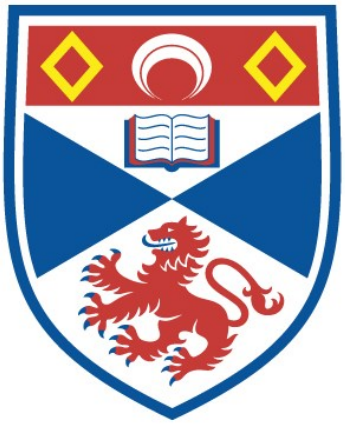
ADAPTATION TO THE IMPACTS OF CLIMATE CHANGE IN SMALL ISLAND COMMUNITIES: AN ANALYSIS OF SCOTTISH CASE STUDIES

Fiona Cunningham

A Thesis Submitted for the Degree of PhD
at the
University of St Andrews



2019

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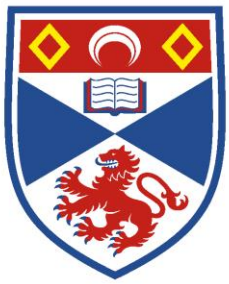

This thesis is submitted in partial fulfilment for the degree of
Doctor of Philosophy (PhD)
at the University of St Andrews

September 2018

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Acknowledgements

A doctoral thesis is submitted with one named individual on the front cover. However, numerous people have been instrumental, in one way or another, to the production of this thesis. First and foremost, my primary supervisor Dr Timothy Stojanovic has provided invaluable insight, support and guidance. Under his careful direction and supervision, it was possible to navigate the challenges and complexities associated with the research. Tim's flexible approach to leadership has given me the opportunity to explore various avenues within the study and has, in turn, allowed me to steer the research process. His detailed knowledge, positive attitude and tireless encouragement have helped me through to the end. I should also extend thanks to Dr Richard Bates, the secondary supervisor for this research. Furthermore, my gratitude goes to both MASTS and ClimateXChange for funding the research. I would also like to thank MASTS Coastal Zone Forum for the provision of further grant funding that enabled field visits to the case studies.

A very large portion of credit must be given to the communities in Unst, South Uist and Westray, particularly the individuals who participated in workshops and focus groups. Thank you for taking the time to share your stories and experiences with me. Your voices have been fundamental to this research. Without you, there would be no thesis. Moreover, my sincere gratitude to community members in the case studies who shared off-record anecdotes and stories, and who made me feel so welcome in their islands. Thanks must be given to those who acted as key gatekeepers in the case studies as well as Shetland, Orkney and the Outer Hebrides more broadly including community development officers, coastal zone managers, marine planners and community council chairpersons. Additionally, thanks to students and staff at the University of St Andrews who assisted in facilitating workshops in the case study islands.

I have been fortunate enough to have a strong support system around me during this process. There are several colleagues, friends and family members who deserve special mention:

Special thanks to Liam O'Brien and Emily Gal: two unwavering sources of moral support. 'Colleagues' on paper, but in reality two wonderfully supportive friends. Thank you for being there through every challenge, crisis (minor or otherwise) and triumph. You both brought light to some considerably bleak days and it is difficult to imagine what this process might have been like without your support.

My sincere gratitude to Dr Rachel Hardie: a person who truly understands the tribulations involved in undertaking such a mammoth piece of work. It is incredibly reassuring to have someone in your corner who knows what it takes to do a PhD and will listen to your deliberations without judgment. Thank you for your advice, your sympathetic ear and most of all your friendship.

I would like to express an enormous thank you to William. It is rare to find someone with such inherent patience and positivity. You have tolerated so much

throughout the entire process. You have held my hand firmly (figuratively and sometimes literally) through each step. Thank you for listening to every problem, no matter how small or insignificant, and for helping me to maintain perspective on the important things in life.

Lastly, I would like to extend special recognition to my family, particularly my parents, who have continually taught me the value of hard work and perseverance by their own example. Undertaking this piece of work has not been an easy task. Thank you for encouraging me to keep going and reminding me of what I was working for, even when I had forgotten. I am forever grateful for your support.

Abstract

The IPCC have identified small islands as high-risk settings facing adverse impacts of climate change, particularly flooding and storm surge, with potentially detrimental consequences for human wellbeing and livelihoods. The Scottish Islands are peripheral locations that are physically exposed to storms and coastal flooding; the frequency and magnitude of which are likely to be exacerbated under changing climatic conditions. Key questions remain about the issues, capacity and priorities of small island communities for adapting to climate change impacts. The research seeks to review and develop theory on the scale of adaptation measures and considers: the appropriateness of top-down versus bottom-up approaches within small island contexts; the role of participatory processes and utility of scenario-based tools in island adaptation; and the effectiveness of 'one-size-fits-all' adaptation planning where local priorities differ significantly. Communities in South Uist (Outer Hebrides), Westray (Orkney) and Unst (Shetland) formed a multiple case study approach. Policy mapping, documentary analysis and deliberative workshops were employed to develop initial background understandings of each case study. Empirical evidence was drawn from focus groups (N=9) which explored local perspectives on issues and priorities for adaptation in the case study communities. The findings highlight that place-based issues and priorities exist within the case studies, with significant variation across all cases despite the communities being of similar population, demographic profile and island context. The research contributes to debate on one-size-fits-all adaptation planning and supports the argument that national adaptation strategies can only be effective in small islands if local issues are understood. The findings support the integration of top-down-and-bottom-up approaches as a pathway for effective adaptation in small island settings. Deeper knowledge of the interface between community-based action and strategic policy in cross-scale climate change governance processes is developed and there is scope to apply a similar approach to understand adaptation planning priorities in other small island locations.

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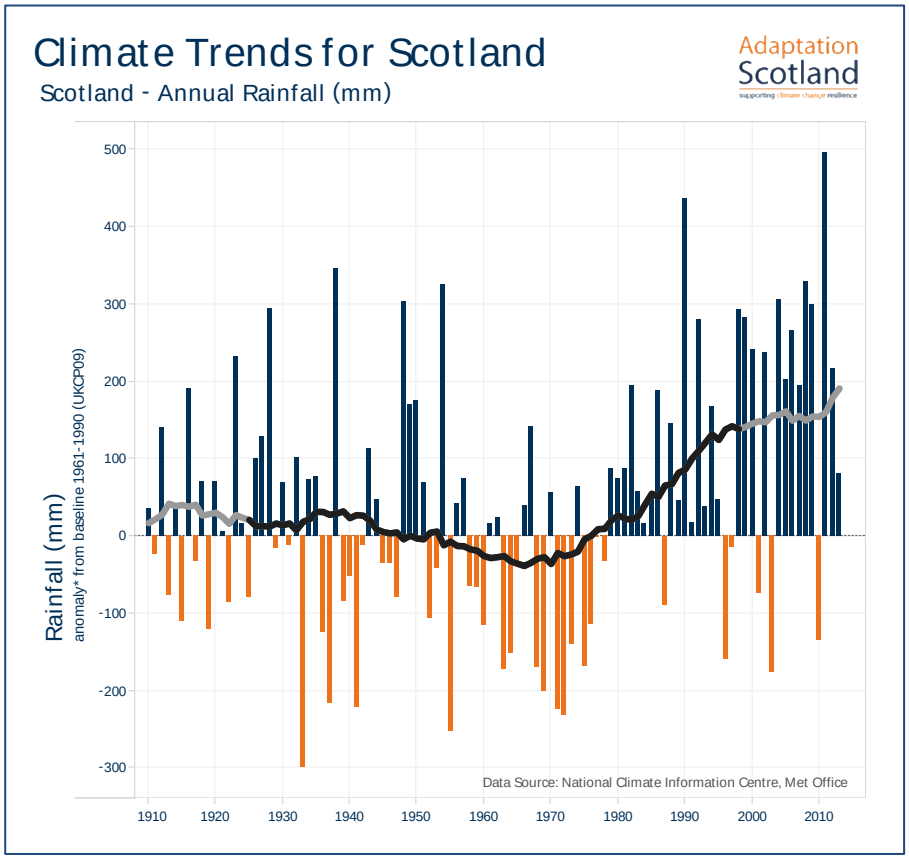
Chapter 1: Introduction

1.1. Rationale and Key Concepts

1.1.1. The Scottish Islands and Climate Change

Change in global climate is leading to adverse climatic hazards and impacts from the scale of the global earth system down to the everyday practices of local communities. Adverse impacts from climate change have harmful consequences for society ranging from: loss of livelihoods due to ecological change; to infrastructure damage due to environmental change such as rising sea levels; or increased mortality due to higher frequency and intensity of events such as storms and floods. For coastal and low-lying regions specifically, the Intergovernmental Panel on Climate Change (IPCC) have projected that sea level is rising globally as a result of climate change and will continue to do so into the future. It is expected with 'very high confidence' that continued sea level rise will increase the severity of erosion, flooding and submergence within coastal settings (IPCC, 2014b). The IPCC have reported that small islands are at a particularly high level of risk to the adverse impacts associated with sea level rise such as flooding and storm surge, especially in terms of harm to human wellbeing and livelihoods (IPCC, 2014b).

At the UK scale, the Committee on Climate Change report that the UK has seen a 15-20cm average rise in sea level since 1900 with a further projected rise of 50-100cm by the year 2100. The Committee indicate that flood risk is "the greatest direct climate change-related [threat] for the UK" alongside increasing temperature (Committee on Climate Change, 2017, p.3). Exposed communities are particularly vulnerable and will experience intensified flooding and coastal change in future as sea level continues to rise. The UK Climate Projections 2009 (UKCP09) highlight that average UK precipitation and wind speeds are currently increasing alongside rises in temperature and sea level. In Scotland, impacts of climate change are already being experienced with tangible increases in sea level, extreme weather, temperature and rainfall. Figures 1.1 and 1.2 illustrate the average trend of increasing rainfall and temperature in Scotland since 1910 according to Met Office data gathered and presented by Adaptation Scotland in 2014. Sea level rise has led to increased erosion and flooding in some areas of the Scottish coastline. These impacts have been, and will continue to be, particularly problematic for communities living in coastal areas with potentially negative consequences for human wellbeing, livelihoods, local economies, infrastructure and cultural heritage (Adaptation Scotland, 2016a). Furthermore, the frequency and intensity of extreme weather events in Scotland is projected to increase with similar negative consequences for coastal communities. It is clear that coastal and island communities, particularly those that are small, exposed and sensitive to change, will bear the brunt of the negative consequences of sea level rise and extreme weather events as a result of climate change.



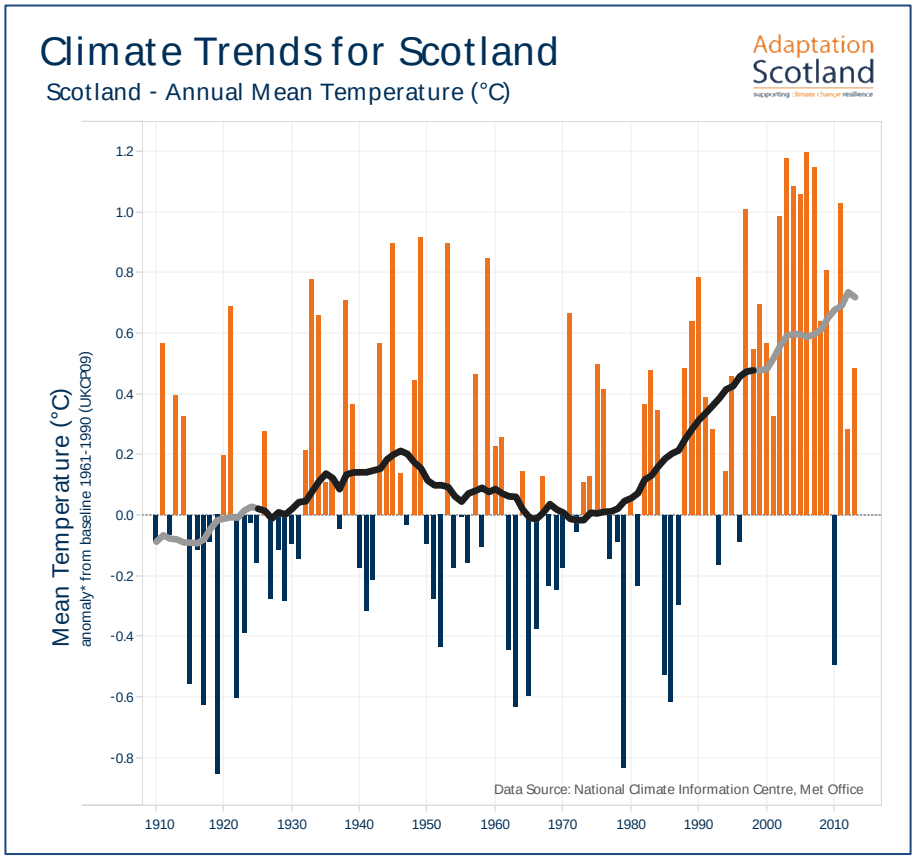


Figure 1.1: The average rainfall trend for Scotland since 1910 (Source: Adaptation Scotland; left) and
Figure 1.2: The average temperature trend for Scotland since 1910 (Source: Adaptation Scotland; right)

The Scottish Islands are peripheral locations that are physically exposed to severe storm events and coastal flooding. Of the inhabited Scottish isles, 93 islands are home to 103,700 people according to Scotland's Census 2011, spread over a geographic region of approximately 10,300km^2. Climatic hazards have significantly affected the Scottish Islands over recent decades. For instance, a severe storm hit Shetland between 31 December and 1 January 1992 where gusts of 172mph were experienced. The event caused two fatalities in Unst and structural damage across Shetland. The storm of 11-12 January 2005 is another example of a climatic event that significantly affected the Scottish Islands, particularly the southern isles of the Outer Hebrides (see Section 1.3.3). More recently, Storms Gertrude and Conor affected the Scottish Islands in January and December 2016 respectively. Wind gusts in excess of 80mph were recorded across Shetland, Orkney and the Outer Hebrides resulting in disruption to energy and transport infrastructures as well as property damage. The Scottish Islands are at risk of increased coastal flooding, erosion and severe weather under changing climatic conditions. Climate hazards and impacts could worsen in frequency and severity as climate continues to change into the future with potentially adverse impacts for coastal areas in Europe's northern periphery, including communities living in the Scottish Islands (McClatchey *et al*. 2014). There is a need to understand the impacts and consequences of climatic hazards for Scottish island communities and to investigate how best to adapt to a changing climate in small island settings.

1.1.2. Adapting to the Impacts of Climate Change in Scottish Island Communities

Key questions remain about the issues, capacity and priorities of small island communities for adapting to impacts of climate change. The social, economic, cultural and infrastructural aspects of small-island life are markedly different for some remote communities in the Scottish Islands in comparison to mainland locations. The inclusion of community-level experiences and knowledge, particularly in peripheral communities, could lead to more effective adaptation in small island settings (Kelman, 2010). Identifying and understanding the ways in which small island communities prioritise climatic and non-climatic factors for adaptation could be beneficial for planning and implementation. Examples of non-climatic priorities could be those related to social, cultural, economic and political issues. However, the identification of key priorities alone might be insufficient for effective adaptation. Understanding the social contexts that influence values is vital for effective adaptation in island settings (Petzold and Ratter, 2015). Therefore, understanding the reasoning, motivation and values underpinning community priorities could be crucial to implementing adaptation that meets the requirements of small island communities. The perceptions held by small island communities are important for producing sustainable development strategies which fit with the context of small islands (Kerr, 2005). Such understandings could contribute to effective and successful adaptation that aligns with the needs of communities in small island settings such as the Scottish Islands.

It is possible that motivations and priorities for adaptation could be rooted in unique place-based values. Local scale adaptation is most effective when place-based social values are considered (Adger, 2016). Differences in economies,

livelihoods, cultural heritage and social values might mean that priorities and motivations are not identical across island communities. This study therefore aims to interpret and evaluate the differences and similarities in approaches to adaptation between Scottish island communities. A key debate concerns the role of different scales in tackling climate change, particularly the effectiveness of top-down adaptation for addressing issues relevant to the community scale. Adaptation is a concept that is applicable at multiple scales. However, if adaptation planning and action is concentrated at UK, Scotland or local authority levels, it could mean that community-level issues are not adequately considered. Standardised adaptation strategies at Scotland or UK-wide scales might not be appropriate for the Scottish islands. Adaptation plans might need to take unique location-specific priorities into account in order to be fully effective.

Additionally, it is important to evaluate how community perspectives can contribute to understandings of small-island vulnerability and adaptation. Scenario-based community engagement is an approach that has the potential to encourage communities to think about current local impacts of climate change, as well as prompting community-level consideration of future climate impacts and potential consequences. A scenario is a representation of how climate might change in future based on current climate projections and best available information on climate change. For example, a scenario of vulnerability to future sea level rise for an area of Scotland can be estimated using UK Climate Projections data and information about the local coastal environment. Vulnerability can be estimated and scenarios produced based on projections. Scenarios can be presented graphically to illustrate how climate-related phenomenon, like sea level rise, might affect communities in future. However, uncertainty is inherent within climate change science (Shackley and Wynne, 1996). It is impossible to definitively predict how climate might manifest in future. Therefore, scenarios are best described as informed estimations about the future. Nonetheless, scenarios might be useful tools for prompting climate discourse at the community level when used as part of community engagement. Tompkins *et al.* (2008) examined the incorporation of stakeholder preferences into coastal planning for climate change using scenario-based stakeholder engagement in Orkney. The authors found it to be a useful tool that promotes comprehensive and inclusive coastal planning. Scenario-based engagement could be employed at the community-level in small islands to understand the consequences of climate impacts at this scale.

Scenario-based community engagement is not a one-way technique that is purely top-down in nature (Reed *et al.* 2013). It can be much broader than a consultation process where scenarios are provided and explained to communities followed by regulated discussion led by facilitators. It can be a two-way process of participation where community-driven discussions are encouraged to support the mutual exchange of information between top and bottom scales. Current approaches that utilise community and public consultation – such as the development of Local Flood Risk Management Plans by Scottish local authorities - are not necessarily bottom-up processes. Decision-makers essentially drive consultation processes, whereas engagement provides a participatory platform for

communities to produce rich dialogues on adaptation. It is important to understand how scenario-based community engagement might inform and enhance adaptation planning through the mutual exchange of information and consideration of community perspectives. It is also necessary to explore the utility of scenario tools, such as hypothetical assessments of island vulnerability, when used to prompt debate and discussion during community engagement. This can enhance understandings of the value of community perspectives when considered in conjunction with other information sources in adaptation planning. Engagement could provide an opportunity for communities to interact with adaptation processes across scales. It is possible that adaptation planning could benefit from local knowledge of climate impacts and consequences passed on through first-hand community perspectives.

1.1.3. Research Questions and Aims

In line with the points discussed above, the research seeks to address the following questions: (1) What are the motivations and priorities for adapting to climate change in small island communities? How do they vary and why? (2) What are the factors and issues that influence how adaptation happens in small island communities? What are the implications for future adaptation planning? (3) How can scenario-based community engagement contribute to adaptation planning? How useful are climate projections and vulnerability assessments when used as tools for engagement at the community scale? The research aims are highlighted in Table 1.1 and serve to address each of the research questions. The research seeks to review and develop theory on the scale of adaptation measures and considers the appropriateness of top-down versus bottom-up approaches within Scottish island contexts. The research also aims to contribute to the debate on 'one-size-fits-all' adaptation planning by exploring the argument that a uniform approach to adaptation across scales might be insufficient when local priorities differ significantly. Furthermore, the study investigates key considerations about the balance of applied and academic research, and develops deeper knowledge of the interface between community-based action and strategic policy in climate change governance processes. It is hypothesised that by taking local motivations and priorities into account during processes of planning and action, future adaptation could have greater practical benefit for Scottish island communities. The present research will aim to contribute to the existing literature on the role of participatory processes in adaptation through the investigation of community perspectives in Scottish island communities. A comparative study can determine if adaptation factors are similar across Scottish island communities, or if there are unique, place-based differences in adaptation priorities. Overall, the research seeks to develop a deeper understanding of island adaptation planning through the investigation of remote and peripheral community case studies in the Scottish Islands.

Research Questions	Research Aims
1. What are the motivations and priorities for adapting to climate change in small island communities? How do they vary and why?	1. To investigate and examine the motivations and priorities for adapting to impacts of climate change in Scottish island communities.
2. What are the factors and issues that influence how adaptation happens in small island communities? What are the implications for future adaptation planning?	2. To evaluate the significance of motivations and priorities for adaptation in Scottish island communities that could potentially inform future adaptation plans.
3. How can scenario-based community engagement contribute to adaptation planning? How useful are climate projections and vulnerability assessments when used as tools for engagement at the community scale?	3. To determine the role of climate projections and vulnerability mapping for scenario-based community engagement in relation to adaptation in Scottish island communities.

Table 1.1: Research Questions and Aims

1.1.4. Key Concepts

This section presents and explores the concepts that are central to the research aims. A key consideration when researching climate change adaptation is to define the adaptation 'of what' 'to what' (IPCC, 2012). This section provides working definitions of the following terms: climate change; (climatic) hazards, impacts and harm; and vulnerability. The concept of adaptation is considered in Section 1.2 and a working definition is provided.

1.1.4.i. Climate Change

A degree of debate exists between two principal climate bodies - the United Nations Framework Convention on Climate Change (UNFCCC) and the IPCC - over the meaning of climate change. The UNFCCC define climate change as:

> "A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." (United Nations, 1992, p.3)

The key message conveyed by this definition is that the causes of climate change are rooted in anthropogenic activity and this type of change should be considered separately from natural climate variability. Contrastingly the IPCC define climate change as:

> "A change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use." (IPCC, 2014a, p.1760)

Unlike the UNFCCC, the IPCC speculate that climate change could be due to natural climatic variability, natural external factors and/or human activity. The IPCC do not provide a definitive answer for the root cause of climate change. The UNFCCC separates climate change from natural climate variability and argues that anthropogenic activity is the source of accelerated climatic change, whilst the IPCC suggests that both natural and anthropogenic factors could potentially contribute to climate change. The current research does not try to identify or debate the causes of climate change but instead accepts the fact that global climate is changing and will continue to change in the coming decades according to climate projections. The research also accepts that human populations are currently experiencing impacts and consequences as a result of a changing climate. There is clear merit in the UNFCCC definition of climate change, and the IPCC do refer back to the UNFCCC definition to provide transparency between the two stances. However, since the current research does not aim to contribute to existing knowledge on the causes of climate change, it is appropriate to adopt the definition provided by the IPCC for the means of this research.

1.1.4.ii. Climate-Related Coastal Hazards

A variety of hazards arise from the climate phenomenon considered above. The current research is concerned with climate-related hazards stemming from the environment that have the potential to adversely affect communities in the Scottish Islands. Smith and Petley define environmental hazards as "all potential threats facing human society by events that originate in, and are transmitted through, the environment" (2009, p.9). Environmental hazards resulting from climate change in the UK include landslides and inland flooding as a result of increased precipitation. Coastal hazards are a branch of environmental hazards that are prevalent within the coastal zone. Coastal hazards are interactions at the marine-terrestrial interface that have the potential to threaten, cause harm and create adverse consequences for human groups in coastal areas (McFadden, 2010). Figure 1.3 illustrates a variety of climate-related coastal hazards and impacts along with related measures of harm. The term 'impacts' is explored in detail in Section 1.1.4.iii. Sea level rise, storm surge, coastal flooding and erosion are key coastal hazards and impacts that are currently affecting Scotland and its islands as a result

of climate change. Coastal flooding and severe erosion can happen independently of sea level rise although it is possible that rising sea level will exacerbate rates of flooding and erosion across Scotland and the UK.

Coastal hazards can manifest in different ways and climate change can influence the frequency and severity of rapid- and slow-onset coastal hazards. Rapid-onset hazards have the potential to substantially affect human groups in a short amount of time and can cause immediate harm unexpectedly and without warning. Although not climate-related, the 2004 Indian Ocean earthquake and tsunami is an example of an extreme rapid-onset coastal hazard that caused widespread harm with high numbers of fatalities and extensive damage to human settlement. Rapid-onset coastal hazards also include coastal flooding, storms and storm surge. Although these occur at a lower magnitude and across a smaller spatial scale than that of a high-magnitude tsunami, both rapid coastal flooding and storm surge have the potential to inflict harm on coastal communities. Gradual or slow-onset coastal hazards also have the potential to threaten communities at the coast, although possible risks and harm are less abrupt in comparison to rapid-onset hazards. Sea level rise and coastal erosion are examples of slow-onset coastal hazards and impacts currently affecting the UK and Scotland. Such hazards might not have instantly perceptible consequences. However, over periods of weeks, months, years and decades, slow-onset hazards can dramatically alter coastal landscapes and have the potential to fundamentally shift the way in which communities sustain ways of life within coastal settings.

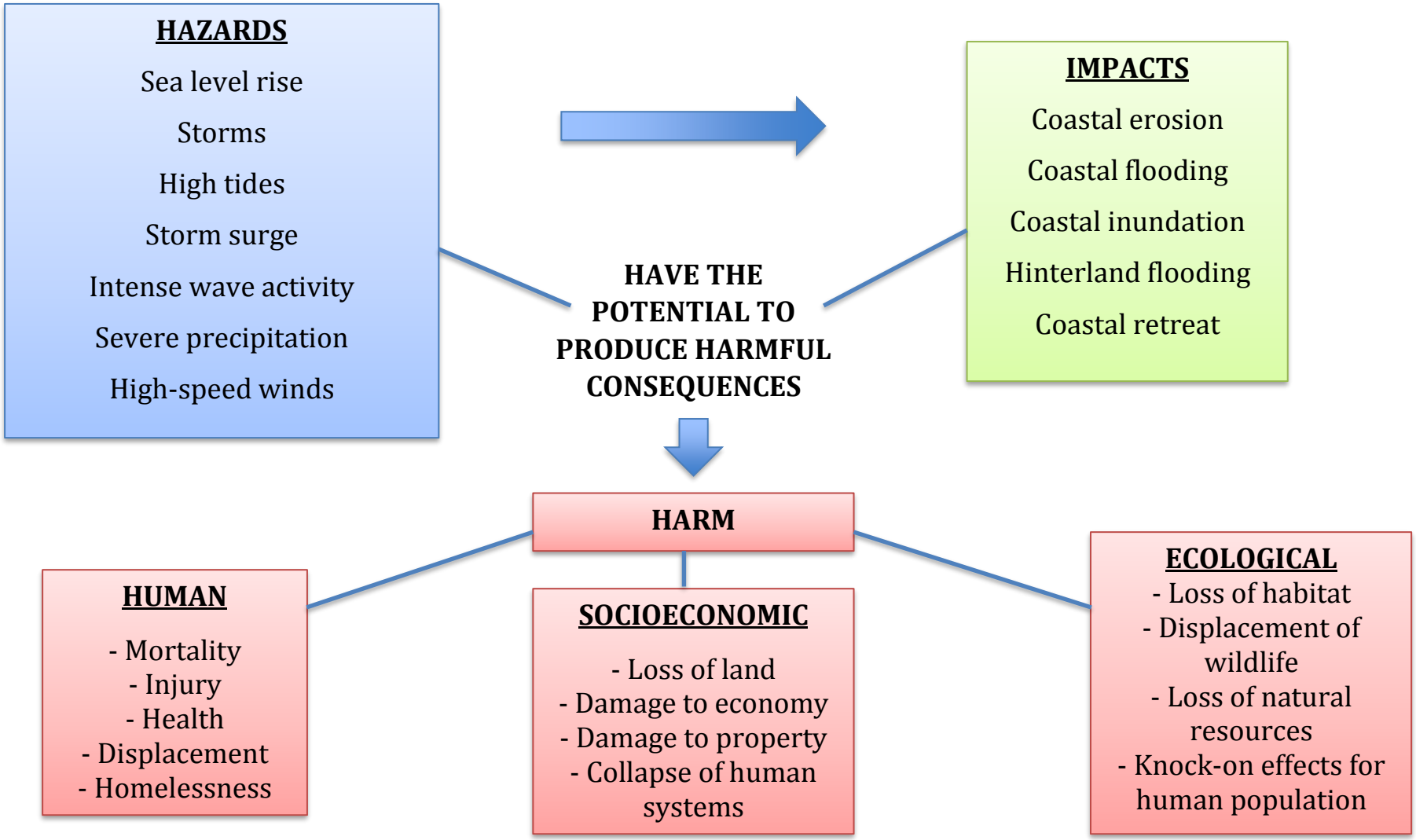


Figure 1.3: The range of climate-related coastal hazards and impacts along with related measures of harm

1.1.4.iii. Climate Impacts

Climatic phenomena that have been altered, exacerbated or intensified as a result of climate change may produce impacts that have beneficial or adverse consequences for human groups depending on how such climatic phenomena manifest. Climate-related coastal hazards can produce impacts within coastal areas and small island settings. It is important to clarify precisely what is meant by the terms 'climate impacts'. The IPCC define climate impacts as:

> "…the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes." (IPCC, 2014a, p.1760)

The IPCC use the terms 'impacts' and 'consequences' interchangeably. However, the terms do not necessarily mean the same thing within adaptation and a distinction must be made between the two concepts to avoid ambiguity. Within this research, the term 'impacts' refers to the physical outcomes resulting from the occurrence of a climate-related hazard. For example, coastal inundation is a physical outcome of sea level rise, and therefore is an impact of sea level rise. Within this study, the term 'consequences' refers to the effects that hazards and impacts might have on human groups and significant human assets. For example, the consequences of coastal flooding – an impact of sea level rise - might include damage to property and infrastructure, and disruption to the daily lives of human groups involved. In the context of this research, climate impacts are seen as the pathway between hazards and consequences.

Current climate impacts in the UK and Scotland include: coastal flooding, erosion and retreat resulting from sea level rise; extreme winds resulting from storms; and overland flooding resulting from increased precipitation (Adaptation Scotland, 2016a; Marine Climate Change Impacts Partnership, 2017). As discussed, the severity of these hazards and associated impacts is likely to increase in future. Climate impacts can become adverse and problematic when there is a significant risk of harm to human groups. The aforementioned climate impacts can have potentially harmful consequences for communities living in Scotland: damage to property; disruption to infrastructure; risks to health and wellbeing; detrimental effects for local economies; and loss of ecologically and culturally significant sites. The hazards, impacts and consequences of climate change currently affecting Scotland are highlighted in Scotland's Climate Change Adaptation Framework (Scottish Government, 2009). However, the SCCAF adopts a similar approach to the IPCC in using the term 'impacts' to refer to both the physical outcomes and societal consequences of hazards. No clear distinction is made between the two. It appears that *impacts* is a broad and, at times, imprecise term that is currently used within climate discourse to refer to everything from the physical effects to the

social, economic and cultural consequences of climate change. This research favours defining hazards, impacts and consequences as complementary terms, each with a distinct meaning. Improved clarification could lead to the increasingly refined use of these terms in future, thus potentially supporting more precise adaptation policy, planning and implementation.

1.1.4.iv. Vulnerability

Vulnerability is a fundamental concept within climate change adaptation. The IPCC define vulnerability as:

> "The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC, 2014a, p.1775).

In the existing adaptation literature, Adger (1999) states that social vulnerability is "the exposure of individuals or collective groups to livelihood stress as a result of the impacts of such environmental change" (pp.249). In a later paper, Adger went on to further discuss 'social vulnerability' as a particular branch of vulnerability exclusively concerning the human population: "the exposure of groups of people or individuals to stress as a result of the impacts of environmental change" (Adger, 2000, pp.348). These definitions of vulnerability, particularly the latter, contain a distinctive 'human' element and centre on the vulnerability of people and communities.

Following the work of Adger and the IPCC, vulnerability is defined within this research as the degree to which a system or group - natural, human or both - is predisposed to and unable to cope with the potentially adverse impacts of climate change. Within this study, the concept of vulnerability is applied to the real-world case study of Pierowall Bay (Westray) in an assessment of hypothetical vulnerability to sea level rise. The hypothetical vulnerability assessment was used as a scenario tool for engaging the Westray community on the subject of local adaptation to climate change, the results of which are presented in Chapter 4.

1.2. Exploring Adaptation in Scottish Island Communities

1.2.1. Adaptation in Theory

Adaptation is a commonplace term that is used in everyday dialogue and appears to be a straightforward concept. On the surface, it does not seem overly complicated or technical. In reality, however, it is a complex and multifaceted term with a variety of meanings across disciplines. The concept is used within fields of geography, sociology, psychology, ecology and biology amongst others. The fundamental definition of adaptation differs depending on the discipline and context within which it is used. For example, the term can relate to physiological alterations in organisms when applied in an ecological context. However, the meaning changes significantly when applied within fields relating to human

actions such as geography and sociology. The variety of meanings attributed to the term can become problematic for research, particularly when presenting the concept to members of the public or scholars across differing fields. Therefore, it is of paramount importance to provide a clear definition of 'adaptation' in any form of academic research. The present study focuses on adaptation in the context of climate change and how the human population, specifically communities, might cope with and respond to adverse impacts of climate change. In this context, adaptation refers to the response of human groups to the impacts of climate change.

Prior to outlining a specific working definition of adaptation, it is important to critically examine the ways in which adaptation has been defined elsewhere in the field of climate change. Global and national climate bodies have outlined working definitions in an effort to provide a common understanding of the concept. The IPCC define adaptation as:

> "The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects." (IPCC, 2014a, p. 1758)

The framework adopted by the IPCC is recognised internationally across climate change-related disciplines. It addresses adaptation in both natural and human contexts, therefore making it a relevant definition for environmental and social science disciplines alike. The definition accepts that adaptation is a process of minimising harm to human groups and natural systems, but advises that it can also be a practice to capitalise on potentially positive opportunities presented by climate change. This implies that effective adaptation practices could have sustained beneficial outcomes for human and natural systems. Global definitions, such as that of the IPCC, are reflected and reinterpreted in supranational and national definitions. For example, the European Climate Adaptation Platform (Climate-ADAPT) have described adaptation as:

> "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation."
>
> (Climate-ADAPT, 2016)

The definition provided by Climate-ADAPT reflects the core points made by the IPCC. At the national level, the Scottish Climate Change Adaptation Programme (SCCAP) outlines adaptation as:

> "The adjustment in economic, social or natural systems in response to actual or expected climatic change, to limit harmful consequences and exploit beneficial opportunities." (Scottish Government, 2014, p.5)

National frameworks, such as the SCCAP, have evidently been influenced by the work of the IPCC. One particularly useful aspect of the Climate-ADAPT definition, which is missing from that of the IPCC, is the addition of examples signposting practical approaches to adaptation. It is important to be specific about the ways in which adaptation can be undertaken as a means of minimising harm and pursuing benefits or opportunities. The addition of practical approaches makes the Climate-ADAPT definition both a comprehensive theoretical definition and a useful real-world framework. Overall, the importance of adaptation as a response to both current and future impacts of climate change is highlighted within global, supranational and national frameworks. Supranational and national bodies have accepted and reinterpreted the IPCC definition of adaptation, thus indicating that the definition is not confined to the international scale. Indeed, it is relevant and useful in real-world contexts across scales.

It appears to be accepted within the field of climate change that adaptation is a process of reducing the level of harm to actual and anticipated impacts whilst taking advantage of potential opportunities offered by a changing climate. These can be classified in many ways. For example, adaptation responses in the coastal zone can vary according to the extent to which they seek to preserve or change existing coastal structures (Cooper and Pile, 2014). However, as highlighted by the Climate-ADAPT definition, it is also important to be explicit about the steps required to undertake adaptation. Effective planning and action for current and future impacts are fundamental components of adaptation. Therefore, in the context of this research, adaptation is defined as:

> *Planning and action to reduce harm to the adverse impacts of climate change, both actual and anticipated, in human and natural systems*

This definition will be followed throughout the present study.

Alongside definitions of adaptation, the published climate literature also points to current challenges for adaptation. Key debates in adaptation exist around the preservation of societal values, the potential for transformative approaches, the development of robust networks across scales and the division of responsibility for planning and implementing adaptation. These debates and challenges are reviewed in Chapter 2.

1.2.2. Adaptation in Practice

1.2.2.i. Adaptation at International, Supranational and National Scales

In addition to theoretical considerations, it is also useful to explore existing adaptation strategy from international to local scales in order to build a picture of how adaptation currently happens in practice. Figures 1.4 and 1.5 illustrate the range of instruments and actors contributing to adaptation from the international to the local island level in the fields relevant to the research: climate change, coastal environments, marine environments, flood risk management and land use planning. The figures were produced during policy mapping as part of the research

(see Chapter 3). Legislation, policy, strategies and plans can be considered as instruments for adaptation. Bodies that produce legislation and policy, and organisations that implement planning and strategies, have influence from international to local scales. The top-down flow of adaptation instruments is conveyed in Figure 1.4.i. using the issue of flooding and coastal change as an illustrative example.

At the international scale, the UNFCCC sets out global targets for reducing emissions and leads in providing adaptation information for countries across the globe. Moreover, the IPCC Fifth Assessment Working Group II AR5 Report 2014 is a global-level instrument that provides advice for adaptation policy, planning and action. Chapter 15 of the IPCC WGII AR5 Report delivers internationally relevant information on practical adaptation strategies. Additionally, the 'Summary for Policymakers' (Section B-2: Sectoral Risks and Potential for Adaptation) indicates with very high confidence the potential for increased flooding and erosion of low-lying coastal areas as a consequence of sea level rise (IPCC, 2014b; Figure 1.4.i). Chapter 5 (Coastal and Low-Lying Areas) presents detailed information on the impacts, vulnerabilities, risks and adaptation possibilities for responding to increased flooding and coastal change, whilst Chapter 23 provides specific climate change guidance for Europe (Kovats *et al*. 2014; Wong *et al*. 2014). WGII will next report in 2021 with the AR6 Synthesis Report to become available in 2022.

At the supranational level, the guidance set out by the IPCC has informed European policy. The EU Adaptation Strategy, published in 2013 by the European Commission, utilised the guidance set out in the IPCC Fourth Assessment Report 2007. In relation to the example of flooding and coastal change (Figure 1.4.i), the European Commission provides specific policy throughout the 'Climate change adaptation, coastal and marine issues' document as part of their EU Adaptation Strategy Package. It is likely that forthcoming IPCC reports will inform future revisions of the EU Adaptation Strategy in relation to flooding and coastal change in Europe. The European Commission acknowledges that the severity of climate impacts varies spatially and, for this reason, adaptation action is a subsidiary matter to be undertaken mainly at national, regional or local levels.

Nationally, the Climate Change Act 2008 is a legislative framework that supports adaptation in the UK. Under this Act, the Adaptation Sub-Committee of the Committee on Climate Change publishes the UK Climate Change Risk Assessment every five years: an assessment of the risks, challenges and opportunities associated with climate change in the UK. The most recent report – the UK CCRA 2017 – refers frequently to the IPCC Fifth Assessment 'Summary for Policymakers' when outlining climate policy in the UK. Reflecting IPCC guidance, and backed by UKCP09 projections, the CCRA 2017 Synthesis Report states that flooding and coastal change is a high magnitude risk to communities, businesses and infrastructure in the UK (Committee on Climate Change, 2017). Chapter 3 of the CCRA 2017 Synthesis Report sets out policy and recommendations for further action in relation to flooding and coastal change. The report conveys a direct flow of top-town policy from the IPCC to the UK level (Figure 1.4.i). However, there is

less evidence of a direct top-down flow of policy from the European scale to the national level within the CCRA, with no mention of the EU Adaptation Strategy. Whilst international-level instruments influence European and national scale policy, the top-down flow of instruments from European to national levels might be less significant.

Sub-nationally, the Climate Change (Scotland) Act 2009 and Scotland's Climate Change Adaptation Framework (2009) are pieces of legislation that provide a framework for adaptation in Scotland. These instruments set out responsibilities for Scottish Ministers and Scottish public bodies to achieve primary goals related to climate change. Furthermore, the Scottish Climate Change Adaptation Programme (2014) presents the adaptation objectives of the Scottish Government, and adheres to policy on flooding and coastal change set out by the UK CCRA 2012 (the most recent CCRA report available during the production of the SCCAP) (Figure 1.4.i). The SCCAP acknowledges the requirement to address flood risk in Scotland as identified within the CCRA 2012, specifically within the SCCAP technical report titled 'A climate change risk assessment for Scotland' (Scottish Government, 2014). The need to respond to risk through the development of flood risk management plans is highlighted in Sections N1-8, N2-18 and N2-20 of the SCCAP. Subsequently, policy provided in the SCCAP is used to guide local authority adaptation and flood risk management. For example in their Scottish Climate Change Declaration Report 2014-2015, Orkney Islands Council indicated their commitment to following policy set out in the SCCAP. The local level planning outlined by OIC in both their Local Flood Risk Management Plan 2016 and Climate Change Report 2017 reflects the objectives of the SCCAP for adapting to impacts of climate change, including flooding and coastal change.

In terms of adaptation actors, a variety exists at each scale from international to local levels (Figure 1.5). In the example of flooding and coastal change, several key actors implement the policy and planning outlined in Figure 1.4.i. The IPCC is a leading global actor in climate change adaptation. At the European level, Climate-ADAPT is a partnership between the European Commission and the European Environment Agency that supports European-level adaptation by providing tools for supranational and national actors to utilise in practice. For example, their Adaptation Support Tool is an assessment tool that can be used by national organisations to assist in the development of adaptation planning and action.

At the national scale, the UK Climate Impacts Programme (UKCIP) utilises the policy presented in the UK CCRA reports to support UK stakeholders through the provision of knowledge and tools for adaptation. Sub-nationally, Adaptation Scotland is active in its role to undertake adaptation based on policy in the SCCAP. The Climate Ready Clyde initiative is a notable example where a regional adaptation plan was created for Glasgow (Adaptation Scotland, 2016b). At the Scottish island level, local authorities undertake action that reflects sub-national policy and planning goals. Development organisations are also important actors at the local level. For instance, Storas Uibhist acts to improve island drainage across

South Uist (Storas Uibhist, 2014). Public organisations, particularly SEPA and SNH, whilst acting sub-nationally, are also operational at the local scale: both organisations have regional offices in Lerwick, Kirkwall, Stornoway and South Uist. Lastly, local stakeholders, households and individuals have the potential to serve as important actors for adapting to coastal, climate, marine and flood-risk issues 'on the ground' with support and guidance from local authorities.

Overall, a range of legislation, frameworks, support and guidance inform and facilitate effective adaptation by actors at national, regional and local scales. In practice, the cross-scale flow of adaptation instruments is top-down in nature from the international scale to the local level, as demonstrated in Figure 1.4.i. The adaptation instruments and actors presented in Figures 1.4 and 1.5 are not exhaustive but provide a comprehensive snapshot of the range of instruments and actors existing across global to local scales.

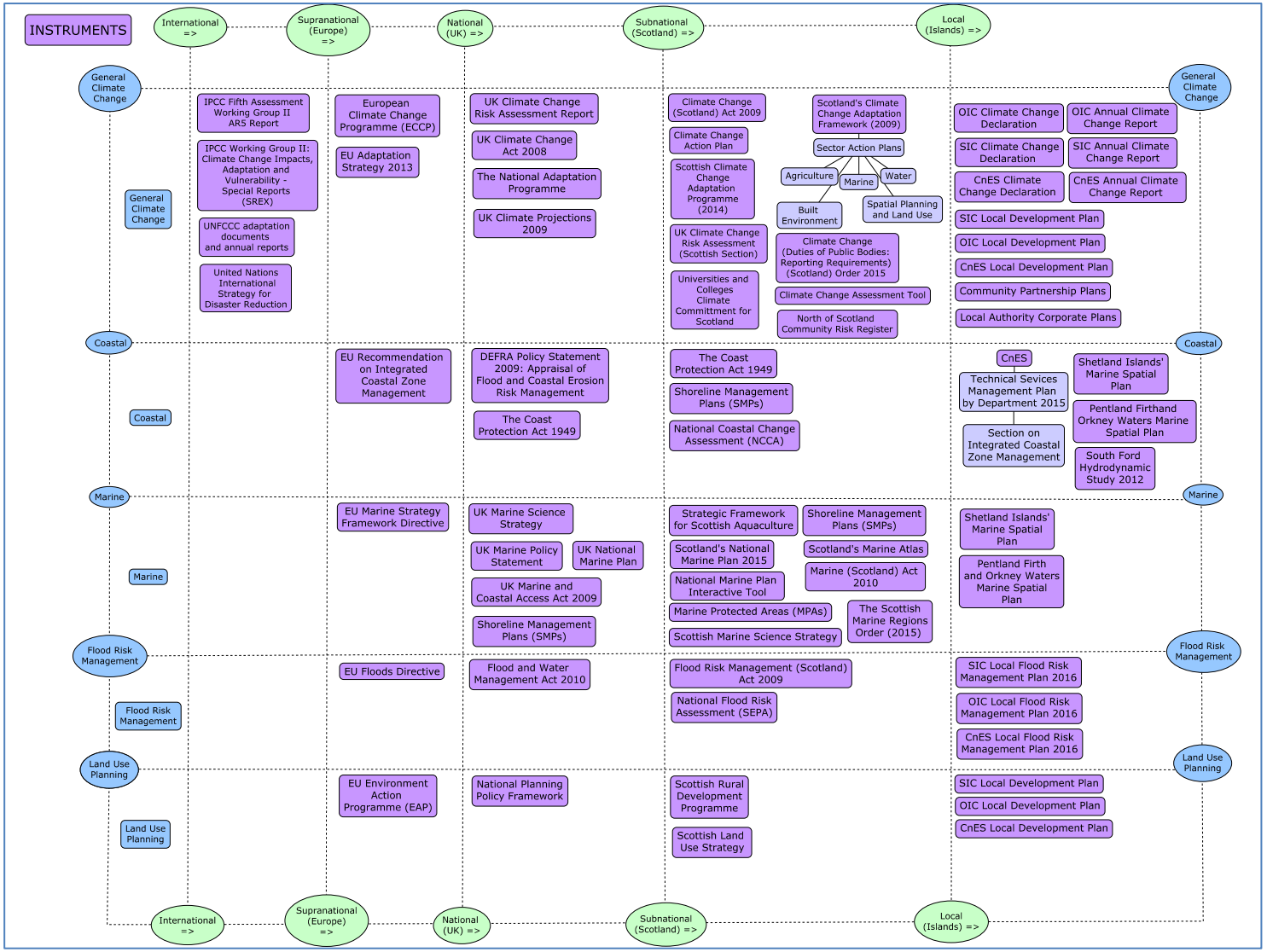


Figure 1.4: Adaptation instruments that contribute to adaptation from the international scale to the local island level across climate-related fields that are relevant to the research

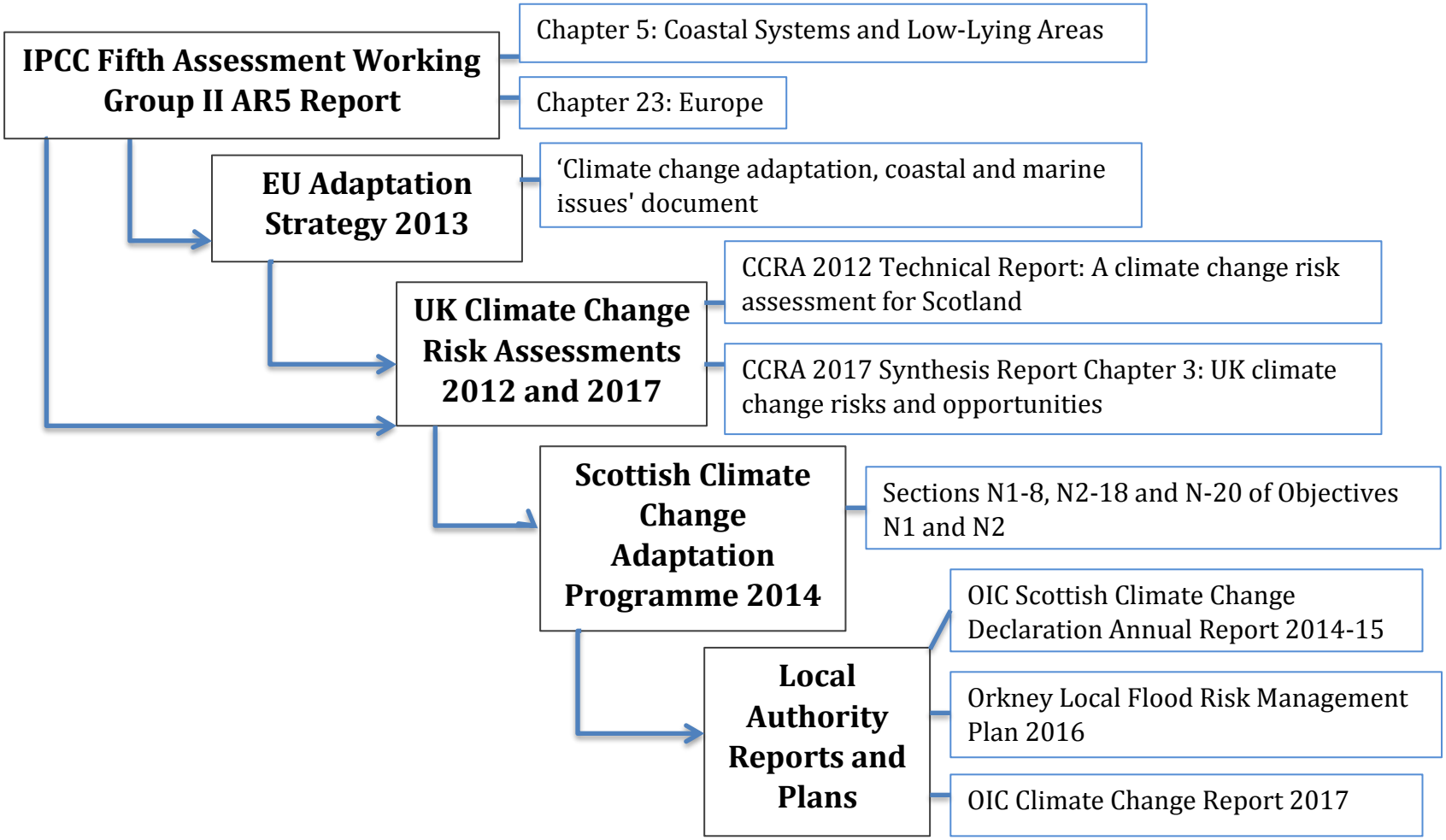


Figure 1.4.i: The international to local top-down flow of adaptation policy instruments relevant to the issue of flooding and coastal change

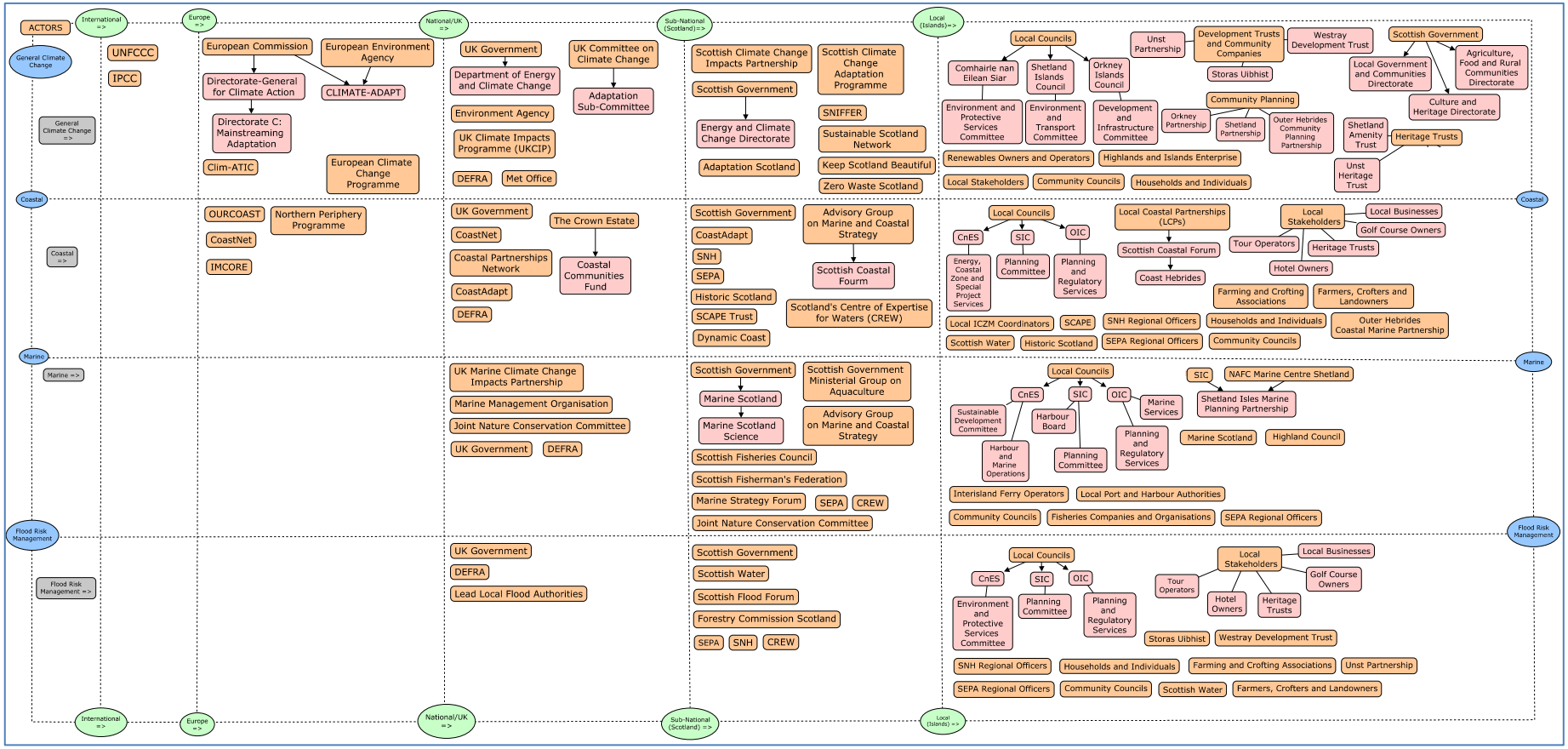


Figure 1.5: Adaptation actors that contribute to adaptation from the international scale to the local island level across climate-related fields that are relevant to the research

1.2.2.ii. Adaptation at the Local Authority Scale

Orkney, Shetland and the Outer Hebrides are taken as case study island groups as part of this research. Orkney Islands Council (OIC), Shetland Islands Council (SIC) and Comhairle nan Eilean Siar (CnES) are the local authorities for Orkney, Shetland and the Outer Hebrides respectively, and are responsible for local adaptation planning and action. Each local authority, along with 177 other Scottish public sector organisations, is obligated under the Climate Change (Duties of Public Bodies: Reporting Requirements) (Scotland) Order (2015) to produce an annual Climate Change Report detailing local progress in adaptation. Additionally, all three authorities developed Local Flood Risk Management Plans (LFMRPs) in 2016 under the Flood Risk Management (Scotland) Act, as well as producing local development plans that encompass both climate and non-climate development issues. This section explores the content of local authority reports and strategies relating to adaptation in the case studies (see Table 1.2) and describes the approaches taken by local authorities to implement adaptation in practice.

Climate Change Reports

The Climate Change Reports, published annually by OIC, SIC and CnES, outline the planning and actions that have been undertaken by each local authority in response to climate change. The most recent reports were published in 2017 with the next round to become available by the end of 2018. Climate Change Reports are not adaptation plans or strategies, but rather an obligatory record of action that has been undertaken in the previous year by each local authority to address climate change. Local authorities must highlight key priorities for adaptation over the coming year within their reports. Of the three local authorities in the case studies, none have published a formal plan or strategy dedicated to climate change adaptation. However, the statutory Climate Change Reports give an indication of how adaptation is being addressed by each local authority and their priorities for the future.

Shetland Islands Council Climate Change Report 2017

The section on 'Adaptation' in the Climate Change Report prepared by SIC (2017b) indicates that the local authority have chiefly focused on building safety standards, flood risk management and emissions reduction when seeking to manage climate-related risks. For example, SIC have taken steps to improve drainage around road surfaces as well as the production of an LFRMP (SIC, 2017b). A number of actions in the report correlate with sustainable development goals such as promoting sustainable travel and encouraging community food growing.

The report indicates that top-down approaches have dominated adaptation by SIC with actions concentrated at the local authority level. Of sixteen actions described in the report, fifteen are top-down in nature. One exception is the encouragement of food growing at the community level. This indicates a degree of community consultation by SIC and implies that a bottom-up approach was

adopted. However, all other adaptation actions - such as maintaining building standards and training council staff in the use of the Climate Change Assessment Tool (CCAT) - indicate that mainly top-down strategies have been employed by SIC. Community consultation and bottom-up actions are not listed amongst future priorities; rather all priorities are focused at the local authority level suggesting a favoured top-down approach to future adaptation. SIC do acknowledge place-based climate-related issues specific to Shetland such as the matter of interisland transport (SIC, 2017b). However, community consultation is mentioned in only one instance.

Comhairle nan Eilean Siar Climate Change Report 2017

In their latest Climate Change Report, CnES (2017) highlight flood risk management as a significant climate-risk issue that has required adaptation planning and action. CnES indicate that they are active in their role to address flood risk across the Outer Hebrides particularly through the development of an LFRMP in 2016. CnES have concentrated on enhancing drainage systems across the Western Isles as well as improving emergency response during flood events. A flood protection scheme has been developed and five flood protection studies are planned to take place (CnES, 2017). As part of this, a LiDAR survey is to be undertaken in the South Ford area at South Uist and Benbecula.

Of fourteen actions outlined by CnES, thirteen are top-down in nature. The report suggests that, like SIC, top-down approaches have dominated adaptation planning and action by CnES. An exception is the biannual meeting with Local Partnership stakeholders to monitor issues related to stakeholder assets (CnES, 2017). This implies that a degree of consultation takes place between CnES and local stakeholders, thus representing a bottom-up approach. Storas Uibhist – the community landowner in South Uist – is an example of a Local Partnership stakeholder. The remainder of actions outlined in the report indicate that CnES have approached adaptation in a largely top-down manner. All priorities for future adaptation are focused at the local authority level: flood forecasting and management along with the maintenance of existing island drainage infrastructure (CnES, 2017). CnES recognise flooding as a significant and serious risk that affects the assets of local stakeholders and therefore requires adaptation action. However, the report contains only one reference to local stakeholders whilst the community scale itself is not mentioned specifically.

Orkney Islands Council Climate Change Report 2017

In their recent Climate Change Report, OIC indicate that adaptation has focused mainly on the issues of flooding and resilience. A considerable proportion of adaptation has centred on flood risk management, particularly the development of an LFRMP alongside a flood protection study for St Margaret's Hope (OIC, 2017b). Additionally, OIC have contributed to the North of Scotland Community Risk Register (CRR) and have created community resilience plans, both of which have been undertaken to enhance climate resilience across Orkney. By

contributing to the CRR, OIC have assisted in identifying the risk and likelihood of severe weather and flooding for Orkney. The report indicates that OIC are concerned with managing climate risks and enhancing resilience and, in turn, are active in their role to adapt to climate change.

Of thirty-four actions listed in the report, thirty-two are top-down in nature. This suggests that OIC have adopted mostly top-down approaches to adaptation across Orkney. One exception is the development of community resilience plans as a means of supporting communities to respond to climate change impacts, particularly flooding. This action has involved direct consultation with communities in Orkney (OIC, 2017b). Another exception is the action by OIC to support community organisations in securing funding for emergency generators in community buildings when power is disrupted. Additionally, although the recent contribution to the CCR is technically a top-down action, the register itself is concerned with the community scale. The report makes it clear that OIC are interested in consulting directly with communities to build resilience and adaptive capacity. Although OIC have taken a primarily top-down approach to adaptation so far, there is significant acknowledgement of the community scale throughout the report (the word 'community' appears approximately fourteen times) particularly in terms of priorities for future adaptation.

Climate Change Reports in Summary

It appears that, with the exception of OIC, community-scale issues are not high on the agendas of local authorities for adaptation in the case study island groups. In particular, SIC and CnES do not appear to prioritise community consultation or bottom-up approaches to a significant extent. The reports indicate that top-down approaches have dominated adaptation planning and action by all three local authorities, although OIC have incorporated community consultation to a more notable degree. Additionally, SIC do appear to acknowledge the need for socially relevant adaptation planning at the community scale within their report but highlight that a lack of funding and training has hindered this kind of action (SIC, 2017b). Although each local authority has considered the community-scale to some extent, the reports suggest that strategies for adaptation have followed a primarily top-down approach. Local authority approaches to adaptation in the case studies are analysed in relation to the research findings in Chapter 6.

Local Flood Risk Management Plans

In 2016, all three local authorities produced statutory Local Flood Risk Management Plans under the Flood Risk Management (Scotland) Act. LFRMPs form a framework for managing flood risk, often in relation to climate change issues. In each island group, the development of LFRMPs involved public consultation as a mandatory component (CnES, 2016; OIC, 2016; SIC, 2016b). However, bottom-up methods were not necessarily the dominant approach undertaken in LFRMP development. Although each local authority employed a bottom-up approach to an extent through statutory public consultation, the

resulting LFRMPs are not community-led documents. Public consultation by each of the local authorities, in collaboration with SEPA, was used to further inform and confirm the technical planning already in place prior to the consultation process.

As highlighted by each local authority in their Climate Change Reports, the final LFRMPs have been used to support adaptation in the case studies. However, the LFRMPs provide planning exclusively for flood risk management rather than adaptation. Adaptation to climate-driven flooding is not considered directly in any of the LFRMPs. Although OIC, SIC and CnES carried out statutory consultation as part of the LFRMPs, this does not necessarily equate to a community-based approach.

Local Development and Corporate Plans

In the Shetland Local Development Plan 2014, SIC indicate the need to "[mitigate] and [adapt] to the causes of climate change" (2014b, p. 19). However, adaptation is covered in a relatively brief manner and is only mentioned in three instances within the plan, with no reference to any specific adaptation strategy. In one instance, SIC refer to adaptation within a building development context, stating that buildings should be located and designed with adaptation in mind. Additionally, Shetland Partnership (comprised of local authority members, external partners and community bodies in Shetland) published their Community Plan in 2013. The plan highlights the need for adaptation in the context of community planning. Whilst it does not feature any specific strategy for adaptation, the community-orientated tone and context of the plan suggests that Shetland Partnership might support community consultation and bottom-up approaches to adaptation. SIC's corporate plan (Our Plan 2016-2020) is situated to operationalize the aims of Shetland Partnership's Community Plan. However, neither adaptation nor the topic of climate change is mentioned within SIC's corporate plan suggesting that adaptation is not necessarily prioritised by SIC in a corporate sense. The aforementioned plans provide limited evidence of how SIC have approached adaptation in planning and practice. The recent SIC Climate Change Report (2017b) is more informative in terms of outlining SIC's approach towards adaptation.

In their Local Development Plan 2012, CnES do not refer to adaptation in any instances. CnES have recognised the risk of flooding in the Outer Hebrides, and that this risk is likely to increase with climate change (CnES, 2012b). The plan focuses on flood risk management in relation to climate change, but adaptation itself does not feature within the document. The document proposes top-down planning and action for flood risk management. However, there is little explicit treatment of how CnES has developed any strategy for adaptation. No information is included in either the Outer Hebrides Community Planning Partnership (OHCPP) Local Outcome Improvement Plan 2017-27 or the CnES Corporate Strategy 2012-2017, which suggests that there is little incorporation of community-based adaptation in local authority planning.

In OIC's Local Development Plan 2017-2022, there is one mention of adaptation. Specifically, the plan refers to adaptation in the context of development at the coast. OIC state that new development may be permitted if it is "adaptive to anticipated coastal change", and if development is proposed in areas deemed vulnerable to coastal change by the National Coastal Change Assessment these proposals should show that "adaptation strategies have been incorporated over the lifetime of the development" (2017a, p. 48). This represents a top-down approach to adaptation by OIC. However, the plan does not contain any dedicated adaptation planning and provides limited evidence of the approach taken by OIC towards adaptation. Furthermore, OIC's corporate plan 'Our Plan 2013-2018' indicates that Orkney Partnership (comprised of local authority members, external partners and community bodies) highlighted tackling climate change as a community-planning priority prior to the production of the corporate plan. Targets to address climate change are included in OIC's corporate plan. However, neither the corporate plan, nor the most recent Orkney Partnership Community Plan 2018-2021 address adaptation in an explicit manner, thus there is limited evidence of the local authority approach to adaptation in Orkney based on these documents.

Altogether, the key tools and documents of the planning systems - local development, corporate and community plans of the three local authorities – show little evidence of the incorporation of community-based adaptation into local planning. Adaptation planning appears to be top-down in nature, and even then is covered in a somewhat limited manner in the plans. The local authority Climate Change Reports provide a more useful indication of local approaches to adaptation. The situation appears to be evolving with Orkney demonstrating some initiatives in this field but, in summary, there is a gap in the implementation of bottom-up approaches.

Case Study	Local Authority	Document Type
Shetland	Shetland Islands Council	- Climate Change Report 2017 - Local Flood Risk Management Plan 2016 - Local Development Plan 2014 - Our Plan 2016 – 2020
Outer Hebrides	Comhairle nan Eilean Siar	- Climate Change Report 2017 - Local Flood Risk Management Plan 2016 - Local Development Plan 2012 - Comhairle nan Eilean Siar Corporate Strategy 2012-2017
Orkney	Orkney Islands Council	- Climate Change Report 2017 - Local Flood Risk Management Plan 2016 - Local Development Plan 2017 – 2022 - Our Plan 2013 - 2018

Table 1.2: Local authority documents consulted in order to investigate current local authority approaches to adaptation in the case studies.
N.B. Our Community Plan 2013 (Shetland Partnership), the Local Outcome Improvement Plan 2017-27 (OHCPP), and the Orkney Community Plan 2018-2021 (Orkney Partnership) were also consulted. However, these documents were not produced by SIC, CnES or OIC and do not represent the local authority approaches taken towards adaptation but were consulted to provide context for local authority documents.

1.2.3. Conclusions

Community-based climate adaptation is one component of a multi-level institutional framework. Supranational policy is intended to provide guidance for national and sub-national policy and planning. In turn, national and sub-national instruments, such the SCCAF, influence planning and action by local authorities. In theory, community-based adaptation could then be supported and guided by local authorities. In the Scottish Islands, it is evident that each local authority has identified key local risks associated with impacts of climate change, primarily flooding. Approaches to adaptation have focused on issues like flood risk, coastal defence and building standards. However, determining whether community priorities are being addressed in current local authority adaptation planning, and how adaptation is happening at the community scale, are important questions for progress in adaption.

1.3. The Scottish Islands - Three Case Studies

As previously indicated, communities are the unit of study for the current research. Island communities, specifically, form the basis of the research through the investigation of case studies in the Scottish Islands. As discussed in Section 1.1, the UK Committee on Climate Change highlighted that exposed coastal communities, such as those in the Scottish Islands, are particularly at risk of experiencing adverse impacts, like flooding and severe weather, as a result of climate change hazards. A consideration of the factors for adaptation at the community level rather than on a broad scale would serve to avoid overlooking the vital social consequences of climate change in individual communities. Füssel and Klein (2006) state that information regarding two fundamental factors must exist before adaptation can occur: "information on what to adapt to and how to adapt" (pp.304). However, a crucial point is absent in the work of Füssel and Klein (2006): that it is imperative to identify and provide information about the exact entity that requires adaptation. Identifying the 'what' in adaptation is essential in order to undertake adaptation that is appropriate and focused. In other words, *what* type of unit or group is adapting as well as *what* is being adapted to. The present study focuses on the adaptation of *Scottish island communities* to the *impacts of climate change* such as coastal flooding, erosion and severe weather events. At this point, it is necessary to explain what is meant by the term 'community'. Within this research, a 'community' is a group of people living within a given location with a common reliance on the same resources and amenities. This definition will be adhered to throughout the research.

1.3.1. The Case Studies

Three Scottish island case studies were selected for the research: Unst (Shetland), Westray (Orkney) and South Uist (Outer Hebrides). A systematic approach was adopted in the case study selection process (see Chapter 3). In each case, the 'community' in question referred to the entire population on each island due to a common reliance on the same services and amenities as well as the presence of a relatively small population on each island. Table 1.3 shows the population and area size of each case study island. Three islands from three differing Scottish Island groups were chosen as study sites in order to undertake a cross-comparison of motivations and priorities for adaptation, thus allowing the 'one-size-fits-all' debate to be addressed. Meaningful comparisons could be drawn between Unst, Westray and South Uist for various reasons including relative similarities in remoteness, the presence of amenities in each location and previous efforts in development by the local communities in each island. Although South Uist is somewhat larger in population and geographical area than Westray and Unst, the island is similar to the other case studies, particularly in terms of remoteness, peripherality and socioeconomic setting. Figure 1.6 highlights the geographical location of each case study. All are geographically remote in comparison to the location of the Scottish Government in mainland Scotland and the location of local authorities in each respective Scottish island group. Furthermore, Unst and Westray are physically isolated from other island

communities in Shetland and Orkney respectively due to the lack of a fixed link to any other island.

Island Group	Island	Population (according to Scotland's Census 2011)	Area (km^2)
Shetland	Unst	632	120.68
Orkney	Westray	588	47.13
Outer Hebrides	South Uist	1754	320.26

Table 1.3: Population and area (km^2) information for each case study island.

