there are people that have very strong beliefs that any climatic changes are the work of God (Wolf & Moser, 2011). Similarly, in Tibet it is believed that the climate is changing as a result of the mountain deities being angered (Byg & Salick, 2009). Research was conducted on rural populations in 10 Sub-Saharan countries (DR Congo, Ethiopia, Ghana, Kenya, Nigeria, Senegal, South Africa, Sudan, Tanzania, and Uganda) by the BBC World Service Trust that demonstrates that these populations have very little understanding of climate change despite already dealing with its impacts (Wolf & Moser, 2011). The Pew Global Attitudes Survey conducted in 2006, found that a large portion of the respondents had never heard of climate change in Pakistan, Indonesia, Nigeria and Egypt (Hamilton, 2011). There are many significant consequences stemming from this lack of basic perception of the issue, such as a lack of pressure on governments to take action and potentially a higher level of vulnerability, thus gaining an understanding of what shapes perceptions of climate change is important (Leiserowitz, 2006).

2.4. Global relationship between tourism and climate change

The current amount and growth of tourism as a means of an international activity is fairly recent with tourism becoming one of the largest economic sectors worldwide

(Moreno, 2010). The relationship between tourism and climate gained academic interest around the 1950s (Scott, Jones & McBoyle, 2006). This interest was focused on the influence that climate change has on tourism activities (Moreno & Amelung, 2009). Most recently however a new viewpoint was acquired of the function that climate and weather have in tourism and thus climate has been identified as a strong influence in shaping tourism activities (Matzarakis, de Freitas & Scott, 2004). There has been a significant amount of research that has identified climate change as a major problem for tourism, largely in part because they are so closely linked, as tourism is affected by climate change as well as impacts upon climate change (Hamilton et al., 2005; Patterson et al., 2006; Gössling et al., 2012). The more significant of these studies have been summarised in Table 1. Due to the weather and climate being highly significant factors in outdoor tourism-related activities, it makes coastal recreation especially vulnerable to this relationship (Zaninović & Matzarakis, 2009).

Table 1: Summary of some of the recent literature on climate change impacts on tourism.

Author	Study location	Likely impacts	Adaptation plans
Bürki et al., 2005	Global examples	Less snow, less glaciers, more extreme events (landslides).	Technical adaptation such as making artificial snow. 'Fatalism'.
Becken, 2005	Fiji	Sea level rise, salt water intrusion into ground water, coastal retreat, flooding, coastal reef damage.	Replanting trees/mangroves, management and behavioural changes from staff and guests.
Hall, 2006	New Zealand	Severe storms, flooding, business operations disrupted.	Water security, biosecurity.
Hamilton, 2007	Germany	Sea level rise, accommodation price increase, accommodation demand decrease.	Dikes, tetrapods, groynes and revetments.
Kyriakidis & Felton, 2008	Global examples	Biodiversity loss, reduced landscape aesthetic, coastal erosion, damage to infrastructure, diseases.	Improve environmental credentials, improve accommodation performance to encourage guests to be green, buy local products to reduce operation costs.
Arcodia et al., 2008	Australia	Higher tropical cyclone wind speeds, drought, increased temperatures, fires, sea level rise.	Encouragement of autonomous reactive behaviour, risk management programs.
Richins et al., 2009	Florida	Decreased tourism, floods, droughts, heat waves, hurricanes and tornados.	Florida Green Lodging Program (FDLP): communication, water conservation, energy efficiency, waste reduction, and clean air practices.
Jarvis et al., 2010	Spain	Tourism decrease, malaria risk increase, flash floods, heat stress and fires.	Environmental management strategies, resources use reduction, behavioural changes.
Walmsley, 2011	Global examples	Reduced snow fall, beach erosion, increased business costs, sea level rise, droughts, disease, fires.	Structural changes. Managerial, policy, research, education and behavioural changes.
Gössling et al., 2012	Global examples	Tourism decrease for hot areas with a tourism increase for warm areas. Reef degradation and reduced snowfall. Change in landscape attractiveness.	Link research with behaviour and action. Fill knowledge gaps. Technical adaptation such as making artificial snow.
Isaac, 2013	St. Lucia, Caribbean	Sea level risk, flood risk, damage to infrastructure, erosion, decrease in coastal tourism.	Develop adaptation policies, further research, implement hard-engineering structures.
Amelung & Nicholls, 2014	Australia	Heat waves, sea level rise, water supply stress, swamps intruded with saltwater, decrease of reef dives and species distribution of ecosystems for nature tourists.	Encouraging local tourism businesses to assess the possible impacts to their business and plan for adaptation. Consider tourist behaviour changes in response.
Oladokun et al., 2015	Nigeria	Sea level rise, drought, flooding, decrease of tourist arrivals, altering ecosystems and affecting species diversity which impacts nature tourists.	Creation of a sector in the Federal Ministry of Environment which implements climate change planning into tourism activities.

Many researchers contend that the consequences of a changing climate will result in the developing countries experiencing the largest amount of suffering (Boley, 2014).It is essential that environmental impact reductions be made the focal point in efforts to plan for responsible tourism (Rogerson & Sims, 2012). The effects of climate change can cause political instability as well as social disorder in these countries which will result in negative tourism-demand consequences as international tourists are inclined to avoid these problems (Hall, Timothy & Duval, 2004). In order to address this, it would be beneficial to improve the understanding of the tourism sector's practices and adaptive capacities which is currently limited (Becken 2005; Gössling & Hall 2006; Ceron & Dubois, 2008). It is thus important to obtain further information of future scenarios of social behaviour and climatic changes to be able to fully predict the impacts that the tourism sector will experience (Amelung et al., 2007).

The lack of information available regarding the fields of climate change research and tourism research reflects the knowledge gaps that exist, particularly in developing countries (Simpson et al., 2008). These knowledge gaps include understanding different tourists' preferences in weather conditions and their expectations of destinations' climate (Scott et al., 2008). Another significant knowledge gap includes the lack of assessing the effect of sea level rise on major tourism areas especially as coastal tourism has been noted to be one of the most popular tourism resources (Singh, 2012). Climate change will affect tourism in developing countries not by only affecting visitation flows, but also in threatening infrastructure and causing coastal degradation and erosion of the beaches (Simpson, 2007). The climate can affect the times of the year in which tourists travel and can also define the environmental context that certain tourism interests stem from (Moreno, 2010). For instance certain climatic conditions are promoted as attractions on its own as in the case of Tarifa, Spain whereby it has a dedicated tourism sector to wind surfing as it experiences very strong winds the whole year (Gómez Martín, 2005). Challenges of the impacts of climate change can leave the tourism sector very vulnerable and these impacts can include responding to warmer temperatures, sea level rise, coastal erosion, decreased snow cover and altered habitats for wildlife (Jopp, 2013).

Climate impact studies have focused on different factors such as global-based studies (Hamilton, Maddison & Tol, 2005; Amelung, Nicholls & Viner, 2007) or specific country focused studies (Hamilton, 2007; Jarvis & Ortega, 2010). Other factors include different types of destinations such as ski areas (Uhlmann, Goyette & Beniston, 2009; Morrison & Pickering, 2013) and coastal areas (Amelung & Viner, 2006; Perry, 2006). Taking the increased interest of research on the topic into consideration the United Nations World Tourism Organisation (UNWTO), along with the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO), assembled the 2007 Second International Conference on Climate Change and Tourism in Davos, Switzerland (Moreno, 2010). The conference created the 'Davos Declaration' which states:

> "Climate is a key resource for tourism and the sector is highly sensitive to the impacts of climate change and global warming, many elements of which are already being felt. It is estimated to contribute some 5% of global CO2 emissions" (UNWTO, UNEP & WMO, 2008: 2).

This statement suggests an important consequence as it hints at impacts already being felt and thus emphasises the need for urgent action, which is appropriate due to indications of certain stakeholders misjudging their ability to adapt to climate change (Simpson, Gössling, Scott, Hall & Gladin, 2008).

The tourism sector is slowly becoming more educated about climate change and is therefore going to be more prepared to incorporate climate change planning into its operations however a large amount of information on the effects of changing conditions on tourism stakeholders, such as tourists, is still missing (Moreno, 2010). The effects of climate change on tourism will have negative and positive outcomes globally (Patterson et al.,2006). Negative impacts include a decrease in the amount of tourists to an area thus an economic impact, this will be caused through factors such biodiversity loss, accommodation price increases and diseases (Hall, 2006; Hamilton, 2007; Kyriakidis & Felton, 2008). It is projected that by the year 2050 the tourism sector would already experience large climate change impacts particularly on the economies of countries as tourism demand for better climates are experienced (Berritella et al.,2004). Climate change may have a few positive impacts however these are concentrated to particular factors such as temperature whereby increases

in typically colder regions will make it more favourable to tourists (Bigano et al., 2005). For instance research done by Tol et al.(2006) concluded that climate change would push tourists towards the poles and up the mountains for holidays thereby being beneficial for these particular regions.

Due to the projected changes and impacts, climate change is being integrated into sustainable tourism development, a topic which is discussed extensively most recently in literature (Becken & Hay, 2007; Turton, Hadwen & Wilson, 2011; William & Ponsford, 2009; Hall et al., 2015). In order to acquire long-term sustainable development the tourism sector has to deal with many climate change response challenges (Turton et al., 2009). A major problem which has been identified is the possibility of encouraging sustainable tourism in developing countries, as this will also be affected negatively by climate change (Amelung et al., 2007).

Future climate change scenarios project impacts that will alter the regional and seasonal tourist flows, thus the outcome will be that some regions will be winners whilst others will be losers (Ehmer & Heymann, 2008). The Mediterranean is projected to experience a decrease in international tourism during the summer months due to the increasing temperatures making it too hot (Amelung & Viner, 2006). The Maldives is exceptionally vulnerable to the changing climate, as sea level rise threatens not only the tourism to the area but more critically the existence of the islands (Reddy, 2011). A study done on Spain expects a decrease in the tourism flow by at least 20% by 2080, due to a steady increase in Europe's summer temperatures (Hein, 2009). According to Agrawala (2007), 91% of the alpine ski areas such as in Austria, France, Germany, Italy, and Switzerland are considered as naturally snow-reliable, however with a warming of 4°C this would decrease to only 30% of the areas being considered reliable. Countries such as Spain, Greece and Turkey will experience improved tourism growth in the autumn and winter months as a result of the enhanced climatic conditions (Amelung & Viner, 2006). However countries that currently have warm favourable climatic conditions and have a mainly coastal tourism attractionwould be affected negatively as sun and beaches lose their appeal (Steyn, 2012). The sun and beaches will become less appealing as ideal climate conditions shift polewards (Hamilton & Tol, 2007; Amelung et al., 2007). Germany and the

United Kingdom provide some of the highest levels of international tourists to South Africa, however with these countries conditions improving and thus benefiting from climate change, international tourism will fall as domestic tourism increases (Hamilton & Tol, 2007).

Hall (2006) considered the attitudes and behaviours of tourism business owners in terms of climate change adaptation and mitigation in New Zealand, and found that of the participants that were interviewed, most of them did identify climate change to be of concern particularly to their business and personal well-being, however climate change was ranked significantly below other more immediate business concerns. It has been identified though that often respondents tend to confuse the concept of climate change with other environmental or cultural problems such as land use and therefore could not comprehend the causes and effects of climate change (Becken, 2005). Butler and Jones concluded that “The most worrying aspect is that to all intents and purposes the tourism and hospitality industries seem intent on ignoring what could be themajor problem of the century.” (Scott et al., 2009: 173). In order for the tourism sector to develop an adaptive capacity, significant planning and research is necessary to measure climate change factors such as the increased storminess and coastal erosion that may take place (Theron, 2011).

People choose to settle in a location that will give them the highest level of comfort and survival possibilities, for which climate plays a significant role (Becken & Hay, 2007). Tourism too is controlled by the same kinds of requirements (Martin & Belén, 2005). Tourism businesses that have immobile capital assets, such as accommodation establishments have far less adaptive capacity than those businesses which provide transportation services (Scott et al., 2009). However, most often these tourist accommodation operators remain nonchalant about climate change, especially factors such as sea level rise despite it being one of the most highly researched topics (Hall, 2006; Buckley, 2008; Jarvis & Ortega, 2010). A possible reason for this is that global historical sea level rise has only been a few millimetres, in contrast most coastal areas are subjected to daily tidal levels of several metres and therefore the significance of sea level rise may not yet be realised (Buckley, 2008). While the existence of climate change is acknowledged, many of the

operators consider it less of a problem as opposed to more immediate concerns such as current business operations (Hall, 2006;Jarvis & Ortega, 2010).

The accommodation sector will be affected by a range of direct and indirect climate change impacts.The direct impacts will affect the attractiveness of different locations, while indirect impacts may cause an environmental change or a societal change. Environmental changes can be experienced through factors such as diseases and the water availability of a destination, while societal changes include incidences of political unrest which may occur in countries that have food and water shortages(Kyriakidis & Felton, 2008).Another climate change impact will be on destination vulnerability hotspots, this means that as the weather patterns begin to change, other destinations will become the new tourist hotspot(Kyriakidis & Felton, 2008). The effects will differ globally with the likely impacts to be a changing environmental aesthetics through factors such as biodiversity loss, erosion and damage from rising sea levels and this in turn will change tourism demand and flows to an area thereby affecting the economy (Walmsley, 2011).

The findings of these studies showed that adaptation of the accommodation sector to the likely impacts experienced consist of improving their environmental performance in terms of reducing resource usage as well as implementing behaviour changes for the staff and managers of the establishments (Becken, 2005; Jarvis & Ortega, 2010). Infrastructure such as coastal tourist accommodation is expected to be damaged by climate change mostly as a consequence of sea level rise and storm surges (Lewis et al., 2011;Cartwright, 2011). If there is sufficient space and it is considered acceptable, the best policy for dealing with climate change impacts in the long-term is to avoid combating coastal erosion and instead allow the natural progression of coastal processes (Theron, 2011). There is little ability to stop coastal impacts from climate change on a large scale and by trying it could possibly lead to other harmful impacts (Harley, 2006). Instead it is more favourable to adapt as this action would be less costly than potential damage incurred and Tol (2004) has projected that adaptation would decrease the climate change impacts by a factor of 10 to 100 globally.

2.5. The Tourism Climate Index

The ability to describe and evaluate a potential or existing tourist destination based upon the suitability of its climate has been desired for a long time (Becken, 2010). This gave rise to the concept of numerical climate indices, which owing to climate comprising of intricate weather variables, and being regarded as a multifaceted tourism resource made for a more appropriate means of assessment (de Freitas et al. 2008). Mieczkowski (1985) made the first attempt of formulating an index that could evaluate the climate suitability of a destination by developing the Tourism Climate Index (TCI) (Tang, 2013). The TCI originally combined seven climatic factors that were related predominantly to sightseeing, and it has since further been adjusted and utilized in various situations. These include such as a study on beach environments by Morgan (2000); the climatic ranking of 17 North American cities for tourism (Scott & McBoyle, 2001); the climate change impact on global tourism flows (Amelung et al., 2007); and the effects of urban sprawl of a metropolis on tourism-climate index oscillation (Roshan et al., 2009).

In order to calculate the TCI, five main sub-indices are created comprised of seven climatic factors (Table 2). To be able to evaluate climatic suitability, the seven climatic factors are measured and the following formula is derived:

$$TCI = 2(4CID + CIA + 2R + 2S + W)$$

Where:
TCI = Tourism Climate Index.
CID = daytime comfort index (combination of maximum daily temperature (ºC) and minimum daily relative humidity (%)).
CIA = daily comfort index (combination of mean daily temperature (ºC) and mean daily relative humidity (%)).
R = precipitation (mm).
S = sunshine (hrs).
W = wind (km/h or m/s).
(Mieczkowski, 1985).

Table 2: Components of Tourism Climate Index (TCI) (After Perch-Nielsen et al., 2010).

Sub-index	**Climatic variable**	**Influence on TCI**	**Weighting (%)**
Daytime Comfort Index (CID)	Maximum daily air temperature (°C) Minimum daily relative humidity (%)	Thermal comfort when maximum tourist activity occurs	40
Daily Comfort Index (CIA)	Mean daily air temperature (°C) Mean daily relative humidity (%)	Thermal comfort over 24 hours period including night time	10
Precipitation	Total precipitation (mm)	A negative factor on overall experience	20
Sunshine (S)	Total hours of sunshine (hours)	A positive factor on overall experience	20
Wind (W)	Average wind speed (km/h or m/s)	Highly depends on air temperature (evaporative cooling effect in hot climates rated positively, while 'wind chill' in cold climates rated negatively	10

The TCI has been acclaimed for its wide application in research; but it has been met with criticism (Scott et al. 2004; de Freitas et al. 2008; Yu et al. 2009a &2009b; Perch-Nielsen et al. 2010; Tang, 2013). The TCI is noted to have three main strengths, with the first being its ability to create a single climate index by integrating three important climatic features (physical, thermal and aesthetic) (Scott and McBoyle 2001; Perch-Nielsen et al. 2010). The physical climatic features consider specific aspects of weather that could influence a tourist's satisfaction that does not include in a thermal sense (e.g. wind and rain), while the aesthetic features include environmental attributes which are climatically controlled (e.g. visibility, level of sunshine or cloud) (Hall & Higham, 2005). The thermal features are more complex as they take into account the overall thermal state of the body, integrating both the perceived thermal state and the thermal sensation experienced (e.g. the heat balance of the body from the level of activity and air temperature (Hall & Higham, 2005). The second strength is the widespread application due to the necessary climate data being readily available from weather stations, and easily utilised owing to simple data provision and calculations (Scott and McBoyle 2001; Perch-Nielsen et al. 2010; Tang, 2013). Lastly, the TCI is capable of measuring common tourist activities and attributable to the rating scale designed by Mieczkowski (scale of -30 to 100), the general public can easily interpret it (Tang, 2013).

Despite the TCI's strengths, it has received criticism for three major deficiencies, prompting the need to improve the index or even develop a new index (Tang, 2013). Firstly, the calculation of the TCI does not account for the dominant effects of

physical features such as rain or wind, as these features, if strong enough, could outweigh other thermal and aesthetic features in influencing tourist total climatic comfort (de Freitas et al. 2004; 2008). This means that even if the thermal and aesthetic features are suitable to tourists, the bad physical features will take precedence over the attractiveness of the climate to the tourists (Tang, 2013). The second critique is of the TCI's subjective rating system of the climatic variables and its weightings of elements, as a lack of available biometeorological literature existed at the time it was created, and therefore it was based upon Mieczkowski's (1985) own expert opinion and included no peer review (de Freitas et al. 2004; 2008). Lastly, in the early 1980s monthly average climatic data was the only data that was widely available at the time, thus resulting in the original TCI having a low temporal resolution (Scott et al. 2004, de Freitas et al. 2008, Yu et al. 2009a and 2009b, Perch-Nielsen et al. 2010).

In spite of this critique, the TCI has been utilized in many studies (Table 3) in order to assess the climatic suitability of an area with research addressing global climate (Amelung, et al., 2007), regional climate (Scott and McBoyle, 2001; Scott et al., 2004; Amelung and Viner 2006; Hein, 2007; Nicholls and Amelung 2008; Amelung and Moreno, 2009; Hein et al., 2009; Perch-Nielsen et al. 2010) and also country or destination climate (Cengiz et al. 2008, Farajzadeh and Matzarakis 2009, Roshan et al. 2009; Yu et al. 2009a and 2009b; Whittlesea and Amelung, 2010). These studies have shown that two types of information, through assessing tourism potential and current climate, can be acquired through the application of the TCI: tourist locations that have good climatic conditions, and which months would offer the most comfortable climate to visit (Amelung et al., 2007; Tang, 2013; Rosselló & Waqas, 2015). Overall the TCI can be combined with climate change projection to benefit tourism climate research, as well as have great consequences for analysing the impact that climate change has on tourism climate resources (Tang, 2013).

Table 3: The application of TCI in existing studies (After Tang, 2013).

Amengual	**Study location**	**Aim of study**	**Data type**
Amelung & Viner, 2006	Mediterranean Region	Impacts of climate change on tourism climatic resources	Monthly
Amelung et al., 2007	Global	Potential implications of climate change on tourism climate resources	Monthly
Hein, 2007	Spain, Mediterranean	Impacts of climate change on tourism climate resources and tourist flow	Monthly
Cengiz et al., 2008	Canakkale, Turkey	Current climate conditions and potentials	Monthly
Nicholls & Amelung, 2008	Northwest Europe	Future climate conditions in Northwest Europe	Monthly
Farajzadeh & Matzarakis, 2009	Northwest Iran	Current climate conditions and potentials	Monthly
Roshan et al., 2009	Tehran, Iran	Effects of urban sprawl of metropolis on tourism-climate index oscillation	Monthly
Yu et al., 2009a	Florida and Alaska	Developed and tested the Modified Climate Index for Tourism (MCIT)	Hourly
Yu et al., 2009b	Alaska	Use MCIT to examine seasonal patterns at two Alaska destinations, King Salmon and Anchorage	Hourly
Perch-Nielsen et al., 2010	Europe	Presented tourism climate resources distribution under projected climate change scenarios	Daily
Whittlesea & Amelung, 2010	South West England	Impacts of climate change on tourism comfort and seasonality under UK Climate Projections	Monthly
Lin & Matzarakis, 2011	Taiwan and eastern China	Tourist thermal perceptions for temperate and sub-tropical regions.	Hourly and monthly
Amengual et al., 2012	Platja de Palma, Spain	Measure the potential of tourism under present conditions and future climatic projections	Daily
Cashman et al., 2012	Barbados, Caribbean	Address the effects of climate change on tourism sustainability of the Caribbean	Monthly
Matzarakis et al., 2013	Luxembourg, central Europe	Assess central Europe's thermal bioclimate and the tourism climate potential	Hourly
Ridderstaat et al., 2014	Aruba, Caribbean	Effect of push and pull climate factors on tourist demand	Monthly
Amelung & Nicholls, 2014	Australia	Assess climate projection impacts on tourism sector in Australia	Monthly
Olya & Alipour, 2015	North Cyprus, Mediterranean	Risk analysis using mathematical approach for tourism climate nexus	Daily
Mokhtari & Anvari, 2015	Markazi and Kharasan, Iran	Evaluate the climate suitability for tourism	Monthly

2.6. Tourism and climate change in South Africa

Africa is considered to be a one of the continents that is most vulnerable to a changing climate due to dealing with multiple stressors and having a low adaptive capacity (Reddy, 2011). Although Africa is currently attempting to adapt to climate variability it is believed that this will be insufficient for future climatic changes (Boko et al., 2007). African tourist destinations do not have the financial capacity to cope with the projected impacts of climate change and this is one of the greatest challenges that it will have to contend with (Ehmer & Heymann, 2008). One of the most threatened areas of African tourism is the wildlife and nature tourism sector, which it is famous for, as the natural characteristics of biomes could be altered by climate change (Reddy, 2011). As a changing climate will be the primary limitation on the distribution of species and the functioning of the ecosystem (Williams et al., 2007).

The United Nations World Tourism Organisation (2009) argues that climate change will become an increasingly critical issue that will highly affect tourism development and management. In the international tourism sector climate change appears to generate far greater risk than opportunity (Ehmer & Heymann, 2008). The relationship that exists between tourism and climate change is considered differently by the various research practices and fields of discipline (Hall, 2012). What results is an extremely unbalanced evaluation of tourism and climate change in terms of both the focus and approach and therefore certain methods are dominant in some studies (Gössling et al., 2012). The level of adequacy of tourism knowledge with respect to climate change adaptation and impacts is show to be inadequate with regards to accommodation establishments and very inadequate with regards to tourists Hall (2012).

South Africa is gradually becoming a more popular tourist destination, which is clear from the range of attractions on offer to tourists in terms of hospitality, diverse cultures, wildlife, beautiful scenery, conference facilities and eco-tourism (Popova, 2006). South Africa is ranked highly as a travel destination in terms of environmental features, despite this it also has one of the worst records of greenhouse gas emissions (Rogerson & Sims, 2012). Before 1994, South Africa initially viewed both

environmental issues and tourism as insignificant, this was due to the belief that it would only benefit those individuals that were advantaged, and it was their concern alone accordingly (Akinboade & Braimoh, 2010). Subsequently, a transformation in the country and its views has followed and this could have been brought about by the fact that South Africa has undergone a considerable increase in tourism within the past decade (Rossouw & Rockman, 2012). The South African national tourism policy states that the South African tourism sector needs to sufficiently prepare itself for the future as environmental issues are becoming more a greater concern in tourist travel (South African Government, 2011). It goes on further to explain that with climate change comes many new challenges, with one of the focus issues being that of emissions generated through travel leading to government aiming to put forward policies to curb the level of Greenhouse gas emissions (South African Government, 2011).

The Southern African region is in fact warming at an alarming rate in comparison to the global average (Rogerson & Sims, 2012) and thus the South African government has put forward the white paper that looks into the development and promotion of tourism and this paper is concerned with making tourism sustainable in the country (Hermann, et al., 2011).

Little in-depth research has been done on mitigation of climate change impacts, sea level rise or the increased frequency and intensity of storms along the South African coast (James & Hermes, 2011). The lack of research inhibits the ability to respond effectively to climate change. South Africa will experience significant changes in response to the changing climate (Boko et al., 2007). Coastal squeeze, an event whereby coastal habitats are prevented from moving landwards in response to sea level rise particularly in areas with beaches that are confined by hard structures such as coastal infrastructure, sea walls or cliffs, is already occurring and is projected to worsen (Theron, 2011). As a result of the coastal squeeze, back shore sections of the beaches will be inundated and upper intertidal zones will undergo compression (James & Hermes, 2011). The services that ecosystems provide will end and biota will be lost as a consequence (Faling et al., 2012). Sea level rise as well as a increased storm intensity will have a strong erosive power that will be able to remove

large volumes of sediment from the beaches causing coastal retreat while exacerbating the risk of coastal infrastructure damage (Blake, 2010).

Rising sea levels will allow for saline intrusion into the groundwater system of South Africa and it will alter the groundwater flow (Theron, 2011). Extreme flooding events are of major interest to climate change research as storm activity will become more frequent and the severity of these storms in South Africa will increase (Boko et al., 2007). These events are of concern and may be caused by high levels of precipitation or storm surges (Tandross et al.,2011). The western half of South Africa will experience reduced rainfall whilst the eastern half, particularly along the coast, will experience increased rainfall making more favourable living conditions however additional development along the coast will only worsen the effects of coastal squeeze (James & Hermes, 2011). In the instance of an extreme height of the storm tide, this can lead to existing coastal defences being breached and thus flooding which will damage infrastructure (Tandross et al., 2011).

