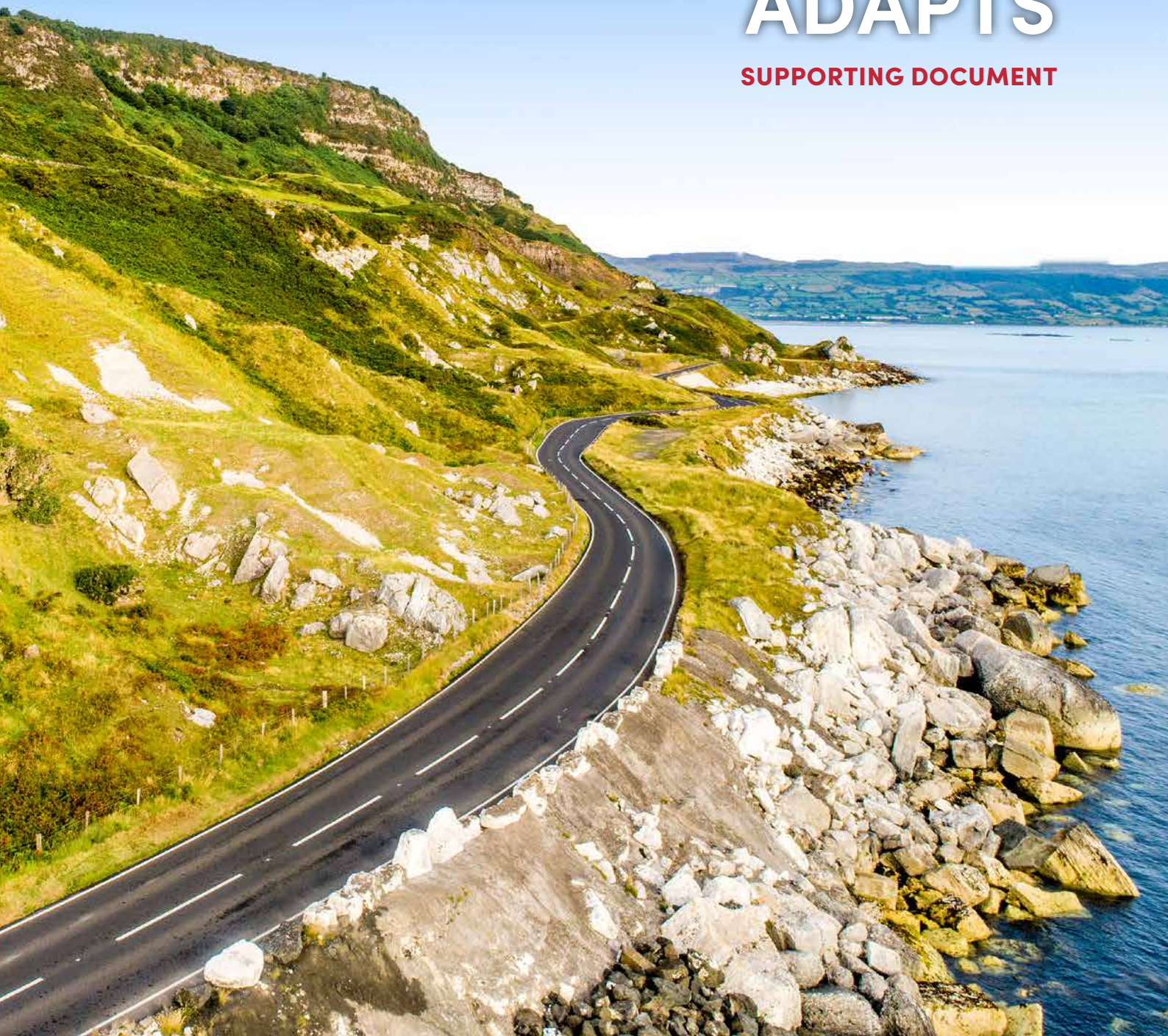


CIVIL SOCIETY AND LOCAL GOVERNMENT ADAPTS

SUPPORTING DOCUMENT



Northern Ireland
Climate Change
Adaptation Programme

2019 – 2024

Prepared by Climate Northern
Ireland in partnership with Northern
Ireland voluntary and community
organisations, academics, private
and the local government sector

 **climate**
Northern Ireland

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Climate Northern Ireland is funded by the Department of Agriculture, Environment and Rural Affairs (DAERA) and delivered by Northern Ireland Environment Link.