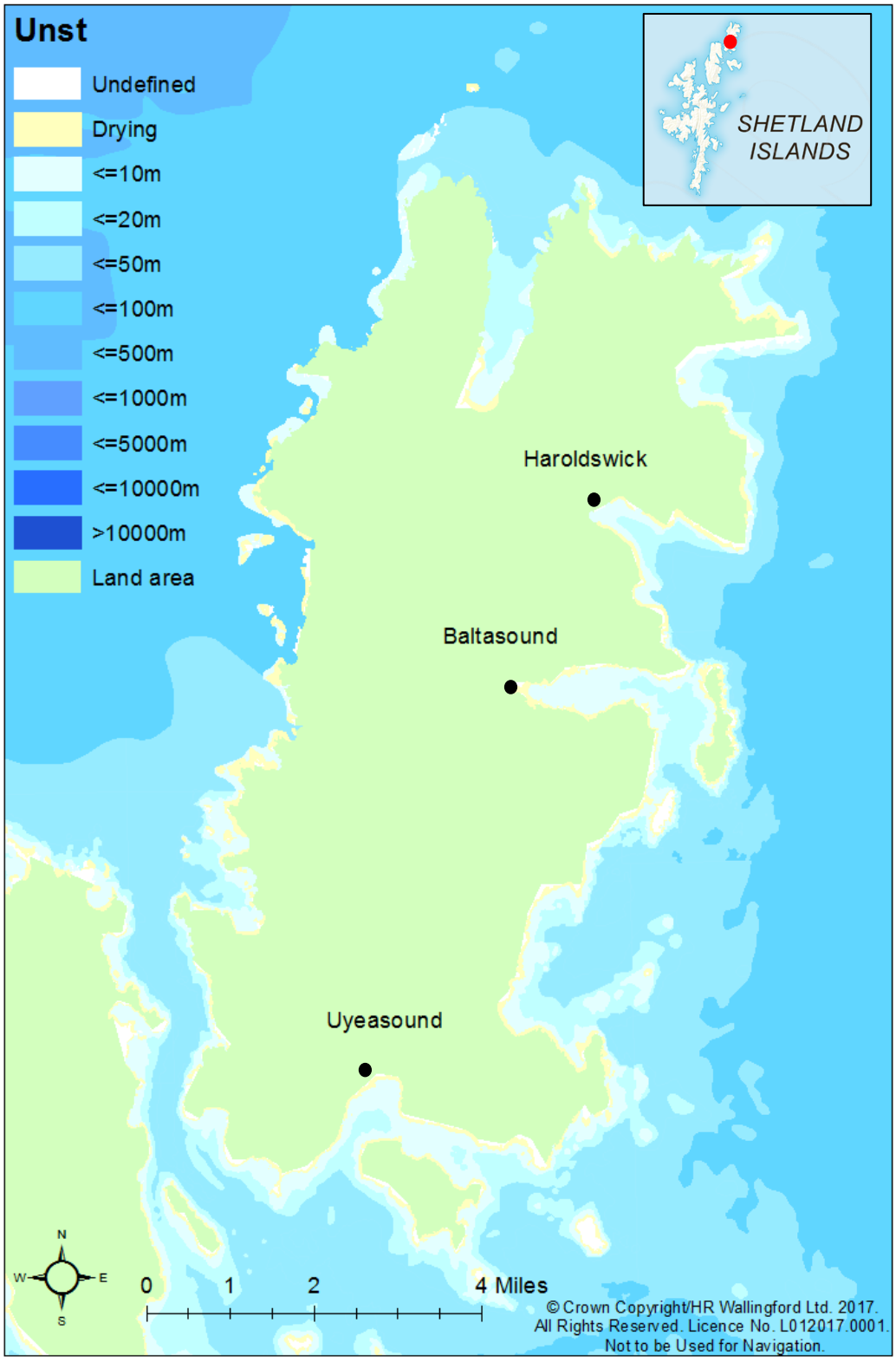


Figure 1.6a: Location of Case Study Islands – Unst (Credit: T. Stojanovic and F. Cunningham)

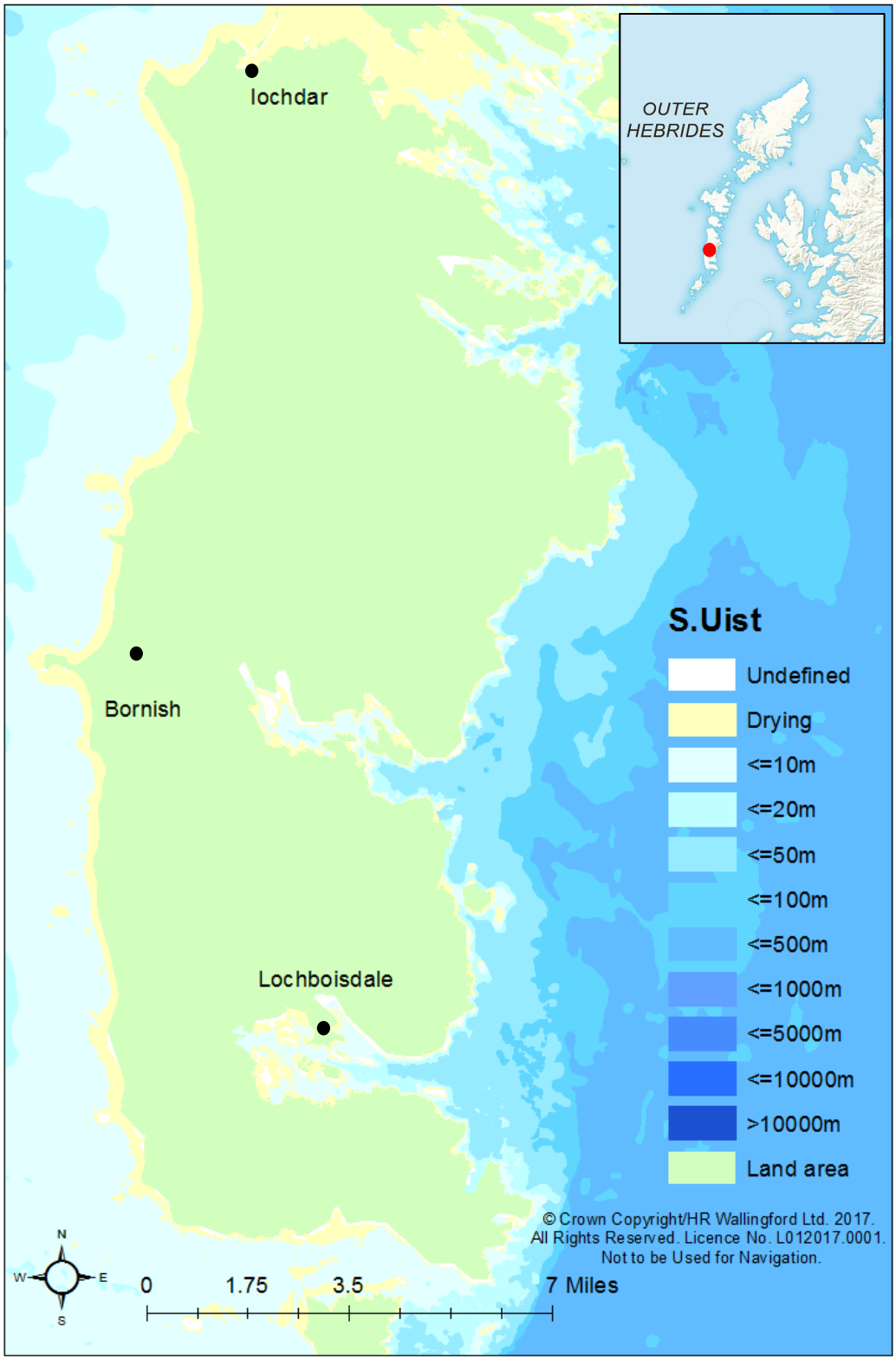


Figure 1.6b: Location of Case Study Islands – South Uist (Credit: T. Stojanovic and F. Cunningham)

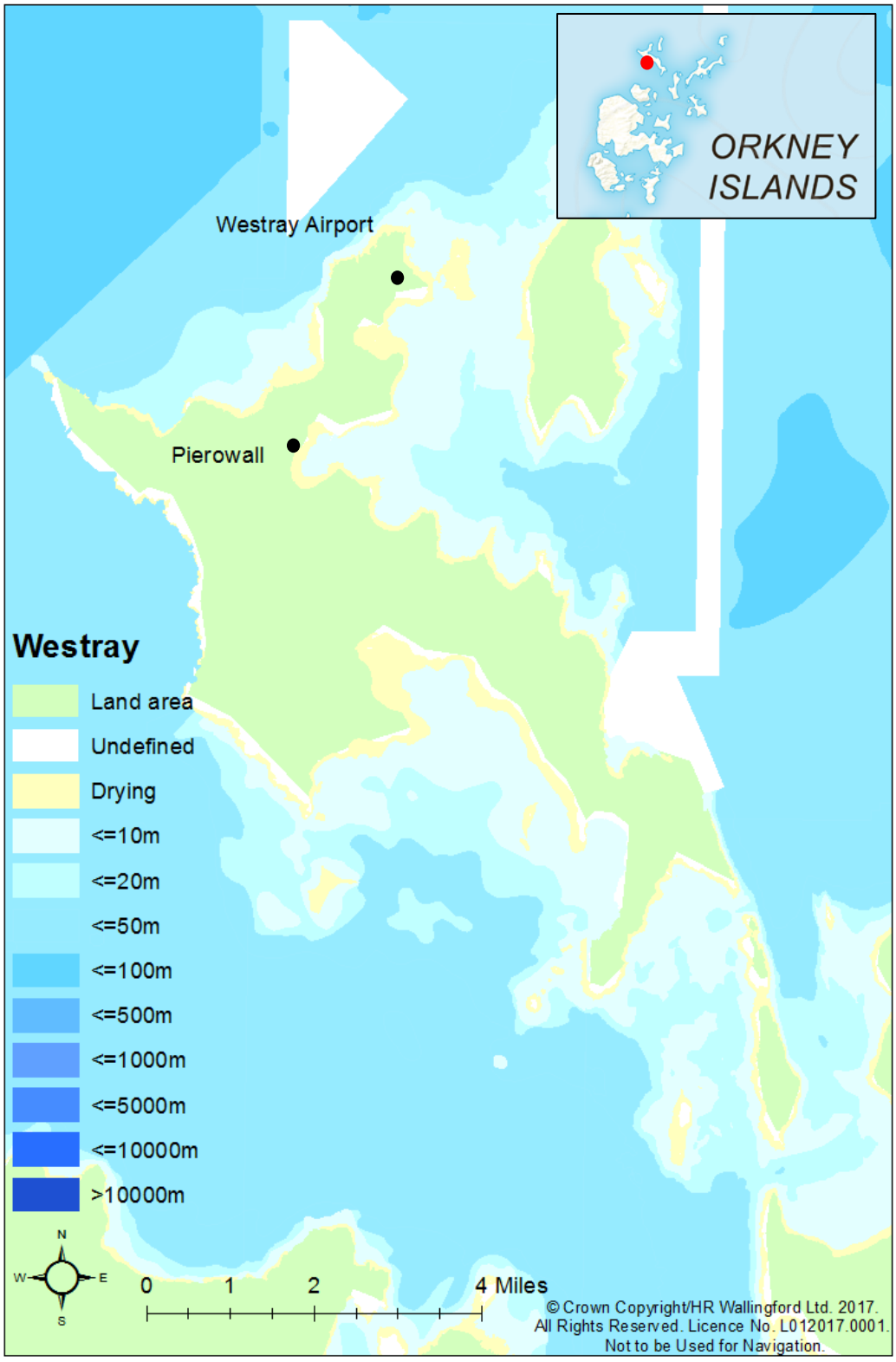


Figure 1.6c: Location of Case Study Islands – Westray (Credit: T. Stojanovic and F. Cunningham)

1.3.2. The Socioeconomic Background of the Case Studies

Unst, Westray and South Uist are physically exposed to impacts of climate change such as flooding, storms, severe winds and coastal erosion. Areas of coastline with low elevation, such as fine sandy bays, are present in all three islands. For example, the west coast of South Uist is largely composed of soft-sediment low-lying coastal land and sensitive machair habitat (Ritchie, 1967), making the west side particularly susceptible to coastal flooding and erosion (Young *et al*. 2014). The predominantly coastal landscapes mean that climate-related coastal hazards can affect the case study communities in multiple locations across each island. The social contexts within Unst, Westray and South Uist are intrinsically related to the peripheral and coastal nature of these islands. Geographical remoteness has the potential to create socioeconomic challenges for communities, particularly when coupled with increasingly adverse climate impacts. A range of social, economic, governance, cultural and practical factors pertain to the case study communities and are specific to small island community settings. The current socioeconomic context of the case studies and existing local issues linked to the themes of governance, settlement, amenities, transport, economy, livelihoods and culture are thus presented.

1.3.2.i. Island Governance

Various state and non-state actors govern the case study islands. Local authorities are the main governing bodies and are responsible for providing a range of public services to support the day-to-day functioning of communities including economic development, environmental protection and cultural services. They also have mandatory and regulatory duties, and permissive powers related to development (Scottish Government, 2017). Although supported by Scottish Government legislation, particularly the Local Government (Scotland) Acts of 1973, 1994, 2003 and 2004, local authorities essentially act independently of central government. Public bodies that act either on behalf of or in partnership with the Scottish Government, like SEPA, are also responsible for governance in the case study islands. In terms of other governance, community councils represent a point of communication between local authorities and communities (Scottish Government, 2018). Community councils are local-scale statutory bodies comprised of voluntary local residents that represent the issues, concerns and views of their community when liaising with the local authority (Improvement Service, 2017). Other local-level governing bodies can include community interest companies and community trusts.

SIC is responsible for providing local authority public services for communities in Shetland, including Unst, under the aforementioned central government legislation (SIC, 2017a). The provision of any manner of permissions or licencing at the local level in Unst is the responsibility of SIC. At the community scale, Unst Partnership and Unst Community Council are community-led organisations that lead on local issues in Unst (Unst Community Council, 2018). Unst Partnership is a registered charity and is comprised of local residents with

voting powers (Unst Partnership, 2015). Unst Partnership aims to support local poverty reduction and economic development, and recently expanded its activities in an asset transfer with Highlands and Islands Enterprise (HIE) (Shetland News, 2018). Both Unst Community Council and Unst Partnership are active in undertaking local-level governance under the overarching administration of SIC.

Westray contains similar community-led organisations that bridge the gap between the community and the local authority. OIC is the governing local authority for Westray, and provides services under the guidance of Scottish Government policy (OIC, 2013). Westray Community Council and Westray Development Trust (WDT) are active community-led groups that represent and act on the views of local people. Westray Community Council is comprised of local residents who convene regularly to address issues of community interest such as pier safety at Rapness (Westray Community Council, 2018). Additionally, WDT was set up in 1998 with the aim of addressing socioeconomic factors that have contributed to depopulation in Westray (WDT, 2000). The Trust has supported a range of local developments including the installation of a community-owned wind turbine. WDT is responsible for distributing revenue from the wind turbine to enhance community development. Although OIC ultimately governs Westray in its capacity as the local authority, Westray Community Council and WDT are significant community-led actors who influence governance at the community level.

CnES is the governing local authority for the Outer Hebrides and provides public services for the South Uist community (CnES, 2018a). Three separate community councils operate across South Uist. The presence of Iochdar, Bornish and Lochboisdale Community Councils in the respective northern, central and southern areas of the island reflects the geographical spread of the population across South Uist. These community councils are comprised of local residents who represent the views of their respective local areas. For example, Iochdar Community Council remains engaged in lobbying for investigations and action at the South Ford causeway following the storm of 2005 (Iochdar Community Council, 2018). In addition, Storas Uibhist Ltd is a key community-led actor involved in community-level governance. Storas Uibhist is the community landlord for South Uist and operates as a subsidiary under the ownership of the community company Sealladh na Beinne Moire Ltd (SnBM). SnBM undertook a community buyout process of South Uist estate land in 2006 for £4.5 million, thus estate land is now owned by the community rather than private owners (Storas Uibhist, 2013a). SnBM is owned and operated by community members, and membership is open to all residents on the South Uist estate. Lochboisdale Development Ltd and South Uist Renewable Energy Ltd are also subsidiaries operating under SnBM. Storas Uibhist is responsible for operating the crofting estate and overseeing fishing, drainage, coastal protection and commercial activity across 93,000 acres in Benbecula, South Uist and Eriskay (Storas Uibhist, 2013b).

There has been recent local tension regarding community-level governance by Storas Uibhist. Community concerns were raised in relation to transparency of actions, the state of finances and community access to information regarding

seaweed-harvesting activities (BBC News, 2018). In July 2018, three new board members were elected in a vote with 70% community turnout (Stornoway Gazette, 2018). The election highlights the potential for community-scale power tensions, but it also conveys the community-led and democratic nature of Storas Uibhist as a governance actor. Whilst three community councils are responsible for representing the views of the community, Storas Uibhist (as a subsidiary of SnBM) has the power to develop and govern activities on estates land. Overall, the governance profile of South Uist is more intricate than Unst and Westray due to the existence of SnBM and its subsidiary companies.

1.3.2.ii. Settlement, Services and Amenities

Baltasound and Pierowall Village are key areas of settlement in Unst and Westray respectively (Unst Partnership, 2010a; Visit Scotland, 2018). A range of services and amenities to meet day-to-day needs are concentrated within these villages: a GP surgery, junior high school, post office, fire station, fuel station, leisure facilities, community halls and convenience shops are present in both settlements (Unst Partnership 2018; Westray and Papa Westray Tourist Association, 2018a). Other smaller areas of settlement such as Haroldswick (Unst) and Skelwick (Westray) also offer some minor services such as additional small shops and community halls. Other facilities in Unst include: a bus and taxi service, the North Isles Learning Centre open part-time as part of Shetland College, and a heritage centre (Unst Partnership, 2018). Other facilities in Westray include: a small airport with flights to Papa Westray and Kirkwall, two ferry ports, and a youth centre (Westray and Papa Westray Tourist Association, 2018a). Due to the significant concentration of services and amenities in Baltasound and Pierowall, these villages can be considered as social and practical hubs for the communities of Unst and Westray.

In South Uist, Lochboisdale is the largest area of settlement and contains a range of services including a police station, post office, bank, ferry port and shops (CnES, 2018b; Outer Hebrides Business Directory, 2018). Since Lochboisdale is located towards the southern end of the island, the amenities located there do not necessarily serve the entire community of South Uist. Other amenities are scattered throughout the island close to or within smaller areas of settlement, particularly convenience stores, community halls and a primary school in Iochdar that serves the north end of South Uist. The presence of amenities across South Uist reflects the geographical spread of population. The neighbouring island of Benbecula offers additional amenities and services for the South Uist community including an airport, hospital, leisure centre and a secondary school (CnES, 2018c). Communities in Unst, Westray and South Uist have local access to most fundamental services and amenities necessary for sustaining the respective communities but other services such as specialised healthcare, extensive higher education and wide-ranging retail options are not readily available within these islands.

The availability of amenities and services in the case studies differs to that of mainland locations, and varies even in comparison to the main towns of each case study island group: Lerwick, Kirkwall and Stornoway. The remote nature of the study islands has led to specific local issues for each community in relation to the provision of local services and amenities. As described, most essential services are available in each island. However, it is often necessary to travel a significant distance for services that are not available locally. For example, Baltasound Junior High School - the school serving the local community in Unst - is equipped to teach children from primary level through to S4 of secondary school. However, children advancing to levels S5-6 are required to travel to Anderson High School in Lerwick on a weekly basis over a distance of 55 miles. The journey requires two separate ferry crossings and takes approximately 90-120 minutes one-way from Unst to Lerwick (Unst Partnership, 2018). School closures are a contentious issue across Shetland and there is local concern that the closure of small-island schools could decrease the range of readily-available services in islands like Unst, thus increasing reliance on interisland transport (Taylor, 2014).

In Westray, the cost of services has been negatively affected by the geographical remoteness of the island in comparison to mainland areas (WDT, 2000). WDT has worked to improve the availability of local in-island services and amenities: a local home-help service has been created for vulnerable and elderly residents, the village youth centre has been refurbished, and a learning centre has been established offering a range of skills development courses (WDT, 2017). However, the provision of essential amenities and services necessary for sustaining the Westray population is an on-going local issue. As a result, the Trust is continually working to secure and provide funding for local projects to improve the quality and availability of facilities on the island (WDT, 2017).

In South Uist, the community has access to a range of essential services and amenities through the main centre of Lochboisdale with others interspersed throughout the island. The causeway between South Uist and Benbecula provides fixed access to further neighbouring services. The Outer Hebrides Community Appraisal Survey indicated that 90% of residents felt satisfied living in South Uist, but they felt that the regeneration of Lochboisdale was a development priority (Outer Hebrides Community Planning Partnership OHCPP, 2007). The Lochboisdale Regeneration Project – a £10 million project which came to fruition in 2015 - was undertaken by Storas Uibhist and Lochboisdale Development Ltd and funded by HIE, CnES, ERDF, Big Lottery Fund and the Scottish Government (Highlands and Islands Enterprise, 2015). Two causeways, new roads infrastructure and marine facilities were developed around Lochboisdale as well as granting access to land for further community, residential and commercial development. However, the diversification and development of locally accessible services for sustaining the population has been acknowledged as a significant priority within local planning (CnES, 2012b). With CnES support, Storas Uibhist and the South Uist community have begun to tackle the on-going issue of local development across the island.

Although the provision of amenities and services appears generally satisfactory on a day-to-day basis in the case studies, the remote geographical location of each island presents challenges and limitations for accessing services beyond the scope of what is locally available leading to the place-specific issues highlighted here. As a result of geographical remoteness, and despite recent development activities across all three islands, the case study communities continue to rely on island transport infrastructure to access services and amenities that are not locally available. Issues surrounding island transport are explored in the following section.

1.3.2.iii. Transport Infrastructure

The remote location of all three case studies means that ferry and air transportation are the sole means of reaching each island from the UK mainland and vice versa. In Unst and Westray, ferries are vital for the movement of people and goods (such as fuel) to and from other islands and the Scottish mainland (Unst Partnership, 2010a; WDT, 2011). Community members in Unst and Westray regularly rely on interisland ferries to reach other areas of Shetland and Orkney respectively. In South Uist, causeways provide fixed road links to both Benbecula and Eriskay. These are regularly relied upon by the local community to reach neighbouring islands and are a critical aspect of interisland transport in South Uist. Ferries are also important within South Uist, particularly when transporting goods and people to mainland Scotland and other Hebridean islands such as Harris in the north and Barra in the south (CnES, 2012b). The substantial reliance on ferries and fixed links within the case studies differs in comparison to the transport infrastructure in place across mainland Scotland, where ferries and fixed links are not widely relied upon to the same extent. As such, it can be posited that this type of transport infrastructure and related local issues are unique to island settings like Unst, Westray and South Uist.

The transport infrastructure currently in place within Unst, Westray and South Uist is relied upon in order to sustain ways of life in each island. However, both ferries and fixed links are at risk of disruption during severe weather events with potentially adverse consequences for local communities. Ferries and causeways can become unsafe during storms thus impeding the ability of communities to travel to, from and within the islands. Transport infrastructure became a prominent issue in South Uist following the 2005 storm (see Section 1.3.3). Additionally, non-climatic issues exist regarding the reduced operation of CalMac Ltd ferries between Lochboisdale and the Scottish mainland, with growing concern over potential knock-on effects for the South Uist economy (CnES, 2018d). Ferry disruption is also a central transport issue in Unst and Westray. Interisland ferries in Unst were recently suspended in December 2017 due to high winds during Storm Caroline (The Shetland Times, 2017). Similarly, ferry services to Westray were cancelled in January 2016 during adverse weather and sea conditions (The Orcadian, 2016).

Ferry disruption can have potentially negative socioeconomic consequences for the case study communities. In Unst, interisland ferries operate on a regular basis with multiple sailings scheduled daily from around 0600 to 2330 hours (SIC, 2018). However, this service is subject to cancellation and postponement depending on weather conditions, particularly during high winds and intense waves as evidenced during Storm Caroline, with knock-on effects for the community (Unst Partnership, 2018). In particular, local residents commuting to mainland Shetland can be negatively affected during ferry disruption (Unst Partnership, 2010a). The improvement of transport links between Unst and the rest of Shetland is a key local planning goal (Unst Community Council, 2006). Unst Partnership (2010a) highlighted the possibility of developing a fixed link, such as a tunnel, between Unst and Yell to reduce dependence on ferries. Approaching SIC about a potential fixed link has since been discussed at Unst Community Council meetings. However, the notion would be subject to substantial funding and backing from SIC and the Scottish Government, and has been a largely divisive issue prompting some community members to highlight that it could negatively impact local employment of ferry staff (Unst Partnership, 2010b). Currently, interisland ferries are readily available in Unst the majority of the time but local concern over disruption has been sufficiently significant to warrant local discussions about fixed link alternatives.

Ferries to and from Westray also run on a daily basis with sailings subject to weather conditions. However, the frequency of sailings is relatively limited in general even during normal conditions. Approximately two or three sailings from Westray to Kirkwall are available throughout each day (OIC, 2018). The already limited service can become further restricted under adverse weather conditions with the potential to cause prolonged inconvenience for community members. Non-climatic socioeconomic issues also exist around interisland ferry transport for Westray. WDT (2000) highlighted that it is not always possible to commute from Westray to Kirkwall for work and to return on the same day, which continues to remain the case currently. WDT is presently working with OIC to improve the availability of interisland ferry services to and from Westray (WDT, 2017). Additionally, the cost of ferry transport between Orkney and the Scottish mainland is a topical issue with calls to deliver cheaper fares since ferries represent a vital link between Orkney and the rest of Scotland (The Orcadian, 2017a). In a recent move, the Scottish Government have established a scheme to reduce fares on sailings from mainland Scotland to Orkney and Shetland throughout the course of 2018 (The Orcadian, 2017b). Overall, the availability and reliability of fixed links and interisland ferries is a significant issue in all three case studies, whilst the affordability of ferries to the Scottish mainland has been an important socioeconomic concern.

1.3.2.iv. Industry, Economy and Livelihoods

Natural resources influence local livelihoods and economies in the case studies, with a significant reliance on the land and sea. Agriculture (crofting) and aquaculture are key industries in the study islands (Scotland's Census, 2011a; b; d).

Primary sectors have been important historically and continue to represent the cornerstones of island life in each of the cases (WDT, 2005; Unst Partnership, 2010a; Storas Uibhist, 2013c). Other industries, such as tourism, are also locally significant. The case study economies, industries and livelihoods are described here alongside existing local issues linked to this theme.

In Unst, public sector work based both locally in Unst and centrally in Lerwick is the main form of occupation accounting for 45-50% of employment across the island (Scotland's Census, 2011a). Aquaculture is the second largest employer whilst crofting, tourism, wholesale, construction and catering are also significant local industries. Although crofting is a key occupation, it is common for crofters in Unst to maintain additional sources of income (Unst Partnership, 2010a). Closures of Unst airport in 2001 (now only available for private and emergency use) and the RAF Saxa Vord station in 2006 resulted in an economic decline of 50% between 1991-2007 (Unst Community Council, 2006). Subsequently, Unst Community Council recognised the need to develop and strengthen the economy through the diversification of local industries. Small businesses have since emerged, such as PURE Energy, along with art/craft initiatives. In relation to protecting the economy, local concern also revolves around connectedness. Maintaining connectedness with the rest of Shetland via telecommunications and interisland transport is a vital aspect of modern livelihoods and community development in Unst (Unst Community Council, 2017). However, severe weather presents problems for maintaining connectedness when both telecommunications and transport are disrupted. Additionally, depopulation is a matter of local concern. The significant decline in population from 1,055 to 632 between 1991-2011 (SIC, 2014a) could produce long-term negative economic outcomes for Unst. Online information packs have been made publicly available by Unst Partnership to encourage migration to Unst, thus highlighting depopulation as an issue that is currently being addressed within local development.

In Westray, agriculture and fisheries are the most significant sectors, accounting for 25-30% of total industry (Scotland's Census 2011b). Other industries include construction, tourism, catering/accommodation and manufacturing. Local businesses include a knitwear manufacturer, wholesale bakery and seafood factory (Go Westray CIC, 2017a). Professional and public sector work is also a key form of employment. Depopulation is a significant concern in Westray, as well as the Orkney Islands in general (OIC, 2014). Between 1991-2011, the population of Westray decreased from 704 to 588 (Scotland's Census, 2011c). The negative population trend has been attributed to individuals relocating for jobs elsewhere combined with decreasing local birth rates (WDT, 2000). There has been a local-scale effort supported by WDT to increase population levels by enhancing and diversifying the Westray economy. For example, the community-owned wind turbine was established in 2009 in a local effort to enhance the economy and empower the community. The turbine is now a key part of the local economy and WDT uses the income from energy production for community benefit (WDT, 2018). In the financial year 2016-17, £42,400 of turbine income was distributed within the community to fund a range of activities

including improvements to the local nursery (WDT, 2017). Other efforts in economic diversification include the development of a quarry and a project to grow local fresh produce. Despite recent success, the matter of maintaining and boosting the island population remains an important issue, evidenced in the recent WDT Annual Report for 2016-17. Local economic development and diversification is an on-going matter in the face of depopulation.

Professional and public sector jobs represent the main occupation across South Uist, accounting for around 50% of total employment (Scotland's Census, 2011d). Construction, agriculture, fisheries and tourism are also significant industries across the island. Crofting is an important livelihood in South Uist, whilst other industries include retail, catering/accommodation, quarrying and manufacturing. Local businesses include hotels, B&Bs, art/craft galleries and salmon producers (Outer Hebrides Business Directory, 2018). Although a reasonable proportion of economic activity is produced internally within the Outer Hebrides, exports and supplies from the UK mainland are essential for supporting local island economies (CnES, 2012b). However, the geographical remoteness of the Outer Hebrides has the potential to create barriers for trade. Challenges exist in terms of sustaining populations and creating diverse internal economies across the island group. Efforts within South Uist to diversify the local economy are evidenced in various activities including the aforementioned Lochboisdale Regeneration Project and the community buyout that led to the creation of Storas Uibhist. In particular, Storas Uibhist have recognised the need to safeguard the crofting sector as an economically and historically significant practice (Storas Uibhist, 2013d). Despite recent progress, preventing economic decline remains a key community-level goal throughout the Outer Hebrides, including South Uist (OHCPP, 2018).

Whilst public sector-type jobs comprise a significant proportion of employment in the case studies, primary industries are also economically important. The prominence of primary industries within the case studies could be specific to rural and small island settings. However, local literature indicates that it is challenging to maintain island economies through primary industries alone. Economic diversification is crucial for sustaining and increasing population levels (Unst Partnership, 2010a; WDT, 2017; OHCPP, 2018). This is a general issue across all case studies for relatively similar reasons: economic decline and the threat of depopulation. Sustaining economies, and therefore populations, by making each island a viable place to live is an on-going fundamental concern across the case studies.

1.3.2.v. Island Culture

Each case study community has a rich cultural heritage that revolves around the natural landscape as well as Gaelic roots in the Outer Hebrides and Norse origins in Shetland and Orkney. The island communities are known for their distinctive local culture over and against globalised western culture. Whilst local heritage attracts tourism, island culture itself is integral to the social profile of each

island. Histories and traditions influence the way in which local people live. Cultural identity, reinforced by island heritage, is a key social characteristic within each case study. Specific local issues pertaining to cultural heritage are outlined here.

Natural Heritage

The natural environment is a significant part of local heritage in the study islands. Natural landscapes host diverse ecology and a variety of coastal features including soft sediment low-lying beaches (Norwick beach, Unst), steep cliffs (Noup Head cliffs, Westray) and dune systems (Kilphedar, South Uist). Diverse wildlife and varied geology in Unst contribute to the island's rich natural heritage (Unst Partnership, 2010a). The geology of Unst is celebrated as part of Shetland's UNESCO Global Geopark status and is an important aspect of heritage and tourism (UNESCO, 2017; Shetland Amenity Trust, 2018a). A survey by Unst Partnership found that the local community valued the "unspoilt" quality of Unst's natural environment (2010a, p.14). Additionally, Hermaness is a designated NNR consisting of cliffs and moorland, whilst Muckle Flugga is a small island to the north of Hermaness that is considered to represent the most northerly point in Britain by local people (Unst Partnership, 2010a). For this reason, Muckle Flugga has become a meaningful piece of cultural identity in Unst.

In Westray and South Uist, the respective natural environments are a central component of local heritage. The natural landscapes of both islands offer land and marine-based recreational activities including cycling and sailing, as well as supporting a variety of flora and fauna, all of which promote tourism and local quality of life (WDT, 2000; Outer Hebrides Tourism, 2014). Areas of natural heritage interest in Westray include Noup Head RSPB reserve and Castle O'Burrian sea stack, which are home to a range of bird life including puffins (Westray and Papa Westray Tourist Association, 2018b). A major component of natural heritage in South Uist is the existence of machair along the island's west coast. Machair is a fertile grassy low-lying plain, the soil of which is composed of sandy siliceous and calcareous material (Ritchie, 1967). In South Uist, machair provides rich habitat for flora and fauna, and fertile land for agriculture. The JNCC (2005) has designated machair in South Uist as a Special Protection Area due to its significance within natural heritage on the island.

Archaeology and Ancestry

The Unst community shows evidence of cultural self-perception that draws on a combination of Scottish, British and Scandianvian identities, particularly the latter which contributes to its 'Viking heritage' (Grydehoj, 2013). Viking sites, such as the excavated longhouse at Hamar, have been maintained and promoted as part of Shetland Amenity Trust's 'Viking Unst' project (Shetland Amenity Trust, 2018b). Unst's Norse history is celebrated further during Up Helly Aa festivities, which take place annually in Norwick and Uyeasound to honour local Viking heritage. Norse heritage is also evident in place names throughout Unst. For example, Sandwick is

a Norse-influenced place name, meaning a wide sandy inlet (Shetland Amenity Trust, 2012). Unst's Heritage Centre and Boat Haven are dedicated museums that showcase history and culture including aspects of local Norse heritage (Unst Heritage Trust, 2012).

Archaeology and local history are also significant aspects of heritage in Westray (WDT, 2011). Links of Noltland is a Neolithic and Bronze Age site on the north coast and was originally a farming settlement (Historic Environment Scotland, 2018). Excavations of the site uncovered a small stone Neolithic figure in 2009, and a Bronze Age building in 2015 (Go Westray CIC, 2017c). Sand dune erosion has threatened the survival of the site and excavations are on-going to record and preserve this area (Go Westray CIC, 2017d). Like Unst, Norse history is culturally important in Westray. A 10th century Viking longhouse was excavated at Quoygrew during a project by Historic Scotland, the University of York and the University of Cambridge between 1999-2006 (Barrett, 2017), and remains an important piece of Westray's Viking past (Go Westray CIC, 2017b). Westray Heritage Centre is a facility that hosts a range of exhibitions and artefacts to illustrate local culture and history (Westray and Papa Westray Tourist Association, 2018c).

Archaeology also plays a significant role in the cultural heritage of South Uist. A range of sites have been excavated and recorded as part of local history across the island. Cladh Hallan is a Bronze and Iron Age settlement near Daliburgh consisting of a series of roundhouses, whilst Dun Mhulan is an Iron Age broch uncovered near Bornish (Outer Hebrides Tourism, 2018a; 2018b). The cultural heritage of South Uist is strongly influenced by its Gaelic roots. Gaelic ancestry has had a marked influence on language, culture and ways of life in South Uist, and Gaelic history itself is regarded as a cultural asset within the islands (Outer Hebrides Tourism, 2014). Kildonan Museum is a hub of island heritage that celebrates the Gaelic history and culture of South Uist. The influence of Gaelic ancestry on arts, culture and ways of life in South Uist is explored in greater detail hereafter.

Traditional Arts, Crafts and Livelihoods

In the case studies, ways of life are shaped by island-based traditions. In Unst, crofting is a key aspect of culture and tradition that remains a socially valued and economically significant livelihood today. Fishing, cooking and crafts are also culturally important traditional activities within the Unst community. Unst Partnership (2010a) highlighted that local people value crofting history as an important part of their island identity. Additionally, Unst Creative is a dedicated local arts and crafts development organisation on the island, and traditional music and arts are celebrated annually during Unst Fest.

In Westray, arts/crafts and land-based activities are significant components of local heritage. Although farming and fishing are economically important as modern livelihoods, these activities have been passed down through local families

across generations and are culturally important to local ways of life (Go Westray CIC, 2017b). Traditional and contemporary arts and crafts - such as painting and pottery - are a major part of Westray's culture, and the creative skills of the local community are celebrated and supported by WDT and the Westray and Papa Westray Craft Association (WDT, 2005; Westray and Papa Westray Tourist Association, 2018b). Whilst being traditionally significant, WDT have recognised arts and crafts as an industry with the potential to help diversify the island economy, particularly through the promotion and marketing of local craft culture to wider audiences outwith Orkney (WDT, 2000).

Arts and crafts – such as textiles and jewellery – also represent an important aspect of local culture in South Uist, whilst ways of life are grounded in traditional activities of crofting and fishing. The influence of Gaelic and Celtic history on local South Uist culture is evidenced in arts, craft, music, poetry and traditional ways of life (Outer Hebrides Tourism, 2018c). The Gaelic language remains widely practiced throughout South Uist: 683 people are fluent whilst 1,260 people possess some degree of Gaelic language skills (Scotland's Census, 2011e). Traditional Gaelic songs have been passed down through generations to form a cultural legacy, evidenced in local music groups such as The Isle of South Uist Folk Club. Additionally, Ceolas is a Gaelic culture and arts organisation created in 1996 in South Uist. Ceolas celebrates Gaelic heritage and aims to encourage traditional culture via performance and education within the local community (Ceolas, 2018). Recently, Ceolas and Lews Castle College (UHI) began a joint project to create a new Gaelic learning centre (Ceolas, 2017) which highlights the level of local value placed on heritage and arts.

Cultural Heritage - Local Issues

Promoting and protecting cultural values, traditions and identities is a local concern related to heritage in the case studies. In Unst, the potentially significant role that cultural heritage can play in attracting tourism and supporting the island economy has been recognised. As a result, the local community have developed a tourism strategy via Unst Partnership in which they attempted to promote partnership working between local businesses and community groups to maximise the attractiveness and popularity of Unst as a place of rich heritage (Unst Partnership, 2010a). SIC (2015) have also highlighted the continued importance of managing and caring for local culture throughout Shetland to enhance the economic impact of island heritage. This is an on-going issue for islands across Shetland including Unst.

Local concerns in Westray also revolve around preserving and promoting cultural heritage for community benefit along with potentially diversifying the island economy. WDT has prioritised promoting local heritage to boost tourism and encouraging traditional and contemporary arts/crafts to establish Westray as a hub of small-scale high-quality creative industries. Developing existing cultural resources on the island could support the longevity of the local community (WDT, 2005). The Trust is committed to preserving and enhancing the archaeological,

cultural and natural heritage of Westray by supporting local community groups in undertaking heritage-based activities (WDT, 2011). Recording vulnerable archaeological sites, such as Links of Noltland, is also a pressing local concern that is being tackled by WDT and the Links of Noltland Legacy Project (Go Westray CIC, 2017d). Whilst the Westray community possess a strong sense of belonging and island identity, they are also willing to embrace new ideas to secure a sustainable future for the island (WDT, 2000).

In South Uist, OHCPP (2007) found that 33% of residents regarded the preservation and promotion of heritage sites as a high priority for local development, whilst 22% prioritised the improved provision of historical information. Outer Hebrides Tourism (OHT) – an independent trade organisation for the local tourism industry - laid out their aims for developing the tourism industry across the Western Isles in their Tourism Outer Hebrides 2020 strategy (2014). OHT, HIE, CnES and Visit Scotland are joint leaders of the Tourism Outer Hebrides 2020 initiative (OHT, 2018). The plan aims to boost tourism in a sustainable manner to enhance island economies and increase population levels (OHT, 2014). Furthermore, CnES (2012a) have highlighted archaeology as a cultural, economic and educational asset, and prioritised recording and promoting local archaeology across the Outer Hebrides. Like Unst and Westray, the promotion, protection and preservation of cultural heritage is an issue of local importance in South Uist and across the Outer Hebrides.

Island-specific heritage is a central part of the socioeconomic profile of each study island. Island heritage is distinctive in its focus on the preservation of traditions linked to land, sea, history and ancestry. General components of heritage – archaeology, ancestry, arts, crafts, traditional livelihoods and natural features – are common across the study islands. However, differing ancestral roots and histories mean that each community possesses a distinct and unique cultural heritage profile, particularly when comparing South Uist (with its Gaelic background) to Unst and Westray (strong Norse ties). Across all cases, the issue of upholding local heritage is significant for preserving cultural legacies and identities. Promoting heritage is pertinent for boosting tourism and, in turn, bolstering island economies and populations. Although cultural identities differ, examples from local literature indicate that there are similar concerns in terms of preserving and promoting cultural heritage.

1.3.3. The South Ford Tragedy of 2005

1.3.3.i. The Storm of January 2005

A severe storm originating in the North Atlantic affected western and northern parts of Scotland on 11-12 January 2005. Exploring the details of the storm can assist in understanding the implications for communities in the Uists and Benbecula. On the morning of 11th January a warm front, along with a deep depression and southwesterly winds, travelled towards the west coast of Scotland (Dawson *et al.* 2007). This area of low pressure intensified throughout the day and

decreased to 944mb as it reached the Uists. Low pressure influenced sea surface level to the west of the islands and caused surface level to rise by 0.69m above typical tide levels (Angus and Rennie, 2014). Wind speeds were recorded in excess of 100km/h with gusts exceeding 140km/h over a prolonged period across South Uist and Benbecula (Muir *et al*. 2013). The force of high-speed winds further elevated sea surface levels. Consequently, sea level rose in excess of the 0.69m rise caused by low air pressure. The storm also occurred during high astronomical tide conditions where the tide was at a naturally high level irrespective of other meteorological conditions. On the evening of 11th January, the influence of low depression and strong winds on sea surface level, coupled with the occurrence of high tide, gave rise to a 2 metre storm surge where seawater was rapidly driven towards and across the west coast of the Uists and Benbecula (Dawson *et al.* 2007). The surge resulted in significant coastal flooding which was severe in the South Ford area near Iochdar.

1.3.3.ii. Consequences of the Storm and Impact on the Community

The storm produced adverse consequences for the Uists and Benbecula. The most serious and significant outcome was the loss of five lives within the same family as a direct result of storm surge inundation. The family: Calum Campbell, his daughter Murdina MacPherson, her husband Archie MacPherson and their children Andrew and Hannah, attempted to evacuate their home in Iochdar when they believed their safety might be compromised due to rising sea level and intense wave activity at the nearby coastline (The Guardian, 2015). The force of the oncoming surge caused the cars in which the family were travelling to be inundated. The event marked a significant tragedy that caused community-wide anguish and grief. It had a deeply profound impact on local people and is considered to be the worst storm in the area within living memory (Richards and Phipps, 2007). Community insights into the lasting impacts of the storm are presented within the empirical results in Chapter 5.

In addition to fatalities, the storm caused substantial damage across the Uists and Benbecula including damage to property, transport infrastructure (roads and causeways), coastal infrastructure (harbours and coastal defence works) and council infrastructure (Balivanich Primary School) (CnES, 2012c). South Uist suffered a marked increase in coastal erosion (Muir *et al*. 2013), particularly in Stoneybridge and Kilbride. Flooding and erosion also adversely affected agricultural land at the coast with some areas losing over 5 metres of economically important land (Young *et al*. 2014).

1.3.3.iii. Institutional Response

Immediately following the storm, initial response by CnES centred on repairing physical damage. Roads, harbours and buildings were repaired and rebuilt (CnES, 2012c). Soon after the event, there was a community-scale effort to understand the nature of the storm and to push for improved flood risk management to increase community safety in future. Local residents created the

Iochdar Flood Action Group to understand flood risks around the South Ford and to press for flood risk action by CnES and the Scottish Government. The group has undertaken public meetings and workshops to discuss flooding and erosion in the wake of the event (SEPA, 2015). However, community-level response has been limited by financial, resource and institutional constraints and relies on support, guidance and funding from groups at higher scales such as CnES and the Scottish Government.

The event raised awareness, at both local and national scales, about the vulnerability of island communities to climate-related hazards and impacts. In relation to long-term flood risk management, the Scottish Government funded a hydrodynamics study to understand coastal dynamics in the South Ford area. Subsequently, the South Ford Hydrodynamics Study was published in 2012, and was largely undertaken by members of CnES with involvement from the Scottish Government, SNH, SEPA, Aberdeen Institute of Coastal Science & Management and Iochdar Flood Action Group. The study identified local coastal processes and the influence of man-made structures, such as the causeway, on hydrodynamics in the South Ford area. It also provided recommendations for minimising risk and increasing safety during future flooding events and was intended as a guide for future flood risk management by CnES supported by the Scottish Government.

CnES and Storas Uibhist have undertaken some measures to tackle flood risk in South Uist. Roads along the west coast have been elevated to provide designated reliable escape routes during future flooding. However, long-term action has been delayed due to financial constraints. In particular, certain recommendations made within the Hydrodynamics Study – such as creating openings and bridged sections in the causeway (Box 1.3) - have been highlighted as considerably high-cost options and outwith the scope of local authority funding (CnES Transportation and Infrastructure Committee, 2015). One of the most recent developments is the inclusion of a flood protection scheme for the South Ford in the Outer Hebrides LFRMP (CnES, 2016). CnES have also applied to the Scottish Government to fund a dune management-based flood prevention scheme and have proposed a feasibility study to better understand the scope for modifications to the causeway (Campbell, 2017). Although tangible long-term flood risk action is gradually progressing at the local authority level in response to the 2005 event, it has been largely delayed and hindered by financial incapacity.

Box 1.3. The South Ford Causeway

Causeways are a type of fixed road link existing within South Uist. The South Ford causeway connects the islands of South Uist and Benbecula across the inlet of water known as the South Ford. It has been suggested, particularly at the community level, that the causeway served to exacerbate the severity of surge flooding within the South Ford area during the storm and contributed to loss of life. Indeed, the South Ford Hydrodynamics Study reports that modelling of the 2005 storm "shows the extent of flooding to be greater with the causeway present than without the causeway" (CnES, 2012c, p.4). The study suggested that modifications to create a 250m opening in the causeway and bridged sections of carriageway would be highly effective in minimizing risk during future flooding events. However, the study concluded that this is the highest cost solution and that other low to medium cost solutions – such as flood alert systems - could also be highly effective whilst being more affordable and therefore viable (CnES, 2012c).

There remains strong local concern over community safety during future storms of a potentially similar magnitude and severity (Ross, 2015). The high cost associated with altering the fixed link between South Uist and Benbecula has resulted in the South Ford causeway remaining in place without modification since the 2005 event. As a result, the existence of the causeway, and in particular its present design, remains a source of conflict within and between community groups, the local council and national institutions.

Institutional response to the tragedy at the UK level has also been delayed and intermittent. In January 2017 the Crown Office issued a public apology for taking over a decade to decide whether a Fatal Accident Inquiry was required into the deaths of the Campbell-MacPherson family (BBC News, 2017). The Crown Office resolved that the South Ford Hydrodynamics Study had covered all necessary issues – including analysis of the causal factors behind the flooding and recommendations for future flood risk management – and therefore decided not to undertake a Fatal Accident Inquiry. However, it was publicly acknowledged that the inaction and lack of decision-making at the national level had been unjust to those affected by the fatalities.

The tragic consequences of the 2005 storm highlighted the vulnerability of small islands to climate-related coastal hazards and emphasised the necessity for adaptive planning and action to minimise the risks posed by similar events in future. Steps have been taken at local and sub-national levels to respond to the event: community flood action groups have emerged, CnES and Storas Uibhist have acted to improve flood risk management and emergency protocol during storms and flooding, and the Scottish Government supported the production of the South

Ford Hydrodynamics Study to better understand the event and potential management options for the South Ford area. Local authority response is on-going but large-scale significant action is hindered by financial constraints. The event has had a lasting impact on the people of South Uist. Concern over future hazards has meant that flood risk management remains a major issue for the South Uist community as well as CnES, the Scottish Government and other relevant national bodies such as SEPA and SNH.

1.4. Conclusions

This study aims to explore small island adaptation through the investigation of priorities and motivations for adaptation in three Scottish island communities. There is a need to better understand the place-based values and experiences related to impacts of climate change in small island communities. The outcomes of community engagement could inform effective adaptation planning and action in these settings. The thesis will critically review the state of existing adaptation research and knowledge within the field of climate change before providing an in-depth account and discussion of the empirical methods, results and findings associated with the current research. A review of existing literature is provided in Chapter 2 after which the research methodology is discussed in Chapter 3. The empirical results are presented in Chapters 4 and 5. Chapter 4 discusses the utility of hypothetical vulnerability mapping as a tool for engagement in a small island community; an additional element of the research. The results of qualitative data collection in the case studies, as a means of researching and understanding priorities for adaptation, are presented and interpreted in Chapter 5; these are the core results of the research. The academic and real-world implications of the results are discussed in Chapter 6. Finally, Chapter 7 identifies the contributions made to existing theory, and planning and practice, and highlights scope for further research in future.

Chapter 2: Literature Review

2.1. Introduction

As described in Chapter 1, hazards and impacts of climate change can have negative and harmful consequences for society. Storms and rising sea levels can damage property and important infrastructure; coastal erosion can damage culturally, economically and ecologically important landscapes; and changes in temperature and precipitation can hinder primary livelihoods such as farming leading to economic disruption. In some severe cases, intense storms and flooding can result in injury and mortality. The consequences of climate-related hazards and impacts are particularly pertinent in island settings that are exposed, sensitive and vulnerable to manifestations of climate change, and where socioeconomic, cultural and institutional contexts might differ significantly to mainland settings. Adaptation has become widely accepted as an approach to enable the human population to cope with the adverse and harmful impacts of climate change. Despite recent efforts to establish international and national frameworks, adaptation is not being operationalized to its full potential across local, national and global scales at present, with particular disadvantages for small island settings. A range of ambiguities and challenges continue to exist within the realms of policy, planning and implementation, leading to stunted progress in climate adaptation. Adaptation seems like a straightforward concept in principle. However, it is a complex issue surrounded by a certain degree of debate.

This chapter presents an extensive literature review exploring the current debates surrounding the concept of adaptation in the context of small islands. It delivers an overview of some of the key themes and thinkers within the current peer-reviewed bodies of island studies and adaptation literature. The debates and issues relating to the island condition within the context of climate change are first reviewed. Key themes within the island literature are explored including island development, environmental change, vulnerability to hazards, social capital, marginalisation, and empowerment. Furthermore, the chapter provides a critical examination and discussion of the key concepts and components underpinning adaptation in theory and practice. Five conceptualisations of adaptation are characterised which may be contrasted with one another. Firstly, the role of extreme climatic events in driving adaptation is explored. Next, the relationship between society and adaptation is examined through the investigation of the debates on social values and transformation. Then, the challenges of defining responsibility and developing networks are considered as pathways for undertaking adaptation in practice. Examples of climate adaptation in the context of coastal and island communities are used to illustrate the implications of each conceptualisation. These coastal and island examples provide insight into the debates, challenges and practices of adaptation in locations similar to the case studies. Section 2.4 forms a discussion that compares and contrasts each theme, and considers these themes within the context of island settings. Finally, the conclusions explore the implications for research, and show how research on

small-island adaptation might benefit or be inhibited by the frames provided in each of these approaches.

2.1.1. Adaptation and Resilience

Adaptation and resilience are two major concepts within the climate literature, the definitions of which are at times overlapping, at times complementary and at times contested (Turner, 2010; Brown, 2015). A similar relationship exists between the concepts of vulnerability and resilience, whereby resilience can be considered as a measure of a system's capacity for response, as part of a vulnerability assessment (Turner *et al*. 2003). Resilience can be considered as a broader framing than adaptation. For example, the ability of a coastal community to diversify livelihoods could lead to responses that mitigate the risk to a community from climate hazards. Klein *et al*. (2003) recommend that resilience should be utilised in climate adaptation studies in a 'restricted sense' to consider the dynamic characteristics of natural systems, and that 'adaptive capacity' provides a better overarching theme for considering the capabilities for undertaking adaptation, given its specificity. The literature on resilience is vast and expanding, and systematic reviews provided by Baggio *et al*. (2015) and Xu and Kajuikawa (2018) show that it remains a widely contested term utilised in different ways in different fields. Adaptation might be considered as 'building resilience' that seeks to enable societies to rapidly return to preferable states after occurrence of an extreme event. But resilience also has a broader meaning that relates to the concept of transformation - long-term change that brings about new ways of living in order to deal with both climate change impacts and non-climatic stressors. Transformation itself is considered in Section 2.3. Given the range of debate concerning the concept of resilience, this study draws on the argument provided by Klein *et al*. (2003) as a first assumption. The study utilises the term 'adaptive capacity' to consider social capability for adaptation, and resilience will be considered through the notion of transformation, whilst space will be given to more neglected notions of adaptation including: responding to harm, defining responsibility, and developing networks.

2.2. The Island Condition in the Context of Climate Change

Small islands can be sensitive to environmental and climatic shifts and, in turn, island communities might be particularly vulnerable to hazards and impacts resulting from such shifts (Mimura, 1999). Vulnerability and marginalisation can inhibit the way small island populations respond to the impacts of climatic and environmental change, as well as their capacity to deal with non-climatic issues related to island development. However, if high levels of social capital are present, it could enhance the capacity of island populations to adapt to climate-related hazards and impacts (Adger, 2003; Jicha *et al*. 2011). This section explores key themes in the island literature including island development, environmental and climatic change, vulnerability, marginalisation, adaptive capacity, social capital, and empowerment with a view to illustrating and reviewing arguments surrounding the island condition in relation to environmental and climatic change.

2.2.1. Small Island Development

Aside from being generally acknowledged as areas of land that are bound by areas of water and geographically separated from larger landmasses, islands are not easily defined either by area or population size. Indeed, these parameters could be considered arbitrary when attempting to produce a straightforward definition of a 'small island' (King, 2002; Kerr, 2005). Small island settings differ in comparison to continental settings in terms of their geographical, spatial, institutional, social, cultural and economic characteristics (Fernandes and Pinho, 2017). Additionally, these characteristics – along with insularity, islander identity and societal structures - help to distinguish small islands such as Orkney from larger islands such as the British mainland (King, 2002; Kerr, 2005). The small islands used as real-world examples in the most recent IPCC report are "principally sovereign states and territories" in the Indian Ocean, Pacific Ocean, Caribbean Sea, Mediterranean Sea and the eastern Atlantic near West Africa (Nurse *et al*. 2014, pp.1618). Although these regions were chosen as exemplars by the IPCC, not all small islands exist in these locations or as sovereign states. Small islands in other parts of the world - such as the Faroe Islands in the North Atlantic Ocean – also fit within the typical characteristics of small islands. Small Island Developing States (SIDS) are thought to be particularly distinctive in terms of island-specific economic, social and governance challenges (McGillivray *et al*. 2008; Barnett and Waters, 2016; Robinson, 2018). SIDS are a group of 57 small island countries and territories located mainly in the tropics, such as the Cayman Islands, Seychelles and Jamaica, that have been highlighted by the UN as particularly sensitive to climate change (United Nations, 2018). SIDS display generally similar characteristics to one another in terms of remoteness, livelihood types, sustainability challenges, developing economies, perceptions of culture and identity, and exposure to impacts of climate change (Kelman, 2010; United Nations, 2018). However, small islands that are considered to be more developed can also be vulnerable to climate impacts, and also face island-specific challenges such as peripherality, marginalisation and constrained resources (Starc and Stubbs, 2014). The exposure and vulnerability of small islands to climate change, and related challenges, are reviewed in Section 2.2.2.

The characteristics highlighted above make small islands unique settings for development. Ensuring that small islands are viable places to live and thrive is an essential component of island development, but there are distinctive challenges and limitations for development in both developed and developing island settings (Storey and Steinmayar, 2011). Small islands are spatially limited in terms of physical boundaries whilst livelihood types are often determined by the local availability of resources; both of which contribute to constrained economies in small island settings (Connell, 2015; 2018). Thus, the development of robust and diverse livelihoods is difficult to achieve and sustain in small islands where economic development is inhibited. Whilst access to adequate livelihoods is crucial for sustaining small island populations, the capacity for livelihood diversification is often limited in reality (Connell, 2018). Additionally, factors of poor governance, power inequalities, social marginalisation and physical remoteness can influence

how island development happens in practice (Baldacchino, 2005; Fernandes and Pinho, 2017). The level of local participation and island independence in decision-making can affect how development takes place (Kerr, 2005). Development challenges in SIDS are also likely to revolve around basic needs such as access to water, energy availability, land use, human rights and gender fairness (Kelman, 2014). The variety of challenges in island settings means that island populations could become disadvantaged when faced with limitations to development, and that successful development is likely to be more difficult to achieve in small remote islands.

On the other hand, small island populations could be well placed to utilise local assets in order to boost development. For example, small-island development can benefit from the availability of intangible but valuable social assets such as indigenous knowledge, community cohesion and traditional culture. Medina *et al*. (2007) argue that 'intellectual capital' - referring to traditional culture and local knowledge – can be used to inform and enhance development in island settings. Local knowledge and social assets can be important for meaningful development that benefits communities and reflects island-scale issues (Gegeo and Watson-Gegeo, 2002). Furthermore, the 'right to the island' has been posited as a model for sustainable and fair development that promotes wellbeing and prosperity in small island settings by empowering local populations to take part in general decision-making processes within their own islands (Clark, 2013; Persoon and Simarmata, 2014; Tsai and Hong, 2014). Wallner *et al*. (1996) argue that small island development should begin at the local level to utilise valuable social assets and knowledge, then spread across scales in a bottom-up manner. Debates around empowerment, social capital and local knowledge in relation to adaptive capacity are reviewed in Sections 2.2.3 and 2.2.4.

Impacts of climate change can further exacerbate existing developmental challenges and threaten the security and sustainability of small island populations (Connell, 2015). Understanding and responding to climate-related hazards is essential if small islands are to develop fairly and sustainably into the future (Forbes *et al*. 2013). However, if the focus on climate change is too high, it might result in attention being diverted away from other development issues and challenges in favour of climate change planning (Kelman, 2014). Indeed, climate change strategies could hinder long-term development in island settings if planning begins to overlook or de-prioritise significant non-climatic issues (Baldacchino, 2018). Climate and development issues are not necessarily independent of one another in practice. For instance, whilst climate change impacts (e.g. sea level rise) have influenced recent migration patterns in the Maldives, other non-climatic factors related to education, health, employment and local politics have also driven the movement of people, thus highlighting that climate change has not been the only determinant of migration (Stojanov *et al*. 2017). Various authors have argued for the need to tackle climate-related issues in small island settings whilst continuing to address underlying matters of general development in order to improve the capacity of island populations to respond to climate change (Pelling and Uitto, 2001; Kelman, 2014; Baldacchino, 2018). Both

development and adaptation could be more successful if the latter is integrated and mainstreamed into other development policy (Meheux *et al.* 2007; Butler *et al*. 2014). These debates raise questions about the balance between climatic and non-climatic issues in planning, and where adaptation fits within non-climatic development. Debates around the concepts of mainstreaming and integration - as components of transformation – are reviewed in Section 2.3.3.

2.2.2. Environmental Change, Climate Change and Vulnerability in Small Island Settings

According to Dahl, "all small islands are in the coastal zone" due to their small spatial size (1997, pp.23). A range of hazards can affect coastal populations, some of which are climate-induced whilst others reflect the natural dynamism of the coast (such as cycles of sediment movement and erosion that occur in natural cycles, although these may become altered due to climate change) (Ewing *et al*. 2010; Burningham and French, 2017). Hazards and impacts in coastal settings can arise from geophysical (tsunamis), climatological (storm surges), or meteorological (flood) events (Kron, 2013). Coastal and marine impacts are prevalent in island settings. Small island communities – when considered as essentially coastal populations – can be significantly affected by both natural and climate-induced hazards at the coast. Climate-related drivers of risk for small islands include sea level rise, shifting precipitation patterns, severe storm events, and increasing air and sea surface temperatures (Nurse *et al*. 2014). Islands are susceptible to slow-onset hazards including sea level rise, coastal erosion and saline intrusion evidenced in a recent empirical study in the Maldives by Stojanov *et al*. (2017) which highlighted the significant threat posed by sea level rise within low-lying small island settings. Islands are also vulnerable to rapid-onset climate hazards such as storm surge (Birkmann *et al*. 2010).

Within the context of climate change, islands and low-lying coastal areas are exposed, sensitive and therefore vulnerable to hazards and impacts associated with climatic shifts (Ashe, 1999; McLeod *et al*. 2010). A range of factors mean that these areas have increased risk or exposure such as: a relatively high concentration of population in the coastal zone, small geographical size, and economic dependence on products and sectors which are at risk (European Commission, 2009). A considerable literature has been developed in island studies to highlight these themes. For example, Pelling and Uitto (2001) detail issues particular to small island states such as: limited resources and populations, fragile single sector economies, restricted connectivity to the global economy, and weak political representation. Other articles from the island studies literature note common issues such as: isolation, the relatively low number of inhabitants, fragile ecosystems, limited usable land area, challenges of access to goods and resources, and greater exposure to climate change (Kelman *et al*. 2011; Philpot *et al*. 2015; Malatesta and Di Friedberg, 2017).

The term 'exposure' is not the same as 'vulnerability': small islands are exposed physically to environmental hazards but the vulnerability of a small island

is determined by the nature of this exposure along with the underlying social, economic, political and institutional characteristics that affect island populations' capacities to cope with hazards (Meheux *et al*. 2007). As highlighted in Chapter 1, vulnerability is an inherently social concept (Adger, 1999; 2000). Due to the high degree of exposure in these settings coupled with small spatial size, small island populations are likely to experience impacts more tangibly than mainland and continental regions despite being responsible for a low proportion of global emissions (London, 2004). Island 'smallness' - in terms of population and spatial size - means that environmental hazards are experienced more quickly and to a more noticeable extent in small island settings than elsewhere (Kelman, 2010). Additionally, the limited spatial area of some small islands could lead to the significant damage of an entire island as a result of one high magnitude hazardous event (Pelling and Uitto, 2001).

The vulnerability of small islands extends beyond coastal and climate-related hazards. Multiple interacting climatic and non-climatic drivers influence small island vulnerability (McCubbin *et al*. 2015). The vulnerability of an island community to environmental and climatic hazards is influenced by its underlying social, economic, historical, political and cultural context along with its physical exposure to hazards (Boruff and Cutter, 2007; Owen *et al*. 2016). Indeed, pre-existing non-climatic challenges can be further exacerbated by impacts of climate change in island settings (Birk, 2014). Factors contributing to high island vulnerability include geographical remoteness and insularity; social, political and economic marginalisation; constrained island economies and economic hardship; inadequate access to basic services such as healthcare and education; reliance on limited natural resources for livelihoods security; restricted capacity for migration; constrained island land and space; and the severity of environmental and climate impacts (McGillivray *et al.* 2008; Schwarz *et al*. 2011; Connell, 2015). The vulnerability of small islands can be better understood and tackled when all of the aforementioned factors are taken into account collectively rather than independently (Barnett and Waters, 2016).

Despite some similar characteristics across small islands, various authors have stressed that island vulnerability needs to be considered as a place-based concept in research and planning, and that vulnerability to climate change cannot be generalised across island settings (Boruff and Cutter, 2007; Owen *et al*. 2016; Sjostedt and Povitkina, 2017). To an extent, the severity and significance of coastal and climate hazards varies depending on physical landscape parameters such as geology, geomorphology and elevation that are unique to each particular island (Gornitz *et al*. 1991; Abuodha and Woodroffe 2010; Forbes *et al.* 2013). For example, an island with steep robust coastal topography is unlikely to have the same level of physical exposure and sensitivity as an island with a predominantly low-lying soft-sediment coastline. Similarly, the place-based socioeconomic, political, institutional and cultural contexts of small islands mean that the underlying drivers of vulnerability can differ from island to island (Baptiste and Kinlocke, 2016). Island diversity needs to be sufficiently recognised in planning in order to address unique island vulnerabilities (Ashe, 1999; Nurse *et al.* 2014).

Amongst the non-climatic drivers, geographical remoteness and political marginalisation on governance agendas are key factors that influence vulnerability in small islands, and are two of the fundamental characteristics that set these places apart from continental and mainland regions in terms of planning and development in the face of climate change (Smith and Rhiney, 2016). According to Fernandes and Pinho (2017), small islands are situated on the 'margins' in a literal geographical sense as well as socially and politically within planning and research. Social and political marginalisation might happen due to the isolated location of islands in relation to centres of governance in mainland regions. Marginalisation is characterised by reduced governance, support and assistance (Kelman, 2010). When faced with marginalisation, small island communities might struggle to deal with climatic and non-climatic pressures, leading to higher levels of vulnerability. For example, Johnston (2014) found that communities in Fiji are dependent on external aid when dealing with hazardous events but the receipt of aid is often limited or delayed directly following an event, thus communities have had no choice but to respond as best they can with limited assistance. This type of situation could lead governments and agencies to believe that small islands are equipped to cope when in fact inherent vulnerabilities remain and assistance is still required. Marginalisation might also affect island livelihoods, with limited capacity for livelihood diversification without government or agency assistance (Birk, 2014). Kelman (2014) argues that the marginalisation of small islands has not been exacerbated by climate change but rather that it has served to further highlight pre-existing marginalisation, and has emphasised the socioeconomic and political neglect contributing to inherent vulnerability. Climate change impacts have exposed intrinsic weaknesses and inequalities in small island settings (London, 2004; Meheux *et al.* 2007; Forbes *et al.* 2013). The degree of physical isolation and the level of socioeconomic marginalisation are both significant in determining island economies and social organisation along with the capacity to deal with impacts of climate change (Rasmussen *et al*. 2009). These debates suggest that vulnerability to climate change impacts is likely to be higher in small island communities that are marginalised on governance agendas.

Conversely, certain arguments posit that perceptions play a key role in determining the significance of marginalisation and vulnerability in island settings. For example, through their investigation of fisheries in Indonesia, Persoon and Simarmata (2014) argue that island marginalisation is a human perception rather than a fixed characteristic. Island perceptions of marginalisation might change either negatively or positively depending on alterations to local social, political and economic contexts. Similarly, island populations might not necessarily perceive vulnerability to climate change as a pressing issue in comparison to other development challenges especially when dealing with slow-onset hazards, the impacts of which are not always immediately tangible (Birk, 2014; Stojanov *et al*. 2017). On the other hand, island communities facing direct and perceptible impacts of climate change are more likely to view themselves as vulnerable and might consider adaptation or mitigation measures - such as migration - as a key priority (Du Bray *et al.* 2017).

As highlighted throughout this section, some of the literature argues that island-specific characteristics – such as remoteness, natural resource dependence and restricted economies - contribute to the vulnerability of island populations to environmental and climatic hazards (Schwarz *et al*. 2011; Connell, 2015; McCubbin *et al*. 2015). However, Kelman (2018) stresses that seeing 'islandness' as a driver for vulnerability can be damaging to adaptation and general development in small islands. Some island characteristics, such as social capital and local knowledge, can create opportunities for development and could help to improve the adaptive capacity of island communities (Kelman, 2018; see Section 2.2.3). This implies that small island populations could possess internal assets to reduce vulnerability whilst enhancing their ability to respond to environmental and climatic hazards.

Additionally, integration with wider external economies and movement towards globalisation could boost island economies, thus helping to reduce vulnerability (Rasmussen *et al*. 2009; Tsai and Hong, 2014). However, economic diversification could damage traditional island structures with negative impacts for vulnerability and island development (Clark, 2013). Governance and support must be fair and transparent with greater cooperation across scales to avoid further exacerbating island vulnerability and marginalisation (Pelling and Uitto, 2001). This raises questions about defining responsibility and developing networks for adaptation that tackles vulnerability in island settings. Islands are uniquely vulnerable to the impacts of environmental and climatic change due to physical exposure alongside non-climatic social, economic, political and cultural factors. However, island populations might have strong internal social structures that make them capable of dealing with local climate impacts provided that issues of governance are addressed. Key debates relating to adaptive capacity and social capital in small islands are explored in Section 2.2.3.

2.2.3. Adaptive Capacity in Small Island Settings

Multiple factors affect the capacity of island and coastal communities to adapt. A review of coastal adaptation mechanisms in Northwest Europe identified a range of related issues influencing adaptive capacity, including decreased employment opportunities in certain maritime sectors (e.g. fishing) and the loss of infrastructure or services due to economic or population decline (Muir *et al*. 2014). In the context of small islands, Smith and Rhiney (2016) found that low socioeconomic status, isolated geographies, poor communication across scales and high dependence on land-based resources had negatively influenced the adaptive capacity of communities in the Caribbean. Small islands often do not have sufficient availability of natural, financial and technological resources to build strong capacity for responding to climate change alongside other development issues (Ashe, 1999). The socioeconomic contexts of small island settings are therefore thought to affect the capacity of communities to adapt. Additionally, climate change hazards and impacts can threaten, and potentially reduce, any existing adaptive capacity in small islands (Nurse *et al*. 2014).

Under the notion that multiple interacting factors influence small-island adaptive capacity, it then stands that decision-making should address varying multiple stressors if capacity is to be increased (McCubbin *et al*. 2015). Addressing a range of socioeconomic issues within adaptation in conjunction with climate-related problems has been posited as a pathway to improving the overall adaptive capacity of small islands (Hernandez *et al*. 2018). However, factors influencing adaptive capacity are not necessarily the same across island settings (Schwarz *et al*. 2011). For example, Rasmussen *et al.* (2009) found significant variation in climate impacts, exposure, terrain, island location and socioeconomic factors across three Polynesian islands despite similar population size. Adaptive capacity is unlikely to be uniform where socioeconomic contexts differ. There are reasons to suppose that distinctive challenges exist for adaptation in island settings, along with a requirement to make adaptation fit with island cultural contexts (Adger *et al*. 2013).

The provision and investment of funding seems like an obvious solution for addressing low adaptive capacity in island settings. In the Solomon Islands, for instance, the national government has aimed to increase the adaptive capacity of vulnerable island communities by directing financial investment into adaptation and mitigation (Ha'apio *et al*. 2018). A boost of financial investment in small islands can occur in some situations when island-scale challenges are recognised at regional and national levels (Baldacchino and Pleijel, 2010). However, an over-reliance on external funding has the potential to reduce island adaptive capacity in the long-term; an increased dependency on national or regional funding can diminish the motivation or necessity for building capacity at the local level (Baldacchino and Pleijel, 2010). In a case study from the Croatian Islands, Starc and Stubbs (2014) found that quick solutions – specifically an influx of national financial investment - have been adopted in an attempt to address climate issues, but it has ultimately delayed the development of true long-term adaptive capacity within these island settings. In this case, the reliance on national funding has removed the necessity for internal capacity building. Whilst the availability of financial capital is fundamental to supporting adaptive capacity, arguments within the literature show that it is not a straightforward solution to enhancing adaptation and adaptive capacity.

The availability of funding is only one of various fundamental components for building long-term adaptive capacity in island settings including but not limited to: high social capital, good governance, local knowledge, empowerment, and stable population sizes (Sjostedt and Povitkina, 2017; Robinson, 2018). For example, sustaining and increasing population levels is key to lasting adaptive capacity in developed islands such as Kokar in Finland where depopulation threatens the capacity of local populations to cope with change (Baldacchino and Pleijel, 2010). It is contended within the island literature that social capital is a major determinant of adaptive capacity in island settings (Kilpatrick and Falk, 2003; Petzold, 2018). Social capital is "the resourcefulness of a people to respond positively, collectively and responsibly to an identified challenge" (Baldacchino, 2005, pp.32) and is characterised by close social networks, high levels of social

trust, norms of reciprocity and collective partnership working towards mutual goals in participatory processes (Jicha *et al*. 2011). In island settings, shared local knowledge and strong place-based identities can strengthen social capital (Kilpatrick and Falk, 2003). According to Dahl (1997), small islands more frequently tend to house close-knit and cohesive communities, the social conditions of which support effective collective working towards shared development goals. High levels of social capital can be developed when individuals within a community are willing to work together for shared benefits, in turn potentially improving community cohesion. Thus, social capital linked to intrinsic cohesion can be used as a building block for enhancing community-level adaptive capacity in small islands and improving long-term adaptation (Smith and Rhiney, 2016).

On the other hand, Petzold has long argued that high social capital does not automatically equate to high adaptive capacity. Since adaptive capacity is influenced by multiple factors, other social, economic, political and cultural issues can threaten adaptive capacity even if social capital is high (Petzold and Ratter, 2015). For example, the Isles of Scilly are economically developed with high social capital but local adaptive capacity is hindered by the geographically remote and isolated location of these islands (Petzold, 2016). The existence of social networks, participation and high levels of trust do not necessarily lead to collective action for adaptation. The utility of high social capital depends on the institutional, cultural and geographical context of an island, alongside how this capital is treated and acknowledged within decision-making (Petzold, 2016; 2018). A further potential shortcoming can be found in the risk that community awareness of existing high social capital could lead to a false sense of security in individuals. In an urban example, Wolf *et al*. (2010) found low individual concern over the risks posed by heat waves in London and Norwich based on strong social networks and high social capital. However, this level of capital could lead to a sense of complacency amongst individuals. Additionally, the existence of noticeably high social capital has the potential to exacerbate the marginalisation of small island communities if bodies at higher scales begin to regard them to be highly capable and not requiring support or guidance (Kilpatrick and Falk, 2003). Also, the severity of future impacts is unknown due to climate change uncertainty, thus present-day levels of adaptive capacity might be insufficient for dealing with future threats (Rasmussen *et al*. 2011). Even if social capital and adaptive capacity are high, there is a degree of uncertainty over how island populations will be able to cope under uncertain futures. These arguments emphasise the complex role of social capital as a component of adaptive capacity in island settings.

In addition to social capital, local knowledge can be a major component for building local adaptive capacity within both developed and developing island settings (Medina *et al*. 2007). Indeed, sharing and promoting existing local knowledge could strengthen social capital. On Erub Island (Torres Straits), islanders have utilised their local knowledge to adapt to environmental and climatic change through various measures such as using indigenous flora to stabilise vulnerable areas of sandy coastline (McNamara and Westoby, 2011). The

study community was empowered to drive adaptation using their understandings of the local environment, in turn demonstrating their capacity to tackle environmental and climatic issues based on this knowledge. Traditional knowledge can support adaptive capacity and can be an important asset for enhancing island-level adaptation, particularly in fragile islands with constrained resources and economies (Medina *et al*. 2007). The challenge of community involvement in the context of capacity building has been considered under the guise of 'indigenous knowledge' in the global south, or the disconnect between technocratic processes and bottom-up, stakeholder-led adaptation (Mercer *et al.* 2007; Sovacool, 2012; Campos *et al.* 2016). Community empowerment, via the promotion and utilisation of traditional knowledge, could enhance adaptive capacity in small islands. However, Hiwasaki *et al*. (2014) and Petzold (2018) argue that relying on local knowledge alone is insufficient for effective adaptation, and planning should utilise both traditional understandings and modern expert views. This raises questions about the utility of approaches to adaptation that are entirely either bottom-up or top-down in style.

2.2.4. Empowerment in Small Island Settings

Debates in the literature point to community empowerment as a basis for successful development and adaptation in small islands, particularly those that are marginalised. The balance of power internal to and outwith small islands can affect the capacity of communities to adapt to climate impacts. The debates surrounding adaptation as upholding societal values are explored in Section 2.3. In small islands, Baldacchino (2005) and Kelman (2010) argue that island-level autonomy is needed in order to address issues of power and poor governance (including abuses of power at regional and national levels and/or lack of defined responsibility for adaptation across scales) that can lead to increased vulnerability and reduced adaptive capacity. Whereas regional or national governance might neglect or misinterpret island-level issues, decisions made at the island-scale are more likely to consider pertinent local issues. In turn, social capital in small islands can be enhanced when island populations are empowered to play an active role in their own governance through enriched social networks and partnership working both internally and across scales (Baldacchino, 2005). On the other hand, Smith and Rhiney (2016) argue that existing social capital can be tapped into in order to drive empowerment. This suggests that the relationship between empowerment and social capital is not linear, but that empowerment serves to support social capital and vice versa. In practice, participatory processes and cross-scale networking can augment levels of self-governance and empowerment (Kerr, 2005; Kelman, 2010). If small island communities are empowered to become part of development processes through increased communication and networking, it could lead to governance that is fairer and more representative of island-level issues (Denton, 2017). Debates around adaptation as developing networks are reviewed in Section 2.3.

Conversely, whilst empowerment can promote adaptive capacity in small islands, island-scale governance can only progress to a limited extent before

external support is required (Rasmussen *et al*. 2009). Although Baldacchino (2005) argues that island communities should be empowered to undertake decision-making, the at-times constrained economic, institutional and political contexts of small islands may mean that local governance is insufficient in isolation when attempting to deal with climate change impacts (Rasmussen *et al*. 2011). Small island governance needs to be supported by bodies at higher scales if development is to be fair, just and effective (Baldacchino, 2005). Support could emerge in the form of, for example, financial investment or technical guidance. However, striking a balance between local empowerment (bottom-up approaches) and national/regional involvement (top-down approaches) is not straightforward. For instance, external input from national or regional scales could threaten existing social structures and island cohesion (Rasmussen *et al*. 2011). Local-level adaptation needs to be supported by higher scales in order to be fair and effective, but organisations operating at these scales should not possess total power over island adaptation (Nurse *et al*. 2014). Instead, partnership working across scales that focuses on encouraging traditional practices and knowledges could be key to transforming power relations and striking a balance between local empowerment and external support (Gegeo and Watson-Gegeo, 2002). These debates highlight the complexities surrounding power and governance in small islands in relation to climate change, thus raising questions over who should be responsible for adaptation. The implications of climate change in small island settings are discussed in relation to the broader adaptation literature in Section 2.4.

2.3. Debates in Adaptation

2.3.1. Adaptation as Responding to Harm

Response, in the context of climate change, is a human action and a central feature of adaptation. Response can take multiple forms; practical mitigation measures such as the installation of flood defences (Jonkman *et al*. 2013); gradual resilience building including the increased robustness of infrastructure (engineered or hybrid ecological structures) or reducing risk by relocating the entity at risk of being harmed (Klein *et al*. 2001; Keijsers *et al*. 2015; Biagini *et al*. 2014; Koerth *et al*. 2014); and adaptive strategies for long-term change where adaptation is incorporated into wider planning agendas (Edwards *et al*. 2006). It can be hypothesized that human response, in one form or another, typically takes place as a reaction to hazardous climatic phenomenon. A further assumption is that response happens when human values are threatened with harm or damage. Harm is a fundamental concept relating to response in adaptation (Hinkel, 2011; Hinkel *et al*. 2014). Harm ensues when something of value – human, social, cultural, economic or otherwise – is damaged or adversely altered. Within the human category, harm can manifest in fatality, injury and deterioration of health as a result of climatic hazards (Penning-Rowsell *et al*. 2005). Economic harm can arise due to a decrease in economic activity, deterioration of assets, or loss of livelihoods (Bosello *et al*. 2012; Smucker *et al*. 2015). Harm motivates human response to climatic events, in turn creating the potential for long-term change through adaptation. Responding to harm can be, in itself, a form of adaptation action depending on the nature of the response.