2.7. Coastal cities

Cities play a large role in intensifying the climate change problem; however they also have the ability to contribute to a significant solution (Kamal-Chaoui & Robert, 2009). Early climate change studies were primarily concerned with the impacts that ecosystems and agriculture would experience, and cities were overlooked by scientists (Rosenzweig et al., 2010). However an immense amount of energy is consumed by cities and this usage results in excessive greenhouse gas emissions (Kamal-Chaoui & Robert, 2009). Climate change will amplify the pressures to cities such as intensifying urban sprawl, poverty and pollution while undergoing a growth in urban populations (Douglas et al., 2008). Many knock-on effects will also take place as a result of cities' economic activities being concentrated and integrated, occurring within infrastructure systems that are very complex with multi-layered governance (Rosenzweig et al., 2010). Based upon the devastation caused by recent extreme climate events, we can note evidence of just how vulnerable small settlements and cities are to climate change (Huq et al., 2007). It is essential that there is an increased understanding of the impacts of climate change, and the consequences this will have for various sectors operating in cities (Mukheibir & Ziervogel, 2007).

Cities have developed completely independent of climate change; however, this means that no prior consideration of the risks of climate change was taken putting a larger number of people living there at risk (Huq et al., 2007). In many cities with a low capacity, adapting to climate change is led by a bottom-up response by the public, which means that the city communities are highly aware of just how important it is to plan for a change in climate so as to reduce their level of exposure while increasing their resilience (Ziervogel & Parnell, 2012). These countries that have a lower capacity have of late been considered by the United Nations Framework Convention on Climate Change (UNFCCC) by developing National Adaptation Plans of Action (NAPA) (Mukheibir & Ziervogel, 2007). By implementing these policies it puts increased pressure on the scientific community to research and put forward newer and improved information on how exactly urban areas will be impacted by changes in the climate (Rosenzweig et al., 2010). Information that is needed include that of expected long-term trends in climate, thresholds as well as the potential for unexpected events (Hallegatte, 2011). This information will help assist decision-makers by focusing the attention on areas that should take priority thereby assisting in the overall adaptation strategies to protect the cities instead of dealing with the damage once it's already been done (Huq et al., 2007). City leaders as opposed to national politicians appear to be more willing to take action against climate change and safeguard their cities (Rosenzweig et al., 2010).

A common misconception is that cities in developed countries are resilient and have a natural adaptive capacity; however this belief was destroyed in 2005, when New Orleans was hit by Hurricane Katrina (Rosenzweig et al., 2010). Unfortunately many cities have been developed in dangerous locations which put them at risk from floods and heavy storms (Huq et al., 2007). Due to the amount of exposed infrastructure and relative position to the ocean, many coastal cities are the focus for extreme climate events like sea level rise and heavy storms (Kamal-Chaoui & Robert, 2009). Storm surges and sea level rise will place a large portion of the population at risk, due to the large concentration of people in cities, and a significant amount of land loss is also expected (McGranahan et al., 2007). This is especially relevant where coastal flooding will occur more frequently such as in port cities in developing

countries that are growing at a fast-paced rate like in India and China, as well as in wealthy developed countries such as the United States, the Netherlands and Japan (Nicholls et al., 2008). Attributable to the structure of cities, there is nowhere for the water to go when flooding occurs as natural channels are blocked by roofs, roads and pavements (Douglas et al., 2008). Another aspect to consider within coastal zones is that the urban environments often encompass deltas, islands and barrier islands, beaches, as well as estuaries, making these urban areas extremely vulnerable to climate change (Hunt & Watkiss, 2011).

A large portion of the world's major cities are located on low lying areas and many of these are within close proximity to the coast thus putting them at the forefront of dealing with sea level rise and storm surges (Nicholls & Lowe, 2004). It has been found that roughly 65% of cities that have populations that exceed 5 million are situated at low elevations in the coastal zones, which coincides with the view that large urban communities are located in low lying areas surrounding the coast (McGranahan et al., 2006). A reason for this may be that coastal regions are the heart of significant socio-economic activities on a national scale (Nordhaus, 2006). There will be a wide range of climate change impacts that coastal cities will be threatened with (Nicholls et al., 2008). These will vary between direct and indirect impacts, with the most obvious direct impact being sea level rise which can cause both inundation and displacement (Hunt & Watkiss, 2011). Other direct impacts include: the erosion of coasts as well as land loss; an increased level of salinity in estuaries and fresh-water aquifers; obstructed drainage; and a large amount of flooding from storms (Kamal-Chaoui & Robert, 2009). The indirect impacts can alter the functioning of coastal ecosystems as well as affect recreational activities and tourism (Huq et al., 2007). Cities may possibly be influenced by four types of flooding: insufficient drainage which will cause localized flooding; development on major rivers banks causing flooding to that infrastructure; catchment areas flooding from small streams that are located in urbanized areas; and lastly coastal flooding caused by a mixture of inland river flows and high tides (Douglas et al., 2008). In South Africa, cities are pushing towards better climate adaptation and are aiming to work together to achieve this (Ziervogel & Parnell, 2012). Regardless of their size,

South African coastal cities are making an effort to help one another improve their responses to climate change (Mukheibir & Ziervogel, 2007).

2.8. Conclusion

The climate change debate is a longstanding one, with more recent acknowledgement that anthropogenic drivers are the main cause of the changing climate. There is an overwhelming amount of evidence to demonstrate that the world's climate is changing, and this is noted in the growth of interest in climate change over the years, particularly in the scientific community increasing the number of studies focused on it. Tourism is fast becoming one of the largest economic sectors worldwide, and the global relationship between tourism and climate change has gained much academic interest recently. The understanding of the tourism sector's practices and adaptive capacities are currently limited, so it's necessary to improve upon this. Despite realising the lack of information between climate change impacts on tourism, huge knowledge gaps remain. To address these knowledge gaps it is necessary to assess climate change in areas where a little research has been done on the topic. These areas include research from an African context as the African tourism sector is widely comprised of wildlife and nature, which means that this is one of the most threatened aspects of the tourism sector. Another aspect is the coastal tourism, as the coastal zones are most threatened by climate change. This will significantly affect the South African tourism sector as it loses its sun and beaches appeal. The existing literature on the South African coastal zone shows that very little in depth research has been done on mitigation of climate change impacts, sea level rise or the increased storminess along the coast. Using this existing literature as the foundation, it will help to build the research by contributing a better understanding of how climate change will impact upon coastal tourism which provides.

3
STUDY SITE & METHODOLOGY

3.1. Introduction

This chapter provides a description of the study sites' location and geography as well as an insight into history and development. It offers an explanation into the origin of factors which will exacerbate problems caused by climatic changes. The tourism sector and its accommodation industry are discussed. This is followed by an account of climate change, with a particular focus on current events and future threats. The methodology that was followed in this research is then explained.

The primary aim of the study is to explore the perceptions held by tourists and tourist accommodation establishments regarding the threats of climate change. As this research is predominantly perception-based, perception is defined for the purpose of this research as the process of interpreting sensory information received through environmental stimuli as well as the actions taken in responding to the stimuli (Gössling et al., 2006).The perceptions of the respondents will be compared withinformation collected through utilising a Tourism Climate Index and a Digital Elevation Model for the study sites to compare the scientific projections for climate change implications on tourism against these perceptions of the tourist establishment owners. The study will therefore address issues linked with climate change, including respondents' awareness and the potential for adaptation strategies that can be implemented. In doing so, the study is aiming to contribute to the knowledge on climate change and its effects on coastal towns relying on tourism as its main economic base. The study will investigate the effects whilst taking into consideration the geomorphological features found around St Francis Bay and Cape St Francis such as the coastal dune and estuary.

The sampling method for the tourists as well as the accommodation establishments is described in this chapter. This is followed by a discussion of the research process and data collection methods. An outline of the data used to provide further climatic

background of the study site is given, presenting the establishment of a TCI and a DEM. To conclude the chapter, an analysis of the statistical methods for this research is detailed.

3.2. Study site

3.2.1. Location and geography

The study sites are located on the coastline of the Eastern Cape Province of South Africa (Figure1). Two towns have been selected for this research: St Francis Bay and Cape St Francis. The study site is positioned halfway between Knysna and Port Elizabeth.

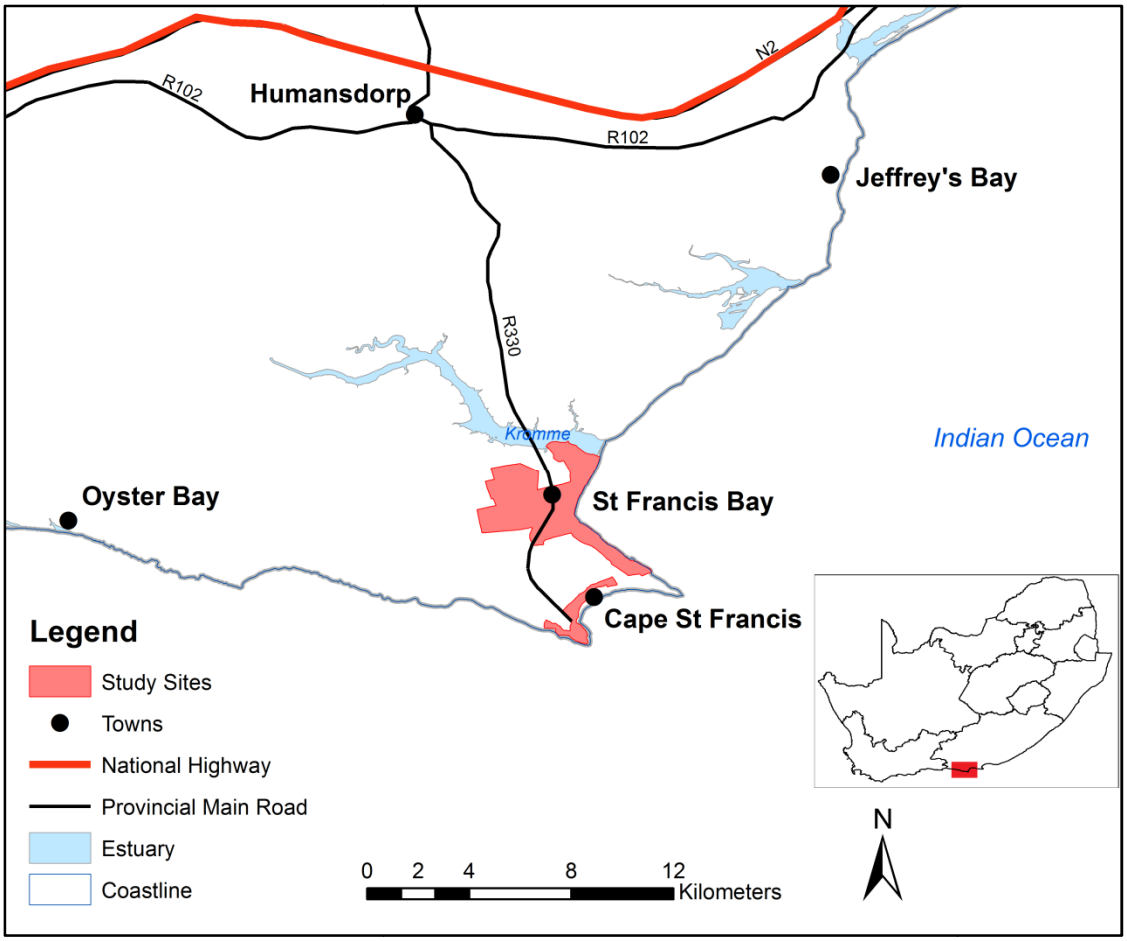


Figure 1: The location of the study sites - St Francis Bay and Cape St Francis, Eastern Cape.

St Francis Bay covers an area of 10.04km² (Frith, 2014) and has an altitude ranging from approximately 0m to 34m.asl. (Eliassen, 2013).While the neighbouring town of Cape St Francis covers a smaller area of 4.38 km² (Frith, 2014) with an altitude ranging from approximately 0m to 15m.asl.(Eliassen, 2013).Census 2011 data estimates the population of these coastal towns to be 4 933 people and 342 people in St Francis Bay and Cape St Francis respectively (Frith, 2014). St Francis Bay is described geomorphologically as a logarithmic-spiral bay, also known as a crenulated bay, commonly observed in headland-bay beaches with its form arising as it curves into a spiral shape due to waves being diffracted by the nearby headland that shelters it (LeBlond, 2006). The bay also has a narrow artificial sand spit found within the northern part of the coast (Figure 2) (Anderson, 2012).

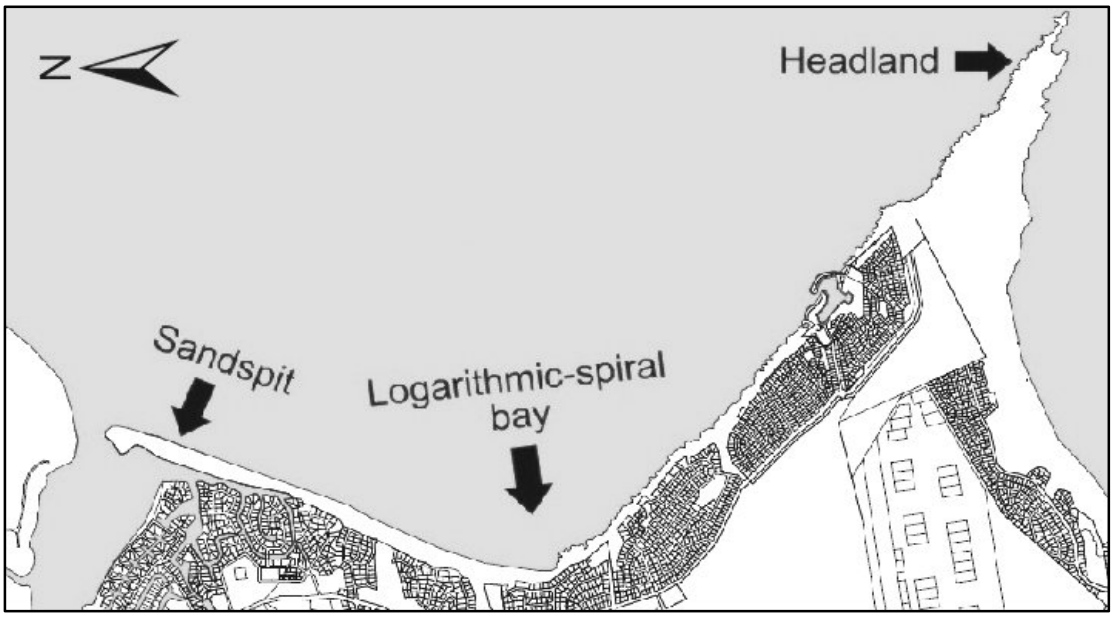


Figure 2: The logarithmic-spiral bay of St Francis Bay showing the artificial sand-spit (After Simpson, 2007).

The Kromme River estuary in St Francis Bay has an extensive man-made canal system connected to it (St Francis Bay, 2014). The headland of Cape St Francis provides protection to St Francis Bay and along with the orientation of the town this results in the swell conditions in the bay differing from the open coastline (Anderson, 2012).

3.2.2. History

Portuguese sailors were ordered by the king of Portugal, King Sebastian, to investigate the coastline of Southern Africa, and in 1575 Manuel de Mesquita Perestrelo, a Portuguese navigator and cartographer, first spotted the area of St Francis Bay while exploring the south and east coast (Figure 3) (Williams, 2012). The area was named after the Patron Saint of animals and the environment, St Francis of Assissi (Lehmkuhl, 2008). During this voyage Perestrelo visited the neighbouring land and named it Bahia de Sao FranciscoIn, now known as Cape St Francis (Frescura, 2014).

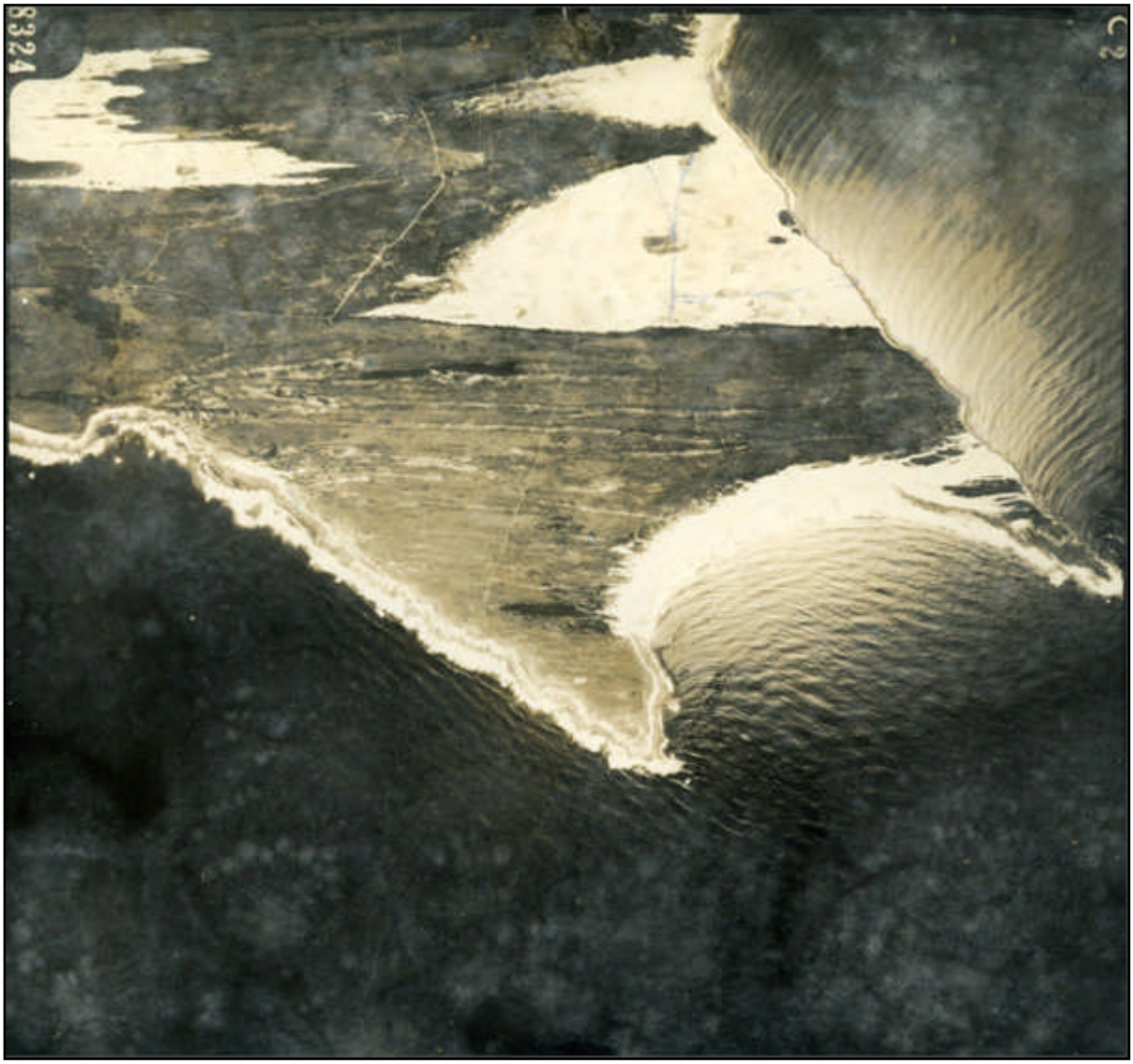


Figure 3: An early aerial photograph taken in 1948 showing the land on which St Francis Bay and Cape St Francis would later be built (Hulett, 2014).

Migrant stock farmers and Cape Dutch hunters explored the coast of the Eastern Cape which soon after led to permanent settlers arriving in 1744 and farms began to be established (Simpson, 2007). Records from 1765 show a man by the name of Jacobus Kok was granted the farming land that makes up present-day Jeffreys Bay and St Francis Bay (Simpson, 2007). In 1785, the passengers and crew of an English ship called *Pigot* stayed on a farm in St Francis Bay while recovering from health problems (Simpson, 2007). By 1820, more settlers moved into the area and earned income through lime burning and extracting wax from indigenous berries (Simpson, 2007). Until 1953, much of the land served a primarily agricultural function for the people who settled there. In 1954, a piece of land in this area was advertised for sale in the “Farmers’ Weekly” and Leighton Hulett, a sugar farmer from a well-known Natal sugar cane family bought it with the idea to develop the land (Figure 4) (Lehmkuhl, 2008).

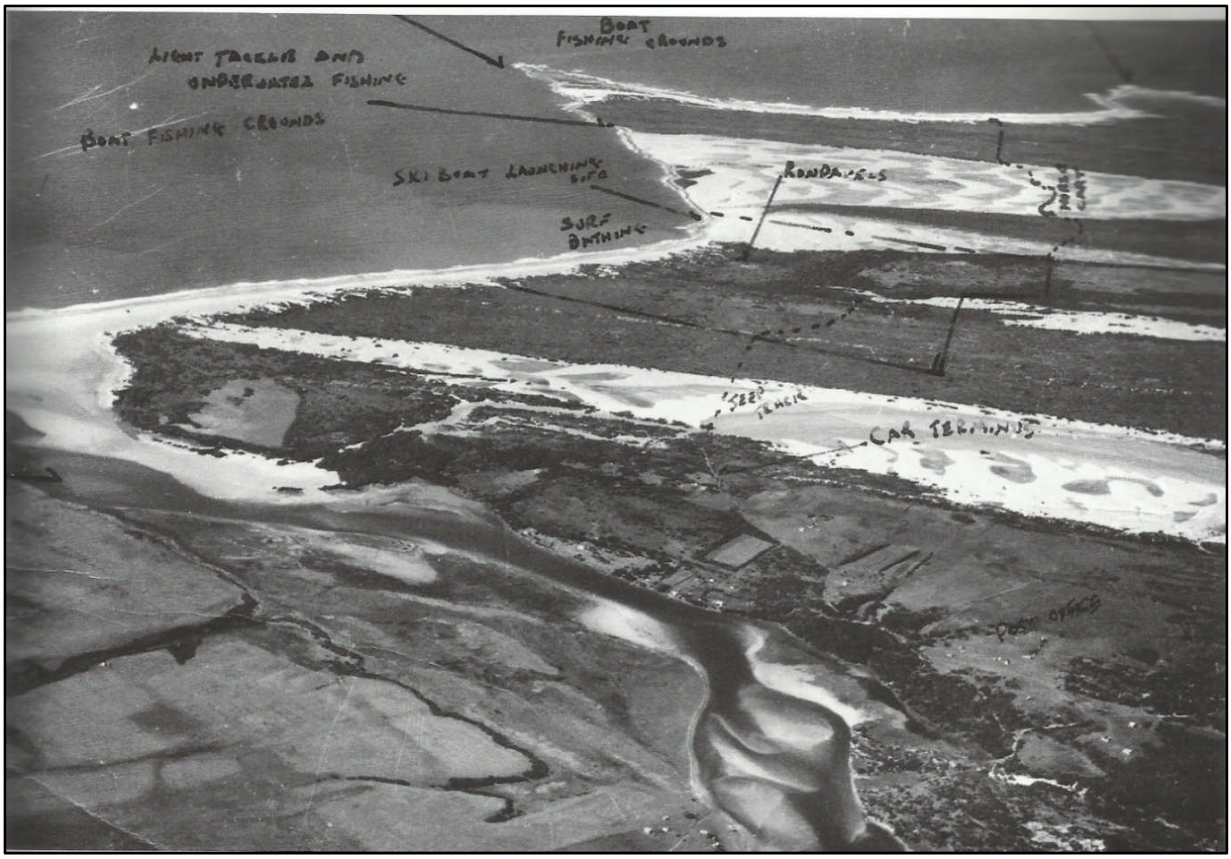


Figure 4: An early aerial photograph from 1956 annotated by Leighton for potential visitors (Simpson, 2007).

He planned to build a fishing camp comprising of seven thatched rondavels which would be able to accommodate many holiday makers (Simpson, 2007). Several of the regular visitors to the area, wanted to own their own place there, and later purchased land from Hulett on which to build their own cottages (Lehmkuhl, 2008). The area just south of Hulett's land was a farm called Ongegunde Vryheid, which was later sub-divided and developed by the farm owner's son John Booysen (Figure 5) (Lehmkuhl, 2008).



Figure 5: An early aerial photograph taken in 1976 of the area before major development of the towns began (Hulett, 2014).

The development of Ongegunde Vryheid was a result of Booysen being interested and influenced by Hulett's development activities, aiming to feed off Hulett's reputation for holiday village in the area, however the new town caused tension

between Hulett and Booysen (Simpson, 2007). The reason for this tension was caused by the Humansdorp Divisional Council which denied Hulett the right to name his town Cape St Francis, and instead Booysen's town was allowed the name (Geocaching, 2014). Another contributing factor was that Booysen's holiday guests had to get to his town on the only road that was present at the time, a private road personally constructed and funded by Hulett for his guest's use (Simpson, 2007). In 1960, more land was acquired in the form of a wetland that offered no commercial value for any agricultural land-use, and it therefore marked the ideal spot to begin canal-building (St Francis tourism, 2014). Hulett's initial plan was to build channels along the verge of the river to make it more accessible to residents' boats (Lehmkuhl, 2008). Trenches were dug in the land to drain the ground and the soil was deposited on the banks to heighten the surface level of the land, which would later be stabilized (Simpson, 2007). However, the Towns Board terminated the development and informed Hulett that the land was located below high tide level and therefore belonged to the government (Figure 6) (Simpson, 2007). After consulting with the Department of Lands as well as observing various rules and regulations, Hulett was allowed to continue with development pumping dredged sand which eventually formed the protective spit (Williams, 2012).

3.2.3. Tourism and accommodation

The adjacent coastal towns, considered to be the Eastern gateway to the Garden Route, are utilized primarily as 'holiday-villages', with properties located there being largely owned as second homes (Mortimer, 2014). Whilst the towns are quiet during the off-seasons, the peak holiday period of December to January as well as the Easter break are extremely busy (Bainbridge, 2010). St Francis Bay has been dubbed "a millionaires' playground", resulting in many tourists opting to vacation in the town for its sense of luxury (Mortimer, 2014). A series of canals and waterways, which are ideal for water sports, exist within St Francis Bay as one of its main tourist attractions (Dickson, 2014). The tourist accommodation options that are available in these towns include many B&Bs, guest houses, lodges and self-catering rentals (ZA Webs,2015). Figure 6 shows the location of the tourist accommodation establishments that are located in St Francis Bay.