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Abbreviations

ACT	Argyll and the Isles Coast and Countryside Trust
AFBI	Agri-Food and Biosciences Institute
ASCE	American Society of Civil Engineers
BBSRC	Biotechnology and Biological Sciences Research Council
BWI	BirdWatch Ireland
CABB	Co-operation Across Borders for Biodiversity project
CAFRE	College of Agriculture, Food and Rural Enterprise
CANN	Collaborative Action for Natura Network project
CCC	Committee on Climate Change
CCRA	Climate Change Risk Assessment
CCRA 2017	UK Climate Change Risk Assessment published in 2017
CERAI	Civil Engineering Research Association of Ireland
C.L.I.M.A.T.E. INTERREG	Collaborative Learning Initiative Managing and Adapting to the Environment INTERREG project
CO ²	Carbon Dioxide
CSA	Community-Supported Agriculture
DAERA	Department of Agriculture, Environment and Rural Affairs
DCSDC	Derry City and Strabane District Council
DEL	Department for Employment and Learning
DOC	Dissolved Organic Carbon
EM	Electromagnetic
ERT	Electrical Resistivity Tomography
ESRC	Economic and Social Research Council
EU	European Union
FP7	European Commission's 7th Framework Programme
GES	Good Environmental Status
IGFS	Institute of Global Food Security
IAHR	International Association for Hydro-Environment Engineering and Research
IPCC	Intergovernmental Panel on Climate Change
LDP	Local Development Plan
LiDAR	Light Detection and Ranging
LPS	Landscape Partnership Scheme
MarPAMM	Marine Protected Area Management and Monitoring project
MI	Marine Institute

Abbreviations

MOSES	Maritime, Ocean Sector and Ecosystem Sustainability project
MPAs	Marine Protected Areas
mph	Miles per hour
MSS	Marine Scotland Science
NC	Natural Capital
NFM	Natural Flood Management
NHS	National Health Service
NI	Northern Ireland
NICCAP	Northern Ireland Climate Change Adaptation Programme
NICCAP2	Northern Ireland Climate Change Adaptation Programme 2019–2024
NIEA	Northern Ireland Environment Agency
NIEL	Northern Ireland Environment Link
NIFRA	Northern Ireland Flood Risk Assessment published in 2018
NILGA	Northern Ireland Government Association
NIMTF	Northern Ireland Marine Task Force
NPA	Northern Peripheries and Arctic
QUBBES	Quantification of Blanket Bog Ecosystem Services to Water Project
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SALINA	SALine INtrusion in coastal Aquifers: Hydrodynamic Assessment and Prediction of Dynamic Response project
SAMS	Scottish Association for Marine Science
SNH	Scottish Natural Heritage
SOLACE	Society of Local Authority Chief Executives
SPA	Special Protection Area
SPPS	Strategic Planning Policy Statement
UCC	University College Cork
UCD	University College Dublin
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UrbanARK	Assessment, Risk Management, & Knowledge for Coastal Flood Risk Management in Urban Areas project
VR	Virtual Reality
WWF	World Wide Fund for Nature
WWT	Wildfowl and Wetlands Trust

Foreword

The Northern Ireland (NI) climate is changing. Whilst working to limit the effects of climate change by reducing greenhouse gas emissions, we must prepare for the stresses and opportunities these unavoidable changes will pose to our society.



I welcome the second Northern Ireland Climate Change Adaptation Programme 2019-2024, which is strengthened by the inclusion of the 'Civil Society and Local

Government Adapts' chapter prepared by Climate Northern Ireland. It is important that our communities, businesses and individuals take a strategic and collaborative approach to preparing for the impacts of climate change. The NI government cannot achieve this alone – a concerted approach with all parts of society is essential.