Adaptation as a response to climate-related harm is evidenced in current real-world examples. An example at the community level, in a developed world island context, is the storm of 11-12 January 2005 in the Uists as highlighted in Chapter 1. Intense gales, storm surge and severe flooding resulted in fatalities along with damage to infrastructure and property (Angus and Rennie, 2014). The incident has been a catalyst for adaptation at the local authority and community levels, and the need for adaptive action in response to the storm of 2005 has been acknowledged at the island scale (Young *et al*. 2014). The case of the Uists illustrates that harm, in terms of human mortality and property damage, can be a motivating factor for response following climatic hazards.

Extreme climatic events, and resultant harm, are crucial for motivating responses within the human population and prompting adaptation across scales (Berrang-Ford *et al*. 2011; Sietz *et al*. 2011). Berrang-Ford *et al.* (2011) argue that changes to national level planning are more likely to be instigated following a rapid-onset climatic hazard such as a major storm or flood, thus extreme climatic phenomenon are necessary for driving adaptation action. Similarly, Sietz *et al.* (2011) contend that extreme events act as a catalyst for the integration of adaptation into other forms of policy and planning. Climatic hazards have the potential to generate widespread harm leading to fundamental changes in how society responds to climatic shifts. Extreme events provide an opportunity for adaptation to be prioritized in planning and policy agendas.

On the other hand, climatic hazards are likely to drive response immediately following an event but this might not be sustained over long-term timescales as populations begin to recover and other non-climatic factors become important in planning agendas. Large-scale response to harm following extreme events is likely to be intermittent, and response driven by extreme events might not be continuous over time and does not necessarily translate into sustained adaptation (Adger *et al*. 2005). Moreover, Tol *et al.* (2008) highlight that the risks involved in slow-onset hazards (e.g. sea level rise) are not given sufficient attention in planning. For example, the risks posed by future sea level rise might be intangible or not yet actualised as harm. It is challenging to justify the use of time and financial resources on adaptation planning and implementation without tangible evidence of harm. However, slow-onset hazards have the potential to cause harm that is equal to, or in excess of, rapid-onset disasters and thus the proactive as well as reactive aspects of adaptation are significant (Birkmann *et al.* 2010).

2.3.2. Adaptation as Upholding Societal Values

Societal values are a core component of effective adaptation. Societal values are the ideals often rooted in social and cultural beliefs that are of importance to the human population. Social and cultural ideals are intrinsic to the way human beings live and behave. The relationship between societal values and adaptation is sensitive, such that it has been argued that adaptation must be place-based to be

effective (Glavovic and Smith, 2014; Lyth *et al*. 2016). The inclusion of societal values in policy and planning can influence the effectiveness of adaptation strategies, and a major characteristic of upholding societal values during adaptation is the inclusion of traditions, ideals and priorities within strategic and flexible planning (Kuruppu, 2009). In reality, societal values might be at odds with wider policy and planning (O'Brien, 2009). Adaptation that upholds social and cultural values is key to successfully responding to climate change without compromising societal ideals (Ensor and Berger, 2009). The consideration of complex human processes, priorities and choices is essential to adaptation policy and planning.

Research efforts in the current body of literature illustrate the relationship between societal values and adaptation. Betzold (2015) notes how engagement with community level leadership, social groups, language and beliefs is important in facilitating adaptation in a Pacific islands context. Furthermore, Robinson (2015) investigated adaptation progress in SIDS across multiple case studies, including islands in the Pacific and Caribbean regions. The study highlighted the diverse range of social conditions across the study islands, and priorities for adaptation were not equal across the case studies due to fundamental social and economic differences (Robinson, 2015). Strategic adaptation - that takes a range of ideals and priorities into account - is essential in situations where societal values are not necessarily uniform across nations, regions or communities.

Adger *et al.* (2009; 2011; 2013) argue that the inclusion of societal values is a necessity for adaptation planning. In particular, effective adaptation can take place when local and community scale issues are considered (Ensor and Berger, 2009; Kuruppu, 2009). However, social and cultural ideals are not currently integrated into policy and planning to a satisfactory extent (Adger and Barnett, 2009; Ford and Goldhar, 2012; Moser, 2013). Technical and engineering solutions are common strategies for adapting to the impacts of climate change. Such approaches seem to assume that technical options are the fundamental solutions to climate change. But adaptation is a social issue, not just a technical matter (Tol *et al*. 2008; Hinkel and Bisaro, 2015; Petzold and Ratter, 2015). Social factors need to be considered in adaptation policy and planning due to the importance of social and cultural values in the daily lives of communities (Adger *et al*. 2013).

Contrastingly, societal values have the potential to act as a barrier to adaptation if local ideals are not reflected in planning (McLeman *et al.* 2011; Wolf, 2011). Adaptation planning might not translate into effective action if local priorities and issues are not appropriately considered during planning processes. Consequently, planning needs to be flexible to a range of societal values that might change over time as both climatic and non-climatic conditions evolve (O'Brien, 2009). Furthermore, societal priorities and values are place-based and different across locations, thus the values of one community might not reflect those of another (Fussel 2007). Adaptation can be more successful when the specific issues, priorities and motivations of human groups are understood (Bryan *et al*. 2009)

along with the awareness that issues, priorities and motivations might not be uniform across places, scales and groups (Champalle *et al*. 2015).

In the island context, small islands are diverse settings with distinct social and economic issues that are not necessarily equal across island locations. For this reason, one-size-fits-all approaches to adaptation could be ineffective in small island settings where issues are unique on an island-by-island basis (Nurse *et al*. 2014; Robinson, 2015). Similarly, Adger (2016) supports the inclusion of local-scale values in adaptation planning in order to facilitate effective action that reflects place-based issues as opposed to one-size-fits-all approaches that neglect these issues, and suggests that this could be advantageous for overcoming barriers and challenges of adaptation at the local scale. Therefore, one-size-fits-all adaptation is inappropriate where social values and priorities differ (Klein *et al*. 2005) and context-specific priorities and values should be considered in adaptation (Osbahr *et al*. 2010). Mercer *et al.* (2012) argue for the benefit of comparing and exchanging knowledge and strategies across island contexts, thus potentially allowing decision-makers and communities to learn from other islands and identify good practice for adaptation in similar settings. However, the context-specific nature of islands should remain a primary concern in adaptation planning, with knowledge integration used to guide and supplement place-specific planning (Mercer *et al.* 2012). The consideration and accommodation of societal values in strategic planning can lead to successful and fair adaptation.

2.3.3. Adaptation as Transforming Societies

Adaptation and transformation are inter-linked concepts. Transformation is a long-term process involving continuous flexible policy, planning and action towards adaptation (Pelling, 2011). Transformation fundamentally alters how societies understand and implement climate change response. Mainstreaming climate change policy into other forms of development planning is a key component of transformation (Klein *et al*. 2007). In essence, transformation is a pathway that can lead to effective adaptation, although it is not the only adaptation pathway that exists. Others include anticipatory planning and resilience building (Few *et al*. 2017). Transformation can be considered in distinction to resilience building (Matyas and Pelling, 2015). Both are promoted as legitimate approaches to adaptation but the two concepts differ in their fundamental principles. A major characteristic of transformation is the transition of a society to a new state or phase to cope with current and future climate change (Duvat *et al.* 2017). Planners, stakeholders and communities often look for ways to return to 'normal' following an extreme event such as a storm or flood. Central to transformation is the idea of societies progressing forward into a new phase of living that encompasses factors for enhanced adaptive capacity rather than attempting to return to the original way of life before the occurrence of an extreme event (Fazey *et al*. 2015). Islands are subject to periods of both rapid environmental and social shifts; both anthropogenic and natural drivers can influence the long-term history of island change (Duvat *et al*. 2017). A transformative approach to adaptation coheres with potentially rapid environmental, social, demographic, economic and political shifts

in small islands when considered in a long-term perspective. Transformation can be supported by strategies that are flexible to accommodate uncertainty and seek to enhance the development of whole systems and societies, rather than those that consider adaptation as an isolated issue (Barnett, 2001; Dessai and Hulme, 2007; Hallegatte, 2009).

Existing empirical evidence illustrates that transformation takes place in real-world societies as a response to climate change. The Cayman Islands Government have undertaken adaptation to the impacts of tropical storms through national-scale policy-making and planning (Tompkins, 2005). In particular, 'Vision 2008' was a national strategic plan produced by the Cayman Islands Government in response to tropical storms that focused on incorporating adaptation into other aspects of island development (Tompkins, 2005). Nurse and Moore (2005) also argue in favour of mainstreaming climate adaptation into existing forms of non-climatic planning. Central to this argument is the idea that adaptation should not be perceived by decision-makers as an isolated issue but should instead be integrated into other types of planning already in place and merged into wider development agendas (Berrang-Ford *et al*. 2011; Brown *et al*. 2014; Berry *et al*. 2015). Emerging approaches that accept climate change as part of general development in a given society as a result of strategic planning, like Vision 2008, are integral to transformation.

The concept of transformation emphasises long-term changes that bring about new ways of living in order to deal with both climatic and non-climatic stressors. Pelling *et al.* (2015) and Moser (2016) regard adaptation as a massive transformational societal change. Human populations face increased risk as a result of climate change. Consequently, adaptation and development have become interlinked concepts. Pelling *et al.* (2015) argue that adaptation is a crucial factor in successful development. Transformation, as an approach for integrating adaptation into other types of planning, offers a platform to allow adaptation to be included in other important development debates. Transformation can be viewed as a positive pathway for adaptation that enables societal change to cope with climate change risk.

Conversely, Adger *et al.* (2011) argue that a response cannot be regarded as a type of adaptation if social traditions and values are compromised in the process. Transformation is underpinned fundamentally by the notion of change. The considerable societal shifts that are essential to transformation could negatively alter existing culture and social customs in one form or another, even inadvertently. Marshall *et al.* (2012) present a similar argument through empirical work on place attachment, identity and transformation in Australia. Transformation can lead to a breakdown in feelings of place and identity in human populations, both of which are key social aspects of adaptive capacity. Identity and place-attachment can obstruct transformational adaptation, and transformation would be better placed as a 'last resort' adaptation pathway (Marshall *et al.* 2012). There is a need to consider and uphold social and cultural values in transformational approaches in order to undertake adaptation that is successful

and fair. Furthermore, Godfrey-Wood and Naess (2016) argue that the nature of transformation required is highly contested itself. According to Moore *et al*. (2014), adaptation cannot equal transformation since many adaptation options do not fundamentally alter dominant feedbacks, and to qualify as transformation changes to natural and social systems would have to be recombined in fundamentally novel ways.

It is clear that transformation is a potential pathway to adaptation that should not be ignored. Arguments become stronger under high-end scenarios of climate change (Berry *et al*. 2017). However, debate over transformation as an effective adaptation pathway, and place-attachment as a barrier to transformation, leads to a key question: can transformation facilitate adaptation and be sensitive to existing values simultaneously, and if so, how?

2.3.4. Adaptation as Defining Responsibility

Responsibility is a fundamental component of adaptation. In the context of adaptation, responsibility is the acceptance of accountability for responding to the impacts of climate change. Identifying, outlining and accepting responsibility for adaptation is a crucial precursor to processes of policy-making, planning and implementation. The notion of responsibility raises a key question: who is responsible for leading and undertaking adaptation efforts? (Morrison *et al*. 2017) Communities, households and individuals might undertake informal adaptation action at the local scale in response to climate change impacts (Tompkins and Eakin, 2012; Koerth *et al*. 2013). Both benefits and challenges can emerge from community-led informal adaptation. On one hand, local knowledge of priorities and issues enables local-level efforts to be focused where they are needed most (Ayers *et al*. 2014). Conversely, local approaches alone might lack the crucial scientific and/or technical knowledge and financial resources to support effective adaptation (Boyle and Dowlatabadi, 2011; Hiwasaki *et al*. 2014; Magnan *et al*. 2016). Lesnikowski *et al*. (2015) found that the needs of marginalised populations are not always adequately addressed in adaptation. However, if local knowledge is incorporated into national adaptation planning and policy-making, it could support increased adaptive capacity and resilience at the community scale (Sovacool, 2012; Aswani *et al*. 2015).

Participatory approaches can help to ensure that the responsibility for adaptation is shared across scales (Marengo *et al*. 2017). Participatory processes are a key technique that allows for the mutual exchange of knowledge across scales, particularly between community, local, regional and national levels (Champalle *et al*. 2015). A lack of participation, and low levels of communication across scales, can hinder the implementation of adaptation strategies that are appropriate and effective (Jamero *et al*. 2018). The combination of both local and scientific/technical information is essential when attempting to respond to climate change in order to understand small-scale priorities and avoid generalising the issues experienced by local populations (Brooks *et al*. 2005; Aswani *et al*. 2015; Ford *et al*. 2016a). Participatory processes, through mutual knowledge exchange,

can support the inclusion of local perspectives in adaptation (Laukkonen *et al*. 2009). In turn, participatory processes that are overseen and supported by regional or national bodies, such as central government, can help to ensure that the responsibility for adaptation is shared across scales.

Published studies demonstrate the use of participatory processes in real-world scenarios as a tool for involving a range of groups across scales, in turn enhancing shared responsibility for adaptation. In Kalundborg – a coastal municipality in Denmark – participatory adaptation has been undertaken across scales involving members of government, key stakeholders and the general public (Bedsted and Gram, 2013). A key finding of the study was that successful adaptation does not rely on one knowledge base alone, but takes a variety of perspectives into account across international, national and local scales. Inclusive techniques, such as participatory processes, help to bring societies together to address collective responsibility for adaptation. Furthermore, Juhola *et al*. (2014) argue that adaptation in Nordic countries has become improved and enhanced as a result of fairly divided responsibility for adaptation which is led and supported primarily at the national scale along with the emergence of strong national economies helping to fund adaptation initiatives.

Local level action often happens in response to national and international planning and policy (Bisaro *et al*. 2010). However, global and national policy and planning do not always reflect local priorities for adaptation (Smit and Wandel, 2006; Laukkonen *et al*. 2009; Boyle and Dowlatabadi, 2011). Effective national scale planning and local adaptation actions need to be undertaken in conjunction where combined efforts can lead to the rational division of responsibility (Smit and Wandel, 2006). Therefore, concurrent national and local approaches that work towards the same fundamental goals are required to enable the even distribution of adaptation accountability. National policy is an effective strategy in itself but local-scale approaches are also an important component of adaptation and should not be ignored (Adger, 2016). Collective action, through a combination of national and local approaches, is required in order to allocate responsibility for adaptation in a fair manner across scales.

Shared responsibility for adaptation across scales might not prove straightforward in practice. Paavola and Adger (2006) support equal participation across social groups as a pathway to socially just adaptation. However, they stress that issues of responsibility pose a problem for successful and fair adaptation, and discuss responsibility in the context of accountability for impacts of climate change such as developed nations with high greenhouse gas emissions. Their work highlights the confusion and uncertainty over who is responsible for undertaking adaptation efforts. As a result, adaptation progress can be stunted by a lack of clear accountability. Furthermore, Green *et al.* (2010) argue that participatory processes at the local scale have been portrayed in an excessively positive light in some of the published literature. Thus, optimistic views of the local ability to solve climate change issues through indigenous knowledge and local action might lead to undue pressure on small communities. There is also a chance that the concept of

'participatory processes' might begin to lose meaning and validity if this approach is applied too often and without due caution in order to fit with popular attitudes (Pelling, 2007). Labelling an approach as 'participatory' does not necessarily mean that it is truly inclusive of community perspectives in practice or justly balanced across scales. Rather, accountability and transparency are key to the notion of adaptation as defining responsibility being translated into practice.

In island settings, participatory processes are a valuable method of supporting and including the perspectives of potentially peripheral groups in processes of adaptation planning and implementation (Bedsted and Gram, 2013). Based on this argument, participatory approaches could offer a way to empower small island communities without placing the burden of adaptation solely at the community level (Sovacool, 2012). In practice, participatory processes can present complex challenges related to issues of communication and power across scales, particularly when ensuring local issues are translated and incorporated appropriately into national policies (Van Aalst *et al*. 2008). An additional challenge for participation is found in the possibility that communities might 'under-report' their experiences of climate change impacts if they feel that certain issues are not worth reporting (Ensor *et al.* 2018). Participation does not always lead to relevant planning and action when communities do not report impacts to the fullest extent based on their perceptions. However, when participation is used and monitored prudently and appropriately, this type of approach can be applied as a tool for effective adaptation, particularly at the local scale (Ford *et al.* 2016b). The inclusion of community-level perspectives in adaptation via participatory processes can lead to a more transparent and fair division of responsibility across scales.

2.3.5. Adaptation as Developing Networks

Networking is a major pathway towards adaptation. Networks are based on the connections and relationships between various groups across multiple scales (Holler, 2014). Government departments, agencies and policy-makers work at national scales whilst local authorities, decision-makers, stakeholders and communities have a focus on local levels. The development of robust networks can lead to increased social capital (Pelling and High, 2005). In turn, strong networks and high social capital can lead to enhanced adaptive capacity and resilience (Osbahr *et al*. 2010). Networks might emerge at a variety of scales, although the development of networks that bridge the national-local divide is crucial in order to comprehensively address adaptation to climate change, because these are the scales across which policy is translated into action (Ford *et al.* 2015). Successful implementation of adaptation strategies is facilitated when there are strong linkages underpinning networks (Barnett *et al*. 2013). Communication, cooperation and coordination are fundamental steps to establishing and enhancing networks for adaptation. Existing research demonstrates that the density of multi-level networks varies and that this influences adaptive capacity, particularly at local scales (Moser *et al*. 2008; Petzold and Ratter, 2015). Effective network

building and institutionalising existing social networks are key approaches for effective adaptation planning.

Initiatives in small-island and coastal communities in Canada and the Caribbean as part of the C-Change project have focused on supporting the transfer of local climate change knowledge across communities through collaboration and communication (Lane *et al*. 2013). The communication of experiences, understandings and techniques across different island and coastal communities has helped to enhance local-scale adaptation. The transfer of knowledge from climate scientists to community members can also inform local decision-making for adaptation (Lane *et al*. 2013). Additionally, Bunce *et al*. (2009) reported that improved 'connectivity' - the movement of knowledge, funding and responsibility via cross-scale networks - was successful in enhancing the recovery of a small island called Rodrigues in the Indian Ocean following a period of severe drought. Effective adaptation is based upon comprehensive networks that exist between different communities and across the science-practice interface.

Network building through improved communication and cooperation does not follow one single trajectory towards a particular scale. Both 'top-down' and 'bottom-up' approaches are important within adaptation (Urwin and Jordan, 2008). Ideally, the communication of scientific knowledge, policy-making and planning decisions between international, national and local scales, and across the science-practice interface, would ensure effective adaptation implementation on the ground (Tribbia and Moser, 2008; Moser, 2010; Tompkins and Eakin, 2012; Berry *et al*. 2015; Ford *et al*. 2015). Alongside this, local knowledge and priorities can inform policy and planning (Bryan *et al*. 2009). Communication and cooperation across scales can enhance the implementation of policy stemming from 'top' national levels but can also facilitate the inclusion of local perspectives and knowledge into adaptation processes (Van Aalst *et al*. 2008; Barnett *et al*. 2013; Celliers *et al*. 2013). As discussed in Sub-Section 2.3.4, participatory approaches can be useful for defining and dividing responsibility for adaptation across scales. However, participatory processes can also be applied as a method to explore community perspectives on local issues for adaptation. Few *et al.* (2007) support the use of small-scale participatory processes within adaptation but highlight the need for strong and clear communication between actors when utilising participation. A mutual, two-way approach to adaptation through top-down and bottom-up approaches, plus participatory processes, could be essential for adaptation strategies that take scientific, expert and local knowledge into account (Urwin and Jordan, 2008).

Fussel (2007) and McLeod *et al*. (2015) argue that network development leads to successful adaptation planning and implementation. Enhanced networking can support adaptation across disciplines and scales through shared resources, information and experiences (McLeod *et al*. 2015). Network building is a process that can happen across geographical locations as well as sectors and scales (Fussel, 2007). Information about adaptive responses to impacts of climate change in a given region or nation can be disseminated to inform and assist adaptation in

other locations. Alongside networking across locations, Fussel supports network building in the realm of adaptation planning, specifically between decision-makers, scientists and stakeholders. Both authors view networking as essential to adaptation, with the communication of knowledge and resources as a critical component of network development.

In contrast, Moser *et al*. (2008; 2014) highlight that networking efforts between national and local scales are disjointed and inadequate, thus requiring improvement in order to facilitate adaptive strategies and action. Furthermore, the sharing of climate change knowledge between scientists, policymakers and stakeholders has the potential to be disjointed and ambiguous if communication is not clear and consistent (Hofmann *et al*. 2011). Insufficient communication and coordination between the national scale (such as policy-makers and decision-makers) and those at the local level (including communities, households and individuals) has led to disconnected networks that do not fully intersect the national-local interface. Tompkins *et al*. (2010) adopt a similar stance and argue specifically that national-level knowledge and information on adaptation is not being adequately exchanged with communities, actors and stakeholders at local levels. As a result, the efficiency and effectiveness of adaptation implementation is reduced. Ford *et al*. (2011) argue that high adaptive capacity does not necessarily lead to successful adaptation in practice if existing networks are poor. Therefore, network building is a crucial component of adaptive capacity and is a significant determinant of success in adaptation. There is a need to build and strengthen networking across the national-local scale divide through shared information (Moser *et al*. 2008; 2014), particularly via top-down approaches (Tompkins *et al*. 2010).

2.4. Discussion

2.4.1. Responding to Extreme Events

The notion that extreme climatic hazards motivate adaptation is evidenced in the literature. However, relying on extreme events to drive adaptation has a significant disadvantage in that these events manifest at irregular intervals. Therefore, adaptive measures that are undertaken in response to such hazards run the risk of losing momentum over long timescales as negative consequences are tackled and a sense of normality is resumed. The need for adaptation becomes less obvious and justifiable. This raises a key question: should we depend on rapid-onset extreme events alone to act as a driver for adaptation? Sustained adaptation to inevitable, albeit sporadic, rapid-onset climatic events as well as slow-onset hazards, such as sea level rise, is essential for responding to current and future climate change. This is especially pertinent in island settings that are exposed, sensitive and uniquely vulnerable to climatic and environmental shifts, and where hazards and impacts are likely to be experienced to a significantly tangible extent. Transforming societies, through building networks and sharing accountability, can be conceptualised as a way for adaptation to become a sustained process rather than intermittent in response to episodic extreme events, particularly in island settings that could be subject to periods of rapid environmental change.

2.4.2. Societal Values and Transformation in Small Island Settings

The preservation of societal values in adaptation policy and planning is a complex issue. Policy and planning does not always reflect or uphold the values, traditions and priorities of the human population, presenting a key challenge for adaptation. Technical and practical adaptation efforts alone are not enough for responding to long-term climatic change. Societal values are crucial to informing adaptive approaches but, as highlighted by the published literature, are not currently considered to an adequate extent in adaptation policy and planning. One-size-fits-all approaches that overlook societal values might result in ineffective or inappropriate adaptation that does not reflect or address significant place-based issues. This is particularly important in small island settings which by nature of their location have different experiences of globalisation and localisation, giving rise to varied social issues. Furthermore, the insensitivity of top-down approaches to societal values and priorities inhibits the implementation of effective adaptation that is fair, just and meets the needs of island populations at local scales. The diversity of island contexts and place-based values need to be acknowledged in adaptation planning. A balanced combination of top-down and bottom-up approaches could be preferential for adaptation that acknowledges and reflects local needs. Societal values need to be recognised and included in adaptation policy and planning, particularly for effective adaptation at local scales in small island settings.

The notion of adaptation becomes further complicated when the idea of transforming societies as a pathway to adaptation is introduced. The very essence of transformation is embedded within the notion of change. Fundamental change within society, as part of adaptation, has the potential to trigger negative consequences for the preservation societal values. Key authors in the current literature have argued that societal values risk becoming damaged, overlooked or lost during processes of adjustment or change (Adger *et al.* 2011, Marshall *et al.* 2012). However, transformation could be important for the development of an adaptive society that is capable of successfully coping with the adverse impacts of climate change, and thus cannot be ignored. The mainstreaming of climate policy into other non-climatic forms of development can help to integrate climate change into wider policy agendas, in turn fundamentally changing how society approaches adaptation. Addressing and balancing both climatic and non-climatic issues within small island development planning agendas could lead to adaptation that fits with the place-based social, economic and cultural context of a given island. Strategies that are purposely designed to be flexible and adjustable, as well as comprehensive, in order to accommodate uncertainty in climate change are also an important aspect of effective adaptation as part of a transformational approach. Major transformational change that is sensitive to the importance of upholding human values could constitute a vital adaptation pathway for facing future climate uncertainty.

To an extent, the idea of transformation can be contrasted with preserving societal values in adaptation. This highlights a major challenge in adaptation and

presents a choice for policy-making and planning: between adaptation that favours societal values and adaptation that supports large-scale adjustments to the way in which society lives. However, it is possible that the two options might not be wholly incompatible. Flexibility is fundamental to transformation that upholds important social and cultural values. Strategic policy and planning that are continuously flexible, not only to a variety of impacts as a result of a changing climate but also to shifts in societal needs, can lead to a transformed society where values are upheld.

2.4.3. Responsibility and Network Development in Small Island Settings

The fair division of responsibility is a problematic issue within adaptation, particularly in terms of defining precisely who is responsible for leading and undertaking adaptation action. A lack of clear accountability across national, regional and local scales leads to the poor or uncoordinated implementation of adaptation measures. Successful adaptation cannot take place when responsibility is evaded, ignored or unevenly distributed. Local level participation is crucial for informing national scale planning about local priorities and needs. Local scale participation can also contribute to the implementation of adaptation measures. However, responsibility for adaptation cannot be successfully placed solely at the local level when small communities cannot meet financial and other capitals. In small island settings, increased local empowerment can lead to improved adaptive capacity and more effective adaptation, as long as responsibility for small island adaptation is fairly defined and divided across scales. Collective action through shared responsibility is of paramount importance to future adaptation in island contexts. Current literature shows that this is not being addressed to an adequate extent in contemporary real-world adaptation efforts.

Network building has the potential to offer a solution to the challenge of determining responsibility, alongside preserving societal values in adaptation. Developing dialogue and strengthening links between local, regional and national groups, through communication and cooperation, creates a prime setting in which knowledge can be transferred. Levels of marginalisation, and hence vulnerability, could be reduced in small island settings if strong cross-scale networks are in place and responsibility is fairly divided. Additionally, social capital in small islands could be supported and enhanced by robust networking and joined-up approaches across scales, leading to increased adaptive capacity at the local level. However, it is apparent that the potential benefits to be gained from network development are not currently being actualised in practice, particularly in the small island examples provided in the literature. Uncoordinated efforts undertaken in isolation at a single scale are not beneficial for long-term comprehensive adaptation of society as a whole. Reciprocal relationships based on good communication between national organisations and local groups, where information and knowledge are exchanged with transparency, are crucial for adaptation. There is a distinct need for improved communication, cooperation and coordination across scales in order to build robust and reliable networks, without which adaptation cannot occur.

The relationship between network building and defining responsibility is a logically straightforward one. The development of strong and coherent networks opens up the potential for defining responsibility more clearly. The existence of strong networks leads to improved communication across national and local scales, in turn leading to the more explicit division of responsibility and roles within adaptation. Network building is a basis for successfully defining responsibility.

2.5. Conclusions

A rise in extreme climatic hazards - both rapid and slow-onset - is unavoidable, particularly as global climate continues to change. Adapting to the harmful impacts of climate change is critical but there are distinctive challenges for adaptation in practice within small island settings. This chapter has highlighted that small island adaptation is a complicated issue that cannot be addressed with a single straightforward solution. Long-term societal change is important but cannot take place instantaneously. In reality, a range of concerted efforts across society can lead to successful adaptation. The different conceptual frameworks reviewed and synthesised in this chapter have the potential to provide a broader perspective on pathways to adaptation. Effective adaptation is rooted in strong relationships, clear communication and the fair distribution of responsibility. However, differences remain in the framings involved, particularly between adaptation as upholding societal values versus transformation. Practical and political challenges also exist in implementing these theories in small islands. Drawing on the literature, there are strong arguments for combined efforts across scales along with improved partnership between scientists, policymakers, planners and the general public. Joined-up approaches could serve to tackle the impacts of current and future climate change for island populations. This chapter has reviewed the key debates within the existing literature on adaptation in coastal and small-island locations. Significant gaps and questions remain about the relevance of these debates within real-world island settings, particularly Scottish island contexts. The remainder of this thesis aims to analyse three Scottish island case studies whilst considering the themes and debates explored within this chapter.

Chapter 3: Methodology

3.1. Introduction

The methodological approach undertaken within the study is now outlined and justified before presenting key results and findings. This chapter reports how and why specific approaches and methods were applied within the study. The research adopted a multiple case study approach to understanding issues, factors, motivations and priorities for adaptation at the community scale in island settings. The study favours a stakeholder-led approach where community perspectives form the basis of qualitative data collection. Four stages were involved in the collection of qualitative data:

1. Policy mapping to explore current adaptation policy and planning in the Scottish Islands
2. Documentary analysis to develop an understanding of significant community groups in the case studies
3. Deliberative workshops to identify key climate impacts in each case study
4. Focus groups to explore the issues, factors, motivations and priorities for adaptation to the key climate impacts identified during deliberative workshops

Additionally, the utility of vulnerability mapping within scenario-based community engagement was explored during focus groups and subsequently analysed to examine the role of vulnerability mapping and community engagement in adaptation planning. The research primarily adopted a grounded theory approach to coding in order to generate themes inductively from the qualitative data gathered during focus groups. This approach was supported by theory-led analysis where theories from the published literature were applied to the data. Multiple iterations of grounded and theory-led coding were undertaken in an in-depth, intensive approach to analysis.

This chapter discusses the key methodological considerations of the study in detail. The multiple case study approach is presented and rationalised. The multiple methods of qualitative data collection are then reported and discussed, followed by an explanation of the approach to analysing of qualitative data. Appendices A and F highlight the ethical approval and considerations of the study.

3.1.1. Research Philosophy

The research is underpinned by a critical realist approach towards developing knowledge. This seeks to generate understanding about the mechanisms that influence priorities for adaptation to impacts of climate change in small island communities. Critical Realism (CR) is about identifying and understanding causation and the mechanisms that influence challenges and issues within societies (Fletcher, 2017). In order to understand how and why these issues exist as well as how problems could be solved, CR philosophy posits

that issues within society must be investigated in an interpretive manner, to bridge the gap between the researcher and respondent's understanding (Sayer, 2000; 2015). CR also aims to characterise the nature of the problem and suggest possible solutions that ought to address these problems based on critical interpretations of society. Thus, research that follows a CR epistemological framework can help to explain social phenomena and can provide practical recommendations for real-world social challenges (Fletcher, 2017). CR differs to Social Constructionism in that the latter seeks to investigate a social issue and report the results, whereas the former seeks to do the same but then interprets the results within wider social contexts. CR research goes beyond accepting what is observed and additionally seeks to analyse the "mechanisms, processes, and structures" that explain observations around societal issues and challenges (Denzin and Lincoln, 2011, pp.11).

These CR arguments support the research methods adopted within this study. A case study approach allows for cross-case comparisons to be drawn and conclusions to be made about whether perceptions are island-wide across island settings or internal and specific to individual island communities. This enables understandings of the subtle differences between islands in terms of perceptions and experiences but also helps to highlight potential similarities. Documentary analysis was used to identify the influencing community groups within each island and was based on key facts recorded in published grey literature rather than participant perceptions. Furthermore, policy mapping was used to identify instruments and actors from the global to the island scale (Chapter 1 - Figures 1.4 and 1.5). Instruments and actors at sub-national and local scales could then be compared against participant perceptions. Deliberative workshops were used to observe participants in each community and to begin identifying perceptions and experiences of climate impacts. Real-world examples provided by participants helped to ensure correspondence between researcher understanding and perceptions of participants. Finally, focus groups were employed to probe participants and explore perceptions and experiences of climate impacts in specific relation to adaptation. Perceptions can be teased out, and examples provide context for the researcher and validate these perceptions. This could not be achieved to the same extent with other methods. The following sub-sections describe the research strategy and explain the key methodological considerations of each method.

3.2. Case Study Approach

Case studies are a strategy for collecting empirical data on a real-world situation or group of people using a range of data collection techniques (Robson, 2002). The research adopted a case study approach in order to address the primary research questions highlighted in Chapter 1. In particular, the research seeks to find out whether issues, factors, motivations and priorities for adaptation differ between Scottish island communities. Case studies are a beneficial method when attempting to analyse how and why people think or behave in certain ways in relation to contemporary events (Yin, 2014). Other approaches to research, such as a survey of all households in the Scottish Islands, could provide answers for questions such as '*what* are the local priorities and

motivations for adaptation in the Scottish Islands?' However, case studies can provide more detailed results about the '*how*' and '*why*', particularly when more than one case study is used. For instance, a question like 'how and why do motivations and priorities differ across Scottish island communities?' can be appropriately addressed using a case study approach. A comparison of groups or situations can be undertaken through the use of multiple case studies, (see Section 3.2.1). Case studies can be advantageous within research that seeks to gather empirical data in order to understand the reasons underpinning the beliefs and opinions of one, or several, human groups. Furthermore, case studies form a good methodological fit for understanding issues, factors, motivations and priorities for adaptation in small island communities within a CR context.

3.2.1. Multiple Case Studies

Having considered the concept of case study design, an exploratory approach was taken when investigating the case studies in order to answer the principal research questions. A case study is an appropriate choice of method particularly when the researcher cannot control the issues that are being explored (Yin, 2014). Climate-related hazards, impacts and consequences fall into the category of issues that are outwith the control of the researcher. The use of multiple case studies supports the investigation of similarities or differences between cases. The results of one case study cannot be generalised to the wider population. The beliefs of one group do not necessarily reflect those of comparable groups. However, the results of multiple case studies could indicate patterns across cases, thus allowing the results to be theoretically generalised whilst helping to validate the findings. This is comparable to a laboratory study where a round of experiments would be undertaken using the same (or similar) variables each time to authenticate the results of the original experiment (Yin, 2014). Therefore, it is logically justifiable to use multiple case studies in order to develop wider conclusions about similarities or differences between the results. Using multiple case studies can allow for a set of final conclusions that can be cross-referenced to highlight common or disparate issues. For these reasons, the present research adopts a multiple case study approach.

The research seeks to identify and compare the issues, factors, motivations and priorities for adaptation across Scottish island communities in order to contribute to current theory on one-size-fits-all adaptation planning. Therefore, it was deemed appropriate to use multiple Scottish island communities as case studies in a comparative analysis to determine whether (and why) cross-case adaptation motivations and priorities were similar or different, and to understand the implications for future adaptation planning. Three case studies from three different Scottish island groups were systematically selected: Unst (Shetland), Westray (Orkney) and South Uist (Outer Hebrides). Section 3.2.2 presents the systematic case study selection process. During methodological design, it was decided that the investigation would employ a maximum of three case studies due to the temporal and logistical constraints of the research. The communities were selected from differing Scottish island groups that have contrasting physical and socio-economic characteristics. Consequently, it is possible to produce a piece of

research that could be considered theoretically representative of the Scottish Islands. The multiple case study approach serves to address the research questions through an analytical comparison of three Scottish island communities.

3.2.2. Systematic Selection of Case Studies

It was of primary importance to select the case study locations within the Scottish islands before any manner of data collection could be undertaken. Around 800 islands exist around Scotland, 93 of which are inhabited (Scotland's Census, 2011f; SNH, 2013). Given the vast assortment of inhabited Scottish islands, a strategic and systematic approach was adopted in order to condense these to an unbiased selection of three case study islands. Initially, each inhabited Scottish island was systematically compared against a set of criteria containing baseline conditions for two fundamental island variables: land area extent (km^2) and population. The criteria consisted of respective minimum and maximum limits: $4km^2$ to $400km^2$ for land area extent, and 500 to 2000 people for population It is important to highlight that these comparisons are relative, especially considering that the Office for National Statistics outline a 'minor' built-up area as consisting of 10,000 usual residents or less based on the England and Wales Census of 2011.

Communities are the unit of study for the research. It was hypothesised that island-wide communities would likely exist in islands that were of small geographical extent and low population. The upper bounding limits of $400km^2$ and 2000 people were imposed because it was posited that islands exceeding these limits would likely be made up of multiple nested communities rather than an island-wide community. Larger islands that plainly exceeded both the upper limits of population and area, such as Mainland Shetland and Mainland Orkney, were known to contain a wide variety of communities spread among towns, villages and hamlets, and were therefore excluded. The criteria containing upper limits for population and land area extent helped to condense the selection to small islands that would likely contain an island-wide community which could be used as a case study. Unst, South Uist and Westray each contain an island-wide community, evidenced in participant responses presented in Chapter 5. It is possible that islands beyond the lower limits of $4km^2$ and 500 people could have been considered within the research. However, these lower boundaries were set as a means of systematically reducing the volume of potential study islands to a more manageable selection within which three comparable case studies could be selected.

Information on population and land area extent was collected for every inhabited Scottish island. Population figures were sourced through Scotland's Census, whilst the work of Haswell-Smith (2004) was consulted to gather values for area extent. The established criteria were then systematically applied to each inhabited Scottish island. Any islands that fell above or below the fixed limits for either of the fundamental variables were removed. Islands that belong to the Inner Hebrides were eliminated due to their relatively close geographical proximity to the Scottish mainland in comparison with Shetland, Orkney and the Outer Hebrides. The remaining potential study islands are presented in Table 3.1.

Having excluded some islands based on the aforementioned criteria, the remaining islands were further refined as part of the strategic approach to case study selection. The next phase of systematic selection involved a preliminary investigation into the geographical location and social background of each potential study island. This phase sought to identify which of the short-listed islands were geographically remote based on their proximity to other islands and key island towns such as Lerwick (Shetland), Kirkwall (Orkney) and Stornoway (Outer Hebrides). The presence of amenities in each island, such as convenience stores and community halls, was explored in an attempt to understand social remoteness, particularly in islands with limited amenities, and the ways in which communities operate within a small island. Community-scale development efforts were also investigated as a means of identifying a community presence within each island.

Three case study islands were ultimately selected based on geographical remoteness and social backgrounds: Unst (Shetland), Westray (Orkney) and South Uist (Outer Hebrides). Unst and Westray are similar in terms of population, remoteness and community development. Both are geographically remote in comparison to mainland areas and each contains a limited selection of amenities. Evidence of active community-driven development in Unst and Westray indicated the existence of an island-wide community in each island. In the Outer Hebrides, Barra was originally considered as a potential case study. Despite being considerably larger in population compared to Unst and Westray, it has the smallest population of the four potential Outer Hebrides case studies and is the most geographically remote. However, when investigating the social background of each potential Outer Hebrides case study, it became clear that climate-related issues were a prevalent part of community life in South Uist following the storm of 2005 and subsequent loss of five community members. It was therefore deemed pertinent to adopt South Uist as a case study despite the existence of a considerably larger population than Unst and Westray.

Although South Uist is connected to neighbouring islands via fixed causeway links, it is geographically remote in relation to Stornoway and the Scottish mainland. Amenities in South Uist are also limited, particularly in comparison to island towns like Stornoway. In this sense, South Uist, Westray and Unst are similar. Active community-driven development is also evident in South Uist. Overall, it was concluded that Unst, Westray and South Uist are relatively similar in terms of remoteness, the presence of island amenities and community-led development initiatives. Therefore, suitable comparisons can be drawn between the three case studies.

	Population (2011)	Area (km²)
Orkney		
South Ronaldsay	909	49.8
Westray	**588**	**47.13**
Shetland		
Whalsay	1061	19.7
Yell	966	212.11
West Burra	776	7.43
Unst	**632**	**120.68**
Outer Hebrides		
South Uist	**1754**	**320.26**
Benbecula	1303	82.03
North Uist	1254	303.05
Barra	1174	68.35

Table 3.1: The selection of potential case study islands following the application of population (500-2000 people) and land area extent (4-400km²) criteria. The islands that were ultimately selected as case studies are highlighted in bold.

3.3. Methods

The research employed multiple methods to gather data about island community adaptation. The methods serve to address the key research questions and aims outlined in Chapter 1. Focus groups were the chief data collection technique used within the research to explore issues, factors, motivations and priorities for adaptation in the case studies. However, policy mapping, documentary analysis and deliberative workshops were initially employed to collect fundamental contextual information for each case study. These methods served as the building blocks for operationalizing focus groups. First, policy mapping was undertaken to produce a fundamental understanding of the current state of adaptation in the Scottish Islands. Secondly, documentary analysis developed initial understandings of social backgrounds and how 'community' is formed within each case study. Next, deliberative workshops were used to identify the specific climate hazards and impacts that have affected the case study communities in a stakeholder-led approach. Each method produced deeper understandings of the case study communities in the context of climate change. Ultimately, the information gathered via the three aforementioned methods informed focus groups looking at priorities and motivations for adaptation in the case studies.

3.3.1. Policy Mapping

Policy mapping was undertaken to explore current policy and planning for adaptation in the Scottish Islands. Policy mapping is a method that can be used to illustrate "the content of policy instruments [and] their position in the

policy making process, while specifying the role of actors in implementing policy decisions" (Bainbridge *et al*. 2011, p.3). To investigate the present state of adaptation to climate change in the Scottish Islands, it was important to acknowledge the wider context of policy and planning from the international scale to the local level. Building a picture of adaptation policy across scales is beneficial for understanding how policy at other levels influences local planning. Adaptation instruments are tools rooted in policy and planning that inform, support and guide adaptive practices. For example, the SCCAP 2014 is a sub-national adaptation instrument. Adaptation actors can be considered as groups that work to put adaptation into practice. For instance, Adaptation Scotland is an adaptation actor working at the sub-national level.

A variety of policy and planning documents were reviewed as part of policy mapping. From these documents, the relevant adaptation instruments and actors - from the international scale to the Scottish island level - were gathered and mapped. As previously presented in Chapter 1, Figures 3.1 and 3.2 illustrate the outcomes of mapping adaptation instruments and actors respectively. Instruments and actors were mapped according to scale: international, supranational, national, sub-national and local (island) scales were used. Instruments and actors were subsequently categorised according to some of the central fields within climate adaptation. In practice, the cross-scale flow of adaptation instruments is top-down in nature from the international scale to the local level (Chapter 1). Policy mapping aided the identification of key instruments and actors for adaptation within the Scottish Islands, and of the top-down policy flows that influence adaptation in these locations. The research sought to develop a detailed insight into the current state of adaptation in the Scottish Islands, to enable a more nuanced understanding of the issues and priorities for adaptation in the case studies and of the implications for future adaptation in the Scottish Islands. The combined policy framework provides a context for local island adaptation.

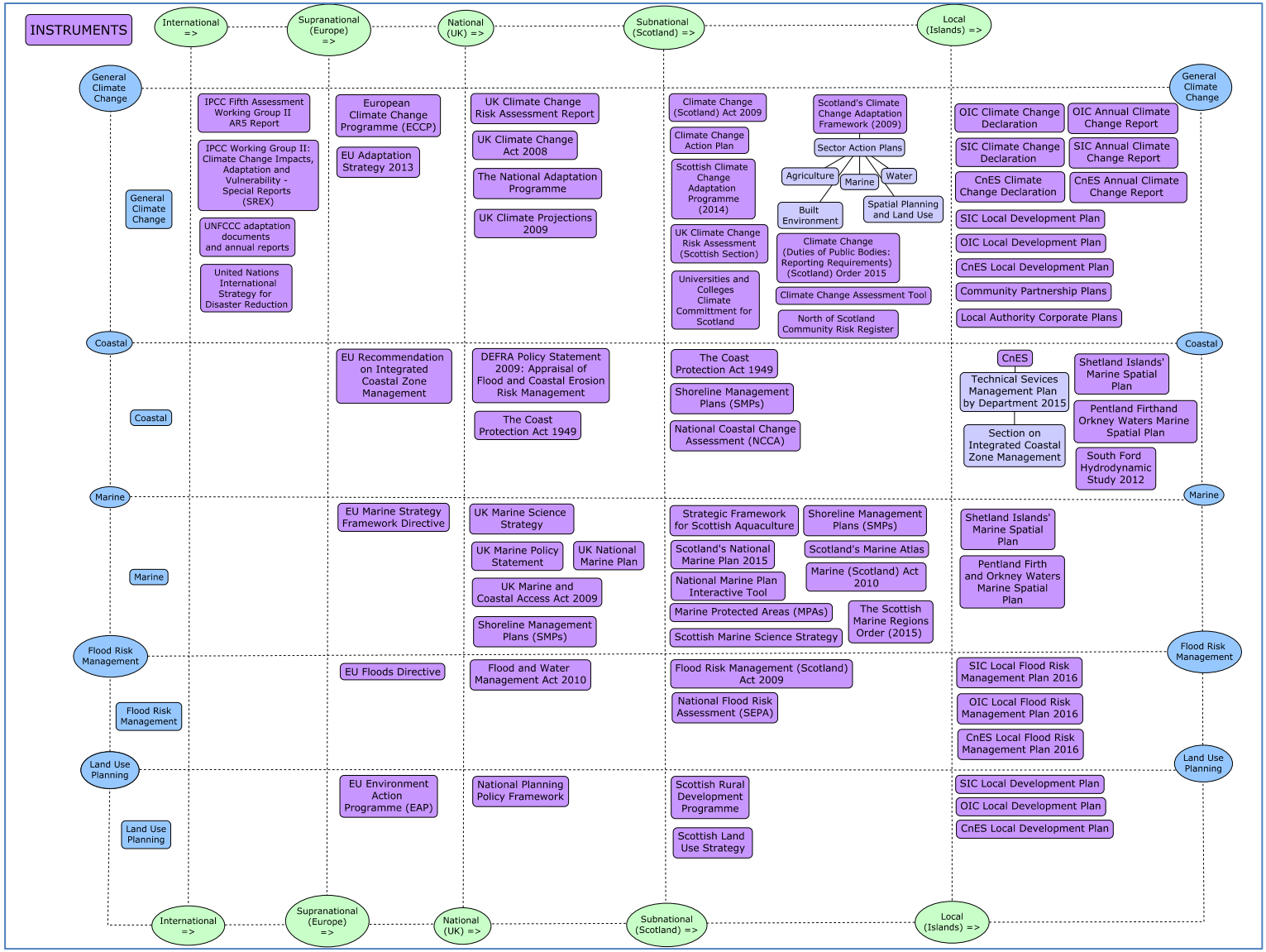


Figure 3.1: Adaptation instruments plotted as part of policy mapping

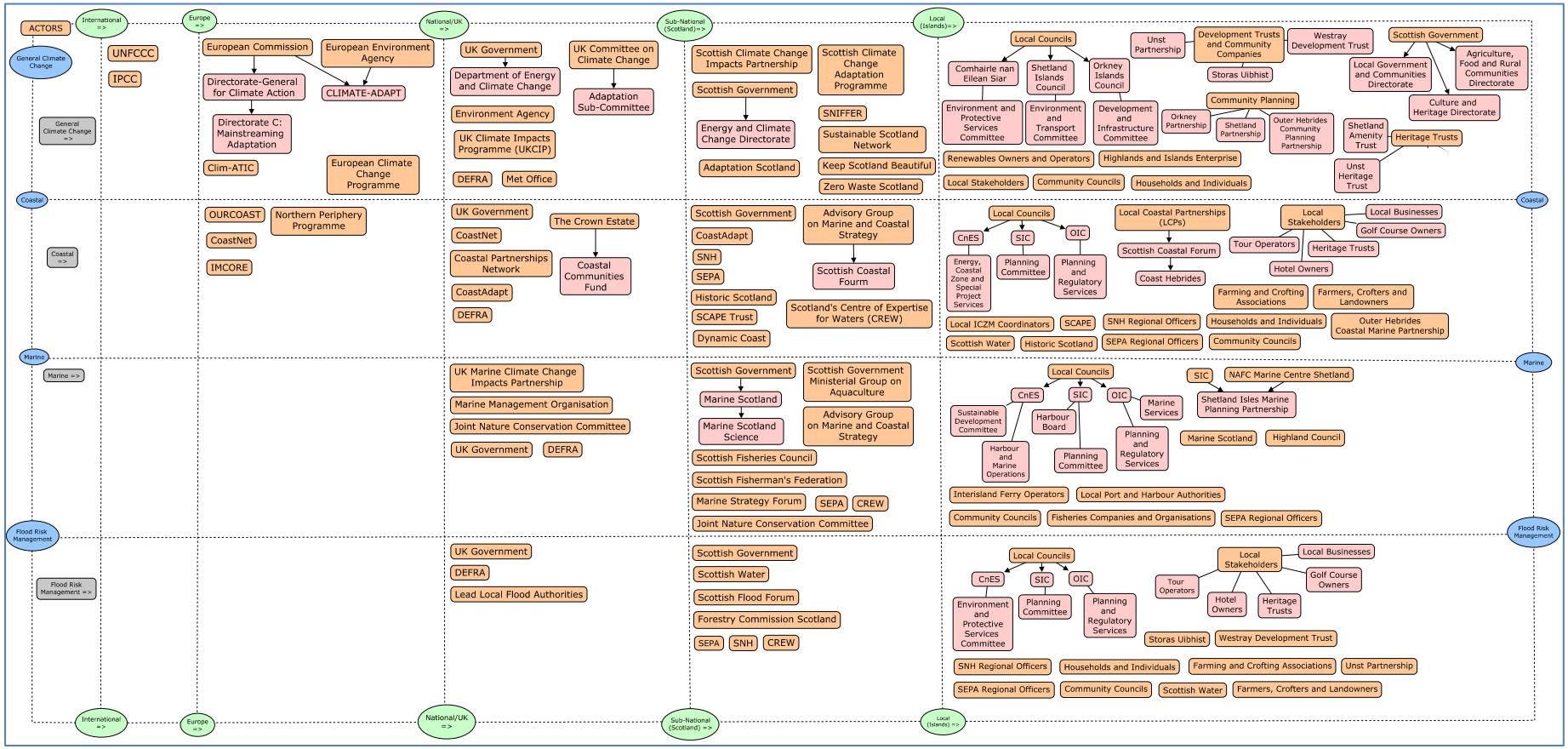


Figure 3.2: Adaptation actors plotted as part of policy mapping

3.3.2. Documentary Analysis

Documentary analysis is a qualitative technique that involves the examination of content contained within documents such as meeting minutes, newspaper articles and technical reports (Robson, 2016). It can be used in a multi-method approach to supplement and/or inform research in an unobtrusive manner and is useful for forming deeper understandings of the research subject (Robson, 2016). Documentary analysis was undertaken to gather information on key community groups in the case studies. During preliminary methodological design, deliberative workshops and focus groups were selected as methods that would be used to gather qualitative data in order to address the major research questions. The research sought to recruit a representative cross-section of the community to participate in workshops and focus groups. In particular, a purposive sampling strategy was employed during focus group recruitment which sought to recruit participants with a shared characteristic, such as belonging to the same pre-existing group like a community council (Section 3.3.4). Communities are the unit of study and, therefore, pre-existing community-level social groups are a representative component for data collection using focus groups. For this reason, it was vital to identify the key community groups within each case study. A basic awareness of social background was developed during systematic case study selection. However, it was recognised that a more in-depth understanding of how 'community' is formed and structured within the case studies would serve to inform workshops and focus groups. Using documentary analysis, it was possible to explore components of 'community' in the case studies and to build a picture of how the communities operate in practice.

A variety of documents pertaining to the case studies were gathered and analysed with three core questions in mind: (1) what are the key community groups, organisations and committees in the case studies and why are they significant within the community? (2) What are the main industries and employment sectors in the case studies and why are they significant within the community? (3) What are the main businesses in the case studies and why are they significant within the community? Although community organisations were targeted during purposive sampling for focus groups, it was possible that island economy and local businesses would be intrinsically linked to community groups due to the small and interwoven social environment of the case study islands. For example, it was anticipated that community-initiated crofting and fishing organisations might exist. Indeed, Storas Uibhist is an example of a community-led organisation that deals with issues related to crofting, drainage and coastal erosion in South Uist.

Table 3.2 highlights the key documents examined within documentary analysis. Local development documents were analysed, and the meeting minutes of community councils and development organisations were also reviewed. The reviewed documents had mostly been compiled by members of the case study communities, thus providing direct insight into significant community components from a local perspective. Local authority documents were also analysed. Although

at times less detailed than community-level documents, local authority publications provided a wider context for understanding the case studies and meant that documentary analysis was not biased to one particular scale. All relevant documents were studied not only with the three key questions in mind, but also for evidence of significant island livelihoods and active community-led development. Detailed records were compiled that served to illustrate the central components of 'community' in each case study. Documentary analysis produced an enhanced understanding of how community is formed in the case studies. Significant industries, livelihoods and community organisations were identified within the analysis. In particular, it was possible to pinpoint pre-existing groups that lie at the centre of each community and provide a platform for addressing community issues. Community councils and development organisations, such as WDT, are key examples of these.

Overall, the records produced during documentary analysis were used to inform later phases of the research, particularly focus group recruitment using purposive sampling. Documentary analysis generated a deeper understanding of the case studies as real-world communities. It was a vital step towards becoming familiar with the case studies before fieldwork.

Unst	South Uist	Westray
• SIC Shetland Local Development Plan 2014 • SIC Economic Development Policy Statement 2015 • SIC Our Plan 2016 to 2020 • Unst Community Council Area Statement 2006 (part of Shetland Local Plan) • Unst Community Development Plan Consultation – Summary Report 2010 • Unst Community Development Plan 2010-2015 • Unst Partnership Welcome Pack – Essential Guide to Unst 2018 • Unst Partnership Meeting Minutes • Unst Community Council Meeting Minutes	• CnES Outer Hebrides Local Development Plan 2012 • Tourism Outer Hebrides 2020 – Tourism Strategy • Outer Hebrides Community Planning Partnership - Economic Regeneration Strategy to 2020 • Outer Hebrides Community Appraisal Survey – Supplementary Report for South Uist and Eriskay 2007 • South Ford Hydrodynamics Study: Final Report 2012 • Lochboisdale Community Council Meeting Minutes • Iochdar Community Council Meeting Minutes • Bornish Community Council Meeting Minutes	• OIC Our Plan 2013-2018 • OIC Orkney Local Development Plans 2014 and 2017 • 'Turning the Tide in Westray' – Original Westray Development Trust Development Plan 2000 • 'The Tide is Turning' – Westray Development Trust Development Plan 2005 • Westray Local Development Plan – A Framework for Development 2011 • Westray Development Trust Annual Reports • Westray Development Trust Board Meeting Minutes • Westray Community Council Minutes

Table 3.2: The documents and publications gathered and analysed as part of documentary analysis

3.3.3. Deliberative Workshops

3.3.3.i. Background and Justification for the Use of Deliberative Workshops

Chapter 1 presented general examples of climate impacts in the UK, Scotland and the Scottish Islands. However, it is important to identify the specific impacts of climate change affecting each case study community in order to understand precisely what each community is adapting to. It is hypothesised that motivations and priorities for adaptation might be influenced by the specific climate impacts affecting a community. Furthermore, the severity of climate hazards, impacts and consequences might differ from one community to the next. A particular type of climate hazard could present severe adverse impacts and consequences for some communities, but not others. For example, UK climate projections indicate that sea level is currently rising around Orkney, Shetland and the Outer Hebrides, and could rise by up to 1m by 2100. However, not all Scottish island communities might be equally affected by sea level rise. For instance, communities within islands with steep coastal topography, such as Unst, might perceive sea level rise as a low-risk local climate impact. Instead, such communities might identify other impacts, such as severe storms, as having greater significant consequences for local people. Published climate data and projections can provide an indication of the type of climate-related hazards and impacts affecting the case study communities. However, identifying impacts using desk-based methods alone runs the risk of overlooking key community knowledge and experiences that could be crucial to understanding adaptation needs. Therefore, direct interaction with the case studies communities in a stakeholder-engagement approach is a primary part of climate impact identification within the current study.

Deliberative workshops were undertaken to identify the impacts of climate change affecting each case study community, both in the past and currently, through the consultation of community perspectives. Deliberative approaches can provide an opportunity for participation where respondents play an active role in sharing local-level knowledge through deliberation of various experiences and issues related to climate change (Fish *et al.* 2011). Community perspectives can provide insight into real-world experiences of climate change that cannot be gleaned from climate data. However, it is possible that some participants might hold misconceptions of climate change. Care was taken to minimise the impact of climate misconceptions on the qualitative data and, thus, the results and findings of the research. At the beginning of deliberative workshops (and also focus groups later in the study) the concept of climate change was clearly defined following the work of the IPCC as:

> *'Changes in the state of the climate that manifest within the natural environment, with the 'natural environment' referring to the land, sea and atmosphere, and that persists for an extended period, typically decades or longer'*

The definition was reiterated to the participants when necessary during workshops and focus groups. UK and Scotland-based examples of climate-related hazards and impacts were provided to clarify how climate change might manifest. Additionally, the group nature of deliberative workshops, and later focus groups, enabled the researcher to identify misconceptions about climate change existing within the group. Any climate misconceptions revealed during group discussions could be addressed either amongst the group or by the researcher. Participants were able to debate the perceptions of others within the group which would not have been possible in other qualitative methods such as individual surveys. Any research dealing with public perceptions comes with the caveat of potential layperson misconceptions regarding the meaning of specific concepts. This does not mean that the experiences, perceptions and opinions of community members are invalid or should be discredited. However, the current research recognises the potential for participant misconceptions of climate change, in terms of understanding the basic referent, and took appropriate steps to reduce any negative effect on the research findings as a whole.

Deliberative workshops offered a means of gathering information through a series of discussions and exercises with multiple participants. The workshops were a vital precursor to gathering data on motivations and priorities for adaptation using focus groups in the case study communities (see Section 3.4). Within the research as a whole, the identification of specific climate impacts in each case study formed a basis upon which community motivations and priorities for adaptation could be better understood.

3.3.3.ii. Deliberative Workshops in Practice

Prior to undertaking focus groups, a deliberative workshop was conducted within Unst, Westray and South Uist respectively. Details of the date, time, venue and number of participants for each workshop are presented in Appendix D. Identical workshops were delivered in each case study. The workshops were structured around three key discussion-based exercises. Although similar to focus groups as a discussion-based method of data collection, the workshops differed from a traditional focus group in several ways. Firstly, the workshops were conducted over an extended timeframe of two hours and aimed to use a higher number of participants than a traditional focus group. The research sought to use ten to twelve participants per workshop to generate a range of ideas for discussion, whereas the focus groups - conducted later within the research - aimed for six to ten participants per group. Secondly, the workshops were used to investigate the relatively broad issue of climate-related hazards, impacts and consequences. A detailed exploration of all climate impacts potentially affecting each case study would not have been possible in an hour-long focus group. Therefore, workshops offered a discussion-based technique that allowed for the in-depth investigation of climate impacts in Unst, Westray and South Uist.

Key gatekeepers, identified during documentary analysis, were instrumental in aiding the recruitment of participants. Gatekeepers, such as the

integrated coastal zone manager for South Uist and community development officers in Unst and Westray, liaised with potential participants on behalf of the researcher and publicised the workshops to the wider community. Furthermore, posters and flyers were distributed within the case studies with the intention of recruiting a representative cross-section of the community. The workshops were structured for the most part, although a semi-structured approach was adopted during some discussions to avoid researcher bias and to allow participants to talk about any aspects of weather, climate or environment they felt had significant impacts for their community. The term 'climate change' was used to a limited extent, with the phrases 'climate impacts' and 'climate-driven environmental change' favoured by the researcher within the workshop. It was anticipated that the phrase 'climate change' had the potential to produce negative reactions among participants, either where some disagreed with the occurrence of climate change or where there was debate over the causes of climate change. Therefore, minimal use of the phrase 'climate change' helped to avoid conflict and unnecessary arguments among participants that could detract from the aims of the workshop.

In general, participants were encouraged to discuss the community-wide consequences of climate-related hazards and impacts that had been experienced within their island. Participants were prompted to think about how local climate hazards and impacts might develop in future and to consider the potential consequences for their community. Participants were given an initial briefing during which the researcher explained the overarching research aims and the purpose of the workshop within the study as a whole, as well as the specific workshop aims:

1. To identify any impact(s) resulting from climate-driven environmental change that have been experienced within the community
2. To establish the most challenging/problematic impacts resulting from climate-driven environmental change
3. To estimate any potential future impacts of climate-driven environmental change using published climate projections

The concepts of adaptation, vulnerability, hazards, impacts and consequences were clearly defined for participants both verbally and in writing at the beginning of the workshop. General background information on climate hazards and impacts currently affecting the UK, Scotland and the Scottish Islands was presented to illustrate evidence of a changing climate and to encourage participants to reflect upon hazards and impacts that might have manifested within their community.

Following the introductory briefing, the bulk of the workshop centred around three main exercises: (1) a group discussion on weather and climate-related environmental change, (2) an exercise to identify and prioritise local impacts of present-day climate-related environmental change that require attention in adaptation planning and (3) a group discussion on the potential impacts of future climate change using published climate projections for a range of variables including sea level, precipitation, temperature and wind speed (Figure 3.3). The workshop materials and discussion guide are presented in Appendix B.

Participants responded to a range of questions during the first and third exercises and were encouraged to discuss any aspects of current and future climate-related change that they felt to be important within their community. These exercises were semi-structured to allow themes to emerge from participants with low researcher influence. However, a highly structured approach was adopted during the second exercise. Participants were asked to identify local present-day climate-related hazards using written responses on small self-stick notes that they applied to a large poster marked 'Hazards'. The process was repeated for the local impacts of climate-related hazards, then subsequently for the local consequences of these hazards and impacts (Figure 3.4). Participants then reflected on their own written responses, and the responses of others, before being asked to rank the hazards, impacts and consequences based on those that had caused the most significant effects for the community as a whole and should be prioritised in future adaptation planning. A colour-coded ordinal ranking system was used; the issues that participants considered to be a high priority for adaptation were marked in red, those of medium priority were marked in orange, low priority corresponded to green and no priority was denoted by blue. The results of the second exercise illustrated the impacts of climate change that had produced the highest level of harm within the case study communities, whilst the discussion-based exercises helped to provide context and a deeper understanding of the results of the participant ranking. The workshops proved to be a beneficial technique for identifying the major impacts of climate change affecting the case study communities using an engagement approach.

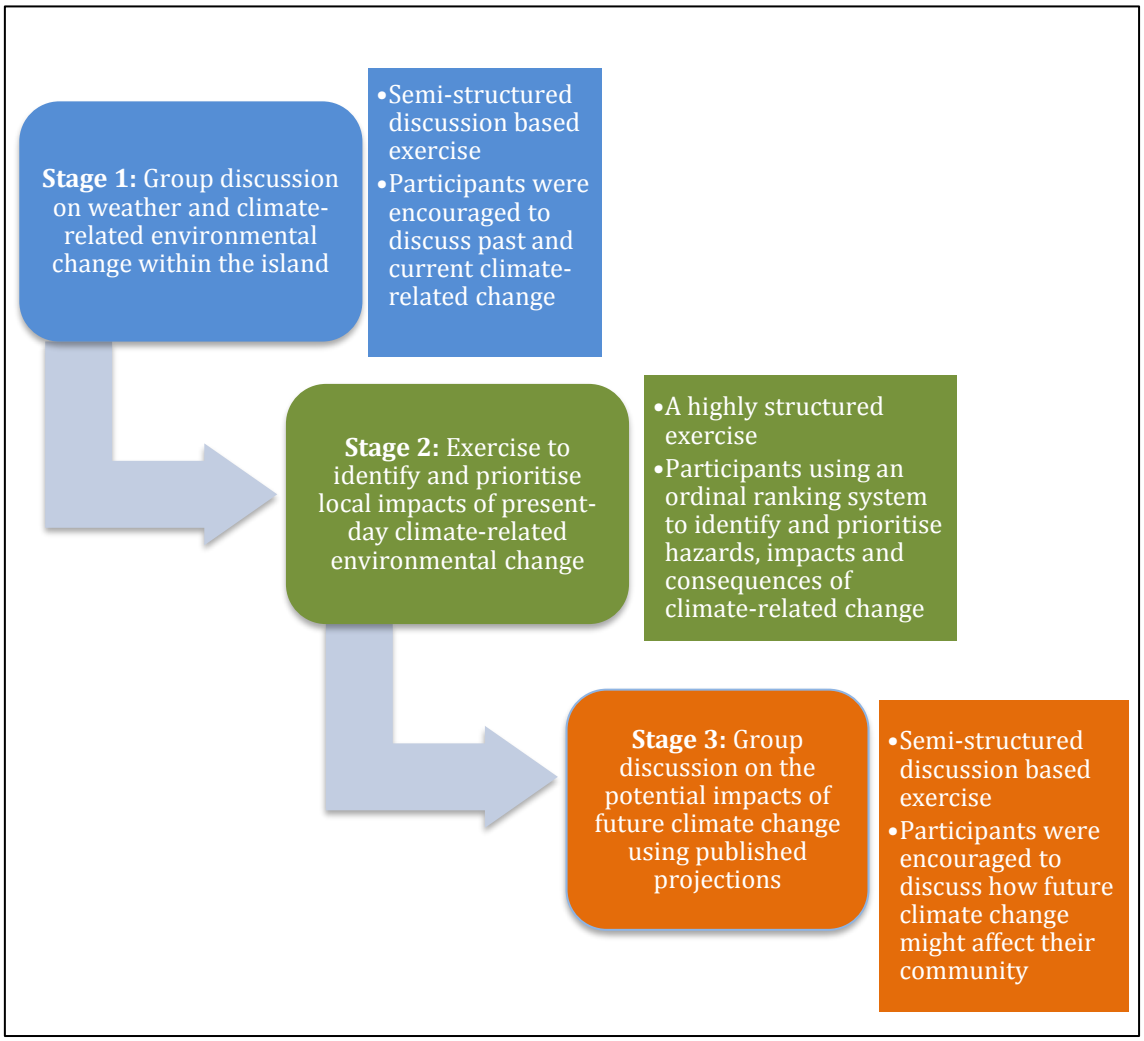


Figure 3.3: Outline of the three main exercises undertaken during deliberative workshops in each case study

Figure 3.4: Photographs illustrating setting up a deliberative workshop (top), the community hall venue for the workshop held in Unst (bottom right) and an example of the ordinal ranking system used by participants to identify and prioritise hazards, impacts and consequences of local climate change (bottom left). Sources: F. Cunningham and T. A. Stojanovic.

3.3.3.iii. Summary

The deliberative workshops were a necessary step between documentary analysis and focus groups. The results of the deliberative workshops were used to inform the focus groups which involved the exploration of factors, motivations and priorities for adaptation to climate impacts in each case study. The focus group discussion guides were tailored to concentrate only on the major climate impacts in each case study leading to a high level of detail within results and findings. A desk-based approach, such as the investigation of weather records for the case studies, could have been employed instead of deliberative workshops. However, the research favours a stakeholder-driven approach from beginning to end and seeks to understand adaptation to climate change in small island communities through the consultation of community perspectives. Rich and detailed community accounts of climate impacts and consequences could not have been gathered through a desk-based approach. The only way to fully understand the social, economic and cultural consequences of climate impacts was to interact directly with the case study communities.

3.3.4. Focus Groups

3.3.4.i. Background and Justification for the Use of Focus Groups

Focus groups are widely used in social science research as a technique for gathering qualitative data from human groups. Morgan and Spanish (1984) define a focus group as "a video- or audio-taped small group discussion that explores topics selected by the researcher" (Morgan and Spanish, 1984, p. 254). Similarly, Robson provides an explanation of a focus group as "an open-ended group discussion guided by the researcher" (2002, p. 285). The use of the term 'open-ended' is key within the definition by Robson as it highlights the importance of allowing flexibility for participants to express their views and opinions during the discussion.

It is this idea of open-ended discussion that sets focus groups apart from other types of interview. Focus groups can be used to find out what people think, but also how they have formed their opinions and why they think in the manner they do (Kitzinger, 1994). Interaction between participants is key to focus groups, making it a useful method for generating rich data (Oates, 2000). Thoughts, ideas and opinions can emerge when participants are encouraged to converse freely during a focus group. Assuming little moderator involvement, participants may be asked to discuss a general topic - such as local adaptation to climate change - but are granted the freedom to drive the discussion in any manner they choose in relation to the issue. Although the researcher may impose a general topic to spark initial conversation, the participants can govern the specific points that are discussed. As a result, key themes are likely to emerge from the participants themselves rather than from any preformed agenda created by the researcher. Whilst one-to-one interviews and written questionnaires can provide some indication of participant perspectives, they cannot always produce rich data equal to that which is gained from a focus group (Kitzinger, 1994). This is due to the lack

of both group interaction and open-endedness in one-to-one interviews and questionnaires. Interaction and flexibility are integral to focus groups in order to tease out reasons and explanations behind participant perspectives, in turn generating rich data on how and why participants possess specific opinions. The qualitative data that can be produced from focus groups ties with the CR perspective adopted within this study. Such data can be analysed and interpreted to form explanations of phenomena inductively from the data itself with a view to understanding how underlying structures - such as social, economic, political and cultural issues –influence the factors and priorities for adaptation in the case study islands.

Focus groups are not necessarily appropriate for all types of research (Robson, 2002). The technique is often more suited to qualitative studies where the researcher is concerned with emerging themes rather than quantifying opinions on a particular topic (Oates, 2000). For instance, a written questionnaire could be used to collect quantitative data on what proportion of people agree or disagree that climate change is occurring, and to explore socio-cultural determinants of perception. In contrast, focus groups could be used to produce data on why participants either agree or disagree with climate change, as well as exploring the personal experiences that led them to form their opinions. Participant responses during focus groups may also lead to the emergence of themes that the researcher had not previously considered. Therefore, focus groups can be an effective method for generating and gathering ideas when research is concerned with the formulation of theory rather than the testing of it (Kitzinger, 1994).

The current research seeks to identify and understand issues, factors, motivations and priorities for adaptation in Scottish island communities through the investigation of local perspectives. This overarching aim is addressed through the consideration of three sub-questions:

1. What are the issues, factors, motivations and priorities for adaptation to the impacts of climate change in the Scottish island case study communities and why are these important?
2. How do the issues, factors, motivations and priorities compare between the case studies?
3. Why are the issues, factors, motivations and priorities similar or different across the case studies?

After considering potential techniques for qualitative data collection, focus groups were identified as an appropriate method for use within the current research. Ultimately, focus groups were selected as the most appropriate method to understand the issues, factors, motivations and priorities of Scottish island communities for adapting to the impacts of climate change. The dates, times, venues and number of participants for focus groups undertaken as part of this research are presented in Appendix D.

There are three key motives for utilising focus groups within this study. Firstly, the research is primarily concerned with investigating adaptation motivations and priorities at the community level. It is therefore important to gather the views of the community as a whole, as far as the research constraints will allow, rather than focusing on individual opinions in a one-to-one interview approach. Kitzinger found that focus groups could help to establish "group consensus" on certain topics (1994, p.109). The method can also illuminate matters upon which participants are in direct disagreement with one another. One-to-one interviews could eventually lead to results and findings that reflect the distribution of views within the community, but such an approach would collect the views of individuals rather than exploring the opinions and experiences of the wider community in a social group setting. Focus groups could be more effective than one-to-one interviews for achieving a key goal of the research: to investigate collective community views on motivations and priorities for adapting to climate change.

Secondly, focus groups can produce information on how and why certain priorities are important within the communities - and how and why the priorities might differ between case studies. Such insights can be gained through conversational interaction. Participants are likely to explain their opinions to the group (Oates, 2000). They may share their opinion then proceed to explain their views to one another, therefore providing justification and reasoning for their perspectives. Alternatively, the rest of the group might question the views of a respondent invoking the need to justify their opinion (Oates, 2000). Thus, focus groups were used in the present research to gather rich qualitative data for addressing how and why issues and priorities are similar or different across the case studies.

Finally, focus groups can serve to empower participants. Kitzinger (1994) argues that focus groups are an ideal method for exploring thoughts and ideas that are generated by the respondents in their own words rather than imposed by the researcher. Approaches with minimal structure give participants freedom to talk about what matters to them most in relation to the central focus group topic. Priority is given to the perspectives and opinions of the participants. The current research favours an engagement-led approach to investigating climate change adaptation in the Scottish Islands. Whilst priorities for adaptation to impacts of climate change were used as the general topic for focus groups, the participants were given free rein over the discussion within that overarching subject. The results, presented in Chapter 5, highlight the main adaptation concerns for each case study community using words, ideas and opinions produced by the community members themselves.

3.3.4.ii. Operationalizing Focus Groups

Sampling Strategy and Recruitment

The collection of data that represents the views of every individual within a population, therefore achieving 'representativeness', is challenging when utilising focus groups. According to Morgan (1997), focus group studies rarely utilise random sampling because the relatively low number of participants used for focus groups means that the sample will seldom be representative of the wider population regardless of whether random selection is undertaken. Furthermore, an assortment of randomly sampled individuals are less likely to find any common ground on which to discuss shared views, potentially limiting the opportunity for formulating a meaningful conversation. This suggests that a certain level of homogeneity among participants is necessary for effective focus groups. Purposive sampling concentrates on choosing "focus group participants by virtue of characteristics thought by the researcher to be likely to have some bearing on their perceptions and experiences" (Barbour, 2008, p.52). The principle goal of purposive sampling is to achieve data richness rather than to produce a statistically representative sample. A purposive sampling strategy – where the sample of participants is carefully selected according to the research aims in order to contribute to the generation of theory – is better suited to focus groups than random sampling because it can lead to richer and deeper data collection (Morgan, 1997).

As part of purposive sampling, it can be advantageous to pinpoint pre-existing groups that might be able to relate to the research topic through their histories and experiences. Kitzinger defines pre-existing groups as "clusters of people who already [know] each other through living, working or socialising together" (1994, p.105). A benefit of sampling pre-existing groups is that participants are familiar with one another and are likely to express their views more willingly, and to question the opinions of others, thus generating detailed and rich data (Kitzinger, 1994). It is important to remember that pre-existing groups will not behave in an entirely natural manner within an artificial focus group setting. However, the use of preformed groups is an effective way of accessing a study population, the participants of which are likely to be comfortable generating a discussion together. Although results might not represent the views of every individual person within a community, the use of purposive sampling with pre-existing groups can produce data that reflects the views of the community as a whole through the social groups and networks that already exist within the community.