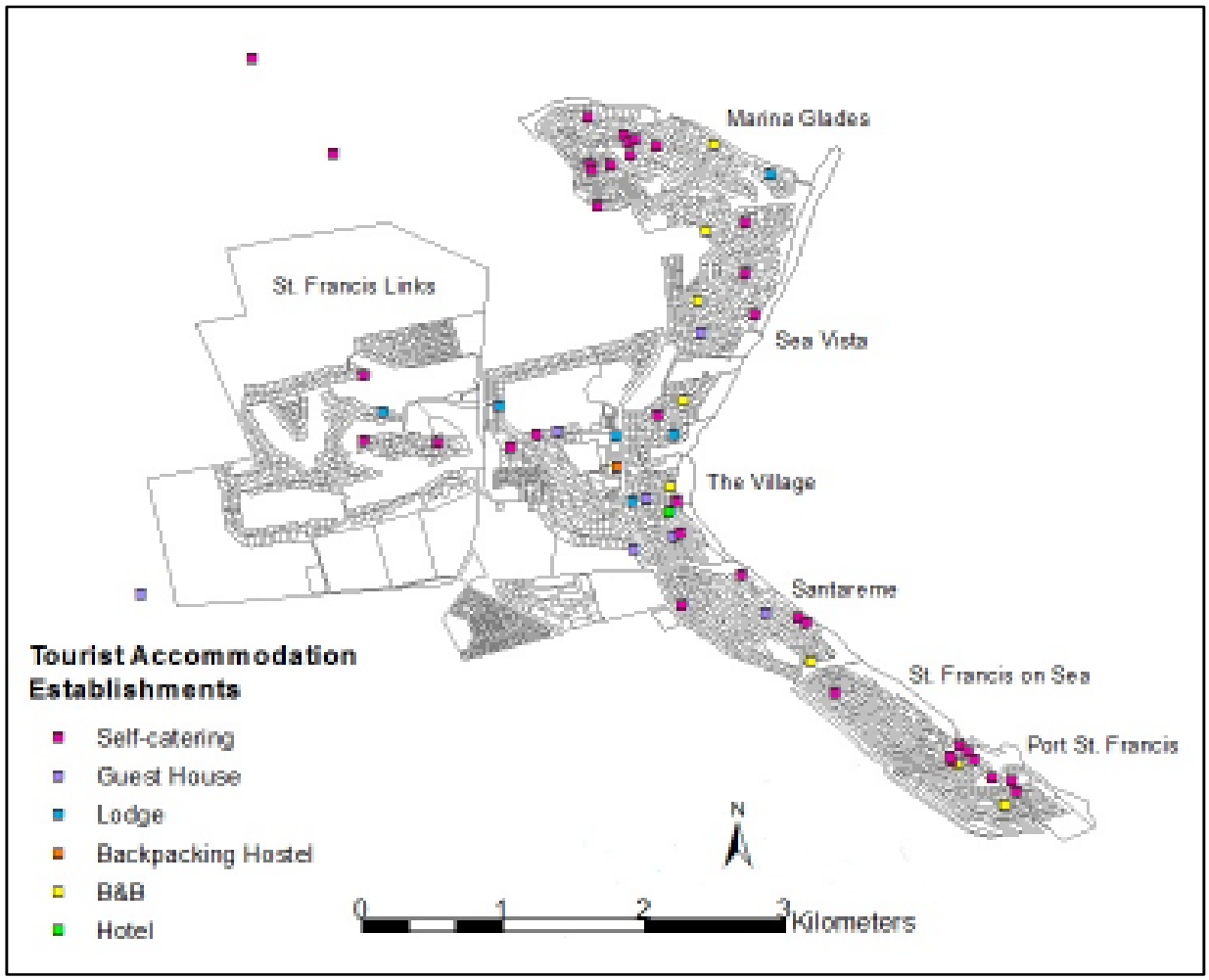


Figure 6: Location of the tourist accommodation establishments in St Francis Bay.

Cape St Francis is slightly smaller than St Francis Bay and characterised as a rustic village, is favoured by surfers and fishermen (St Francis Tourism, 2014). The tourist accommodation establishments there are most commonly self-catering as shown in Figure 7. A nature reserve forms a network linking the towns, making it a popular eco-destination for tourists providing peaceful surroundings and many hiking opportunities (Elsden & Rossoux, 2009).

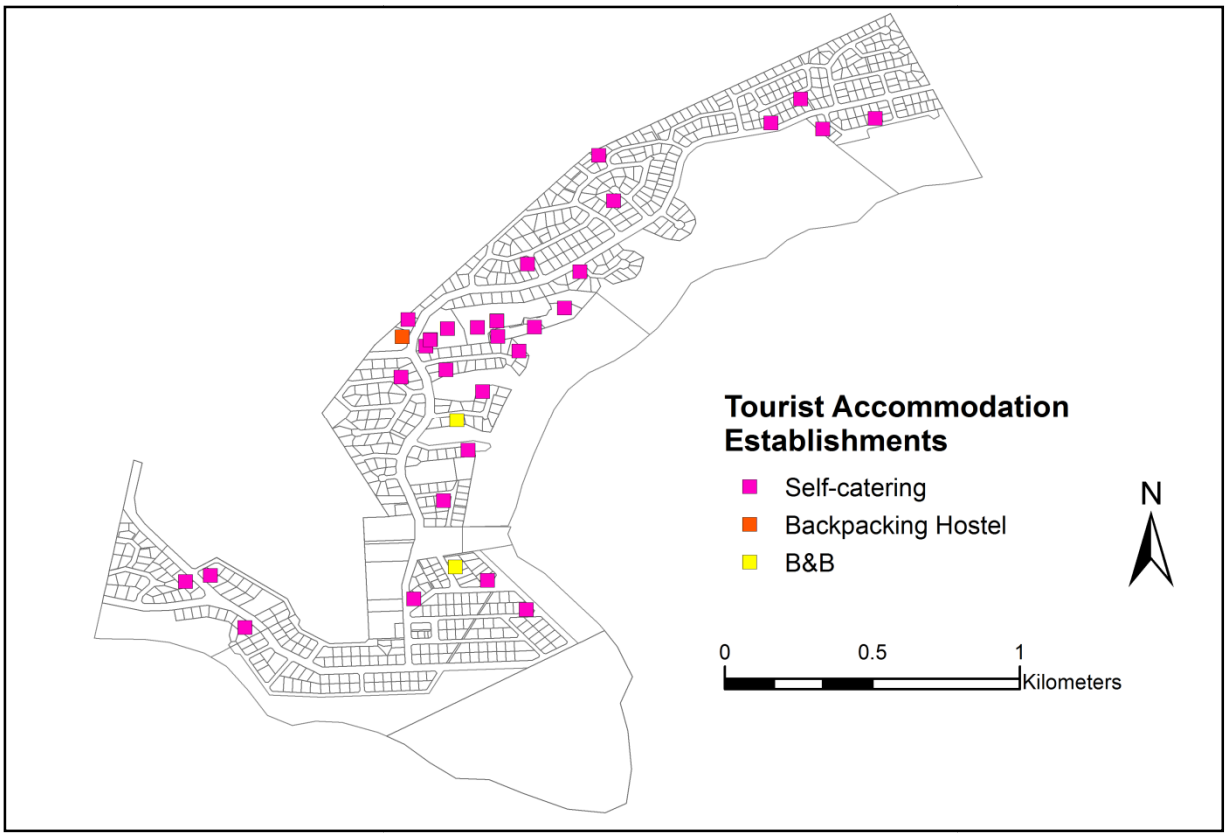


Figure 7: Location of the tourist accommodation establishments in Cape St Francis.

A large number of the second homes located in the towns are rented out to tourists and these homes are predominantly located along the canal system, an area of St Francis Bay which is commonly known as '*Little Venice*' attributable to the low lying land that exists among the waterways (Mortimer, 2014). During the development, Leighton Hulett insisted that the village conformed to a particular style and structure as noticed on present day maps and this has led to the white walls and thatched roof character that are still prominent today (St Francis Bay, 2014).

3.2.4. Climate change in St Francis Bay and Cape St Francis

Despite the mention of both St Francis Bay and Cape St Francis in various academic publications, very few recent studies include the climate of these areas or how this climate is projected to change. St Francis Bay is however included in studies such as those done by Schumann et al. (1987) on coastal upwelling along the south coast; Lubke (1985) on the erosion of the St Francis Bay beach; Baird and Heymans (1996) on ecosystem changes caused by the Kromme estuary; and Schumann et al. (2005) on the oceanic variability in the western sector of Algoa Bay. The results of these

studies suggest that an increase in the salinity of the estuary water of St Francis Bay will result in a decline in biomass (Baird and Heymans, 1996). A loss in biomass will have major consequences as climate and biogeochemical processes are influenced by the change, particularly the carbon cycle (Boyce et al., 2010). Studies based on the upwelling in the region explained that the Agulhas current was found to have minimal influence on the Cape south coast (Schumann et al., 1987) and the dominant south-westerly offshore is important in upwelling the colder water to the area from the region of Algoa Bay (Schumann et al., 2005).

Studies that address the area of Cape St Francis demonstrate the importance of the geomorphology and Cainozoic geology of the continental shelf between Cape Seal and Cape St Francis (Ludwig et al., 1968, Dingle and Rogers, 1972; Thackeray and Feast, 1974; Emery et al., 1975; Cairns, 1975). Ludwig et al. (1968) studied nine seismic-refraction profiles with all of these occurring on the continental shelf of southeastern Africa. Similarly in the paper by Emery et al. (1975), a number of seismic-reflection profiles were recorded in order to establish the structure of the continental margin. Some palaeogeographies during the Pleistocene are shown by Dingle and Rogers (1972) with all the samples dredged from the sea floor that lies just south of CapeSt. Francis. They found that the Pleistocene glacial cycles caused sea level to rapidly change and this along with the occurrence of upliftwould result in the wide continental shelf alternating between getting exposed and inundated.

The towns are situated where the climate transitions between the sub-tropical and Mediterranean climate associated with an average maximum winter temperature of 12°C, whilst in summer the average maximum temperature is in the region of 33°C (St Francis Bay, 2014). Estimates of surface air temperature from Global Climate Models (GCMs) project an increase of between 1°C and 3°C throughout the country by 2050 with the interior having the greatest increase and the strongest trends for the daily minimum temperature (Boko et al., 2007). The worst case scenario projections give a global average of 6.3°C increase in temperature by the end of the century (Tandross et al., 2011). Overall lower temperature increases are expected towards the coast of the Eastern Cape, whilst the north-west of the province will experience the highest temperature increases (Carter et al., 2010).

The projections for future precipitation are neither spatially nor temporally uniform, and the effects of these changes uncertain in Southern Africa (Tandross et al., 2011). Models project an increase in the intensity of rainfall events, concentrated within a short time frame (James & Hermes, 2011), with an increase in the duration of dry spells within the next few decades (Boko et al., 2007). An increase in rainfall is projected to occur in the northern and eastern parts of the country with a drying trend in the western and southern regions by 2100 (Tandross et al., 2011). The increased sea levels coupled with intense rainfall periods will also affect the estuarine systems such as the Kromme estuary in St Francis Bay with higher water volumes flooding the estuary and promoting beach erosion leaving the beach vulnerable to storm events (James & Hermes, 2011). The sea water is likely to change the nature of the estuary resulting in a 'reverse estuary' whereby the level of salinity will possibly increase upstream in response to the low levels of freshwater inflow thereby reducing its environmental function (Sheaves et al., 2007).

Sea level rise and extreme storm events are projected to be the most critical threat to sandy beaches such as St Francis Bay and Cape St Francis (James & Hermes, 2011). However, the environment is already stressed by human-related threats which include the disruption of sand transport; pollution, ground water removal, and recreational activities (Schlacher et al., 2007). This has resulted in the modification of the environment thus reducing its resilience to natural events (James & Hermes, 2011). Predicted impacts for the next century are controversial, however Rahmstorf (2007) suggests that a 0.5m sea level rise increase be expected by 2050 and a 1m rise by 2100. This is based upon a global average, and it is acknowledged that various areas may experience a higher or lower sea level rise (Mather et al., 2009).

The study sites of this research have experienced a number of extreme storm events, such as flooding incidents, in the past due to high precipitation levels. In 1996, the Sand River overflowed its channel and the St Francis Bay village was inundated from the flood waters (Illenberger, 2010b). By 1998, the Sand River had once again been dammed up as a consequence of the dunes, and the town used a

bulldozer to breach the dam amidst concern of inundation similar to the 1996 event (Illenberger, 2010b). It is possible then to forecast further flooding events, as a result of the dunes causing blockages along the Sand River. In November 2007, St Francis Bay experienced a 1:200 year flood event that damaged the R330 regional road (Thorpe, 2014). The floodwaters flowed down a steep V-drain, which caused sediment erosion and alluvial fan deposition into a section of the St Francis Bay Golf Course (Illenberger, 2010b). The catchment area for this flood was formed by the Eastern Valley Bottom wetland which is restricted by the low east-west trending dunes (Illenberger, 2010b). The problem identified with the flow path of the flood is that it could no longer run a natural course across the R330which floods at this location used to do; however this was before the St Francis Bay village was built (Ellery, 2012). In 1992, the transverse dunes entirely blocked the Sand River, and this resulted in a dam of water being formed which was breached in the following months due to high precipitation (Illenberger, 2010b). The dune was eroded as a consequence, with large volumes of water flowing down into the Kromme estuary due to the river channel still being blocked with sand (Thorpe, 2014).

It has been found that off the east coast of South Africa, a periodic cut-off low pressure system occurs with the highest frequency of occurrence in the months of September, October and November which can result in raised water levels and large waves for the area (Anderson, 2012). As mentioned previously, the study sites have experienced a number of flooding incidents in the past due to the flow path being blocked by the coastal dunes the periodic cut-off low pressure system is projected to be problematic (Illenberger, 2010b). It can be expected then that both towns will be most affected by climate change impacts arising from sea level rise and storm surges causing severe flooding, however further research on this area is required. Other projected climatic concerns include erosion as the log-spiral bay is expected to experience further retreat based on past events and will eventually be breached causing damage to the canal area of St Francis Bay particularly (Anderson, 2012).

Projections of changes in wind fields and currents are not well researched both globally and in South Africa (James & Hermes, 2011). The north-easterly winds tend to dominate the summer months whilst the winter is ruled by the south-westerly

winds in South Africa (Mather, 2011). The wind velocity is expected to increase during all the seasons by 2100 (Boko et al., 2007). Currently the winds can reach and exceed speeds of up to 80km/h during storms and Theron and Rossouw (2008) describe the harsh impacts that are projected with an increase in the wind systems. These are based on a 10% wind speed increase causing a 26% increase in wave height and an 80% increase in wave power making coastlines vulnerable to climate change events (James & Hermes, 2011). Roualt et al. (2010) demonstrated that sea surface temperature around South Africa is linked to altered wind systems. The Agulhas current, which flows past St Francis Bay and Cape St Francis, has been intensified by the pole-ward shift of the westerly winds as well as an increase in the trade winds in the south Indian Ocean and the continuation of this trend over the next decades will cause seas on the east coast of South Africa to warm (James & Hermes, 2011).

The altered wind patterns will affect coastal features such as sand dunes and the coastal protection that these dunes offer are under threat (Barbier et al., 2011). The dune fields that are located near the towns were stabilised in order to develop the Santareme Town and this has resulted in a reduction in the sediment supply which has led to rapid shoreline retreat taking place (Anderson, 2012). Coastal sediment undergoes a cyclical movement offshore in winter and onshore in summer in South Africa (Mather, 2011). The increasing wind velocity that is expected will intensify sediment transportation in the dune fields by at least 40% (Theron, 2011) in a west to east direction (Illenberger, 2010a). This will result in sand encroachment onto St Francis Bay and Cape St Francis causing sand to ‘swallow’ the infrastructure (Shinbrot & Hermann, 2011). There is a large amount of concern in the area regarding the vulnerability of the tourist accommodation establishments to climate change factors (Theron & Rossouw, 2008). These factors include: changing wind fields and changes in storm intensities, in addition to the long term global concern of sea level rise to create conditions that may overwhelm current infrastructure (Theron & Rossouw, 2008)

3.2.5. Conclusion

The location and geography of the study sites place these towns at risk from climate change, particularly due to their low elevation relative to sea level. Also they have a large proportion of tourist establishments and rely heavily on tourism income. These towns are thus ideal for the research to investigate the mitigation and adaptation of climate change in small towns. Both St Francis Bay and Cape St Francis have a fairly narrow beach, the influence of tides and storm surges in the future may dramatically erode the beach while damaging the towns' infrastructure along the coast. The methodology employed in this research was aimed at further exploring the potential problems that the towns would have to address in relation to their climate and the projected sea level rise.

3.3. Methodology

The research methodology is separated into qualitative and quantitative. The qualitative methodology comprised of the human side of the research involving the implementation of questionnaires to the tourists and tourist accommodation establishments. The quantitative methodology comprised of the physical side of the research involving the calculation of a TCI and modelling a DEM for the study sites.

3.3.1. Sample population of the research

St Francis Bay and Cape St Franciswere chosen due to their close proximity to the ocean and focus on tourism as a main economic driver, thus making the towns - particularly the tourism sector, highly vulnerable to climate change. Interviews were carried out in two towns, the interview process makes up the qualitative investigation and allows for in-depth information to be obtained from the participants (Creswell, 2007).The samples for the research are made up from two groups: the tourist accommodation establishments and tourists. A variety of accommodation types are available in the towns, including self-catering, backpacker hostels, B&B's and lodges.

All of the accommodation establishments in the towns were approached for interviews, currently there are a total of 57 establishments in St Francis Bay and 35 establishments in Cape St Francis (Table 4).

Table 4: Accommodation types in St Francis Bay and Cape St Francis

Accommodation type	St Francis Bay establishments	Cape St Francis establishments
Backpacker Hostel	1	1
Bed & Breakfast	8	5**
Guest House	9	0
Hotel	1	0
Lodge	5	0
Self-Catering	33*	29**
Total no. of establishments	**57**	**35**
* 6 self-catering establishments are private homes with apartments within the home rented out to tourists. ** 3 establishments can be accommodated as a self-catering or B&B		

These establishments were ordered by priority level for interviews based on their level of expected vulnerability to climate change. This vulnerability is classified upon their current mean height above sea level, their distance from the ocean and protective barriers to the sea already in place. The priority levels were divided into first, second and third order and mapped accordingly for each town (Figure 8 and Figure 9).

Based on Figure 8, the St Francis Bay map, the first priority level establishments were approached first for participation in the interviews, and consisted of those accommodation establishments located in the canal system known as the Marina Glades as well as Port St. Francis, which would comprise of all the establishments located within the port area. Second priority level establishments were approached thereafter, with these establishments being identified as those directly along the beach front within the Village and Santareme sections located at a slightly higher elevation. Third priority level establishments were approached last with these establishments located away from the immediate coastline extending further inland to the St. Francis Links.

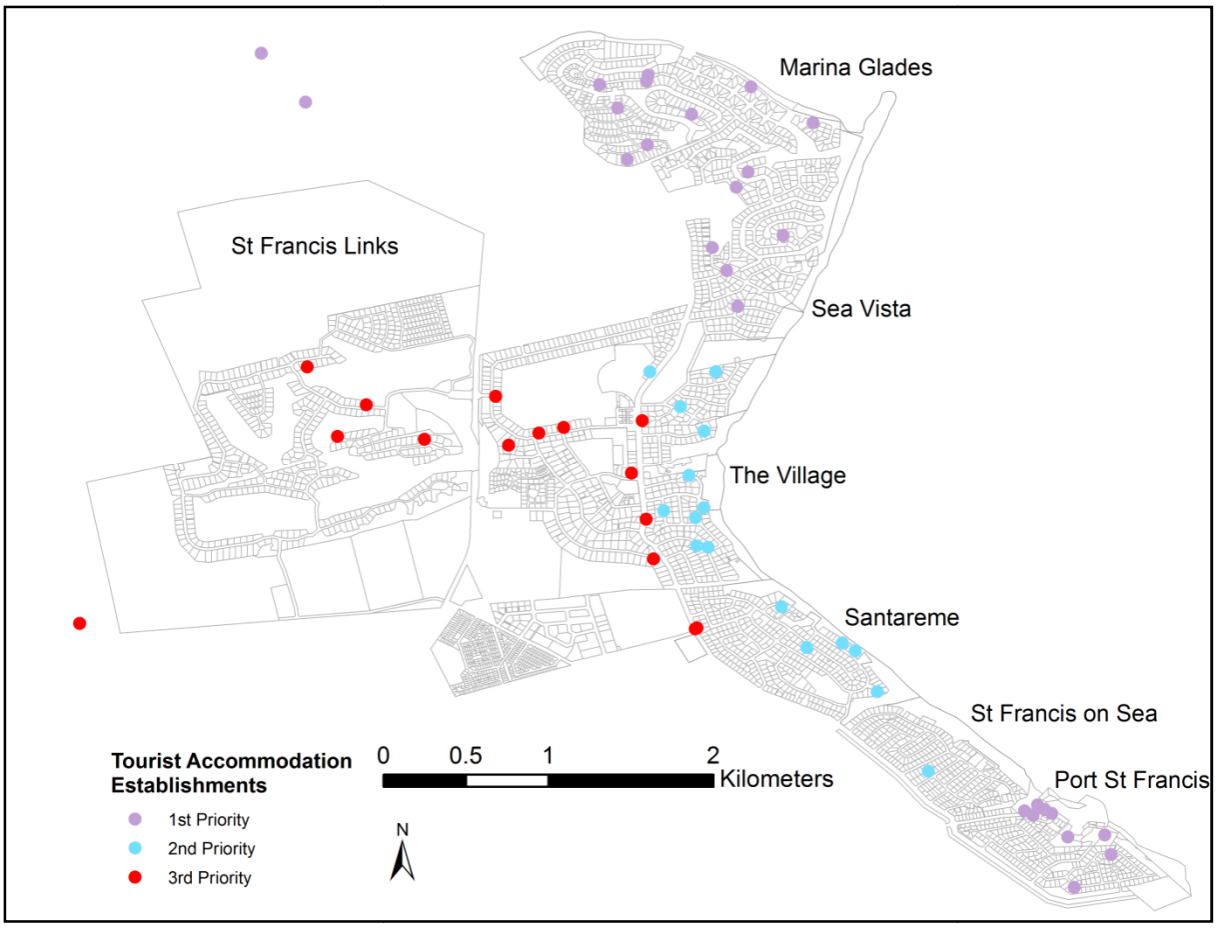


Figure 8: Level of priority of tourist accommodation establishments in St Francis Bay.

For Cape St Francis, the accommodation establishments were again approached in order of priority, starting at first priority level and finishing with those third priority establishments. The map of Cape St Francis is shown in Figure 9, indicating the location of the different priority level accommodation establishments. First priority establishments in this town were chosen according to their immediate height above sea level.

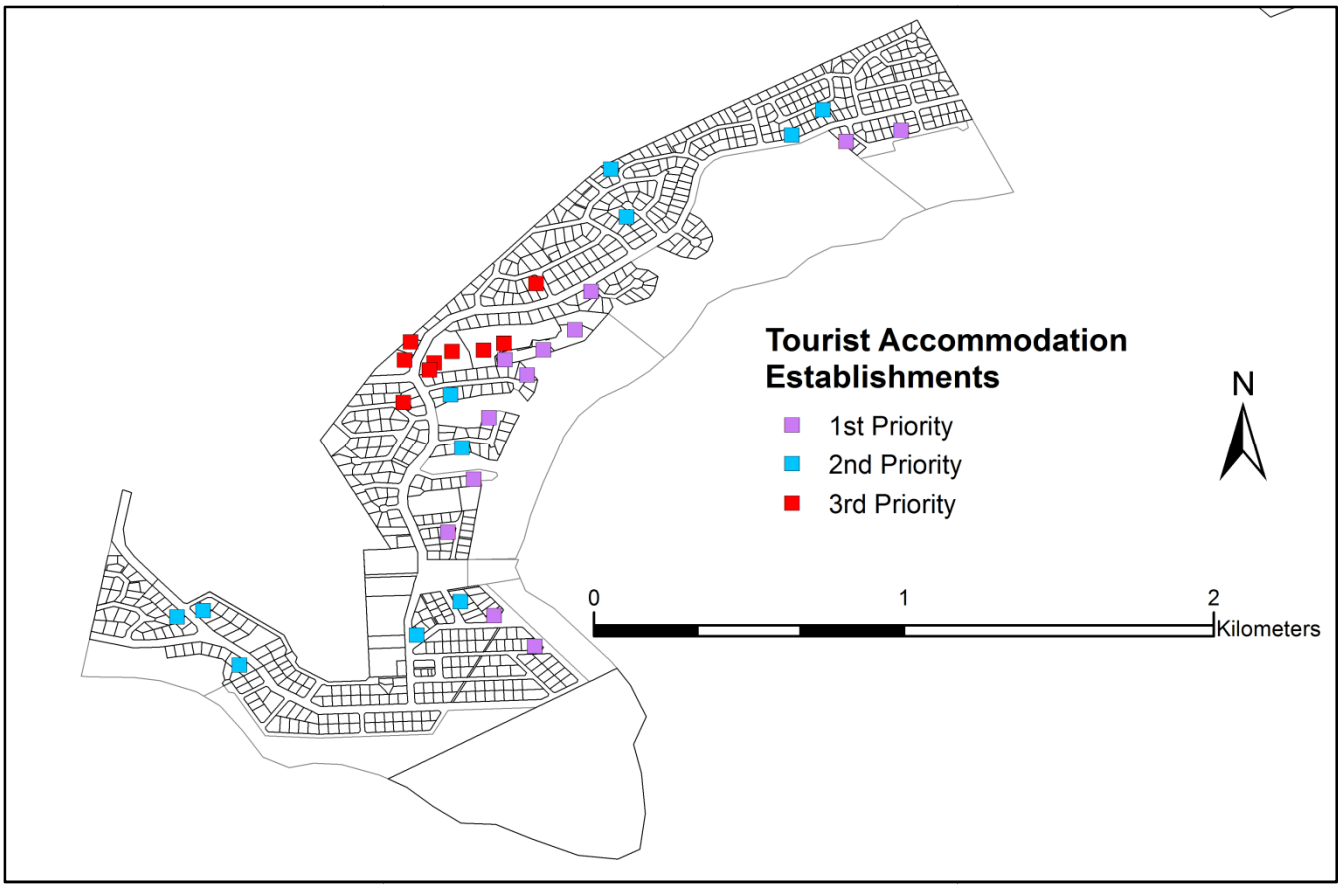


Figure 9: Level of priority of tourist accommodation establishments in Cape St Francis.

The tourist respondents were chosen using a non-probability sampling strategy of convenient sampling. Convenience sampling is a method that selects target population groups by means of whether the target members meet certain practical criteria, for instance their geographical proximity or willingness to participate(Dörnyei, 2007; Farrokhi & Mahmoudi-Hamidabad, 2012; McCreesh et al., 2012). This strategy was selected due to the unknown size of the population of tourists. These tourists were approached on the beaches, and in the restaurants, bars and shops located in the towns. A sample size of tourists equal to that of the sample size of accommodation establishments was desired to obtain a balanced result from the responses. As there were a total of 53 respondents from the accommodation establishments, the tourists were approached and asked to participate in the study until 53 respondents were obtained. Of the tourist accommodation establishments that participated, St Francis Bay had 36 respondents and Cape St Francis Bay had 17 respondents, yielding response rates of 63% and 54% respectively.