The Civil Society and Local Government Adapts chapter highlights the considerable and varied role that these organisations and individuals will play, alongside central government, in preparing for our changing climate. Community and voluntary organisations will undertake a variety of strategic and practical actions, such as promoting partnership working to deal with climate risks to habitats, heritage and coastal communities. Their close links with volunteers and communities enable considerable awareness raising and engagement with climate change adaptation across NI. The private sector will integrate climate adaptation thinking in their processes and provide exemplars to encourage action across our business community. Academic researchers will continue to build understanding of how NI will be impacted by future climate change, and how we can best prepare.

The work of Local Government is central to achieving local resilience to the impacts of climate change. During the lifetime of this programme, it is hoped that all local councils will consider how they are vulnerable to climate change, develop a strategic climate change adaptation plan, and take action.

I am grateful to all those who have engaged with Climate Northern Ireland in mapping the climate change adaptation work happening across NI, and to those who have contributed case studies, projects and actions to this first Civil Society and Local Government Adapts chapter. Whilst the chapter, and this Supporting Document, illustrate considerable and varied contributions, this is only the beginning. It is a strong foundation, which will enable more collaborative working across civil society and local government. Climate Northern Ireland looks forward to continuing development of the Civil Society and Local Government Adapts chapter at the mid-point (2021) with additional projects and actions from across NI.

Success will require strategic vision, continued partnerships, sharing of information and collaborative action. Climate Northern Ireland will continue to raise awareness of the impacts of climate change, developing the networks necessary to enable collaborative action, and gathering scientific evidence to support decision-making.

Richard Kirk
Climate Northern Ireland Chair

Introduction

Rathlin Island

Photo credit: Jane McCullough

Civil Society and Local Government Adapts

 **Climate**
Northern Ireland



Introduction

The climate in Northern Ireland (NI) is changing. This presents a wide range of risks and opportunities to our land, infrastructure, built environment, economy and other vital societal support structures.

Planning for these changes will enable NI to build resilience to the potential negative impacts of climate change and take advantage of any opportunities. The 2008 UK Climate Act requires the UK government to publish a UK-wide climate change risk assessment (CCRA) every five years (this includes a summary for NI: the NI Evidence Report). The NI government then develops a Northern Ireland Climate Change Adaptation Programme (NICCAP) which outlines their five-year approach to addressing the risks and opportunities identified within the NI Evidence Report.

Voluntary and community organisations, businesses, researchers and local councils also play an important and interconnected role in climate resilience. It is therefore imperative that central government, local government and civil society take a collaborative approach to considering climate change impacts, undertaking climate change adaptation planning, implementing practical actions and monitoring progress.

Climate Northern Ireland (Climate NI) was commissioned by the Department of Agriculture, Environment and Rural Affairs (DAERA) to work with civil society and local government to develop their response to the climate change risks and opportunities identified as relevant to Northern Ireland (NI) in the UK CCRA 2017 Evidence Report: Summary for Northern Ireland (NI Evidence Report 2017). These responses are outlined in a chapter titled 'Civil Society and Local Government Adapts', which is included in NICCAP2 (2019–2024). The chapter outlines the contribution of these sectors to delivering the outcome objectives of NICCAP2 and to addressing the risks and opportunities outlined in the NI Evidence report 2017.

Flooded housing area in NI

Photo credit: Northern Ireland Flood Risk Assessment (NIFRA), Department for Infrastructure (2018)

1: Civil society is the aggregate network of non-governmental actors and institutions that have a presence in public life, expressing the interests and civic values of members in society. For the chapter titled 'Civil Society and Local Government Adapts', the concept of civil society refers to and includes academics, community and voluntary organisations, and the private sector.



Path closures due to rock falls at Giant's Causeway World Heritage Site

Photo credit: National Trust

Purpose of NICCAP Supporting Document

This NICCAP Supporting Document presents additional information on the projects and associated actions detailed in the Civil Society and Local Government Adapts' chapter within NICCAP2.

This document has been designed for use as a reference paper to provide further information about the climate change adaptation actions and case studies outlined in the 'Civil Society and Local Government Adapts' chapter and the associated delivery plans (a copy of these delivery plans is provided in Annex 1 of this document). Hyperlinks from the projects listed in the NICCAP 'Civil Society and Local Government Adapts' chapter will direct readers to the relevant section in this document.