The present study employed a purposive sampling strategy when operationalizing focus groups and made use of pre-existing groups in the case studies. During documentary analysis, community councils were identified as central organisations within all three case studies and were approached initially as part of the sampling strategy. It was anticipated that a variety of community members would comprise each community council, therefore providing a cross-

section of perspectives. Community councillors might also have first-hand experience of dealing with community-level impacts and consequences of climate change, and could provide rich accounts on this issue. A range of other pre-existing community groups were identified during documentary analysis, of which the following participated in focus groups: Unst Partnership, Gardiesfauld Youth Hostel Committee and Uyeasound Public Hall Committee (Unst); Storas Uibhist (South Uist); Westray Development Trust (Westray). Table 3.3 conveys the focus groups undertaken within each case study.

	Focus Group 1	**Focus Group 2**	**Focus Group 3**	**Additional One-to-One Interviews**
Unst	Unst Community Council and Unst Partnership	Gardiesfauld Youth Hostel and Uyeasound Public Hall Committees	Open Focus Group	N/A
South Uist	Lochboisdale Community Council	Storas Uibhist Board	Open Focus Group	N/A
Westray	Westray Community Council	Westray Development Trust	Open Focus Group	Telephone Interview 1 Telephone Interview 2

Table 3.3: The series of focus groups and interviews undertaken to gather qualitative data in the case study communities

When designing the sampling strategy, it was recognised that the recruitment of pre-existing groups might lead to the inadvertent exclusion of other community members wishing to share their experiences and opinions. Therefore, 'open' focus groups that welcomed the participation of any interested community members were conducted in each case study. Gatekeepers, such as the chairpersons of community councils, were instrumental in publicising the open focus groups to the wider community through the distribution of event flyers within each island. Additionally, the researcher formally invited deliberative workshop participants to attend the open focus groups. Recruitment materials are presented in Appendix C. Upon reviewing the data gathered during Westray focus groups, it became apparent that data richness was slightly less satisfactory compared with data collected in Unst and South Uist, and that data saturation had not yet been achieved. Therefore, two additional interviews were undertaken separately via telephone with individuals who had previously attended the deliberative workshop in Westray but were unable to participate in the focus groups. This resulted in a sufficiently rich dataset for Westray.

Sample Size

Traditionally, eight to twelve people is an acceptable number of participants per focus group (Robson, 2002). However, Morgan (1997) makes the point that it can be challenging to control a large group and that certain participants might not get the opportunity to express their opinion. Furthermore, a large group has the potential to diverge into a range of smaller conversations that can be difficult to record and moderate. Oates (2000) argues that eight to twelve is too large a group and suggests that a group of six to ten participants is more practical. Similarly, Kitzinger (1994) used groups with an average of six participants per session and found this to be a sufficient number.

The present research attempted to use groups of six to ten participants where possible following the work of Kitzinger and Oates. However, since the study seeks to target preformed groups, the number of people in a pre-existing group influenced focus group size to an extent. Willingness and availability to participate were also key factors that influenced the sample size of both the preformed and open focus groups. In practice, some focus groups contained less than six participants although no groups exceeded ten participants. The largest group contained seven participants. In the smallest group – the open focus group in Westray – only one participant was present and was therefore counted as an interview. Consequently, the two additional interviews contributed to the Westray dataset. In terms of data richness, smaller groups of three or four participants tended to yield more in-depth and detailed data than larger groups. It was necessary to exercise flexibility as a facilitator, and to adjust the structure of the agenda accordingly depending on the number of participants within each focus group, to ensure the collection of rich data.

Number of Groups

According to Oates (2000), the number of focus groups that should be conducted varies depending on the specific aims of the research and the level of participant variety required. For example, the use of heterogeneous participants is likely to require a greater number of groups in order to draw out any common themes or perspectives across the different groups (Morgan, 1997). When gathering data in a focus group, the ultimate goal is to arrive at a stage where no new information or knowledge is being produced. This is also known as the 'saturation point' of data collection. The number of groups required to reach saturation point depends on a range of issues including the use of heterogeneous or homogeneous groups and the level of structure in the focus group agenda.

Nine focus groups were originally conducted in total; three groups in Unst, Westray and South Uist respectively, with the open focus group in Westray classed as an interview and two additional interviews undertaken thereafter (Table 3.3). It was anticipated that undertaking three focus groups in each case study could generate enough data to produce reliable results for cross-case comparison given the time constraints of the research. Saturation point was reached in Unst and

South Uist, where relatively similar themes emerged across the three focus groups in each respective case study. In Westray, saturation point was reached when additional interviews were undertaken and it became apparent that interview responses reflected topics emerging from the focus groups data.

Group Composition

A major issue for operationalizing focus groups is whether to compose groups using homogeneous or heterogeneous participants. The former have common backgrounds with similar social characteristics whereas the latter come from different backgrounds with varying social characteristics. Employing a homogeneous approach can support increased communication among participants who share a common background, as well as providing a safe environment in which respondents can freely share their views with relatively similar people (Robson, 2002). The drawback of homogeneous groups, however, is that most participants might possess similar views which could result in low levels of debate thus leading to a lack of explicit reasoning for their views (Kitzinger, 1994). Heterogeneous groups, on the other hand, can produce detailed and thought-provoking discussions. Participants coming from different social backgrounds often must defend or explain their opinions to the rest of the group (Oates, 2000). However, potential disadvantages of heterogeneity in focus groups include: dominance by vocal participants; lack of respect by some respondents for the opinions of others; and inequalities of power in cases where participants feel inadequate in comparison to others (Robson, 2002).

By using mostly preformed groups in the current study, complete homogeneity or heterogeneity could not be guaranteed. Both the preformed and open focus groups contained largely heterogeneous group compositions but with some degree of homogeneity. For example, community council members represented a range of differing age groups, livelihoods and social backgrounds. However, a certain degree of homogeneity existed within the community councils due to the fact that they were all part of the same organisation. In the open focus groups, the majority of participants were previously acquainted in some manner due to relatively low population numbers and high levels of personal familiarity among the case study communities. Participants exhibited shared understandings of their communities despite the largely heterogeneous composition of the open focus groups. Homogeneity and familiarity had to be addressed directly when operationalizing both the preformed and open focus groups to minimise the potential for participants to gloss over the motivations behind their views. Therefore, the moderator utilised prompts and probing to encourage participants to explain the reasoning underpinning their responses.

Focus Group Structure

The appropriate level of structure was a key consideration when designing the focus groups. An advantage of a structured approach, with high moderator involvement and adherence to a detailed agenda, is improved efficiency in data

collection since all participants generally stick to pre-defined topics. However, a major drawback is that the agenda has been set according to the assumptions of the researcher with little room for flexibility. This may result in the moderator inadvertently excluding topics that are important to participants (Morgan, 1997). A non-structured approach, with a highly flexible agenda and little moderator involvement, allows participants to drive the discussion according to the issues they deem important and allows for greater levels of group interaction.

Whether the moderator is highly involved in the discussion, or barely involved at all, depends on the aims of the research (Oates, 2000). It is possible to combine both structured and non-structured approaches when conducting focus groups (Stewart *et al*. 2007). With this in mind, a semi-structured approach was adopted in the present study to form a deep understanding of motivations and priorities for adaptation in the case studies. Allowing participants the freedom to drive the discussion was beneficial for exploring the reasoning underpinning specific priorities. However, it was necessary to prepare a broad discussion guide to motivate initial discussion and to bring the conversation back to the central topic if it began to diverge into unrelated subjects. The discussion guides are presented in Appendix C. All key questions within the discussion guides were covered at some point during the groups, but the goal was to encourage free discussion among the respondents wherever possible. Discussion guides were as similar as possible across the case studies to allow comparisons during analysis. Moderator involvement was high at the beginning of each focus group to explain the central topic and aims of the session. However, discussion was gradually handed over to participants with less moderator involvement. Overall, the focus groups were semi-structured with balanced and flexible use of discussion guides and moderator involvement in order to encourage the emergence of themes in a grounded approach.

Research Instruments and Recording

Focusing materials can assist in encouraging interactive discussion between respondents (Oates, 2000). In all focus groups, materials were provided near the beginning of the session as a focusing tool that helped to initiate conversation amongst participants. Climate projections were used as focusing materials in all three case studies. Specific climate projections were used for each case study based on the results of deliberative workshops. Various climatic hazards were highlighted during the workshops as having had significant impacts and consequences for the case study communities: severe wind and storms (Unst), coastal flooding (South Uist) and rising sea level (Westray) (see Chapter 5). Unst participants were given local UKCP09 wind projections, whilst local UKCP09 sea level projections were provided for South Uist and Westray participants. The discussion guides and focusing materials therefore reflected the key climatic hazards affecting each case study as identified by community members during deliberative workshops.

The audio from focus groups and interviews was recorded using a tape recorder before being transcribed and analysed using NVivo software. The use of a tape recorder allowed the researcher to give full attention to participant responses, to react with appropriate prompts and probes, and to concentrate visually on non-verbal data such as body language, gestures and facial expressions. The audio data remains true to the participants' own words and can be quoted verbatim within the research.

3.3.4.iii. Focus Groups for Scenario-Based Community Engagement

As explained, focus groups were employed to collect qualitative data to enable understandings of motivations and priorities for adaptation in the case studies, and whether any cross-case similarities or differences exist, thus addressing two of the research questions outlined in Chapter 1. However, focus groups were also used to test the utility of climate scenarios and vulnerability mapping as tools for engaging communities in discussions about adaptation in order to address the third research question: how can scenario-based community engagement contribute to adaptation planning and how useful are projections and vulnerability assessments as tools for engagement at the community scale? The time constraints of the research meant that it was not possible to test the utility of vulnerability mapping in all three case studies. Therefore, Westray was selected as a single case study for this particular phase of research.

A section of each focus group in Westray was dedicated to examining the use of vulnerability mapping and climate projections as tools for scenario-based community engagement. A hypothetical assessment of vulnerability to sea level rise was produced for Pierowall Bay in Westray prior to conducting the focus groups (see Chapter 4). The vulnerability maps - distributed during Westray focus groups - provided a visual illustration of potential vulnerability along the coastline of Pierowall Bay to future sea level rise. Graphs illustrating projected sea level rise were distributed alongside the vulnerability maps to help participants visualise the potential level of change across Pierowall Bay. The maps and projections were used to facilitate discussion on priorities for adaptation in relation to vulnerable areas of the coastline. Moreover, participant responses to the vulnerability map and sea level projections were analysed later in the study with a view to examining the role of scenario-based community engagement in adaptation planning. The focus groups, as a semi-structured environment, were a suitable method for examining the level of engagement generated by vulnerability mapping. Participants were free to react to and engage with the vulnerability map and sea level projections in any manner they chose: positively, negatively, constructively, critically or not at all.

3.3.4.iv. Summary

Overall, focus groups are appropriate for use within the current research due to the stakeholder-driven and community-based nature of the study. The results of qualitative data gathered during focus groups serve to enhance the

understanding of the issues, factors and priorities for adaptation to climate change in each case study community, as well as why these are important. The use of focus groups also enables conclusions to be drawn as to how and why issues, factors and priorities for adaptation might vary across the case studies.

3.4. Methods of Data Analysis

3.4.1. Analysis of Qualitative Data

Qualitative research deals with words, experiences, stories and behaviours. It can produce understandings of social processes in a way that attempts to offer explanations about how and why individuals, households, communities and other human groups think and behave in the way they do (Barbour, 2008). The goal of qualitative research is not necessarily to identify how many people possess a specific opinion, but to understand why the opinion of one individual might differ to another and to produce theory on the wider implications of such variation. The present study employs a qualitative approach to both data collection and analysis due to the fundamental goal of understanding and comparing priorities for adaptation across Scottish island communities.

After undertaking the data collection methods described in Section 3.3, the empirical qualitative data was analysed to produce results and findings about adaptation in Scottish island communities. Initially, the information collected during policy mapping and documentary analysis was reviewed informally to gain an understanding of the concepts of 'adaptation' and 'community' in the context of the case studies. The qualitative data collected during deliberative workshops consisted of transcripts, written participant workbooks and hazard-impact-consequence posters that were colour-coded in terms of risk factor by the participants. Having collated and examined these data, the key impacts of climate change in each case study were identified. These results directly contributed to the design of focus groups that were used to gather data on issues, factors, motivations and priorities for adaptation, as well as to test the utility of scenario-based community engagement using hypothetical vulnerability mapping. This section highlights and explains the approaches undertaken to analysing qualitative data gathered during focus groups and interviews in the case studies.

3.4.2. Grounded Theory

The interpretation of empirical qualitative data was a central aspect of formal analysis within the research. This phase of analysis employed a grounded theory approach using coding as a technique to rigorously analyse the data. Originating from Glaser and Strauss, 'grounded theory' is "the discovery of theory from data…systematically obtained from social research" (1967, p.2). Within their work, Glaser and Strauss stressed the importance of generating new theory from qualitative data rather than focusing solely on applying existing theories to data. They argued for the advantages of letting empirical data drive the production of theory rather than attempting to fit pre-defined theories to the data. Grounded theory is "intimately linked to [the] data" (p.4) from which it is generated and

therefore draws on inductive arguments to support conclusions, contrasting with theories that have been based solely on assumptions made by the researcher which are rendered invisible within deductive approaches (Glaser and Strauss, 1967).

The research favours a stakeholder-led approach to exploring small island adaptation, where community perspectives and experiences form the basis of investigation. Therefore, a grounded theory approach was employed to develop theory on small island adaptation through themes that emerge inductively at the community level. However, in contrast to Glaser and Strauss, the current research also applies existing adaptation theory to the empirical data. If a grounded theory approach is paired with the application of existing theory during analysis, it could lead to more nuanced and detailed understandings of small island adaptation. A dual approach was employed to rigorously analyse the empirical data. Grounded theory analysis was conducted initially, followed by the application of existing theory and knowledge from the adaptation literature.

3.4.3. Coding

Coding can be used to analyse qualitative data when employing a grounded theory approach to research (Robson, 2016). When coding is applied to qualitative data, it can uncover patterns and themes that aid understandings of relationships, linkages, similarities and differences (Cope and Kurtz, 2016). A key feature of coding is the iterative comparison and analytical questioning of participants' responses leading eventually to the generation of theory from the data. Responses can be coded and compared not only across focus groups and interviews within one case, but also across focus groups and interviews between multiple case studies. With this in mind, coding can be a beneficial method of analysis within research that uses a multiple case study approach. Coding was used in the present study to identify and understand the issues and priorities for adaptation in the case studies. The use of coding enabled a cross-case comparison of community priorities for adaptation and the reasoning underpinning these priorities. As an iterative process, this led to the emergence of key themes grounded in the data that formed a major set of results within the study. This led to the development of findings on the wider implications of adaptation to the impacts of climate change in Scottish island communities.

In practice, the process of coding was undertaken systematically in order to analyse the qualitative data gathered during focus groups in a detailed and in-depth manner. NVivo software was used to organise and code the data. Focus group transcripts were imported into the software and organised according to case study. The research adopted an iterative and strategic approach to coding and the qualitative data was analysed and interpreted with the core research questions in mind. Initially, broad-brush coding was undertaken for each focus group, as well as the individual interviews from Westray. This approach involved a broad and brief exploration of each transcript, without becoming involved in finer details, which led to the identification of overarching themes. For example, transport infrastructure emerged as a broad theme across all three case studies during initial

broad-brush coding. This preliminary phase of coding led to increased familiarisation with the data, and the overarching themes became the first codes that emerged from the datasets. A more detailed approach was employed in subsequent rounds of coding for each transcript as described below.

Qualitative data has many layers and can be examined through various analytical lenses. Descriptive or inductive coding – where *in vivo* codes are produced based on the terms and phrases used by participants - is a type of analytical lens that can be applied during coding to categorise the data (Cope and Kurtz, 2016). Analytical coding offers another approach to analysis, where the descriptive codes are further examined in relation to theory-based themes present in the existing literature (Cope and Kurtz, 2016). Therefore, it was important to examine the qualitative data from both inductive and analytical coding approaches in an iterative process. Inductive coding, where codes emerge from the data in a grounded theory approach, was undertaken before theory-led coding. Inductive coding did not involve the use of any preconceived questions or themes. Instead, themes emerged from the qualitative data in participants' own words. Emerging themes were grouped into categories such as 'Lives and Livelihoods'. During later iterations of inductive coding, sub-categories emerged within each broad category. For example, the sub-codes 'Industries and Economy' and 'Cultural Heritage' emerged within the 'Lives and Livelihoods' code. Eventually, it was possible to form comparisons between the case studies using the codes and sub-codes that were grounded in the data.

Following several iterations of inductive coding, an analytical theory-led coding approach was employed. Theory-led coding involved the application of pre-defined themes to the data. In this study, the themes applied during theory-led coding were derived from the key debates and theories outlined in Chapter 2. Five theory-based themes were applied to the data: (1) Responding to Harm, (2) Developing Networks, (3) Defining Responsibility, (4) Upholding Societal Values and (5) Transforming Societies. Again, each code contained a range of sub-codes that were also influenced by the literature. For example, the sub-codes 'Connections and Relationships', 'Communication' and 'Coordination' were part of 'Developing Networks'. Theory-led coding offered a new way of looking at the data and allowed for links to be made between existing theory and participant responses. Grounded theory analysis could then be linked to existing debate in the published literature. Overall, coding offered a means of rigorous and iterative data analysis.

3.4.4. Scenario-Based Community Engagement Using Vulnerability Mapping

Analysis of qualitative data gathered during Westray focus groups enabled a comprehensive examination of the utility of climate projections and vulnerability mapping as tools for scenario-based community engagement within the case study of Westray. This phase of analysis aimed to dissect the ways in which participants responded to a map conveying hypothetical vulnerability to sea level rise in Pierowall Bay, as well as published projections of sea level rise for this area. It was important to assess how participants responded to scenarios of vulnerability to

sea level rise, and particularly the level to which respondents engaged with the vulnerability map and sea level projections. Participant observation can be a beneficial technique for interpreting the behaviour and actions of participants, in turn leading to improved understandings of the experiences and perspectives underpinning these actions (Robson, 2016). Participant observation was employed during this element of the Westray focus groups in order to gauge participant reactions and responses to the tools presented with little researcher involvement. It was important to initially allow respondents the freedom to discuss the material, and the implications for Pierowall Bay, in any manner they chose whilst the researcher acted as an observer. Questions and probing were then gradually introduced as part of a semi-structured approach to assessing the utility of vulnerability mapping and climate projections. Analysis of the data collected during this phase of research indicates whether respondents showed an active interest in the map and projections, and ultimately whether vulnerability mapping could be a useful tool for community engagement in adaptation planning.

This analysis involved an exploration of the Westray focus group transcripts. Specific sections of the focus group transcripts, where participants had been provided with the hypothetical vulnerability map and sea level projections, were subjected to analysis. This phase of analysis was undertaken after rigorous coding had been applied to the data as described in Section 3.4.3. At that point, the researcher had developed a high level of familiarity with the transcribed data and codes. The codes produced during previous rigorous coding were useful in providing background context for participant responses to the vulnerability map and sea level projections. Previously coded data was re-examined from a new perspective and three core questions were applied to the data:

1. How did participants initially respond to the vulnerability map and sea level projections - actively, passively or not at all?
2. How did participants attempt interact with the materials?
3. How did the materials encourage discussion among participants about future adaptation in Westray?

Subsequently, participant responses were categorised based on these core questions. It was then possible to draw out key themes across the focus groups based on how participants had engaged with the materials. For example, a common theme across all Westray focus groups was the willingness and ability of participants to actively contribute to interpretations of local vulnerability to sea level rise. Participants were keen to offer their own understandings of local vulnerability based on their knowledge of coastal land around the island. Full results of the analysis are described and interpreted in Chapter 4. Overall, the analysis of focus group transcripts, using the aforementioned key questions as a framework, enabled the utility of vulnerability mapping and climate projections as tools for scenario-based community engagement to be assessed. The analysis produced interpretations about the implications of employing such tools for engagement at the community scale within adaptation planning.

3.5. Conclusions

The methodological considerations of the research have been discussed in detail within this chapter. The chapter has reported the methods of qualitative data collection and analyses undertaken to address the research questions and aims. A multiple case study approach allowed cross-case comparisons to be made during the analysis stage. Analytical cross-case comparisons allowed a key research question to be addressed: what are the motivations and priorities for adaptation across Scottish island communities and how do they vary? Systematic selection of the case studies was a fundamental part of the research. The study used policy mapping and documentary analysis to develop understandings of the current state of adaptation in the Scottish Islands as well as the key components of 'community' in each case study. Deliberative workshops identified the key climate impacts affecting the case studies in a stakeholder-led approach. Focus groups were the chief method for investigating issues, factors, priorities and motivations for adaptation, as well as exploring the utility of vulnerability mapping for community engagement. The research favoured a grounded theory approach to the analysis of qualitative data. Theory-led data analysis was also undertaken as a means of supporting grounded theory analysis in a rigorous approach. Ultimately, the analysis of qualitative data gathered during focus groups allowed the research questions to be addressed. Chapters 4 and 5 present and discuss the results of the analyses described in this chapter. Specifically, Chapter 4 reports and examines the outcomes of climate projections and hypothetical vulnerability mapping when used as tools for scenario-based community engagement in Westray. Furthermore, Chapter 4 considers the utility of the aforementioned scenario-based tools for adaptation planning according to the results of the research. Chapter 5 presents and interprets the results of focus groups to investigate motivations and priorities, as well as issues and factors, for adaptation to key impacts of climate change in the case studies.

Chapter 4: Assessing the Utility of Scenario-Based Engagement Tools in a Scottish Island Community

4.1. Introduction

The research seeks to explore scenario-based community engagement by investigating the utility of climate projections and vulnerability mapping as tools for engaging small island communities in adaptation discussions. In order to address this aim, a map of hypothetical vulnerability was produced for and applied to one case study: the potential vulnerability of Pierowall Bay in Westray to impacts of sea level rise. This chapter presents the results of the exercise, along with an assessment of the usefulness of vulnerability scenario mapping as a focusing technique for encouraging adaptation discourse at the community level. This analysis contributes to broader understandings about the relationship between community engagement and adaptation planning in small island communities. Summaries of empirical results and key findings are available in Tables 4.1 and 4.2.

Assessing the Utility of Vulnerability Mapping as a Tool for Community Engagement in Adaptation			
Empirical Results	*1. Vulnerability Hotspots: establishing the significance of potentially vulnerable locations*	*2. Participant Input: validating and critiquing the hypothetical assessment of vulnerability*	*3. Establishing Adaptation Priorities*
	In response to the sea level projections and map of hypothetical vulnerability to sea level rise for Pierowall Bay, participants were initially concerned about the consequences for Broughton as a low-lying area with a history of minor coastal inundation and flooding. Broughton is perceived as an area already vulnerable to coastal inundation due to the low-lying topography of this area. Participants went on to highlight other areas of the bay around Pierowall Village that they considered to be low-lying and potentially susceptible to inundation. Respondents have a pre-existing knowledge of vulnerable hotspots within their island and used their own experiences to pinpoint potential areas of risk.	Participants began to intuitively validate and critique the hypothetical assessment of vulnerability in a number of ways: 1. Sharing knowledge of biogeophysical factors 2. Sharing knowledge of socio-economic factors 3. Drawing on general perceptions 4. Drawing on personal experience Participants were able to intuitively engage with the resources despite lacking access to the specific coastal data that was used to produce the map. They offered their own estimations of vulnerability based on personal experience and local knowledge. Respondents demonstrated a deep knowledge of the local coastline. Consequently, they critiqued certain aspects of the map and suggested that the estimation of vulnerability for Broughton might be higher than indicated based on local knowledge.	Respondents began to consider the potential consequences of sea level rise and highlighted several adaptation priorities: • Economy • Roads Infrastructure • Housing • Amenities Pierowall Bay was identified as an area of high social value containing businesses, housing and amenities as well as being a social hub within Westray. Respondents deduced that negative consequences of sea level rise could be damaging to the village and therefore identified this area as highly vulnerable. The map of hypothetical vulnerability, coupled with sea level projections, encouraged participants to consider factors that are vital for sustaining normal ways of life within Pierowall Village and Westray as a whole.

Table 4.1: Summarised empirical results regarding the utility of hypothetical vulnerability mapping as a tool for scenario-based community engagement in adaptation within the case study of Westray

Assessing the Utility of Hypothetical Vulnerability Mapping as a Tool for Community Engagement in Adaptation				
Key Findings	Participants were keen to be involved in discussions about adaptation during the focus groups and expressed a desire to develop active communication with scientists/planners. The sea level projections and map of hypothetical vulnerability encouraged participants to think about the future viability of Pierowall Bay in relation to rising sea level. Small-scale vulnerability mapping could be an effective tool for encouraging active community participation in island and coastal communities.	If approximations and scenarios are based on reliable data, participants need not be presented with a range of in-depth coastal and climate information. Participants actively engaged with the vulnerability map because the output was straightforward and digestible, not complex or technical. Scenarios must be backed up by in-depth data at academic and planning levels. However, coastal and climate information for community engagement processes should be uncomplicated for inclusive engagement.	The lack of sufficient data available at the small island scale for coastal variables is a key challenge. Adaptation can be inhibited if communities and local authorities lack adequate access to coastal and climate data. Certain types of coastal data, such as that required to examine shoreline change and mean wave height, are difficult to source the small island scale. Island adaptation planning could be hindered when there is a distinct lack of readily available coastal data. If the issue of adaptation in the Scottish Islands is to be tackled successfully, the improved collection and availability of sufficient data will be crucial.	Participants demonstrated that they know the lay of the land around their island and have first-hand knowledge of local climate impacts and consequences. This type of information cannot be obtained from coastal or climate data alone. Although community perceptions may be subjective, effective engagement provides a voice for communities and is a platform for knowledge exchange across scales. A two-way stream of communication could be opened up via community engagement between decision-makers and local people to inform small island adaptation.
	SUMMARY Vulnerability mapping is a useful technique for community engagement. As evidenced in Westray, it encourages communities to consider how climate change might affect their local area in future. Effective and continuous communication, cooperation and coordination between communities and decision-makers could be key to avoiding inaction, marginalisation and conflict. Vulnerability mapping is an example of an effective technique that could be used for engaging communities in adaptation discussions. Ultimately, community engagement could help to inform adaptation through the consultation and incorporation of local knowledge into planning.			

Table 4.2: Key findings on the utility of hypothetical vulnerability mapping as a tool for scenario-based community engagement in adaptation within the case study of Westray

4.2. Community Engagement in Adaptation

4.2.1. The Benefits and Challenges of Community Engagement in Adaptation

4.2.1.i. Introduction

Within the current body of adaptation literature, various authors have evaluated community-scale participatory approaches and the use of community engagement as a tool for adaptation (Paavola and Adger, 2006; Tompkins *et al*. 2008; Moser and Ekstrom, 2011; Moser, 2013). Participatory approaches at the community scale involve the consultation and inclusion of local community members by decision-makers in adaptation planning and implementation. Moreover, community engagement is a component of participation that centres upon direct communication between decision-makers, local stakeholders and community members. Community engagement can be undertaken using various consultation techniques including workshops, focus groups and interviews. The purpose of community engagement, as a component of participatory processes, is to understand community-level values and priorities in order to undertake adaptation that complements local ideals. Key thinkers within the existing literature have highlighted the utility and benefits of community engagement. However, community engagement also presents a range of challenges for adaptation in practice. In order to contextualise the current research, it was necessary to develop a critical understanding of the advantages as well as the potential obstacles involved in community engagement for adaptation. This section will explore the benefits and challenges of community engagement in processes of adaptation as discussed in the existing literature.

4.2.1.ii. Community Engagement as an Effective Tool for Adaptation

Community engagement has been presented in the literature as a beneficial technique for planning in adaptation. For example, Tompkins *et al.* (2008) use the case studies of Christchurch Bay and Orkney to highlight the usefulness of engagement with local stakeholders at the community level. Their findings indicate that engagement can provide a platform upon which local-scale climate change discourse can occur, thus providing an insight into climate challenges at this level. In theory, engagement has the potential to be an inclusive social process of equal participation that allows for the vocalisation of community-level knowledge and priorities, in turn contributing to effective adaptation planning (Paavola and Adger, 2006; Moser, 2013). The inclusion of local voices can be valuable for understanding the complexities of climate change impacts at community scales (Kelman, 2010). Furthermore, Green *et al*. (2010) stress that community members are likely to possess optimum knowledge in terms of prioritising local needs. Knowledge and experience of tangible climate impacts means that communities can inform adaptation via engagement.

Some empirical studies have indicated that participants are capable of understanding scientific climate information and, in some cases, do not necessarily

need precise climate evidence to make valuable contributions to planning processes. For example, Moser and Ekstrom (2011) found that communities in two case studies in California were capable of understanding climate change impacts in their local area and were able to engage with the climate concepts presented to them. Furthermore, Tompkins *et al.* (2008) suggest that technical climate information is not essential for community engagement. The authors found that participants were able to interpret a range of climate scenarios and to discuss the possible future impacts in a meaningful way based on their existing knowledge and experiences. However, it has been argued that the impacts of slow-onset hazards, such as sea level rise, might not be felt or experienced directly by local people (Aswani *et al*. 2015). Therefore, expert scientific knowledge of slow-onset climate change hazards is also essential for adaptation planning. Community knowledge, communicated through engagement, is important in its own right but adaptation requires a range of knowledge types and information from both scientific and local sources (Hovelsrud *et al*. 2010; Kelman, 2010; Bedsted and Gram, 2013).

4.2.1.iii. Challenges of Community Engagement in Adaptation

In contrast, the published literature indicates that the use of community engagement in adaptation can also incur a range of significant challenges. Community engagement does not automatically result in implementation or action on the ground, and one of the major challenges of participatory approaches is translating engagement and planning into real-world action (Moser and Ekstrom, 2011; McLeod *et al.* 2015). Moreover is the potential for increased feelings of marginalisation if communities are consulted but then adaptation takes an alternative route led by local authorities or similar bodies where community values and priorities are possibly overlooked (Ford *et al*. 2016b). Community engagement might be less effective if communication and cooperation across scales is poor. Furthermore, challenges might arise when community engagement is employed as a means of incorporating a range of knowledge bases into adaptation. Few *et al*. (2007) suggest that the use of engagement involving a range of community members, stakeholders and planners might induce conflict or augment existing tensions between varying groups across scales due to variations in power. Although it may be crucial to involve a range of knowledge types via stakeholders, community members and planners in the process of adaptation, it might be difficult to avoid conflict when undertaking engagement in practice. Additionally, community response to engagement is not always positive or productive. Tompkins *et al.* (2008) highlighted that stakeholders might not be interested in engaging in climate change adaptation for various reasons: they might regard other non-climatic issues as being more important or they might see climate change adaptation as a complex issue and feel unqualified to pass comment.

4.2.1.iv. Summary

The use of community engagement in adaptation has a range of benefits as evidenced in the literature, particularly in terms of encouraging climate change discourse at the community level as well as the potential for including local

knowledge and priorities in planning processes. However, community engagement is not without challenges when used in practice. It may be the case that community members and stakeholders are passive or uninterested in engaging in climate change adaptation. Conflict, marginalisation and inaction are some of the key difficulties to overcome in processes of engagement. However, the notion that communities do not necessarily need precise climate data in order to engage in a meaningful way is an interesting hypothesis to test. The consideration of the benefits and challenges of community engagement raises several questions for the current research: (1) How can scenarios of future local climate change impacts encourage active participant responses as part of community engagement? (2) How useful are climate and coastal data for engagement? (3) What are the challenges for producing scenarios for small island settings? (4) How can community engagement inform adaptation in small island settings?

4.2.2. Examining Community Engagement as a Tool for Island Adaptation

Taking into consideration the four key questions raised in the preceding sub-section, it is necessary to further explore how small island communities respond to engagement in order to better understand the relationship between engagement and adaptation at that scale. Unique island settings can influence distinctive local experiences related to climate change (Green *et al*. 2010). For example, it is possible that the impacts of coastal flooding could be experienced differently and more dramatically by a community in a small island setting compared to a community in a mainland location due to the physical, environmental and socioeconomic constraints of a small island. Small islands are principally coastal settings meaning that the coast dominates the landscape of small islands and therefore plays a significant social and physical role in day-to-day life (Dahl, 1997; Lane *et al*. 2013). The Scottish Islands in particular are peripheral locations that are exposed to severe impacts of climate change such as storms and coastal flooding. Engagement could be a crucial tool for understanding the unique climate challenges faced by island communities. The current research attempts to address the aforementioned four key questions in the context of Scottish island communities using Westray, Orkney as a case study. It is important to understand the role that engagement could play in adaptation planning within a real-world setting, particularly within a small island community with potentially unique climate-related knowledge and values.

Consequently, the current research seeks to examine the response of community members to climate change scenarios in the form of vulnerability mapping and sea level projections for Westray. The extent to which respondents related to, understood and engaged with the material is significant in determining how similar techniques for community engagement could be utilised for effective adaptation planning. Furthermore, this component of the research seeks to examine the utility of mapping potential vulnerability to the impacts of climate change as a tool for engagement at the community scale. The notion that communities could engage in meaningful discussions on climate change when presented with relatively basic and straightforward climate scenarios is explored within the empirical data presented in this chapter. Respondents might not

necessarily require detailed climate data to make meaningful contributions to adaptation. Simple scenarios of vulnerability to climate change impacts could be effective in sparking rich dialogues at the community scale, provided this permits a sufficiently comprehensive basis for engagement. The overall purpose of this part of the research is to investigate how community engagement, using hypothetical vulnerability mapping as a tool, could inform adaptation planning in small island contexts and to explore the challenges associated with engagement at this scale through empirical data gathered in Westray.

Relating back to the key challenges of engagement as presented in the published literature, the idea that there might not be an active community response, and that the quality of engagement can be difficult to predict from one community to another, is a significant challenge signposted within the literature that is further explored here within the empirical data. The challenges of inaction, marginalisation and conflict were not directly explored when using vulnerability mapping for engagement. However, respondents referred to these challenges in other sections of the focus groups, the details of which are explored in Chapter 5.

4.3. Mapping Vulnerability to Sea Level Rise in Westray

4.3.1. Sea Level Rise at Pierowall Bay, Westray: A case study

A map illustrating hypothetical vulnerability of Pierowall Bay in Westray to sea level rise was produced using secondary data as part of the research (see Section 4.3.3). Resource and time limitations prevented the whole coastline of Westray being mapped for vulnerability to sea level rise. Therefore, the research focused solely on Pierowall Bay – an area of coastline adjacent to Pierowall Village as the main area of settlement on the island, illustrated in Figures 4.1 and 4.2. Further justification for the selection of Pierowall Bay, as opposed to other areas of the Westray coastline, is reported in this section.

Pierowall Bay was taken as a case study following investigation of the island as a whole. Field visits to Westray, and documentary analysis, indicated that Pierowall Bay is the centre of population, economy and social activity on the island. During previous deliberative workshops, participants explained that the bay – and particularly Pierowall Village - is fundamentally important to the people of Westray because it serves as a community hub within the island. A significant proportion of housing is situated within and around the bay. It is also the area with the highest concentration of population on the island. As highlighted in Chapter 1, the majority of essential island amenities and services are located in Pierowall. In terms of economy, several local businesses are situated within the bay such as hotels and food production services. Furthermore, community organisations and social venues are based in the area making it a social centre for the community. The main road on Westray runs along the coastline of Pierowall Bay linking the north and south ends of the island and ensuring straightforward access to the ferry terminals at both Gill Pier (leading to the neighbouring island of Papa Westray) and Rapness (leading to the Orkney mainland). For these reasons, Pierowall Bay

was recognised as a socioeconomic hub of vital importance to community life in Westray. Therefore, it was considered relevant to adopt Pierowall Bay as a location for mapping potential vulnerability to the impacts of sea level rise.

In order to map vulnerability to the impacts of climate change in Pierowall Bay, it was necessary to first identify the key climate-related hazards and impacts affecting the Westray community. Sea level rise - and the potential for resultant increased coastal erosion and inundation - was highlighted by the participants of the deliberative workshop in Westray as a key concern for the local community (see Chapter 5). Workshop participants illustrated their perception that Pierowall Bay, although relatively sheltered, is low lying in places. In particular, Pierowall Village and the residential area of Broughton are situated within close proximity of the sea. Workshop participants were concerned that sea level rise could have potentially negative consequences in future for these areas of settlement. Following the outcomes of the deliberative workshop, the potential vulnerability of Pierowall Bay to sea level rise was mapped and subsequently presented to Westray community members during focus groups as a tool for engagement.

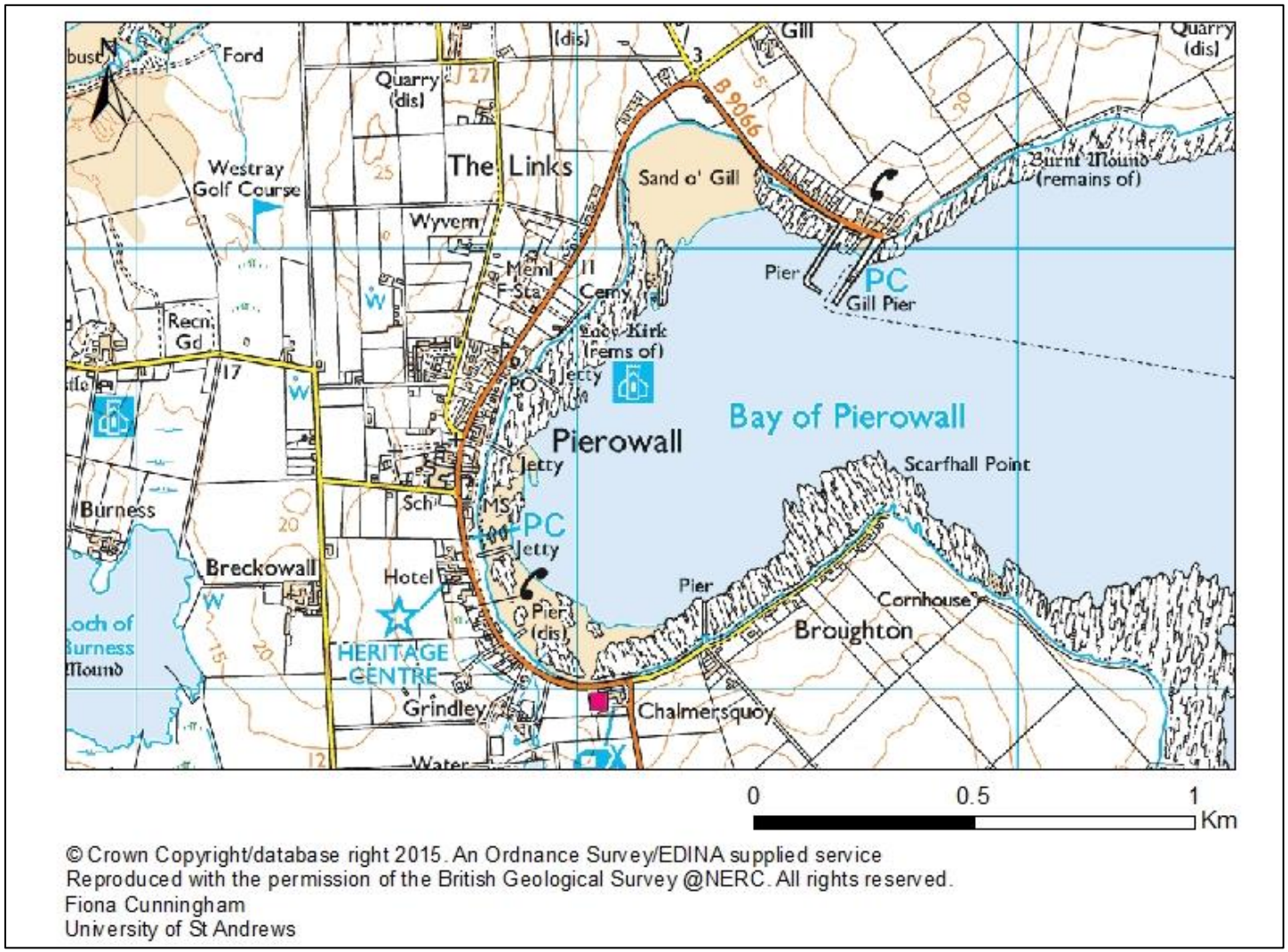


Figure 4.1: Location of Pierowall Bay within Westray

Figure 4.2: Views of Pierowall Bay to the north (top) and south (bottom). Source: F. Cunningham.

4.3.2. Using 'Vulnerability' as a Concept in Practice

Before discussing the creation of the hypothetical vulnerability map and presenting the empirical results of its use during Westray focus groups, it is necessary to first clarify what is meant by the term 'vulnerability' in this context and to justify the reasons for employing this concept as part of hazard scenario mapping. As discussed in Chapter 1, vulnerability is defined within this research as the degree to which a system or group - natural, human or both - is predisposed to and unable to cope with the potentially adverse impacts of climate change

following Adger (1999; 2000) and the IPCC (2007; 2014a). During focus groups, participants were given the aforementioned definition of vulnerability in order to clarify what is meant by the term in the context of the research. 'Vulnerability' is used within this research because it encompasses society and human groups as well as natural systems. Data on physical coastal parameters were consulted to create a hypothetical map of vulnerability (see Section 4.3.3) but the key focus was to present the information to people living in Westray in a way that could be clearly understood and interpreted. The concept of vulnerability encourages respondents to consider the human aspects of climate change and is perhaps more relatable than concepts that could be viewed as technical such as 'sensitivity' or 'susceptibility'. 'Vulnerability' was used in this research in an attempt to facilitate inclusion and to encourage engagement. Vulnerability could be considered as a familiar and commonplace term, therefore serving to encourage participants to respond to the hypothetical vulnerability map without feeling isolated or excluded by overly scientific or technical terminology.

4.3.3. Production of a Hypothetical Vulnerability Map

The research originally aimed to assess the vulnerability of Pierowall Bay to sea level rise using an index approach following the work of Gornitz *et al.* (1991) and Abuodha and Woodroffe (2010). A comprehensive assessment of vulnerability would aim to explore vulnerability to a range of climate-based hazards in detail, but a more focused approach was adopted since the topic of this thesis is adaptation of Scottish island communities to climate change impacts. It was important to introduce the concept of vulnerability and how sea level rise might impact the Westray community in future when engaging participants in discussions about adaptation. Therefore, the research was refined and an approximation of potential vulnerability to sea level rise was made based on four key physical coastal parameters for which secondary data could be gathered.

Secondary data for the parameters of geology, geomorphology, coastal slope and tidal range were collected and examined. An ordinal approach was adopted when ranking vulnerability in order to produce a mapped output that was informative but not overly complex. Vulnerability to sea level rise in Westray was ranked 'very low', 'low', 'medium', 'high' or 'very high' depending on the coastal environment of the bay according to the four physical variables. The goal was to ensure participants from a range of backgrounds could interpret the map efficiently and effectively. Bedrock geology and tidal range were found to be largely uniform across the bay. Therefore, coastal slope and geomorphological features were the chief parameters that accounted for any variation in ranked vulnerability across the bay. Table 4.3 illustrates a five-point scale that was adapted from the work on vulnerability index assessments published by Gornitz *et al.* (1991) and Abuodha and Woodroffe (2010). The scale was utilised in order to produce an approximate ordinal ranking of vulnerability to the impacts of sea level rise across Pierowall Bay. On this basis, low-lying areas with a sloping angle of less than 10 degrees are considered as highly or very highly vulnerable whilst those with a slope greater than 45 degrees are considered to have very low vulnerability. Similarly, geomorphological features that tally with low-lying coastline, such as

shingle and sand beaches are associated with high vulnerability whilst hard-rock and soft-rock cliffs are deemed as having lower vulnerability. After applying the five-point scale to the gathered data, it was then possible to produce approximations of vulnerability to sea level rise in Pierowall Bay.

Pierowall Bay is generally low-lying in terms of elevation with a gradual sloping gradient, although some areas of the bay are slightly steeper than others. Geomorphologically, some parts of the bay are comprised of low-lying rocky coast whilst shingle and sandy beaches are also present. Devonian Old Red Sandstone composes the geology of the bay. Therefore, Pierowall Bay falls under medium to very high vulnerability categories when the five-point scale is applied, with slight variations in ranking across the bay depending on differences in geomorphology and coastal slope. However, the tidal range for this part of Westray is 4 metres indicating very low vulnerability in terms of tidal processes in this area. Due to the tidal range and sheltered nature of the bay, it was deemed misleading to class any part of the bay as displaying very high levels of vulnerability. For this reason, vulnerability to sea level rise was approximated at either medium or high vulnerability rankings. The final mapped output is presented in Figure 4.3. A 'medium' vulnerability ranking was applied to areas of the bay with geomorphology and coastal slope that rated as either medium or high on the five-point scale, whilst a 'high' vulnerability ranking was applied to areas of the bay with geomorphology and coastal slope that measured as high or very high on the scale. Overall, the mapped output provided a reasonable basis for engaging Westray community members in discussions about the hypothetical vulnerability of Pierowall Bay to sea level rise, particularly when used alongside UKCP09 sea level projections.

Parameters	Rankings				
	Very Low	***Low***	***Medium***	***High***	***Very High***
Geology	Plutonic, volcanic and high-medium grade metamorphic rocks	Low-grade metamorphic rocks	Most sedimentary rocks	Coarse and/or poorly-sorted unconsolidated sediments	Fine unconsolidated sediment
Coastal Slope (degrees)	>45	>20.1 - 45	10.1 - 20.0	6.1 - 10.0	0.0 - 6.0
Geomorphology	Hard-rock cliffs	Soft-rock cliffs	Low-lying rocky coast	Beaches (cobble/gravel/ shingle), estuary, lagoons, salt marsh	Machair, beaches (sand)
Tidal Range (m)	≥4	3-3.9	2-2.9	1-1.9	≤1.0

Table 4.3: The five-point scale used to rank vulnerability of Pierowall Bay to sea level rise using four key coastal variables. Shaded cells indicate the characteristics of Pierowall Bay. Adapted from Gornitz *et al.* (1991) and Abuodha and Woodroffe (2010).

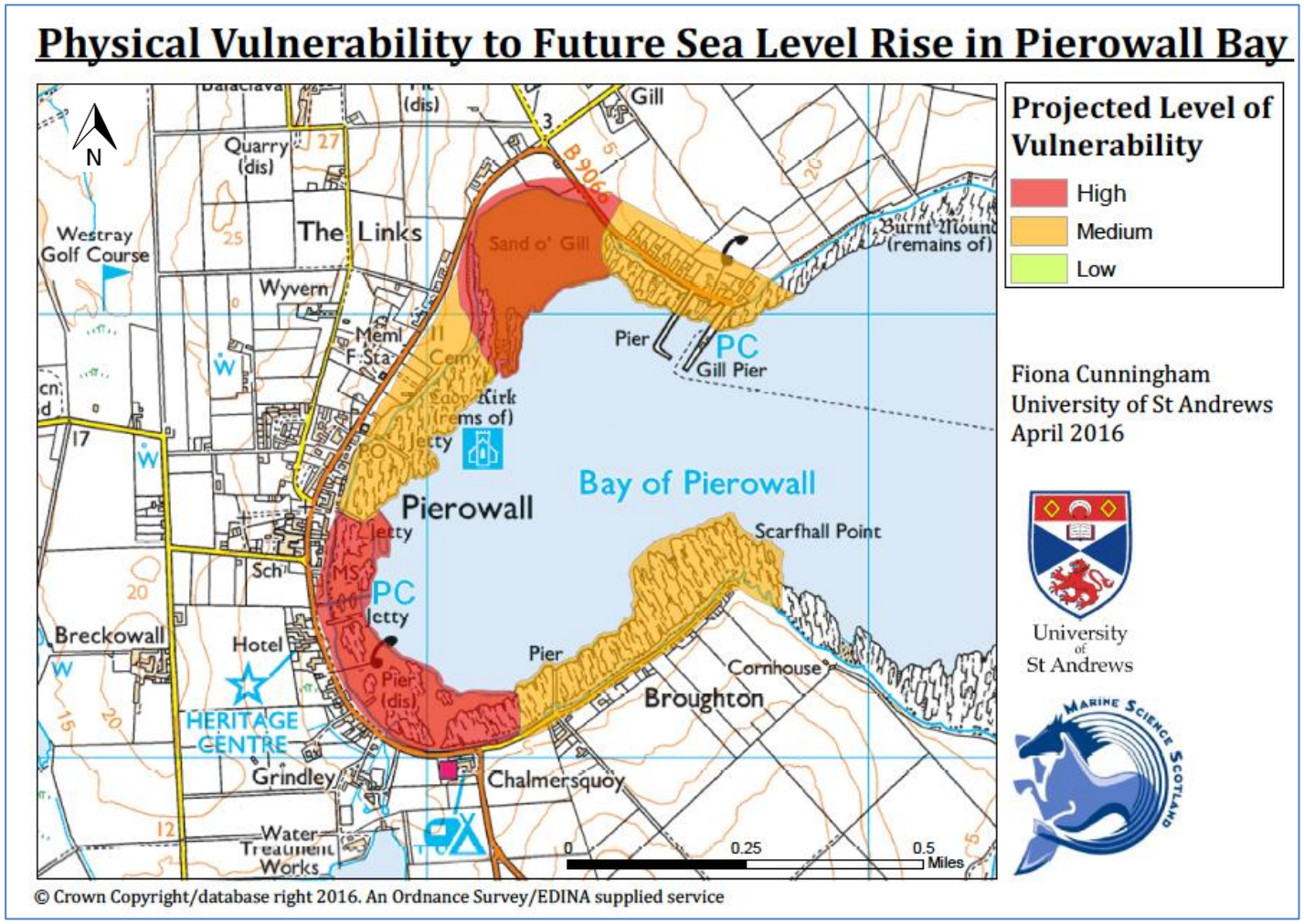


Figure 4.3: The map illustrating hypothetical vulnerability to sea level rise in Pierowall Bay that was employed as a community engagement tool during the series of focus groups in Westray

4.4. Empirical Results

UKCP09 sea level projections for Westray (Figure 4.4) were presented to respondents alongside the hypothetical vulnerability map during focus groups in order to introduce a scenario of potential future vulnerability of Pierowall Bay to sea level rise. As a thought experiment, participants were encouraged to reflect upon and discuss future scenarios of sea level rise and to consider the potential impacts for their island and the Westray community. A semi-structured approach was adopted during this section of the focus groups, where an explanation of the map and projections was initially provided for participants followed by a period of time where respondents had free rein to drive discussions about the potential vulnerability of Pierowall Bay in relation to the scenarios for local sea level rise. Participant responses to scenarios of sea level rise and vulnerability are reviewed in the following sub-sections. Moreover, the sub-sections consider the effectiveness of vulnerability mapping as a means of engaging community members on the topic of adaptation within the case study of Westray.

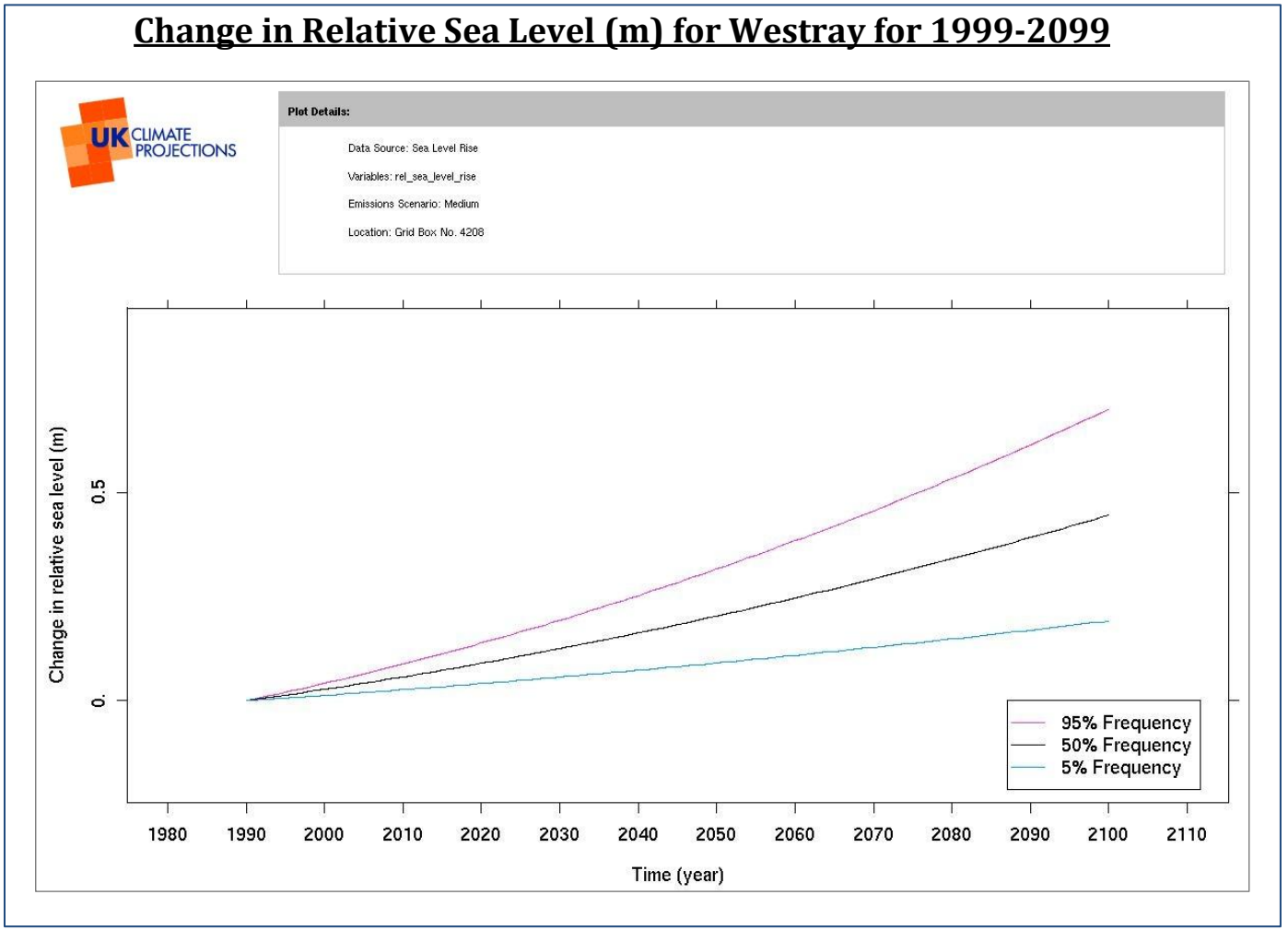


Figure 4.4: The UKCP09 sea level projections for Westray that were presented to respondents during focus groups

4.4.1. Community Response to Potential Vulnerability in Pierowall Bay

Participant responses to projected sea level rise and the hypothetical vulnerability map of Pierowall Bay can be categorised into three key stages: (1) initial concern about hazard risk in locations that they considered to be particularly vulnerable; (2) spontaneously offering their own input for and against the information presented in the vulnerability map based on first-hand experiences; (3) beginning to subtly prioritise various aspects of Pierowall Bay - such as homes, businesses and roads - that they considered important for the continuation of normal life in Westray. The three stages did not necessarily follow the same consecutive pattern in each focus group, but respondents from all three focus groups initiated discussion on each of the stages at some point during the sessions.

4.4.1.i. Vulnerability Hotspots: establishing the significance of potentially vulnerable locations

In terms of concern regarding particularly vulnerable locations within Pierowall Bay, respondents were worried about the effect of rising sea level on low-lying areas, especially Pierowall Village and the small area of Broughton situated towards the south end of the bay. They explained that the sea has been known to reach some buildings during high tides and storms, especially in Broughton, although no major inundation has yet occurred. Interestingly, respondents across all three focus groups mentioned Broughton as a problematic and vulnerable area before they had considered the vulnerability map in detail. They strongly emphasised the low elevation of Broughton and highlighted existing community concern for housing situated close to the coastline in this area. Participants discussed the idea that increasing sea level could exacerbate the risk of coastal flooding in Broughton, which is seen by many as an already vulnerable location.

> *Broughton already has problems. When they get a high tide it's like being on a boat. It would be vulnerable as far as the houses [are concerned].*
>
> Westray Participant
> WDT Focus Group

Furthermore, some noted that the properties of specific friends, acquaintances and neighbours are located in other low-lying areas of Pierowall Bay and could be susceptible to inundation as a result of rising sea level. It appears that, in introducing the topic of vulnerability to sea level rise in Pierowall Bay, respondents were prompted to reflect on past experiences of coastal flood risk across the community. The fact that Broughton was highlighted in all three focus groups indicates that vulnerability in this particular area is likely to be a community-wide concern in Westray.

4.4.1.ii. Participant Input: validating the hypothetical assessment of vulnerability

Respondents across all three Westray focus groups were eager to offer their own opinions and interpretations of the hypothetical vulnerability map. Participants began to intuitively validate the hypothetical assessment of vulnerability by (1) sharing knowledge of local biogeophysical factors, (2) sharing knowledge of socio-economic factors, (3) drawing on general perceptions and (4) drawing on personal experience. Participants did not have access to the specific coastal data that was used in the production of the map. However, they were able to intuitively engage with the approximations presented and to offer their own estimations of vulnerability whilst giving examples and justifications for their suggestions. For example, one participant pointed out that the bay is geologically uniform in terms of sandstone bedrock although the superficial geology is soft and dynamic in places such as the Sand O' Gill. The participant surmised that geology probably has very little influence on the susceptibility of Pierowall Bay to coastal flooding and inundation but that elevation is a key factor influencing vulnerability levels around the bay; an understanding that was matched by respondents in other focus groups indicating that perceptions of the coastal environment could be mutual across the community. Figure 4.3, presented earlier in the chapter, illustrates the hypothetical vulnerability ranking for Pierowall Bay, for which all areas of the bay are rated as either high or medium in terms of vulnerability to sea level rise. In general, the respondents confirmed and agreed with the information presented on the hypothetical vulnerability map, although they pointed out that the vulnerability rating could be altered for some areas based on their knowledge of the lay of the land and nature of the coastline, particularly around Broughton. Several participants suggested that the vulnerability of the Broughton area might be higher than indicated on the hypothetical vulnerability map. Based on their local existing knowledge, they explained that Broughton is less sheltered than the rest of the bay and elevation is particularly low in this area.

> *The Broughton area is most vulnerable [to coastal flooding]. That's where it's low-lying and there are a lot of houses. And that's a high risk.*
>
> Westray Participant
> Westray Community Council Focus Group

> *I think there's a perception that Broughton is exposed. If the tide and the wind get together, the sea then comes on to the road and it can come up to some of the buildings [in Broughton]. There are buildings that get washed [by the sea]. [The terrain] is low there although it starts sloping up after Broughton.*
>
> Westray Participant
> WDT Focus Group

Participants explained that, historically, the bay was an attractive location for settlement due to the low-lying nature of the coastline and the close proximity of fertile hinterland. The bay has been developed over time, with Pierowall Village becoming the centre of population and the heart of the community on the island. Therefore, respondents suggested that the presence of population, coupled with

the low-lying coastline, could augment the vulnerability of the village to the impacts of sea level rise in future. Respondents agreed that the level of vulnerability at Pierowall Village is likely to be high, particularly across areas of low elevation such as the Sand o'Gill. It became clear that the community, through their histories and experiences, are familiar with the coastline around their island and have a deep knowledge of the lay of the land locally. Respondents are aware of weak and vulnerable areas due to past experiences and local knowledge, particularly those that have lived in Westray for a considerable amount of time.

4.4.1.iii. Establishing Adaptation Priorities

After reflecting upon the varying degrees of hypothetical vulnerability presented in the map of Pierowall Bay, respondents began to consider the human and social sides of vulnerability. Participants highlighted a number of adaptation priorities: (1) economy, (2) roads infrastructure, (3) housing and (4) amenities. Each of the priorities was described within the context of Pierowall Bay: an area that they considered to be a "magnet for the population". They expressed concern about certain aspects of the bay that they considered "important" to sustaining life in Westray, such as the protection and maintenance of homes, businesses and the roads infrastructure. The north end of Pierowall Bay was highlighted as a particularly important area in terms of economic activity:

> [Gesturing to vulnerability map – Gill Pier area] That's where the hauliers are. I know the haulier is obviously really important to the island. That area of the island is still quite important. The crab factory is there and the bakery is there. So that is important. And the ferry to Papay is there too.
>
> Westray Participant
> Westray Open Community Focus Group

If the impacts of sea level rise were to threaten the north end of the bay, participants believed it could lead to detrimental consequences for the economy of Westray. Furthermore, the roads infrastructure in low-lying areas was highlighted as a concern with emphasis that if the main road through Pierowall Bay was compromised, it could lead to negative impacts for businesses in that area with knock-on effects for the island economy. Respondents discussed this issue in terms of long timescales and began to reflect on possible scenarios where it might become more difficult in future to continue living and working around Pierowall Bay in the manner which is currently undertaken. The level of population and amenities present within Pierowall Village as a community hub means that the area is of high social value. For this reason, respondents surmised that inundation caused by sea level rise would be damaging for the community and perceived the village as a highly vulnerable area based on socioeconomic factors. The hypothetical vulnerability map encouraged participants to reflect on the crucial aspects of maintaining normal ways of life on the island which led to discussions being driven towards the notion of adaptation.

4.4.2. Interpretation

In Sub-Section 4.2.1, four key questions emerged from the existing literature on community engagement in climate change adaptation that were important for the research: (1) How can scenarios of future local climate change impacts encourage active participant responses as part of community engagement? (2) How useful are climate and coastal data for engagement? (3) What are the challenges for producing scenarios for small island settings? (4) How can community engagement inform adaptation in small island settings? The current sub-section will address the four key questions in the context of the Westray case study and, in doing so, will discuss the wider implications of the results.

4.4.2.i. How can scenarios of future local climate change impacts encourage active participant responses as part of community engagement?

In terms of responding to the hypothetical vulnerability map and sea level rise projections, participants in Westray actively engaged with the material that was presented to them. Specifically, the vulnerability map prompted respondents to think about how Pierowall Bay might be vulnerable to sea level rise in future and to consider how vulnerability might be addressed in terms of coping and adapting. Moreover, sea level projections encouraged participants to talk about the impacts for Westray as a whole, particularly related to the future viability of travel infrastructure, housing and the island economy. Participants were keen to be involved in adaptation discussions. They expressed a desire to receive more information and to communicate with scientists and planners in order to drive and implement adaptation action in their community. The projections of sea level and the hypothetical vulnerability map aided discussions about the future of Westray in relation to impacts of sea level rise. The resources served as effective focusing tools that encouraged respondents to consider the future viability of Pierowall Bay as a hub for population and economy, and to prioritise the important aspects of island life that they believed should be considered in future adaptation planning, especially for areas of the coastline that could be regarded as highly vulnerable. Vulnerability mapping at the local scale could be an effective tool for encouraging the active participation of community members in engagement attempts for adaptation in other island and coastal communities.

4.4.2.ii. How useful are climate and coastal data for community engagement?

Accessing and utilising reliable climate and coastal data can be beneficial for creating scenarios of vulnerability for use in community engagement as part of adaptation. However, as long as approximations and scenarios are based on reliable data, participants need not be presented with a range of in-depth facts and figures. Westray participants responded actively and engaged with the map of hypothetical vulnerability to sea level rise because the output was straightforward and digestible. They were not confronted with any overly complex technical data. This made it possible for any and all of the participants to interpret and engage with the map regardless of expertise or background. Certainly, there has to be

legitimacy to approximations and, ideally, an increase in the availability of coastal and climate data at the Scottish Island scale could be advantageous for further informing and verifying outputs like the hypothetical vulnerability map. Approximations and scenarios must be backed up by climate and coastal data at academic and planning levels. However, it is essential that the coastal and climate information utilised for community engagement processes be uncomplicated and concise to encourage effective and inclusive engagement.

4.4.2.iii. What are the challenges for producing scenarios for small island settings?

Mapping vulnerability to impacts of climate change is a useful technique for community engagement. As evidenced in Westray, it encourages communities to consider how climate change might affect their local area in future. Through the production of the hypothetical vulnerability map, it became clear that a number of challenges exist for investigating detailed coastal characteristics in small island settings, particularly for a small-scale section of the coast like Pierowall Bay. A key issue is the lack of sufficient data available at the small island scale for coastal variables. Vulnerability index assessment literature originally informed the research and facilitated the mapping process. Based on the published literature, additional variables could be included in constructing a vulnerability index, including shoreline change and mean wave height. However, both shoreline change and wave height data were difficult to source at the appropriate scale at the point in time when vulnerability mapping was being undertaken. An account of data that is currently readily available (as well as that which is unavailable) for assessing the vulnerability of Pierowall Bay to sea level rise is provided in Appendix E. Ultimately, the data sourced for geology, tidal range, geomorphology and coastal slope were reliable and readily available at the time of the assessment leading to the decision to move forward with those parameters.

McLeod *et al.* (2015) highlighted the insufficient availability of climate data as a key challenge associated with participatory approaches to adaptation. Adaptation can be inhibited if communities and local authorities are faced with the challenge of inadequate access to coastal and climate data for their local area. Although some data are freely available and easily obtained, such as the climate projections published by the UKCP09, it is clear that certain types of coastal data are either difficult to access or non-existent at the small island scale, as has been found in the case study of Pierowall Bay in Westray. Indeed, even in cases where data is available and can be accessed, it is seldom available at local or site-based scales. Westray, like many other Scottish islands, is peripheral and exposed to climatic hazards, the impacts of which can be adverse and severe. The Scottish Islands, particularly small islands like Westray, have been overlooked in terms of data collection and availability. Island adaptation planning could be hindered when there is a distinct lack of readily available coastal and climate data. Future improvements to the availability of climate and coastal data for the Scottish Islands could allow for detailed and accurate assessments of vulnerability to the impacts of climate change to be made. In turn, this could be beneficial for adaptation planning in small island settings. If the issue of adaptation in the Scottish Islands is to be

tackled successfully, the improved collection and availability of sufficient data will be crucial.

4.4.2.iv. How can community engagement inform adaptation in small island settings?

The outcomes of community engagement could be beneficial for adaptation in the Scottish Islands and other small island settings. In the case study of Westray, participants illustrated their knowledge of the coastline and demonstrated that they know the lay of the land around their island. They have experienced various climate hazards that could be exacerbated by sea level rise, such as coastal flooding and erosion. They are aware of the potentially weak and vulnerable areas of coastline, and the socioeconomic assets that might be adversely affected such as housing and local businesses. Furthermore, they have first-hand knowledge of the local impacts and consequences of the aforementioned hazards, as well as the social values and priorities within their community. This type of information cannot be obtained from coastal or climate data alone. Communities could provide rich first-hand information to help inform and enhance adaptation planning. Community perceptions of vulnerability to climate impacts are not necessarily scientific or formed through the consultation of hard climate data. Perceptions cannot provide scientific information about climate impacts or levels of physical vulnerability to sea level rise. Community perceptions are formed through experiences and local knowledge; both of which have the potential to be subjective. Nonetheless, effective engagement provides a voice for communities and is a platform for knowledge exchange across scales. Community-level values can begin to be understood and incorporated into adaptation as a result of engagement. Mutual benefits could occur from community engagement where decision-makers provide climate and coastal information where possible, potentially in the form of scenarios and projections, whilst communities contribute knowledge and understandings of local climate impacts. A two-way stream of communication could be opened up via community engagement between decision-makers and local people. However, there remains the potential for conflict across scales. Effective and continuous communication, cooperation and coordination between communities and decision-makers could be key to avoiding inaction, marginalisation and conflict. Vulnerability mapping is an example of an effective technique that could be used for engaging communities in adaptation discussions. Ultimately, community engagement could help to inform adaptation through the consultation and incorporation of local knowledge into planning.

4.5. Conclusions

The research findings support the benefits of engagement in adaptation and recognise the challenge of encouraging active responses from participants. Hypothetical vulnerability mapping was effective for initiating discussions about sea level rise in Westray and could be a useful tool for engagement in similar settings. Furthermore, there is scope for sea level vulnerability mapping to be utilised in conjunction with other types of coastal assessments, such as the national coastal erosion susceptibility model for Scotland produced by Fitton *et al.*

(2016), to further enrich engagement at the community scale. The improved availability of climate and coastal data at the small island scale would further benefit scenario mapping and modelling for adaptation in the Scottish Islands. However, hard scientific technical data fails to provide a full understanding of social issues and local knowledge. As evidenced in the empirical results, participants actively engaged with the scenario-based tools and identified vulnerability hotspots within Pierowall Bay based on local understandings of the coast. Furthermore, participants used their local coastal knowledge to validate the hypothetical assessment of vulnerability based on their own experiences of climate-related coastal issues in Pierowall Bay. The sea level projections and hypothetical vulnerability map encouraged dialogue on socioeconomic values and priorities for adaptation. Therefore, community perspectives, gathered using scenario-based community engagement tools, can further contribute to understandings of factors influencing vulnerability and adaptation in small island settings. Although the vulnerability map was an effective tool for engaging the Westray community in discussions about local sea level rise, participatory processes are not without challenges. Westray participants reported experiences of inaction, marginalisation and conflict related to adaptation. Other case study communities reported similar perceptions (discussed in further detail in Chapter 5). Overall, community engagement that utilises scenario techniques such as vulnerability mapping could lead to more effective and successful adaptation in small island settings.

Chapter 5: Priorities and Motivations for Adapting to the Impacts of Climate Change in the Case Study Communities

5.1. Introduction

This chapter reports and discusses the results of the qualitative data gathered during deliberative workshops and focus groups to understand motivations and priorities for adaptation to the impacts of climate change in the case study communities. First, the concept of 'community' is examined in the context of the cases in Section 5.1.1. An awareness of the meaning of community in the case studies, and the ways in which it is formed, is a precursor to understanding the context and reasoning behind priorities for adaptation. Secondly, the results of the deliberative workshops are presented in Section 5.1.2. Specifically, this section sets out the key impacts of climate change affecting each case study community as identified and ranked by participants during the workshops. Sections 5.3 to 5.5 contain the results of grounded theory analysis of the data collected during focus groups. Each respective heading corresponds to a major theme that emerged from the data for either some or all of the case studies. Section 5.6 presents the results of theory-led analysis, the themes of which correspond to those discussed in Chapter 2 as part of the literature review. Lastly, the results presented in this chapter are summarised in the concluding Section 5.7.

5.1.1. Conceptualising Community

The current research seeks to explore adaptation to the impacts of climate change in the Scottish Islands at the community level. Therefore, it is necessary to address the concept of 'community' in the case study islands in order to better understand adaptation at this scale. In particular, it is essential to consider how those living in Unst, South Uist and Westray perceive 'community' in order to understand the real-world meaning of the term in the context of the case study islands. This section will explore and illustrate how 'community' is conceptualised in each of the cases.

5.1.1.i. Perceptions of 'Community'

When discussing impacts of climate change in all three case studies, respondents' use of the word 'community' referred to the whole population within each island rather than specific groups of people or particular places. Participants suggested that, when faced with the challenges posed by climate change, their respective communities are not confined to in-island spatial boundaries such as specific villages or hamlets. Even in South Uist - the largest of the case studies in terms of area and population - participants highlighted the importance of coming together as one interconnected community to address consequences of climate change. For the most part, community has been formed through the social bonds and connections within each case study island.

Across the case studies, respondents perceived 'community' on their island in a positive light and it was associated with strong connections and relationships within the islands. They emphasised that a fundamental component of their communities is the sharing of mutual support in times of need, particularly following adverse climate events. The consistency of perspectives across the case studies suggests that perceptions of 'community' might be similar across Scottish island communities, and such perceptions could be unique to small island settings.

5.1.1.ii. Community Councils

In all three case studies, community councils are key groups that seek to address both climatic and non-climatic issues where possible across each island. As described in Chapter 1, Unst and Westray are each served by one community council respectively. The situation is slightly different in South Uist where three separate community councils serve the island from north to south. South Uist is somewhat larger than Unst and Westray in terms of area and population which accounts for the presence of three community councils as a means of ensuring community needs are met and responsibilities are geographically spread. As formal groups composed of local residents, community councils in the case studies are important in the provision of community-level support for a range of island issues, including climate change impacts and consequences. Some respondents see community councils as potentially having the ability to drive change. In Unst, for example, respondents looked to their community council as the first tier of support for adaptation. One participant noted:

> *[Emergency planning] should come from the local authority. But it could be organised by, for instance, the community council.*
>
> Unst Participant
> Unst Open Community Focus Group

Community councils represent a potential link between communities and local authorities. Within the case study islands, they are active organisations that listen to and consider community needs.

5.1.1.iii. Conceptualising Community in Unst

Alongside Unst Community Council, there are several other significant groups in Unst that develop and support the island community. Unst Partnership is a prominent community development group also comprised of local people. The Unst Community Development Plan 2010-2015 highlighted aims and objectives relating to a range of community development issues such as energy, local industry and the environment. That the Partnership was initiated and is run by local people for the good of the community highlights the drive and motivation of the Unst community to steer and safeguard their own futures. Furthermore, the hall associations of Uyeasound, Baltasound and North Unst Public Halls are active community teams that coordinate social groups and events within Unst. The three

public halls in Unst host events such as local Up Helly Aa festivals. The halls are physical hubs for the community which are run and maintained by local representatives.

5.1.1.iv. Conceptualising Community in South Uist

Aside from the community councils, Storas Uibhist is one of the key community groups in South Uist. Storas Uibhist describe themselves as a 'community company' due to their community focus but legal incorporation. However, the fundamental objectives of the group are similar in many ways to those of both the Unst Partnership and Westray Development Trust. They seek to promote and enhance community development with a particular interest in maximising land-based activity such as crofting, coastal protection and outdoor leisure to the benefit of the community. The existence of Storas has enabled increased community empowerment in South Uist by allowing the local community to have a say in how the land is used. It is a central organisation within the community.