Permission from the accommodation establishments was obtained in order to approach the guests staying there. The tourists were approached during times when they were located in the public areas of the establishments, such as the bar or pool areas and were then administered the questionnaire. A maximum group for sampling of the tourists interviewed from each of the accommodation establishments was followed. These maximum groups included no more than 15 guests per tourist accommodation establishment. Selection bias can occur when human judgement influences the participants chosen for the research (Stake, 2010; Hannes et al., 2010; Olson, 2013).To avoid selection bias, tourists were selected at the entrances of these areas thereby allowing for those tourists entering the public areas to be interviewed. Interviews were carried out with tourists that were willing to participate in the research until the maximum group was reached.

Two similar questionnaires were used during the data collection process: the one was aimed at obtaining information from the tourist accommodation establishments (Appendix A), and the other was aimed at the tourists visiting St. Francis Bay and Cape St Francis (Appendix B). The questions used in the questionnaire will be semi-structured in order to obtain specific information necessary to answer to research questions whilst allowing the participants to elaborate or add additional information thus gaining further insight into their perceptions (Turner, 2010). The questionnaire will assess the participants' current perceptions of climate change and how concerned they are about it. Also, it will assess where they get their information about climate change from and what they are doing to adapt.

Additional research was done through contacting other organizations that would be involved in any climate change adaptation or mitigation. These organizations included the local and provincial government, the district and local municipality and the local resident's organisation. This was to further explore climate change in St Francis Bay and Cape St Francis, and determine whether climate change mitigation and adaptation is a priority for organisations concerned with the development of the towns.

3.3.2. Ethical considerations

The ethical considerations for this research were addressed through providing two forms. Every interview participant was given a participant information sheet (Appendix C), to read prior to the commencement of the interview, as well as asked to sign an interview consent form. The purpose of this participant information sheet was to provide a copy of the background information regarding the purpose of the research. It was also used to inform the participants that all information acquired from the interviews will be treated as confidential and the data will be destroyed upon completion of the research, and that they have the right to withdraw from the study at any time if they so choose.

3.3.3. Data analysis

3.3.3.1. Qualitative data analysis

The perception data that dealt with the social sciences side of human geography was obtained through personal one-on-one interviews involving the administering of questionnaires. This approach was employed to explore the perceptions of climate change threats and adaptation possibilities. Interviews were carried out with the accommodation establishment during a relatively off-season periods of September and with tourists during the peak holiday period of December in 2014. The tourist accommodation establishments were contacted telephonically prior to the data collection process in order to set up interview times. The telephone numbers for these establishments was acquired from the St. Francis Bay tourism office.

The data was first analysed through concept mapping in order to easily display the findings and examine the antecedents and consequences that were identifiable in the questionnaire responses. Concept mapping is a useful tool for describing research data ideas through a visual form (Brownson et al., 2006; Hay & Kinchin, 2008) by displaying various concepts and their links to one another graphically (Wang et al., 2006). By making use of concept mapping, it enabled the data to be condensed in a meaningful way through displaying the collected information on a single page. Concept mapping is very similar to methods that make use of coding (Nesbit & Adesope, 2006), as they both allow for an identification of main themes and act as a visual tool for interpreting the theme relationships. Due to the coding

characteristic of concept mapping, this made the data analysis process simpler and the data easier to work with when it was later analysed through the coding method of thematic analysis. A comparison between the different accommodation establishment types was performed to identify if and why their perceptions vary. An evaluation of the tourists' perceptions and the tourist accommodation establishments' perceptions was also done to determine how they differ in terms of being resident to the area, as opposed to just visiting.

The decision to analyse the qualitative data through thematic analysis was applied to the questionnaires due to this method's usefulness in revealing similarities anddifferences across the data set. Thematic analysis identifies and analyses themes or patterns within the data set to find which themes are important to address the research questions posed (Harper & Thompson, 2011). The analysis made use of themes that emerged from the data once the interview responses had been collected. The information received during the interviews were all transcribed and then coded manually thereafter. The data was organised according to the process of coding as described by Braun and Clarke (2006) which is the process of grouping data to aid analysis. Codes are formed to represent the themes that are identified and then associated with the raw data to act as summary markers for later analysis. The process of thematic analysis follows six steps:

1. Becoming familiar with the data.
2. Generating initial codes.
3. Searching for themes.
4. Reviewing themes.
5. Defining and naming themes.
6. Producing the report.

(Braun and Clarke, 2006)

For the purpose of this research the process of coding was done manually simply by highlighting important information with different colours. This was done to capture reoccurring patterns in the data and information that related to the research questions. These highlighted codes were then analyzed to tabulate the similar

responses that could later be placed under defining themes. Through this process it was possible to identify four main themes: The vulnerability of the tourism sector in St Francis Bay and Cape St Francis; insufficient climate change mitigation and adaptation; climate change awareness; and perceived climate change threats to the towns. The relationship between these themes was explored and later integrated into the quantitative analysis

3.3.3.2. Quantitative data analysis

Quantitative data analysis was carried out alongside the qualitative data analysis as this enables meaningful results to be extracted from a large collection of qualitative data (Collins et al., 2006; Creswell, 2007; Stake, 2010). The questionnaire that was used consisted of various close-ended questions that included all of the groups of interest to address the research questions. The questions types included checkboxes so respondents could choose more than one of options available. Five point Likert-scale questions were used for rating purposes, with the scale points being: strongly disagree, disagree, neutral, agree and strongly agree. The data collected from the questionnaires and interviews were further explored through statistical analysis by calculating the mean and Pearson's correlation coefficient as this will help improve the value of the data analysis (Lenvin & Fox, 2007). This research used statistical analysis toexplore trends over time, specifically through the methods of correlation. The quantitative data collection was done simultaneously with the qualitative data through examining the questionnaires and one-on-one interviews mentioned previously. The findings of both the quantitative and qualitative data will be interpreted and integrated into the results chapter.

The data was analysed by parametric tests. Parametric tests are easy to interpret and make use of the actual data rather than the values obtained from ranking the data (Anderson et al., 2005). The mean value of the data was calculated. The significance of the mean is that every value in the dataset was included in the calculations and it is the only measure of central in which a value of zero is obtained when calculating the sum of the deviations of each value from the mean.

3.3.3.2.1. Tourism Climate Index (TCI)

A TCI was calculated for the study sites to explore the climate of the area. A changing climate can influence the attraction of the area to tourists. An increase in temperature and humidity from climate change will decrease the level of thermal comfort of the tourists. An additional concern for the study sites is sea level rise which too will affect the tourism attraction of the area. The sea level rise and the climate suitability will be addressed and later compared with the perceptions obtained by the research. The TCI was calculated using the method outline earlier in the literature review chapter developed by Mieczkowski (1985). This index gave the daytime comfort index (CID) the greatest weighting to show that tourists tend to be more active during the day (Perch-Nielsen et al., 2010). This was followed by levels of sunshine and precipitation with the second greatest weightings, and then by daily thermal comfort and wind speed (Tang, 2013). The TCI was calculated using the formula outlined in the literature review:

$$TCI = 2(4CID + CIA + 2R + 2S + W)$$

Where:

TCI = Tourism Climate Index.

CID = daytime comfort index (combination of maximum daily temperature (ºC) and minimum daily relative humidity (%)).

CIA = daily comfort index (combination of mean daily temperature (ºC) and mean daily relative humidity (%)).

R = precipitation (mm).

S = sunshine (hrs).

W = wind (km/h or m/s).

(Mieczkowski, 1985).

Once the components have been totalled the result is multiplied by two, in order to give the TCI a maximum score of 100. The rating categories are described in Table 5 and have been colour coded by their mapping category, with green representing excellent scores and red representing unfavourable scores.

Table 5: Rating categories of the Tourism Climatic Index (Mieczkowski 1985).

TCI Score	Descriptive Category	Mapping Category
90-100 80-89	Ideal Excellent	Excellent
70-79 60-69	Very good Good	Very good and good
50-59 40-49	Acceptable Marginal	Acceptable
30-39 20-29 10-19 < 10	Unfavourable Very Unfavourable Extremely Unfavourable Impossible	Unfavourable

The rating scheme that was created for the original TCI was used in this research (Table 6), with the range of values starting at -3.0 and extending to 5.0. Each of the sub-indices of the TCI use this rating scheme range, with the highest value of 5.0 being considered as representative of optimal conditions. The rating scheme is used in the calculation of the TCI (Table 6) and obtained score will be able to identify what the current climate of the area is like. Additionally this score will indicate how suitable the climate is for tourism and the level of attractiveness to tourist's comfort. The TCI will explore the trend in the changes in climate and help to identify whether the climate is ultimately improving or getting less suitable. As the climate is very similar for the towns, it was only necessary for one TCI calculation to be done to cover the whole area.

Table 6: The rating system that is used by the TCI (Tang, p.47, 2013).

Rating	Effective Temperature (°C)	Mean Monthly Precipitation (mm)	Mean Monthly Sunshine (hrs/day)	Wind Speed (km/h)			Wind Chill Cooling (watts/m²/hr)
				Normal	Trade Wind	Hot Climate	
5.0	20 - 26	0.0 - 14.9	≥10	<2.88	12.24-19.97		
4.5	19 27	15.0 - 29.9	9	2.88 - 5.75			
4.0	18 28	30.0 - 44.9	8	5.76 - 9.08	9.04 - 12.23 19.80 - 24.29		<500
3.5	17 29	45.0 - 59.9	7	9.04 - 12.23			
3.0	16 30	60.0 - 74.9	6	12.24 - 19.79	5.76 - 9.08 24.30 - 28.79		500 - 625
2.5	10 - 15 31	75.0 - 89.9	5	19.8 - 24.29	2.88 - 5.75		
2.0	5 - 9 32	105.0 - 104.9	4	24.30 - 28.79	<2.88 28.80 - 38.52	<2.88	625 - 750
1.5	0 - 4 33	105.0 - 119.9	3	28.8 - 38.52		2.88 - 5.75	750 - 875
1.0	-5 - -1 34	120.0 - 134.9	2			5.76 - 9.08	875 - 1000
0.5	35	135.0 - 149.9	1			9.04 - 12.23	1000 - 1125
0.25							1125 - 1250
0.0	>36 -10 - -6	>150.0	<1	>38.52	>38.52	>12.24	>1250
-1.0	-15 - -11						
-2.0	-20 - -16						
-3.0	<20						

The scores obtained for St Francis Bay and Cape St Francis have the same colour coding to aid visual interpretation of the data. A TCI score of 70 or higher is regarded as reflective of the climate suitability of the area being most attractive to tourists. This score would be representative of climate conditions that would be appealing to the typical tourist that might participate in less strenuous activities (e.g. sight-seeing) (Bakhtiari & Bakhtiari, 2013). The study sites TCI score was calculated on an annual basis first to identify the trend of climate suitability for the time period of 1978 to 2014. The Tourism Climate Index is often classified by a conceptual framework introduced by Scott and McBoyle (2001) consisting of six annual TCI distributions. One of those distributions was identifiable in the monthly TCI analysis – the winter peak. St Francis Bay and Cape St Francis's annual TCI score was calculated for a period of 37 years, from 1978 to 2014, using the data acquired from the South African Weather Services. In order to calculate the annual TCI of the study sites, the

monthly data was used in finding the mean of each of the climatic variable per year. These variables were then used to calculate the annual TCI.

Correlation allows for an examination of the relationship between variables and to determine how well they are related. Pearson's correlation was used for the TCI as it is statistically strong meaning that it is more reliable in identifying that two variables are related (Norman, 2010).

The Pearson's correlation was calculated for the data using the formula:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Where:

r = Pearson's correlation coefficient

n = total number of observations

Σxy = sum of all the values in the dataset

Σx = sum of the x values

Σy = sum of the y values

Σx^2 = sum of the squared x values

Σy^2 = sum of the squared y values

Where an r of -1 means there is a perfect negative linear relationship between variables, while an r of 1 means there is a perfect positive linear relationship between variables, and an r of 0 means that there is no linear relationship between variables. Linear regression was used to determine the strength of the relationship through determining the equation for a line of best fit for the data. That linear equation is then used to predict values for the data, and this was used for the annual and monthly TCI calculations with the regression line indicated on a scatter plot.

3.3.3.2.2. Digital Elevation Model (DEM)

A DEM covering the area of the study site of St Francis Bay and Cape St Francis was created (Figure 3). The purpose of this DEM was to model the potential sea level rise for the area and to plot out which areas would be at risk of flooding. It was then possible to contrast it against the perceptions gathered from the interviews. By performing this comparison it lends to the understanding of their adaptive capacity and how prepared and informed the accommodation establishments are for potential impacts arising from sea level rise such as storm surges. The data used for this DEM was acquired from Viewfinder Panoramas using the DEM World Coverage Map (2014). The map was created by Christoph Hormann with data credited to Jonathan de Ferranti.The raw data used is produced from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) (J-Space Systems, 2014). ASTER is an imaging instrument which has been put aboard the National Aeronautics and Space Administration's(NASA) leading satellite called Terra which is part of their Earth Observing System (EOS) (NASA, 2014). The development of ASTER is a part of a cooperative effort between NASA, Japan's Ministry of Economy, Trade and Industry (METI), and Japan Space Systems (J-Space Systems, 2014). The data is from ASTER's Global Digital Elevation Model (GDEM) version 2 and is produced at a3 arc second resolution (90m). A higher resolution would yield more precise projections of potential sea level rise for the study sites; however for the purpose of this research the DEM provided a sufficient demonstration of change in sea level.

As with most sea level rise vulnerability assessments, this research used a simple inundation model known as the bathtub approach as this method is easily employed (Mcleod et al., 2010). This method maps land adjacent to the sea as well as areas that fall below a given elevation in order to represent a potential sea level rise projection (Brunel and Sabatier, 2009). The mapping process makes use of a deterministic line to indicate inundation by making use of two variables: the inundation level and the ground elevation (Schmid et al., 2013). The bathtub approach does not account for coastal dynamics such as the wind, waves or tide, and therefore is considered an overly simplistic (Levine et al., 2008). However, it quickly generates estimates that are reasonably easy to calculate (Hawkes et al.,

2009). One of the benefits of using a DEM to illustrate sea level rise is it helps to visually identify specific locations that may be affected.

The inundation levels were created using the raster calculator function in the spatial analyst tool in ArcGIS. Two sea level rise scenarios were created as a DEM for the projected sea levels for the 2050 and 2100 was desired, these years mark the half point and end of the 21st century which are in line with the temporal projections of climate change literature. The expected sea levels as mentioned in the study site chapter were used. The DEM was created using an input of 0.4m used for the 2050 sea level rise projection illustrating 0.4m rise and 1.6m of sea level rise used for the 2100 sea level rise projection illustrating 1.6m rise These values were used for the DEM projection as previous literature has stated that there will be an average rate of change of 0.3mm/yr along the south coast of South Africa. This tested the Boolean statement at each cell of the DEM (is the value within the cell less than or equal to 0.4 meters or alternatively 1.6m.

3.3.4. Conclusion

St Francis Bay and Cape St Francisare low-lying and are located along the coastline which places them at high risk for climatic events such as sea level rise. The research is also concerned with the impact that a changing climate will have on the tourism sector within these towns as tourism is one of the main economic drivers, therefore the focus was placed on tourists and one specific tourism operator – the accommodation establishments. The methodology used followed a mixed-methods approachmaking use of the thematic analysis method as well as concept mapping, while comparing this qualitative data against the quantitative data acquired from developing a Tourism Climate Index and a Digital Elevation Model. This is done to investigate how the perceptions of climate change the tourists and tourist accommodation establishments differ from the scientific projections of climate change.

4
RESULTS

4.1. Introduction

This section presents the findings of the research conducted in St Francis Bay and Cape St Francis. The research was comprised of two main methods: a qualitative approach and quantitative approach and the results will be organised into two main sections presenting the findings of each of these approaches. The qualitative research focused on the perceptions of two tourism groups: the accommodation establishments and the tourists. Each of these groups will form a sub-section of the results under the qualitative research. Each sub-section will provide a brief socio-demographic description of the individuals interviewed, followed by the results of the questionnaire into the perception of climate change of the respondents. The quantitative research looks at a DEM of the study sites with projected sea level rise as well as a TCI to investigate climate trends for the area and the suitability of the climate to attract tourists. These two sub-sections will be presented under the quantitative research.

4.2. Qualitative research

4.2.1. The tourist accommodation establishments

4.2.1.1. Demographics

Of the accommodation establishments interviewed (*n* = 53), 36 were from St Francis Bay and 17 from Cape St Francis Bay. Owners of establishments made up 44 of the respondents, while the remaining interviews were done with the establishment managers. Overall 37 of the respondents were female and 16 male. The range of ages of the respondents was between 22-73, with the largest number of respondents falling in the 51-60 age group (21 respondents).

4.2.1.2. The background of the establishments

The time period in which the accommodation establishments have been owned, by the current owner, ranges from 6-46 years. A lot of the smaller establishments had originally been bought as a second home to rent out to tourists which is a common practice in South Africa (Hoogendoorn & Visser, 2011), this includes the longest owned establishment bought as a cottage to the most recently bought establishment which is a holiday flat. The remainder of the establishments are comprised of residents that converted part of their property into tourist accommodation, as well as a few owners that specifically bought property in the towns to build an accommodation establishment. The peak period of occupancy for the establishments is generally from December to January, due to guests holidaying there for Christmas and New Year's, as well as during the month of April for the Easter holidays. The period of June to July experiences a high rate of bookings but is not considered a time of peak occupancy as it falls within the winter months which would appeal less to the typical sun and sea tourist.Pertaining to their average annual occupancy rate the establishments estimated that they were occupied 50-60% of the year.

The majority (±60%) of their guests are domestic tourists from South Africa, particularly from cities such as Johannesburg, Pretoria and Durban. While the remainder (±40%) of their guests are mostly European tourists from countries including Germany, Italy, France and the United Kingdom. A possible reason for the presence of European tourists is the fact that South Africa focused its marketing of its tourism industry on the European market (Rogerson & Visser, 2011). Europeans also do not experience jet lag when travelling to South Africa and this could add to its appeal as a holiday destination, particularly as the European Union had a hand in providing technical assistance to South Africa during the development of the Tourism White Paper (South African Government, 1996). Occasionally some of the establishments get tourists arriving from other African countries, however it was pointed out that this was quite seldom. The accommodation establishments believe that tourists from other African countries choose to go to the bigger coastal destinations such as Durban or Cape Town. This decision to visit larger tourist destinations can be linked to these urban centres having been the foundation of tourism as the country developed as discussed in a paper by Rogerson and Visser

(2011). The majority of the tourists to St Francis Bay and Cape St Francis visit the towns for the smaller, less crowded beaches and the large range of water activities. Many of the tourists bring their own surf boards for surfing in the towns while some drive up to Jeffrey's Bay for surfing lessons. The small fishing boats are also used by tourists, who get taken out on fishing trips by local fisherman. A small portion of guests stay there to attend weddings and also to visit the Addo National Park. The location of each of the respondent accommodation establishments was mapped to show their approximate location from the sea (Figure 10).

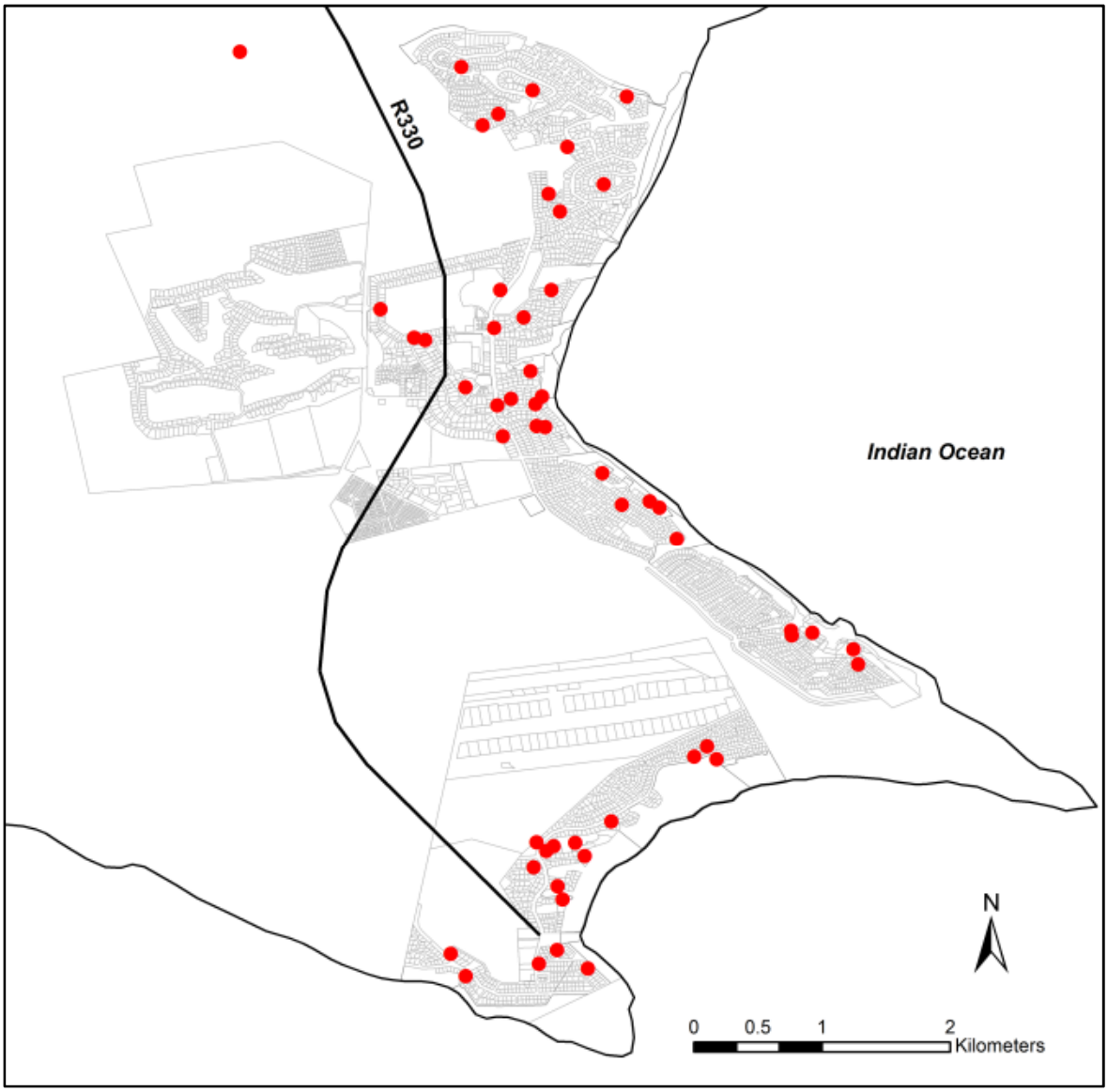


Figure 10: Location of interviewed accommodation establishments in St Francis Bay and Cape St Francis.

4.2.1.3. Climate change perception

To determine the knowledge about climate change held by the accommodation establishments, the owners and managers were first asked how familiar they were with the term climate change. All of the respondents were aware about climate change, and many of them were used to hearing about climate change quite often through the news. One of the respondents had heard about it through the eco-school that their children attended. When asked whether they believed that climate change was a cause for concern 35people felt that it was, while 3 of the respondents were indifferent to it. When asked whether they thought that the world's climate is changing, 48 of the responses agreed that the world's climate is indeed changing. The remaining establishments felt that it was not, and argued that while climate change is a common term, they were not entirely convinced it would occur anytime soon, if at all. One of the owners stated that climate change was 'a lot of nonsense'. They were then asked when they thought the effects of climate change would be felt, 42 of them answered that we are currently experiencing the effects whereas the rest of the establishments felt that the effects would only be experienced in a 100 years or more.

Figure 11 shows the overall level of concern that the tourism accommodation establishments have in relation to their location to the coastline. In general, the establishments that are the closest to the ocean showed more concern than those further inland. This is interesting as the area closest to the ocean is probably under greatest threat, however not all of the tourism accommodation establishments near the ocean had high concern. Some of the establishments that were located within close proximity to the ocean that showed little concern were situated in areas such as the Port of St Francis Bay. This area is protected by sea defence barriers and this could heighten the establishment's sense of safety. The establishments situated in areas that have been identified as vulnerable to climate change such as along the Kromme River estuary and in the Marina Glades canal system had a medium to high level of concern about the threats of climate change. In Cape St Francis there were two establishments near the coast that has a low level of concern. However, they are situated at a higher altitude than the rest of the town and there are large boulders along the beach which could aid as a means of sea defence.

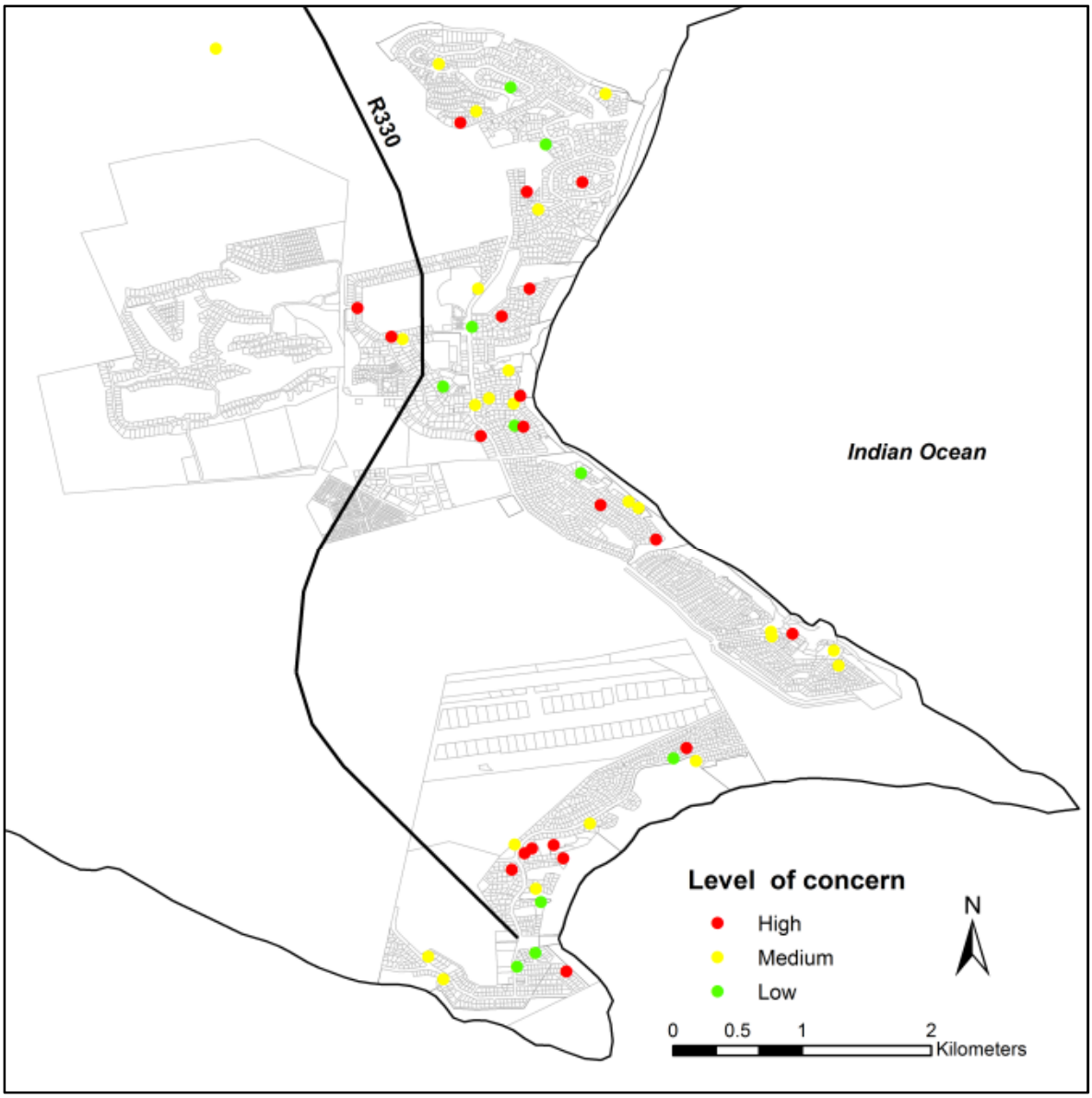


Figure 11: The level of concern that the accommodation establishments have for climate change.

