

**CLIMATE CHANGE IN SCOTLAND'S INNER HEBRIDES:
A MIXED METHODS EVALUATION OF THE EFFECTS OF
CLIMATE CHANGE ON THE ISLE OF TIREE:
"THE LAND BELOW THE WAVES"**

BY

DUNCAN SINCLAIR

AUGUST 2020

Submitted as part assessment for the degree of Master of Science
(M.Sc.)

in

Climate Change: Managing the Marine Environment

Supervisor: Teresa Fernandes

School of Energy, Geoscience, Infrastructure and Society

Heriot-Watt University, Edinburgh

Acknowledgements

I would like to thank the staff within Heriot- Watt's School of Energy, Geoscience, Infrastructure and Society, for providing resources and facilities, and for encouraging students to achieve their full potential. In particular, Professor Teresa Fernandes for her support and professionalism throughout this project, and for ensuring any knowledge gaps in my research were accounted for. A final thank you must go to the residents of Tiree, who kindly gave their time to participate in this study and helped further a young scientist career. *Sincere thanks.*

Abstract

As the Intergovernmental Panel on Climate Change continues to identify man-made climate change as a risk to nature and humanity, small islands settings are increasingly viewed as highly vulnerable environments. The complexity of predicting climate change and its subsequent impacts mean there are numerous questions which must be answered in order to determine a course of preventative action, or to implicate management of potential changes. Scottish islands display some of the most diverse natural habitats on Earth, and community settlements exhibit a continuation of traditional practices, and a time-honoured way of life, that should be preserved in order to maintain ecological balance and culture. The islands of the Inner Hebrides are highly exposed to coastal flooding, rising sea levels, and severe weather events, which are likely to be augmented by changes in climactic conditions. Questions therefore remain regarding the long-term future of these islands. By understanding community perspectives, and demonstrating potential change through use of Geographical Information Systems, analysis of climate related impacts can be evidenced. This research uncovered several common concerns amongst Tiree's residents, which link to the projections of the 2300 rise in sea level. A summary of the contrasting methodologies used in this research show that the Isle of Tiree is vulnerable to change, with many local people citing concerns over the stability of the islands economy and society in the face of a changing climate, and sea level rise data showing that large sections of Tiree are at risk of future flooding. Given the uncertainty of future impacts, more research is needed to understand what may be required to secure the islands future.

Contents

| | |
|---|-----------|
| Acknowledgements..... | 1 |
| Abstract..... | 1 |
| Abbreviations..... | 4 |
| 1. Introduction | 5 |
| 1.1. Aims and approach..... | 8 |
| 2. Tiree in context | 10 |
| 2.1. Society and Economy | 11 |
| 2.2. Environment and Landscape | 14 |
| 2.3. Climate | 15 |
| 2.4. Wildlife | 17 |
| 2.4.1.Machair | 18 |
| 2.4.2.Bees..... | 19 |
| 2.4.3.Birds | 20 |
| 2.5. Flora..... | 21 |
| 2.5.1.Coastal | 21 |
| 2.5.2.Grassland | 21 |
| 2.5.3.Heath | 21 |
| 2.5.4.Wetland | 22 |
| 2.6. Marine Life | 22 |
| 3. Methodology | 24 |
| 3.1. Qualitative Methods: Sample population | 24 |
| 3.2. Qualitative Methods: Interview and Questionnaire | 25 |
| 3.3. Quantitative Methods: Sea level Rise | 26 |
| 4. Results | 29 |
| 4.1. Questionnaire..... | 29 |

| | | |
|--------|--|----|
| 4.2. | Interviews..... | 33 |
| 4.2.1. | Understanding of fundamental principles of climate change..... | 33 |
| 4.2.2. | Commonly established concerns..... | 34 |
| 4.2.3. | Future prospects..... | 34 |
| 4.2.4. | Recognised local change..... | 37 |
| 4.2.5. | Socio-economic prospects..... | 38 |
| 4.2.6. | Environmental concerns..... | 39 |
| 4.2.7. | Community response..... | 40 |
| 4.2.8. | Industry..... | 41 |
| 4.2.9. | Personal reflections..... | 43 |
| 4.3. | Geographical Information Systems (GIS) Analysis..... | 45 |
| 4.3.1. | RCP 2.6..... | 49 |
| 4.3.2. | RCP 4.5..... | 49 |
| 4.3.3. | RCP 8.5..... | 50 |
| 5. | Discussion | 51 |
| 5.1. | Discussion of results obtained from qualitative research..... | 51 |
| 5.2. | Awareness..... | 51 |
| 5.3. | Concerns and Implications..... | 53 |
| 5.3.1. | Economic change..... | 53 |
| 5.3.2. | Societal change..... | 55 |
| 5.3.3. | Environmental change..... | 56 |
| 5.4. | Strategies..... | 58 |
| 5.5. | Discussion of the quantitative assessment results (GIS)..... | 61 |
| 5.5.1. | Environmental..... | 61 |
| 5.5.2. | Economic and societal..... | 62 |
| 6. | Limitations..... | 63 |

| | | |
|----|---|----|
| 7. | Conclusions and further research | 64 |
| 8. | References | 65 |
| 9. | Appendices | 82 |

Abbreviations

e.g. = for example (*Latin: exempli gratia*)

et al. = and others (*Latin: et alii*)

i.e. = that is to say (*Latin: id est*)

N= number

°C= degrees Celsius

Fig. = figure

mm= millimetres

m = metres

km²= square kilometre

t= tonnes

mph= miles per hour

KWatt m⁻¹=Kilowatt metre to the (minus one)