5.1.1.v. Conceptualising Community in Westray

Westray Development Trust is a key development group in Westray operated by the local community. The aims of the Trust are rooted in principles of sustainability, seeking to enhance community development and prosperity by maximising local assets. WDT is at the centre of community on the island. It was instrumental in encouraging the local community to pool their finances towards buying a community wind turbine for the island. This highlights the success of the Trust in unifying the community, and the success of the Westray community itself in taking steps towards self-sufficiency. Another active community group is the Westray Heritage Trust. The Heritage Trust focuses on showcasing local cultural heritage in Westray, particularly archaeology, through the dissemination of information to the public. The Heritage Trust is an important community group that gives a voice to local history in Westray.

5.1.1.vi. Summary

The term 'community' has a similar meaning across the case studies. Community is not confined to individual settlements or specific geographical locations within each island. Considering the topic of climate change brings together a range of people in networks that span spatial boundaries. Community is produced and strengthened through social connections, relationships and bonds. The community councils and key community-led development organisations represent the cornerstones of each case study community. The sense of community is strong across all three islands; it is evident that genuine island identity exists on the ground. Consequently, the motivations and priorities for adapting to the impacts of climate change at the community scale are meaningful and can be contrasted with studies which might explore only the individual or household level.

5.1.2. Impacts of Climate Change

Before attempting to explore and understand the priorities and motivations for adapting to the impacts of climate change in the case study islands, it is useful to identify the specific climate impacts affecting each community. Moreover, it is essential to examine the ways in which impacts of climate change manifest in each case study, and the social, economic and cultural consequences that have ensued as a result. Although all three case studies are part of the Scottish Islands, differences within their physical and social settings might result in diverse impacts and consequences experienced by each community. The study seeks to pinpoint the specific climate change impact(s) that respondents consider to be of most importance for future adaptation planning. Without establishing local climate change impacts, there is a risk that discussion can be based on abstract ideas or notions of adaptation for impacts which have not been mutually understood. The following sub-sections present the key climate hazards, impacts and consequences identified as significant by participants in each case study. A summary of climate hazards, impacts and consequences is illustrated in Table 5.1.

	UNST	SOUTH UIST	WESTRAY
Hazards	• Storms • High winds	• Storms • Storm surge • Intense precipitation	• Sea level rise
Impacts	• Risk to human safety • Risk to physical assets	• Coastal flooding • Coastal erosion • Inundation • Land saturation due to raised water table	• Coastal inundation • Coastal erosion
Consequences	• Disrupted transport, communications and energy infrastructures • Damage to property • Some instances of injury and mortality	• Mortality • Damage to roads • Saturated farmland • Damage to ecologically and economically important coastal dunes and hinterland	• Damage to cultural and economic assets at the coast • Potential inundation of properties, dwellings and businesses in future based on recent participant experiences

Table 5.1: Summary of significant climate change hazards, impacts and consequences identified by participants in each case study

5.1.2.i. Impacts of Climate Change in Unst

Storm events are a significant hazard that has been experienced in Unst according to respondents. Specifically, intense wind associated with storms has led to adverse impacts and consequences for the Unst community. A major concern for many participants was the threat to safety and wellbeing posed by storm events and associated intense winds. Consequences of intense winds have included damage to property, airborne debris and prolonged power cuts. Respondents

explained that although instances of injury and mortality have been rare during past storm events, they fear that the community (and vulnerable people in particular) might be at risk during future storms.

The effect of storms on transportation and communications has also led to negative consequences for the Unst community. It was highlighted that interisland ferry transport ceases during severe high winds. Respondents explained that disruption to the movement of people and goods on and off the island has resulted in adverse outcomes for the local community. For example, bringing essential supplies to the island, such as food and fuel, becomes more difficult. Another consequence of storms and intense wind has been the disruption of communications due to power cuts and damaged telephone masts. Participants indicated that this has presented challenges for community members and local businesses relying on telephone and Internet for livelihoods. They noted the potential for knock-on economic effects for the island as a result of disrupted communications.

5.1.2.ii. Impacts of Climate Change in South Uist

In South Uist, storms and storm surge were highlighted as key hazards associated with climate change that have been experienced by the local community. Generally, storms and storm surge have led to impacts such as flooding and coastal erosion. More specifically, respondents explained that the storm and storm surge of 2005 had major social consequences for the community of South Uist due to the loss of five community members. They indicated that the harm incurred during the 2005 event has had a profound impact on the entire community of South Uist, particularly in terms of emotional stress. Other consequences of flooding and coastal erosion as a result of storms and storm surge include damage to roads, farmland and coastal dune systems.

Participants also noted changes in the frequency of precipitation - specifically rainfall - as an important impact of climate change in South Uist. They explained that precipitation had been experienced for extended periods during what had previously been fairly dry periods resulting in land saturation. This has had negative outcomes for farming and crofting because it has limited the way in which the land can be used. For example, participants explained that it might not be possible to harvest within designated timeframes if the land is saturated. Respondents indicated that this issue has the potential to negatively impact the island economy.

5.1.2.iii. Impacts of Climate Change in Westray

Sea level rise was outlined by participants as a significant hazard linked to climate change in Westray, the impacts of which are beginning to manifest in parts of the island. Respondents have noticed that the highest high water mark is gradually extending further inland during high tides, specifically around Broughton – a residential area situated towards the south end of Pierowall Bay – to

the point where the sea has almost reached dwellings in some instances. Furthermore, some coastal flooding has been experienced in Pierowall Village in the past with damage to dwellings and local businesses as a result. Respondents explained that poor drainage has contributed to such instances of flooding. However, they also expressed concern over the potential for the increased frequency of coastal flooding in low-lying parts of Pierowall Bay and Broughton in future as a result of rising sea level which, coupled with poor drainage, could lead to negative consequences such as further damage to homes and businesses.

The increased erosion of soft coastal areas around Westray was also highlighted as a notable impact related to climate change. Respondents illustrated the importance of tourism in boosting the local economy. They explained that local tourism is chiefly reliant on coastal walking paths and cultural heritage, particularly archaeology, for drawing visitors to the island. Coastal erosion, as a result of increasingly intense storms and wave action, has led to the deterioration of both archaeological sites and coastal walking trails around the island. Participants indicated that coastal erosion has resulted in negative consequences for the heritage and economy of Westray, and expressed concern that this could continue to worsen into the future.

5.1.2.iv. Summary

As discussed in the preceding section, perceptions of community are relatively similar across the case study islands. However, the impacts of climate change prioritised by each community are different; intense wind as a product of storms is a major issue in Unst, storm surge and coastal flooding have had significant consequences in South Uist and sea level rise is a key concern in Westray. Although storms were reported as being a significant hazard in both Unst and South Uist, the impacts resulting from storms are evidently different for each community. The consequences of intense wind for transport, communications and vulnerable residents is a key concern in Unst, whilst major coastal flooding resulting from past storm surge in South Uist has negatively impacted the wellbeing of community members. The dissimilarity of significant impacts across the case studies highlights the necessity for adaptation that considers the specific needs of small island communities in greater detail and raises questions over the potential success of top-down approaches if community engagement is overlooked in processes of adaptation planning. If one-size-fits-all national policy develops adaptation strategies for addressing each kind of climate impact, these could be applied as necessary within each island. However, it is important that the social contexts of small islands – namely the issues, factors and priorities for adaptation – are also considered during the implementation of national adaptation strategies.

5.2. The Empowerment of Small Island Communities

Community empowerment is a key theme emerging from the empirical evidence gathered in Unst, South Uist and Westray. Of all discussion topics that arose during the semi-structured focus groups, the matter of empowerment appears more frequently across the data from all case studies than any other subject. Respondents in each island alluded to the idea of community empowerment in one form or another, with the majority expressing the need for increased empowerment in relation to climate change issues. In the context of the case studies, respondents perceived empowerment as top-down support and partnership that could enable their communities to actively engage with adaptation processes.

Upon analysis of the gathered data, 'Island Perspectives' emerged as a broad code that encompassed responses specifically relating to the ways in which participants regarded life in an island setting. Within this, two distinct sub-themes became apparent. Firstly, island perspectives that related to feelings of remoteness, marginalisation and disenchantment: geographical and social remoteness in comparison to the rest of Scotland and the UK; marginalisation on both local and national development and planning agendas; and disenchantment with groups at higher scales such as local authorities and central government. Secondly, island perspectives that related to feeling capable of adaptation at the community level: strong human networks and relationships within communities; extensive local knowledge; and community willingness to adapt. However, respondents also discussed the limitations around leading adaptation within their own communities. 'Peripherality and Marginalisation' and 'Community Cohesion and Capital' were therefore used to correspond to the two clear sub-themes within the overarching 'Island Perspectives' code. All codes and sub-codes within the theme of empowerment are presented in full in Figure 5.1.

This section will present and explore community empowerment as a central theme grounded in the data from the case studies. Furthermore, it will illustrate and discuss the ways in which empowerment was prioritised in the study communities and the implications for adaptation. The quotes presented in this section, and throughout the rest of this chapter, only represent an exemplar of a range of instances in which similar examples can be given.

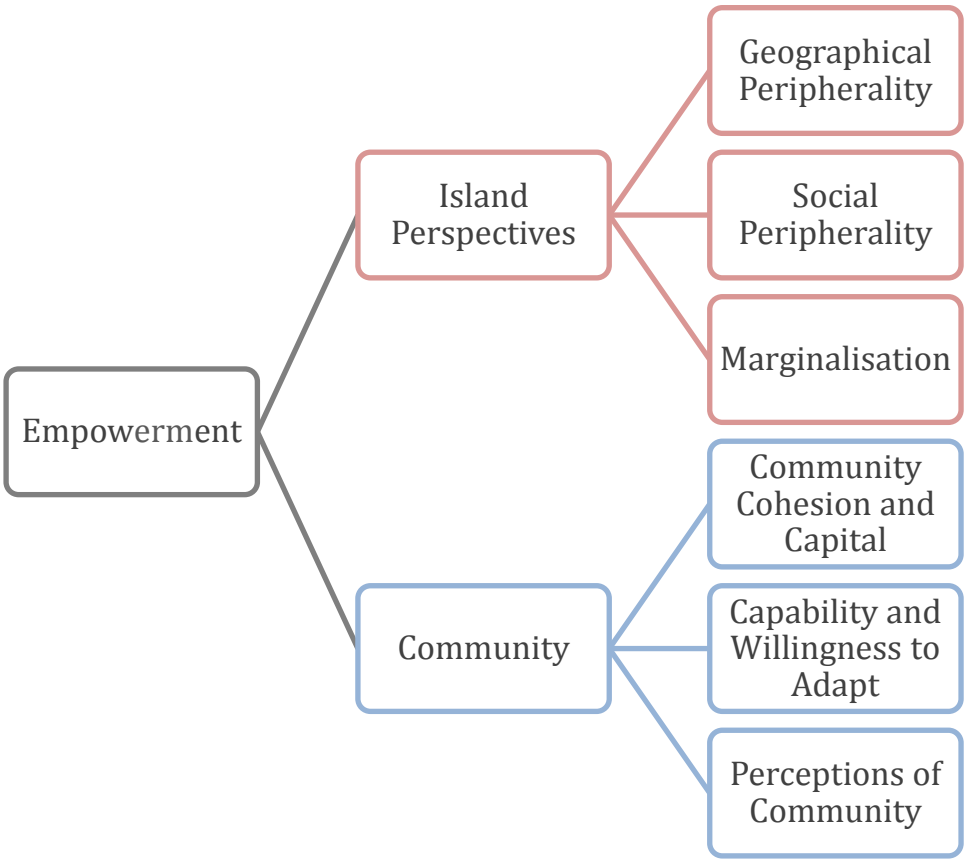


Figure 5.1: Coding tree illustrating codes and sub-codes related to community empowerment

5.2.1. Peripherality and Marginalisation in the Case Studies

5.2.1.i. Peripherality and Marginalisation in Unst

Respondents in Unst reported a distinct sense of geographical remoteness in comparison to the rest of Shetland, and indeed, the rest of the UK. The location of Unst at the periphery of local and national boundaries was pointed out in both positive and negative contexts. Some participants were proud of the cultural status of Unst in representing the most northerly point in Britain and highlighted that

Shetland Islands Council (SIC) and central government should value the island for this reason. One participant noted:

> *We should [be a priority] because we are Britain's most northerly island.*
>
> Unst Participant
> Unst Community Council and Unst Partnership Focus Group

Others thought that the level of geographical remoteness experienced by the Unst community meant that local people had learned to become more robust and resilient than those in other parts of the UK, particularly when dealing with the consequences of severe winds such as interruption to food supply due to ferry disruption. However, respondents felt a strong sense of geographical detachment from Mainland Shetland and Lerwick, with the latter being the main town in Shetland and the base of SIC:

> *There's still a lot of ocean between Unst and Lerwick.*
>
> Unst Participant
> Unst Open Community Focus Group

Moreover, participants indicated that they felt even further removed geographically from the rest of the Scotland and the UK. They viewed the spatial expanse between Unst and the rest of Shetland, Scotland and the UK as having largely negative consequences for community development on the island. Respondents suggested that the geographical peripherality of Unst has, in part, contributed to social marginalisation of the island community.

Social marginalisation was reported to be a key problem hindering adaptation to the impacts of severe storms in Unst. Respondents felt that Unst and the rest of Shetland have been overlooked at Scottish and UK government scales in terms of planning and support for dealing with climate change.

> *I think it's a shrug of the shoulders and 'oh well it's Shetland'.*
>
> Unst Participant
> Unst Open Community Focus Group

They believed that neither Unst nor Shetland had been prioritised in terms of planning, funding and resource allocation for dealing with climate issues. Participants suggested that this could be attributed to a lack of understanding of the problems being experienced on the ground in Unst and the rest of Shetland:

> *They're not really priorities are they? The islands. I don't think people down in Westminster, or in Holyrood, fully appreciate what it's like to live on islands until they actually come here. Until they actually understand the difficulties that communities have and how [we] have to build [our] own resilience. [The government] don't seem to want to put the commitment in. You read a lot of*

things about what should be put in place but not a lot is actually moved forward.

Unst Participant
Unst Community Council and Unst Partnership Focus Group

I think because we're a tiny dot in the middle of the sea and because our population is very small then we're not considered a priority.

Unst Participant
Unst Community Council and Unst Partnership Focus Group

Respondents emphasised their belief that the real-world issues and challenges, both climatic and non-climatic, being faced by the Unst community have not been properly understood, acknowledged or taken into account in planning at central and national government scales. As a result, participants in Unst felt marginalised and misunderstood by Scottish and UK governments.

Furthermore, some participants suggested that SIC has paid insufficient attention to the needs of the Unst community, particularly following severe wind events. Some respondents felt that there had been "no response" by the local council to assist the Unst community in dealing with the impacts of severe storms. There was also a feeling of being undervalued and overlooked by SIC in terms of general development. One participant stated:

We're so used to being at the end of the line for so many things and you don't feel very valued within Shetland by your own council.

Unst Participant
Gardiesfauld and Uyeasound Focus Group

Respondents believed that an increased level of support from the local council could lead to improved response and adaptation to the consequences of severe storms in Unst. However, the Unst community reported feeling largely cut off and forgotten by the local council.

It is important to note that Unst respondents also reported experiences of inclusion where sufficient support has been supplied, particularly by external agencies. For example, power companies have responded promptly following power cuts due to wind damage, and several respondents praised the efforts of linesmen.

Scottish Hydro are in here like a shot and they're putting the poles back up and getting it all sorted so that the power is back on as fast as possible. But nobody else gives a sod about us.

Unst Participant
Unst Community Council and Unst Partnership Focus Group

It is clear that some positive instances of inclusion have been experienced in Unst. However, the above evidence indicates that these occurrences are rare, and that the Unst community feel that marginalisation is the norm.

5.2.1.ii. Peripherality and Marginalisation in South Uist

In South Uist, respondents strongly emphasized their feelings of social marginalisation as a small island community in comparison to the rest of the Outer Hebrides, Scotland and the UK. Primarily, they felt undervalued by their local council as well as central government. Several participants indicated their belief that local councillors and MSPs have not adequately acknowledged the needs of the community following major climatic events in South Uist, particularly the storm of 2005. The community voices of South Uist are going unheard at the local authority level.

> *Our voices are not being listened to. We try to fight but we're just fighting against concrete walls. It's just bonkers.*
>
> South Uist Participant
> Lochboisdale Community Council Focus Group

They explained that this has resulted in feelings of social isolation, particularly in relation to the local authority. Moreover, respondents feel that South Uist has not been prioritised in general non-climatic decision-making in comparison to other areas of the Outer Hebrides. For example, they highlighted the existence of superior roads infrastructure in Stornoway compared to that of South Uist. The feeling of being ignored and unrecognised by the local council has led to intense frustration within the community:

> *It's a case of 'those are just the southern isles'. The council doesn't give a damn.*
>
> South Uist Participant
> South Uist Open Community Focus Group

Furthermore, respondents thought that more could be done by central government to assist in supporting adaptation to the impacts of climate change. For example, the drainage of farmland – a long-term challenge in South Uist that has the potential to be exacerbated by increased precipitation associated with climate change – has not been granted sufficient consideration and support by central government according to participants.

> *But how much support have we actually had from the authorities with our ambition to improve the quality [of local drainage]? I have to say that it has not always been supported from the government. The government has not been as positive about our in-island drainage as they could have been.*
>
> South Uist Participant
> Storas Uibhist Focus Group

Alongside this, participants felt that South Uist has received different treatment in comparison to other areas of the UK where similar climate issues have been experienced. They suggested that if similar challenges brought on by storms, coastal erosion and drainage were being experienced in a more central part of the UK with a higher population, that decision-makers would have invested greater levels of time, effort and money into addressing problems. Participants strongly expressed the notion that their lives matter too despite the small population and remote location of South Uist.

> *The idea that we have to adapt to living just at the edge of the sea and you're going to drown anyway. And you think 'get lost'. Why should we put up with that? Nobody else would, would they? They built the Thames Barrier. They build barriers all over the shop. Why shouldn't we have a bit of a barrier?*
>
> South Uist Participant
> Storas Uibhist Focus Group

Respondents perceived the local council and central government as having overlooked the key challenges currently being experienced by the South Uist community, particularly those issues related to climate change. Participants felt ignored, unheard and less prioritised than other communities in the Outer Hebrides and other areas of the UK.

Participants suggested that the social marginalisation of South Uist could be attributed, in part, to the geographical remoteness of the island in comparison to Stornoway and Edinburgh as the bases of local and central government. Part of the problem, according to respondents, is that decision-makers and planners lack real-world experience of the climatic and non-climatic problems being encountered in South Uist. Respondents prioritised the need for planners to understand the issues that are being experienced 'on the ground'. They emphasized that South Uist is a unique island with a unique set of issues with one participant stating: "It's that uniqueness that creates some of the problems we face". Participants felt that planners based in Stornoway as part of CnES or in Edinburgh at the Scottish Government – both a considerable distance from South Uist - find it challenging to fully appreciate significant issues, particularly the impacts and consequences of climate change, in a small island community like South Uist.

> *It's like hitting your head against a wall. And you do get vexed. You have to go to somebody in Edinburgh and they can't understand the issues. They wonder what you're talking about.*
>
> South Uist Participant
> South Uist Open Community Focus Group

As a result, participants have become disenchanted with the work of the local authority and central government, since they believe it is rare that their needs are listened to and considered in adaptation planning. Respondents conveyed a clear desire to have a say in how adaptation happens within South Uist and to become empowered as a community. If local authorities and central government listen to

and engage with the community about island-specific issues, it could lead to reduced social marginalisation and improved adaptation in South Uist.

5.2.1.iii. Peripherality and Marginalisation in Westray

Participants in Westray did not express strong feelings of geographical remoteness on the whole. However, they made it clear that living in an island location creates limitations in terms of shifting housing, amenities and infrastructure away from the coast in order to respond to sea level rise. As a result, respondents believed that adaptation options were restricted to an extent by the limited spatial boundaries of Westray as an island.

> *There's also less opportunity for people saying "well I'll just move ten miles further away from it". You can't go ten miles away from it because you're in the sea on the other side [of the island] after about two or three miles.*
>
> Westray Participant
> WDT Focus Group

Participants expressed that this could be particularly problematic for adapting to the potential future impacts of sea level rise, such as increased coastal flooding and erosion, as the sea continues to encroach on the land. However, respondents strongly expressed their desire to remain living within Westray and that moving away from the island would be a last resort in responding to sea level rise.

Westray respondents, like those in Unst and South Uist, raised the issue of feeling marginalised and overlooked as an island community at local council and central government scales. Social marginalisation was not commonly raised across all focus groups in Westray but several participants indicated feeling isolated and disregarded as a community. In particular, some participants felt that the local council, central government and external agencies believe that community members have chosen to live in Westray and therefore they, the community, are responsible for dealing with the climatic and non-climatic challenges of living on a small, remote island.

> *There seems to be a perception that "oh it's just the North Isles; it doesn't matter". And "oh but you choose to live out there so it's up to you".*
>
> Westray Participant
> WDT Focus Group

In this case, the 'North Isles' refers to the islands within Orkney that are situated to the north of Mainland Orkney. These include Westray, Sanday and Eday amongst others. Respondents also suggested that the consequences of coastal flooding and erosion in Westray might not be fully realised by decision-makers because only a minor number of people have been affected in comparison to more populated areas elsewhere in the UK.

> *We're not talking about big numbers. It's a small place. But if you're the person that's flooded then it's a big impact.*
>
> Westray Participant
> Westray Community Council Focus Group

However, respondents stressed that the effects are no less problematic and damaging regardless of the number of people affected. In this case, adaptation in Westray could be hindered if the local council and central government lack adequate understandings of the climate challenges faced by Westray as a small island community.

Furthermore, respondents reported a lack of central government funding for small places, especially the islands. They also believed that any available funding tends to pass through national and sub-national scales first before reaching the community level. They felt that small island communities, like Westray, receive the leftovers and are not prioritised on the funding agendas of national and sub-national decision-makers.

> *Depending on what it is that one's discussing, there's a view that London takes the value and then poor old Scotland gets the leftovers. It doesn't do well. And then talking at a Scotland level, Edinburgh and Glasgow grab it and the islands get the bum's rush.*
>
> Westray Participant
> WDT Focus Group

Respondents acknowledged that the population of Westray is small and therefore perhaps not seen as a priority for spending funds. However, it was clear that they viewed this as a problem for the Westray community, especially in the context of adapting to the impacts of sea level rise. Restricted funding from national and sub-national government has contributed to feelings of marginalisation within the community.

5.2.1.iv. Interpretation

Geographical peripherality was a key topic grounded in discussions, particularly in Unst and South Uist. Unst respondents explicitly discussed geographical peripherality on several occasions. The issue was also raised by South Uist participants, although sometimes it was expressed less directly than in Unst. The remote location of Unst appears to be at the forefront of the minds of community members. South Uist respondents focused primarily on social marginalisation during the focus groups. However, they suggested that geographical remoteness – particularly in comparison to Stornoway as the centre of decision-making for the Outer Hebrides - has contributed to feelings of social isolation within the community.

Conversely, little was expressed either explicitly or indirectly regarding geographical peripherality in Westray. However, respondents mentioned the

restricted geographical environment of Westray as an island setting in terms of attempting to move further inland and away from problems of flooding, erosion and sea level rise at the coast. Furthermore, several remarks regarding the marginalisation of the North Isles by the local council, and of Orkney in general at UK and Scottish Government levels, could suggest that the remote geographical location of Westray has a part to play in adding to the social marginalisation of the island.

Participants in all three islands felt marginalised in the eyes of decision-makers, particularly in terms of planning and funding agendas. They argued that small island communities are not sufficiently being heard, acknowledged or prioritised at local authority or central government scales. Participants across all three case studies raised social marginalisation as a significant issue impeding adaptation to the impacts of climate change on each island, as well as inhibiting general community development. The sense of social marginalisation was particularly strong in Unst and South Uist. Overcoming peripherality and marginalisation appears to be a key priority for the communities of Unst and South Uist for adapting to climate change impacts. The issue of marginalisation was raised in every focus group in both case studies. Contrastingly, the topic appeared to be of less significance to the Westray community, although a minor number of participants raised the issue and felt strongly about the matter. However, social marginalisation was not mentioned in every focus group and interview as it was in Unst and South Uist.

The issue of community engagement was discussed across the case studies, with particular emphasis in Unst and South Uist. Participants in these case studies explicitly expressed their view that community-scale climate challenges are not being fully grasped by local authorities or by the Scottish and UK governments. They argued that this was due to a lack of understanding by decision-makers based in distant locations far removed from the case study islands of real problems being faced on the ground. In contrast, Westray participants alluded to the same issue but were less explicit in their responses. It is possible that geographical and social peripherality has contributed to the inadequate levels of engagement that were perceived by respondents in the case studies.

Respondents across all cases clearly felt that peripherality and marginalisation had hindered effective responses to the impacts of climate change thus far. In particular, social marginalisation has impeded effective adaptation due to issues such as inadequate funding and insufficient facilitation from local, sub-national and national governments. The communities of Unst and South Uist share many similarities in their views and experiences of peripherality and marginalisation in relation to climate change issues as well as non-climatic community development. Responses in Westray were similar to the other case studies in some ways, but it seemed that there was slightly less emphasis on issues of peripherality and marginalisation than in the other communities. A reduction of social marginalisation through improved engagement and inclusion in processes of planning and development could lead to increased community empowerment;

something that is a distinct priority for the case study communities in adapting to the impacts of climate change.

5.2.2. Community Cohesion and Capital in the Case Studies

5.2.2.i. Community Cohesion and Capital in Unst

Respondents in Unst reported that the island community felt prepared for storms and severe gales to an extent. They believed that storms were 'part of the package' of living in Unst and explained that the community frequently experiences intense wind to the point where respondents have come to expect it on a regular basis. As a result, some respondents explained that the community feel relatively resilient and well prepared for the consequences of strong gales, particularly in comparison to other areas of the UK where severe gales are less common. Respondents indicated that strong social bonds within the Unst community have been particularly beneficial for dealing with storms. They provided examples of community members assisting one another and ensuring the safety of others during and after storm events. According to participants, the community is strong and cohesive with a high level of trust among community members. They attributed this cohesion to a willingness to work together as a community to deal with the negative consequences of storms. Respondents viewed the robust community as a significant asset and benefit of living in Unst.

On the other hand, respondents explained that the negative effects of storms are at times beyond the coping capacity of the community. The community can only respond to and cope with storms to a certain extent before outside assistance, from bodies such as the local authority, becomes essential. However, they believed that local authority support during and after storms has been inadequate so far. In particular, respondents felt that there needed to be better leadership from the local authority in terms of emergency planning and that they would like to receive a formal emergency strategy for dealing with storms. The community have taken steps to improve community-level emergency response during storms. For example, routine emergency training is undertaken by community-level agencies such as an elderly care facility called 'Care at Home'. However, participants believed that the community would be better supported if the local council were to work towards improving response to storms. Additionally, respondents emphasised the importance of readily available emergency resources - such as power generators - that could be accessed by the community during storms. However, they felt that the provision of emergency resources was beyond the scope of the communities' financial capabilities.

> *We haven't got the resources. It costs money to put a generator in each [local] hall or to build an [emergency] plan.*
>
> Unst Participant
> Unst Open Community Focus Group

They highlighted that the distribution of specific resources by SIC, particularly emergency generators, would be beneficial for ensuring community safety during storms. Community bonds are strong within Unst and in some ways the community feel prepared for storm events. The Unst community may be strong and cohesive but respondents highlighted that they remain reliant on support from the local authority for coping with and adapting to storms and severe gales.

5.2.2.ii. Community Cohesion and Capital in South Uist

In South Uist, respondents explained that the community are close-knit and often help and support one another during and after storm and flood events. They indicated that strong community bonds exist within the island and that these links become invaluable when a storm or flood occurs. According to participants, the community are largely obligated to deal with the direct consequences of storms and flooding without a great deal of external assistance from bodies like the local authority. They rely on high social capital to resume normality following an extreme event. Furthermore, there is an attitude of resilience among islanders that respondents believe is unique to island populations and comes with the territory of living in an island setting. Respondents felt that the community are generally prepared and ready to tackle the challenges brought on by storms and coastal flooding. In addition to high social capital and feelings of preparedness, participants explained that the South Uist community has a wealth of local knowledge relating to the land and sea. This has been developed through inherited family histories and direct experience of working with the natural environment of the island. They believed that local knowledge and understanding was a key strength of the community and could be beneficial to adaptation planning.

However, respondents highlighted that the 2005 storm has brought a new awareness and understanding of climate impacts that was not realised within the community prior to the event. They were unaware that storms and flooding could produce such dangerous and fatal consequences prior to 2005. As a result, participants believed that the community could usually cope with the immediate consequences of floods and storms, such as minor property damage, but identified the essential need for assistance and guidance from the local authority for addressing long-term adaptation such as alterations to the South Ford causeway. They indicated that there is a requirement to go down official avenues in order to implement adaptive action that simply cannot be undertaken by the community alone. Furthermore, whilst the community possess rich local understandings about the natural environment of South Uist, participants felt that this knowledge was not being adequately translated into adaptation. Respondents reported that they have found it difficult to communicate local knowledge and understandings to planners and decision-makers. Storas Uibhist is an example of successful decision-making and action at the community level that takes local knowledge into account. However, they are limited to an extent by funding and are not necessarily responsible for adaptation across the whole of South Uist. Respondents expressed a strong desire to become part of planning processes for adaptation and to be able to assert some level of influence over what happens within their island. Storas

Uibhist represents a step forward in this direction but even the community landowner is bound by limitations. Essentially, community limitations could be overcome through increased local authority guidance and support for long-term adaptation.

5.2.2.iii. Community Cohesion and Capital in Westray

Respondents in Westray felt that rich local knowledge of the coast exists within the community. Local people understand the tides and are aware of interactions between the sea and the land. Long family histories in Westray meant that some participants were able to recount how the coastline had changed historically via knowledge passed on through generations. Respondents indicated a high awareness of any currently on-going coastal change such as areas of coastal erosion. Furthermore, individuals within the community have made personal efforts to protect their property and land from coastal erosion and inundation where possible. For example, one participant explained how a neighbour living near the coast had installed a buffer consisting of rubber tyres to protect their land and property from coastal inundation during high tides. In Pierowall Bay, a resident personally improved drainage around their property following a flood event. These individual efforts indicate that the community are capable of dealing with small-scale climate impacts to an extent, although participants stressed that these efforts were motivated by a lack of wider support from the local authority for responding to erosion and flooding. Additionally, the community-funded wind turbine is an example of a community-driven effort to actively develop and bring positive change to the island. The Westray community are proactive in developing their island and protecting their assets where possible. Rich and detailed local understandings of the coast mean that the Westray community feel well placed to recognise and comprehend coastal change associated with sea level rise.

However, respondents pointed out that although they possess local understandings of the coast, the community lacks the strategic guidance and financial support to respond to long-term coastal change such as increased erosion and inundation. Individual initiatives to address minor flooding and drainage issues have been effective but sea level rise is a bigger issue beyond the scope of community capabilities. Respondents believed that strategic adaptation planning led by the local authority would be beneficial for overcoming community limitations for adapting to the impacts of sea level rise. They also expressed that community funding, such as that gathered to fund the community wind turbine, can only go so far in terms of community development and adaptation in Westray.

> *For the last number of years the central government has only really been funding major and multi-million pound schemes. I think this is one of the real problems for small places like the islands where there's not the funding. And the local authority can't really afford to pay.*
>
> Westray Participant
> Westray Community Council Focus Group

Although the community turbine is a success story of locally driven community development, participants felt that it was a once-in-a-lifetime event. Therefore, the community are limited financially in terms of implementing island-wide adaptive measures. Ultimately, financial support from central government is needed to tackle the long-term issue of sea level rise.

5.2.2.iv. Interpretation

Participants across the case studies reported similar community cohesion within their respective islands. In particular, high social capital was emphasised explicitly in both Unst and South Uist. Respondents in both case studies displayed resilient attitudes to the impacts and consequences of climate change affecting their own communities. They attributed feelings of resilience and preparedness to the strong social bonds and relationships within their communities. This type of high social capital might be unique to islands, or at least unique to peripheral areas, where social connections are heightened due to the geographically remote position of the communities.

Conversely, Westray respondents placed less direct emphasis on high social capital and community cohesion during the focus groups in comparison to Unst and South Uist. They did not provide examples of social capital related to climate impacts in detail in the same manner as Unst and South Uist respondents. However, the climate impacts affecting the Westray community are fundamentally different to those affecting Unst and South Uist. Sea level rise in Westray is a slow-onset hazard meaning that impacts such as coastal erosion are gradual. On the other hand, storms and storm surge in Unst and South Uist are fast-onset and potentially high-risk hazards with sudden consequences for communities, resulting in the need for rapid immediate response. Past coastal flooding in Westray has been low-risk and minor. Therefore, the community has not needed to exploit any existing social capital in order to recover from these events. However, the fact that the island wind turbine was funded through a community buy-in is an example of the community working together to create positive change for local socioeconomic development. This constitutes indirect evidence of potentially high social capital within Westray.

Furthermore, rich and detailed local knowledge was also highlighted as a community advantage in some of the case studies. Local understandings of coastal processes were emphasised in South Uist and Westray. Participants in both case studies believed that local knowledge could be beneficial for adaptation planning, particularly in relation to flooding and erosion. However, participants in South Uist indicated that the consideration in planning of local understandings of marine and coastal processes has been limited. Similarly, Westray participants suggested that the implementation of effective adaptation could be realised if community knowledge of local coastal processes was considered in planning by the local authority. Contrastingly, little emphasis was placed on local environmental knowledge in Unst. This could be due to differences in the type of climate hazards and impacts affecting the Unst community in comparison to those in South Uist

and Westray. Communities in South Uist and Westray deal with impacts that are inherently linked to the coast: storm surge, inundation and erosion. Therefore, knowledge of the land and sea is significant for adaptation to these impacts. However, the Unst community described storms as a meteorological hazard, rather than a coastal hazard, with major consequences across the island. Therefore, knowledge of the coastal environment in Unst is less significant for dealing with storms as a key climate hazard in comparison to the other case studies. According to respondents, local knowledge of the environment is a significant community asset for adaptation in South Uist and Westray but it is not significant to the same extent for adaptation in Unst.

Despite emphasising community assets related to social capital and local knowledge, all three case study communities felt limited in terms of their capacity to respond and adapt to the impacts of climate change at the community scale. A desire for strategic guidance and action from the local authority in order to overcome technical and logistical limitations was highlighted in all three case studies. Financial limitations were identified as a specific challenge for community-scale adaptation in South Uist and Westray. Participants in both case studies felt that the community could only go so far in adapting to the key impacts of climate change affecting their communities. It was made clear in both case studies that significant financial assistance from either the local authority or sub-national scale would be required to adequately and successfully adapt to climate impacts, and that independently securing this type of funding was beyond the scope of community capabilities. Financial limitations were also mentioned in Unst but participants framed this issue specifically in the context of physical resource allocation, citing the distribution of emergency supplies for use during storms as being outwith the financial capabilities of the community. Ultimately, a lack of strategic guidance and financial capacity for adaptation are fundamental limitations to adaptation at the community scale in the case studies.

5.2.3. Summary

Community empowerment is a key priority for adaptation to the impacts of climate change in all three cases. The theme of community empowerment is composed of two sub-components that aid understandings of this adaptation priority: 'Peripherality and Marginalisation' and 'Community Cohesion and Capital'. Feelings of peripherality and marginalisation were indicated in all three case studies. Geographical peripherality was highlighted as particularly problematic in Unst and South Uist, whilst respondents in all three case studies felt socially marginalised by groups at other scales such as the local authorities, central government and external agencies. Moreover, high social capital was identified as a community asset in Unst and South Uist, as was local environment-based knowledge in South Uist and Westray. Respondents in all three case studies indicated a desire and willingness to become part of adaptation processes in order to improve the response to climate impacts in their communities. Small island communities might contain social assets that could enhance adaptation when incorporated into adaptation planning and action. However, if social marginalisation of small island communities is high, it could mean that logistical,

technical and financial limitations for adaptation continue to exist within these settings. In turn, negative effects for adaptation in small island communities might ensue. The empowerment of small communities, particularly those in remote island settings, could lead to successful adaptation where local voices are included in planning and community assets contribute to effective implementation.

5.3. Ensuring Community Safety and Wellbeing

The safety and wellbeing of community members in relation to the impacts of climate change is a major theme grounded in the data gathered from all three case studies. It emerged as a particularly important topic during respondent discussions in Unst and South Uist. Respondents in Westray occasionally talked about issues of safety and wellbeing within their island but it was a less significant concern for the community. The broad code 'Safety and Wellbeing' arose from the gathered data. This code encompasses all aspects of human harm resulting from climate hazards: injury, illness, emotional stress and mortality. The 'Safety and Wellbeing' code contains data relating to past experiences of harm within the community as a consequence of climatic events, as well as the potential for human harm as a result of future climate hazards. Furthermore, as highlighted in Figure 5.2, 'Vulnerable People' emerged as a distinct sub-code under 'Safety and Wellbeing'. It was clear that the safety and wellbeing of vulnerable community members was a specific issue in at least one case study. The theme of community safety and wellbeing, in relation to the impacts of climate change, are discussed in this section. Additionally, the section will explore and examine the ways in which the case study communities perceive safety and wellbeing as a priority for adapting to the impacts of climate change.

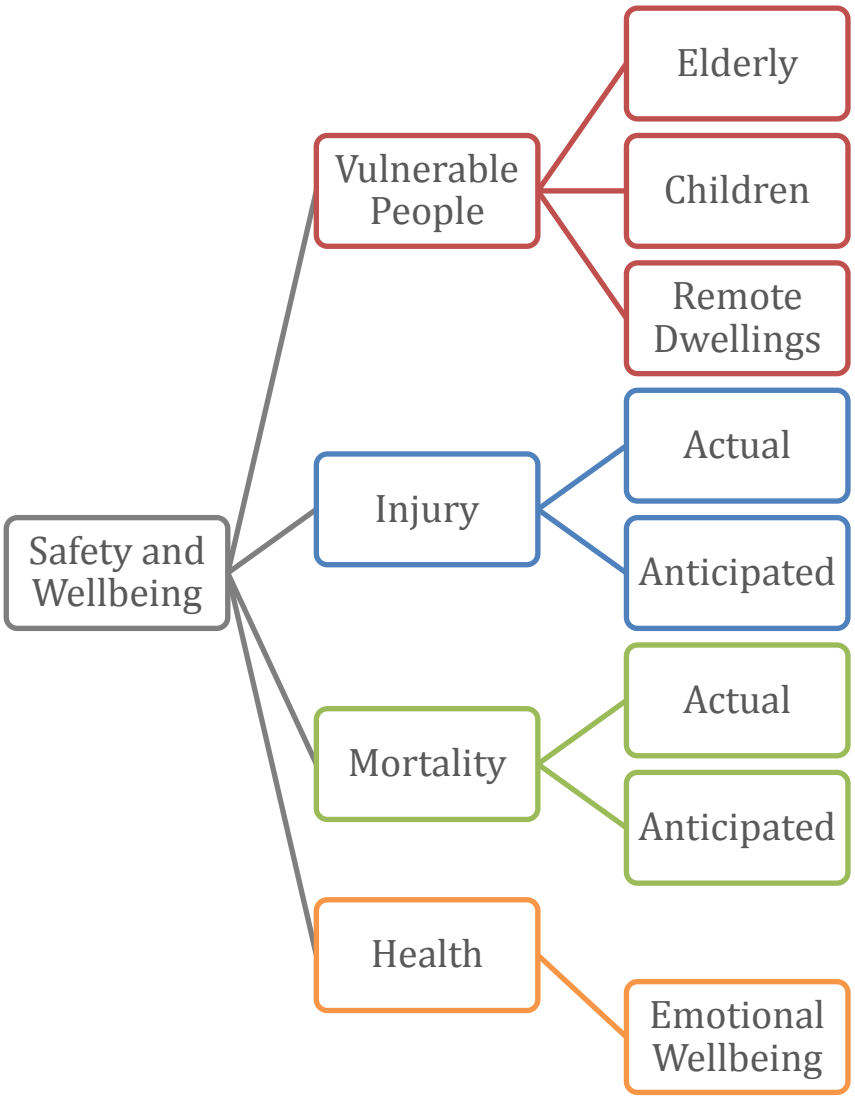


Figure 5.2: Coding tree illustrating codes and sub-codes related to ensuring community safety and wellbeing

5.3.1. Community Safety and Wellbeing in the Case Studies

Ensuring the safety of community members, particularly vulnerable people, during and after storm events is a primary priority for the Unst community. The issue was mentioned on numerous occasions and highlighted as a significant concern across the Unst focus groups. Respondents explained that the community has frequently been affected by power cuts as a consequence of storms and severe winds. Participants identified power cuts as a key safety concern for the whole community, but particularly for members of the population who might be considered vulnerable including the elderly and single-occupant or remote

households located away from the centres of population. They indicated that vulnerable people, namely the elderly, have suffered most during past power cuts with the loss of electricity increasing the risk of injury due to a lack of heating, lighting and cooking sources. Respondents stressed the importance of ensuring the safety of all community members before, during, and directly after storm events, but particularly the elderly and those residing in more remote areas and especially when power cuts have been experienced.

> *A priority would be the vulnerable people. You would want to make sure that somebody would be thinking to check the old folk. Because obviously they're more vulnerable than most of the families would be in their houses. You would be thinking "who's the folk that's most at risk here?"*
>
> Unst Participant
> Gardiesfauld and Uyeasound Focus Group

Moreover, respondents indicated that the ability of emergency services to reach the island is significantly reduced during storms and severe winds. For example, severe gales might make it impossible for ambulance crews to attend a serious medical emergency on Unst via either helicopter or boat. Participants were worried about the potential for considerable negative impacts on safety and wellbeing in the event of an emergency during storms.

Respondents emphasised that the existence of high social capital in Unst, mainly in the form of strong networks and community bonds, has been beneficial to ensuring the safety and protection of vulnerable community members during storm events. There is a noticeable willingness to support and assist one another by any means possible. Several participants indicated that they, as an island community, feel relatively prepared for the risks presented by storms and feel fortunate to have some emergency aids based on the island such as community medical and fire teams. They explained that living within a remote island setting has meant that they cannot afford to ignore the potential risks posed by storms, and instead they have attempted to cope with the consequences head-on as a community. However, they acknowledged that the community could only go so far in safeguarding the wellbeing of those living in Unst – vulnerable or otherwise. The danger posed by venturing outdoors during storms means that community-led emergency response could be limited during severe storm events. According to respondents, the local council have attempted to operate emergency plans in response to severe storms. While respondents recognised the efforts of the local council, they felt that emergency planning could be more strategic and better organised in a coordinated approach by SIC in future. It is clear that the protection of community members - specifically vulnerable individuals - is high on the list of priorities for the Unst community. Increased coordination and support from the local council could lead to adaptation that focuses on community safety during storm events.

Similarly, community wellbeing was prioritised highly in South Uist, particularly in relation to storm and storm surge events. Respondents explained that the vulnerability of the South Uist community was highlighted and fully comprehended by community members following the major consequences of the 2005 storm. The deaths of five community members at the South Ford area profoundly impacted not only the families involved but also the community as a whole. Participants indicated that the issue remains raw within the community and the potential for harm, such as injury and mortality during storm events, has been fully realised as a result of the incident.

> *It had a huge impact on the whole community. And it really did focus on how vulnerable we are as an island group. Nobody actually realised it could happen to that extent. We've got a realisation about it now that we didn't have before.*
>
> South Uist Participant
> Storas Uibhist Focus Group

The community had previously been unaware of the full scope for potential vulnerability up until that point. Consequently, community concern over safety during storms has undoubtedly increased since 2005.

One of the key aspects of safety mentioned by South Uist respondents was the issue of the South Ford causeway. Respondents reported that a great deal of contention persists around the existence of the causeway following the 2005 storm. There has been continued disagreement and debate across scales over the most suitable course of action to be taken for the causeway which, coupled with financial constraints, has led to frustration within the community. Participants felt dissatisfied that essentially no plans relating directly to the causeway have come to fruition despite various investigations and reports having been undertaken by the local council and external agencies over a lengthy period of time since the incident. Respondents felt strongly about the need for adaptive action in the South Ford area, particularly pertaining to the causeway, to safeguard the community in the north end of South Uist against the risks posed by future storms and storm surge. Although debate exists surrounding the best course of action to be taken in the South Ford area, it is clear that safety in this location is a universal concern across the community.

Furthermore, South Uist respondents felt that the community has not been made sufficiently aware of any emergency planning currently in existence despite the presence of a local flood action group. Participants explained that any response to storms and flooding is currently led on a community or individual basis with the local council usually recommending remaining indoors during adverse weather. They highlighted their belief that there needs to be an explicit and detailed flood action plan disseminated across the South Uist community from the local council. They acknowledged that plans might already be in place, but stressed the point that any such plans have not been adequately communicated to community members. They highlighted the need for a clear flood action plan which could be

circulated to and followed by the community in the event of future storms and storm surge. This issue, along with the challenges surrounding the South Ford causeway, suggests that the matter of ensuring the safety and wellbeing of the South Uist community has not yet been sufficiently addressed in the eyes of the respondents. The direct consequences of climate change hazards on human life has resulted in priorities for adaptation surrounding safety and wellbeing that are emotionally-driven across the South Uist community and especially in Iochdar close to the South Ford area.

In contrast to both Unst and South Uist, safety and wellbeing was not a significant adaptation priority for the Westray community although the issue was mentioned occasionally during focus groups. Some participants expressed concern regarding the long-term wellbeing of community members living in low-lying coastal areas of the island. They felt that those living in dwellings situated at the coast could be at risk of flooding in the near future and particularly over long timescales as sea level continues to rise. However, they suggested that coastal flooding was unlikely to directly affect the safety of Westray community members. It was implied, though, that the flooding of homes and businesses could have a knock-on effect for the wellbeing of individuals on the island. For example, the potential for emotional stress brought on by factors such as temporary displacement, personal upheaval and financial strain could have a negative impact on wellbeing.

Participants implied that any hazards associated with sea level rise, such as increased coastal flooding and erosion, have not yet had a significant tangible impact on the safety and wellbeing of the Westray community. Flooding and erosion have affected a minor proportion of the population but the community as a whole has not experienced noticeable impacts of climate change. Therefore, in the eyes of the community, coastal flooding and erosion have had very little impact on wellbeing and there has been virtually no impact on community safety. Some respondents suggested that sea level rise could have an impact on safety and wellbeing in future in the long-term, especially if rising sea levels were coupled with high tides and a depression which could increase the potential for storm surge. However, they reported that safety and wellbeing is not currently viewed within the community as a key priority for adaptation.

5.3.2. Interpretation

The safety and wellbeing of community members during hazardous events associated with climate change was not equally prioritised across the case studies. On one hand, safety and wellbeing is a high priority for adaptation in the communities of Unst and South Uist. The topic was often at the centre of discussions driven by respondents during focus groups in both communities. There was a focus on minimising the risk of injury and mortality during severe storms in both case studies. The safety of vulnerable community members was highlighted as a key concern in Unst whereas South Uist respondents did not prioritise any one particular section of the community. Instead, their concern lies in the safety of the whole island community with the belief that anyone could

potentially become at risk of harm during storms and storm surge regardless of demographic characteristics. Both case studies are also similar in their desire for increased strategic emergency planning by local authorities, and for the appropriate circulation of this information.

On the other hand, the way in which the Westray community prioritised safety and wellbeing was fundamentally different to that of the Unst and South Uist communities. Respondents rarely mentioned the subject during discussions. They acknowledged the potential for future risks to safety and wellbeing associated with coastal flooding and erosion as a result of sea level rise. However, past and present experiences of coastal flooding and erosion have had very little impact on the safety and wellbeing of the community. They suggested that safety and wellbeing could become more of a priority in future if the impacts of sea level rise were to worsen, but currently the community considers safety and wellbeing to be a low priority for adaptation to the impacts of sea level rise.

The prioritisation of safety and wellbeing has been motivated by past experiences of risk and harm evidenced in participant responses. In South Uist, the consequences of the 2005 storm have triggered a high level of concern for community safety, in turn motivating the community to consider safety and wellbeing as a paramount priority for adaptation. The Unst community have not suffered many major instances of harm but they are acutely aware of the level of risk attached to severe storm events. The community feel that the geographical location of Unst as a remote island community further contributes to this level of risk. In Westray, however, impacts of climate change have not threatened the safety and wellbeing of community members to a significant extent. The impacts of sea level rise are not yet tangible and respondents felt that climate change does not currently pose a risk to the safety of the community. It is evident that experiences of risk and harm have influenced the way in which safety and wellbeing is prioritised for adaptation in the case studies.

5.3.3. Summary

Evidently, community safety and wellbeing is a significant priority for adaptation in some communities but it is not uniformly ranked to the same extent across the case studies. While safety and wellbeing is a key community priority for future adaptation to the impacts of climate change in Unst and South Uist, it is a low priority for adaptation in Westray. Issues of significance in one island community might be considered unimportant in another, as is apparent in the disparity between Westray compared to Unst and South Uist within the theme of safety and wellbeing. It is worth noting that respondents in Westray speculated that safety and wellbeing might become an important issue for the community in future as the impacts of sea level rise begin to manifest. Direct experience of hazards is likely to sensitise communities to climate change adaptation, thus explaining the different result in Westray in comparison with Unst and South Uist. The Westray community can see how sea level rise might become problematic through a more abstract consideration of the future. If adaptation planning does not take subtle differences such as these into account, it could lead to adaptation

that is at odds with, and potentially overlooks, the unique needs of Scottish island communities.

5.4. Maintaining and Enhancing Island Lives and Livelihoods

Sustaining a satisfactory way of life is fundamentally important to all three case study communities, not only in terms of adapting to climatic hazards but also for continuing to exist and thrive within their island settings regardless of climate change. Issues tied to lives and livelihoods were highlighted clearly and frequently in all three case studies leading to the emergence of a major grounded theme. The term 'island lives' refers to any factors that respondents considered imperative to conducting a normal way of life within the island. The term also encompasses less practical aspects of daily life, such as the social and cultural identities of island communities. Moreover, respondents in all three case studies made it clear that maintaining and enhancing the core livelihoods within their respective communities is a major aspect of supporting island life. When analysing the empirical data, a wide range of codes emerged which were then classified into four overarching codes: 'Industries and Economy', 'Infrastructure', 'Cultural Heritage' and 'Depopulation'. It is important to note that the relatively inexplicit 'Infrastructure' code included the sub-codes of 'Transport', 'Communications' and 'Energy' (see Figure 5.3). The theme of lives and livelihoods, and the related motivations and priorities for adaptation in each case study community, will be explored and discussed presently.

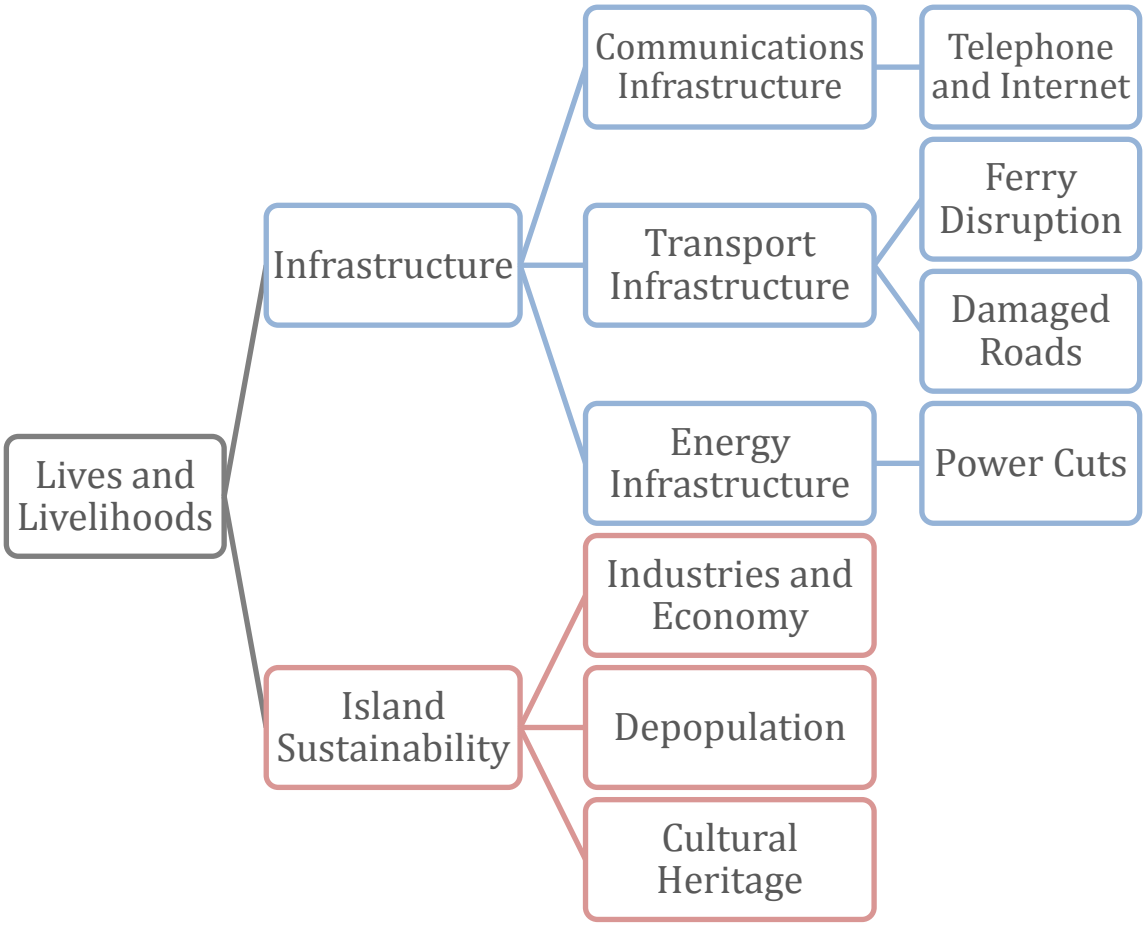


Figure 5.3: Coding tree illustrating codes and sub-codes related to maintaining and enhancing island lives and livelihoods

5.4.1. Lives and Livelihoods in the Case Studies

Respondents in Unst made it clear that the existence of adequate island infrastructure is essential to maintaining a satisfactory quality of life across the community. Specifically, they highlighted transport and communications infrastructures as being crucial to everyday life in Unst. In terms of transport, respondents explained that access to interisland ferries is vital for sustaining livelihoods and is a significant factor in the routine of many community members. Interisland ferries are utilised on a daily basis for purposes such as commuting to

work and school in other parts of Shetland as well as being used for the importation or exportation of commodities. However, participants reported that interisland ferries have been unable to operate during storms and severe gales leading to negative consequences for the community; problems with employment, the potential for reduced income, and the inability to export fresh produce such as seafood are some examples of the challenges faced. Participants were concerned that increased disruption to interisland ferry services in future, as a consequence of storms and severe gales, could have a detrimental effect on the livelihoods of individuals and on the wider economy of Unst. Access to interisland transport infrastructure is fundamental to sustaining lives and livelihoods in Unst, and is therefore a key community priority for adaptation.

Likewise, respondents highlighted the importance of communications infrastructure for maintaining lives and livelihoods in Unst. In this context, the term 'communications' refers to the use of telephone and Internet. The matter was flagged as a troublesome issue, particularly during and after severe gales in Unst. Respondents highlighted that existing telephone and Internet services are largely poor quality at the best of times: storms exacerbate a pre-existing problem with services remaining unavailable for prolonged periods of time following severe gales. They explained that many community members rely on telephone and Internet as part of their livelihoods, with increased proportions of the community working remotely. Furthermore, participants expressed concern that being left without a means of communication during and after storms has had a generally detrimental effect on the daily lives of community members. Participants acknowledged that the demand for high quality communications services has increased within their community over recent decades and accepted that poor service might be "part of the package" of living in Unst. However, they felt that the response of communications agencies could be improved directly following storm events to minimise negative outcomes. In terms of sustaining population on the island into the future, participants remarked that problems with transport and communications could eventually discourage people from living in Unst, potentially exacerbating depopulation. Consequently, they viewed the maintenance and improvement of island infrastructure as fundamental to sustaining lives and livelihoods in Unst.

In South Uist, participants highlighted the importance of supporting and developing the local industries of crofting and tourism in order to sustain and enhance livelihoods across the island. Respondents reported that drainage of farmland has been a major issue for crofters across South Uist. An increased occurrence of precipitation at unseasonal times of the year, coupled with poor drainage, has resulted in waterlogged farmland and difficulties for harvesting. Respondents explained that national farming subsidy regulations mean that the Scottish Government enforces strict harvest dates for crofters. However, respondents argued that the rigidity of dates was counterproductive to supporting crofting in South Uist, particularly due to difficulties harvesting on specific dates brought on by drainage issues.

> *Take the example of last year where the ploughing was about six weeks later for your basic arable. And the [Scottish] Government's agricultural department has fixed dates. They set the dates in Edinburgh with no understanding that if the drainage system is not sufficient and places are waterlogged, you can't plough on time and you have to go and get special permissions and all that. Or if you're ready to harvest and you do it a day early then you lose your subsidy. It's this absolute rigidity of dates. It impacts on crofting. The rigidity out of the department is surreal, especially in a community like this where people can identify whether they are ready to harvest. And if you're three days early from the date then you lose all your money, but you want to keep your harvest. If you wait for the date then you've lost the harvest because it floods or something else happens. When did farming start to go by a list of book dates that didn't use the farmer's experience?*
>
> South Uist Participant
> Storas Uibhist Focus Group

Participants indicated that Storas Uibhist has been generally successful in their efforts to improve drainage within the island, although the scope of the problem means that more remains to be done. Tourism is also a major industry in South Uist according to participants. They expressed the desire to attract increased numbers of tourists to South Uist in order to support the local economy. However, they felt that threats to tourism, such as the degradation of the machair as a source of tourist interest, could have a detrimental effect on the island economy. It is evident that supporting local industries in order to sustain the island economy is a significant community priority for maintaining and enhancing island lives and livelihoods in South Uist.

Transport infrastructure is also an important aspect of community life within South Uist. Respondents described the importance of maintaining good quality roads across the island. Specifically, road links between the islands of Benbecula, South Uist and Eriskay are vital to allow the efficient movement of the community between these locations. Causeways currently comprise all of the road links between the aforementioned islands. Participants believed that, due to experiences of increasingly frequent flooding of roads, it would be advantageous to invest in maintaining roads throughout South Uist. As mentioned previously in Section 5.3, the South Ford causeway remains a source of concern and anxiety within the community. Respondents are keen to see adaptive action undertaken on the causeway: a feature that is viewed by many as a high-risk road link. It is clear that respondents want to maintain a convenient direct road link between South Uist and Benbecula but would like to see adaptive alterations in order to increase feelings of safety and security. Evidently, maintaining and adapting roads infrastructure, especially road links between neighbouring islands, is a high priority for the South Uist community to allow for continued interisland movement thus sustaining contemporary ways of life.

Like the South Uist community, Westray participants illustrated the significance of local industries in relation to sustaining lives and livelihoods on the island. Respondents indicated that farming and tourism also form the main industries in Westray, as well as a range of local businesses that were deemed to be important for the island economy such as a seafood processing company, a bakery and a hotel. Participants discussed the climate-related challenges for farming, tourism and local businesses. Poor drainage around the island, related to increased precipitation, has resulted in waterlogged farmland leading to challenges for managing and feeding livestock with knock-on financial effects. Furthermore, local flooding at the coast in Pierowall and Broughton has resulted in the inundation of homes and businesses leading to negative consequences for lives and livelihoods. Respondents explained that recent flooding in Pierowall was due to poor drainage rather than being attributed to a climatic hazard. However, they made it clear that increased coastal flooding in future would be detrimental to those living and working in Pierowall and Broughton. In terms of tourism, participants were worried about the potentially adverse effects of increasing coastal erosion along tourist walking routes. They stressed that walking routes are a significant draw for tourists and were concerned that degradation of these routes could result in decreased tourist rates for the island, thus causing a detrimental effect on the island economy. Respondents made it clear that the stability of local industries is fundamental to sustaining the lives and livelihoods of the community. Therefore, adapting to the impacts of climate change is crucial for maintaining key industries and thus preserving the economy of Westray.

Respondents believed that the types of industries present on the island could have a significant impact on population levels. Encouraging community members to remain living in Westray, and attracting new incomers, was highlighted as a priority for tackling depopulation and preserving the viability of the island into the future. Some participants suggested that transforming Westray in terms of enhancing current industries and creating new opportunities for prosperity could add to the appeal of living there.

> *I think the priority is probably the population. I think people are acutely aware that the population has been held, possibly grown a little. It's things like the youth – encourage them and support them because otherwise the school ends up with smaller numbers and then that deteriorates. It's really about preserving the population and not just subsidising them.*
>
> Westray Participant
> WDT Focus Group

They believed that maintaining and enhancing livelihoods and improving the quality of life in Westray are vital elements for safeguarding the future of the island. It is evident that sustaining the current population, as well as preserving the longevity of the island in the long-term, is a major priority in Westray.

Additionally, cultural heritage was identified as a central aspect of community lives and livelihoods in Westray. Respondents felt that the cultural

heritage of Westray, specifically archaeology, was important in an educational sense as well as boosting the economy through tourism. They believed that maintaining and enhancing unique cultural assets could have a positive impact on tourism and the island economy as well as being of educational interest to the wider public. In particular, it was highlighted that a range of archaeological sites in Westray are currently at risk of being degraded by coastal erosion. Monitoring and recording these areas is a priority for upholding local cultural heritage values. Respondents felt that archaeology in Westray is often overlooked on funding and planning agendas. Some participants suggested that this might be attributed to the aesthetic unattractiveness of the sites in comparison to other more aesthetically appealing heritage spots such as castles. However, participants stressed that the monitoring and maintenance of archaeological sites is vital to understanding and preserving the cultural identity of Westray.

5.4.2. Interpretation

The maintenance and enhancement of lives and livelihoods is undoubtedly important across all three case studies. Sustaining a satisfactory quality of life is fundamental for all three communities. In particular, the sustainability of lifestyles - where it is possible to continue current ways of life related to, for example, transport, employment and economic productivity of local sectors – was important in all three communities. However, the priorities for sustaining island lifestyles are not uniform across the cases. Each community prioritises a unique combination of factors for upholding lives and livelihoods despite some instances of overlap. The Unst community prioritises staying connected to areas outwith the island through reliable transport and communications infrastructures. Transport infrastructure is also important in South Uist in terms of retaining safe fixed road links between neighbouring islands, as well as the preservation of local industries. The Westray community value local industries in a similar manner to respondents in South Uist. Cultural heritage is also a significant priority in Westray but was not alluded to in any other case study community.

Community priorities are similar in some instances such as the importance of sustaining local sectors and preserving key industries in South Uist and Westray. Both communities face similar challenges for farming related to waterlogged land and poor drainage with the potential for adverse economic consequences. The high prioritisation of local industries in South Uist and Westray is motivated by the desire to maintain and enhance the island economy in order to sustain good qualities of life in each community. However, the Unst community rarely mentioned the maintenance of local industries and it was clear that this was not a significant priority for adapting to the impacts of climate change. Unlike Westray, the community in Unst were largely concerned with maintaining connections outwith the island through both interisland transport and telecommunications. The South Uist community also prioritised the existence of transport links between neighbouring islands with an emphasis on the safe use of causeways. The prominent reliance on interisland transport could be unique to remote island communities like Unst and South Uist where access to other islands is a crucial part of daily life.

Despite some similarities across the case studies, the motivations driving the priorities of each community are fundamentally different. Priorities for maintaining lives and livelihoods in Unst are motivated by the geographic peripheral location of the island and the need to maintain external connections for economic security and access to commodities. The South Uist community also prioritise staying connected geographically through interisland transport but the focus is more on the safety of causeways as road links. This is plainly motivated by the consequences of the 2005 storm. Although sustaining local industries was important in both South Uist and Westray, the motivations in South Uist were largely based around maintaining a strong island economy whereas the Westray community explicitly explained that demographic sustainability was the key driver behind their motivations to enhance existing local industries and create new attractive opportunities. Demographic sustainability was emphasised strongly in Westray with the concern that depopulation could reduce the capacity of the community to function in a socially sustainable way. This issue was less prevalent in the other communities. It is evident that each case study community faces unique climatic and non-climatic challenges for preserving island lives and livelihoods.

5.4.3. Summary

All in all, the maintenance and enhancement of island lives and livelihoods is a crucial priority for all three case study communities. However, it is important to note the differing motivations that influence the high prioritisation of lives and livelihoods across the cases. Adaptation planning that considers not only lives and livelihoods as a general priority, but that recognises the potential for important unique community values across small island settings, could be beneficial in the long-term. The existence of sustainable lifestyles and secure livelihoods could provide a solid foundation for applying adaptive measures in small island settings. If communities feel secure in their livelihoods and economies, then they might feel better equipped to deal with climate challenges. Successful adaptation could happen if island lives and livelihoods were supported and enhanced. Furthermore, effective adaptation could happen if issues of demographic and social sustainability were dealt with in adaptation planning. Communities could be safeguarded and supported through adaptation that specifically addresses the consequences of climate change for their lives and livelihoods. Essentially, societal and environmental issues are intertwined and, therefore, adaptation cannot be separated from broader social issues.

5.5. Operationalizing Adaptation in Small Island Communities

The actualisation of adaptation in practice is a further key theme that emerged from the case studies. It refers to the factors and components that the case study communities considered to be essential for undertaking adaptation in an effective manner. Operationalizing adaptation was believed to be important across all three case studies, although the motivations and priorities for implementing adaptation were not necessarily uniform. Respondents across the

case studies described the crucial factors for successful adaptation within their communities such as improved communication across scales, better definitions of responsibility and increased funding and financial support. The importance of building resilience as a means of adapting to impacts of climate change was emphasised within some case study communities. As a result, the codes 'Networking', 'Responsibility', 'Financial Support' and 'Resilience and Preparedness' materialised from the gathered data, as conveyed in Figure 5.4. Although respondents outlined these components of their own accord, there is a strong link between the codes grounded in the data and the axial themes emerging from the literature, which are explored in detail in Section 5.6. The necessary factors for actualising adaptation, and the motivations and priorities underpinning this grounded theme in each case study community, will be presented and analysed in the current section.

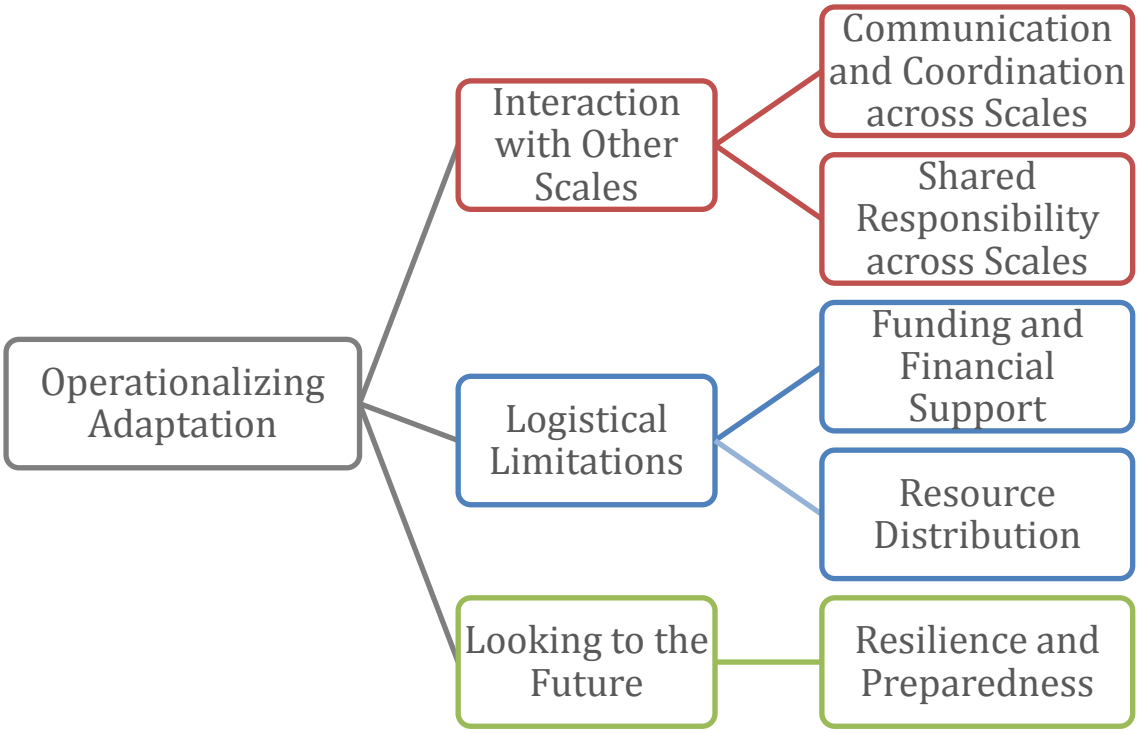


Figure 5.4: Coding tree illustrating codes and sub-codes related to operationalizing adaptation

5.5.1. Operationalizing Adaptation in the Case Studies

As conveyed in Section 5.2, respondents in Unst felt marginalised in comparison to the rest of Shetland and the UK. They felt that they were often at the

end of the line for receiving services, both from the local council and from external agencies such as telecommunications companies. As previously discussed, marginalisation could be a potential barrier to effective adaptation in small island settings. It is possible that marginalisation has contributed to the challenges associated with implementing adaptation in Unst. Respondents in Unst felt that improved communication and coordination between the local authority and the community is crucial in order to respond and adapt to the consequences of storms, especially in terms of emergency planning. Some respondents felt that the local authority could initiate and implement measures to enhance community resilience, such as equipping the community with emergency resources like power generators for use during storms. They also believed that the local authority should increase their own level of responsibility for formulating and distributing a formal emergency strategy for Unst which could be followed by the community during severe storm events. Furthermore, participants highlighted that the community could benefit from the improved cooperation of external agencies in terms of responding rapidly to the consequences of storms, particularly damage to communications infrastructure. Respondents felt that the adaptation needs of the Unst community ought to be better recognised and valued by the local authority, central government and external agencies to enable effective and more coordinated adaptive action in future.

Social capital is high within Unst and respondents made it clear that there is a community-wide willingness to respond and adapt to the impacts of severe storms. The community want to be involved in undertaking adaptive action and were interested in building community resilience to the impacts and consequences of future climatic hazards. In order to do so, however, participants highlighted that local authority support and assistance is essential, as is cooperation from external agencies. They felt that the fair distribution of information, funding and resources from the local authority to the community would be a crucial component of successful adaptation to the impacts of storms. Respondents believed that the local authority should lead on planning, supporting and facilitating adaptive measures that could be implemented by the Unst community on the ground. Participants suggested that successful adaptive measures could materialise if SIC and external agencies supported the already robust community, particularly through improved communication. The Unst community felt capable of implementing adaptation action provided that the local authority and external agencies were willing to share responsibility for facilitating adaptation where necessary.

In South Uist, respondents felt that significant community issues had not been sufficiently prioritised within planning by CnES and external agencies. For example, they reported that there has been a substantial focus on environmental land designation, often related to wildlife conservation, across South Uist by external agencies such as SNH. However, they felt that social issues had not been awarded adequate attention in comparison to environmental issues. They felt that the local council and external agencies had prioritised the development of land designations and wildlife conservation over supporting the people living in South Uist. They believed that effective adaptation to the impacts of flooding and storm

surge could not materialise whilst community priorities continued to be overlooked.

Additionally, participants highlighted that funding for adaptation (particularly coastal protection) has been unevenly distributed across South Uist. For example, they explained that coastal protection work has been undertaken at the southern end of the island because the work incurred a lower cost than the estimated expenditure of dealing with coastal adaptation at the north end of the island around the South Ford area. As illustrated in Section 5.3, adaptation of the South Ford causeway is a key priority in the eyes of the community motivated by past fatalities. However, adaptive measures have yet to be undertaken in that area due, in part, to funding constraints.

> *It's the place where we lost five people and it's the last place that's going to be sorted. You just couldn't write it.*
>
> South Uist Participant
> Lochboisdale Community Council Focus Group

Respondents expressed their feelings of inequality related to the general distribution of funding across the Outer Hebrides as an island group more widely. They felt that funding for development, including adaptation, had been unevenly distributed in favour of Harris and Lewis, and particularly the town of Stornoway. Participants made clear their belief that insufficient funding has created a barrier to the implementation of adaptive measures in South Uist, and that any action undertaken to date has not addressed some of the most significant priorities for adaptation within the community.

Furthermore, respondents highlighted that poor communication between the local authority and the community has further hindered progress in operationalizing adaptation in South Uist. They felt that the local authority had been reluctant to accept responsibility for dealing with issues of climate change in South Uist and that community adaptation issues had been ignored. Respondents expressed a willingness to be involved in adaptation action locally but highlighted that a lack of necessary support and funding has impeded any potential community-scale efforts. Adaptation could be actualised in South Uist through improved definitions of responsibility along with better communication and coordination between the local authority and the community in a joined-up approach. Improved communication across scales could help to overcome the barriers currently hindering adaptation action in South Uist. Respondents felt that it was important to maintain a reliable two-way dialogue between community members and the local authority, where both parties are communicating regularly, to ensure that adaptation priorities are being addressed. They wanted to see South Uist community needs included on local authority agendas, and thought that improved communication could be beneficial to achieving this. According to participants, adaptation in South Uist has been inhibited by insufficient communication across scales, as well as inadequate access to funding and

continued marginalisation on planning agendas in comparison to other areas of the Outer Hebrides.

Like the other case studies, respondents in Westray felt that access to funding is a limiting factor for operationalizing adaptation within their community. Participants believed that the peripherality of Westray, as a small island in the north of Orkney, has led to the community being marginalised in terms of central government and local authority funding allocations. Furthermore, they felt that the impacts of climate change in Orkney, as an island group, are not fully appreciated or understood by decision-makers at Scottish and UK scales. As a result, respondents believed that funding is not being adequately distributed to meet the adaptation needs of Orkney generally, with negative knock-on impacts for Westray as a small peripheral island within the Orkney island group. Participants felt that climate-related problems were more severe in Orkney, and Westray, in comparison to other areas of Scotland, and that Orkney therefore required a greater amount of financial input to enable adaptation to the impacts of climate change.