To explore the impact that climate change will have on their business, the accommodation establishments were asked to rank the extent to which they felt climate change would negatively affect their business and St Francis Bay and Cape St Francis. Of the respondents, 13 disagreed that it would negatively affect their establishment. Some of the respondents (35 people) felt that climate change would however have more of a negative effect on the towns. The respondents that said this had generally been affected by or been within close proximity to previous events,

such as the fires that destroyed many of the houses on the canals in 2012 as well as the flooding events that occurred near the St Francis links golf course. The properties located closer to the coast in Cape St Francis overall agreed that their town was vulnerable to negative impacts of climate change.

The establishments were asked whether their property had experienced any damage resulting from the weather in the last 5 years, includingtheir actual building, the garden area or vehicles. Of those that had experienced damage to their establishment (14 respondents), most of it had been caused by flooding. Flooding had occurred in the low-lying establishments as the flow path of the flood waters had washed straight through the grounds. This had caused severe water damage to the property by damaging the infrastructure and furniture. Previous flooding events had also resulted in a bridge in St Francis Bay to be washed away. The loss of this bridge hindered access to some of the establishments, with it noted that the bridge had been washed away four times in the period of two years. The establishments that had experienced flooding were located along the Marina Glades canal system and along the coast near the Santareme area of St Francis Bay. Cape St Francis respondents have also experienced some flooding but along the main road R330 which has washed away the Sand River Bridge hindering access to the town. Some of the establishments had also experienced problems from heavier than usual rainfall, as the roofs of their accommodation experienced leaks, causing water damage to their rooms. One of the establishment owners had to have their driveway reinforced as the heavy rains caused it to subside, while another had to personally fix the potholes in the small road leading to their establishment as the road was becoming too difficult to drive on.

A follow up question explored what impacts climate change may have on their accommodation establishment in the future. Flooding was mentioned by the majority of the respondents, along with possibility of bridges being washed away a lot more as a consequence. This brought up the concern of loss of access to the establishment creating revenue loss. Sea level rise was stated to be the largest impact for beach front properties, with those establishments experiencing some damage flooding or the infrastructure totally collapsing if the foundation is eroded.

The loss of the beach through erosion was mentioned, with respondents worried about coastal retreat leading to ‘the beach front properties becoming exposed’. One of the respondents stated in jest that they ‘may have a beach front property in a few years’. The beach erosion would also mean the town would become less of a tourist attraction. General infrastructure damage outside of the accommodation properties is expected to have a negative impact through roads breaking up, especially with regards to potholes. For the most part, it was expressed that the greatest impact would be through the deterioration in the number of guests visiting as the towns lose their attraction to tourists and the reservation patterns being altered in response to the climate. This impact was expressed as ‘already noticeable’ by some of the establishments. When asked whether they felt climate change could impact on tourist accommodation establishments, 44 answered yes.

The impacts of climate change were further explored by asking how they thought climate change would affect the towns. It was believed that climate change will have a definite negative effect, as the amount of tourists would decline having severe consequences on the towns. The establishments feel that tourists will be less attracted to the area as climate change will spoil the environment and the ability of tourists to be comfortable and enjoy their holiday. These consequences included a loss of income from the tourism sector which will allow for the area to deteriorate. The towns would no longer be considered tourist attractions and one respondent worried that the towns ‘would be removed from tourism maps’. The reasons as to why the establishments felt there would be a decrease in tourism were in part due to the loss of beaches and increased temperatures becoming unpleasant. However, it was also explained that climate change would lessen the ability of the towns to offer tourism activities once the climate become unsuitable. Such activities included fishing, surfing or even hiking, and this presented the concern that the towns may not be able to compete with other towns in offering alternate attractions.

The establishments were asked who they feel should take responsibility in dealing with climate change. This responsibility included providing information about climate change mitigation and adaptation, as well as taking care of potential costs involved to assist with this action. There were eight parties mentioned: environmental groups;

individuals and their families; industry/companies; local authorities; the tourism sector; state/provincial government; national governments; and the international community. Figure 12 shows the number of respondents that selected each of the listed parties as responsible for climate change action. All of the parties were selected, which shows that every one of them should have a level of responsibility.

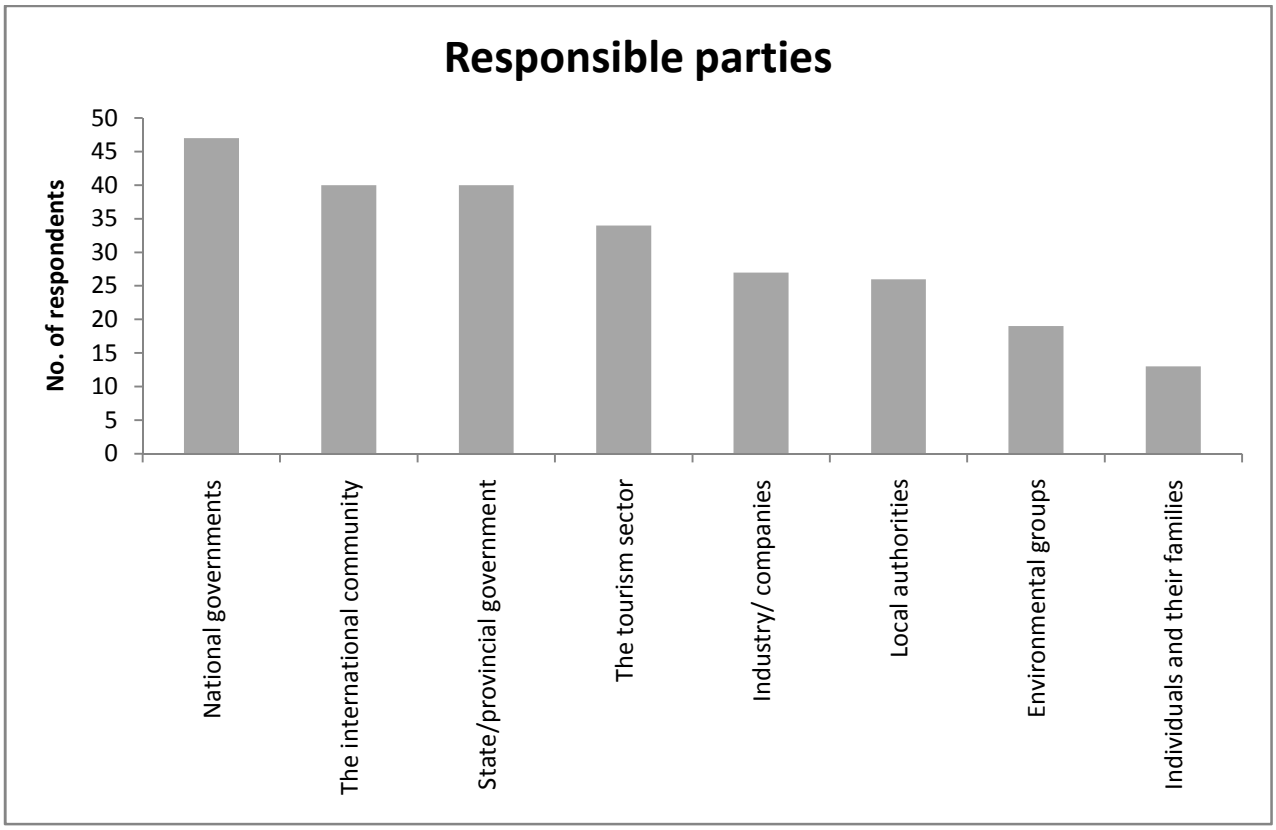


Figure 12: Number of respondents that feel each of the parties should be responsible for climate change action.

It was found that only 5 of the respondents felt that environmental groups should not be responsible for climate change action. The respondents thought that the environmental groups already are trying to assist with climate change, however the problem is too big for them alone and more powerful organisations need to step in and take action. National governments were ranked as being the party that should be responsible. Of the 47 of the people who strongly agreed to this, many said that the national government should be trying to better the country that they govern, by investing more resources into preparing for impacts from climate change. The

international community and state or provincial governments were considered equally responsible for taking some action under the national government. The tourism sector was ranked third by 34 of the respondents to be responsible for climate change action by working alongside government.

These answers were elaborated through asking the establishments what they thought the government could do to assist, particularly the local government to help their towns. One of the most important problems for the towns that the government could address was by performing maintenance and repairs on the local infrastructure such as the roads that have a lot of pot holes. A few of the respondents also suggested improving the safety infrastructure of the area by upgrading the local fire station as it was unable to cope with the fires experienced in St Francis Bay in 2012. The local government could also assist in promoting the area where the towns are located, specifically promotion in the form of highlighting the tourist attraction of the beaches as being very safe and clean. The respondents felt that this would in turn encourage local businesses and tourism organisations to make sure the areas are indeed safe and clean, as getting the locals to assist is imperative. The establishments also believed that it is important for the local government to prohibit any planned activity or development in the area which could possibly affect the towns in a negative way through damaging the surrounding environment, an example given was the nuclear power station at Thyspunt. Instead the environment should receive proper investment throughtherehabilitation of the beaches to cope with erosion and the rehabilitation of the coastal dune fields.

The respondents were then asked what they felt the tourism sector could do to deal with the effects that climate change may have on tourism in St Francis Bay and Cape St Francis. The majority answered that they should assist in the same way as the government, and that a partnership between the parties should be developed to address issues such as climate change. It was mentioned that it is important that the tourism sector maintains the towns as a tourist attraction and should increase the marketing of smaller towns, so that these towns will be able to compete with larger tourism destinations and have a chance to effectively cope with impacts of climate change. It is believed that if climate change does negatively affect the area then it is

the smaller towns that would have less ability to cope and would thus lose a large portion of their tourism income. As a result the respondents would like the tourism sector to focus on them and provide them with increased opportunities to develop so they can be competitive with the larger tourism towns. Suggestions on how the tourism sector could market the towns included the creation of travel packages that have specials making use of the local accommodation. The creation of links to tourism attractions not in the area was proposed, with these links forming travel pathways whereby more tourists would stop over in the towns and visit. Many of the establishments thought the tourists activities on offer could be improved through holding more events in the towns such as on the beaches or the surrounding areas. Such event ideas included holding surfing competitions, starting more festivals such as the popular Calamari Festival which is already held annually for tasting the Chokka squid and flea markets so tourists can enjoy the local foods and crafts.

After researching the study sites, a number of potential climate change impacts could greatly impact on the area. Three of these impacts were chosen along with three other environmental problems and organised into natural threats and anthropogenic threats and the accommodation establishments were asked to rank them in order of severity. Figure 13 shows the threats ordered in terms of perceived severity and givesthe number of respondents that selected each threat. The top natural threat was believed to be sea level rise, while pollution of the Kromme estuary and ocean was the most severe anthropogenic threat.

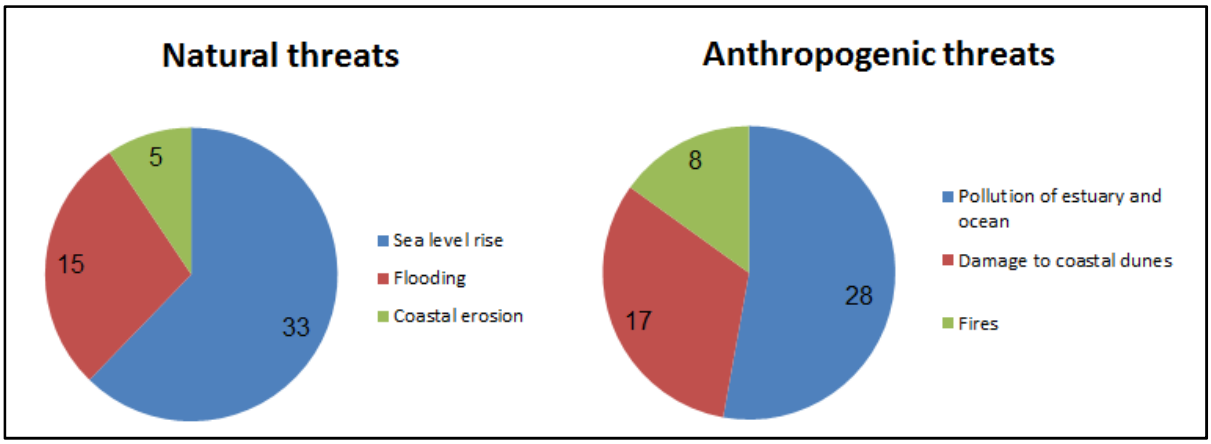


Figure 13: Natural and anthropogenic threats ranked in order of perceived severity.

The last two questions dealt with finding out what the accommodation establishments have done so far to mitigate the effects of climate change and to adapt to it. Future plans to implement measures were also discussed. Just over half of the respondents (28 respondents) had started employing greening measures to their accommodation establishments. Energy conservation was the most common answer, with some of the buildings being insulated as well as installing energy-saving light bulbs. Some of the establishments were going green through recycling of the waste generated from their business or by planting water-wise plants in the grounds of their establishment to conserve water resources. A few stated they support green initiatives in the area and in doing so gain helpful information on how to make their business more environmentally friendly. Some of the establishments were concerned about climate change bringing hotter and more humid weather and have decided to install air-conditioning systems in the rooms to make the weather more manageable for tourists. However, in such cases the establishment has not taken into account the consequences of such adaptation responses.

The promotion of tourism during winter months or when the weather conditions are bad is being considered through increasing indoor activity at some of the establishments. Means of promoting indoor activity included providing DSTV, a digital satellite TV service, and DVD players in each of the rooms, and making sure there is Wi-Fi for guests to enjoy as well as creating a lounge area with a selection of books to read or board games to play. For instance increasing the level of indoor activity through promoting the use of DVD players and DSTV, as well as the installation on air-conditioning units will all result in an increase in the electricity usage which in turn is contributing to climate change. None of the establishments mentioned relocation of their business in response to sea level rise. The methods that were mentioned to deal with sea level rise involved the use of sea defences such as the ones that were currently in place, like the tetrapods (a concrete tetrahedral structure) used in the port of St Francis Bay. These methods were not discussed with particular reference to their establishments but rather to protect the towns as a whole.

Some of the establishments were not planning at this stage to implement any adaptation measures, thus they were asked to elaborate why and also to provide what kinds of priorities rank higher to their business than climate change adaptation. Respondents suggested that the effects of climate change are still a long way off, and it was mentioned a few times that the owners of the accommodation establishments would no longer be alive or perhaps would have decided to sell and move elsewhere by the time these effects did occur. As a result, they did not feel the need to make any changes as it would be a waste of time and money. Others felt that implementing changes would only become necessary once problems arose from climate change and started directly affecting their business.

In response to higher ranking priorities than climate change, the establishments felt that current issues that faced their business were more significant. Examples of the current issues that were given included: improving the competitiveness of their business and in doing so increasing their annual revenue. In order to improve their competitiveness, the establishments said they needed to improve their marketing to make their accommodation advertisements reach a wider market or perhaps invest in word-of-mouth marketing through a higher number of satisfied guests. A small portion of the respondents wanted to train their staff by sending them on courses and to attend various hospitality workshops, and this was linked back to the establishments desire to improve their business. Many of the answers also included plans to upgrade their current infrastructure by making the establishment look better through newer and more modern décor. Other upgrades involved creating more facilities through installing jacuzzis and swimming pools.

4.2.2. The tourists

4.2.2.1. Demographics

Of the tourists interviewed (n= 53), 31 were female and 22 were male. The range of ages of the tourists was between 20-73, with the highest number of respondents falling in the 45-54 age group (16 respondents). The majority of them were married (33 people) with no widowed or separated individuals amongst the interviewed tourists. A total of 39 of the respondents had a university degree, with a third of them having completed a post-graduate degree. The majority of the tourists were currently

employed (42 people) with three of them being self-employed, and 4 of respondents are retired. With regards to their permanent residence, the interviews included South Africans (25 respondents) and international tourists (27), with the domestic tourists residing in Johannesburg, Durban, East London, Pretoria and Kimberley. International travellers included seven countries of residence: India, China, Germany, United Kingdom, New Zealand, United States and Canada. This corresponds to an extent with what the accommodation establishments said. They too stated that their local guests come from Johannesburg, Pretoria and Durban while many of their international guests came from Germany, Italy, France and the United Kingdom.

4.2.2.2. Climate change perception

The first Likert-scale question that was presented to travellers addressed whether they had heard of climate change. The respondents were familiar with the term as all of them selected the “strongly agree” option. There was large amount of indifference to whether climate change was a cause for concern as 25 people chose a neutral stance, with only 3 of the tourists not at all concerned about it. The tourists that were not concerned about it, were domestic tourists. When asked whether they thought that the world’s climate is changing, nearly all of the responses agreed that it was, while three answers showed uncertainty.

To better understand what is perceived to be the cause of climate change, tourists were asked to rate on a Likert-scale to what extent they agree with climate change being caused by human activity and to what extent by natural processes. A substantial amount of tourists rated natural processes as neutral (36 respondents), which during the interview process created confusion as most of the respondents had never considered natural processes to have an effect on climate change. A total of 38 of the tourists ‘agreed’ or ‘strongly agreed’ that climate change was caused by human activity. In general more of the international tourists (specifically from the UK, Germany and China) felt that climate change was caused by human activity while more of the local tourists felt it was caused by natural processes.

A table with various options of when one could expect to feel the effects of climate change was created before the interviews offering options such as ‘currently’; ‘never’ as well as a number of year intervals. The majority of respondents (46 people) believed that the effects of climate change are currently being felt, especially in the context of a variable like temperature as there were a few comments such as “winter is not as cold anymore” and “maximum temperatures are getting higher and higher”. While some of the tourists were unsure as to whether the world’s climate is changing, 2 people felt that if it did change at all it would take at least 100 years before any effects were experienced. In order to investigate from what the tourists had heard about climate change a list of sources was created providing a number of options that enabled more than one to be selected. The answers from this question were tabulated and ranked accordingly (Table 7).

Table 7: Sources of climate change information

Source	**No. of times selected**	**Rank**
Television	45	1st
Internet	40	2nd
School/college/university	36	3rd
Newspaper	35	4th
Radio	35	
Environmental groups	31	5th
Friends/family	29	6th
Government agencies	18	7th
Specialist publications/academic journals	17	8th
Public libraries	9	9th
Local council	3	10th
Other*	1	11th
Energy suppliers	0	12th
*Generation Earth - a green networking platform		

The answers indicated that television was the most common source of climate change information through watching their local news programmes as well as environmental programmes. The internet was selected 40 times marking it as the second most common source, while educational facilities such as school, colleges or universities were mentioned to be the third most common source of climate change information. Of the respondents that selected radio as a source, all of them were employed. The news reports that air in the radio sometimes discuss climate change and this was commonly heard on the car radio whilst travelling to or from work. While some of the international tourists listened to radio shows streamed over the internet and had too heard it on news reports. One of the tourists expressed an interest in the work of a local green networking platform Generation Earth. Generation Earth has access to attend the Conference of the Parties (COP) and provides information acquired there about climate change.

The tourists were then asked to rank a set of ten environmental problems in order of what they feel to be most important to deal with to the least important, with 1 = most important and 10 = least important. The environmental problems were ranked as follows in Table 8:

Table 8: Environmental problems ranked by importance

Problem	**Rank**
Water shortages	1st
Pollution	2nd
Salinity	3rd
Erosion	4th
Sea level rise	5th
Water quality	6th
Flooding	7th
Heat waves	8th
Drought	9th
Climate change	10th

A total of 31 of responses chose water shortages as the environmental problem of most concern.However, it was interesting to note that climate change ended up being ranked as the environmental problem of least concern. The decision for this

was based upon the perception that climate change is not as significant as the other problems listed due to it being considered as an external problem, thus a problem which is not currently going to directly affect them, and therefore it is not their concern to deal with.

The last question in this section of the questionnaire asked how vulnerable they thought a list of various sectors would be to climate change. Figure 14 shows the tourists' perceived level of vulnerability of each sector to climate change. The focus of this research is addressing tourism and coastal communities, in an attempt to better understand the perception of these sectors, they were included in the list for this particular vulnerability question. The answers indicated that tourism is the 5th most vulnerable sector, while coastal communities are the 7th.

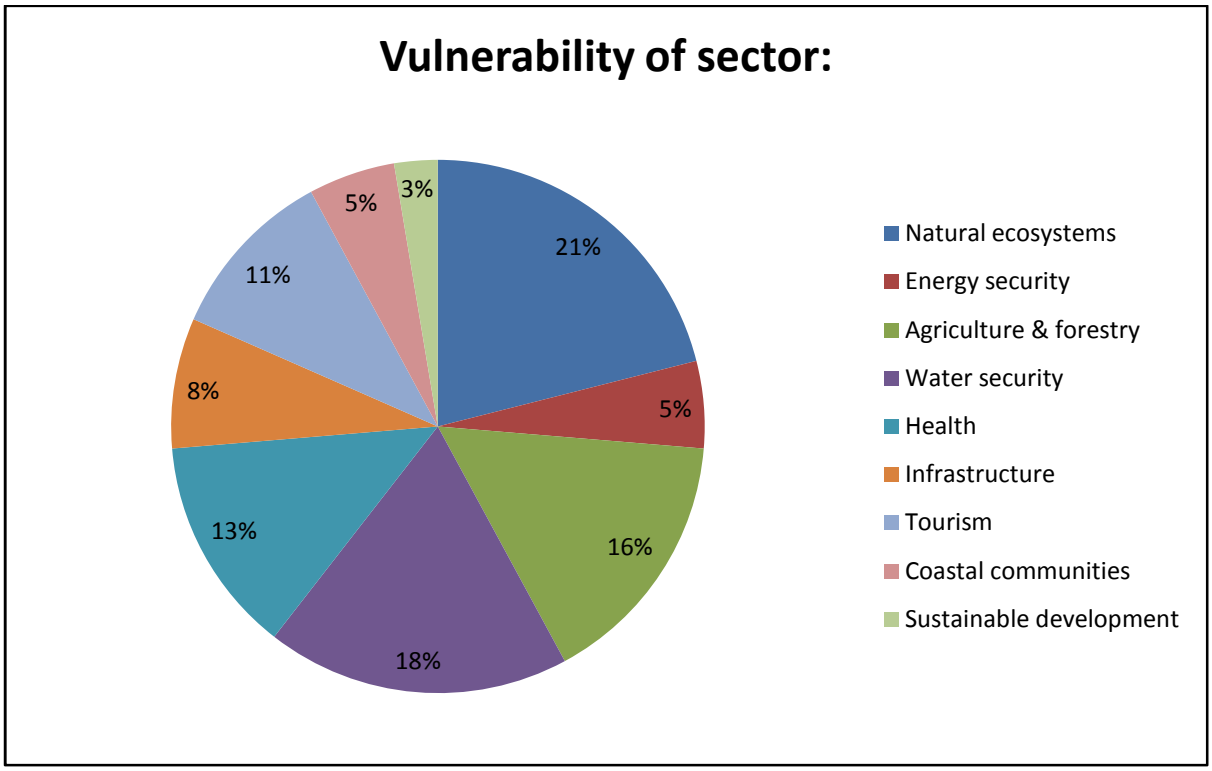


Figure 14: The perceived vulnerability of various sectors to climate change.

Tourism was mentioned to be a sector that could 'sufficiently cope' with a changing climate as it could change too, altering tourist attractions in relation to the climate and offer new sources of interest instead. Coastal communities were viewed as far less vulnerable, as the idea that the worst possible problem for coastal communities

would be sea level rise and this problem is ‘manageable’. Further explanation of this claim, was that coastal protection barriers could be constructed and be effective enough to mitigate damage. Of the responses given, the local tourists favoured selecting options that consisted of natural resources such as water security and energy, whereas the international tourists chose options such as infrastructure and the tourism sector.

4.2.2.3. Tourism preferences

In the first question, tourists were asked what types of holidays they enjoy. Almost all of the respondents answered that ‘sun and sea’ as well as ‘safaris and wildlife’ types were attractive holidays, with many adding that this was their ‘favourite’ or ‘first’ choice when selecting a holiday (Table 9). Holiday types that involved hiking and camping was also a popular choice selected by 33 tourists. The snow and ski holidays were chosen the least with only 11 respondents selecting it. Some of the reasons for this included warmer temperatures causing snow to be wet particularly in the US. Tourists were also disappointment with the lack of snow or real snow at certain ski resorts, and are going on these types of holidays less frequently.

Table 9: Holiday types that tourists normally choose.

Holiday Type	**Rank**	**No. of times selected in this rank**
Sun and sea	1st	49
Safaris and wildlife		49
Hiking and camping	2nd	33
Food and wine	3rd	25
Cultural	4th	18
Cruises	5th	12
Snow and ski	6th	11

To explore why tourists may choose a particular location when planning a holiday, a list of various destination elements was presented in a Likert-scale, so that

respondents could rate how crucial each element was to them. The results showed that the three most important aspects of a destination included the area having high levels of safety and security whist offering clean surroundings and unspoiled nature. The tourists were less concerned with the overall nightlife and sporting facilities of a destination. The local climate conditions of a destination was ranked fifth, the majority of respondents felt that while climate was important to the attractiveness of a destination, there are things that have a higher priority. Overall personal comfort is the most important thing as 'a holiday should be an improvement on day-to-day living'. All of the answers were graphed (Figure 15) based upon the elements that were rated as 'very important'.

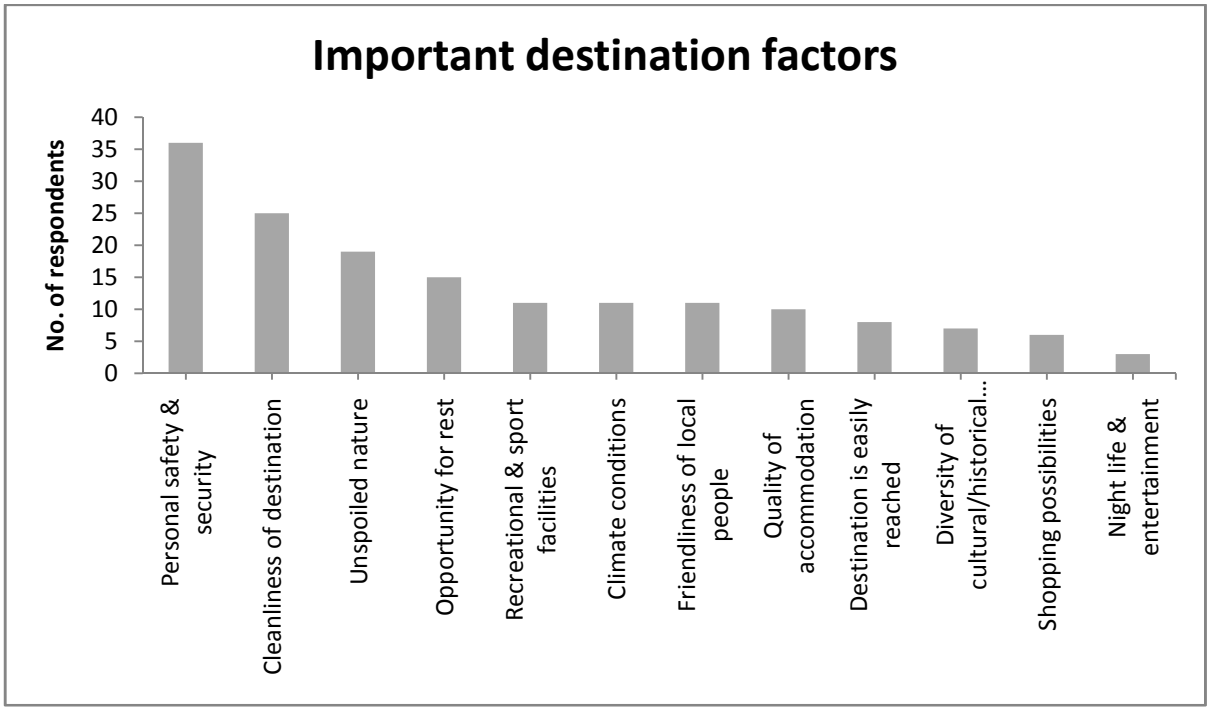


Figure 15: Destination factors ranked by level or perceived importance.

There are various types of accommodation establishments in St Francis Bay and Cape St Francis, and the tourists were asked what types of accommodation they would most likely choose to stay at as well as why (Figure 16). Self-catering establishments were the most popular choice for the reason that being that the respondents preferred to be able to cook their own meals which created a homely, relaxed feel. However, while staying at a self-catering establishment tourists will still opt to eat out at a restaurant occasionally to try local speciality dishes. Hotels and

lodges were ranked high as they offer a sense of luxury and quality accommodation and provide numerous amenities for guests to enjoy. Guest houses and B&B's were closely ranked, chosen primarily for their low rates. They offer comfortable accommodation at cheaper prices as compared to hotels and lodges. These types of accommodation are also smaller allowing guests some privacy, which aids the desire for 'peace and quiet' while on holiday. The least popular accommodation types were backpacker hostels and camping and caravan parks. These particular types were described as being attractive to students, mostly due to cheap rates, or tourists who were 'passing through' the area, therefore needing accommodation only for a short period. Of the respondents interviewed three were students that were on holiday with their families, with two of them staying in the self-catering accommodation while one was staying in a B&B.

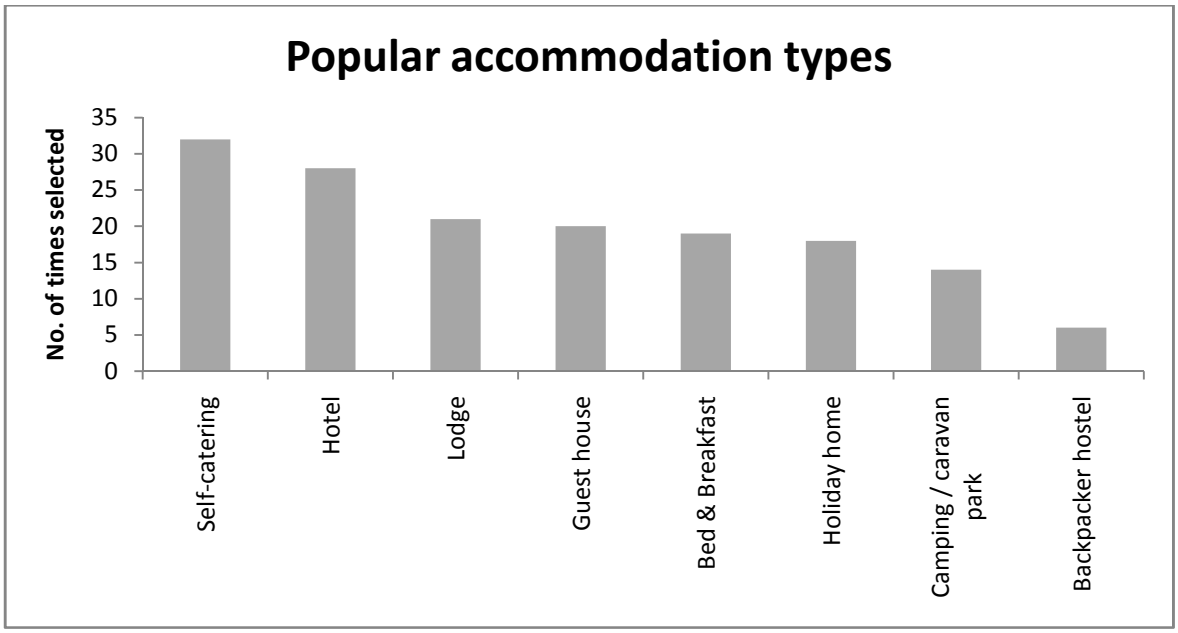


Figure 16: The most popular type of holiday accommodation.

To further explore the influence of climate change on the tourists' travel habits, they were asked about their views on accommodation establishments being actively involved in climate change adaptation. Almost half of the respondents (26 tourists) would be willing to pay higher accommodation rates in order to assist the establishment with its adaptation costs. These respondents were all employed and between the ages of 30-55. A few of the tourists (13 respondents) said that they would not be happy to pay additional costs and if would likely seek alternate

accommodation at lower rates. This was due to the belief that climate change adaptation costs are the responsibility of the government, and that these costs should be handled by the government in order to maintain the appeal of the destination to tourists. The remainder of the tourists were indifferent to paying higher rates, stating that they were not against it however they may feel differently if it increased the overall cost of the holiday dramatically. When asked whether they would choose to stay at a particular accommodation establishment based upon the establishment advertising their actions of adapting to climate change, 31 of the respondents said that they would in fact chose to stay there. This was based upon the appeal of a positive impact being made to improve their establishment, as well as creating the idea that the establishment is one that is 'caring', 'more involved in making sure things are right' and 'concerned about the environment'.

Tourists were then asked to rate what level of influence certain changing weather conditions would have on their decision to travel to St Francis Bay or Cape St Francis (Figure 17).

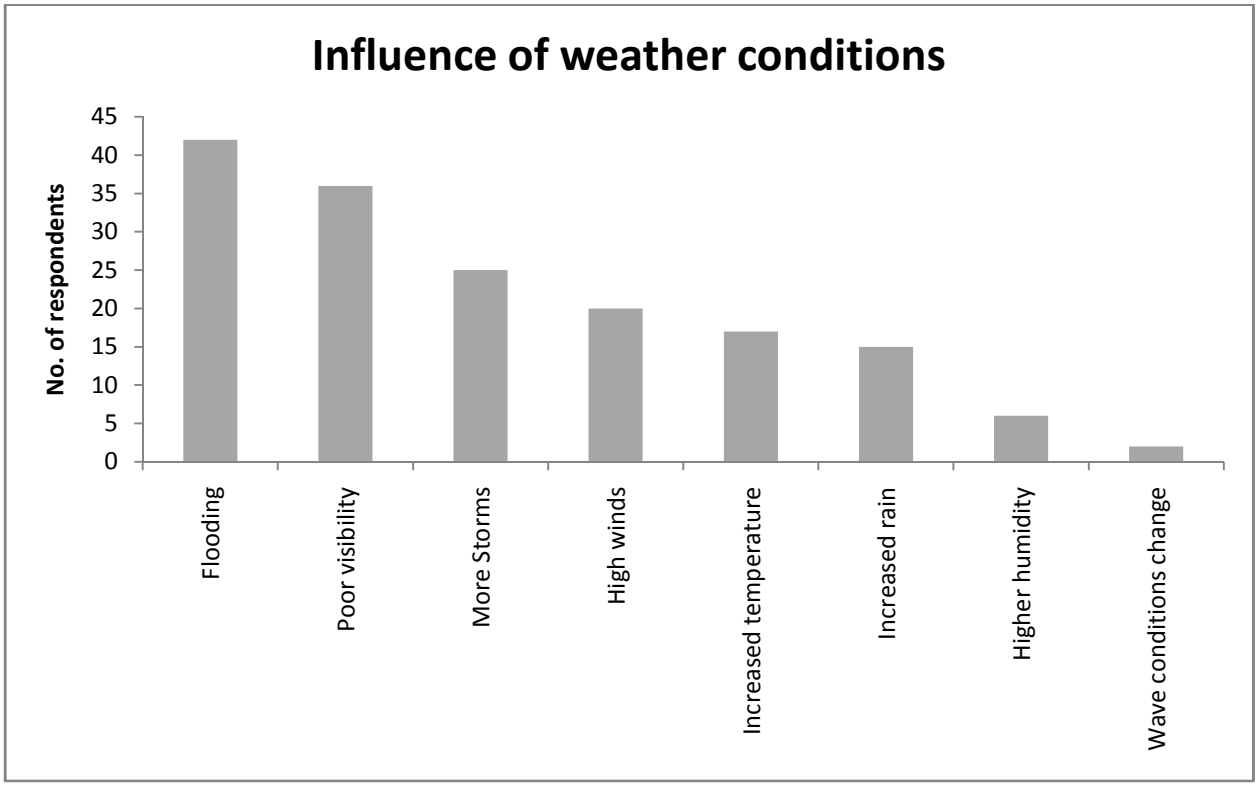


Figure 17: Level of influence of weather conditions on travel decisions.

They were also asked to explain which of these would lead to them ultimately cancelling their accommodation. Flooding was ranked as the weather condition that would have a huge impact on travel decisions as it would damage infrastructure, potentially resulting in roads being closed or difficult to drive along. Depending on the level of flooding, it was also mentioned to be dangerous and a 'risk'. Poor visibility was rated by 35 of the tourists as being the second weather condition that would have a huge influence on their travel decision, as it was mentioned that part of the appeal of a destination would be to have good views and enjoy the scenery. Tourists said they are less likely to cancel their accommodation due to high levels of humidity or changes in the wave conditions. Humidity, while lowering the level of thermal comfort, was not considered a factor that would make a destination unappealing as efforts could be made to cope with it such as staying in the shade or swimming. Wave conditions did not have a big influence, with respondents stating that 'when weather conditions are bad at the coast you stay away from the beach and visit other tourist attractions', this was expressed alongside with the idea that wave conditions would not be unpleasant for the entire duration of the holiday. The weather conditions that were stated as being conditions under which they would likely cancel their accommodation included: flooding; poor visibility; more storms and high winds. These conditions were ranked as were ranked first to fourth, on their level of influence.

4.2.2.4. Motives for choosing a holiday destination

Of the 53 tourists interviewed, 39 were staying at accommodation establishments located in St Francis Bay and Cape St Francis. The remaining 14 tourists were staying at nearby towns (Table 10). Those who were not staying in St Francis Bay and Cape St Francis had travelled for a day trip to visit the towns, while some were stopping at the towns on their way to their holiday destination. The tourists were asked if they had stayed at either St Francis Bay or Cape St Francis before, with 31 people having previously stayed there. The appeal of the canals of St Francis Bay as well as the peace and quiet of both small towns was stated as being a major incentive for deciding to stay there previously. It was also revealed that many of the tourists had heard of the towns through word-of-mouth, and the good reviews had

enticed them to holiday there. The towns that these respondents came from included:

Table 10: Respondents that stayed in nearby towns.

Town	**No. of respondents**
Jeffrey's Bay	3
Port Elizabeth	7
Oyster Bay	1
Knysna	1
Paradise Beach	2

Only a few respondents (17 people) were returning to the towns for a holiday but had chosen to stay in a different accommodation establishment. There was no definite cause for this, other than 'wanting to try a new place', rather than the previous stay having been of a poor standard. Of those who had visited the towns previously 35 tourists had stayed in the same establishment. Their reasons for returning were based on having a good holiday experience there. Many of the establishments were mentioned to have 'friendly staff'' that were very concerned with their guests' enjoying their stay and this significantly enhanced the attraction of booking there again. The accommodation was also rated to be very clean, with rooms that were of an especially good standard. Figure 18 indicates the location of where the interviewed tourists stayed.

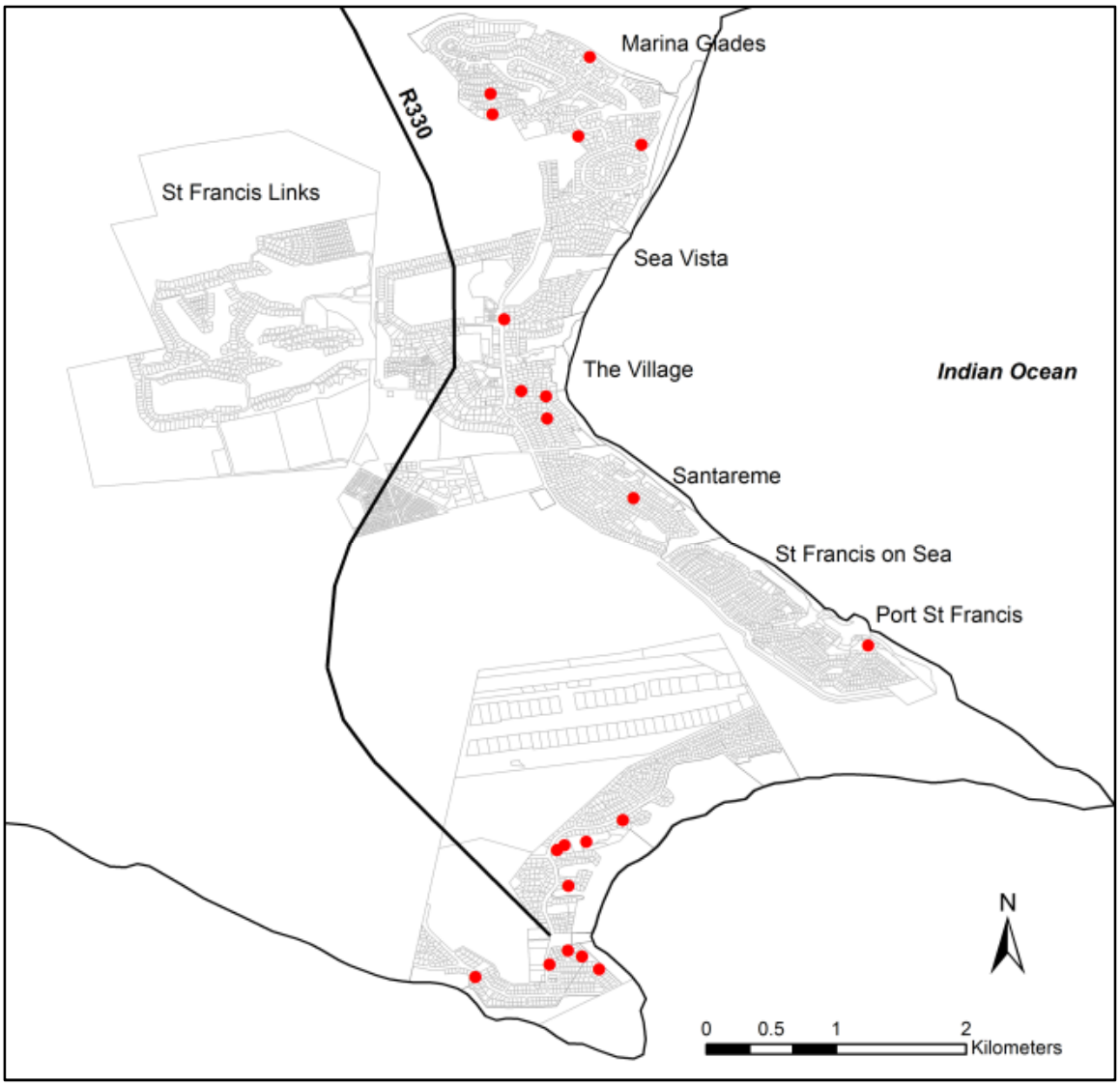


Figure 18: Location of where interviewed tourists stayed in St Francis Bay and Cape St Francis.

In order to explore why tourists chose to visit St Francis Bay and Cape St Francis, they were asked about the tourist attractions on offer that most appealed to them. Most tourists gave answers about relaxing on the beaches and swimming in the ocean. A stated prerequisite of wanting to spend time on a beach is that it was located in an area that was safe and secure, in addition to being well maintained and clean. Both of the towns are rated as top tourist attractions for their beaches and were expressed to be safe, secure and clean by the tourists. Many of the water sports on offer were popular among the respondents, these included: kayaking; surfing; kite-surfing and using jet skis. Some of the more relaxing water activities such as yachting, snorkelling and fishing were not brought up as often, but were still

however stated by a few as attractions of the town. Located between the towns are some of the dune fields, with walking trails passing through them as well as trails that pass through the local nature reserves, Seal Bay nature reserve and Irma Booysen Flora reserve. These walking trails proved to be highly appealing to tourists, many of them opting to go for early morning hikes highlighting the birdlife and small buck spotted. Whilst the sand dunes provide the opportunity for sand boarding, only one tourist pointed it out. St Francis Bay's golf course was referred to as 'one of the best golf courses' with views of the sea to enjoy while playing a round of golf. Responses indicated a high level of interest in the golf course among the tourists, with some having played there before. In response to climate change potentially affecting the activities by reducing the ability to offer them, 46 tourists answered to the extent of 'agree' or 'strongly agree' that they would no longer visit the towns if these tourist attractions were no longer available.

The next questions that were asked aimed to help explain the function of climate alongside tourism, thus tourists were asked to describe the climate of the area. In general, the respondents labelled the climate as 'warm' and 'wet', referring to the conditions overall as pleasant due to it being warm but not too hot. The tourists within the 18-30 year range were less informative offering very basic descriptions of the climate whilethe tourists within the 40-60 year range went into more detail explaining the aspects of the climate they had noted. Those tourists who had visited before had been during the winter months and offered descriptions of the area being 'fairly rainy' and 'cloudy' most days, saying that the experience of the winter climate was that it was mild and these were descriptions mostly from local. There were a few tourists who described the area as being 'windy'. Three of the tourists that were from overseas countries stated that the climate was 'Mediterranean', this arose from information they had read whilst making their booking.

The perception of exactly how climate change would affect tourism to St Francis Bay and Cape St Francis was extensive. The storminess of the area is expected to increase resulting in big waves and this was described alongside flooding. Many of the tourists expect major damage to occur to the towns due to flooding, especially since a few of them had heard about previous flooding incidents. One such an

incident that a tourist mentioned was of Sand River which had washed away part of the Sand River bridgeon the R330. This was considered as a severe problem in the event the towns get closed off from neighbouring towns,therefore anyone injured in the flooding would not be able to get help easily. Sea level rise was stated by nearly all the respondents as being particularly dangerous, leading to flooding of the roads and beach front properties as well as damaging nearby infrastructure. It was also linked a few times to salinity, with the threat of fresh water resources being contaminated by the sea water and respondents suggested that this would result in water problems for the towns.

Another concern that was associated with sea level rise by the majority of tourists was the erosion of the beaches. If the beaches are eroded then tourism is expected to significantly decrease as it will lose its ‘major draw-factor’. One of the tourists brought up that changes in the ocean currents could occur and that it would ‘alter the weather inland’, thus making the weather conditions unattractive to tourists. Other threats from climate change to tourism included damage to the ecosystem and the marine life being threatened. These would affect the aesthetics of the area, while having a huge influence on the tourism activities on offer particularly fishing and snorkelling. All of these effects were considered consequences of climate change that will result in less tourists wanting to visit and in turn make area less appealing.

Nearly half of the respondents (24 tourists) make sure to check the climate of an area when planning a holiday. This is largely due to the planning of holiday activities, so they know what to expect and what tourist attraction options they have to enjoy. This was further explained by asking the tourists what kind of information they use to assess the climate, while the information is obtained through speaking to travel agents and also looking on the internet sites about the destination, the respondents use other means to assess the climate. The first addressing their purpose for visiting, again this involved the planning of activities. The second means was based upon their personal choice, depending on what kind of conditions they like with many mentioning they like warmer holidays, describing the typical ‘sun and sand’ holiday types, so they usually will travel to places that can provide this. Some tourists would travel to areas of colder climates to make a change from their usual hot climate

where they live. The last means of assessing climate was largely based upon the expected temperature. This weather variable was most commonly looked into in determine the projected maximum and minimum temperatures. However, this is linked to their personal choice, as they seemingly use temperature as a way to establish what they feel would fall into their level of thermal comfort.

4.3. Quantitative research

4.3.1. The Tourism Climate Index (TCI)

A TCI for the study sites was calculated in order to investigate the relationship between tourism and climate. The TCI demonstrates the overall climatic suitability of an area for tourism, especially for outdoor tourist activities, as it helps in understanding the influence that climate may have on the arrival of tourists and length of visits to the destination. The TCI scores for the two towns have an annual range of 73 to 86, therefore categorised as having a very good to ideal climatic suitability for each year annually. The long term annual averagefor the range of 73-86 in the 37 year period is found to be 80, classified as excellent by the rating category table. Over the last 5 year period, the climate is shown to have an average TCI score of 80.

The CID (maximum daily temperature and minimum daily relative humidity) and the wind had very high scores so contributed positively to the high TCI scores, whereas rainfall and sunshine hours negatively contributed to it with a mean score of 3.5 for both. The lowest score obtained overall was calculated for 1996, with rainfall being the factor that contributed to this low score as the rain score for this year was low because of a high level of rainfall which can be explained by high storms from the El Niño Southern Oscillation (ENSO) storms. However, the score for 1996 still remained within a classification of very good conditions. The annual TCI score calculated is shown in Table 11.

Table 11: Rating scores of the annual TCI's for the study sites since 1978.

Year	TCI Score	Year	TCI Score
1978	81	1997	77
1979	81	1998	82
1980	85	1999	82
1981	79	2000	82
1982	80	2001	83
1983	79	2002	80
1984	81	2003	79
1985	82	2004	82
1986	82	2005	83
1987	86	2006	82
1988	84	2007	80
1989	79	2008	79
1990	77	2009	79
1991	84	2010	84
1992	78	2011	73
1993	80	2012	75
1994	76	2013	86
1995	76	2014	82
1996	72		

Scores have been shown to fluctuate, experiencing intervals of increased excellent suitability and then periods where it has dropped back down. The years 1994 -1997 make up the longest period of low scores. The period of 1994-1995 and 1997 experienced warming events due to an increase in the sea surface temperature caused by a warming in the Benguela current system. This warming event moved South over Africa from Angola occurring with a lag of between one to four months (Roualt, 2013). In 1996 there was a La Niña event, however the recorded rainfall over the period of summer was fairly low when compared to the long-term average (Mpheshea&Rouault, 2013). The years indicated in yellow (excluding 1989 and 2003) were found to have slightly lower than average maximum and minimum temperatures. While other low scores indicated in yellow experienced a higher than average rainfall (1989, 2008 and 2009) (Appendix D).There is a weak change over time, as the correlation coefficient is -0.10264. The reason for this is because there are many outliers (Figure 19). The relationship can be described by the linear

regression equation: $y = -0.0313x + 142.79$. The rate of change is a 0.0313 decrease in the TCI score per year. Thus, the climate is slowly becoming less ideal for tourists.The driving factor behind this appears to be a slow annual increase in the overall mean temperatures and humidity for the area.

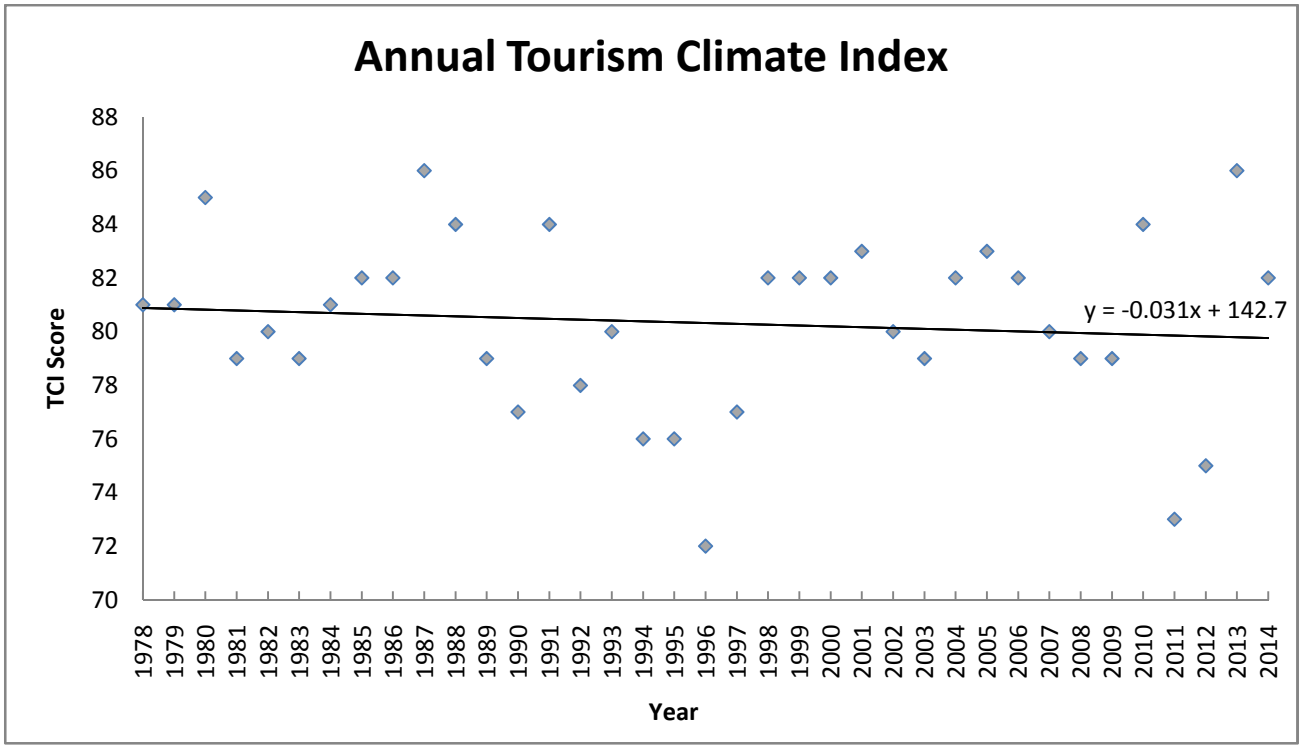


Figure 19: The annual trend of the TCI scores from 1978-2014 for St Francis and Cape St Francis.