> *The problem is not the same everywhere, yet there's a [public] perception that the resources should be spent equally throughout the country. And those things jar with one another because obviously there's a lot less coastal erosion in [say] East Lothian than there is in Orkney.*
>
> Westray Participant
> Individual Interview

Respondents made it clear that the Westray community wants to play an active role in implementing adaptation measures locally within their island. Indeed, the community-funded wind turbine is a testament to the will of the community to attempt to tackle the issue of funding as a limitation to implementing local action. However, respondents made it clear that external financial support, from either the local authority or central government, is a necessary factor for operationalizing adaptation to the impacts of sea level rise in Westray.

Respondents in Westray also highlighted the issue of communication across scales as a barrier to actualising effective adaptation within their island. Participants believed that increased coordination and communication with OIC could be beneficial for tackling the impacts of sea level rise, particularly coastal erosion. They felt that it was important to have community members 'on the ground' to monitor erosion in Westray because they believed that people living on the island are familiar with the land and coastline. Respondents argued that local people are best placed to monitor coastal change on a regular basis and can identify and report changes as they happen. Participants believed that this approach could be thorough and efficient for adapting to coastal change induced by sea level rise. However, they stressed that this would be best achieved through continuous mutual communication with OIC for technical support and information. Participants also felt well placed to implement adaptive action but highlighted the need for formal support and guidance from OIC in order to do so. The community

have illustrated that they are keen to drive adaptive measures on the ground in Westray but stressed the need for a systematic and mutual stream of communication with OIC in a joined-up approach to adaptation.

5.5.2. Interpretation

It is clear that there are several common barriers across the case studies for operationalizing effective adaptation that takes local priorities into account. In particular, funding and resource allocation was reported as a limitation to undertaking adaptive action at the community scale in all three case studies. The issue was emphasized most strongly in South Uist where participants indicated that adaptation in the South Ford area simply cannot happen without substantial financial input. The loss of five lives in the South Ford area fuels strong community feeling regarding the issue of funding for adaptation in South Uist. Participants in Unst and Westray put slightly less emphasis on the issue of funding and resource allocation in comparison to South Uist respondents. Nevertheless, the topic arose during every focus group in Unst and Westray. Participants in both of these case studies believed that adaptation action could be easier and more effective if increased financial support was available for adaptation from the respective local authorities and central government.

A lack of clearly defined cross-scale responsibility for operationalizing adaptation has inhibited adaptation in the case studies. Additionally, communication across scales, particularly between communities and local authorities, was reported as a limitation to adaptation in practice across all three case studies. The issue was of equal importance to participants in Unst, South Uist and Westray. In South Uist and Westray, respondents raised the same issue: outside bodies, namely local authorities and central government, do not fully understand the impacts and consequences of climate change within the case study islands and therefore adaptation planning does not currently meet the needs of the communities. This specific issue was not raised explicitly in Unst. However, respondents in Unst highlighted that they feel undervalued and overlooked by their local authority in terms of planning; a concern that was also raised by participants in South Uist and Westray. Overall, participants in all three case studies believed that improved communication between the community and local authority could be beneficial for successful adaptation in future.

Ultimately, it appears that social marginalisation might contribute to the aforementioned barriers to operationalizing adaptation in the case studies. Participants in all three case studies felt that part of the reason for inadequate adaptation action to date was because their needs had not been prioritised on the agendas of central government or those of the respective local authorities. In each case study, respondents felt that inadequate funding and poor communication between the community and the local authority was due, in part, to the geographical and social peripherality of their island in comparison to the rest of their island group, and indeed to the rest of Scotland and the UK. Social marginalisation could be a contributing factor to the challenges faced by the case study communities for adaptation in practice. Based on the empirical data, it

appears that adequate negotiation for adaptation responsibility between different scales of governance has not yet taken place, thus hindering progress in adaptation in the case studies.

5.5.3. Summary

Overall, operationalizing adaptation is a key priority for all three case study communities. It is evident that respondents in Unst, South Uist and Westray care about how adaptation happens within their communities and that they want to play an active role in implementing local adaptive measures. However, respondents highlighted existing barriers that hinder the implementation of adaptive action across the case studies. The problem of social marginalisation and peripherality lies at the core of this issue. Furthermore, inadequate definitions and divisions of cross-scale responsibility for adaptation have hindered adaptation action in the case studies. Strong relationships could be built across scales and divisions of responsibility could be clarified if multilevel communication was improved, thus potentially leading to reduced social marginalisation. If a reliable two-way stream of communication is developed across scales, issues such as funding and resource distribution could be addressed. In turn, this could lead to the operationalization of adaptation that takes the priorities of small island communities into account.

5.6. Axial Themes in the Case Studies

The theory-derived themes of 'Developing Networks', 'Defining Responsibility', 'Upholding Societal Values' and 'Transforming Societies' were applied to the data as codes during analysis in order to understand the real-world issues in each case study in relation to theoretical themes in the adaptation literature. In some cases, additional sub-codes were formulated to analyse the data in further detail. This section presents the results of theory-led coding analysis.

5.6.1. Adaptation as Developing Networks

As raised in the literature review, the development of reliable and robust networks is a fundamental factor for effective adaptation. Strong connections across scales – across community, local authority, sub-national, national and international levels – that follow both top-down and bottom-up pathways can facilitate successful adaptation. As previously stated, communication, coordination and cooperation are key elements that could lead to improved network development. When approaching the case studies, these elements were adopted as codes in order to investigate the status of each one within Unst, South Uist and Westray. An additional code – 'connections and relationships' – was applied to capture the state of networking within the communities themselves rather than across various scales. Figure 5.5 illustrates the main codes and sub-codes involved in the process of theory-led coding.

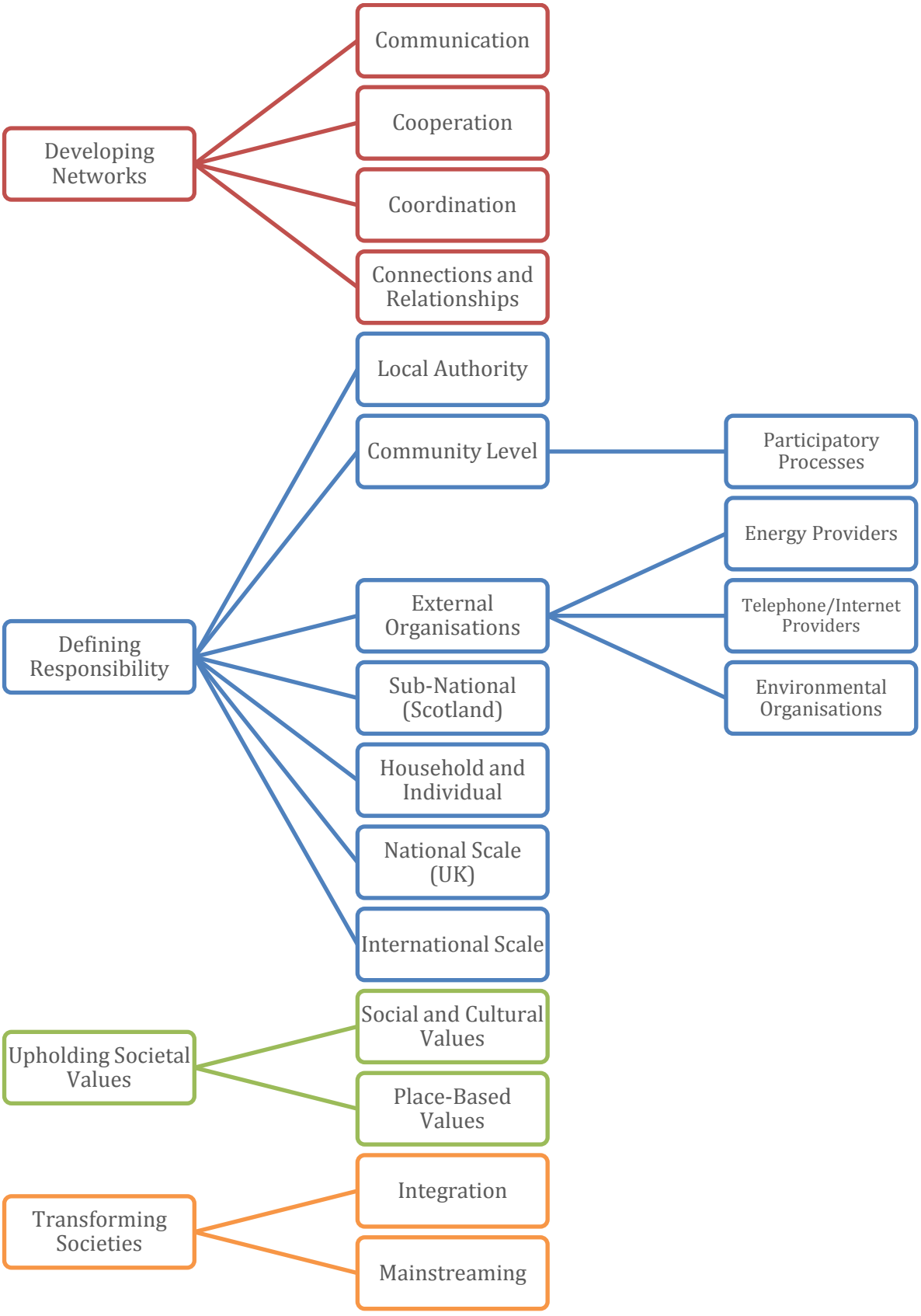


Figure 5.5: Coding tree illustrating the theory-led codes and sub-codes

5.6.1.i. Networks in the Case Studies

In Unst, participants highlighted the importance of connections and relationships at the community level. They described the strong feeling of community spirit within Unst and explained the tendency for community members to rely upon and assist one another during and after hazardous climatic events, particularly storms. In terms of building networks beyond the community scale, participants indicated their belief that there is a gap in communication and coordination between the local authority and the Unst community regarding emergency planning for, and long-term adaptation to, severe storms.

Similarly, participants in South Uist indicated that they also felt a profound sense of community within the island. South Uist respondents stressed the distinct need for increased and improved networking between community, local authority and sub-national government scales in order to address the issues that stemmed from the storm of 2005. They explained that their efforts to communicate with members of local authority and MSPs have gone unanswered and have therefore proved ineffective. In particular, they felt that their voices have been largely unheard and, in some cases, disregarded by the local authority. One participant stated:

> *There's a very, very strong local opinion that since we're covered from Stornoway we could get a little sympathy from Stornoway and [be] listened to. But the people that you need to be speaking to aren't here and you can't get in touch with them and you're going round in circles. And everything's been kicked into the long grass. People are getting very frustrated.*
>
> South Uist Participant
> South Uist Open Community Focus Group

Respondents in Westray were concerned with obtaining expert knowledge and information from OIC, the Scottish Government and external agencies to enable adaptation action at the community scale. They felt that direct communication and coordination between the local authority and the Westray community is currently lacking and that a stronger path of communication between these scales would be beneficial for adaptation. They stressed that improved communication between OIC and the Westray community could aid local community members in adapting to the impacts of climate change, namely coastal erosion and sea level rise, on the ground.

5.6.1.ii. Interpretation

It is evident that effective networks and connections at the community scale, in the form of community spirit and mutual support, have been successfully built over time in both Unst and South Uist. Less was mentioned directly about community-level networks in Westray, although there is a subtle sense of community which is evidenced in the eagerness of Westray respondents to liaise with the local authority, central government and external agencies in order to

inform and drive their own adaptation action. The notion of wanting to undertake and steer adaptation in their own island indicates the desire for self-sufficiency as a whole community.

There is clear room for improvement in relation to network development beyond the community scale in all three case studies. In South Uist, particularly, respondents highlighted that networks are currently weak, inefficient and ineffective. The networking gap across community, local authority and sub-national scales partially hinders the implementation of effective and successful adaptation measures, although it must be highlighted that a lack of funding is also a crucial factor. Responses from participants in South Uist convey the need for increased and improved communication and coordination from central government and local authority down to the community level. In Unst and Westray, it is evident that respondents want to take steps towards adaptation; the Unst community want to improve emergency response and long-term adaptation planning, whilst the Westray community are eager to implement measures on the ground to adapt to coastal erosion. However, technical knowledge and support information needs to be imparted from the top-down in order to coordinate adaptation at the community scale.

5.6.1.iii. Summary

Networks are robust at the community scale, especially in the case studies of Unst and South Uist. However, adaptation is not currently being undertaken to its full potential in any of the case study islands. Adaptation could be better-supported and facilitated through improved mutual communication and coordination between communities, local authorities and central government.

5.6.2. Adaptation as Defining Responsibility

The acceptance of responsibility for responding to the impacts of extreme climate events is a vital factor for successful adaptation. Adaptation action led at the community scale can be positive and productive but is often limited in terms of expert information and financial resources. Effective adaptation planning and implementation can happen when responsibility is acknowledged and shared fairly across scales: individual, household, community, local authority, sub-national (Scotland), national (UK), supranational (Europe), and international. During analysis, each scale was adopted as a code when examining the concept of responsibility in the case studies, as conveyed in Figure 5.5. The 'External Organisations' code was also applied to differentiate between governmental and non-governmental organisations. Examples of external organisations that are relevant in the case studies include energy providers and communications companies. External organisations are considered at the sub-national scale and above.

5.6.2.i Defining Responsibility in the Case Studies

In Unst, various parties have demonstrated responsibility for responding to the impacts of severe storms. For example, participants explained that it has been the responsibility of external agencies such as energy and telecommunication companies to undertake maintenance and repairs where necessary in response to power cuts and communication disruption following intense storm events. Similarly, respondents highlighted that SIC have been active in their responsibility to monitor and maintain transport infrastructure and council housing. However, respondents felt that SIC needed to assume a greater level of responsibility for coordinating and facilitating long-term emergency planning for storm events. A respondent in Unst stated:

> *We need that planning from the local authority don't we? The local authority needs to take [planning for storms] seriously and I don't think they do [currently]. The attitude is "oh it's always been windy in Shetland". And people have to learn to live with it. That's the attitude [of the council].*
>
> Unst Participant
> Unst Open Community Focus Group

Unst participants indicated that they are willing to accept a certain level of responsibility for dealing with the impacts of storms at the community scale where possible. For example, they are keen to assist one another in terms of ensuring the wellbeing of vulnerable community members by checking that they are safe, secure and sheltered with essential supplies such as food and gas stoves. However, they highlighted the need for more support from SIC in terms of setting out clear emergency procedures and supplying essential emergency resources such as power generators. There is a responsibility at the local authority scale to facilitate long-term planning for storm events in Unst.

Conversely, South Uist participants indicated that key issues, particularly those arising from the storm of 2005, are beyond the scope of individual or community responsibility. There is a clear and definite need for a long-term solution in the South Ford area in order to address feelings of safety and wellbeing on the island, although there continues to be debate over the best approach to take. There is little that the community alone can do to address this problem. Storas Uibhist has some responsibility for drainage and coastal management within South Uist. However, participants believed that the responsibility for adaptation cannot fall solely on the shoulders of the community landowner – a relatively small organisation with limited funds. One participant from South Uist pointed out:

> *[Storas Uibhist] were asked to pay for this feasibility study for the causeway [at] the South Ford. But the point was that it's not the stakeholder responsibility. It's a council road so it's their responsibility. And the minute that [Storas] start to do anything like that and start taking responsibility for it, well, suddenly it's a bottomless pot of money. And the estate can't do everything. When you're trying to get agencies and the council to take*

> *responsibility for what they should be doing, and they're refusing to do it, you're stuck between a rock and a hard place.*
>
> South Uist Participant
> South Uist Open Community Focus Group

Accountability needs to be negotiated between local authority and sub-national levels in order to facilitate and financially support whichever adaptation option is put in place. However, as previously stated, limited communication resulting from weak networks is currently a fundamental barrier hindering effective adaptation in South Uist. Communication must first be improved in order to then address the issues surrounding fair divisions of responsibility for adaptation.

In Westray, respondents discussed several instances where the response to impacts of climate change, such as coastal flooding and erosion, has been initiated and undertaken at the individual scale. They spoke positively about such efforts and emphasized the success of individual adaptation. For example, the house of a local resident was flooded and repairs to drainage were undertaken independently by the local resident to prevent future flooding at that particular site. Westray participants indicated their willingness to take responsibility for monitoring some aspects of environmental change on the island such as coastal erosion and road blockages caused by high tides. They were also keen to be involved in the implementation of adaptation measures at the community scale where possible. They acknowledged the benefits of being 'on the ground' and therefore having the ability to observe adverse impacts first-hand and respond promptly. However, they identified the need for OIC to take responsibility for overseeing and supporting community-level adaptation, particularly through the provision of information, resources and funding. Responsibility for adaptation in Westray does not lie at the individual and community scales alone. Support from OIC is essential, especially as the impacts of climate change begin to intensify over time. It is evident that responsibility for adaptation has been accepted at the individual and community levels so far to a certain degree of success, but the local authority have a responsibility to assist and support communities where needed.

5.6.2.ii. Interpretation

Both Unst and Westray community members have faced similar issues related to identifying responsibility for adaptation. In both case studies, there is a noticeable willingness to accept responsibility for some aspects adaptation and to drive forward implementation at the community scale. Both communities are keen to be involved in adaptive response within their own islands but recognise that they are limited in terms of expert information, key resources and funding. Furthermore, it was clear that individual and community responsibility has not been accepted out of choice but rather through necessity in some cases. Help and support from local authorities is crucial in both Unst and Westray. Responsibility must be fairly divided between communities and local authorities to enable effective long-term adaptation into the future.

The situation in South Uist differs to that of the other case studies, mainly due to the fact that respondents have faced issues of mortality within the close-knit community as a result of the 2005 storm. Consequently, the climate-related problems experienced within South Uist are of a greater magnitude compared to Unst and Westray, particularly in terms of the capital required for adaptive measures that could ease feelings of concern over future safety in the South Ford area. In this case, the debate over who is responsible between the local authority and central government in terms of the planning and funding of adaptive measures in the north end of the island remains unresolved, and this is inhibiting adaptation. However, as mentioned, strong networks are a vital precursor to sharing responsibility. Network development must first be addressed in order to produce a clear and fair division of responsibility for successful adaptation in South Uist.

5.6.2.iii. Summary

Successful adaptation can only happen when there is acceptance of responsibility across scales to avoid the burden falling at any one scale or on a single group. The question of fair divisions of responsibility across scales remains unresolved in all of the case studies and there are significant improvements to be made in each island. The issue, although also important in Unst and Westray, is currently most pressing in South Uist. Directly addressing the matter of responsibility could lead to more equitable and effective adaptation in future in all three case studies.

5.6.3. Adaptation as Upholding Societal Values

As discussed in Chapter 2, the preservation of societal values is key to fair and effective adaptation. The relationship between societal ideals and adaptation is complex. Social and cultural values have the potential to differ across locations and, indeed, might vary temporally in any one location. The acknowledgment of human choices and priorities through strategic and flexible planning can enhance adaptive practices. 'Social and Cultural Values' was applied as a code during analysis in order to investigate community beliefs and ideals in Unst, South Uist and Westray (see Figure 5.5). Similarly, the code of 'Place-Based Adaptation' was used as a means of assessing spatial variance in societal values between the case studies.

5.6.3.i. Societal Values in the Case Study Communities

Unst respondents described three key societal values that are fundamental to life on the island: reliable transport links to mainland Shetland, the wellbeing of vulnerable community members, and the status of the Unst community as a strong, close-knit unit. In terms of transport, Unst residents greatly rely on interisland ferries for the movement of people and goods. Respondents indicated that negative consequences have ensued when interisland transport has been compromised during storm events, such as being stranded at length on a neighbouring island whilst commuting home from the Shetland mainland. Therefore, the Unst community places a great deal of value on maintaining reliable transport links as

part of adaptation in Unst. Furthermore, participants illustrated that the care and wellbeing of vulnerable people is of high importance to the community. One respondent noted:

> *You would want to make sure that if there was - say it was really bad snow - that somebody would be thinking to check the old folk because obviously they're more vulnerable than most of the families would be in their houses. You would be thinking "who's the folk that's most at risk here?"*
>
> Unst Participant
> Gardiesfauld and Uyeasound Focus Group

In particular, the existence of a care home for the elderly in Uyeasound, as well as numerous other vulnerable residents across the island, means that respondents considered emergency planning and coordination as essential. Participants very clearly conveyed a sense of pride in their community and in their ability to assist each other during and after intense storms. It is evident that immense value is placed on connections and relationships within the Unst community.

In South Uist, participants highlighted safety and wellbeing alongside the importance of land and local historical knowledge as major societal values within their community. The safety and wellbeing of community members during storm events has become a key consideration since 2005, particularly for those living in the north end of the island close to the South Ford. Participants emphasized the importance of farmland and coastal land, particularly the machair. They indicated that crofting remains central to the economy of the island and that the sufficient provision of land on which to croft is crucial to sustaining the island population. Furthermore, some participants identified the machair as a major draw for tourists, particularly those interested in wildlife. Respondents made it clear that land is a socially and economically valuable aspect of life in South Uist. Participants also felt that local historical knowledge, passed down through generations, is extremely valuable for informing adaptation. Some participants highlighted concern that valuable local understandings of how to work with the land are gradually being lost with each generation. Additionally, they felt that local knowledge has not been given sufficient attention in processes of adaptation.

Westray respondents identified Pierowall Village, depopulation and cultural heritage as fundamental social values within their community. Pierowall is the centre of population on the island, with respondents estimating that just under half of the entire Westray population reside in village. Participants also prioritised a number of businesses and amenities located in Pierowall. Therefore, participants pinpointed the village as being of high social and economic importance for the community. Depopulation was also a major concern for respondents. A Westray participant stated:

> *If anything can survive the changes that are coming then Westray possibly can. But if the population sinks too far then it'll be a bit like global warming.*

The Gulf Stream may turn around or stop. Well the same thing might happen in terms of our island surviving.

Westray Participant
WDT Focus Group

Respondents stressed that maintaining an adequate island population is vital in order to support life on the island in future, as also highlighted previously in Section 5.4 within the grounded theme of Maintaining and Enhancing Island Lives and Livelihoods. Furthermore, most respondents held cultural heritage and local human history in high regard. They explained that rare archaeological sites are continuously being exposed in Westray due to erosion around the coast. Respondents identified the significance of local archaeology for understanding human history, not only for Westray and Orkney but also at UK, European and international levels. They emphasized that archaeological sites around Orkney can help the global population to understand how human settlements and lifestyles have developed from prehistory through to the present day. Participants believed that local archaeology is of high cultural significance and should be taken into consideration in adaptation planning.

5.6.3.ii. Interpretation

The support and security of livelihoods, alongside sustaining general island life, is a common societal value across all three case study communities. The ability to function as a community with a stable economy is a basic ideal held by most participants in Unst, South Uist and Westray. However, the essential components that are required for maintaining livelihoods and lifestyles are unique and specific to each case study. Interisland transport is vital for the movement of people and goods to and from Unst, but is less significant for the communities of South Uist and Westray based on the gathered data. The value placed on land, particularly the machair, for farming and tourism was emphasized in South Uist but to a far lesser extent in the other case studies. Furthermore, the maintenance and development of Pierowall Village as a hub for population was highlighted as a primary concern in Westray whereas participants in Unst and South Uist did not raise this type of issue.

In terms of other societal ideals, the communities of Unst and South Uist display some similarities but the Westray community does not share these values to the same extent. It is evident that safety is a key social value in both Unst and South Uist. Respondents in Unst believe that caring for vulnerable people during extreme climate events is a priority for their community, whilst those in South Uist highlighted the need to address concerns over community-wide safety and wellbeing following the storm of 2005. However, respondents in South Uist communicated a far greater need for urgent action to address safety compared with Unst respondents, presumably spurred on due to the loss of life in 2005. Additionally, respondents in both Unst and South Uist value their own community identities and histories. Participants in Unst believe that their community is strong and robust due to the reliable networks and connections that have been built up

locally across the island. Similarly, there is a sense of pride in local knowledge in South Uist, particularly in a practical sense relating to land use.

Conversely, Westray respondents highlighted the value they place on local cultural heritage, namely archaeology. The importance of documenting and preserving local archaeology was expressed clearly by participants. Unst and South Uist respondents mentioned the topic of cultural heritage briefly as both islands have rich histories and notable archaeological sites. However, it was emphasized to a lesser extent in these case studies in comparison to Westray. This indicates that although the case studies may share similar historical and cultural backgrounds, cultural heritage is not always valued equally across the three communities.

5.6.3.iii. Summary

Peripheral island communities have unique values in comparison to communities in mainland areas, evidenced in participant responses. For example, the value placed on interisland ferry transport in Unst is directly linked to its existence as a remote island location: "*If the ferries can't run then that's basically everything – fuel for heating [and] everything else. All will be affected*" (Unst Participant, Unst Open Community Focus Group). The issue of adaptation as upholding societal values becomes further complicated when specific beliefs and ideals are found to be dissimilar across island locations. To expand, the security of island livelihoods and lifestyles is of high value across the case studies. However, when examining this matter in more detail, it is clear that the needs of each community differ markedly depending on the specific social, economic and cultural issues within each island. What matters to one community might not matter to another. The safeguarding of unique community values during processes of planning could lead to improved adaptation in small island locations.

5.6.4. Adaptation as Transforming Societies

The concept of transformation, as a pathway for adaptation, refers to long-term alterations to the manner in which societies respond to climate change. As indicated in the literature review, transformation that is supported by continuous and flexible planning can lead to successful adaptation. The mainstreaming and integration of climate change issues into non-climatic forms of development policy, planning and action is central to transformation. Thus, the codes of 'Mainstreaming' and 'Integration' were applied to the data gathered in each focus group to explore the concept of transformation across the case study communities (see Figure 5.5).

5.6.4.i. Transformation in the Case Study Communities

In Unst, some participants suggested the need for transformative approaches in order to adapt to the impacts of severe storms. Respondents acknowledged the potential for increased storminess in future and suggested the need for a new all-encompassing approach to storm response. A respondent stated:

> *There needs to be an overall look at this. There needs to be a strategic look at this. And I'm not sure that's happening. We can all – in our little villages and communities and all the rest of it – do what we can. But…you've not got an overall overarching look at this.*
>
> Unst Participant
> Unst Open Community Focus Group

Participants indicated a desire for clear long-term emergency planning set out by the local authority that could then be implemented at the community level. Respondents implied that future planning ought to take more than simply climate-related impacts into account, but rather should also encompass a range of social factors such as the vulnerability of individuals. They were keen to adopt a new way of dealing with storm events, with an emphasis on safety, in the hope of enabling successful and coordinated action before, during and after storms in future.

Little was mentioned regarding transformation in South Uist. In some focus groups, it was not alluded to in any manner. However, the concept was referred to in one focus group where participants illustrated the need for local authority and central government to look at the wider picture concerning impacts of climate change in South Uist. One participant summarised it as:

> *It isn't purely about how much storm damage and how many centimetres we're losing of our coastline each year. It's about the whole big picture.*
>
> South Uist Participant
> Lochboisdale Community Council Focus Group

Respondents in this focus group emphasized that complex land use designations across South Uist, coupled with increasing rates of coastal erosion, have resulted in negative outcomes for crofting on the island. They highlighted the need for strategic and coordinated planning at local authority and central government levels in order to address issues of land use linked to climate change.

Participants in Westray also indirectly touched upon the concept of transformation. Specifically, respondents talked about fundamentally changing the way Westray operates as an island community, not only from a climate perspective but also in terms of the wider sustainability of the population. They advocated boosting both the population and economy of Westray as a means of building a larger and stronger community that could work as a foundation on which to begin to tackle adaptation. Although participants did not mention the term 'transformation' directly, the idea of adopting a comprehensive view of adaptation, as not only involving climatic issues but also non-climatic factors, aligns with the concept of transformation in adaptation.

5.6.4.ii. Interpretation

The concept of transformation was indirectly referred to, in one form or another, in all three case studies. However, the level of emphasis on the need for

transformative approaches differed between the case studies. Respondents in Unst and Westray discussed transformation to a greater extent than respondents in South Uist. Although respondents in Unst did not use the term 'transformation', their suggestions for an overarching, comprehensive approach to adaptation aligns strongly with the notion of transformation. Similarly in Westray, participants did not talk about 'mainstreaming' or 'integration' specifically. However, their ideas for addressing problems of climate change alongside non-climatic issues, such as depopulation, correspond to the key components of transformative approaches to adaptation. For those instances where there is an absence of data related to transformation, it is possible to speculate that focus group respondents did not view climate change adaptation as an issue which would require broad scale societal transformation.

5.6.4.iii. Summary

Transformation, and its meaning within climate change discourse, is not a commonplace term. As a result, it is understandable that the use of the term in relation to adaptation does not occur at the community scale in everyday conversations about climate change. The meaning of transformation is relatively uncomplicated but the term itself can become abstract when used in an ordinary, non-academic discussion about climate change. Although the term 'transformation' was not used specifically in the case study communities, it is clear that some respondents have intuitively begun to adopt a transformative perspective, evidenced in their responses regarding future adaptation. If the concept of transformation were to be increasingly included in community-scale discourse, adaptation could evolve along a transformative pathway where climate issues are integrated with non-climatic factors in strategic and flexible adaptation planning.

5.7. Conclusions

This chapter has presented and interpreted the results of qualitative analysis performed on the data gathered during deliberative workshops and focus groups in order to understand the issues, factors, motivations and priorities for adaptation in the case studies. A sense of community is prevalent in each case study, having been formed through social connections and relationships. The key climate hazards and impacts affecting each case study community differ significantly, according to community perspectives. The use of focus groups produced results about motivations and priorities for adaptation that represent community views in each case study. Four key themes emerged as a result of grounded theory coding analysis of the focus groups data:

- The empowerment of small island communities
- Ensuring community safety and wellbeing
- Maintaining and enhancing island lives and livelihoods
- Operationalizing adaptation in small island communities

These themes can be interpreted as broad priorities, within which case-specific priorities are identified. Although the themes are similar across the case studies, distinct differences exist in the context of each community. Furthermore, the motivations for adaptation are not uniform. The similarities and differences between the case studies, and related implications, are discussed in Chapter 6. Additionally, the results of theory-led coding highlight the relevance of theoretical components of adaptation within the real-world case study settings. The role of theory-led themes for adaptation in small island locations is furthered discussed in Chapter 6 based on the empirical evidence from the case studies.

Chapter 6: Discussion

6.1. Introduction

Chapters 4 and 5 presented and interpreted the empirical results of the study. This section will discuss the key findings emerging from the results. The major themes related to the research findings are reviewed and linked back to the research questions identified in Chapter 1. Firstly, Section 6.2 synthesises and examines the results presented in Chapter 5 in order to respond to Research Question 1: 'What are the motivations and priorities for adapting to climate change in small island communities? How do they vary and why?' The chapter then discusses three key themes within the study:

- The role of scale in adaptation for small island communities (Section 6.3)
- The role of community perspectives and social values in adaptation (Section 6.4)
- The role of climate projections and vulnerability mapping in scenario-based community engagement for adaptation (Section 6.5)

Sections 6.3 and 6.4 address the first part of Research Question 2: What are the factors and issues that influence how adaptation happens in small island communities? Section 6.5 reviews the role of climate projections and vulnerability mapping as tools for community engagement, thus responding to Research Question 3: How can scenario-based community engagement contribute to adaptation planning? How useful are climate projections and vulnerability assessments when used as tools for engagement at the community scale? The implications of the findings for future adaptation theory and planning are considered in Section 6.6.

6.2. Analysing Motivations and Priorities for Adaptation across Scottish Island Communities: Explaining Differences and Similarities

A fundamental aim of the research is to identify motivations and priorities for adaptation in small island communities, particularly those within the Scottish Islands. Moreover, the study seeks to evaluate similarities and differences in motivations and priorities across small island communities in order to contribute to understandings of adaptation in these settings. This section will address:

1. What are the motivations and priorities for adapting to climate change in small island communities? (Sub-Section 6.2.1)
2. How do they vary and why? (Sub-Section 6.2.2)

The section will synthesize and discuss the key results presented in Chapter 5 with a view to understanding and explaining differences and similarities across the case studies. The implications of cross-case commonalities and differences for theory and planning are presented in Section 6.6.

6.2.1. Synthesis of Motivations and Priorities

Four key themes emerged from the data that illustrated the priorities of the case study communities for adapting to the impacts of climate change: (1) the empowerment of small island communities, (2) ensuring community safety and wellbeing, (3) maintaining and enhancing island lives and livelihoods and (4) operationalizing adaptation. Although the four themes were grounded in the data, each case study community does not necessarily perceive each theme in the same manner, and these were not equally significant across the case studies. On one hand, community empowerment, maintaining and enhancing lives and livelihoods, and operationalizing adaptation were prioritised at a consistently high level across the cases, although not necessarily for the same reasons. Conversely, the theme of safety and wellbeing was not equally significant across the case studies, a matter that is discussed in Section 6.2.2.

Priorities are closely linked, and indeed overlap, in each case study. Participants across the cases indicated that a range of priorities were of equal importance for planning. An Unst participant illustrated this: "[we're] dealing with different things. There's no one [single] thing that gets prioritised". Specific priorities under one key theme cannot be considered in isolation without incorporating other priorities that are closely related. For example, community empowerment and operationalizing adaptation are closely related within each case study. The successful operationalization of adaptation could be enhanced by increased community empowerment. The case study communities already possess community capital, particularly in the form of social capital, to operationalize adaptation to some degree but increased community empowerment could lead to more streamlined planning and effective implementation. Therefore, in this example, operationalizing adaptation could be better addressed if community empowerment is considered in parallel. Consequently, since no single dominant priority emerged from the data, this could mean that an overarching approach that takes multiple issues and priorities into account is required when addressing adaptation in the Scottish Islands.

Although most key themes were significant across the case studies (with the exception of safety and wellbeing) each community expressed a unique combination of specific priorities within the key themes (Table 6.1). For example, under the lives and livelihoods theme, the Unst community prioritise staying connected to the rest of Shetland and the UK via reliable transport and telecommunications, whereas the Westray community prioritise the maintenance and protection of the island economy in order to sustain local ways of life. On the other hand, the South Uist community prioritise both connectedness and the long-term protection of their island economy. There are instances of overlap across the case studies throughout the four key themes, but there are also instances of divergence. This variation is discussed in the following sub-sections.

Priority Themes for Adaptation in the Case Studies		
Unst	**South Uist**	**Westray**
Community Empowerment - Addressing geographical peripherality - Inclusion of community-scale challenges in local authority and central government planning agendas - Support and coordination for adaptation from local authority and central government	**Community Empowerment** - Addressing geographical peripherality - Inclusion of community-scale challenges in local authority and central government planning agendas - Support and coordination for adaptation from local authority and central government	**Community Empowerment** - Inclusion of community-scale challenges in local authority and central government planning agendas - Support and coordination for adaptation from local authority and central government
Safety and Wellbeing - Protecting vulnerable community members - Minimising the risk of injury and mortality	**Safety and Wellbeing** - Minimising the risk of injury and mortality - Increased safety around the South Ford area for future storms	**Safety and Wellbeing** - **Not** currently prioritised but participants highlighted the potential for this to become a future priority as the risk to community safety increases with rising sea level
Lives and Livelihoods - Staying connected to the rest of Shetland and the UK through transport and telecommunications	**Lives and Livelihoods** - Connectedness with the rest of the Outer Hebrides and the UK - Long-term protection of island economy	**Lives and Livelihoods** - Maintenance and protection of island economy for sustaining island life and population
Operationalizing Adaptation - Community-specific strategic emergency planning to cope with storms	**Operationalizing Adaptation** - The adaptation of the South Ford Causeway	**Operationalizing Adaptation** - Strategic action to deal with coastal erosion and inundation

Table 6.1: The main sub-priorities for each case study community under the overarching priority themes

6.2.2. Explaining Similarities and Differences across the Case Studies

6.2.2.i. Similarities across the Case Studies

As described, most of the key overarching themes are prioritised similarly across the case studies. Cross-case similarities can be attributed to comparable social issues and challenges within each island community. Figure 6.1 illustrates the major commonalities and differences across the case studies. Each community felt marginalised in some way, whether it was geographically or socially. Community empowerment is a significant priority in all three case studies motivated by similar factors, particularly perceptions of marginalisation on planning agendas. Geographical remoteness also drives priorities in Unst and South Uist. Geographical peripherality appears slightly less significant in Westray although it was alluded to indirectly during the focus groups. Nevertheless, participants in all case studies highlighted the significance of geographical remoteness in comparison to centres of decision-making, be it local authorities in Lerwick, Stornoway and Kirkwall or central and national government in Edinburgh and London. Respondents across the cases also felt that they could offer something to processes of adaptation - that their knowledge and experience could be valuable. Participants used examples of high social capital to justify their ability to work together as a community for enacting positive change, and to contribute to adaptation with local authority and central government support. Community willingness to be involved in adaptation emphasises the significance of empowerment as a priority within the case studies. Perspectives of empowerment were more or less uniform across the cases motivated by experiences of small island marginalisation and peripherality.

Furthermore, all communities felt limited in their capacity to adapt to impacts of climate change. Respondents in each case study voiced the need for assistance from governing bodies for effective adaptation. The factors underpinning community limitations were alike across the cases. Communities felt constrained by a lack of strategic guidance for adaptation, as well as financial and resource limitations. The overarching priority of community empowerment is driven by these constraints. Moreover, respondents in each community believed that enhanced local authority and central government support was needed in order to address community-level limitations and to facilitate effective adaptation in practice. Priorities for operationalizing adaptation are rooted in the desire of the communities to ensure that their islands are safe and sustainable places to live. Each community valued island sustainability through the diversification and enhancement of island lives and livelihoods. However, the requirements for operationalizing adaptation were influenced by differing socioeconomic factors across the cases. The case study communities all value operationalizing adaptation and maintaining island lives and livelihoods in a similar manner. However, the factors motivating these particular priorities are not necessarily uniform across the cases.

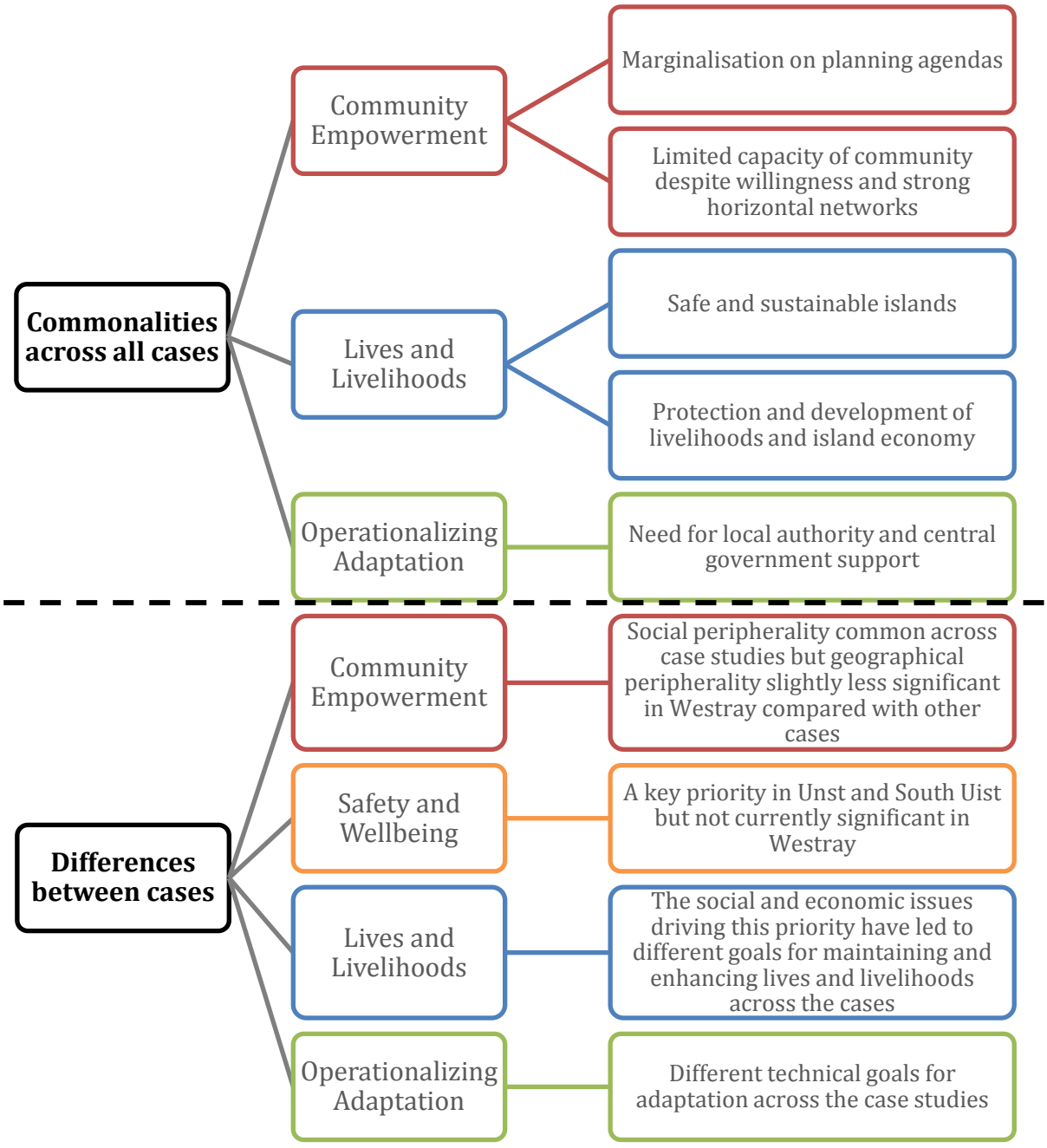


Figure 6.1: Commonalities and differences in issues and priorities for adaptation across the case studies in relation to the key grounded theory themes

6.2.2.ii. Differences across the Case Studies

The risk of harm posed by climatic events is a major motivation for adaptation in the case studies. However, when asked to identify key hazards that had significantly affected their communities, participant responses differed markedly across the cases: storms were highlighted in Unst, storm surge in South Uist and sea level rise in Westray. Motivations are driven by the fundamental hazards and impacts affecting each community and are therefore different across the cases. The priorities of the case study communities were influenced by the specific climatic hazards that brought impacts and consequences to their respective islands. Additionally, different non-climatic issues and factors motivate each of the priorities identified in the case studies. Social issues such as peripherality and marginalisation, local economy and island sustainability haven driven priorities for adaptation. Social issues are similar in some instances, such as feelings of peripherality and marginalisation. However other issues, such as the particular challenges for island economies, are context-specific within each case. Climate hazards and impacts put extra pressure on existing sensitive non-climatic issues, thus producing significant social drivers behind priorities in adaptation.

Some thematic priorities vary across the communities. There was a marked difference in the way Unst and South Uist respondents prioritised safety and wellbeing in comparison to those in Westray. Westray participants anticipated that safety and wellbeing might become a significant priority depending on how sea level rise manifests in future. However, they felt that it did not require high prioritisation in current adaptation planning for Westray. Instead, they emphasised the maintenance of livelihoods alongside strategic planning and action to deal with erosion and flooding over ensuring community health and safety at the present. However, the theme of safety and wellbeing was strongly emphasised as an important priority by respondents in Unst and South Uist. For instance, Unst respondents prioritised the safety and wellbeing of vulnerable community members during storm events. The focus of concern for the vulnerable and elderly was also illustrated in the results of focus groups employed by Zsamboky *et al*. (2011) in which the impacts of climate change on disadvantaged coastal communities in the UK were investigated. Although Westray respondents mentioned safety and wellbeing in relation to sea level rise, and recognised that it might become a high priority in future, but they did not perceive this to be an immediate priority for the community at present. Therefore, the key themes were mostly significant across the case studies with the exception of community safety and wellbeing.

Although some themes appear consistently across the case studies, participant interpretation of these themes appears to vary slightly across the communities. For example, operationalizing adaptation is a significant priority in each community. However, it is motivated by different place-based climate hazards and impacts. Therefore, the matter of 'operationalizing adaptation' in practice means something different for each community. Operationalizing adaptation in South Uist means implementing a long-term adaptive solution to the South Ford

causeway to avoid future consequences similar to those of the 2005 storm. In Unst, operationalizing adaptation relates to strategic emergency planning. Operationalizing adaptation in Westray means monitoring and responding to coastal erosion and inundation. The limitations and challenges faced by the case study communities for operationalizing adaptation are noticeably similar but the technical goals for adaptation are different. Although the general thematic priorities for adaptation are similar in some ways across the cases, there are distinct differences in the specific motivations and sub-priorities for adaptation. Priorities and motivations are not entirely uniform. Each case study community has a unique story to tell about impacts and consequences of climate change.

6.2.3. Summary

The priorities for adaptation could be interpreted as consistent, or at least similar, across the case studies. Indeed, in the theme of community empowerment, corresponding priorities are rooted in similar social issues and challenges across the cases. However, when considering the results of the data in greater detail, the picture of adaptation in small island communities becomes more complex. The same general cross-case adaptation themes might be identified. However, the way in which communities perceive and prioritise these themes is markedly different across the cases and is dependent on specific island histories, community experiences and socioeconomic situations. Furthermore, there are unique motivations underpinning community priorities in each case study. As discussed above, all three communities believed lives and livelihoods to be a significant priority for adaptation. However, the specific motivations underpinning this priority were varied and diverse across the communities. Analysis of qualitative data has identified the subtle differences between the case studies that could be crucial to effective planning that upholds the values of island communities. A one-size-fits-all national plan could be successfully applied at the island scale provided that planners and decision-makers at the local authority level acknowledge island-specific issues for adaptation and utilise national adaptation instruments accordingly. However, one-size-fits-all adaptation strategies might overlook the subtle and unique differences of communities within the Scottish Islands. The implications for adaptation theory and planning are further developed in Section 6.6.

6.3. The Role of Scale in Adaptation

The concept of scale is at the centre of priorities for adaptation in the case studies. If the role of scale is better understood it could serve to address current challenges for adaptation in small island settings. Developing networks and defining responsibility are practical components of adaptation, both of which link directly to scale. The development of strong networks across scales can be beneficial for adaptation, whilst defining responsibility for adaptation can lead to the fair division of responsibilities across scales. In line with the first part of Research Question 2, this section will discuss the concept of scale as a factor that influences how adaptation happens in small island communities. The role of scale in adaptation is examined within the context of the case study communities and for

small island settings more widely. The relationship between the four grounded theory themes and the theory-led themes of developing networks and defining responsibility, as two key components of adaptation, are explored.

6.3.1. The Role of Scale in the Case Studies

Scale-related ideas dominated much of the dialogue during focus groups in all case studies. The main scales considered by participants were:

- The community scale
- The local authority scale
- The sub-national Scotland scale
- The national UK scale

In all case studies, the participants discussed how actors at the aforementioned scales could influence adaptation at the community level. Participants did not explicitly discuss supranational or international scales in relation to adaptation within their communities. This suggests that communities do not see interaction at supranational or international levels as a priority for community-scale adaptation. It can be inferred that although international and supranational frameworks eventually feed down to local and community levels via national and sub-national scales (Figures 1.4 and 1.4.i, Chapter 1), communities perceive themselves as far removed from international or supranational actors. However, actors and instruments at the local authority, sub-national and national levels are significant for adaptation at the community level.

The four themes that emerged from the data, outlined in Chapter 5, are closely linked to issues of scale. In particular, the data shows that community empowerment and operationalizing adaptation concern relationships between different actors across scales within the multi-level governance of adaptation. Within community empowerment, issues and priorities are fuelled by perceptions of inequalities across scales. All three case study communities felt marginalised on planning and funding agendas as a result of poor communication with other levels, particularly the relevant local authority and central government. Spatial scale, in relation to geographical remoteness, also contributes to feelings of peripherality in Unst and South Uist, thus further motivating the priority of empowerment in these particular case studies. The case study communities are limited in their capacity to adapt to the impacts of climate change. They are constrained by financial, technical and logistical limitations and are therefore reliant on local authority and central government scales for support. However, the empirical evidence suggests disconnect between community-level issues in peripheral islands and the planning agendas of local authorities and central government. Limited coordination across scales currently acts as a barrier to operationalizing adaptation that incorporates specific community-scale priorities and issues in the case studies. Additionally, ineffective cross-scale communication of local issues has hindered island adaptation and local development. The way forward lies within improved communication and cooperation across scales.

Additionally, scale is a significant factor within the grounded themes of ensuring safety and wellbeing and maintaining lives and livelihoods, although to a slightly lesser extent than empowerment and operationalizing adaptation. Participants in Unst and South Uist identified safety and wellbeing as a significant priority within their communities. However, they felt that the respective local authorities had not sufficiently accepted responsibility for ensuring community safety. Although both communities have some internal capacity for ensuring safety and wellbeing during storms and flooding, they ultimately rely on the local authority for support but respondents felt that sufficient guidance had not yet been received. Furthermore, participants discussed how the issue of scale has affected island lives and livelihoods. Like the arguments made for operationalizing adaptation, participants felt that the maintenance and enhancement of island lives and livelihoods had been hindered by limited understandings across scales of island-specific issues. The long-term sustainability of small-island settings could be better assured through enhanced cross-scale communication of local issues between community and local authority levels, as well as with central government. In turn, this could provide a solid basis for effective adaptation.

Scale plays a key role in the priorities for adaptation highlighted by participants in the case studies. The communities in question are dependent on other scales for support in adapting to impacts of climate change. National government, central government and, to an extent, local authorities have access to funding, resources and technical knowledge. They also possess the power and influence to drive adaptation and to address issues that are outwith the scope of community capabilities. However, the case study communities felt that they had not yet received sufficient support and guidance for adaptation from authorities at local, sub-national and national scales. The communities believed that mutual communication and cooperation across scales is currently inadequate and that adaptation planning does not effectively consider community-scale issues. Whether this is a perception or a representation of reality, it arguably needs to be attended in order to generate progress in adaptation. Respondents in all three case studies also felt that the division of responsibility for aspects of island adaptation had not yet been clearly accepted or defined across community, local and sub-national scales. Inequalities of scale have contributed to feelings of marginalisation and misrepresentation on local, sub-national and national adaptation planning agendas. Ultimately, the challenges of scale motivate priorities for adaptation across the case studies.

6.3.2. The Role of Networks and Responsibility in Addressing Issues of Scale

Based on the empirical evidence, two main scale-related challenges exist within all three case studies: (1) communication across scales and (2) the division of responsibility across scales. As illustrated in Chapters 2 and 5, developing networks and defining responsibility are two key components of adaptation. Improved communication across multiple levels can lead to the development of robust and reliable cross-scale networks. Chapter 2 explored the importance of strong networks and the significance of fairly divided responsibility for successful adaptation according to the existing literature whilst Chapter 5 illustrated the

significance of these components within the real-world contexts of the case studies. Both components are strongly related to the challenges of scale identified in the study islands.

The development of networks across scales is an important factor for adaptation in the case studies. The lack of strong networks across scales, particularly in terms of communication and coordination between the community and local authority, was identified as a key problem in all case studies. Limited communication and coordination across scales was highlighted as an issue underpinning all four grounded themes. Participants in Unst, South Uist and Westray felt that communication was insufficient across scales and desired a more coordinated approach to adaptation between the local authority and community levels. Respondents in all case studies indicated that they desire stronger links with local council and central government. Effective networks already exist within the community scale due to the connections, relationships and bonds amongst community members. These strong horizontal networks have contributed to high social capital at the community scale. However, the strength of networks across other scales could be improved according to the empirical evidence. Consequently, it is clear that the dominance of top-down approaches by local authorities (evidenced in the Climate Change Reports 2017, Chapter 1) is not currently functioning effectively for successful adaptation of small-island communities, the implications of which are discussed in Section 6.6. Indeed, inadequacies in communication serve to exacerbate challenges of scale, such as marginalisation, and produce adaptation planning that does not consider community needs. The development of vertical networks across multiple scales, through improved communication and coordination, is essential for addressing the challenges of scale related to adaptation in small island settings. This coheres strongly with the findings of Nunn *et al*. (2014) which called for increased cross-scale communication to overcome barriers to effective adaptation in peripheral Pacific island settings.

Defining responsibility is also a significant factor for effective adaptation in the case studies. The empirical evidence suggests that responsibility for adaptation has not been fairly or clearly distributed across scales in Unst, South Uist and Westray. Although respondents described community assets in the form of social capital and local knowledge, each case study community is limited in their capacity to respond and adapt to the impacts of climate change. This is a significant pitfall of high social capital at the community scale. Communities with high social capital may appear resilient to external bodies existing outwith the community at other scales, but their capacity to adapt remains constrained by island-specific issues, a finding which reflects the empirical work of Johnston (2014) in Fijian communities and Petzold (2016) in the Isles of Scilly. If it appears outwardly that communities can utilise high social capital – in the form of social bonds, connections and local knowledge - to respond and adapt to impacts of climate change, it could lead governing bodies to perceive them as highly capable of managing their own adaptation. Imbalanced responsibility is then placed on communities if they are perceived to be 'coping' which could exacerbate marginalisation (Kilpatrick and

Falk, 2003; Green *et al*. 2010). However, the case study communities clearly expressed their limitations for community-led adaptation. Even established community-led organisations like Storas Uibhist, Unst Partnership and WDT are not fully capable of bearing the majority of responsibility for adaptation. The responsibility and capacity of these organisations to implement adaptation measures at the community level is limited by financial, logistical and institutional constraints. It is not within their remit to take full responsibility for implementing adaptation measures. Responsibility must be fairly and transparently defined, distributed and accepted across a variety of scales if adaptation is to be effective in small islands.

Overall, network development and shared responsibility could serve to address each of the four overarching priorities identified by participants. If strong networks are in place and responsibility for adaptation is fairly distributed across scales:

- Community empowerment could be better facilitated and developed
- Safety and wellbeing could be successfully addressed
- Island lives and livelihoods could be better communicated and understood by decision-makers within local authorities and central government
- Effective adaptation to address the impacts of climate change could be operationalized in practice

The concepts of network development and defining responsibility are inherent within the key grounded themes. Both are essential precursors to addressing challenges of scale in the case studies. Effective adaptation can happen if the grounded themes are addressed through the development of strong networks and shared responsibility across scales.

6.3.3. Summary

The role of scale is largely similar across the case studies, although specific scale-related challenges manifest in slightly different ways due to the varying contexts of each case study. Participants in South Uist feel that community priorities for adaptation to storm surge following the events of 2005 have been largely overlooked at local authority and central government scales. Conversely, Unst participants believe that the local authority, central government and external sub-national agencies have not taken appropriate responsibility for adaptation to storms. Westray respondents feel that adaptation action to tackle impacts of sea level rise, such as coastal erosion, has been hindered by ineffective streams of communication across scales, particularly between the local authority and community levels. Despite differing backgrounds and contexts, challenges of scale are significant for adaptation in each case study.

Limited communication and inequalities in responsibility across scales represent the main problems faced by the case study communities. Consequently, respondents in all three case studies currently view scale as a barrier to adaptation.

Based on this finding, scale interactions can be posited as a potential barrier for adaptation in Scottish island communities more widely as well as small island settings generally. In the case studies, challenges of scale have hindered the development of adaptation that reflects community needs. Communication is not currently functioning to an adequate extent across scales in the case studies. Opportunities for communicating up to local authority and central government scales would be beneficial for adaptation in small island communities. Equally, consistent top-down communication is also important. This corresponds with the findings reported by (Suckall *et al*. 2014) where inadequate governance to facilitate cross-scale cooperation was found to inhibit effective adaptation at the community scale in Zanzibar. Similarly, responsibility for adaptation is not transparently divided and accepted across scales at present. If relationships across scales were to become more flexible, responsive and cooperative it would lead to adaptation that is supportive of community needs and considerate of community limitations.

Scale need not hinder adaptation. If issues of scale are addressed in adaptation, functions across scales could be deployed advantageously where each scale works to its strengths and knowledge is shared from both the top-down and the bottom-up to produce effective adaptation in small island communities. Developing networks and defining responsibility are key components that could be used to address challenges of scale in adaptation. In the case studies, it appears that horizontal networks are strong within communities but vertical networks are limited across scales. The latter needs to be addressed and strengthened. If both horizontal and vertical networks are strong, and responsibility is clear and just, challenges of scale can be addressed and effective adaptation can begin to happen. These practical components need to be in place in order to bring remote island community adaptation onto the planning agendas of local authorities as well as central government and national government. Adaptation can only happen when issues of scale are resolved and the practical components of adaptation are properly put in place. Effective long-term adaptation strategies could begin to emerge if challenges of scale are first resolved in small island communities. Adaptation planning for Scottish island communities needs to take challenges of scale into account, a discussion of which is provided in Section 6.6.

6.4. The Role of Community Perspectives and Societal Values in Adaptation

Community perspectives are key to understanding issues, factors, motivations and priorities for adaptation in small island settings. Not only can community perspectives highlight key climate impacts that have had significant consequences locally, but they can also serve to illustrate the social, economic and cultural issues driving priorities for adaptation. Upholding societal values in planning can be a potential pathway for successful adaptation. Participatory processes, in which community perspectives are considered and explored, are an essential element of upholding societal values in adaptation. Societal values are best understood through direct interaction with human groups. Transformation offers an additional potential pathway that integrates adaptation into other non-

climatic forms of development planning. This section explores the role of community perspectives in adaptation. Additionally, it discusses the relationship between community perspectives and upholding societal values - a potential pathway for adaptation in small island communities. It also considers the role of transformation in small island communities, based on the community perspectives gathered in the case studies.

6.4.1. Exploring Community Perspectives in Scottish Island Case Studies

The research employed an engagement-led approach to the collection of qualitative data in the case studies in order to tackle Research Questions 1 and 2 set out in the introductory chapter. A key research goal was to explore community experiences of climate change and to understand how community values link to adaptation in the case studies. Therefore, community perspectives were central to understanding the factors and issues that influence how adaptation happens in the study communities.

Community members provided first-hand accounts of local climate impacts and identified significant community priorities for future adaptation. Community perspectives can provide insight into the unique issues and values within a certain place. Community perspectives can also offer reasons to explain precisely why specific issues are prioritised and valued. In the present study, the overarching themes for adaptation are largely similar across the case studies. However, in spite of similarities, priorities are valued in different contexts across the case studies. Fundamentally, the impacts and consequences of climate change vary across the communities. Community perspectives illuminated similarities and differences and served to explain the context of adaptation priorities within each case study.

Taking a grounded approach, the researcher did not attempt to produce or impose predefined themes within the case studies. Participants were able to freely discuss their experiences of climate change and the key community issues for adaptation. The empirical data arose directly from community members within the case studies. It was produced solely from the experiences, values and opinions of participants in an attempt to measure perceptions. Subsequently, community perspectives led to the emergence of grounded themes during data analysis. The key themes and priorities reflect the significant climate-related issues that have been experienced within each community in the words of the community members themselves. The research could have undertaken a survey-based approach to understanding issues and priorities for adaptation in small island communities, but this would have established adaptation factors *a priori* and focused more on the household rather than community scale. A set of predefined themes would have restricted the ability of the research to uncover underlying social processes which significantly affect adaptation. This type of top-down approach could potentially overlook significant community issues. A key justification of the research approach was to develop an unbiased understanding of the issues, factors, motivations and priorities for adaptation and to gather research data through direct interaction with community members.

Community perspectives do not represent scientific or technical forms of understanding. They are not based on scientific research and, indeed, contain an element of subjectivity. However, community perspectives can provide important information about the social issues surrounding climate change and about how impacts of climate change affect people within small communities. Community perspectives can also give insight into small-scale factors and priorities for adaptation. Not only that, but community perspectives can explain why these issues, factors and priorities are important to allow for deeper understandings of how climate change affects small island communities. This information cannot be gained from scientific climate or coastal data but only from the communities themselves. Top-down approaches to adaptation planning that utilise only hard scientific data might fail to consider significant climate-related issues at the community scale. Community perspectives tell us about the significant climate and non-climate issues of importance within communities. The consideration of community perspectives can lead to adaptation that is better targeted towards significant community issues and priorities. Therefore, bottom-up participatory approaches are vital in adaptation, the implications of which are explored in Section 6.6.

6.4.2. The Role of Societal Values and Transformation in Adaptation

6.4.2.i. Upholding Societal Values

As discussed in Chapter 2, upholding societal values is a potential pathway to producing adaptation planning and practice that reflects the ideals of human groups. Societal values are the issues and subjects that are of the highest importance and significance to human groups. The direct consultation of community perspectives is essential for understanding societal values for adaptation within small island communities. It is important to note that the empirical results represent the prevailing community perspectives in each case study island. This does not necessarily mean that perspectives are uniform across each case study community. Indeed, it is likely that minority views exist in each community that vary to the dominant perspectives found within the empirical data. However, interaction with participants via multiple focus groups has led to the emergence of perspectives that are common across the focus groups in each island. Therefore, these can be thought of as the dominant community-level view within each case study.

Factors and priorities for adaptation are driven by social ideals, although there is a degree of variation in social values for adaptation across the case studies. All three communities valued sustaining general island life, but Unst and South Uist participants also valued the safety of community members whilst Westray respondents did not. Instead, participants in Westray valued safeguarding cultural heritage. Therefore, some social ideals are place-specific across the case studies. Although financial support was highlighted as a priority for operationalizing adaptation, the key issues and factors for small-island adaptation do not lie entirely within financial solutions. Simply injecting money into island-level adaptation is not an effective means of addressing the significant social issues

illustrated within the case studies. The work of Starc and Stubbs (2014) in developed Croatian islands tallies with this argument. Similarly, in line with Tol *et al*. (2008), the answers for tackling small-island adaptation do not necessarily lie in purely technical solutions such as hard coastal defences. There needs to be an emphasis on understanding community perceptions of disempowerment and considering island-scale social ideals in planning if adaptation is to be truly effective in future.

Evidence from the case studies indicates that adaptation planning and action does not currently reflect the values and priorities of the case study communities to a thorough extent. Therefore, based on cross-case analysis, it can be inferred that upholding societal values - as a component of adaptation – might not be happening to a sufficient degree in small island settings within the Scottish Islands. If planning takes social values into account, it could lead to adaptation that is appropriate to deal with climate impacts at the community scale based on place-specific issues. Inadequate consideration of community values and priorities can be posited as a key factor explaining why the case study communities feel marginalised within local authority and central government planning agendas. However, the marginalisation of small island communities could be addressed if adaptation planning were to consider and uphold community values, a notion that aligns with the work of Kelman (2010) and Adger (2016). In order to do so, the practical components highlighted in Section 6.3 should first be in place. Societal values can be included and upheld within small island adaptation if suitable networks and shared responsibility are in place across scales. In turn, this could lead to successful adaptation that reflects the social values and ideals of small island communities.

6.4.2.ii. Transforming Societies

As explored in Chapter 2, transformation is a potential pathway towards adaptation that is based on long-term, flexible adaptive planning integrated with non-climatic development goals. Ideas around transforming societies were indirectly raised in each case study. Participants across the cases talked about the ways in which planning could take an overarching approach through the integration of significant non-climatic issues into adaptation. However, in comparison to the other themes of developing networks, defining responsibility and upholding societal values, the issue of transformation was less significant within the case studies on the whole. Participants perceived their ideas related to transformation as far-off solutions that might eventually be reached in future if other adaptation challenges were first addressed. To elaborate, the empirical evidence indicates that strong networks, fair responsibility and upheld societal values need to be addressed first in order to pave the way for transformative approaches in future. In essence, other adaptation challenges need to be dealt with initially before transformation can be considered in the case studies. Participants saw transformative approaches as an end-goal that might be achieved in the long-term, but the other components of adaptation were highlighted with greater urgency.

An alternative perspective could be that transformation might offer a means of addressing challenges of scale in adaptation. However, based on the empirical evidence produced within this research, community understandings focus on upholding societal values in adaptation using networks and responsibility as pillars to do so. This particular route towards adaptation is not without its challenges but when networks are strong, responsibility is shared and values are upheld, then transformative approaches have a solid basis on which to develop. Transformation is then the next step towards adaptation that is integrated into a wider long-term strategy for development. Such a finding refutes debate by some key thinkers (Nurse and Moore, 2005; Berrang-Ford *et al*. 2011) that transformation and mainstreaming can be a means of solving existing challenges in adaptation. Aiming for transformation without first addressing existing problems such as social marginalisation and inadequacies in communication across scales could be problematic, as these issues indicate that structures are not sufficiently in place to support such an approach. An overarching approach to adaptation is required in the long run, but challenges surrounding networks, responsibility and values arguably need to be dealt with first to create a springboard for transformation as an ideal goal in adaptation.

6.4.3. Summary

Community perspectives play a key role in identifying and explaining the factors, issues, motivations and priorities for adaptation at the community scale, as demonstrated by the results of the qualitative, community-focused approach adopted within this study. By exploring community perspectives in the case studies, it was possible to identify factors and priorities for adaptation and to understand the reasons underpinning differences and similarities across the cases, therefore addressing Research Questions 1 and 2. Community experiences, perspectives and knowledge might not be scientific or technical, but they are important for understanding the consequences of climate change within wider social non-climatic contexts in small island settings. This finding aligns with thinking by Medina *et al.* (2007) who argue for the incorporation of traditional island knowledge in adaptation. Without interaction with community members on the ground, it is impossible to comprehend the social, economic and cultural values of small island communities. Upholding societal values in planning offers a pathway to effective adaptation that reflects community priorities and local issues. However, societal values can only be upheld in adaptation if the values themselves are directly identified and understood by planners and decision-makers. Furthermore, transformative approaches that integrate adaptation into other forms of development planning could be a potential pathway towards successful adaptation in future. However, transformation can only happen when strong networks are in place and when responsibility for adaptation is clearly and fairly defined, accepted and distributed across relevant scales. Based on the empirical evidence, the concept of transformation is currently less significant within the case studies in comparison to other components of adaptation. Transformation is an ideal end-goal. However, societal values need to be included within adaptation,

facilitated by network development and shared responsibility, before transformative approaches can be applied successfully.

6.5. The Role of Vulnerability Mapping in Scenario-Based Community Engagement for Adaptation

Community engagement is a fundamental element of bottom-up approaches to adaptation that consider community perspectives. In order to gather community perspectives, and thus to understand social values, it is imperative to engage with communities on the ground. Vulnerability mapping is a scenario-based tool that could be utilised in planning to understand climate-related issues at the community scale. The research seeks to determine the role and utility of climate projections and vulnerability mapping when used as tools for scenario-based community engagement in adaptation at the small island community scale, using a Scottish island case study. Furthermore, a key goal is to understand how scenario-based community engagement can contribute to adaptation planning in small island settings. This section provides a discussion of the results presented in Chapter 4. The role and utility of vulnerability mapping and climate projections as scenario-based tools for community engagement in adaptation is explored here. In particular, the section considers how scenario-based tools might be used within bottom-up participatory adaptation approaches as a means of identifying and upholding societal values in planning. Furthermore, the section evaluates the potential for scenario-based tools, such as those applied within the current study, to be used as a means of tackling challenges of scale in adaptation. Overall, the section addresses Research Question 3, as set out in Chapter 1.

6.5.1. Analysing the Utility of Scenario-Based Tools in the Case Studies

Climate projections and vulnerability mapping are useful scenario-based tools for prompting and encouraging community-level discussion about adaptation to current and future climate impacts. Respondents in Westray actively engaged with the vulnerability map. In particular, respondents intuitively linked the mapped output to their own experiences of climate impacts at the coast and personal knowledge of the coastline around Pierowall Bay. Participants used their knowledge and experiences to argue that vulnerability to sea level rise could be higher in reality for specific areas of Pierowall Bay compared to the rankings of hypothetical vulnerability displayed on the map. Community experiences of climate impacts and knowledge of coastal land can highlight local issues that might be overlooked in approaches using solely scientific climate and coastal data. For example, the area of Broughton was ranked as 'medium' vulnerability because this section of the bay is composed of low-lying rocky coast. However, participants highlighted that the exposed nature of the coastline at Broughton has led to instances of coastal inundation in the past. Therefore, they believed that a ranking of 'high' vulnerability should be applied to the Broughton area in the mapped output. As a result, vulnerability mapping is a useful tool for exploring real-world community experiences of climate impacts. Such perspectives can provide valuable

information for adaptation planning but cannot be collected from desk-based data alone.

The effectiveness of vulnerability mapping and climate projections as scenario-based tools largely stems from the fact that both were presented in conjunction with one another during the Westray focus groups. The combined approach using both sea level projections and vulnerability mapping led participants to intuitively begin to prioritise issues of importance around Pierowall Bay in relation to future impacts of sea level rise in vulnerable areas. If presented in isolation, the map might have seemed abstract and challenging to comprehend. However, the use of UKCP09 sea level projections helped to provide climate-related context for the rankings of vulnerability. It was important to specify the precise hazard to which Pierowall Bay might be vulnerable. Therefore, sea level projections gave context to the vulnerability map and helped to focus discussions amongst participants. When used in conjunction, the projections and map provided a relatable representation of potentially vulnerable areas across Pierowall Bay. Vulnerability mapping, even when hypothetical in nature, provides an effective means of illustrating potential scenarios of future climate impacts and of how communities might be affected. If only one type of tool was used in isolation, it might have had a different effect on engagement. Vulnerability mapping offers a way in which to represent potential change in a manner that can be easily comprehended by non-expert groups. In future, vulnerability mapping could be improved with the inclusion of sea level rise scenarios plotted directly on to the map. Suggestions for further development of vulnerability mapping are discussed in Chapter 7.

6.5.2. The Role of Climate Projections and Vulnerability Mapping in Adaptation

Vulnerability mapping and climate projections can be used as tools within scenario-based engagement to address challenges of scale for adaptation in small island settings. In particular, climate projections and vulnerability mapping could be effective practical instruments for developing networks across scales. Community engagement that utilises vulnerability mapping and climate projections could be a means of passing projected climate information and guidance from the top-down to the community level, whilst also providing an opportunity for bottom-up communication of community-level knowledge and values. The conversations that happen during community engagement could influence adaptation planning and practice. However, it is important that top-down perspectives do not dominate instances of community engagement and that communication is truly mutual between decision-makers and community members, a finding that coheres with the stance of Urwin and Jordan (2008) for mutual two-way approaches to adaptation.

Vulnerability mapping and climate projections can also be used to facilitate the identification of societal values in adaptation. These tools encourage community participation, as evidenced in the empirical results. Thus, the tools can be used to explore social values and priorities for adaptation in small island communities. Engagement itself can be a step towards developing strong networks

across scales. If decision-makers undertake community engagement using vulnerability mapping and climate projections as scenario-based tools it could serve to strengthen communication and connections across scales. The work of Chilvers *et al.* (2014) tallies with this finding, in which engagement is seen as an advantageous practice for enhancing cross-scale relationships. However, engagement alone is not enough for truly addressing challenges of scale in adaptation. It is imperative that the societal values identified during community engagement are then acknowledged and upheld in planning in order to strengthen and validate connections made across scales. If engagement is undertaken but planning fails to adequately incorporate the social values and priorities identified at the community scale, it could lead to continued and augmented perceptions of marginalisation by small island communities, as hopes are raised by participation but then go unfulfilled. The outcomes of community engagement must be reflected in planning if issues of scale are to be tackled. Therefore, not only can vulnerability mapping and climate projections be considered as useful tools for encouraging active participation at the community level, they are also beneficial practical instruments for developing networks and identifying societal values at the community scale.

6.5.3. Summary

Scenario-based community engagement is an effective technique for gathering and understanding community perspectives on adaptation. As part of scenario-based engagement, vulnerability mapping combined with climate projections can encourage communities to consider how climate impacts might affect their local area in future. These scenario tools look at more than just current impacts of climate change. Vulnerability mapping and climate projections prompt community members to consider and anticipate the potential consequences of future change. In this way, the outcomes of scenario-based community engagement can contribute to adaptation planning that anticipates the real-world community-level consequences of future climate impacts. In turn, adaptation can anticipate how future impacts and consequences might affect small island communities. Additionally, vulnerability mapping and climate projections could be used to support network development and the preservation of societal values in adaptation planning. Ultimately, bottom-up participatory adaptation approaches could utilise these scenario tools as a means of identifying and upholding societal values at the community level.

6.6. Implications for Future Adaptation Theory and Practice

The implications of the research findings for adaptation theory and practice have been alluded to throughout this chapter. This section explicitly discusses the consequences of the key findings for future adaptation theory. In particular, one-size-fits-all vs. place-based adaptation is considered in light of the research findings. Furthermore, the research considers the relationship between top-down and bottom-up approaches and points to the requirement for community perspectives in adaptation - a finding that is examined in this section. Implications

for the key theoretical components of, and pathways to, successful adaptation are presented here. In addition, the practice-relevant implications for future adaptation planning in Scotland are explored, namely the need for unique place-based priorities to be considered in planning; the requirement for practice-based approaches that address issues of scale; and practical tools that can be utilised to explore and include societal values in planning.

6.6.1. Implications for Future Adaptation Theory

6.6.1.i. Adaptation Strategy for Small Island Settings

Community-level issues, factors, motivations and priorities for adaptation have implications for one-size fits-all theory in small island locations. Adaptation priorities are similar across the case studies but are not always uniform in terms of importance. The themes show that despite commonalities, social contexts vary across the cases. Although priorities might appear similar, the specific issues and factors for adaptation are unique to each community. Furthermore, motivations underpinning adaptation priorities differ across the case studies. This has implications for approaches to understanding how adaptation can happen effectively in small island settings.

When considering the results of policy mapping, it appears that a variety of actors and instruments are available across national, sub-national and local scales that could be employed for effective adaptation at the island level. However, the focus group data highlights that the case study communities currently feel marginalised on adaptation planning agendas and indicates that current adaptation practices do not fully reflect community-level issues and priorities. This suggests that, despite the existence of instruments and actors for adaptation at the local (island) scale, the one-size-fits-all policy and planning offered by national government, central government and local authorities within these instruments is not necessarily translating into adaptation that upholds societal values in practice at the small island scale.

In theory, certain components of one-size-fits-all national and sub-national policy can be applied to address specific adaptation issues at the island level. For example, the annual Climate Change Reports produced by SIC, OIC and CnES are influenced by national and sub-national policy instruments and seek to report on local authority planning and action for adaptation. However, the issues that have been identified within the most recent Climate Change Reports do not tally strongly with the local priorities that have been revealed in this study. Specific gaps within the Climate Change Reports are discussed in Section 6.6.2. It is possible that limited vertical networks across scales have contributed to gaps between the planning set out in local-level instruments and the priorities of the case study communities. The development of strong vertical networks across scales, through improved multi-level communication and coordination, could serve to address community-level issues, factors and priorities for adaptation. Furthermore, the improved utilisation of available instruments is needed,

especially at the local authority level, if adaptation is to comprehensively incorporate small-island issues.