The TCI scores were then calculated on a monthly basis to identify the trend of climate suitability for each month annually for the time period of 1978 to 2014 (Figure 20). The overall scores ranged from 81 to 95, therefore categorised as having an excellent or ideal climatic suitability all year round. The linear relationship gives the regression equation: $y = -0.0514x + 90.424$. The rate of change is a 0.0514 decrease in the TCI score for each month over the 37 year period. This indicates that the climate for each month is slowly becoming less suitable for tourists. The long term best season is summer (December to February), leading into autumn (March to May) with the highest TCI scores obtained.

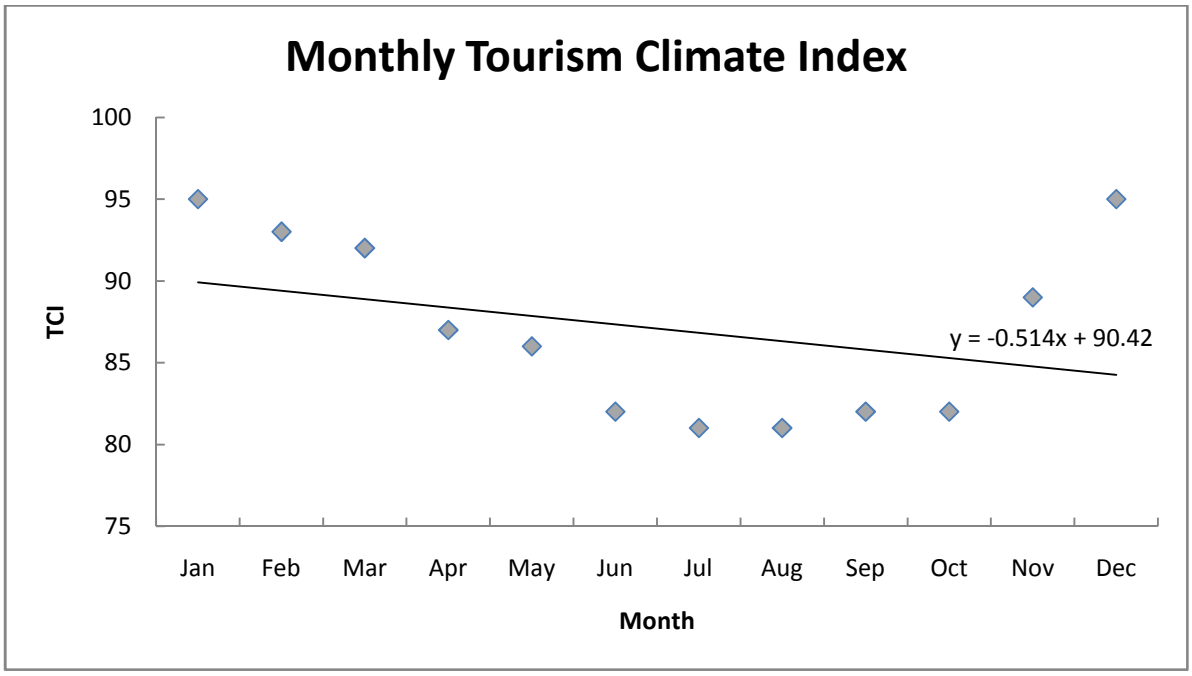


Figure 20: The monthly trend of the TCI scores from 1978-2014 for St Francis and Cape St Francis.

The summer months of January and December reflect the highest scores when averaged across the entire data period. While specific months are peak holiday periods, the TCI score shows that any of the months would have provided attractive conditions for tourists in the years 1978 to 2014, which is particularly well-suited for a coastal region and its accompanying tourism activities. The months of January, February, March and December have the overall highest scores that are all rated as ideal, indicating that these months would be the best for tourism. Despite the excellent conditions, it is noted that from June to October the TCI scores drop to their lowest. However, the graph indicates a 'winter peak' of seasonality. This means that despite the low score that the winter months have fairly favourable climate conditions for tourism (Amelung et al., 2007). All of the monthly scores fall within the range of scores from 70 or higher chosen by this research that would indicate that the study sites have a climatic comfort that would be attractive to tourists.

4.3.2. Digital Elevation Model

One of the major concerns of climate change in a low-lying coastal town is the effect of the sea level changes. The projected sea level rise for South Africa places the low-lying coastal towns at risk. Trends in sea level rise have been substantiated by measurements made in South Africa where evaluations of 50 years of data have shown a sea level rise of 0.42mm/yr on the West Coast; 1.57mm/yr on the South Coast and 3.55mm/yr on the East Coast (Goschen, 2011). An expected rate of change of 0.3mm/yr was determined, thus St. Francis Bay which lies on the south coast will experience a sea level rise of 1.57±0.3mm/yr which produces an estimate of a 0.4m rise by 2050 and a 1.6m rise in sea level by 2100 (Breetzke et al., 2008; Mather et al., 2009; Rouault et al., 2009; Stainforth et al., 2007).

The study sites are both located at particularly low elevation with St Francis Bay ranging from approximately 0 to 34m.asl and Cape St Francis ranging from approximately 0 to 15m.asl. (Eliassen, 2013). A DEM was created for the study sites to determine the impact of the projected sea level rise, on tourism. This research also uses this DEM to compare it with the perceptions of how the towns will be affected by climate change with scientific climate risks.The DEM was modelled to shown the areas of inundation of low-lying coastal land at the study sites based upon these expected rates of rise for the years 2050 and 2100.

Figure 21 shows the sea level passing the first border line of the town, this immediate area is the current beach. The DEM shows parts of the beach being pushed back by 2050. By 2100 sea levels will start to reach parts of the town near establishments such as houses and roads.By 2050 it is projected that the sea level rise will result in a large volume of sea water flowing into the permanently open Kromme estuary. St Francis Bay will lose at least half of its beach, as the beach becomes narrower especially the area located in front of the Sea Vista portion of the town. The canal system is primarily protected by the artificial spit, however the 0.4m level rise almost completely inundates the protective spit. The Santareme area of St Francis Bay is the least affected by the increase in sea level. The Marina Glades is the highest risk area for inundation by 2100. Despite the projected risk for Sea Vista, there is only one accommodation establishment located there that would be

vulnerable to potential flood damage. The Marina Glades has twelve establishments that may be affected, however two of these are located near the spit placing these at highest risk.

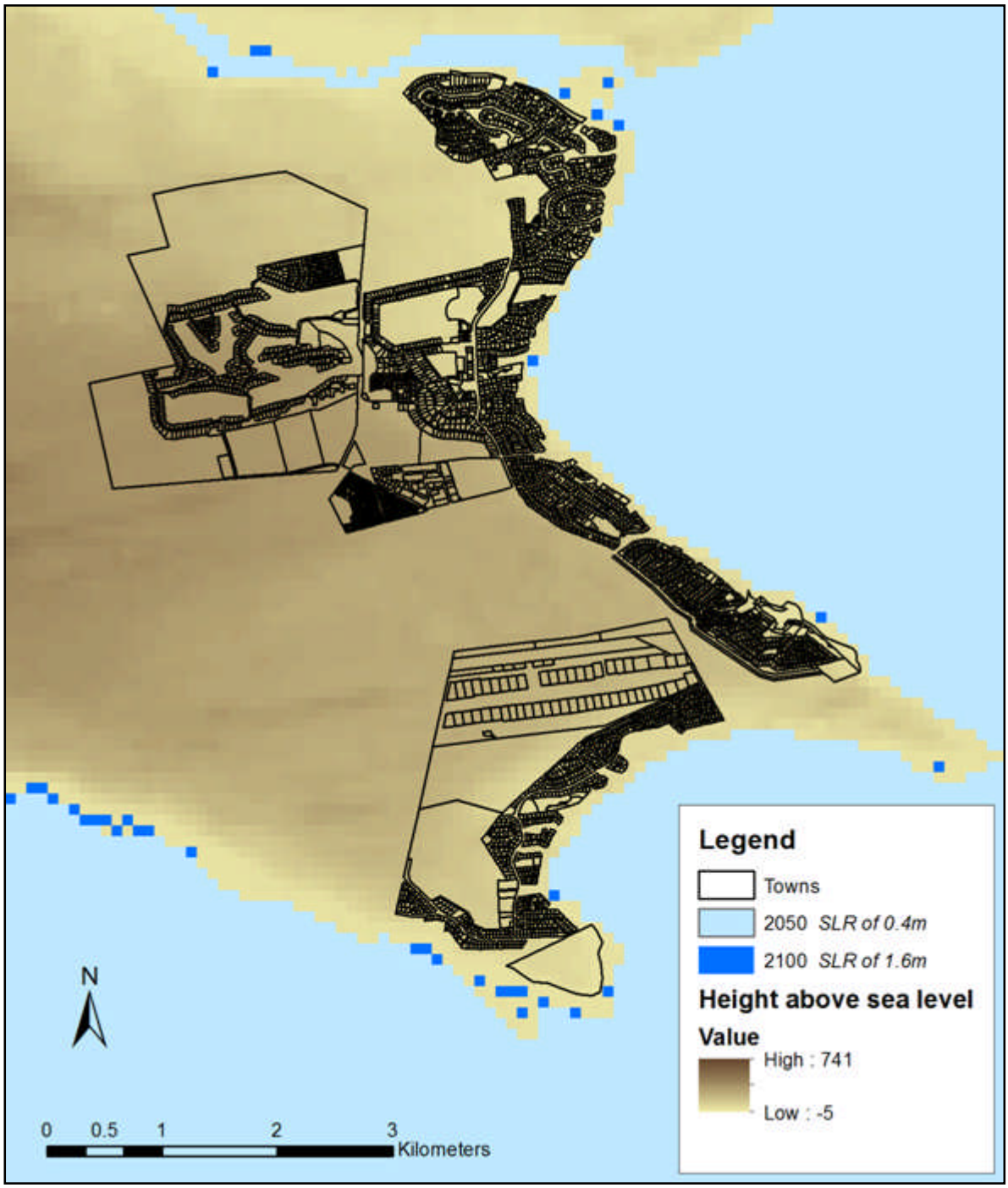


Figure 21: DEM illustrating predicted sea level rise for both towns for the years 2050 and 2100.

Cape St Francis will experience a loss of almost half of its beach area by 2050 as it gets narrower; however the town is still projected to not be at immediate risk from

sea level rise. This is not taking into account the events of storm surges. The 1.6m rise will result in partial inundation of the town located just behind the Seal Point Headland. At least three of the accommodation establishments are located behind this headland and will be affected, particularly in 2100 where the establishments will have no beach left in front of their properties. There are eleven accommodation establishments that are located along or very near to the beachfront, and if the beach becomes narrower by 2050, these establishments will be at risk from high tides and storm surges. It is interesting to note that while the towns will experience further damage by 2100, the majority of the damage will be felt by 2050.

4.4. Conclusion

The results reveal that the perceptions of climate change of both the tourists and the tourist accommodation establishments are quite similar. Despite both sample groups being aware of the changing climate, their attitudes overall appear to determine their behaviour. Many of the respondents agreed that the effects of a changing climate can already be felt which means that the climate of St Francis Bay and Cape St Francis could threaten the amount of tourists that visit. Climate was listed in the top five elements that make a holiday destination appealing. Many of the tourists felt that if the climate changed to such an extent that they could no longer enjoy the local attractions of the towns then they would have no desire to return. With the potential consequence of less tourists, this would severely affect both towns as tourism is their main economic driver. It would be expected of the tourist accommodation establishments to plan for this problem and find ways to address it.For the most part this does not seem to be the case.

The towns' biggest tourist attraction is their beaches. Many of the tourists visit in order to sun bathe and enjoy the many water sports and other water related activities such as going on boat trips around the canals. While the establishments are aware that climate change will have a negative effect on tourism, particularly to their towns, they are not that concerned with addressing the impacts through implementing mitigation and adaptation planning into their business. The common belief is that the government should take responsibility in addressing climate change and should work

alongside the tourism sector in creating mitigation and adaptation plans to assist the tourism operators.

The TCI showed that the climate for the study sites is very suitable for tourists based on comfort levels. The scores obtained showed that for the period 1978-2014 the climate was could be described as very good to ideal for tourism. The trend over the years shows that the TCI score is decreasing, which means that the towns will slowly become less attractive for tourism with regards to climate comfort. In determining which months of the year are the most suitable, it would appear that the summer months have the ideal climate; however the winter months still have a TCI score that would be described as excellent.

The DEM for the study sites indicate that the sea level rise could result in the beach retreating in St Francis Bay and the flow of the ocean into the Kromme estuary will likely cause the artificial spit to be washed away. If this occurs then the canal system will be left very vulnerable to storm surges and flooding. Cape St Francis is protected by the Seal Point headland and while the beach there will significantly get narrower, it is the area located directly behind the headland that is at the most risk from sea level rise damage. There are at least 13 accommodation establishments that are under threat from sea level rise, with 11 of them located in St Francis Bay and the remaining 2 located behind the headland in Cape St Francis. These quantitative aspects of climate change are compared with the perceptions obtained by the research in chapter 5.

5
DISCUSSION

5.1. Introduction

The research has investigated the perceptions of climate change and explored how this influences decision making in the tourism sector of small towns and the threats of climate change were tested scientifically. Chapter 4 presented the results of the research, separating the qualitative and quantitative findings. These findings were further divided into sections that provided insight into the tourists' perceptions and the tourist accommodation establishments' perceptions. The following chapter provides a discussion of the results, which expands upon the influence that climatehas on tourism and how individuals respond to the changes in this climate. The limitations of the research and how these may have influenced the data are discussed.

5.2. Empirical findings

Climate change is becoming an increasingly concerning problems for many sectors, particularly the tourism sector. This research explored the issue of climate change within the tourism sector as it is a major economic contributor. The study sites chosen for this research rely to a large extent on their tourism sector to drive their livelihood. The damage to the economy that climate change will likely have may have detrimental effects on the towns. While the threat of climate change on tourism has been investigated more frequently within the literature, there is very little research that integrates climate change and tourism within South Africa. What makes this research even more significant is its added component of the threat of coastal towns to climate change. A large amount of research has identified the vulnerability of coastal areas to climate change. This research is therefore important as it merges the vulnerability of the coastal area to climate change with that of the tourism sector's vulnerability to climate change. The towns of St Francis Bay and Cape St Francis were chosen for the research as they are most evidently identified to be at risk, particularly from sea level rise due to their low elevation. The results of

this research could infer potential risks that other coastal towns in South Africa may experience.

One TCI was calculated for the towns as they have a very similar climate. The long-term annual trend showed that the towns are experiencing a climate which is becoming less suitable for tourists. A change in the climate variables used in the calculation of the TCI was noted. The data obtained from the South African Weather Services showed a change in the average maximum and minimum temperatures. The long-term trend indicated that both the maximum and minimum temperatures were decreasing. While this currently is not a problem for the towns, in the future the decreasing temperatures will significantly affect the tourism comfort and will likely alter the tourism flow to the towns as conditions become colder. The tourism accommodation establishments have considered options to cope with changes in temperature, mainly colder weather as they would like to promote more indoor activities. However, the activities mentioned (such as using DSTV or DVD players will have a negative impact in the future as the electricity usage will increase and therefore contributing to climate change. The accommodation establishments also considered the use of air-conditioning systems for hot weather conditions, but this too will have a long-term negative impact through the production of Chlorofluorocarbons (CFCs) into the atmosphere and by using a large amount of energy.While CFCs are being phased out many of the substitutes used for refrigerants also release greenhouse gases.

The tourist accommodation establishments are not extremely concerned about the temperature changes to make any major changes to their business. The tourists were slightly more concerned about the temperature changes. It is evident from the interviews that the tourists all felt that they would travel to destinations with more suitable climate. While, they are not necessarily concerned with the temperature decreases at St Francis Bay or Cape St Francis, they are concerned about global temperature changes making holiday destinations less appealing. However, they have the benefit of simply choosing to visit an alternate destination should shifts in comfort levels occur. The tourist accommodation establishments should be far more concerned than they currently are, especially taking into consideration the observed

trend of the TCI. It is beneficial that they begin to implement adaptation measurements to their establishments such as making their business greener. They could implement their plans of increasing indoor activity and installing air-conditioning units but by shifting to using a renewable energy resource.

The rainfall changes that were identified by the weather data show a decrease in the long-term trend. The low rainfall is of a high concern for tourists visiting the towns. A decrease in rainfall will result in the area becoming drier and will negatively impact the water supply. Droughts may occur and this will have an impact on parts of the environment that are not able to withstand dry conditions, such as some of the flora in the nature reserve surrounding the towns and also the water supply for the fauna found in the nature reserve. This could also impact tourism as some nature-tourists will find activities such as hiking or bird-watching less enjoyable. The tourism accommodation establishments identified water resources as being extremely vulnerable to climate change but are not concerned with the potential decrease in rainfall as shown by the TCI, which they should be more concerned than they currently are. The establishments have had previous experience with high levels of rainfall and have dealt with the consequences of flooding and water damage to their business. Thus, their concern lies with the government implementing measures to combat potential flood risks, like securing the Sand River Bridge that has been washed away a number of times, rather than dealing with low future rainfall.

The relative humidity has increased slightly over the period of 1978-2014 as the temperature has decreased. High levels of humidity can cause tourists to sweat more and be tired. It will affect the thermal comfort factor of the towns and will deter tourists who enjoy active holidays and participating in the water sports on offer as the humidity will cause them to have less energy. Neither the tourist accommodation establishments nor the tourists were concerned about humidity caused by a changing climate. Tourists ranked higher humidity as having the second least level of influence over their decision to travel. While the effects of high humidity mentioned may have a negative impact on personal comfort, the rate of change in humidity does not appear to pose any major concern for affecting tourism for the towns in the near future.

The number of sunshine hours and wind are also important factors in determining tourist comfort. Both of these climate variables have a decreasing long-term trend. Reduced wind speeds could affect the wind powered turbines that are located in the wind farms of Eastern Cape, thus causing a higher reliance on power stations and the contribution to further climate change. Less sunshine hours will result in the sun's heating being less effective and aiding the lower temperatures, as well decreasing the length of the day. These climate variables are not currently worrying for the tourists or the tourist accommodation establishments, and while the scientific findings have observed the decrease in each variable, it is slow and not presently a significant factor that they need to adapt to. The sunshine hours and wind should however be considered in the long-term planning for tourist comfort when developing adaptation plans.

The rising sea level will likely impact 2 accommodation establishments in Cape St Francis and 11 establishments in St Francis Bay. The owners and managers of the accommodation establishments were the most concerned about this threat. Many have noted the beach already being eroded and this coastal retreat puts some of the beach front properties at risk. However, there did not appear to be a significant relationship between the location of the tourist accommodation establishments and their level of concern for climate change. It was initially expected that the establishments located along the beach front, in Port St Francis, along the Kromme River estuary and the canal system would be the most concerned about sea level rise. These establishments were thus considered first priority establishments when conducting the interviews, due to them having the highest potential risk. However, the establishments with the highest level of concern were fairly distributed in the towns, while some of the beach front establishments hadan overall low level of concern. This is fairly surprising considering the projected sea level rise shown on the DEM. A response of high concern for the establishments located along the canals of St Francis Bay was anticipated and responses showed a medium to high level of concern due to evidently low-lying nature of the canal infrastructure and the only protective measure being the artificial spit that was built along the mouth of the Kromme estuary. The artificial spit is expected to be completely inundated while

severe coastal erosion takes places. Some of the accommodation establishment owners not located in the canals were more concerned about this area being affected by sea level rise than where their establishment was located. One of them even stated that “A major danger is the spit which cuts the ocean from the canals. If the sea breaks through I think it will be a disaster for the canal houses. The spit is getting ever narrower.”

Certain areas of the towns are protected by sea barrier defences such as in the case of Port St Francis with a sea wall built around the port and tetrapods placed in front of this wall. While the Santareme and parts of Cape St Francis have large boulders placed on the beach in front of these areas. The establishments located behind these types of sea defences have the lowest levels of concern regarding climate change. The establishments could be completely confident in the sea defence barriers to protect them and this could explain their heightened sense of safety. Their confidence is not necessarily misplaced as projections for 2050 and 2100 show these areas to be significantly less affected by sea level rise, and in turn may be at less risk from storm surges and flooding. However, as noted earlier these types of sea defences appear to increase the level of sand loss experienced elsewhere along the coast which means sea defences can make nearby areas more vulnerable to the impacts of sea level rise.

One of the accommodation establishments provided photos they had taken in 2010. Both of the photos were taken at the same spot along the beach in front of Anne Avenue in St Francis Bay. Figure 22 shows the beach as it was in August, while Figure 23 shows at least 1m of erosion using some of the same rock on the beach as an indicator (circled).



Figure 22: The beach along Anne Avenue in St Francis Bay in August 2010.



Figure 23: The same spot in December 2010 showing about a 1m of erosion had taken place.

The owner described the beach erosion as being the worst ever and suggested two possible reasons for this. Firstly the Santareme area was built in an area that was previously a nature reserve that was 80% sand that used to feed the bay with sand.Secondly, the stands along the sea fronthave been built with multi-million rand houses and the owners have had no option but to protect their properties with tons of large rocks.The rocks make for a huge backwash at high tide further eroding the beach. Many of the owners felt the Santareme area should never have been built, but was built due to greed by the developers. As problems such as these arise, it would seem vital that the accommodation establishments start planning how they can protect their business against both the direct and indirect effects. Aside from planning for damage to the infrastructure of their business, the accommodation establishments will need to adapt soon to curb potential losses of revenue by maintaining a good tourist market. Coastal facilities and activities are highly vulnerable to sea level rise, and this may impact upon the towns' ability to sustain its tourism sector. This is especially significant in regards to the effects it may have such as flooding, as the tourists listed flooding as the number one factor under which they would cancel their booking and ranked their personal safety as the highest concern when considering a destination for a holiday. These are very influential factors which could impact the tourism sector in St Francis Bay and Cape St Francis. As the DEM showed that much of the damage will be felt by 2050 already, it makes it imperative that proper planning and adaptation begin.

The threat of sea level rise is the most concerning, especially given the high incidents of flooding in the town. While these flooding events were caused by heavy rainfall, the consequences of these floods give insight into how the towns may be affected in the future. The towns appear to be plagued by a very low level of drainage. This is evident is the amount of potholes in the roads during the time of the research fieldwork, almost 90% of the roads had potholes in them. While some roads had a few potholes in them, one road in Cape St Francis was particularly bad whereby an entire portion of the road was damaged and cars were forced to ride off-road in order to pass it. When interviewing the accommodation establishments many mentioned the potholes as a problem but were waiting for repairs to be done by a pothole team from Humansdorp. There is a pothole team specifically for St Francis

Bay and Cape St Francis, however this team does not have the necessary equipment to keep up with the level of road repairs needed. In 2011 after a period of heavy rainfall, the Kouga local municipality estimated that R35 million was required in order to be able to fix the roads in the St Francis Bay and Cape St Francis, as well their neighbouring town of Oyster Bay. Thus, a large portion of the establishments have experiencing problems with guests complaining about the ease of access. One of the accommodation owners had to personally fix the potholes in the small road leading to their establishment as the road was becoming too difficult to drive on.

Aside from the potholes, there are many other infrastructural problems in the towns, and the probability of climate change aggravating these problems is very high. For instance the flooding that previously occurred has washed away the Sand River Bridge numerous times in the period of a few years, often the towns are left stranded as their means of access is to other towns is lost. During these incidents, theProvincial Roads Department constructed a temporary causeway, however this causeway was further washed away and reconstructed twice before the Department installed a stronger structure. This structure was then tarred but was not tested under flood conditions, and was found to be unsuitable to cope if floods occurred to the same extent that they had previously. Especially as the dune fields aggravate the flood conditions by accumulating against the pipes installed in the causeway thus blocking them and preventing any drainage. A new bridge was called for, but the construction of this bridge was awaiting an Environmental Impact Assessment (EIA) so as to improve upon the previous bridge and make it more robust in coping with climate-related events in the future. The EIA thus far has identified that a bridge is necessary to elevate the route above its 1:100 year floodline. It has also identified at least three suitable alternatives for the development of a new bridge: a ‘suspended concrete bridge’, a ‘cast in situ cellular structure’ or a ‘cast in situ 3 span bridge’. However construction of the new bridge had not yet begun at the time of the research.

As certain areas may be impacted differently according to their location within the towns and the accommodation establishments may likely be affected in terms of infrastructure as well as business income. The owners and managers of the

establishments felt that climate change would have more of a negative impact on the towns as a whole than their individual business. This is most likely as many of the respondents had not personally experienced any previous damage to their property by any weather or climate related incidents. However, certain events that have affected the towns have made the individuals there more aware of potential threats and damage that may arise from such events. The most extensive events were that of the 2012 fires and the numerous flooding events. Efforts have been made to successfully respond to future occurrences of similar events, such as improved response of the fire department to the towns. As no fire station is present in the towns, the local residents volunteered to try and stop the fires until emergency services arrived. The fires were intensified by the strong south westerly winds. In January 2013, St Francis Bay acquired a fire truck from Humansdorp fire station as well as a large amount of equipment to assist their volunteers that will be used to service both St Francis Bay and Cape St Francis.

The majority of tourists and tourist accommodation establishments that were interviewed felt that the government and related authorities should be responsible for climate change planning and implementing mitigation and adaptation action. The Kouga local municipality, the Eastern Cape government and the Department of Environmental affairs were all contacted for information regarding their climate change strategy. After being put in contact with numerous representatives, they all declined to be interviewed once the topic of the research was discussed. As a result the research was unable to acquire any information on the climate change plans that would affect the study sites. Although, there are a few documents available to the public that address the topic of climate change for the area of interest. The Coastal Management Plan for Kouga local municipality, as drawn up by an environmental consultancy, suggests that all of the precincts follow a generic plan when addressing climate change. The generic plan states that the precincts should conduct research into the impacts of climate change on the local beaches, particularly sea level rise. It further states that the precincts will need to ensure that its infrastructure is capable of withstanding the effects of climate change such as flooding and storm surges. The infrastructure therefore should be investigated in terms of its design and its building materials. However, The Integrated Development Plan put forward by the

municipality, suggests that in managing the environment this planning needs to be integrated into addressing climate change, but is suggests that “This more the Department of Environmental Affairs function.” Both of these plans created for the Kouga municipality, suggest two different parties be responsible for addressing climate change.