The question remains: what does this mean for one-size-fits-all theory? The results of the study indicate that national adaptation strategies provide components and instruments that can be used to facilitate adaptation at sub-national and local scales, as evidenced in Figure 1.4 (Chapter 1). This coheres with the analysis provided by Dronkers and Stojanovic (2016) which details the strong steer that national adaptation strategies provide to local adaptation in North Sea coastal contexts. However, limited vertical networks potentially constrain the application of these instruments in a way that sufficiently considers island-scale factors, issues and priorities for adaptation. National strategy offers a range of adaptation options, certain aspects of which can be applied within local-scale planning to address specific island issues. However, the results of this study indicate that there is currently a mismatch between the constituents of local authority adaptation planning and island-level priorities and issues. It is the responsibility of actors across scales, particularly those within local authority and central government, to ensure that local adaptation meets island-level needs through improved communication and coordination as part of strong networks across scales. When applied without consideration of place-based issues and priorities, one-size-fits-all adaptation does not result in effective adaptation in small island settings. However, one-size-fits-all national adaptation planning can be applied successfully at the small-island scale if central government and local authorities ensure that the components derived from national strategy reflect island-level issues. This coheres strongly with the findings reported by Chapin *et al.* (2016) for coastal communities in Alaska. Furthermore, this argument refutes the findings presented in the work of McLeman *et al*. (2011) and Robinson (2015), both of which consider one-size-fits-all planning to be inappropriate and ineffective for adaptation at the local community scale.

6.6.1.ii. Community Perspectives in Adaptation

The research findings have implications for theory on participatory processes and community perspectives in adaptation. Participatory processes are a tool for gathering community perspectives and in turn understanding the place-based issues, values and priorities of a small island community. However, participation is not merely consultation. Instead, participation is a two-way mutual process by which a shared stream of communication is opened up across scales and where community perspectives are understood and valued. Participatory processes are not without challenges. It is the responsibility of those initiating participation, such as planners and decision-makers, to ensure that processes are ethical, fair and inclusive. Truly bottom-up participatory processes are those that listen to community perspectives but also incorporate these into effective planning and action. In this way, participatory processes can be used to involve community perspectives in adaptation agendas.

Furthermore, the inclusion of community perspectives in adaptation practices can aid the development of key practical components: developing networks and defining responsibility. Engagement to gather local perceptions is in itself a step towards developing vertical networks and defining responsibility across scales. Moreover, societal values can be addressed in small-island adaptation if community issues and ideals are identified. Policy and planning cannot begin to identify and uphold societal values in small-island adaptation without first directly communicating with the people living in island settings. Therefore, community perspectives play an important role in upholding societal values in adaptation.

In the case studies, current adaptation practices do not fully reflect the island-level issues, factors, motivations and priorities for adaptation conveyed in the empirical data. Participants believed that small-island issues had been overlooked within decision-making at local authority and central government scales, in turn contributing to strong feelings of marginalisation and peripherality. The results of this study suggest that community perspectives are not currently incorporated to a detailed extent within adaptation planning and action for the case studies, particularly in Unst and South Uist. For example, South Uist respondents believed that community priorities relating to the South Ford causeway had not yet been translated into action that reflects community values. The involvement of community perspectives in adaptation processes could help to reduce feelings of marginalisation and peripherality in small island communities, in turn enhancing community empowerment - a theme of similar significance across the case studies. The work of Kelman (2010) strongly corresponds with this finding, particularly the utility of participation as an opportunity for empowerment at the small-island scale. However, the only way to truly understand and include small-island issues, factors, motivations and priorities for adaptation in policy and planning is to engage directly with communities. For this reason, community perspectives should be an integral component for understanding adaptation in small island communities. In terms of one-size-fits-all theory, small-island issues and priorities need to be upheld within planning and implementation by local authorities if national adaptation strategies are to be successful. However, issues and priorities can only be deduced through the gathering and understanding of community perspectives.

6.6.1.iii. Bottom-up versus Top-down Approaches in Adaptation

A substantial degree of debate exists around the merits and drawbacks of bottom-up and top-down approaches to adaptation. Based on the results of this study, it is argued that bottom-up approaches alone are not entirely sufficient or appropriate for two reasons: (1) responsibility cannot be placed entirely on the communities for informing adaptation planning and (2) community perspectives are subjective. It is important to include scientific and technical information alongside community perspectives in adaptation planning in an integrated approach. Approaches that are entirely top-down in nature are also inappropriate and insufficient for adaptation in small island communities because they omit key

social information that can only be gathered through the consultation of community perspectives. Furthermore, as discussed in Sub-Section 6.6.1.i, current top-down approaches to adaptation in Scotland, using a one-size-fits-all national strategy, have led to disconnect between planning by local authorities and community-level priorities at the small island scale. Evidence from the case studies indicates that current adaptation strategy in the Scottish Islands does not yet incorporate island-level issues and priorities to a thorough extent.

Ultimately, a combination of both top-down and bottom-up approaches needs to be applied within adaptation planning and practice. This finding corresponds with the work of Aswani *et al.* (2015) which highlighted the need for increased integration of both top-down and bottom-up approaches for adaptation in island settings using the Western Solomon Islands as a case study. Both approaches should be used in conjunction with one another. The grey area between the two is where effective adaptation can happen: where communities are supported and guided by local authorities from the top-down through mutual connections that also allow for the communication of community priorities from the bottom-up. However, an approach to adaptation that balances both bottom-up and top-down methods is not a simple or straightforward process. There is a fine balance to be struck. Improved communication through network development and the fair division of responsibility could provide an opportunity for addressing the gap between bottom-up and top-down approaches. Networks and responsibility need to be consistent, fair and clear. If networks and responsibility are consistently developed and proportionately shared by groups at the appropriate scales, a balance can be struck between bottom-up and top-down approaches. Addressing the gap between both approaches is key to effective adaptation planning and action.

6.6.2. Implications for Future Adaptation in Practice

Of the three local authorities in the case studies, none have produced an explicit plan or strategy that is dedicated specifically to climate adaptation. Climate change reporting has been, and will continue to be, undertaken in response to central government legislation. This provides an indication of adaptation-related actions that have been undertaken to address climate change, as well as some priorities for future adaptation, and builds a picture of how adaptation is happening in the case studies from a local authority point of view. However, the reports do not set out a formal plan or strategy for adaptation. In terms of other local authority documents, it appears that whilst local flood risk management plans and local development plans allude to adaptation in some ways, these documents are not set out to deal with adaptation directly and there is no formal local authority plan for adaptation in any of the three case studies.

The most recent Climate Change Reports published by SIC, OIC and CnES in 2017 show that top-down approaches have dominated adaptation planning and action by all three local authorities, as highlighted in Chapter 1. The majority of actions listed in the Climate Change Reports by SIC, OIC and CnES are top-down in nature, although OIC also clearly prioritise community-scale engagement and

bottom-up approaches for moving forward with future adaptation in Orkney. There is some evidence of bottom-up approaches in the development of local flood risk management plans by each local authority through statutory consultation, and the significance of bottom-up approaches for addressing flood risk in the case studies has been highlighted in the LFRMPs. However, the statutory bottom-up approaches undertaken towards developing LFRMPs relate only to flood risk rather than adaptation. Based on the information provided in the Climate Change Reports, it appears that similar approaches have not yet been adopted by the relevant local authorities for adaptation in the case studies, with perhaps the exception of OIC.

In the Climate Change Reports, the actions and priorities outlined by each local authority do not always align strongly with the specific community issues and concerns highlighted by participants in the case studies. In Shetland, for example, a mismatch was noted between topics such as building safety standards highlighted in council plans and more practical needs of emergency planning highlighted by the Unst community. Similarly in South Uist, flood risk management has been undertaken by CnES but community-level priorities around the safety of the South Ford causeway remain unresolved. In Orkney, OIC have considered community-level priorities to an extent in terms of building community resilience and adaptive capacity. However, the empirical evidence suggests that mutual cross-scale networks require improvement for operationalizing adaptation in Westray. Additionally, the information provided in the Climate Change Reports suggests that other cross-case community-level adaptation priorities, such as addressing geographical peripherality and maintaining connectedness, have not been directly considered in local authority adaptation planning. Whilst local authority planning and practice currently addresses some of the broad themes emerging from the empirical data (mainly safety and wellbeing), the dominance of top-down approaches means that community-level issues are not yet being fully reflected in adaptation as evidenced in the recent Climate Change Reports.

The increased use of bottom-up approaches by local authorities could help to ensure that local planning considers and aligns with community-level issues, priorities and motivations for adapting to climate impacts. Bottom-up and participatory approaches to adaptation – where communities have a platform to communicate their values and priorities to decision-makers - are essential for the inclusion of community perspectives in adaptation. However, participants in the case studies highlighted a range of community limitations for adaptation, indicating that efforts cannot be focused solely at the community-scale in bottom-up approaches. Clearly, top-down approaches are also required in practice in Scottish island communities to provide support, technical information, guidance, strategic planning and funding for adaptation. As suggested in 6.6.1.iii, a combined approach of both top-down and bottom-up methods is ideal for adaptation in practice. For this to be successful, communication and cooperation are essential to building strong networks and sharing responsibility across scales. Subsequently, community priorities related to marginalisation and empowerment could be

addressed through increased consultation with and involvement of small island communities in planning processes.

Developing networks and defining responsibility are practical components of adaptation that should be applied to planning and practice by decision-makers within local authorities and central government in Scotland in order to address challenges of scale in the Scottish Islands. Successful adaptation can be operationalized in small Scottish island settings if stronger networks are developed across scales and if the division of responsibility for adaptation is clarified. The consideration of societal values in planning and practice can produce adaptation that meets community-level needs. However, societal values can only be incorporated into adaptation when reliable and fair relationships exist across community, local authority and central government scales. The inclusion of community-level issues and priorities in planning through the routes of network development and shared responsibility would lead to more effective adaptation in Scottish island contexts. Furthermore, adaptation policy, planning and practice in Scotland would benefit from clearer distinctions between climate 'hazards', 'impacts' and 'consequences'. This is important for both theory and practice. If network development is to succeed through clear communication, there needs to be better clarification of these terms in policy and planning as well as within the academic literature.

In terms of practical tools for adaptation planning, vulnerability mapping supported by climate projections is a useful technique for engaging communities in adaptation discussions. However, data is difficult to access by laypersons, community members, local stakeholders and local authorities. In some cases, such small-scale data does not exist at a sufficient level of detail for producing accurate vulnerability maps. Actual vulnerability to impacts of climate change cannot be fully comprehended by local authorities or community members if critical coastal data is not available or is inaccessible. This is a challenge for evaluating vulnerability in practice. Alternatively, as evidenced in the findings, mapping hypothetical vulnerability based on best knowledge is still a beneficial way of engaging with the community. It is also a useful tool to find out precisely what matters to the community for adaptation. A certain area might not appear particularly vulnerable in terms of physical factors on paper. However, community-level experiences of harm in such areas might mean that these locations are subject to greater climate-related risks than can be ascertained from desk-based methods. As a result, decision-makers can utilise similar scenario-based methods to explore local knowledge and community experiences that have the potential to inform planning.

Overall, the major themes underpinning factors and priorities for adaptation are similar across the case studies. On the surface, this might appear to suggest that general adaptation planning could be applied to the Scottish Islands as a whole. However, this type of planning approach could ignore the finer details and issues within each island unless community-level values are considered and upheld. Based on the empirical evidence, the values and priorities of small Scottish

island communities are not yet fully reflected in adaptation planning and action on the whole, thus contributing to feelings of social marginalisation in the case studies.

6.6.3. Summary

This section has illustrated and discussed the implications of the research for adaptation theory and practice. The findings indicate that national adaptation strategies in Scotland contain the necessary components and instruments for effective adaptation in island settings. However, one-size-fits-all approaches can only be successful in island settings if the components derived from national strategies lead to planning and practice that reflects community-scale issues, values and priorities. It is the responsibility of governmental bodies, such as central government and the relevant local authorities, to ensure that components of national planning are applied appropriately in small island settings. Community perspectives are therefore essential to this process. The application of national strategy at the local scale must be informed to some extent by community perspectives if a one-size-fits-all approach is to be effective. Island-level issues, factors, motivations and priorities for adaptation can only be identified through engagement and interaction with communities in a participatory approach. That being said, adaptation planning should not rely on participatory approaches and community perspectives alone. Scientific and technical data are also fundamental for adaptation planning and action. Both bottom-up and top-down approaches need to be undertaken in conjunction for effective adaptation that is suitably informed by policy, science and perceptions and where multiple scales are involved in adaptation from the national scale to the community level. Combining bottom-up and top-down approaches is not a simple process. However, network development and clear, fair divisions of responsibility can help in forming a balance between the two. In terms of practical tools, vulnerability mapping and climate projections are scenario-based methods for community engagement that could be utilised within vertical network development. The research shows that a certain level of disconnect exists between the priorities of small island communities in relation to current adaptation planning and action. If strong vertical networks are developed and shared responsibility is improved across scales, it could serve to address current gaps in adaptation practice in the Scottish Islands.

6.7. Conclusions

This chapter has presented and explored the key themes and findings arising from the results of the study. In line with Research Question 1, the chapter provided a synthesis and discussion of the motivations and priorities for adaptation in small island communities based on the case study results. The chapter also explained how and why commonalities and differences exist across the case studies. In effect, although similar cross-case themes were identified, the issues, factors and motivations underpinning priorities are not uniform across the cases.

In response to Research Question 2, the chapter discussed the underlying issues and factors influencing adaptation priorities in the case studies which led to a developed understanding of both the role of scale and the role of community perspectives for adaptation in small island settings. Scale currently acts as a barrier to effective adaptation in the case studies due to the need for clear divisions of responsibility and improved vertical networks across scales. If communication and cooperation are improved, especially between central government, local authority and community levels, it could serve to address challenges of scale in small island settings. Community perspectives and, by extension, participatory approaches are central to understanding island-level issues for adaptation and for producing adaptation that upholds societal values. Transformation could be a potentially successful pathway to adaptation in future but societal values need to be effectively included in adaptation processes before transformative approaches can be undertaken. Scenario-based community engagement that utilises climate projections and hypothetical vulnerability mapping could aid network development and the inclusion of community perspectives in adaptation planning.

The research findings have considerable implications for future theory and practice. In particular, it is possible that one-size-fits-all national adaptation strategies could be applied successfully in small island settings provided that planners within local authority and central government consider community-level issues and utilise appropriate components of national planning to reflect local values. Combining bottom-up and top-down approaches could be complex in practice but is essential to adaptation where communities are both guided and supported from the top-down and listened to from the bottom-up. Developing networks and defining responsibility could help to address key gaps in small-island adaptation practice within the Scottish context. The conclusions of the study including contributions to theory and planning, research limitations and scope for further research are presented in Chapter 7.

Chapter 7: Conclusions

7.1. Contributions to Existing Theory

The research makes a number of academic contributions to existing theory in adaptation. The findings related to Research Questions 1 and 2 fit within the literature on small island adaptation and participatory processes. In particular, the research contributes to the one-size-fits-all debate in adaptation. The research findings indicate that priorities and motivations might be similar across the case studies, but it is crucial to note that the issues and factors for adaptation are not uniform across cases. Different factors motivate adaptation and drive priorities in each community. Specifically, the key climate impacts that significantly affect each community are fundamentally different. This particular finding also contributes to the climate impacts literature. In Scotland, the current national one-size-fits-all strategy for adaptation offers a range of instruments for local-scale adaptation. Despite this, the empirical results indicate that small-scale island issues and community values are not being fully considered in adaptation planning at present. Improved vertical networks, which focus on communication and coordination across scales, could serve to address this issue. As evidenced in this study, a one-size-fits-all approach to adaptation in small island settings has the potential to overlook significant place-based values and priorities that could be essential for effective adaptation. However, one-size-fits-all national strategies can be successful in small island settings if central government and local authorities consider small island issues, factors and priorities when applying components of national strategy at the local level. This is important within island contexts because planning that fails to reflect place-based issues can lead to increased social marginalisation in already peripheral small island settings.

Furthermore, the research develops theory on the role of community perspectives and bottom-up participatory approaches in adaptation. Community perspectives are essential for understanding experiences and consequences of climate impacts in small island communities. Factors and priorities for adaptation must be established in consultation with community perspectives. Bottom-up approaches are beneficial for producing adaptation that takes community priorities and values into account. However, adaptation cannot rely on bottom-up participatory approaches alone. Placing responsibility entirely on the community would be circumscribed by resource limitations, knowledge gaps and perceived derogations of responsibility at higher levels. Therefore, an integrated balance of both top-down and bottom-up approaches can allow for the inclusion of community perspectives in adaptation planning whilst ensuring communities are supported and guided by local and national governments.

Additionally, the findings develop understandings of the utility of vulnerability mapping and climate projections for community engagement in adaptation. These findings, related to Research Question 3, contribute to the literature on scenario-based community engagement in adaptation. In particular, the research develops theory on the function of vulnerability mapping. The key

findings highlight that detailed technical climate or coastal data is not necessarily essential for engaging communities in discussions about the potential consequences of future climate impacts and the implications for local adaptation priorities. Hypothetical scenarios based on available data can be effective for the purpose of initiating conversations about community-level adaptation priorities.

7.2. Contributions to Planning and Practice

The research makes several contributions to policymaking, planning and practice in adaptation for small island settings, particularly those in the Scottish Islands. The findings are relevant for local authorities governing small islands, not only in Scotland but also further afield. The outcomes are also applicable at central and national government scales. Firstly, the research has made a clear theoretical distinction between the meanings of climate 'hazards', 'impacts' and 'consequences' which is useful in practice. This clarification of climate change terminology makes a contribution to defining terms that are often used somewhat interchangeably within planning and policy. Policy analysis highlighted that clear-cut definitions of these terms need to be mutually acknowledged across scales to reduce ambiguity in policy and planning. Adaptation policy and planning can be more effective if distinct definitions of these terms are acknowledged and put into practice.

Secondly, the research contributes to practical understandings of national adaptation practices and the effectiveness of one-size-fits-all planning. The findings indicate that the national strategy for adaptation currently employed within Scotland does not address issues and priorities for adaptation in island settings. Recent progress at the local authority level, particularly through climate change reporting, highlights a significant effort to address issues for adaptation at Orkney-, Shetland- and Outer Hebrides-wide scales. However, the results of this study highlight the existence of a gap between the work of local councils and priorities at the community scale. The local authority adaptation action highlighted in the Climate Change Reports does not strongly tally with the community-level issues, values and priorities identified within this research. The work of OIC to produce community resilience plans can be seen as an exception to this argument, although not all community-level priorities in Westray are considered in local authority planning. Whilst it is clear that local authority planning has addressed some of the key themes grounded in the data, action has not necessarily reflected the specific community issues and priorities existing under these themes. This suggests that each relevant local authority is not yet considering the priorities and values of small islands within Orkney, Shetland and the Outer Hebrides to a full extent. The findings highlight that place-based issues and priorities exist within the case studies. Some commonalities are present but there are also distinct differences in the social factors and motivations for adaptation. These community-level issues and factors need to be considered when applying national adaptation strategies at the small island scale. Local authorities can employ the relevant components of national adaptation strategy to small island settings provided that community-level issues are taken into account and reflected in planning and action.

Furthermore, the research develops practical understandings of bottom-up and top-down strategies for adaptation. The findings indicate that participants in all case studies felt marginalised on local authority and central government planning agendas. Adaptation has not taken island-level knowledge or values into account to a meaningful extent, as evidenced in participant responses. Bottom-up strategies, that utilise participatory processes and community engagement, are essential for including local voices and values in planning. Community perspectives are key to understanding island-scale issues. If participation and engagement are used as methods of two-way mutual communication, it could result in reduced perceptions of marginalisation in small island communities. It is clear that whilst top-down approaches continue to dominate adaptation planning and action in the case studies, each local authority has undertaken a bottom-up approach to some degree within adaptation planning, particularly OIC. Scenario-based engagement that utilises vulnerability mapping and climate projections is a useful practical approach that can be used by planners and decision-makers within participatory processes, as evidenced in the research findings. Effective participation relies on good quality communication across scales. Strong horizontal networks are already in place within the case studies. However, communication and cooperation need to be improved across scales in order to develop strong and reliable vertical networks between national, sub-national, local and community actors. If both strong vertical and horizontal networks are in place, participatory processes can be used to identify and include social values in small island adaptation.

As well as contributing to policymaking and planning at national, sub-national and local scales of governance, the research also makes a practical contribution to the applied-theoretical divide at the community level. The full thesis will eventually become part of the public sphere where it can be accessed by community members in Unst, Westray or South Uist, and indeed other small island communities in Scotland and further afield. Furthermore, a summarised version of the key research findings will be delivered directly back to the case study communities via the community councils and development trust organisations in each island. Community members can use the findings as they see fit. By sharing the research outcomes with the case study communities, the research crosses the applied-theoretical divide and places information in the hands of the communities where it might be useful for future adaptation processes.

7.3. Limitations of the Research

7.3.1. The Approach to Research

The research employed a qualitative approach using community perspectives to explore adaptation in small island communities. The various limitations involved in this type of approach are explored within this sub-section. Key caveats are associated with the exploration of community perspectives. Firstly, community perspectives are subjective. Participants might hold various pre-defined opinions regarding the topic of climate change that could influence the data and results. Furthermore, participants might possess a pre-existing agenda

for taking part in the research and could work to impose their own bias within responses. Secondly, community perspectives are evolving. What matters to a community might change over time if the social, political or economic context changes. Different climate hazards and impacts might begin to manifest, or existing hazards and impacts could worsen significantly. The priorities for adaptation are driven by what it takes for the community to exist safely and sustainably within their island. If the climatic, environmental, social, political and economic context begins to change, it could have a direct influence on community priorities for adaptation. Therefore, the research findings only represent the views of the case study communities at the time of data collection. There is no guarantee that community values and priorities will remain constant over time.

Furthermore, qualitative research can be subjected to researcher bias during phases of research design as well as data collection and analysis. Caution was taken to limit researcher bias by adopting a systematic approach to case study selection; using open, participant-led methods of data collection such as focus groups and deliberative methods; and employing a rigorous approach to data analysis through software analysis and coding routines. Community perspectives gathered during deliberative workshops identified the key climate hazards, impacts and consequences in each case study. Community perspectives gathered during focus groups then highlighted significant motivations and priorities for adapting to those hazards, impacts and consequences initially identified by the community. The semi-structured approach applied during workshops and focus groups aimed to minimise the potential for researcher views to influence the data. A rigorous approach to coding was undertaken from both grounded and theory-led perspectives in order to limit researcher input and subjectivity. The results are dependent on the (hopefully well-grounded) interpretations made by the researcher. However, researcher bias is a limitation of qualitative approaches and some degree of researcher subjectivity will likely always exist within any kind of qualitative research. This study is no different, and it is acknowledged that unintentional researcher bias might have limited the research to an extent.

Moreover, limitations involving representativeness were experienced within the study. In the early stages of research design, it was plain that at least three focus groups were required in each case study in order to gather data that could potentially be considered as representing community-wide motivations and priorities. If data was produced from a lower number of groups, the results could not be considered as being in any way representative of community-wide perspectives. Undertaking a series of three focus groups in each case study, supplemented by additional telephone interviews where necessary, helped to highlight any participant opinions that diverged from the emergent community-wide perspectives. Many themes, experiences and opinions were similar across the focus groups in each case study and data richness was achieved to a sufficient extent given the temporal constraints of the research. The results should not be considered as representative of the entire community in each case study- certain individuals in the case studies might disagree with the results. However, given the time constraints of the research, the data can be considered as representing shared

views within each community to a sufficient extent to make meaningful interpretations of adaptation in small island communities. A higher number of focus groups could have increased the representativeness of data and results within the study.

Furthermore, time-based constraints meant that only one deliberative workshop could be undertaken in each case study. Thus, the level of representativeness in the workshop phase of research was lower than that of the focus groups. In order to avoid misrepresentation of community views, the workshops sought to use slightly more participants in each workshop in comparison to each focus group. Given more time, the research would ideally have performed a series of workshops in each case study to increase the level of representation in this phase of the research.

7.3.2. Resource Availability for Mapping Vulnerability

Resource availability was a major constraining factor for mapping the vulnerability of Pierowall Bay to sea level rise. Access to coastal data at the small island scale is challenging. Simply put, the necessary coastal data to undertake a full assessment of vulnerability to sea level rise – such as shoreline change – are difficult to source for a small-scale section of coastline within Westray. Where suitable coastal datasets exist, they are often costly to access and are beyond the financial capacity of a doctoral research programme. It was only possible to assess vulnerability using coastal parameters for which data was freely available. Therefore, the vulnerability map can only be considered as a representation of hypothetical vulnerability since it was not possible to include the necessary range of coastal parameters. Ideally, any integrated assessment of vulnerability to sea level rise should also take socioeconomic factors into account as well as coastal parameters. The presence of population or important social assets could influence the vulnerability ranking of an area. For example, the vulnerability ranking for a section of coast could be higher where important socioeconomic factors prevail. Ideally, the research would have undertaken a detailed assessment using both physical and socioeconomic parameters to measure the vulnerability of Pierowall Bay to sea level rise. However, the temporal constraints associated with the research meant that it was not possible to analyse both physical and socioeconomic vulnerability within the timeframe of the study. A more interdisciplinary approach, using both coastal and socioeconomic variables, could have further developed arguments about the utility of vulnerability mapping as a tool for scenario-based engagement.

7.3.3. Uncertainty in Climate Change

Ultimately, climate change is subject to the same uncertainties that are relevant to any field of research which deals with complex futures. The research deals with climate projections as published by the UK Climate Projections in 2009. Updated climate projections will be published periodically in future, with updated projections already having been released in 2018 as UKCP18. Updated sets of projections might differ significantly to those published in 2009. On one hand,

climate projections might vary through time as more data becomes available. However, actual climate hazards and impacts could continue to change in unprecedented ways in future. Climate projections are not predictions. Climate will not necessarily follow the exact patterns set out in projections. Consequently, the specific results from each case study are a snapshot of priorities based on how climate change is projected to manifest at a specific time in a particular place at the time of data collection. The research findings provide an indication of the motivations, priorities and challenges for adaptation to significant impacts of climate change in Scottish island communities based on the information available at the time of the study. The findings highlight priorities for adapting to climate impacts that have already been experienced in the case studies. However, uncertainty in climate change means that hazards, impacts and consequences might vary in future in ways that cannot be predicted. Thus future priorities, motivated by climate impacts, might differ from those identified within this study.

7.4. Further Research

7.4.1.The Application of Methodological Approach to Wider Contexts

The present study leaves scope for a number of opportunities for further research within the field of small island adaptation. Most prominently, the methodological approach adopted within this study could be applied to other islands in Scotland or to island contexts further afield. For example, qualitative investigations of community perspectives could be used to explore priorities for adaptation in other small island communities in a participant-led approach. This would test the theoretical findings of the study, particularly those concerning scale, across a wider set of contexts, including other small island settings outside of the Scottish Islands. Furthermore, there is scope for an extended investigation into how integration between bottom-up and top-down approaches can occur in adaptation planning and practice. The current research explored the concept of transformation in relation to the case study communities. However, further research that develops a deeper understanding of the potential for transformation as a pathway for adaptation in small island communities more broadly would be a beneficial contribution to adaptation theory and practice.

7.4.2. Further Research Exploring Community Perspectives

As described in Section 7.3.1, community perspectives are not fixed. They are subject to change over time depending on prevailing climatic, social, economic and political factors. Further research in the same case studies could be undertaken over the coming years to examine how motivations and priorities vary over time at the community scale, and the implications of any variation for adaptation planning. Based on the analysis of case study data, this investigation found that community motivations for adaptation are underpinned by climate impacts, whilst priorities for adaptation are motivated by social values. Motivations and priorities might shift if climate impacts and social contexts begin to markedly change. It is worth noting that all qualitative data collection was

undertaken prior to the UK Brexit referendum. The social, economic and political implications of Brexit might have a distinct influence on social values within the case studies. Further research into variation in motivations and priorities over time in the case study communities could contribute to understandings of how social contexts influence adaptation priorities in small islands.

7.4.3. The Development of Vulnerability Mapping as a Tool for Engagement

The current study explored the role and utility of vulnerability mapping and climate projections in community engagement for adaptation. Due to constraints of time, however, it was only possible to examine the utility of these tools in one case study. It would be beneficial to further investigate this issue using a multiple case study approach in order to undertake cross-case analysis between various communities. This would serve to develop understandings of how vulnerability mapping and climate projections could be used as tools for engagement in other island contexts. Furthermore, vulnerability mapping could be further developed as a scenario tool if projected sea levels were to be illustrated directly onto the vulnerability map showing the potential position of the highest high water marks in future. This could provide a visual representation of how sea level might change around coastlines and how it might affect areas that are already considered vulnerable based on the coastal features present. Additionally, it is possible that scenario tools were effective for community engagement in this study because those participants choosing to attend the workshops and focus groups had a fundamental interest in local climate change. It would be beneficial to adopt a random sampling approach with a view to comparing results between purposive and random sampling strategies. In this manner, it could be possible to determine the utility of vulnerability mapping and climate projections as tools for engagement in situations where participants are randomly sampled with potentially no prior interest in climate change impacts and adaptation.

7.5. Conclusions

This study has sought to understand community-level adaptation to climate change in small islands. Through a participatory approach the study questioned large-scale assumptions and found that key climate impacts and adaptation themes vary across the case study islands, despite their similar characteristics. Therefore, motivations for adaptation reflect this variation. Furthermore, motivations for particular priorities were tied to case-specific social, economic and cultural values. A strong example is found in the priorities for maintaining and enhancing lives and livelihoods. This was prioritised across all case studies but the underlying drivers for this priority were diverse across the cases. This finding implies that place-based issues and factors for adaptation are different across island settings. The one-size-fits-all adaptation strategy currently in place in Scotland does not sufficiently consider island-scale community issues, priorities and values. Case study participants felt that island issues had been overlooked and misinterpreted in current adaptation planning and implementation. Based on the key findings, this research argues that national adaptation strategy can be suitably applied at the

island level but approaches to one-size-fits-all strategies must fundamentally change if adaptation is to be effective and appropriate within island settings. A combination of bottom-up and top-down approaches, with clear communication and shared responsibility, offers a pathway to adaptation that considers and reflects island issues and priorities.

Scaling of adaptation is currently a fundamental barrier to effective adaptation in Scottish island communities based on the evidence from the case studies. Inadequate communication across scales has led to marginalisation and insufficient adaptation action. Challenges of scale need to be addressed. Developing networks and defining responsibility are practical components of adaptation that could be advantageously deployed for overcoming challenges of scale in small island adaptation. Particularly, vertical network development and shared responsibility across scales are primarily important for operationalizing effective adaptation. When cross-scale networks are strong and responsibility is fairly divided and accepted, societal values can begin to be upheld in adaptation planning. Transformation, as a pathway towards successful adaptation that is integrated into non-climatic development goals, could be important in future within small island settings. However, at present, the problems associated with networks, responsibility and societal values first need to be addressed in order to evolve towards transformative approaches.

Ultimately, Scottish island communities face unique issues related to climate change due to their peripheral and remote settings, both geographically and socially. Small-island community values and priorities are not sufficiently incorporated into adaptation planning approaches in Scotland at present. Factors and priorities for adaptation in Scottish island communities are closely tied to underlying social, economic, cultural and political issues. However, adverse climate impacts serve to exacerbate existing island issues and threaten societal values such as sustainable economies. If policy and planning do not begin to acknowledge the unique distinctions between small island communities, it could lead to detrimental consequences for island lives and island development. Addressing adaptation in an integrated top-down-and-bottom-up approach that considers community perspectives and place-based priorities could pave the way for safer, more stable and more sustainable ways of life in small island settings.

References

ABUODHA, P. A. O. & WOODROFFE, C. D. 2010. Assessing vulnerability to sea-level rise using a coastal sensitivity index: a case study from southeast Australia. *Journal of Coastal Conservation*, 14, 189-295.

ADAPTATION SCOTLAND. 2016a. *Impacts in Scotland* [Online]. Available: https://www.adaptationscotland.org.uk/why-adapt/impacts-scotland [Accessed 3 June 2017].

ADAPTATION SCOTLAND. 2016b. *Interim impact report January 2015 - June 2016* [PDF]. Available: https://adaptationscotland.org/application/files/5514/7738/6062/AS_Impact_Report_2015-2016 [Accessed: 15 February 2018].

ADGER, W. N. 1999. Social vulnerability to climate change and extremes in coastal Vietnam. *World Development,* 27**,** 249-269.

ADGER, W. N. 2000. Social and ecological resilience: Are they related? *Progress in Human Geography,* 24**,** 347-364.

ADGER, W. N. 2003. Social capital, collective action, and adaptation to climate change. *Economic Geography*, 79 (4), 387-404.

ADGER, W. N. 2016. Place, well-being, and fairness shape priorities for adaptation to climate change. *Global Environmental Change,* 38**,** A1-A3.

ADGER, W. N., ARNELL, N. W. & TOMPKINS, E. L. 2005. Successful adaptation to climate change across scales. *Global Environmental Change,* 15**,** 77-86.

ADGER, W. N. & BARNETT, J. 2009. Four reasons for concern about adaptation to climate change. *Environment and Planning A,* 41**,** 2800-2805.

ADGER, W. N., DESSAI, S., GOULDEN, M., HULME, M., LORENZONI, I., NELSON, D. R., NAESS, L. O., WOLF, J. & WREFORD, A. 2009. Are there social limits to adaptation to climate change? *Climatic Change,* 93**,** 335-354.

ADGER, W. N., BARNETT, J., CHAPIN III, F. S. & ELLEMOR, H. 2011. This must be the place: Underrepresentation of identity and meaning in climate change decision-making. *Global Environmental Politics,* 11**,** 1-25.

ADGER, W. N., BARNETT, J., BROWN, K., MARSHALL, N. & O'BRIEN, K. 2013. Cultural dimensions of climate change impacts and adaptation. *Nature Climate Change,* 3**,** 112-117.

ANGUS, S. & RENNIE, A. 2014. An Ataireachd Aird: The storm of January 2005 in the Uists, Scotland. *Ocean & Coastal Management*, 94, 22-29.

ASHE. J. W. 1999. Small island developing states and global climate change: overcoming the constraints. *Natural Resources Forum*, 23, 187-193.

ASWANI, S., VACCARO, I., ABERNETHY, K., ALBERT, S. & DE PABLO, J. F. L. 2015. Can perceptions of environmental and climate change in island communities assist in adaptation planning locally? *Environmental Management*, 56, 1487-1501.

AYERS, J., REID, H., HUQ, S., RAHMAN, A. & SCHIPPER, E. L. F. 2014. *Community-Based Adaptation to Climate Change: Scaling it up*. Abingdon: Routledge.

BAGGIO, J. A., BROWN, K., & HELLEBRANDT, D. 2015. Boundary object or bridging concept? A citation network analysis of resilience. *Ecology and Society*, 20 (2).

BAINBRIDGE, J. M., POTTS, T. & O'HIGGINS, T. G. 2011. Rapid policy network mapping: a new method for understanding governance structures for implementation of marine environmental policy. *PLoS ONE* 6(10): e26149.

BALDACCHINO, G. 2005. The contribution of 'social capital' to economic growth: lessons from island jurisdictions. *The Round Table*, 94 (1), 31-46.

BALDACCHINO, G. 2018. Seizing history: development and non-climate change in Small Island Developing States. *International Journal of Climate Change Strategies and Management*, 10 (2), 217-228.

BALDACCHINO, G. & PLEIJEL, C. 2010. European islands, development and the cohesion policy: a case study of Kokar, Aland Islands. *Island Studies Journal*, 5 (1), 89-110.

BAPTISTE, A. K. & KINLOCKE, R. 2016. We are not all the same!: Comparative climate change vulnerabilities among fishers in Old Harbour Bay, Jamaica. *Geoforum*, 73, 47-59.

BARBOUR, R. S. 2008. *Introducing Qualitative Research: a student's guide to the craft of doing qualitative research*. London: SAGE Publications.

BARNETT, J. 2001. Adapting to climate change in Pacific Island Countries: the problem of uncertainty. *World Development*, 29 (6), 977-993.

BARNETT, J., MORTREUX, C. & ADGER, W. N. 2013. Barriers and Limits to Adaptation: Cautionary Notes. In Boulter, S., Palutikof, J., Karoly, D. J. & Guitart, D. eds. *Natural Disasters and Adaptation to Climate Change*. Cambridge: Cambridge University Press, 223-235.

BARNETT, J. & WATERS, E. 2016. Rethinking the vulnerability of small island states: climate change and development in the Pacific Islands. In Grugel, J. & Hammett, D. eds. *The Palgrave Handbook of International Development*. London: Palgrave Macmillan, 731-748.

BARRETT, J. 2017. *Quoygrew and the Viking Age Transitions Project* [Online]. Available: https://www.arch.cam.ac.uk/research/projects/quoygrew [Accessed: 15 July 2018].

BBC NEWS. 2017. 'Apology for delay deciding on inquiry into fatal storm', *BBC News*, 23 January. Available: http://www.bbc.co.uk/news/uk-scotland-highlands-islands-38717260 [Accessed: 25 January 2018].

BBC NEWS. 2018. 'Community landowner Storas Uibhist embroiled in row', *BBC News*, 7 June. Available: https://www.bbc.co.uk/news/uk-scotland-highlands-islands-44396018 [Accessed: 31 July 2018].

BEDSTED, B. & GRAM, S. 2013. Participatory Climate Change Adaptation in Kalundborg, Denmark. In Schmidt-Thomé, P. & Klein, J. eds. *Climate Change Adaptation in Practice: From strategy to development to implementation*. Chichester: Wiley, 11-23.

BERRANG-FORD, L., FORD, J. D. & PATERSON, J. 2011. Are we adapting to climate change? *Global Environmental Change,* 21**,** 25-33.

BERRY, P. M., BROWN, S., CHEN, M., KONTOGIANNI, A., ROWLANDS, O., SIMPSON, G. & SKOURTOS, M. 2015. Cross-sectoral interactions of adaptation and mitigation measures. *Climatic Change*, 128, 381-393.

BERRY, P.M., BETTS, R.A., HARRISON, P.A. & SANCHEZ-ARCILLA, A. 2017. *High-End Climate Change in Europe: impacts, vulnerability and adaptation*. Sofia: Pensoft Publishers.

BETZOLD, C. 2015. Adapting to climate change in small island developing states. *Climatic Change,* 133 (3), 481-489.

BIAGINI, B., BIERBAUM, R., STULTS, M., DOBARDZIC, S. & MCNEELEY, S. M. 2014. A typology of adaptation actions: A global look at climate adaptation actions financed through the Global Environment Facility. *Global Environmental Change*, 25, 97-108.

BIRK, T. 2014. Assessing vulnerability to climate change and socioeconomic stressors in the Reef Islands group, Solomon Islands. *Danish Journal of Geography*, 114 (1), 59-75.

BIRKMANN, J., BUCKLE, P., JAEGER, J., PELLING, M., SETIADI, N., GARSCHAGEN, M., FERNANDO, N. & KROPP, J. 2010. Extreme events and disasters: A window of opportunity for change? Analysis of organizational, institutional and political changes, formal and informal responses after mega-disasters. *Natural Hazards,* 55**,** 637-655.

BISARO, A., WOLF, S. & HINKEL, J. 2010. Framing climate vulnerability and adaptation at multiple levels: Addressing climate risks or institutional barriers in Lesotho? *Climate and Development*, 2, 161-175.

BORUFF, B. J. & CUTTER, S. L. 2007. The environmental vulnerability of Caribbean island nations. *The Geographical Review*, 97 (1), 24-45.

BOSELLO, F., NICHOLLS, R. J., RICHARDS, J., ROSON, R. & TOL, R. S. J. 2012. Economic impacts of climate change in Europe: sea-level rise. *Climatic Change*, 112 (1), 63-81.

BOYLE, M. & DOWLATABADI, H. 2011. Anticipatory adaptation in marginalized communities within developed countries. In Ford, J. & Berrang-Ford, L. eds. *Climate Change Adaptation in Developed Nations: From Theory to Practice.* Dordrecht: Springer Netherlands, 461-473.

BROOKS, N., ADGER, W. N. & KELLY, P. M. 2005. The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation. *Global Environmental Change*, 15 (2), 151-163.

BROWN, K. 2015. *Resilience, Development and Global Change*. Abingdon: Routledge.

BROWN, S., NICHOLLS, R. J., HANSON, S., BRUNDRIT, G., DEARING, J. A., DICKSON, M. E., GALLOP, S. L., GAO, S., HAIGH, I. D., HINKEL, J., JIMENEZ, J. A., KLEIN, R. J. T., KRON, W., LAZAR, A. N., NEVES, C. F., NEWTON, A., PATTIARATACHI, C., PAYO, A., PYE, K., SANCHEZ-ARCILLA, A., SIDDALL, M., SHAREEF, A., TOMPKINS, E. L., VAFEIDIS, A. T., MAANEN, B. V., WARD, P. J. & WOODROFFE, C. D. 2014. Shifting perspectives on coastal impacts and adaptation. *Nature Climate Change*, 4, 752-755.

BUNCE, M., MEE, L., RODWELL, L. D. & GIBB, R. 2009. Collapse and recovery in a remote small island – a tale of adaptive cycles or downward spirals? *Global Environmental Change*, 19, 213-226.

BURNINGHAM, H. & FRENCH, J. 2017. Understanding coastal change using shoreline trend analysis supported by cluster-based segmentation. *Geomorphology*, 282, 131-149.

BUTLER, J. R. A., SUADNYA, W., PUSPADI, K., SUTARYONO, Y., WISE, R. M., SKEWES, T. D., KIRONO, D., BOHENSKY, E. L., HANDAYANI, T., HABIBI, P., KISMAN, M., SUHARTO, I., SUPARTARNINGSIH, S., RIPALDI, A., FACHRY, A., YANUARTATI, Y., ABBAS, G., DUGGAN, K. & ASH, A. 2014. Framing the application of

adaptation pathways for rural livelihoods and global change in eastern Indonesian islands. *Global Environmental Change*, 28, 368-382.
BRYAN, E., DERESSA, T. T., GBETIBOUO, G. A. & RINGLER, C. 2009. Adaptation to climate change in Ethiopia and South Africa: options and constraints. *Environmental Science & Policy*, 12 (4), 413-426.
CAMPBELL, R. 2017. 'Safety delays spark anger after tragedy', *The Press and Journal (Inverness, Highlands and Islands)*, 11 January. Available: https://www.pressreader.com/uk/the-press-and-journal-inverness-highlands-and-islands/20170111/282784946160514 [Accessed: 24 January 2018].
CAMPOS, I., VIZINHO, A., COELHO, C., ALVES, F., TRUNINGER, M., PEREIRA, C., SANTOS, F. D. & PENHA LOPES, G. 2016. Participation, scenarios and pathways in long-term planning for climate change adaptation. *Planning Theory and Practice*, 17 (4), 537-556.
CELLIERS, L., ROSENDO, S., COETZEE, I. & DANIELS, G. 2013. Pathways of integrated coastal management from national policy to local implementation: Enabling climate change adaptation. *Marine Policy*, 39, 72-86.
CEOLAS. 2017. *Bòrd na Gàidhlig Supports Cnoc Soilleir Project* [Online]. Available: http://www.ceolas.co.uk/2017/04/bord-na-gaidhlig-supports-cnoc-soilleir-project/ [Accessed: 31 July 2018].
CEOLAS. 2018. *About Ceolas* [Online]. Available: http://www.ceolas.co.uk/about/ [Accessed: 31 July 2018].
CHAMPALLE, C., FORD, J. D. & SHERMAN, M. 2015. Prioritizing climate change adaptations in Canadian Arctic communities. *Sustainability*, 7, 9268-9292.
CHAPIN, F. S., KNAPP, C. N., BRINKMAN, T. J., BRONEN, R. & COCHRAN, P. 2016. Community-empowered adaptation for self-reliance. *Current Opinion in Environmental Sustainability,* 19, 67-75.
CHILVERS, J., LORENZONI, I., TERRY, G., BUCKLEY, P., PINNEGAR, J. K. & GELCICH, S. 2014. Public engagement with marine climate change issues: (re)framings, understandings and responses. *Global Environmental Change*, 29, 165-179.
CLARK, E. 2013. Financialization, sustainability and the right to the island: a critique of acronym models of island development. *Journal of Marine and Island Cultures*, 2, 128-136.
CLIMATE-ADAPT. 2016. *Glossary* [Online]. Available: http://climate-adapt.eea.europa.eu/help/glossary [Accessed: 1 November 2016].
COMHAIRLE NAN EILEAN SIAR. 2012a. *Corporate Strategy 2012-17* [PDF]. Available: https://www.cne-siar.gov.uk:443/media/9855/corporatestrategy2012-17.pdf [Accessed: 17 April 2018].
COMHAIRLE NAN EILEAN SIAR. 2012b. *Outer Hebrides Local Development Plan* [PDF]. Available: https://www.cne-siar.gov.uk/media/1645/outer-hebrides-local-development-plan.pdf [Accessed: 17 April 2018].
COMHAIRLE NAN EILEAN SIAR. 2012c. *South Ford Hydrodynamics Study – Final Report* [PDF]. Available: http://www.coasthebrides.co.uk/index.php/south-ford-study-report.html [Accessed: 15 January 2018].

COMHAIRLE NAN EILEAN SIAR. 2016. *Local Flood Risk Management Plan: Outer Hebrides Local Plan District* [PDF]. Available: https://www.cne-siar.gov.uk/media/7596/oh-lfrmp.pdf [Accessed: 26 March 2018].

COMHAIRLE NAN EILEAN SIAR. 2017. *Public Sector Climate Change Duties 2017: Comhairle nan Eilean Siar Climate Change Report* [XLS]. Available: https://www.keepscotlandbeautiful.org/media/1557931/comhairle-nan-eilean-siar-ccr-2016.xlsx [Accessed: 17 April 2018].

COMHAIRLE NAN EILEAN SIAR. 2018a. *Mission Statement* [Online]. Available: https://www.cne-siar.gov.uk/your-council/mission-statement/ [Accessed: 31 July 2018].

COMHAIRLE NAN EILEAN SIAR. 2018b. *Ward 1: Useful Information* [Online]. Available: https://e-sgire.org/communities/ward1/information/ [Accessed: 28 February 2018].

COMHAIRLE NAN EILEAN SIAR. 2018c. *Ward 2: Local Information* [Online]. Available: https://e-sgire.org/communities/ward2/information/ [Accessed: 28 February 2018].

COMHAIRLE NAN EILEAN SIAR. 2018d. *Anger at Further Disruption to Uist Ferry Services* [Online]. Available: https://www.cne-siar.gov.uk/news/2018/may/uist-economic-tasforce-angered-at-further-disruption-to-uist-ferry-services/ [Accessed: 21 July 2018].

COMHAIRLE NAN EILEAN SIAR TRANSPORTATION AND INFRASTRUCTURE COMMITTEE. 2015. *South Ford Causeway (Flood Risk Management Options and Strategy)* [PDF]. Available: https://www.cne-siar.gov.uk/media/committeearchive/2015/04-april/transportation/urgent-items/J%20Item%2010B%20-%20Supplementary%20Report%20South%20Ford%20Options%20April%202015.pdf [Accessed: 05 February 2018].

COMMITTEE ON CLIMATE CHANGE. 2017. *UK Climate Change Risk Assessment 2017 Synthesis report: priorities for the next five years* [PDF]. Available: https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Synthesis-Report-Committee-on-Climate-Change.pdf [Accessed: 14 August 2017].

CONNELL, J. 2015. Vulnerable islands: climate change, tectonic change, and changing livelihoods in the Western Pacific. *The Contemporary Pacific*, 27 (1), 1-36.

CONNELL, J. 2018. Islands: balancing development and sustainability? *Environmental Conservation*, 45 (2), 111-124.

COOPER, J. A. G. & PILE, J. 2014. The adaptation-resistance spectrum: A classification of contemporary adaptation approaches to climate-related coastal change. *Ocean and Coastal Management,* 94, 90-98.

COPE, M. & KURTZ. H. 2016. Organizing, coding and analyzing qualitative data. In Clifford, N., Cope, M., Gillespie, T. & French, S. eds. *Key Methods in Geography*, 3rd ed. London: SAGE Publications, 647-664.

DAHL, C. 1997. Integrated coastal resources management and community participation in a small island setting. *Ocean & Coastal Management*, 36, 23-45.

DAWSON, A. G., DAWSON, S. & RITCHIE, W. 2007. Historical climatology and coastal change associated with the 'Great Storm' of January 2005, South Uist and Benbecula, Scottish Outer Hebrides. *Scottish Geographical Journal*, 123 (2), 135-149.

DENTON, A. 2017. Voices for environmental action? Analyzing narrative in environmental governance networks in the Pacific Islands. *Global Environmental Change*, 43, 62-71.

DENZIN, N. K. & LINCOLN, Y. S. 2011. *The SAGE Handbook of Qualitative Research*. 4th ed. London: Sage.

DESSAI, S. & HULME, M. 2007. Assessing the robustness of adaptation decisions to climate change uncertainties: a case study on water resources management in the East of England. *Global Environmental Change*, 17, 59-72.

DRONKERS, J. & STOJANOVIC, T. 2016. Socio-economic impacts- coastal management and governance. In Quante, M. & Colijn, F. eds. *North Sea Region Climate Change Assessment. Regional Climate Studies*. Cham, Heidelberg, New York, Dordrecht, London: Springer Verlag.

DU BRAY, M. V., WUTICH, A., LARSON, K. L., WHITE, D. D. & BREWIS, A. 2017. Emotion, coping, and climate change in island nations: implications for environmental justice. *Environmental Justice*, 10 (4), 102-107.

DUVAT, V. K. E., MAGNAN, A. K., WISE, R. M., HAY, J. E., FAZEY, I., HINKEL, J., STOJANOVIC, T., YAMANO, H. & BALLU, V. 2017. Trajectories of exposure and vulnerability of small islands to climate change. *WIREs Climate Change*, 8 (6), e478.

EDWARDS, A. M. C., & WINN, P. S. J. 2006. The Humber Estuary, Eastern England: Strategic planning of flood defences and habitats. *Marine Pollution Bulletin*, 53 (1-4), 165-174.

ENSOR, J. & BERGER, R. 2009. Community-based adaptation and culture in theory and practice. In Adger, W. N., Lorenzoni, I. & O'Brien, K. L. eds. *Adapting to Climate Change: Thresholds, Values, Governance*. Cambridge: Cambridge University Press, 227-239.

ENSOR, J. E., ABERNETHY, K. E., HODDY, E. T., ASWANI, S., ALBERT, S., VACCARO, I., BENEDICT, J. J. & BEARE, D. J. 2018. Variation in perception of environmental change in nine Solomon Islands communities: implications for securing fairness in community-based adaptation. *Regional Environmental Change*, 18, 1131-1143.

EUROPEAN COMMISSION. 2009. *The economics of climate change adaptation in EU coastal areas* [PDF]. Available: https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/docs/body/report_en.pdf [Accessed: 08 September 2018].

EUROPEAN COMMISSION. 2013. *The EU Strategy on adaptation to climate change* [PDF]. Available: https://ec.europa.eu/clima/sites/clima/files/docs/eu_strategy_en.pdf [Accessed: 15 February 2018].

EUROSION. 2018. *Summary* [Online]. Available: http://www.eurosion.org/project/index.html [Accessed: 03 March 2018].

EWING, L., FLICK, R. E. & SYNOLAKIS, C. E. 2010. A review of coastal community vulnerabilities toward resilience benefits from disaster reduction measures. *Environmental Hazards*, 9 (3), 222-232.

FAZEY, I. R. A., WISE, R. M., LYON, C., CAMPEANU, C., MOUG, P. & DAVIES, T. E. 2015. Past and future adaptation pathways. *Climate and Development*, 8 (1), 26-44.

FERNANDES, R. & PINHO, P. 2017. The distinctive nature of spatial development on small islands. *Progress in Planning*, 112, 1-18.

FEW, R., BROWN, K. & TOMPKINS, E. L. 2007. Public participation and climate change adaptation: avoiding the illusion of inclusion. *Climate policy*, 7, 46-59.

FEW, R., MORCHAIN, D., SPEAR, D., MENSAH, A. & BENDAPUDI, R. 2017. Transformation, adaptation and development: relating concepts to practice. *Palgrave Communications*, 3, 17092.

FISH, R., BURGESS, J., CHILVERS, J., FOOTITT, A., HAINES-YOUNG, R., RUSSEL, D. & WINTER, D. M. 2011. *Participatory and Deliberative Techniques to embed an Ecosystems Approach into Decision Making: an introductory Guide.* Defra Project Code: NR0124.

FITTON, J. M., HANSOM, J. D. & RENNIE, A. F. 2016. A national coastal erosion susceptibility model for Scotland. *Ocean & Coastal Management,* 132, 80-89.

FLETCHER, A. J. 2017. Applying Critical Realism in Qualitative Research: methodology meets method. *International Journal of Social Research Methodology*, 20 (2), 181-194.

FORBES, D. L., JAMES, T. S., SUTHERLAND, M. & NICHOLS, S. E. 2013. Physical basis of coastal adaptation on tropical small islands. *Sustainability Science*, 8, 327-344.

FORD, J. D., BERRANG-FORD, L. & PATERSON, J. 2011. A systematic review of observed climate change adaptation in developed nations. *Climatic Change,* 106**,** 327-336.

FORD, J. D. & GOLDHAR, C. 2012. Climate change vulnerability and adaptation in resource dependent communities: A case study from West Greenland. *Climate Research,* 54**,** 181-196.

FORD, J. D., BERRANG-FORD, L., BUNCE, A., MCKAY, C., IRWIN, M. & PEARCE, T. 2015. The status of climate change adaptation in Africa and Asia. *Regional Environmental Change*, 15, 801-814.

FORD, J. D., CAMERON, L., RUBIS, J., MAILLET, M., NAKASHIMA, D., WILLOX, A. C. & PEARCE, T. 2016a. Including indigenous knowledge and experience in IPCC assessment reports. *Nature Climate Change*, 6, 349-353.

FORD, J. D., STEPHENSON, E., CUNSOLO WILLOX, A., EDGE, V., FARAHBAKHSH, K., FURGAL, C., HARPER, S., CHATWOOD, S., MAURO, I., PEARCE, T. & AUSTIN, S. 2016b. Community-based adaptation research in the Canadian Arctic. *WIREs Clim Change*, 7, 175-191.

FÜSSEL, H. M. 2007. Adaptation planning for climate change: Concepts, assessment approaches, and key lessons. *Sustainability Science,* 2**,** 265-275.

FÜSSEL, H. M. & KLEIN, R. J. T. 2006. Climate change vulnerability assessments: an evolution of conceptual thinking. *Climatic Change*, 75, 301-329.

GEGEO, D. W. & WATSON-GEGEO, K. A. 2002. Whose knowledge? Epistemological collisions in Solomon Islands community development. *The Contemporary Pacific*, 14 (2), 377-409.

GLASER, B. G. & STRAUSS, A. L. 1967. *The Discovery of Grounded Theory: strategies for qualitative research.* London: Aldine.

GLAVOVIC, B. C. & SMITH, G. P. 2014. Introduction: Learning from Natural Hazards Experience to Adapt to Climate Change. In Glavovic, B. C. & Smith, G. P. eds. *Adapting to Climate Change: Lessons from Natural Hazards Planning*. Dordrecht: Springer Netherlands, 1-38.

GODFREY-WOOD, R. & NAESS, L. O. 2016. Adapting to climate change: Transforming development? *IDS Bulletin,* 47 (2), 49-62.

GORNITZ, V., WHITE, T. W. & CUSHMAN, R. M. 1991. Vulnerability of the U.S. to future sea level rise. *Coastal Zone'91*, 2354-2368.

GO WESTRAY CIC. 2017a. *Business Directory* [Online]. Available: https://westraycommunity.co.uk/business-directory/?doing_wp_cron=1532265877.4039568901062011718750 [Accessed: 21 March 2018].

GO WESTRAY CIC. 2017b. *Farming* [Online]. Available: https://westraycommunity.co.uk/employment/farming/ [Accessed: 21 April 2018].

GO WESTRAY CIC. 2017c. *History* [Online]. Available: https://westraycommunity.co.uk/history/?doing_wp_cron=1532861525.9275150299072265625000 [Accessed: 21 April 2018].

GO WESTRAY CIC. 2017d. *Links of Noltland Legacy Project* [Online]. Available: https://westraycommunity.co.uk/links-of-noltland-legacy-project/?doing_wp_cron=1532862104.1393411159515380859375 [Accessed: 21 April 2018].

GREEN, D., ALEXANDER, L., MCLNNES, K., CHURCH, J., NICHOLLS, N. & WHITE, N. 2010. An assessment of climate change impacts and adaptation for the Torres Strait Islands, Australia. *Climatic Change,* 102**,** 405-433.

GRYDEHOJ, A. 2013. Ethnicity and the origins of local identity in Shetland, UK—Part I: Picts, Vikings, Fairies, Finns, and Aryans. *Journal of Marine and Island Cultures*, 2 (1), 39-48.

HA'APIO, M. O., WAIRIU, M., GONZALEZ, R. & MORRISON, K. 2018. Transformation of rural communities: lessons from a local self-initiative for building resilience in the Solomon Islands. *Local Environment*, 23 (3), 352-365.

HALLEGATTE, S. 2009. Strategies to adapt to an uncertain climate change. *Global Environmental Change*, 19, 240-247.

HASWELL-SMITH, H. 2004. *The Scottish Islands*. Edinburgh: Canongate.

HERNANDEZ, Y., PEREIRA, A. G. & BARBOSA, P. 2018. Resilient futures of a small island: a participatory approach in Tenerife (Canary Islands) to address climate change. *Environmental Science and Policy*, 80, 28-37.

HIGHLANDS AND ISLANDS ENTERPRISE. 2015. *New £10m port opens in Lochboisdale* [Online]. Available: http://news.hie.co.uk/all-news/new-10m-port-opens-in-lochboisdale/ [Accessed: 04 March 2018].

HINKEL, J. 2011. "Indicators of vulnerability and adaptive capacity": Towards a clarification of the science-policy interface. *Global Environmental Change*, 21 (1), 198-208.

HINKEL, J., LINCKE, D., VAFEIDIS, A. T., PERRETTE, M., NICHOLLS, R. J., TOL, R. S. J., MARZEION, B., FETTWEIS, X., IONESCU, C. & LEVERMANN, A. 2014. Coastal flood damage and adaptation costs under 21st century sea-level rise. *Proceedings of the National Academy of Sciences*, 111 (9), 3292-3297.

HINKEL, J. & BISARO, A. 2015. A review and classification of analytical methods for climate change adaptation. *Wiley Interdisciplinary Reviews: Climate Change,* 6**,** 171-188.

HISTORIC ENVIRONMENT SCOTLAND. 2018. *Links of Noltland on the Island of Westray, Orkney* [Online]. Available: https://www.historicenvironment.scot/visit-a-place/places/links-of-noltland/ [Accessed: 21 April 2018].

HIWASAKI, L., LUNA, E. & SHAW, R. 2014. Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities. *International Journal of Disaster Risk Reduction*, 10, 15-27.

HOFMANN, M. E., HINKEL, J. & WROBEL, M. 2011. Classifying knowledge on climate change impacts, adaptation, and vulnerability in Europe for informing adaptation research and decision-making: A conceptual meta-analysis. *Global Environmental Change*, 21, 1106-1116.

HOLLER, J. 2014. Adaptation policy and adaptation realities: local social organization and cross-scale networks for climate adaptation on Mount Kilimanjaro. *GeoJournal*, 79 (6), 737-753.

HOVELSRUD, G. K., WHITE, J. L., ANDRACHUK, M. & SMIT, B. 2010. Community adaptation and vulnerability integrated. In Hovelsrud, G. K. & Smit, B. eds. *Community Adaptation and Vulnerability in Arctic Regions*. London: Springer, 335-348.

IMPROVEMENT SERVICE. 2017. *What is a Community Council?* [Online]. Available: http://www.communitycouncils.scot/what-is-a-community-council.html [Accessed: 22 July 2018].

IOCHDAR COMMUNITY COUNCIL. 2018. *Iochdar Community Council Meeting Tuesday 8th May 2018* [PDF] Available: https://e-sgire.org/media/331735/minutes___iochdar_community_council__18_05_08_.pdf [Accessed: 17 April 2018].

IPCC. 2007. *Glossary of Terms Used in the IPCC Fourth Assessment Report: Glossary of Synthesis Report* [PDF]. Available: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_appendix.pdf [Accessed: 30 November 2013].

IPCC. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change.* [Field, C.B., Barros, V., Stocker, T. F., Qin, D., Dokken, D. J., Ebi, K. L., Mastrandrea, M. D., Mach, K. J., Plattner, G.-K., Allen, S. K., Tignor, M. & Midgley, P. M. eds.] Cambridge: Cambridge University Press.

IPCC. 2014a. Annex II: Glossary. In Barros, V. R., Field, C. B., Dokken, D. J., Mastrandrea, M. D., Mach, K. J., Bilir, T. E., Chatterjee, M., Ebi, K. L., Estrada,

Y. O., Genova, R. C., Girma, B., Kissel, E. S., Levy, A. N., MacCracken, S., Mastrandrea, P.R. & White, L.L. eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, 1757-1776.

IPCC. 2014b. Summary for policymakers. In: Field, C. B., Barros, V. R., Dokken, D. J., Mach, K. J., Mastrandrea, M. D., Bilir, T. E., Chatterjee, M., Ebi, K. L., Estrada, Y. O., Genova, R. C., Girma, B., Kissel, E. S., Levy, A. N., MacCracken, S., Mastrandrea, P. R. & White, L. L. eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, 1-32.

JAMERO, M. L., ONUKI, M., ESTEBAN, M. & TAN, N. 2018. Community-based adaptation in low-lying islands in the Philippines: challenges and lessons learned. *Regional Environmental Change*, 1-12.

JICHA, K. A., THOMPSON, G. H., FULKERSON, G. M. & MAY, J. E. 2011. Individual participation in collective action in the context of a Caribbean Island State: testing the effects of multiple dimensions of social capital. *Rural Sociology*, 76 (2), 229-256.

JOHNSTON, I. 2014. Disaster management and climate change adaptation: a remote island perspective. *Disaster Prevention and Management*, 23 (2), 123-137.

JOINT NATURE CONSERVATION COMMITTEE. 2005. *SPA Description: South Uist Machair and Lochs* [Online]. Available: http://jncc.defra.gov.uk/default.aspx?page=1851 [Accessed: 11/09/2018].

JONKMAN, S. N., HILLEN, M. M., NICHOLLS, R. J., KANNING, W. & Van LEDDEN, M. 2013. Costs of adapting coastal defences to sea-level rise – new estimates and their implications. *Journal of Coastal Research,* 29 (5), 1212-1226.

JUHOLA, S., GOODSITE, M E., DAVIS, M., KLEIN, R. J. T., DAVIDSDOTTIR, B., ATLASON, R., LANDAUER, M., LINNER, B. O., NESET, T. S., GLAAS, E., ESKELAND, G. & BALLANTYNE, A. G. 2014. Adaptation decision-making in the Nordic countries: assessing the potential for joint action. *Environment Systems and Decisions*, 34, 600-611.

KEIJSERS, J. G. S., GIARDINO, A., POORTINGA, A., MULDER, J. P., RIKSEN, M. J. & SANTINELLI, G. 2015. Adaptation strategies to maintain dunes as flexible coastal flood defense in The Netherlands. *Mitigation and Adaptation Strategies for Global Change,* 20 (6), 913-928.

KELMAN, I. 2010. Hearing local voices from small island developing states for climate change. *Local Environment*, 15, 605-619.

KELMAN, I. 2014. No change from climate change: vulnerability and small island developing states. *The Geographical Journal*, 180 (2), 120-129.

KELMAN, I. 2018. Islandness within climate change narratives of small island developing states (SIDS). *Island Studies Journal*, 13 (1), 149-166.

KELMAN, I., LEWIS, J., GAILLARD, J. C. & MERCER, J. 2011. Participatory action research for dealing with disasters on islands. *Island Studies Journal*, 6 (1), 59-86.

KENT, G. 2000. Ethical principles. In Burton, D. ed. *Research Training for Social Scientists: a handbook for postgraduate researchers*. London: SAGE Publications, 61-67.

KERR, S. A. 2005. What is small island sustainable development about? *Ocean and Coastal Management*, 48, 503-524.

KILPATRICK, S. & FALK, I. 2003. Learning in agriculture: building social capital in island communities. *Local Environment*, 8 (5), 501-512.

KING, R. 2002. The geographical fascination of islands. In Lockhart, D. G., Drakakis-Smith, D. & Schembri, J. eds. *The Development Process in Small Island States*. London: Routledge, 13-37.

KITZINGER, J. 1994. The methodology of Focus Groups: the importance of interaction between research participants. *Sociology of Health and Illness*, 16, 103-121.

KLEIN, R. J. T., NICHOLLS, R. J. RAGOONADEN, S., CAPOBIANCO, M., ASTON, J. & BUCKLEY, E. N. 2001. Technological options for adaptation to climate change in coastal zones. *Journal of Coastal Research*, 17 (3), 531-543.

KLEIN, R. J. T., NICHOLLS, R. J. & THOMALLA, F. 2003. Resilience to natural hazards: How useful is this concept? *Global Environmental Change Part B: Environmental Hazards,* 5 (1), 35-45.

KLEIN, R. J. T., SCHIPPER, E. L. F. & DESSAI, S. 2005. Integrating mitigation and adaptation into climate and development policy: Three research questions. *Environmental Science and Policy,* 8**,** 579-588.

KLEIN, R. J. T., ERIKSEN, S. E. H., NÆSS, L. O., HAMMILL, A., TANNER, T. M., ROBLEDO, C. & O'BRIEN, K. L. 2007. Portfolio screening to support the mainstreaming of adaptation to climate change into development assistance. *Climatic Change*, 84 (1), 23-44.

KOERTH, J., VAFEIDIS, A. T., HINKEL, J. & STERR, H. 2013. What motivates coastal households to adapt pro-actively to sea-level rise and increasing flood risk? *Regional Environmental Change*, 13, 897-909.

KOERTH, J., VAFEIDIS, A. T., CARRETERO, S., STERR, H. & HINKEL, J. 2014. A typology of household-level adaptation to coastal flooding and its spatio-temporal patterns. *SpringerPlus*, 3 (1), 466.

KOVATS, R.S., VALENTINI, R., BOUWER, L. M., GEORGOPOULOU, E., JACOB, D., MARTIN, E., ROUNSEVELL, M. & SOUSSANA, J. F. 2014. Europe. In Barros, V.R., Field, C.B., Dokken, D. J., Mastrandrea, M. D., Mach, K. J., Bilir, T. E., Chatterjee, M., Ebi, K. L., Estrada, Y. O., Genova, R. C., Girma, B., Kissel, E. S., Levy, A. N., MacCracken, S., Mastrandrea, P. R. & White, L. L. eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, 1267-1326.

KRON, W. 2013. Coasts: The high-risk areas of the world. *Natural Hazards*, 66 (3), 1363-1382.

KURUPPU, N. 2009. Adapting water resources to climate change in Kiribati: the importance of cultural values and meanings. *Environmental Science and Policy*, 12, 799-809.

LANE, D., CLARKE, C. M., FORBES, D. L. & WATSON, P. 2013. The gathering storm: managing adaptation to environmental change in coastal communities. *Sustainability Science*, 8, 469-489.

LAUKKONEN, J., BLANCO, P. K., LENHART, J., KEINER, M., CAVRIC, B. & KINUTHIA-NJENGA, C. 2009. Combining climate change adaptation and mitigation measures at the local level. *Habitat International*, 33, 287-292.

LESNIKOWSKI, A. C., FORD, J. D., BERRANG-FORD, L., BARRERA, M. & HEYMANN, J. 2015. How are we adapting to climate change? A global assessment. *Mitigation and Adaptation Strategies for Global Change*, 20, 277-293.

LONDON, J. B. 2004. Implications of climate change on small island developing states: experience in the Caribbean region. *Journal of Environmental Planning and Management*, 47 (4), 491-501.

LYTH, A., HARWOOD, A., HOBDAY, A. J. & MCDONALD, J. 2016. Place influences in framing and understanding climate change adaptation challenges. *Local Environment*, 21 (6), 730-751.

MAGNAN, A. K., SCHIPPER, E. L. F., BURKETT, M., BHARWANI, S., BURTON, I., ERIKSEN, S., GEMENNE, F., SCHAAR, J. & ZIERVOGEL, G. 2016. Addressing the risk of maladaptation to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, 7 (5), 646-665.

MALATESTA, S. & DI FRIEDBERG, M. S. 2017. Environmental policy and climate change vulnerability in the Maldives: From the 'lexicon of risk' to social response to change. *Island Studies Journal*, 12 (1), 53-70.

MARENGO, J. A., NUNES, L. H., SOUZA, C. R. G., HARARI, J., MULLER-KARGER, F., GRECO, R., HOSOKAWA, E. K., TABUCHI, E. K., MERRILL, S. B., REYNOLDS, C. J., PELLING, M., ALVES, L. M., ARAGÃO, L. E., CHOU, S. C., MOREIRA, F., PATERSON, S., LOCKMAN, J. T. & GRAY, A. G. 2017. A globally deployable strategy for co-development of adaptation preferences to sea-level rise: the public participation case of Santos, Brazil. *Natural Hazards*, 88 (1), 39-53.

MARINE CLIMATE CHANGE IMPACTS PARTNERSHIP. 2017. *Marine climate change impacts: 10 years' experience of science to policy reporting* [PDF]. Available: http://www.mccip.org.uk/media/1770/mccip-report-card-2017-final-artwork-spreads.pdf [Accessed 31 July 2017].

MARSHALL, N. A., PARK, S. E., ADGER, W. N., BROWN, K. & HOWDEN, S. M. 2012. Transformational capacity and the influence of place and identity. *Environmental Research Letters,* 7.

MATYAS, D. & PELLING, M. 2015. Positioning resilience for 2015: the role of resistance, incremental adjustment and transformation in disaster risk management policy. *Disasters,* 39 (s1), s1-s18.

MCCLATCHEY, J., DEVOY, R., WOOLF, D., BREMNER, B. & JAMES, N. 2014. Climate change and adaptation in the coastal areas of Europe's Northern Periphery Region. *Ocean & Coastal Management*, 94, 9-21.

MCCUBBIN, S., SMIT, B. & PEARCE, T. 2015. Where does climate fit? Vulnerability to climate change in the context of multiple stressors in Funafuti, Tuvalu. *Global Environmental Change*, 30, 43-55.

MCFADDEN, L. 2010. Coastal hazard, vulnerabilities and resilience. *Environmental Hazards,* 9 (3), 217-221.

MCGILLIVRAY, M., NAUDE, W. & SANTOS-PAULINO, A. 2008. Small Island States Development Challenges: Introduction. *Journal of International Development*, 20, 481-485.

MCLEMAN, R. A., BRKLACICH, M., WOODROW, M., VODDEN, K., GALLAUGHER, P. & SANDER-REGIER, R. 2011. Opportunities and barriers for adaptation and local adaptation planning in Canadian rural and resource-based communities. In Ford, J. D. & Berrang-Ford, L. eds. *Climate Change Adaptation in Developed Nations: From theory to practice*. Springer: London, 449-460.

MCLEOD, E., HINKEL, J., VAFEIDIS, A. T., NICHOLLS, R. J., HARVEY, N. & SALM, R. 2010. Sea-level rise vulnerability in the countries of the Coral Triangle. *Sustainability Science*, 5, 207-222.

MCLEOD, E., MARGLES WEIS, S. W., WONGBUSARAKUM, S., GOMBOS, M., DAZÉ, A., OTZELBERGER, A., HAMMILL, A., AGOSTINI, V., COT, D. U. & WIGGINS, M. 2015. Community-Based Climate Vulnerability and Adaptation Tools: A Review of Tools and Their Applications. *Coastal Management,* 43**,** 439-458.

MCNAMARA, K. E. & WESTOBY, R. 2011. Local knowledge and climate change adaptation on Erub Island, Torres Strait. *Local Environment*, 16 (9), 887-901.

MEDINA, A. J., GONZALEZ, A. M. & GARCIA FALCON, J. M. 2007. Intellectual capital and sustainable development on islands: an application to the case of Gran Canaria. *Regional Studies*, 41 (4), 473-487.

MEHEUX, K., DOMINEY-HOWES, D. & LLOYD, K. 2007. Natural hazard impacts in small island developing states: a review of current knowledge and future research needs. *Natural Hazards*, 40, 429-446.

MERCER, J., DOMINEY-HOWES, D., KELMAN, I. & LLOYD, K. 2007. The potential for combining indigenous and western knowledge in reducing vulnerability to environmental hazards in small island developing states. *Environmental Hazards*, 7 (4), 245-256.

MERCER, J., KELMAN, I., ALFTHAN, B. & KURVITS, T. 2012. Ecosystem-based adaptation to climate change in Caribbean small island developing states: integrating local and external knowledge. *Sustainability*, 4, 1908-1932.

MIMURA, N. 1999. Vulnerability of island countries in the South Pacific to sea level rise and climate change. *Climate Research*, 12, 137-143.

MORGAN, D. L. 1997. *Focus Groups as Qualitative Research*. 2nd ed. London: SAGE Publications.

MORGAN, D. L. & SPANISH M. T. 1984. Focus groups: a new tool for qualitative research. *Qualitative Sociology*, 7, 253-270.

MORRISON, T. H., ADGER, W. N., BROWN, K., LEMOS, M. C., HUITEMA, D. & HUGHES, T. P. 2017. Mitigation and adaptation in polycentric systems: sources of power in the pursuit of collective goals. *Wiley Interdisciplinary Reviews: Climate Change*, 8 (5), e479.