It was found that tourists liked the idea of the accommodation establishments becoming actively involved in climate change adaptation and many stated that they would actually choose to stay at an establishment if they knew that it was making an effort to deal with climate change. Some of these respondents were even willing to pay higher accommodation fees in order to assist the establishment with the cost of developing adaptation strategies and implementing them. It is unexpected that the tourists showed this interest, despite not being overly concerned about the climate change effects on the towns, and also stating that they felt both the tourism sector and coastal communities were capable of dealing with climate change on their own. Perhaps the fact that the tourists would not be required to engage in any form of climate change action themselves is appealing, and thus they are happy to pay a fee if it allows them to avoid any responsibility. The responses to the questions that addressed how they felt about the accommodation establishments implementing mitigation and adaptation strategies could also be built upon a social obligation. This social obligation to care about climate change and the tourist accommodation establishments could have been caused by the identification of the main theme of the research.

The problem of social obligation and self-reported knowledge identified could influence the overall findings of the research. It is important to determine the perceptions of climate change in order to investigate the associated behaviour of individuals. The perceptions of both the tourists and tourist accommodation establishments do not appear to be based on a full understanding of climate change. A lot of the responses were given from opinions formed by small bits of information they had acquired over the years. While both groups that were interviewed are aware that the impacts of climate change may be damaging to the towns, they seem less aware at how high the level of threat is. The establishments can identify that

problems such as sea level rise may be threatening to the area, but do not seem to realise that their business is likely going to be at high risk to damage. Even more so, the research respondents are aware that the towns may experience problems in general but are not distressed by this possibility. The reason for this is the expectancy that such problems will likely be handled by third parties, which means they would not have to get involved. The level to which the tourists and tourist establishments are actually concerned about climate change is likely as a result of lack of personal experience with climate related events in order to understand the severity of the problem. It is also related to the perception that climate change will not affect them in the future as they assess their level of risk from their immediate circumstances and environment.

5.3. Comparison to the literature

The findings of this research were compared to the existing literature on climate change and tourism. It was found that a large portion of the results support previous findings, and this research can thus be seen as an extension of the existing research. The most evident finding was how dependent the tourism sector is on climate, even more so for St Francis Bay and Cape St Francis as the tourism sector is their primary economic driver and any change in the climate could significantly change the tourism sector there. Perch-Nielsen (2008) and Hernandez & Ryan (2011) described tourism as being highly vulnerable to climate change and it is clear that they have a directly proportional relationship. Previous research has indicated that the tourism sector is a large contributor to climate change. Many studies have focused on areas such as travel within the tourism sector and how long haul destinations may emit significant emissions (Scott et al., 2008). However this research was considered with tourist accommodation establishments and a study by Cole (2012) found that many accommodation establishments want to provide their guests with comfort and luxury but this often leads to the overuse of resources. During the interviews with the accommodation establishments in St Francis Bay and Cape St Francis, they were asked how they were planning to adapt. Many of the changes suggested installing air-conditioning units or promoting indoor activities and as mentioned previously, this will likely contribute to climate change through emissions and high energy usage. While the establishments want to make their

guests as comfortable as possible, it is a concern that they make worsen the situation by overusing energy resources.

A simple way of addressing climate change and avoiding overuse of resources would be to make their businesses greener. Some of the accommodation establishments were slowly starting to become more environmentally friendly through recycling and using energy efficient light bulbs. While the green changes may be currently minimal, the literature suggests that by adopting green practices and emphasising sustainability the tourism sector can be a key player in leading climate change adaptation strategies (Mukogo, 2014). The literature has also found that through making these changes tourism operators such as the accommodation establishments have the ability to educate their guests and encourage them to take part in environmental management initiatives (Pollock, 2008). Actions such as these will greatly aid the tourism sector in becoming more sustainable, nevertheless the findings from St Francis Bay and Cape St Francis indicate no current initiatives on behalf of the accommodation establishments to encourage guests to be environmentally friendly. There was a lack of planning and action from the accommodation establishments themselves thus possibly being the root of why they have not fully embraced environmental programmes for their guests as yet.

The perception context of this research could explain perhaps why the accommodation establishments have not been very active in climate change planning. Lorenzoni & Pidgeon (2006) found that the social context plays a large role in influencing the perception of risk of climate change.As found in previous literature the level of understanding of climate change was high and both the tourists and tourist accommodation establishments were interested in participating in adaptation against climate change but were not actually taking an active role to do so (Weber, 2010; Semenza et al., 2008; Spence et al., 2011). Potential reasons for this in this literature have been suggested as a lack of experiencing the consequences of climate change first-hand. It was also discussed earlier that social obligation could be a factor in explaining the responses given by the tourists and tourist accommodation establishments. The interest to participate may then be a result of understanding the impacts of climate change and feeling obligated to care. None of

the literature appeared to address this issue, and was concerned primarily with lack of action being linked to a lack of experience.

There is a lot of literature on the vulnerability of coastal cities to climate change (Nicholls &Lowe, 2004; Sherbinin et al., 2006), however most of these studies have focused on islands or major cities as opposed to small coastal towns. There is not a considerable amount of literature on South African coastal towns and this finding is supported by James & Hermes(2011) who stated that little in-depth research has been done from a South African context. Even less literature is available on the study sites that were used in this dissertation. This makes for comparing certain findings with previous literature difficult. McGranahan et al., (2007) noted that much of climate change research is now concentrating on individual issues with particular attention to sea level rise. This is one aspect of this dissertation that is easily comparable to previous literature, particularly as sea level rise was identified to be the biggest threat to the towns studied. However, Singh(2012) noted that as coastal tourism is one of the most popular types of tourism, there still remains a substantial knowledge gap in the assessment of how sea level rise on major tourism areas. The findings of this research on St Francis Bay and Cape St Francis address such an issue by investigating the effect of sea level rise of the towns through exploring the impacts on the tourism accommodation establishments and the potential changes to the tourism flows.

The literature that exists on sea level rise in South Africa suggests the rising sea levels will cause the groundwater system to be affected by saline intrusion (Theron, 2011). The DEM that was produced for this research showed that by 2050 the artificial spit across the mouth of the Kromme River estuary will be breached, and the increasing sea level will mean that there will be a high level of saline intrusion into the fresh water supply located in the study sites. It was found that there are some measures being put in place to cope with sea level rise, and these included the use of the tetrapods by the port and the placement of large boulders in front of some of the beach front properties to act as a sea defence barrier. Some of the accommodation establishments were not happy about this and suggested that these

sea defences were exacerbating the problem by causing considerable backwash and thus further erosion of the sand. This is not an unfounded claim as the literature too suggests that efforts to curb the effects of sea level rise are leading to other harmful impacts (Harley, 2006).

The findings from this research are supported by previous literature but are unique in the contribution it makes to the South African tourism and climate change research. It has been identified by many studies that a lack of adaptation will have severe negative consequences on the tourism sector. This will have a detrimental effect on the economy and the livelihoods of the people living in these tourist destinations. This is found to be true for St Francis Bay and Cape St Francis, and the inferred impacts to other South African coastal areas are worrying. Future research on the entire South African coastline will contribute to this research and therefore create literature in this context that may be comparable to future studies.

5.4. Relevance of the findings

The primary aim of the research was to explore the perceptions of tourists and tourist accommodation establishments of the threats of climate change. The knowledge of climate change is very high among the tourists and the tourist accommodation establishments, as is the perception of a changing climate having negative impacts. The tourists' and the accommodation establishments' perceptions are based upon climate change having significant impacts only in the future and this has resulted in little action taking place to address climate change. There is potential for many adaptation strategies to be implemented, however the necessary planning and decision making needs to integrate scientific findings with the perceptions in the tourism sector in order for this adaptation to take place. The perceptions of climate change when compared to the scientific findings of the TCI and the DEM do relate to an extent but the tourism sector in St Francis Bay and Cape St Francis needs to be more concerned than it currently is.

5.5. Conclusion

The research has explored the potential impacts that climate change will likely have on part of the coastal area in the Eastern Cape. It is evident that climate change will

have a significant impact upon the towns of St Francis Bay and Cape St Francis. There will be a long-term change in the climate variables resulting in the level of tourist comfort decreasing. The climate of an area is an important drawing factor to tourists and this decrease in tourist comfort will alter tourism flows as tourists begin to choose alternate holiday destinations in the future. The towns will be affected largely by sea level rise, with at least 11 of the 88 current accommodation establishments vulnerable to damage from climate change. It is important that adaptation occurs, however the action needed to do this is heavily influenced by perception. While the tourists understand and perceive climate change as a threat, they have the option of travelling elsewhere as opposed to addressing the problem. The tourist accommodation establishments perceive the threat on a temporal level, that it is far away and they will not be around to deal with the impacts and consequences of climate change, and thus it is not their responsibility.

6
CONCLUSION

6.1. Introduction

The aim of this research was to explore the perceptions of climate change within the tourism sector, specifically that of the tourist accommodation establishment operators as well as the tourists. This was investigated through understanding these groups' knowledge of climate change, their attitudes and beliefs towards a changing climate and how they are planning to respond. TCI outputs to describe the climatic suitability for tourism as well as a DEM with projected sea level rise were compared against these perceptions. This chapter focuses on the key findings of the research. Recommendations are suggested for future research that can be implemented by the tourism sector to assist in addressing knowledge gaps while providing information that can be useful in the planning for climate change as well as managing it. The research questions investigated the level of understanding of climate change, perceptions of short-term versus long-term effects and adaptation action that is being considered.

6.2. Key Findings

The following points highlight the key findings that were identified by the research and are explained below :

- St Francis Bay and Cape St Francis are at high risk from sea level rise

The towns have a very low altitude and are located very close to the coastline. While climate change may have many impacts on both towns, they are most likely at the greatest threat from sea level rise

- The tourism sector is the main economic driver for the towns

Tourism is extremely important for St Francis Bay and Cape St Francis as it the primary economic driver, which means that the potential effects of climate change on

this sector can have devastating consequences for their economy and the livelihood of the people that work within the tourism sector operating there.

- Influence of environment exacerbating climate change impacts

Factors which further worsen the problems arising for these coastal areas include the local coastal dune fields, beaches, and the Kromme River estuary. Both St Francis Bay and Cape St Francis have a fairly narrow beach, the influence of tides and storm surges in the future may dramatically erode the beach while damaging the towns' infrastructure along the coast. One of the biggest problems for the towns could result from the man-made structures put in place to assist with aspects of sea level rise. This includes the sea defences such as those placed by the Port and the Santareme area. Backwash caused from these defences significantly erodes the beach which is leaving the areas near this beach less protected.

- Climate change concern does not match action

The level of concern expressed about climate change by the tourists and tourist accommodation establishments is fairly high as they are quite familiar with the term and its potential impacts. Despite this, it appears there remains a lack of action in addressing climate change through implementing adaptation methods. Instead of employing anticipatory adaptation, many of the establishments have yet to even consider planning for climate change and instead are going to engage in reactive adaptation which they will implement once climate change impacts upon them.

- The long-term threats are held as the government's responsibility

Overall the tourists and tourist accommodation establishments agreed that the government is responsible for planning and implementing a strategy for climate change. Suggestions included addressing threats such as sea level rise through implementing sea defence barriers which be put in place by the government and local municipality.

- The short-term threats are perceived as manageable

The establishments do not currently feel as if the short-term threats will make a significant impact upon their business and are planning to make use of simple solutions to ensure that their business caters for a change in weather conditions. These short term solutions involved encouraging increased indoor activity in colder months while changing aspects of their establishment to be greener.

- None of the establishments had considered relocating

Climate change is only expected to significantly affect the towns in the next century, and many of the owners felt they would not be around to experience these effects and therefore were not concerned about responding to it. Thus, a temporal aspect of perceiving climate change is evident with none of the establishments' considering moving their business to a site that may be less impacted by climate change effects such as sea level rise.

- Tourism will likely decrease

If that climate changes or further impacts upon other tourist attractions at the destination then the tourist arrivals will likely decrease. The towns currently have on offer a large variety of water related activities. All of these activities will likely be modified in response to the climate. This may be in terms of the loss of appeal to tourists, the extent to which they operate or even ability to offer them at all. It was highly stated that the tourists would no longer visit the towns if these kinds of tourist activities were affected. Tourists also stated a variety of weather conditions that would likely make them cancel their booking. All of those weather conditions may worsen under a changing climate for St Francis Bay and Cape St Francis.

- TCI and DEM indicate poor climate and increasing threat of sea level rise

While the average score calculated for the annual TCI is found to be 80, which is classified as excellent by the rating category table, the long-term trend in the climate is becoming less ideal for tourist comfort. This is most likely attributed to increasing temperatures which will result in the towns becoming less attractive as a holiday destination. The DEM indicates that much of the damage from sea level rise will be felt by 2050, with the beaches of both towns becoming narrower and the artificial spit that protects the canal system of St Francis Bay being completely washed away. At least 11 accommodation establishments are at threat from the immediate sea level rise, while the remaining establishments will likely be affected by storm surges and flooding events.

6.3. Limitations of the research

6.3.1. Owner presence

During the fieldwork process it was discovered that both towns have a primarily tourism function and thus many of the accommodation establishments are not owned by locals and are instead serving a holiday home function. As a result it was found

that many of the owners instead only operate their business during peak holiday season. Their lack of continuous presence may affect their perception of the impact that climate change has on their establishment, as they are not experiencing the full force of any climatic changes that are taking place nor their associated problems. As a result their absence may affect their overall concern and response to thesituation.

6.3.2. Sample size

The sample size of the research was limited to the available tourist accommodation establishments in the towns and even more so by the establishments that were willing to participate in the research. The aim of this research was to investigate the relationship between tourism and climate change through a perception-based approach in St Francis Bay and Cape St Francis. While this was achieved, the research would have benefited from a larger sample size to improve the level of analysis and better represent the perceptions and related behaviours in response to climate change.

6.4. Recommendation for future research

This research focused on two of the small coastal towns located in the Eastern Cape. The first recommendation is that there are opportunities for similar studies to be carried out across the entire coastline of South Africa, as this will give insight into how different parts of the coastline may be impacted and the effect on the towns located along the coastline as this will have major impacts on South Africa's tourism economy. It could also identify whether an area or province has a climate change strategy in place and if this strategy is going to be feasible in the long term. This dissertation only represents an attempt to explore the perceptions of one tourism business – the tourism accommodation establishments. Thus, a second recommendation would be that further investigation could be aimed at addressing other types of tourism businesses, such as local transportation companies, restaurant owners or even tour operators. Their perceptions could be useful at gaining insight into the difference between types of businesses as well as acquiring an overall perception of the tourism industry within a town. Both of these recommendations could make use of a TCI and DEM for comparison against perceptions as done in this research, there are also opportunities for other types of

modelling and projections to be used. The findings of all this type of research could be useful in contributing to South Africa's climate change knowledge and identifying the level of vulnerability of the coastal areas. Therefore, the research may act as a foundation for future research to build upon and be beneficial in assisting the tourism sector in developing improved climate change plans in managing the likely consequences of a changing climate.

6.5. Conclusion

The research aimed to explore the perceptions of tourists and tourist accommodation establishments of the threats of climate change, and in doing so has an impact on tourism research and tourism geography in South Africa. It merges the fields of tourism and climate change in South Africa and there is an urgent need for this type of research to be taken seriously especially given how big a role the tourism sector plays in the South African economy. If mitigation and adaptation are not taken seriously and implemented into planning of a strategy for the future, it will have national and international implications. This is especially relevant as the impacts on climate change on the tourism sector can have detrimental effects on the South African economy.

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APPENDIX A: Tourism accommodation semi-structured questionnaire

St Francis Bay and Cape St Francis Accommodation Questionnaire

Name: ……

Gender: Male ☐ Female ☐

Age:

18-30	31-40	41-50	51-60	61-70	71 and over

Name of accommodation establishment:
……..

Position at accommodation establishment:
……..

Address:
……
……..
……

Telephone: ……

Fax: ……

E-mail: ……

Website: ……

Please read each of the following questions and select the answer most appropriate to you.

About your establishment

1.1. How long have you had the establishment?

……

1.2. How close is your establishment in relation to the sea?

……

1.3. What is the peak period of occupancy at your establishment?

……

1.4. On average, what is the total number of occupants annually?

……

1.5. Where are the majority of your guests from? *(South Africa, Africa, Overseas countries)*

……

Climate Change issues

2.1. I have heard of climate change

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.2. The world's climate is changing.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.3. Climate change is a cause for concern.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.4. When, if at all, do you think the world will start experiencing the effects of climate change?

We are already feeling the effects		In the next 100 years	
In the next 10 years		Beyond the next 100 years	
In the next 25 years		Never	
In the next 50 years			

2.5. Climate change will negatively affect...

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
...My business					
...St Francis Bayor Cape St Francis in general					

2.6. In the last 5 years, has your establishment has experienced a form of weather caused damage (including to your building, garden or vehicles)?

Yes	No

2.7. If yes, please elaborate:

……
……
……
……

2.8. What **impacts**, if any, do you think climate change may have on your accommodation establishment?

……
……
……
……

2.9. The following parties should be responsible for taking action against climate change:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Environmental groups					
Individuals and their families					
Industry/ Companies					
Local authorities					
The Tourism Sector					
State Government					
National Governments					
The International community					

2.10. Please list the following three natural threats as well as the following three anthropogenic threats in order of severity:

Natural threats	Order of severity	Anthropogenic threats	Order of severity
Sea level rise		Pollution of estuary and ocean	
Flooding		Damage to coastal dunes	
Coastal erosion		Fires	

2.11. How do you think climate change will affect tourism to St Francis Bay and Cape St Francis?

……
……
……
……

2.12. Do you think climate change could impact on tourist accommodation establishments?

……

2.13. What do you feel the local government should do to deal with the effects that climate change may have on tourism in St Francis Bay and Cape St Francis?

……
……
……

2.14. What do you feel the tourism sector should do to deal with the effects that climate change may have on tourism in St Francis Bay and Cape St Francis?

……
……
……

2.15. What measures have you / will you put in place to deal with all possible threats of climate change?

……
……
……
……
……

2.16. What priorities rank higher to your business than climate change adaptation?

……
……
……
……

APPENDIX B: Tourist semi-structured questionnaire

St Francis Bay and Cape St Francis Tourist Questionnaire

About you

1.1. Are you:

Male	Female

1.2. Please indicate the age bracket you are in:

18-30	31-40	41-50	51-60	61-70	71 and over

1.3. Where is your permanent residence?

……

1.4. What is your marital status?

Single	Married	Widowed	Divorced	Separated

1.5. What is your highest qualification obtained?

Less than Grade 12 (Matric)	
Grade 12 (Matric)	
Bachelor's degree	
Honours degree	
Master's degree	
Doctoral degree	
Other:	

1.6. What is your current occupation?

……

Climate Change issues

2.1. I have heard of “climate change”.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.2. Climate change is a cause for concern.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.3. The world's climate is changing.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.4. Climate change is caused mostly by human activity.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.5. Climate change is caused mostly by natural processes.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

2.6. When, if at all, do you think the world will start experiencing the effects of climate change?

We are already feeling the effects		In the next 100 years	
In the next 10 years		Beyond the next 100 years	
In the next 25 years		Never	
In the next 50 years			

2.7. Where have you heard about climate change? *Tick as many as you feel apply:*

Television		Specialist publications/academic journals	
Radio		School/ college/ university	
Newspaper		Government agencies/ information	
Internet		Public libraries	
Environmental groups (e.g. Worldwide Fund for Nature)		Friends/ family	
Energy suppliers		Local council	
	Other *(Please write in)*		

2.8. Please rank a set of environmental problems in order of what **you feel** to be MOST important to LEAST important: *1 = least important; 10 = most important.*

Problem:	**Rank:**
Water shortages	
Pollution	
Water quality	
Drought	
Climate change	
Salinity intrusion (sea water mixing in fresh water resources)	
Erosion	
Heat waves	
Flooding	
Sea level rise	

2.9. Please rate how vulnerable you feel each of the following sectors would be to climate change?

Sector:	**Not at all vulnerable**	**A little vulnerable**	**Moderately vulnerable**	**Very vulnerable**	**Extremely vulnerable**
Natural ecosystems					
Energy security					
Agriculture & forestry					
Water security					
Health					
Infrastructure					
Tourism					
Coastal communities					
Sustainable development					

Tourism issues

3.1. What holiday types do you normally enjoy?

……
……
……

3.2. Please rate how important each element is to you when choosing a holiday destination:

Element:	**Not at all important**	**Slightly important**	**Important**	**Fairly important**	**Very important**
Personal safety & security					
Destination is easily reached					
Cleanliness of destination					
Unspoiled nature					
Climate conditions					
Diversity of cultural/historical attractions					
Quality of accommodation					
Friendliness of local people					
Shopping possibilities					
Night life & entertainment					
Opportunity for rest					
Recreational & sport facilities					

3.3. What type of holiday accommodation are you most likely to choose?

Hotel	
Lodge	
Guest house	
Bed & Breakfast	
Self-catering	
Holiday home	
Backpacker hostel	
Camping / caravan park	

3.4. Why do you like this type of accommodation?

……
……
……

3.5. I would be willing to pay higher accommodation prices to assist with the costs associated with adapting to climate change.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

3.6. I would choose a particular accommodation establishment based upon whether they are actively involved in adapting to climate change.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

3.7. What level of influence would changing weather conditions have on your decision to travel to St Francis Bay or Cape St Francis?

	No influence				Huge influence
	1	2	3	4	5
Increased rain					
Increased temperature					
Higher humidity					
More Storms					
High winds					
Poor visibility					
Flooding					
Wave conditions change					

3.8. Under which of those above mentioned conditions would you cancel your accommodation?

……
……
……

St Francis Bay and Cape St Francis

4.1. Are you staying in St Francis Bay or Cape St Francis?

……

4.2. If not, where?

……

4.3. Which accommodation establishment are you staying at?

……

4.4. Why did you choose to book at this accommodation establishment?

……

4.5. Have you stayed at St Francis Bay or Cape St Francis or surrounding areas before?

……

4.6. Are you staying at a different place as opposed to your previous visit to St Francis Bay or Cape St Francis or the surrounding areas?

……

4.7. If yes, why did you change this time?

……
……

4.8. Why did you choose to visit St Francis Bay or Cape St Francis?

……
……
……
……

4.9. I would still visit St Francis Bay or Cape St Francis if the above mentioned was no longer relevant.

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree

4.10. How would you describe the climate of St Francis Bay and Cape St Francis?

……
……

4.11. How do you think climate change will affect tourism to St Francis Bay and Cape St Francis?

……
……
……

4.12. Do you check the climate conditions before making an accommodation booking?

……

4.13. What means of information do you use to assess whether the climate conditions of an area are within your comfort level?

……
……
……

4.14. Where would you travel to as an alternative to St Francis Bay or Cape St Francis should the climate conditions become unfavourable?

……
……..

APPENDIX C: Consent and participant information form

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http://www.wits.ac.za/geography/

Dear Sir/ Madam,

Perceptions of climate change

I am currently a Masters student at the University of the Witwatersrand undertaking research based around the perceptions of climate change. The aim of the project is to identify what the tourist accommodation establishments and tourists think about climate change and what adaptation strategies they have in place to deal with any effects of climate change they may experience. The research focus is on tourist accommodation establishments located within the towns of St Francis Bay and Cape St Francis, as well as the tourists visiting these towns.

Your help and assistance in completing the following questionnaire will be invaluable for the research. Please note that all information acquired will be treated as confidential and the data will be destroyed upon completion of the research. You have the right to withdraw from the study at any time should you wish. It is also important to that you know that there will be no payment for participation.

Should you have any queries or concerns about the survey, please do not hesitate to contact me on the e-mail address provided.

Thank you very much for your help.

Kind regards

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APPENDIX D: Annual climate variable log

Data was sourced from the South African Weather Services (2014).

Year	Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)	Rainfall (mm)	Min Humidity (%)	Mean Humidity (%)	Sunshine (hrs)	Wind (m/s)
1978	20.33	14.30	17.32	53.43	77.38	82.00	7.83	6.92
1979	20.15	14.19	17.17	57.88	76.49	81.41	7.93	6.63
1980	20.59	14.28	17.44	49.06	77.67	81.45	9.96	6.93
1981	20.23	14.25	17.24	74.18	78.97	83.58	7.76	6.84
1982	20.08	13.86	16.97	54.19	76.90	81.03	7.92	6.76
1983	21.13	14.70	17.91	61.99	76.94	81.94	7.58	6.63
1984	20.25	14.48	17.36	49.20	78.26	82.57	7.69	6.74
1985	20.28	14.60	17.44	46.12	81.45	7.69	7.28	6.21
1986	20.39	14.53	17.46	48.28	81.16	85.12	7.75	6.23
1987	20.52	14.92	17.72	52.63	81.55	7.09	7.52	5.98
1988	19.92	14.26	17.09	36.73	82.34	85.94	7.39	6.53
1989	19.68	13.93	16.81	41.30	78.98	19.92	7.67	6.16
1990	19.58	14.22	16.90	46.87	77.33	82.39	7.63	6.47
1991	20.36	14.93	17.64	37.01	78.03	82.98	7.63	6.21
1992	20.52	14.68	17.60	74.43	76.93	81.28	6.50	6.34
1993	20.66	15.03	17.85	65.95	79.52	84.25	7.60	6.15
1994	19.63	14.43	17.03	61.13	78.53	81.28	7.38	6.36
1995	19.45	14.16	16.80	58.66	81.00	7.57	7.18	6.20
1996	19.69	13.81	16.75	77.94	78.48	14.43	7.55	6.38
1997	19.80	14.53	17.16	54.41	76.98	19.45	7.60	7.14
1998	20.04	14.55	17.30	54.75	77.67	82.24	7.79	6.35
1999	20.62	15.03	17.82	53.68	77.81	82.26	7.79	5.97

2000	20.31	14.63	17.47	49.58	77.24	81.39	7.71	6.60
2001	20.35	14.80	17.58	37.74	77.83	7.79	7.63	7.22
2002	20.14	14.50	17.32	60.83	77.53	82.26	7.73	7.53
2003	20.64	15.07	17.85	61.61	78.41	7.80	7.80	6.45
2004	20.66	14.35	17.50	53.81	80.49	84.48	7.69	6.83
2005	20.61	14.27	17.44	40.27	76.88	20.14	7.91	7.07
2006	20.51	14.41	17.46	45.16	77.55	81.37	7.13	6.41
2007	20.60	14.36	17.48	63.78	72.62	77.10	7.88	6.51
2008	19.82	13.78	16.80	41.75	75.48	79.49	7.83	5.95
2009	19.72	13.93	16.83	34.28	73.46	78.24	7.78	6.47
2010	20.08	14.43	17.25	37.33	74.48	78.92	7.33	6.18
2011	19.24	13.63	16.44	76.88	75.01	79.03	7.34	6.40
2012	19.67	13.83	16.75	73.25	76.89	81.07	7.53	6.42
2013	20.21	13.99	17.10	43.87	75.32	79.96	8.26	6.22
2014	20.36	14.06	17.21	51.73	75.99	79.89	7.53	5.94