MOORE, M.L., TJORNBO, O., ENFORS, E., KNAPP, C., HODBOD, J., BAGGIO, J. A., NORSTRÖM, A., OLSSON, P. & BIGGS, D. 2014. Studying the complexity of change: toward an analytical framework for understanding deliberate social-ecological transformations. *Ecology and Society* 19 (4).

MOSER, S. C. 2010. Now more than ever: The need for more societally relevant research on vulnerability and adaptation to climate change. *Applied Geography*, 30, 464-474.

MOSER, S, C. 2013. Navigating the political and emotional terrain of adaptation: community engagement when climate change comes home. In Moser, S. C. & Boykoff, M. T. eds. *Successful Adaptation to Climate Change: Linking science and policy in a rapidly changing world*. London: Routledge, 289-305.

MOSER, S. C. 2014. Communicating adaptation to climate change: The art and science of public engagement when climate change comes home. *Wiley Interdisciplinary Reviews: Climate Change,* 5**,** 337-358.

MOSER, S. C. 2016. Reflections on climate change communication research and practice in the second decade of the 21st century: What more is there to say? *Wiley Interdisciplinary Reviews: Climate Change*.

MOSER, S. C., KASPERSON, R. E., YOHE, G. & AGYEMAN, J. 2008. Adaptation to climate change in the Northeast United States: Opportunities, processes, constraints. *Mitigation and Adaptation Strategies for Global Change,* 13**,** 643-659.

MOSER, S. C. & EKSTROM, J. A. 2011. Taking ownership of climate change: participatory adaptation planning in two local case studies from California. *Journal of Environmental Studies and Sciences*, 1, 63-74.

MUIR, D., DAWSON, A. G., GAGNON, A. S. & O'MAHONY, C. 2013. Vulnerability and Adaptation to Extreme Coastal Flooding: an example from the South Ford area, Scottish Outer Hebrides. In Allsop, W. & Burgess, K. eds. *From Sea to Shore–Meeting the Challenges of the Sea (Coasts, Marine Structures and Breakwaters 2013)*. London: ICE Publishing, 22-32.

MUIR, D., COOPER, J. A. G. & PÉTURSDÓTTIR, G. 2014. Challenges and opportunities in climate change adaptation for communities in Europe's northern periphery. *Ocean & Coastal Management*, 94, 1-8.

NATIONAL COASTAL CHANGE ASSESSMENT. 2018. *What is the National Coastal Change Assessment (NCCA)?* [Online]. Available: http://www.dynamiccoast.com/about_project.html [Accessed 03 March 2018].

NUNN, P. D., AALBERSBERG, W., LATA, S. & GWILLIAM, M. 2014. Beyond the core: community governance for climate-change adaptation in peripheral parts of Pacific Island Countries. *Regional Environmental Change*, 14, 221-235.

NURSE, L.A., MCLEAN, R.F., AGARD, J., BRIGUGLIO, L.P., DUVAT-MAGNAN, V. PELESIKOTI, N., TOMPKINS, E. & WEBB, A. 2014. Small islands. In Barros, V.R., Field, C. B., Dokken, D. J., Mastrandrea, M. D., Mach, K. J., Bilir, T. E., Chatterjee, M., Ebi, K. L., Estrada, Y. O., Genova, R. C., Girma, B., Kissel, E. S., Levy, A. N., MacCracken, S., Mastrandrea, P. R., & White, L. L. eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, 1613-1654.

NURSE, L. & MOORE, R. 2005. Adaptation to global climate change: An urgent requirement for small island developing states. *Review of European, Comparative & International Environmental Law*, 14 (2), 100-107.

OATES, C. 2000. The use of focus groups in social science research. In Burton, D. ed. *Research Training for Social Scientists: a handbook for postgraduate researchers*. London: SAGE Publications, 186-195.

O'BRIEN, K. L. 2009. Do values subjectively define the limits to climate change adaptation? In Adger, W. N., Lorenzoni, I. & O'Brien, K. L. eds. *Adapting to Climate Change: Thresholds, Values, Governance*. Cambridge: Cambridge University Press, 164-180.

OFFICE FOR NATIONAL STATISTICS. 2011. *2011 Census: characteristics of built-up areas* [Online]. Available: https://www.ons.gov.uk/peoplepopulationandcommunity/housing/articles/characteristicsofbuiltupareas/2013-06-28 [Accessed: 14 August 2017].

ORKNEY ISLANDS COUNCIL. 2013. *Our Plan 2013-2018* [PDF]. Available: www.orkney.gov.uk/files/council/council-plans/our_plan_2013-2018.pdf [Accessed: 17 April 2018].

ORKNEY ISLANDS COUNCIL. 2014. *Our Islands, Our Future* [PDF]. Available: http://www.orkney.gov.uk/Files/Committees-and-Agendas/Policy-and-Resources/PR2017/20-06-2017/I15__Our_Islands_Our_Future.pdf. [Accessed: 17 April 2018].

ORKNEY ISLANDS COUNCIL. 2015a. *Ports Handbook for Orkney: 6th Edition* [PDF]. Available: https://www.orkneyharbours.com/site/assets/files/.../ports_handbook_2015_small.pdf [Accessed: 03 March 2018].

ORKNEY ISLANDS COUNCIL. 2015b. *Scottish Climate Change Declaration Annual Report 2014-15* [PDF]. Available: http://www.orkney.gov.uk/Files/Committees-and-Agendas/Policy-and-Resources/2015/24-11-2015/I13__Scottish_Climate_Change_Declaration.pdf [Accessed: 15 February 2018].

ORKNEY ISLANDS COUNCIL. 2016. *A Flood Risk Management Plan for Orkney* [PDF]. Available: www.orkney.gov.uk/Files/Planning/Flooding/Orkney_LFRMP_Accessible.pdf [Accessed: 17 April 2018].

ORKNEY ISLANDS COUNCIL. 2017a. *Orkney Local Development Plan 2017* [PDF]. Available: http://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/Local-Plan/OLDP_2017/Orkney_Local_Development_Plan_2017_2022.pdf. [Accessed: 17 April 2018].

ORKNEY ISLANDS COUNCIL. 2017b. *Public Sector Climate Change Duties 2017: Orkney Islands Council Climate Change Report* [XLS]. Available: https://www.keepscotlandbeautiful.org/media/1560725/orkney-ijb-ccr-2017.xlsx [Accessed: 17 April 2018].

ORKNEY ISLANDS COUNCIL. 2018. *Published Timetables* [Online]. Available: http://www.orkneyferries.co.uk/timetables.php [Accessed: 06 March 2018].

OSBAHR, H., TWYMAN, C., ADGER, W. N. & THOMAS, D. S. G. 2010. Evaluating successful livelihood adaptation to climate variability and change in southern Africa. *Ecology and Society*, 15 (2).

OUTER HEBRIDES BUSINESS DIRECTORY. 2018. *Outer Hebrides Business Directory – Isle of South Uist* [Online]. Available: http://www.businesshebrides.co.uk/businesses/browseLocation/page:1/island:8/lang:_en [Accessed: 21 March 2018].

OUTER HEBRIDES COMMUNITY PLANNING PARTNERSHIP. 2007. *The Outer Hebrides Community Appraisal Survey – Supplementary report for South Uist and Eriskay* [PDF]. Available: http://194.83.245.247/communitysupport/documents/communitysurvey/Area%205%20South%20Uist%20and%20Eriskay_Final.pdf [Accessed: 21 March 2018].

OUTER HEBRIDES COMMUNITY PLANNING PARTNERSHIP. 2018. *Economic Regeneration Strategy to 2020* [PDF]. Available: https://www.cne-siar.gov.uk/media/5768/economic-regeneration-strategy.pdf [Accessed: 21 March 2018].

OUTER HEBRIDES TOURISM. 2014. *Tourism Outer Hebrides 2020 – Tourism Strategy* [PDF]. Available: https://www.visitouterhebrides.co.uk/industry/toh2020 [Accessed: 24 July 2018].

OUTER HEBRIDES TOURISM. 2018a. *Cladh Hallan Roundhouses* [Online]. Available: https://www.visitouterhebrides.co.uk/see-and-do/cladh-hallan-roundhouses-p522041 [Accessed: 24 July 2018].

OUTER HEBRIDES TOURISM. 2018b. *Dun Mhulan* [Online]. Available: https://www.visitouterhebrides.co.uk/see-and-do/dun-mhulan-p523091 [Accessed: 24 July 2018].

OUTER HEBRIDES TOURISM. 2018c. *Culture and Heritage* [Online]. Available: https://www.visitouterhebrides.co.uk/see-and-do/culture-and-heritage [Accessed: 24 July 2018].

OWEN, S. D., KENCH, P. S. & FORD, M. 2016. Improving understanding of the spatial dimensions of biophysical change in atoll island countries and implications for island communities: a Marshall Islands' case study. *Applied Geography*, 72, 55-64.

PAAVOLA, J. & ADGER, W. N. 2006. Fair adaptation to climate change. *Ecological Economics,* 56**,** 594-609.

PELLING, M. 2007. Learning from others: the scope and challenges for participatory disaster risk assessment. *Disasters*, 31 (4), 373-385.

PELLING, M. 2011. *Adaptation to Climate Change: From Resilience to Transformation*. Abingdon: Routledge.

PELLING, M. & UITTO, J. I. 2001. Small island developing states: natural disaster vulnerability and global change. *Global Environmental Change Part B: Environmental Hazards*, 3, 49-62.

PELLING, M. & HIGH, C. 2005. Understanding adaptation: What can social capital offer assessments of adaptive capacity? *Global Environmental Change*, 15, 308-319.

PELLING, M., O'BRIEN, K. & MATYAS, D. 2015. Adaptation and transformation. *Climatic Change,* 133**,** 113-127.

PENNING-ROWSELL, E., FLOYD, P., RAMSBOTTOM, D. & SURENDRAN, S. 2005. Estimating injury and loss of life in floods: a deterministic framework. *Natural Hazards*, 36 (1-2), 43-64.

PERSOON, G. A. & SIMARMATA, R. 2014. Undoing 'marginality': the islands of the Mahakam delta, East Kalimantan (Indonesia). *Journal of Marine and Island Cultures*, 3, 43-53.

PETZOLD, J. 2016. Limitations and opportunities of social capital for adaptation to climate change: a case study on the Isles of Scilly. *The Geographical Journal*, 182 (2), 123-134.

PETZOLD, J. 2018. Social adaptability in ecotones: sea-level rise and climate change adaptation in Flushing and the Isles of Scilly, UK. *Island Studies Journal*, 13 (1), 101-118.

PETZOLD, J. & RATTER, B. M. W. 2015. Climate change adaptation under a social capital approach – an analytical framework for small islands. *Ocean and Coastal Management*, 112, 36-43.

PHILPOT, D., GRAY, T. S. & STEAD S. M. 2015. Seychelles, a vulnerable or resilient SIDS? A local perspective. *Island Studies Journal*, 10 (1), 31-48.

RASMUSSEN, K., MAY, W., BIRK, T., MATAKI, M., MERTZ, O. & YEE, D. 2009. Climate change on three Polynesian outliers in the Solomon Islands: Impacts, vulnerability and adaptation. *Danish Journal of Geography*, 109 (1), 1-13.

RASMUSSEN, K., MAY, W., BIRK, T., MATAKI, M. & MERTZ, O. 2011. Prospects for climate change on three Polynesian outliers in Solomon Islands: exposure, sensitivity and adaptive capacity. *Danish Journal of Geography*, 111 (1), 43-57.

REED, M. S., KENTER, J., BONN, A., BROAD, K., BURT, T. P., FAZEY, I. R., FRASER, E. D. G., HUBACEK, K., NAINGGOLAN, D., QUINN, C. H., STRINGER, L. C. & RAVERA, F. 2013. Participatory scenario development for environmental management: A methodological framework illustrated with experience from the UK uplands. *Journal of Environmental Management*, 128, 345-362.

RICHARDS, L. A. R. & PHIPPS, P. J. 2007. Managing the impact of climate change on vulnerable areas: a case study of the Western Isles, UK. In McInnes, R., Jakeways, J., Fairbank, H. & Mathie, E. eds. *Landslides and Climate Change: Challenges and Solutions.* Proceedings of the International Conference on Landslides and Climate Change, Ventnor, Isle of Wight, UK, 21-24 May 2007, 435-442.

RITCHIE, W. 1967. The Machair of South Uist. *Scottish Geographical Magazine*, 83 (3), 161-173.

ROBINSON, S. A. 2015. Climate change adaptation trends in small island developing states. *Mitigation and Adaptation Strategies for Global Change,* 1-23.

ROBINSON, S. A. 2018. Adapting to climate change at the national level in Caribbean small island developing states. *Island Studies Journal*, 13 (1), 79-100.

ROBSON, C. 2002. *Real World Research: A resource for social scientists and practitioner-researchers.* 2nd ed. Oxford: Blackwell.

ROBSON, C. 2016. *Real World Research: A resource for social scientists and practitioner-researchers*. 4th ed. Oxford: Blackwell.

ROSS, P. 2015. 'Tragedy on South Uist: the storm that swept a family away', *The Guardian*, 10 October. Available: https://www.theguardian.com/lifeandstyle/2015/oct/10/south-uist-storm-tragedy-10-years-on-peter-ross [Accessed: 25 January 2018].

SAYER, A. 2000. *Realism and Social Science*. London: Sage.

SAYER, A. 2015. Critical realism in geography. In Wright, J. ed. *International Encyclopedia of the Social & Behavioral Sciences.* 2nd ed. Oxford: Elsevier, 277-280.

SCHWARZ, A., BENE, C., BENNETT, G., BOSO, D., HILLY, Z., PAUL, C., POSALA, R., SIBITI, S. & ANDREW, N. 2011. Vulnerability and resilience of remote rural communities to shocks and global changes: empirical analysis from Solomon Islands. *Global Environmental Change*, 21, 1128-1140.

SCOTLAND'S CENSUS. 2011a. *Scotland's Census 2011 - National Records of Scotland Table QS605SC – Industry - All people aged 16 to 74 in employment the week before the census – Unst* [Online]. Available: http://www.scotlandscensus.gov.uk/ods-analyser/jsf/tableView/tableView.xhtml [Accessed: 20 March 2018].

SCOTLAND'S CENSUS. 2011b. *Scotland's Census 2011 - National Records of Scotland Table QS605SC - Industry All people aged 16 to 74 in employment the week before the census – Westray* [Online]. Available: http://www.scotlandscensus.gov.uk/ods-analyser/jsf/tableView/tableView.xhtml [Accessed: 20 March 2018].

SCOTLAND'S CENSUS. 2011c. *Scotland's Census 1991 - National Records of Scotland Table KS101SC - Usual resident population - All people* [Online]. Available: http://www.scotlandscensus.gov.uk/ods-analyser/jsf/tableView/tableView.xhtml [Accessed: 20 March 2018].

SCOTLAND'S CENSUS. 2011d. *Scotland's Census 2011 - National Records of Scotland Table QS605SC - Industry - All people aged 16 to 74 in employment the week before the census – South Uist* [Online]. Available: http://www.scotlandscensus.gov.uk/ods-analyser/jsf/tableView/tableView.xhtml [Accessed: 25 March 2018].

SCOTLAND'S CENSUS. 2011e. *Scotland's Census 2011 - National Records of Scotland Table QS211SC - Gaelic language skills - All people aged 3 and over – South Uist* [Online]. Available: http://www.scotlandscensus.gov.uk/ods-analyser/jsf/tableView/tableView.xhtml [Accessed: 24 July 2018].

SCOTLAND'S CENSUS. 2011f. *Scotland's Census 2011: Inhabited islands report* [PDF]. Available: http://www.scotlandscensus.gov.uk/news/inhabited-islands-analytical-report [Accessed: 03/05/2017].

SCOTTISH GOVERNMENT. 2009. *Scotland's Climate Change Adaptation Framework* [PDF]. Available: http://www.gov.scot/Resource/Doc/295110/0091310.pdf [Accessed 21 June 2017].

SCOTTISH GOVERNMENT. 2014. *Climate Ready Scotland: Scottish Climate Change Adaptation Programme* [PDF]. Available: http://www.gov.scot/Resource/0045/00451392.pdf [Accessed: 14 June 2017].

SCOTTISH GOVERNMENT. 2017. *Local authorities: factsheet* [Online]. Available: https://beta.gov.scot/publications/local-authorities-factsheet/ [Accessed: 22 July 2018].
SCOTTISH GOVERNMENT. 2018. *Community empowerment: community councils* [Online]. Available: https://beta.gov.scot/policies/community-empowerment/community-councils/ [Accessed: 22 July 2018].
SCOTTISH NATURAL HERITAGE. 2013. *Coasts and Seas* [Online]. Available: http://www.snh.gov.uk/about-scotlands-nature/habitats-and-ecosystems/coasts-and-seas/ [Accessed: 21/02/14].
SEPA. 2015. *Flood Risk Management Strategy: Outer Hebrides*. Available: apps.sepa.org.uk/frmstrategies/pdf/lpd/LPD_02_Full.pdf [Accessed: 22 January 2018].
SHACKLEY, S. & WYNNE, B. 1996. Representing uncertainty in global climate change science and policy: boundary-ordering devices and authority. *Science, Technology and Human Values*, 21 (3), 275-302.
SHETLAND AMENITY TRUST. 2012. *Place Names: Signposts to the past* [PDF]. Available: https://www.shetlandamenity.org/assets/Place%20Names/placenames%20leaflet.pdf [Accessed: 18 April 2018].
SHETLAND AMENITY TRUST. 2018a. *About Geopark Shetland* [Online]. Available: https://www.shetlandamenity.org/about-geopark-shetland [Accessed: 18 April 2018].
SHETLAND AMENITY TRUST. 2018b. *Viking Unst* [Online]. Available: https://www.shetlandamenity.org/viking-unst [Accessed: 18 April 2018].
SHETLAND ISLANDS COUNCIL. 2014a. *Shetland in Statistics* [PDF]. Available: www.shetland.gov.uk/economic_development/documents/ShetlandInStatistics2014.pdf [Accessed: 14 July 2018].
SHETLAND ISLANDS COUNCIL. 2014b. *Shetland Local Development Plan* [PDF]. Available: https://www.shetland.gov.uk/planning/documents/ShetlandLocalDevelopmentPlanAdopted26_09_2014.pdf [Accessed: 17 April 2018].
SHETLAND ISLANDS COUNCIL. 2015. *Economic Development Policy Statement* [PDF]. Available: https://www.shetland.gov.uk/economic_development/documents/EconomicDevelopmentPolicyStatement201317FINAL.pdf [Accessed: 14 July 2018].
SHETLAND ISLANDS COUNCIL. 2016a. *Our Plan 2016 to 2020* [PDF]. Available: https://www.shetland.gov.uk/documents/OurPlan2016-20final.pdf [Accessed: 17 April 2018].
SHETLAND ISLANDS COUNCIL. 2016b. *Shetland Local Plan District: Local Flood Risk Management Plan* [PDF]. Available: https://www.shetland.gov.uk/planning/documents/lfrmp.pdf [Accessed: 17 April 2018].
SHETLAND ISLANDS COUNCIL. 2017a. *Constitution Part A: Governance* [PDF]. Available: www.shetland.gov.uk/about_how_we_work/PartAGovernance-V2.0.pdf [Accessed: 14 July 2018].
SHETLAND ISLANDS COUNCIL. 2017b. *Public Sector Climate Change Duties 2017: Shetland Islands Council Climate Change Report* [XLS]. Available:

https://www.keepscotlandbeautiful.org/media/1560653/shetland-islands-council-ccr-2017.xlsx [Accessed: 17 April 2018].
SHETLAND ISLANDS COUNCIL. 2018. *Timetable and Fares Information* [Online]. Available: http://www.shetland.gov.uk/ferries/timetable.asp [Accessed: 06 March 2018].
SHETLAND NEWS. 2018. 'Unst Partnership to grow after asset transfer', *Shetland News*, 20 June. Available: http://www.shetnews.co.uk/news/16527-unst-partnership-to-grow-after-asset-transfer [Accessed: 21 July 2018].
SIETZ, D., BOSCHÜTZ, M. & KLEIN, R. J. T. 2011. Mainstreaming climate adaptation into development assistance: Rationale, institutional barriers and opportunities in Mozambique. *Environmental Science and Policy,* 14**,** 493-502.
SJOSTEDT, M. & POVITKINA, M. 2017. Vulnerability of small island developing states to natural disasters: how much difference can effective governments make? *Journal of Environment and Development*, 26 (1), 82-105.
SMITH, R. J. & RHINEY, K. 2016. Climate (in)justice, vulnerability and livelihoods in the Caribbean: the case of the indigenous Caribs in northeastern St Vincent. *Geoforum*, 73, 22-31.
SMITH, K. & PETLEY, D. N. 2009. *Environmental Hazards: assessing risk and reducing disaster*. London: Routledge.
SMIT, B. & WANDEL, J. 2006. Adaptation, adaptive capacity and vulnerability. *Global Environmental Change,* 16**,** 282-292.
SMUCKER, T. A., WISNER, B., MASCARENHAS, A., MUNISHI, P., WANGUI, E. E., SINHA, G., WEINER, D., BWENGE, C. & LOVELL, E. 2015. Differentiated livelihoods, local institutions, and the adaptation imperative: assessing climate change adaptation policy in Tanzania. *Geoforum*, 59, 39-50.
SOVACOOL, B. K. 2012. Perceptions of climate change risks and resilient island planning in the Maldives. *Mitigation and Adaptation Strategies for Global Change*, 17, 731-752.
STARC, N. & STUBBS, P. 2014. No island is an island: participatory development planning on the Croatian Islands. *International Journal of Sustainable Development and Planning*, 9 (2), 158-176.
STEWART, D. W., SHAMDASANI, P. N. & ROOK, D. W. 2007. *Focus Groups: Theory and practice.* 2nd ed. London: SAGE Publications.
STOJANOV, R., DUZI, B., KELMAN, I., NEMEC, D. & PROCHAZKA, D. 2017. Local perceptions of climate change impacts and migration patterns in Male, Maldives. *The Geographical Journal*, 183 (4), 370-385.
STORAS UIBHIST. 2013a. *Who owns Sealladh na Beinne Moire?* [Online]. Available: http://www.storasuibhist.com/frequently-asked-questions/ [Accessed: 20 July 2018].
STORAS UIBHIST. 2013b. *About Us* [Online]. Available: http://www.storasuibhist.com/about-us/ [Accessed: 21 March 2018].
STORAS UIBHIST. 2013c. *Estate Business* [Online]. Available: http://www.storasuibhist.com/estate-business/ [Accessed: 21 March 2018].

STORAS UIBHIST. 2013d. *Estate Business – Crofting* [Online]. Available: http://www.storasuibhist.com/estate-business/crofting/ [Accessed: 21 March 2018].
STORAS UIBHIST. 2014. *Drainage Maintenance Update* [Online]. Available: http://www.storasuibhist.com/drainage-maintenance-update/ [Accessed: 15 February 2018].
STOREY, D. & STEINMAYER, V. 2011. Mobility as Development Strategy: the case of the Pacific Islands. *Asia-Pacific Population Journal*, 26 (4), 57-72.
STORNOWAY GAZETTE. 2018. 'New board members for Uist community landlord', *Stornoway Gazette*, 12 July. Available: https://www.stornowaygazette.co.uk/news/new-board-members-for-uist-community-landlord-1-4767838 [Accessed: 31 July 2018].
SUCKALL, N., TOMPKINS, E. & STRINGER, L. 2014. Identifying trade-offs between adaptation, mitigation and development in community responses to climate and socio-economic stresses: evidence from Zanzibar, Tanzania. *Applied Geography*, 46, 111-121.
TAYLOR, R. 2014. 'Either S1-S3 or closures, councillors agree', *The Shetland Times*, 1 July. Available: http://www.shetlandtimes.co.uk/2014/07/01/either-s1-s3-or-closures-councillors-agree [Accessed: 01 March 2018].
THE ORCADIAN. 2016. 'North Isles ferry cancellations', *The Orcadian*, 26 January. Available: https://www.orcadian.co.uk/north-isles-ferry-cancellations/ [Accessed: 06 March 2018].
THE ORCADIAN. 2017a. 'McArthur: Orkney being left "high and dry" over ferry fares', *The Orcadian*, 26 May. Available: https://www.orcadian.co.uk/mcarthur-orkney-left-high-dry-ferry-fares/ [Accessed: 06 March 2018].
THE ORCADIAN. 2017b. 'North Isles ferry fares cut in 2018', *The Orcadian*, 22 August. Available: https://www.orcadian.co.uk/northern-isles-ferry-fares-cut-2018/ [Accessed: 06 March 2018].
THE SHETLAND TIMES. 2017. 'Storm Caroline forces ferry cancellations and road closures', *The Shetland Times*, 8 December. Available: http://www.shetlandtimes.co.uk/2017/12/08/storm-caroline-forces-ferry-cancellations-road-closures [Accessed: 06 March 2018].
TOL, R. S. J., KLEIN, R. J. T. & NICHOLLS, R. J. 2008. Towards successful adaptation to sea-level rise along Europe's coasts. *Journal of Coastal Research,* 24**,** 432-442.
TOMPKINS, E. L. 2005. Planning for climate change in small islands: Insights from national hurricane preparedness in the Cayman Islands. *Global Environmental Change,* 15**,** 139-149.
TOMPKINS, E. L., FEW, R. & BROWN, K. 2008. Scenario-based stakeholder engagement: incorporating stakeholders preferences into coastal planning for climate change. *Journal of Environmental Management*, 88, 1580-1592.
TOMPKINS, E. L., ADGER, W. N., BOYD, E., NICHOLSON-COLE, S., WEATHERHEAD, K. & ARNELL, N. 2010. Observed adaptation to climate change: UK evidence of transition to a well-adapting society. *Global Environmental Change,* 20**,** 627-635.

TOMPKINS, E. L. & EAKIN, H. 2012. Managing private and public adaptation to climate change. *Global Environmental Change*, 22, 3-11.

TRIBBIA, J. & MOSER, S. C. 2008. More than information: what coastal managers need to plan for climate change. *Environmental Science and Policy*, 11, 315-328.

TSAI, H. M. & HONG, S. K. 2014. Island development: local governance under globalization. *Journal of Marine and Island Cultures*, 3, 41-42.

TURNER, B. L. 2010. Vulnerability and resilience: coalescing or paralleling approaches for sustainability science? *Global Environmental Change*, 20 (4), 570-576.

TURNER, B. L., KASPERSON, R. E., MATSON, P. A., MCCARTHY, J. J., CORELL, R. W., CHRISTENSEN, L., ECKLEY, N., KASPERSON, J. X., LUERS, A., MARTELLO, M. L., POLSKY, C., PULSIPHER, A. & SCHILLER, A. 2003. A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences of the United States of America*, 100 (14), pp. 8074-8079.

UNESCO. 2017. *Shetland UNESCO Global Geopark (United Kingdom of Great Britain and Northern Ireland)* [Online]. Available: http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/list-of-unesco-global-geoparks/united-kingdom/shetland/ [Accessed: 18 April 2018].

UNITED NATIONS. 1992. *United Nations Framework Convention on Climate Change* [PDF]. Available: https://unfccc.int/resource/docs/convkp/conveng.pdf [Accessed: 15 May 2017].

UNITED NATIONS. 2018. *Small Island Developing States* [Online]. Available: https://sustainabledevelopment.un.org/topics/sids [Accessed: 15 June 2018].

UNST COMMUNITY COUNCIL. 2006. *Shetland Local Plan: Unst Community Council Area Statement* [PDF]. Available: www.shetland.gov.uk/developmentplans/documents/UnstCCStatement.pdf [Accessed: 10 July 2018].

UNST COMMUNITY COUNCIL. 2017. *Minutes of the meeting held on Monday 16th January 2017 at 7pm in the Baltasound School, English Room* [Online]. Available: http://www.shetland-communities.org.uk/subsites/ucc/february-2017-minutes.htm [Accessed: 03 March 2018].

UNST COMMUNITY COUNCIL. 2018. *Minutes of the meeting held on Monday 30th April 2018* [Online]. Available: http://www.shetland-communities.org.uk/subsites/ucc/april-2018-minutes.htm [Accessed: 22 July 2018].

UNST HERITAGE TRUST. 2012. *The Unst Heritage Trust, Unst, Shetland* [Online]. Available: http://www.unstheritage.com/web/ [Accessed: 21 April 2018].

UNST PARTNERSHIP. 2010a. *Unst Community Development Plan 2010-2015* [PDF]. Available: www.hie.co.uk/common/handlers/download-document [Accessed: 10 July 2018].

UNST PARTNERSHIP. 2010b. *Unst Community Development Plan Consultation: Summary report following an 'Ideas Day' held in Unst on the 23rd of October 2010* [PDF]. Available:

www.unst.org/2010/Ideas%20Day%20Report%2022.10.10-1.pdf [Accessed: 10 July 2018].
UNST PARTNERSHIP. 2015. *Unst Partnership* [Online]. Available: http://www.unstpartnership.com/ [Accessed: 22 July 2018].
UNST PARTNERSHIP. 2018. *Welcome Pack – Essential Guide to Unst* [PDF]. Available: www.unstpartnership.com/uploads/3/0/8/3/30837619/welcome_pack_final_2018_pdf.pdf [Accessed: 10 July 2018].
URWIN, K. & JORDAN, A. 2008. Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance. *Global Environmental Change*, 18, 180-191.
VAN AALST, M. K., CANNON, T. & BURTON, I. 2008. Community level adaptation to climate change: the potential role of participatory community risk assessment. *Global Environmental Change*, 18 (1), 165-179.
VISIT SCOTLAND. 2018. *Pierowall* [Online]. Available: https://www.visitscotland.com/info/towns-villages/pierowall-p238411 [Accessed: 01 March 2018].
WALLNER, H. P., NARODOSLAWSKY, M. & MOSER, F. 1996. Islands of sustainability: a bottom-up approach towards sustainable development. *Environment and Planning*, 28, 1763-1778.
WESTRAY COMMUNITY COUNCIL. 2018. *Minute of the Meeting of Westray Community Council held in the Community Classroom, Westray Junior High School on Monday 16 April 2018 at 19:00* [PDF]. Available: https://westraycommunity.co.uk/community-council-minutes/ [Accessed: 16 July 2018].
WESTRAY DEVELOPMENT TRUST. 2000. *Turning the Tide in Westray: Westray Development Trust Development Plan 2000* [PDF]. Available: https://westraydevelopmenttrust.co.uk/community-planning/ [Accessed: 06 March 2018].
WESTRAY DEVELOPMENT TRUST. 2005. *The Tide is Turning…five years on: Westray Development Trust Development Plan 2005* [PDF]. Available: https://westraydevelopmenttrust.co.uk/community-planning/ [Accessed: 06 March 2018].
WESTRAY DEVELOPMENT TRUST. 2011. *Westray Local Development Plan: A Framework for Development* [PDF]. Available: https://westraydevelopmenttrust.co.uk/community-planning/ [Accessed: 06 March 2018].
WESTRAY DEVELOPMENT TRUST. 2017. *Westray Development Trust Annual Report 2016-2017* [PDF]. Available: https://westraydevelopmenttrust.co.uk/annual-reports/ [Accessed: 06 March 2018].
WESTRAY DEVELOPMENT TRUST. 2018. *Background to the Turbine Project* [Online]. Available: https://westraydevelopmenttrust.co.uk/arrival-and-installation-of-the-westray-turbine/ [Accessed: 21 March 2018].
WESTRAY AND PAPA WESTRAY TOURIST ASSOCIATION. 2018a. *General Information in Westray* [Online]. Available:

http://westraypapawestray.co.uk/general-information/ [Accessed: 01 March 2018].

WESTRAY AND PAPA WESTRAY TOURIST ASSOCIATION. 2018b. *Westray: 'the Queen O'The Isles* [Online]. Available: https://westraypapawestray.co.uk/westray/ [Accessed: 21 April 2018].

WESTRAY AND PAPA WESTRAY TOURIST ASSOCIATION. 2018c. *Heritage Centre* [Online]. Available: https://westraypapawestray.co.uk/2010/10/heritage-centre/ [Accessed: 21 April 2018].

WOLF, J. 2011. Climate Change Adaptation as a Social Process. In Ford, J. D. & Berrang-Ford, L. eds. *Climate Change Adaptation in Developed Nations: From theory to practice*. Springer: London, 21-32.

WOLF, J., ADGER, W. N., LORENZONI, I., ABRAHAMSON, V. & RAINE, R. 2010. Social capital, individual responses to heat waves and climate change adaptation: An empirical study of two UK cities. *Global Environmental Change*, 20, 44-52.

WONG, P.P., LOSADA, I.J., GATTUSO, J. P., HINKEL, J., KHATTABI, A., MCINNES, K.L., SAITO, Y. & SALLENGER, A. 2014. Coastal systems and low-lying areas. In Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., MacCracken, S., Mastrandrea, P.R. & White, L.L. eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, 361-409.

XU, L. & KAJIKAWA, Y. 2018. An integrated framework for resilience research: a systematic review based on citation network analysis. *Sustainability Science*, 13 (1), pp. 235-254.

YIN, R. K. 2014. *Case Study Research: design and methods*. 5th ed. London: SAGE Publications.

YOUNG, E., MUIR, D., DAWSON, A. G. & DAWSON, S. 2014. Community driven coastal management: an example of the implementation of a coastal defence bund on South Uist, Scottish Outer Hebrides. *Ocean & Coastal Management*, 94, 30-37.

ZSAMBOKY, M., FERNÁNDEZ-BILBAO, A., SMITH, D., KNIGHT, J. & ALLAN, J. 2011. *Impacts of climate change on disadvantaged UK coastal communities* [PDF] Available: https://www.jrf.org.uk/report/impacts-climate-change-disadvantaged-uk-coastal-communities [Accessed: 17 September 2017].

Appendices

Appendix A: Ethical Approval Form

University of St Andrews

University Teaching and Research Ethics Committee
School Of Geography And Geosciences

4th November 2014
Fiona Cunningham
Geography and Geosciences

Ethics Reference No: *Please quote this ref on all correspondence*	**GG11211**
Project Title:	Vulnerability and Adaptation to Impacts of Climate Change in Scottish Island Communities
Researchers Name(s):	Fiona Cunningham
Supervisor(s):	Dr Timothy Stojanovic

Thank you for submitting your application which was considered by the Geography and Geosciences School Ethics Committee on the date specified below. The following documents were reviewed:

1. Ethical Application Form	22 October 2014
2. Participant Information Sheet	22 October 2014
3. Participant Consent Form	22 October 2014
4. Debriefing Form	22 October 2014
5. Other (Recruitment emails)	22 October 2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years. Projects, which have not commenced within two years of original approval, must be re-submitted to your School Ethics Committee.

You must inform your School Ethics Committee when the research has been completed. If you are unable to complete your research within the 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely,

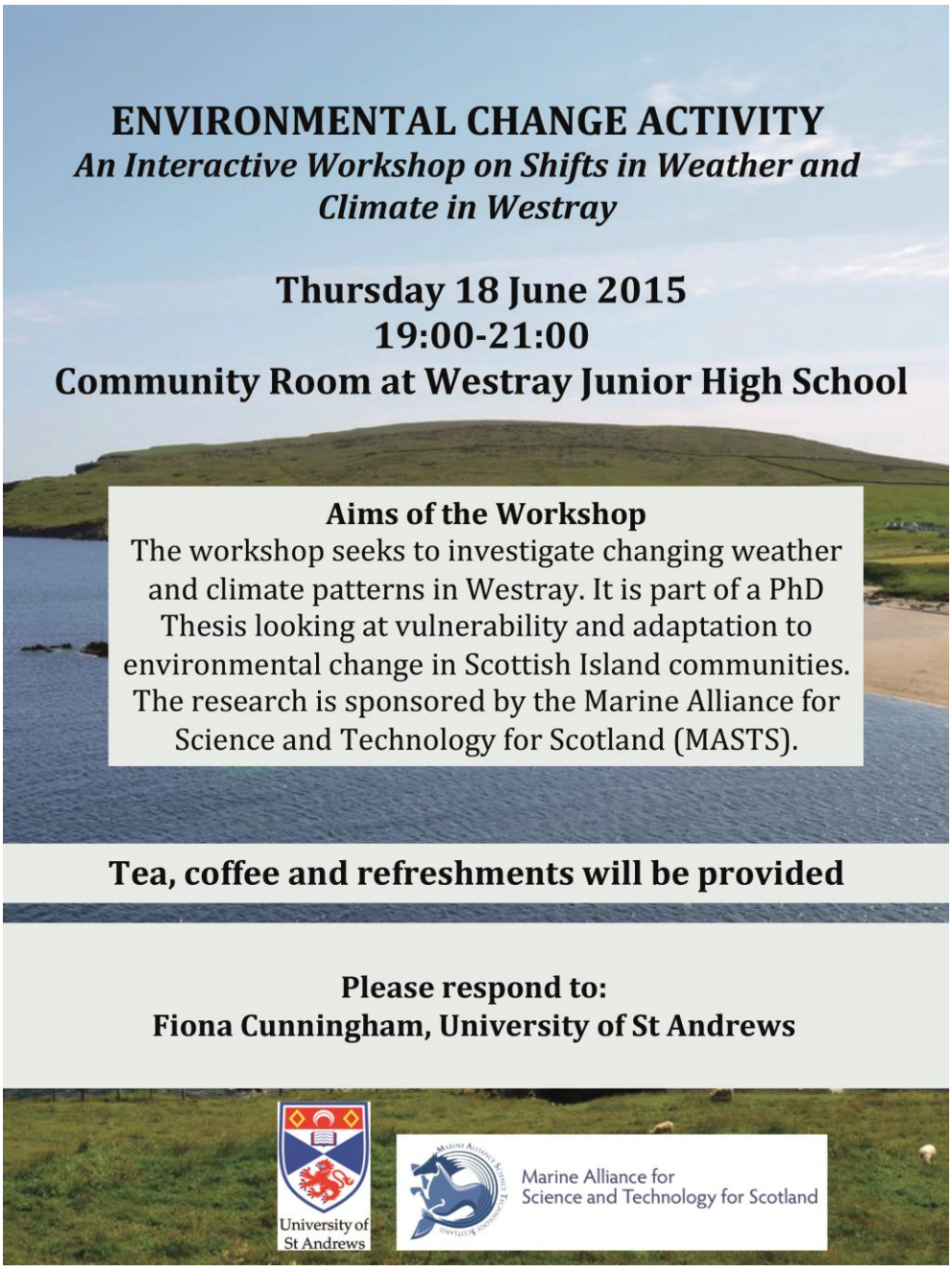
Dr. Matt Southern
Convenor of the School Ethics Committee

UTREC School of Geography and Geosciences Convenor, Irvine Building, North Street, St Andrews, KY16 9AL
Email: ggethics@st-andrews.ac.uk Tel: 01334 463897
The University of St Andrews is a charity registered in Scotland: No SC013532

Appendix B: Deliberative Workshops Materials

The materials and documents related to the deliberative workshops are illustrated in this appendix. Recruitment flyers and emails were distributed within the case studies (Figure B.1). The workshop discussion guide, including the session outline, is presented in Figure B.2. Although the discussion guide employed in Unst is used as an example within this appendix, the questions outlined in the deliberative workshop discussion guides were identical for all three case studies.

Figure B.1: Deliberative Workshops Recruitment Materials



Recruitment Email

Deliberative Workshops

Dear X,

You are invited to attend a two-hour workshop on climate-driven change in the communities of Shetland, Orkney and the Outer Hebrides to be held at (venue TBC) in November 2014 (date TBC). Further details can be found in the attached flyer. Breaks and refreshments will be provided. I am keen to ensure that a representative collection of the community is present at the workshop. I would be very grateful if you could let me know if you are willing to attend via return email if possible. My address and daytime telephone number are also listed at the bottom of this email. Please do not hesitate to contact me if you have any questions about the study. Please do not feel obliged to participate and be aware that you are free to withdraw from the study at any time without giving an explanation.

Kind regards,

Fiona Cunningham
University of St Andrews

Figure B.2: Deliberative Workshops Outline and Discussion Guide (Unst Example)

University of St Andrews

Environmental Change Workshop

Baltasound Public Hall - Wednesday 25 March

Workshop Outline

19:00 Welcome

19:05 Introduction to the Research and Workshop Briefing

19:15 Icebreaker Session

19:20 Weather and Environmental Change in Unst: Group Discussion

19:40 Identifying the Effects of Present-Day Environmental Change: Part 1

19:55 Break (coffee, tea and refreshments)

20:00 Identifying the Effects of Present-Day Environmental Change: Part 2

20:20 Looking to the Future: Scenarios of weather, climate and environmental change for Unst

20:50 Discussion and Conclusion

21:00 Close

2

Weather and Environmental Change in Unst

Take a moment to reflect on the weather in Unst.

1. a. What kind of weather events have you experienced during your time on the island? How would you describe these weather events?

1. b. How often do you see this type of weather occurring in Unst?

Take some time to think about environmental change in Unst.

(Note: 'Environmental change' in this instance refers to any changes within the natural environment relating to the land, sea or atmosphere. Some examples of environmental change experienced in other parts of the world include changes in air temperature, in the frequency of flooding and in rates of coastal erosion.)

2. a. What instances of environmental change have you experienced during your time in Unst? How would you describe the instances of environmental change that you have witnessed?

2. b. How often do you notice these kinds of environmental events occurring e.g. daily, weekly, monthly, annually?

5

Identifying the Effects of Present Day Environmental Change

Think about the hazards *and* impacts that you have just described.

1. What were the consequences for you personally as a result of these events?

2. What were the consequences for the **community as a whole**?

3. What were the **challenges or problems** that arose as a result of these events? How would you describe these challenges/problems?

4. What were the **opportunities or positive impacts** that arose as a result of the events? How would you describe these opportunities/positive impacts?

7

Looking to the Future

Take a moment to think about the projections of future climate that we have just discussed.

1. Which 'hazard-impact-consequence' combination has caused the **most significant challenges** for the community as a whole?

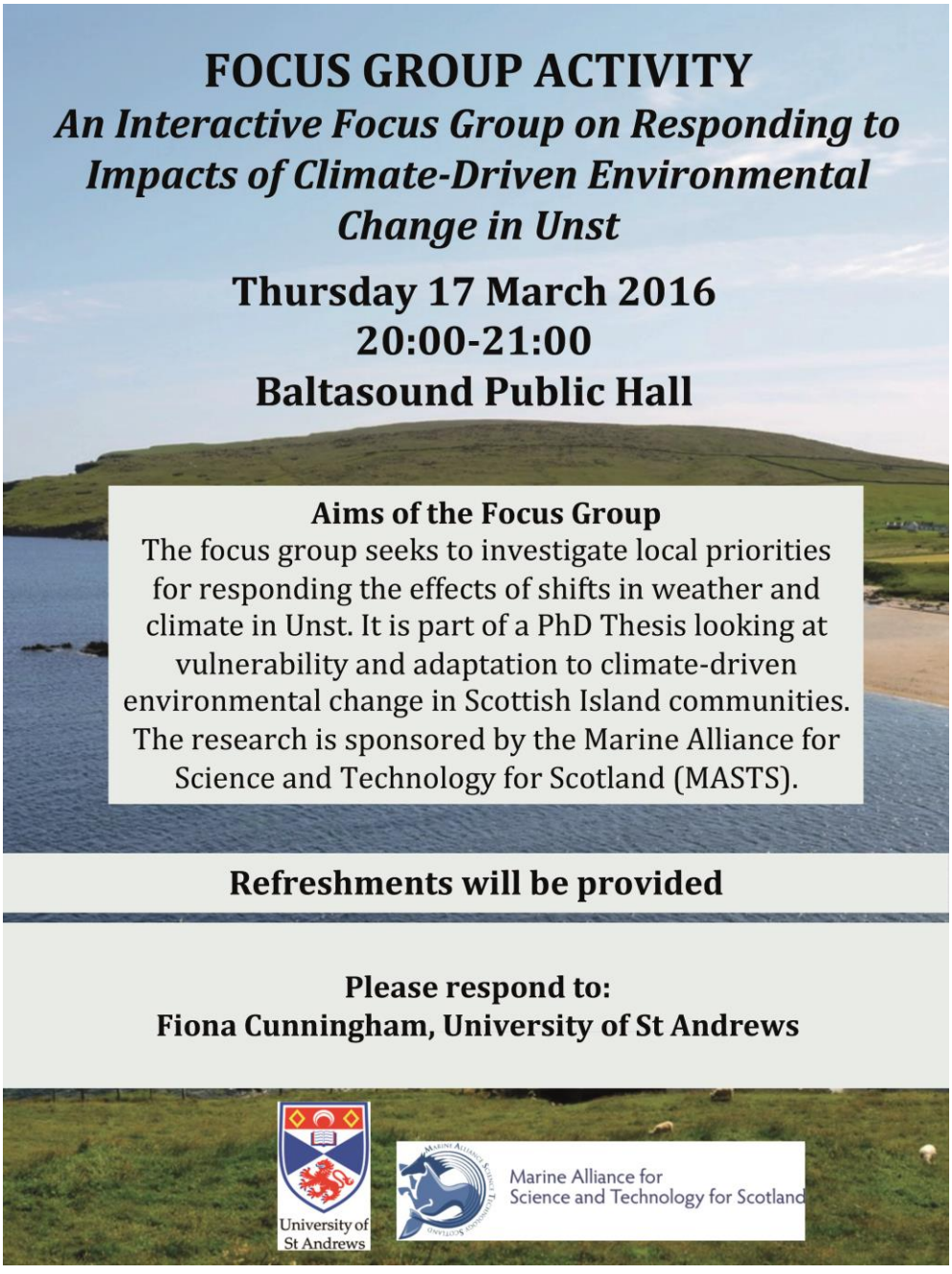
2. Which impacts should be **prioritised in future planning** for adaptation?

8

Appendix C: Focus Groups Materials

Relevant materials and documents from the focus groups are presented in this appendix. Recruitment flyers and emails were distributed within the case studies to recruit participants for an open community focus group in each case study (Figure C.1). Bespoke recruitment emails were also circulated to pre-existing groups such as community councils and development trust organisations, an example of which is also presented in Figure C.1. The focus group discussion guides are presented for Unst, South Uist and Westray in Figures C.2, C.3 and C.4 respectively.

Figure C.1: Focus Groups Recruitment Materials



Recruitment Emails

Adaptation Focus Groups

Dear X,

You are invited to attend an hour-long focus group on adapting to environmental change in the communities of Shetland, Orkney and the Outer Hebrides to be held at (venue TBC) in April 2015 (date TBC). Further details can be found in the attached flyer. Breaks and refreshments will be provided. I am keen to ensure that a representative collection of the community is present at the focus group. I would be very grateful if you could let me know if you are willing to attend via return email if possible. My address and daytime telephone number are also listed at the bottom of this email. Please do not hesitate to contact me if you have any questions about the study. Please do not feel obliged to participate and be aware that you are free to withdraw from the study at any time without giving an explanation.

Kind regards,

Fiona Cunningham
University of St Andrews

Dear X,

I am currently undertaking research that seeks to identify community priorities for responding to climate change in Unst through the use of small focus groups. I hope to talk to a range of people within the community and am keen to meet with pre-existing groups such as the Community Council.

I was wondering if there might be some possibility of holding a small focus group with the Community Council at some stage over the next couple of months? I am aware that the schedules of the Community Councillors are likely to be busy and I would be grateful for even a very brief amount of time to talk with the council.

If it would be more convenient, perhaps it would be possible to integrate the discussion into the normal activities of the council e.g. to add the discussion on to the end of a council meeting. The discussion could potentially last for up to an hour, although this is flexible depending on the preferences of the council.

I would be extremely grateful if you could let me know whether this idea is something that might be feasible. Please do not hesitate to contact me if you have any questions about the study. Please do not feel obliged to participate and be aware that you are free to withdraw from the study at any time without giving an explanation.

Kind regards,

Fiona Cunningham
University of St Andrews

Figure C.2: Focus Groups Discussion Guide for Unst

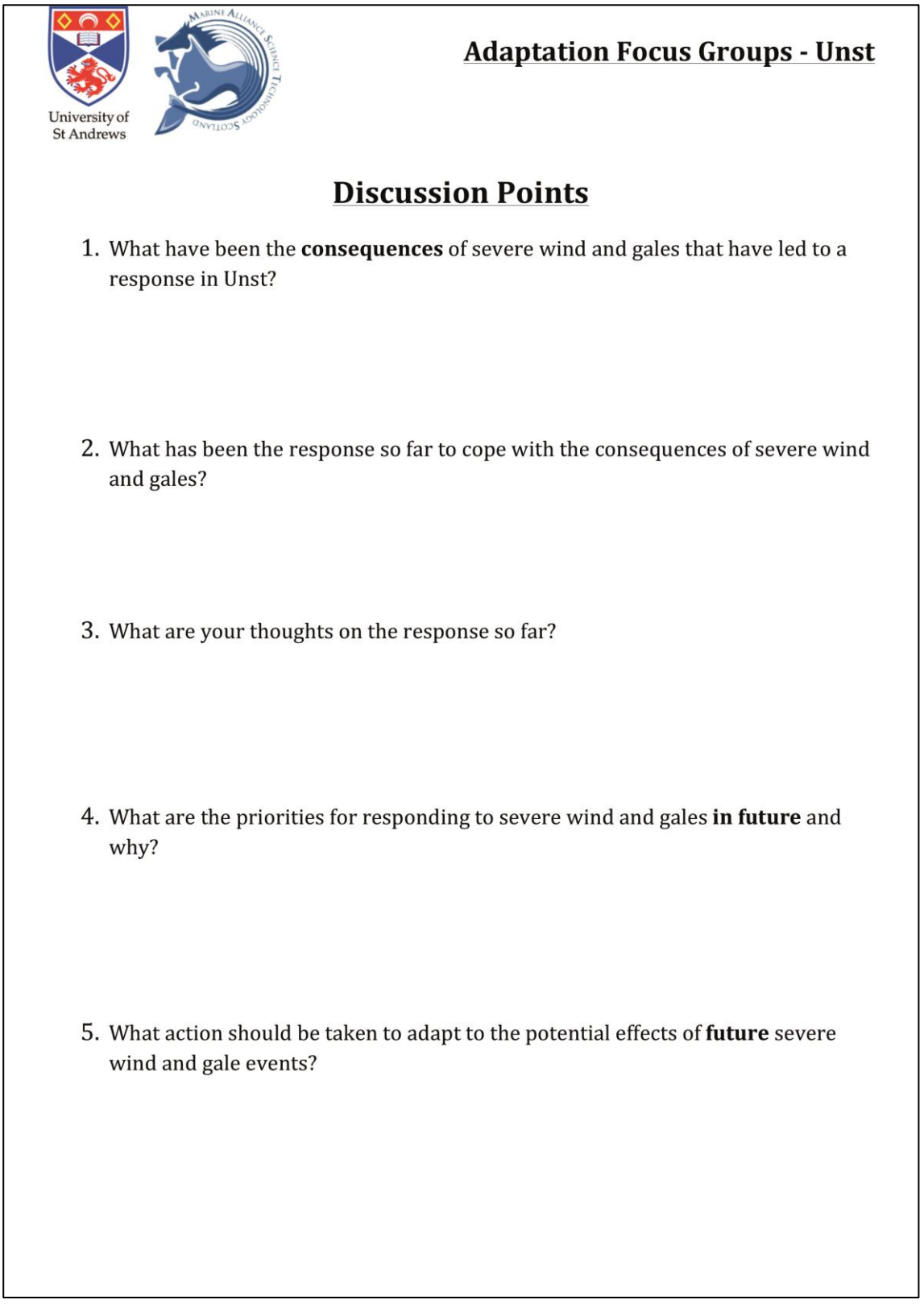
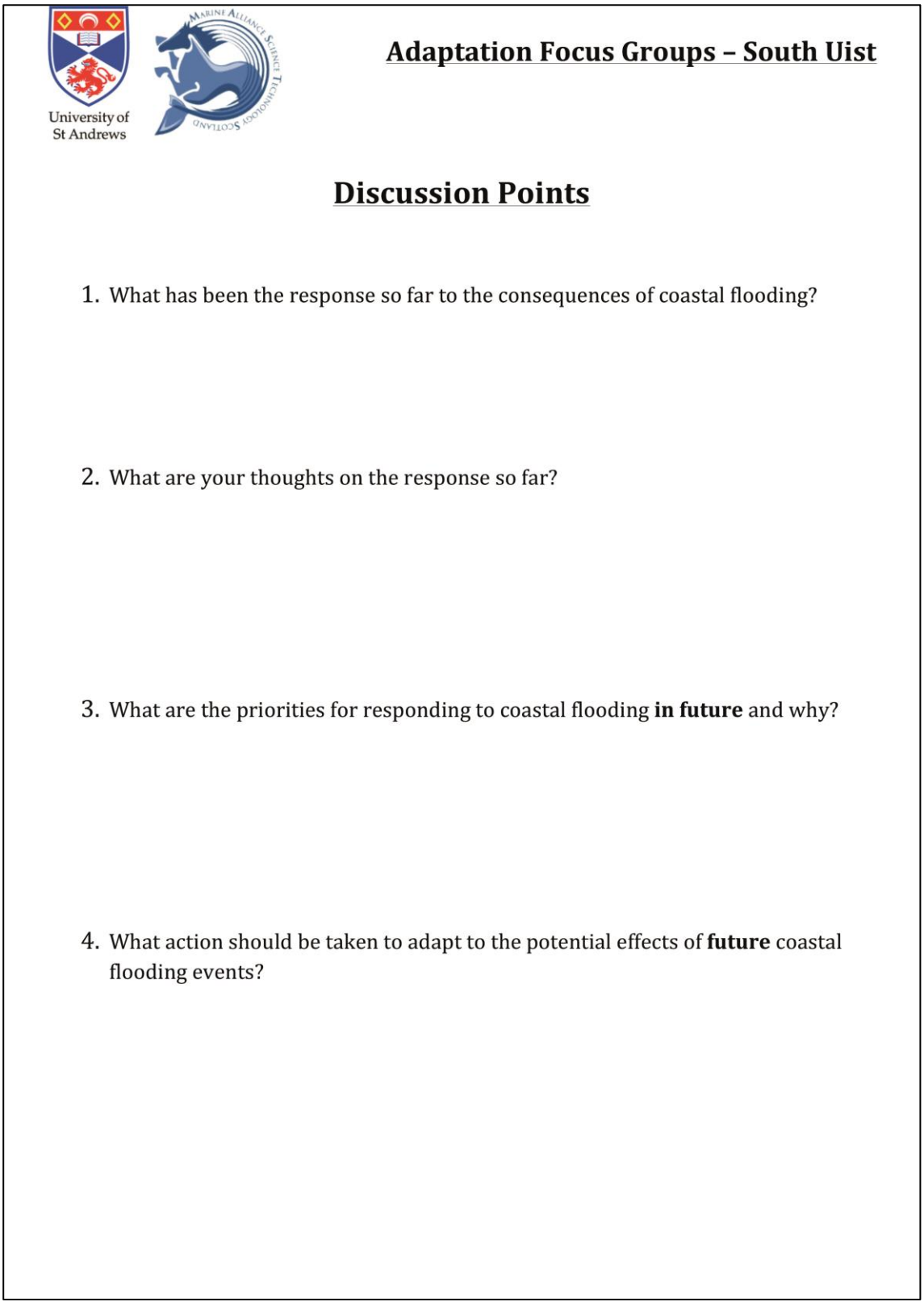


Figure C.3: Focus Groups Discussion Guide for South Uist



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Adaptation Focus Groups – South Uist

Discussion Points

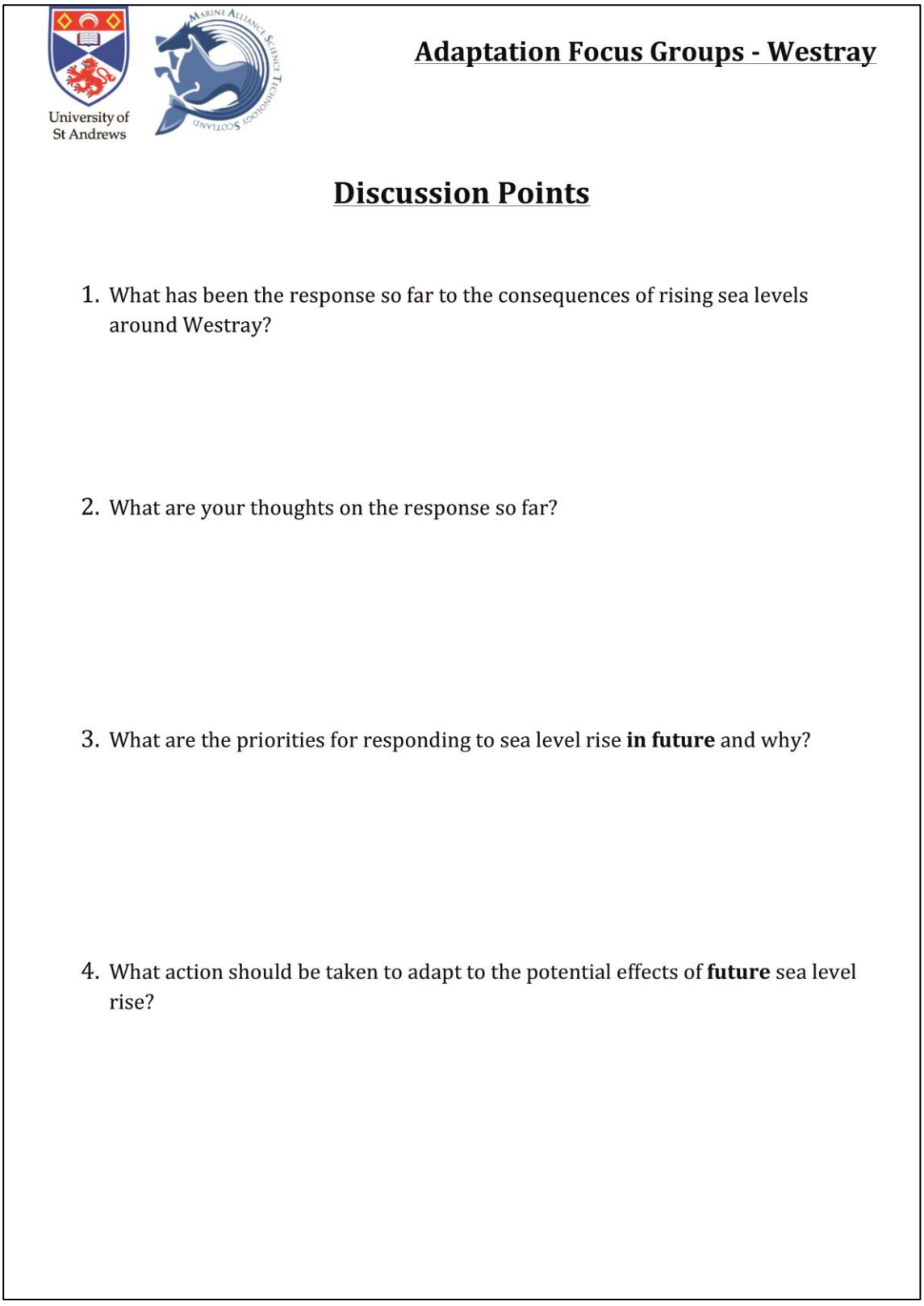
1. What has been the response so far to the consequences of coastal flooding?

2. What are your thoughts on the response so far?

3. What are the priorities for responding to coastal flooding **in future** and why?

4. What action should be taken to adapt to the potential effects of **future** coastal flooding events?

Figure C.4: Focus Groups Discussion Guide for Westray



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Adaptation Focus Groups - Westray

Discussion Points

1. What has been the response so far to the consequences of rising sea levels around Westray?

2. What are your thoughts on the response so far?

3. What are the priorities for responding to sea level rise **in future** and why?

4. What action should be taken to adapt to the potential effects of **future** sea level rise?

Appendix D: Fieldwork Details

The dates, times, venues, event types and number of participants for all workshops, focus groups and interviews are presented in this appendix. Table D.1 illustrates the details of deliberative workshops in each case study, whilst details of focus groups and interviews are provided in Table D.2.

Table D.1: Details of Deliberative Workshops in the Case Studies

Case Study	Workshop	Venue	Time & Date	Participants
Unst	Open Community Workshop	Baltasound Public Hall	19:00 – 21:00 25/03/2015	8
South Uist	Open Community Workshop	West Gerinish Community Hall	19:00 – 21:00 28/04/2015	11
Westray	Open Community Workshop	Westray Junior High School	19:00 – 21:00 18/06/2015	6

Table D.2: Details of Focus Groups and Interviews in the Case Studies

Case Study	Focus Group/Interview	Venue	Time & Date	Participants
Unst	Unst Community Council and Unst Partnership Focus Group	Unst Partnership Office	19:00 – 20:00 14/03/2016	4
	Gardiesfauld Youth Hostel and Uyeasound Public Hall Committees Focus Group	Gardiesfauld Youth Hostel	20:00 – 21:00 15/03/2016	3
	Open Community Focus Group	Baltasound Public Hall	20:00 – 21:00 17/03/2016	4
South Uist	Lochboisdale Community Council Focus Group	Gleus House, Daliburgh	20:00 – 21:00 04/04/2016	6
	Storas Uibhist Board Focus Group	Storas Uibhist Office	15:00 – 15:30 07/04/2016	3
	Open Community Focus Group	West Gerinish Community Hall	19:30 – 20:30 05/04/2016	6
Westray	Westray Community Council Focus Group	Westray Junior High School	19:30 – 20:15 18/04/2016	7
	Westray Development Trust Focus Group	Westray Development Trust Office	20:30 – 21:30 18/04/2016	2
	Open Community Focus Group	Westray Junior High School	19:30 – 20:30 20/04/2016	1
	Telephone Interview 1	N/A	11:00 – 11:45 13/12/2016	1
	Telephone Interview 2	N/A	14:00 – 14:40 13/12/2016	1

Appendix E: Data Availability

This appendix reviews data availability for assessing vulnerability to sea level rise in Pierowall Bay (Westray Case Study).

E.1. Availability of Data for Assessing Vulnerability to Sea Level Rise in Pierowall Bay

Influenced by the work of Gornitz *et al.* (1991) and Abuodha and Woodroffe (2010), the availability of data for six coastal variables was initially investigated when attempting to assess the vulnerability of Pierowall Bay to sea level rise: geology, tidal range, coastal slope, geomorphology, wave height and shoreline change. Additionally, published climate projections were used to support vulnerability mapping and to encourage discussion when used within community engagement as part of the research. Data was found to be readily available for the coastal variables of geology and tidal range, as were climate projections for the UK. The British Geological Survey (BGS) provide a UK Geology map as a downloadable dataset which is free for commercial, research and public use and can be easily accessed via the BGS website. This dataset was used in the production of the vulnerability map for Pierowall Bay. The BGS also offer an online map tool - the Geology of Britain Viewer - which is readily available to the general public and allows the user to quickly identify superficial and bedrock geology for any given site in the UK. The Orkney Ports Handbook (OIC, 2015a) was used to ascertain the tidal range around Pierowall Bay when producing the vulnerability map. This resource is freely available in PDF format via the Orkney Islands Council Harbour Authority website. The handbook contains tidal range figures for all piers and harbours in Orkney including Pierowall Pier. Furthermore, The UK Climate Projections (UKCP09) provide projections of climate change for Orkney, including projections of temperature, precipitation and sea level rise, all of which are readily and freely available to the public with unrestricted downloadable content. The UKCP09 projections were used to support vulnerability mapping within the research, although these did not contribute directly to the mapped output itself.

For the variables of coastal slope and geomorphology, the Marine Digimap Hydrospatial Data Natural and Physical Features dataset, supplied by EDINA Digimap at the University of Edinburgh, was readily available to the researcher. This dataset was analysed in ArcGIS to establish the coastal gradient across Pierowall Bay and to identify geomorphological features along the coastline. However, all datasets owned by Digimap, including the Marine Digimap Hydrospatial Data Natural and Physical Features dataset, are unavailable to the general public. Digimap is an academic resource intended for research use and its datasets are available to subscribing academic institutions. Although Marine Digimap data was freely available to the researcher during the production of the hypothetical vulnerability map in this study, it is not a resource that can be used outwith academic institutions, either commercially or by the general public. Two other potential data sources for studying coastal slope and geomorphology across Pierowall Bay are the NEXTMap and EUROSION databases. The NEXTMap database

provides elevation data for the UK in the form of Digital Elevation Models (DEMs). However, all NEXTMap datasets are subject to licencing and are not readily or freely available to either academic researchers or the public. The EUROSION database – a project appointed by the Environment Directorate-General of the European Commission - provides elevation and geomorphology data for Europe, including the UK, and is readily available for public use (EUROSION, 2018). However, this data is only available at the 1:100,000 scale which is too large for undertaking a meaningful investigation of elevation and geomorphology for a small area like Pierowall Bay where the coastline extends to approximately 3km in length. Rudimentary approximations of geomorphological features could be deduced from recent satellite aerial imagery of Pierowall Bay. The National Marine Plan Interactive (NMPI) tool - a user-friendly service supplied by Marine Scotland - provides readily available satellite imagery of Westray from 2014 that can be accessed for free by the general public. Overall, though, the availability of readily accessible formal datasets containing site-specific elevation and geomorphology data for Pierowall Bay is limited outwith Marine Digimap.

As part of the present study, reliable and readily available data for the variables of shoreline change and wave height were challenging to source at the appropriate scale for Pierowall Bay. In principle, rates of shoreline change can be estimated for an area of coastline by undertaking comparative spatial analysis of good quality maps and aerial photographs using GIS software such as ArcGIS. A relatively small range of historic maps and aerial photographs do exist for Pierowall Bay, however these are not always freely available to the general public and are not necessarily of a suitable standard for undertaking spatial analysis to quantify shoreline change. One of the most comprehensive stores of historic maps and aerial images of the UK is Historic Digimap also supplied by EDINA. However, as highlighted, Digimap datasets are available to subscribing academic institutions only, and are not available to the general public. Furthermore, not all university institutions subscribe to the Historic Digimap dataset and it was not available to the researcher when undertaking the assessment.

Historic maps and aerial photography for Westray can be accessed via other sources: The National Library of Scotland holds two historic maps of Westray, surveyed in 1879 and 1900 respectively; the National Collection of Aerial Photography (NCAP) holds four oblique aerial images of Pierowall Bay, taken in 1942; and Canmore holds an oblique image of Pierowall Bay from 2009. However, these maps and images are not always freely available: historic maps must be purchased as image files from the National Library of Scotland for a fee although the NCAP and Canmore allow free image file downloads. Furthermore, images from the NCAP and Canmore have been captured at oblique angles, meaning that shoreline change rates cannot be straightforwardly deduced. The images might be useful for making simple approximations about how the shoreline of Pierowall Bay has changed since 1942 and whether there are any noticeable areas of erosion or accretion. However, the limited range of oblique images supplied by NCAP and Canmore are generally of insufficient quality for quantifying shoreline change rates using spatial analysis.

On the other hand, the NMPI tool provides readily available recent satellite imagery of Westray from 2014. Therefore, contemporary aerial imagery for Pierowall Bay is easily accessible. Furthermore, the National Coastal Change Assessment (NCCA) is a recent project (published in late 2017) that aims to assess shoreline change for Scotland with outputs that are readily available to the general public. A range of actors including SNH, the University of Glasgow, the Scottish Government and Adaptation Scotland, amongst others, worked to produce the NCCA. The project aimed to provide estimates of past erosion and accretion rates for the coastline of Scotland, including Pierowall Bay, in order to understand shoreline change across Scotland (National Coastal Change Assessment, 2018). Project outputs became available in March 2017 including the publication of an interactive online map in which the position of the shoreline for various years (1900, 1975 and 2014) can be viewed for any section of the Scottish coastline including Pierowall Bay. This tool was not available at the time of the original assessment of vulnerability to sea level rise in Pierowall Bay. However, it can now be readily accessed by the general public and could be useful for understanding vulnerability to sea level rise in Pierowall Bay in future.

When investigating the coastal variable of wave height during the production of the hypothetical vulnerability map, it became apparent that data for Pierowall Bay was not available at a site-specific scale at the time of the assessment. The British Oceanographic Data Centre (BODC) and Marine Environmental Data and Information Network (MEDIN) are sources that were explored as part of the wave height investigation but neither source offers data at a site-specific scale for Pierowall Bay or in a format that can be straightforwardly obtained and comprehended by a non-expert audience. Both sources are challenging to navigate when attempting to find basic wave height values. For example, the BODC requires the user to submit a wave data request using a form that is geared towards expert or technical users. As a result, it was challenging to source wave height data at a site-specific scale when attempting to assess vulnerability to sea level rise in Pierowall Bay. Shortly after the assessment was undertaken, however, wave height data for Pierowall Bay became available through the NMPI tool. The tool contains site-specific wave height data for Pierowall Bay which is provided in the form of a colour-coded map. The data is easy to understand and can be readily accessed for free by any member of the public through the NMPI online facility.

As wave height and shoreline change data were not available to the researcher when undertaking the assessment, these variables were not analysed as part of vulnerability mapping. However, data for these variables has since become readily available and could be integrated into future iterations of mapping vulnerability to sea level rise in Pierowall Bay. As indicated, several sources provide coastal data that is readily available for public use when considering vulnerability in Pierowall Bay. The BGS, Orkney Ports Handbook, UKCP09, NMPI and NCCA are all sources of coastal and climate data that can be readily accessed by the general public, including local communities. Moreover, these sources

provide data outputs that are user-friendly and can be interpreted by a non-expert audience. However, challenges remain for data access by the general public, particularly when considering a small area of coastline such as Pierowall Bay. EUROSION, the NCAP and Canmore are sources that provide readily available coastal data to the public. However, in the case of Pierowall Bay, the data provided by these sources is either captured at too large a scale (in the case of EUROSION data) or is not of sufficient quality for formally assessing shoreline change (in the cases of aerial imagery by the NCAP and Canmore). Other types of data are either unavailable to the public, are only available at a cost, or are tailored towards expert users. Marine and Historic Digimap, as an educational resource, is unavailable to the wider public. Data held by NEXTMap and the National Library of Scotland must be either bought or licenced. The BODC and MEDIN are platforms that are challenging when used by non-experts and, therefore, data is not easily accessible for the general public in these cases. Overall, particularly due to the recent development of the NMPI and the NCCA, data is now readily available to the public for all of the aforementioned coastal variables except coastal slope and geomorphology for which readily available datasets are still limited other than those provided for academic use by Digimap.

Appendix F: Ethical Considerations

Any form of data collection involving direct interaction with the human population is subject to ethical considerations. In particular, qualitative research that investigates the views, opinions and experiences of human participants should be ethically sound before data gathering techniques are undertaken. Qualitative data collection methods; from focus groups to interviews, surveys to questionnaires, and even observational methods, should be carried out with the physical and psychological comfort of participants in mind. Appropriate steps can, and should, be taken to eliminate or minimise any potential harm, damage or problems for participants (Kent, 2000). In the current research, qualitative data was deemed essential for answering the fundamental research questions set out in Chapter 1. It was important to interact directly with community members in order to understand the priorities and motivations of the case study communities for adapting to the impacts of climate change. As a result, it was mandatory to gain ethical approval from UTREC prior to conducting deliberative workshops and focus groups with human participants. The following paragraphs discuss the ethical considerations of the current study and illustrate the ways in which any key ethical issues were approached before undertaking the deliberative workshops and focus groups.

Ethically, it was important to provide clarity and transparency about the research to participants both before and during workshops and focus groups in order to allow them to make informed decisions about taking part in the study. Participants for both the workshops and focus groups were recruited by invitation emails sent personally by the named researcher. Upon invitation to attend the workshops and focus groups, participants were given an information sheet and a consent form. These documents provided details about the aims of the research and the purpose of the workshops and focus groups. The documents stressed that participants were in no way obliged to participate and were free to withdraw from the study at any time without giving reasons. It was made clear that participants may choose not to answer questions or to take part in certain aspects of the workshops and focus groups without providing an explanation. Participants were invited to read and sign the consent form to allow their responses to be recorded and used within the research if they wished. At the end of each workshop and focus group, participants were provided with a debriefing sheet that reiterated the information provided in the participant information sheet.

The ethical risks associated with the study were very low. The research did not use children or vulnerable people as participants. The research topic was not of an overly sensitive or delicate nature generally. Highly sensitive topics might include those related to drug use, health issues and violence. The subject matter of the workshops and focus groups - impacts and consequences of climate change – was not significantly intrusive or personal. Therefore, the risk of inducing upset or distress among participants was low overall. However, it was recognised that there was a small risk involved with members of the South Uist community who were personally affected by the loss of five lives during the severe storm event in

January 2005. It was anticipated that the psychological effects of the event would likely still be raw within the community and that extra sensitivity should be applied during workshops and focus groups in South Uist. Additionally, the discussion guide was altered slightly for the South Uist focus groups, with questions framed from a strictly 'community' angle rather than concentrating on personal experiences of climate impacts and consequences.

Furthermore, climate change is a highly topical issue in a broader sense and has the potential to fuel arguments during deliberative workshops and focus groups. The research accepts that global climate is changing, with impacts and consequences for the human population at international, national and local scales, but this study does not attempt to provide explanations for the changing climate. It was important to highlight the stance of the research at the beginning of workshops and focus groups, and to continue to reinforce this viewpoint throughout in order to minimise tension within the groups over a potentially debatable issue.

Participant confidentiality represented another key ethical consideration within the research. It was acknowledged that participants might be concerned about confidentiality and the risk of their responses being divulged to individuals other than the named researcher and supervisor. In particular, there was a very small risk to those members of the community who might represent an opinion that contradicts the policy of their employer. Tensions could potentially arise if the personal views of such participants were to be divulged outside of the workshops and focus groups. To avoid this, personal identifiers were removed from the data during coding. Data from the workshops and focus groups has remained confidential throughout the rest of the study, including within the thesis and any other publications arising from the research, and is only available to the named researcher and supervisor. Participants were notified that the data would be stored on a computer system for a period of at least five years before being destroyed. The respondents were informed verbally and via the participant information sheet, consent form and debriefing sheet that no statements are to be attributed to them by name in any reports of the research.

Ultimately, an ethical application form was completed and submitted to the University of St Andrews Teaching and Research Ethics Committee (UTREC) in October 2014. The application was approved in November 2014 (Appendix A) after which deliberative workshops and focus groups commenced.