Whilst not a complete picture, this supporting document outlines the information gathered from a first exercise in mapping the climate change adaptation actions² undertaken across civil society and local government. It provides a strong starting point for coordinated action across society. Climate NI aims to continue to map existing, and encourage new adaptation actions during the lifetime of NICCAP2. To enable the NICCAP2 to reflect this mapping there will be an opportunity to incorporate additional adaptation actions (including research projects) into the programme at a set mid-programme review stage.

Approach

The NICCAP2 'Civil Society and Local Government Adapts' chapter contents and this supporting document were developed by Climate NI in partnership with businesses, voluntary and community organisations, academics and the local government sector³. Contributors were identified using a variety of methods, including a stakeholder mapping exercise (undertaken in partnership with Climate NI steering group⁴ and wider networks). Engagement methods facilitated participation from a range of sectors and stakeholders.

Contributions for the civil society section were gathered using an online submission form which provided participants with information about the climate risks and opportunities facing NI and asked for submissions of future projects which aim to prepare for these. Contributors were also asked to provide case studies to illustrate the climate change adaptation work which has already been completed in NI.

The local government section was developed in partnership with the Northern Ireland Local Government Association (NILGA), Sustainable Northern Ireland and local government representatives. A mapping exercise of climate change adaptation planning and activities was undertaken in collaboration with local councils and used as a basis on which to develop strategic actions for the sector.

2: The information contributed and outlined in the chapter does not provide a complete overview of climate change resilience and adaptation efforts in a given sector. Rather, it is a reflection of civil society and their approach to addressing the impacts of climate change in NI.

3: Ownership of the content of this chapter is with Climate NI and the listed contributors from civil society and local government.

4: Climate NI work is guided by a cross-sectoral steering group, for further information please see our website: <https://www.climateinireland.org/aboutus/steering-group.php>

Supporting Document Structure

This document presents additional information on the projects and associated actions detailed in the Civil Society and Local Government Adapts chapter within NICCAP2. This is outlined in the following sections:

1. Civil Society Adapts: Actions and Case Studies

Further detail about each of the projects⁵ and associated climate change adaptation actions listed in the NICCAP2 'Civil Society and Local Government Adapts' chapter and delivery plans are outlined within this supporting document under each relevant NICCAP2 outcome objective (see table 1 for a list of NICCAP2 outcome objectives).

These illustrate how non-government sectors will contribute to delivering NICCAP2 outcome objectives.

In addition, case studies are included within this document to illustrate the valuable civil society contributions to climate change adaptation undertaken in NI prior to NICCAP2.

Outcome Objective Natural Capital (NC) 1 Vision:
We will have species, habitats and water bodies that are resilient to the impacts of climate change.

Outcome Objective Natural Capital (NC) 2 Vision:
We have coastal communities, habitats, landforms and infrastructure that are resilient to impacts of climate change.

Outcome Objective Natural Capital (NC) 3 Vision:
We have soils and woodland that are resilient to the impacts of climate change.

Outcome Objective Infrastructure Services (IF)1 Vision:
We have transport and network services that are resilient to the impacts of flooding and extreme weather.

Outcome Objective People and Built Environment (P)1 Vision:
We have people, homes, buildings and communities that are resilient to the impacts of flooding and extremes of weather.

Outcome Objective Disruption to Businesses and Supply Chains (B)1 Vision:
We have businesses that can adapt to impacts of climate change and extreme weather.

Outcome Objective Food Security/Global Food Production (I)1 Vision:
We have a food system resilient to impacts of climate change.

Table 1. NICCAP2 outcome objective

5: Projects and their associated actions listed are identified as either as research, strategic or practical projects. All academic projects are listed as research projects. For private sector and community and voluntary sector stakeholders, projects that are undertaking adaptation planning and research are listed as strategic, whilst projects implementing adaptation activities are deemed as practical.



2. Local Government Adapts

An outline of the climate change adaptation actions which will be implemented within the Local Government sector over the lifetime of NICCAP2.

3. Supporting and Collaborating with Government Departments

An outline of the ways in which civil society and local government sectors will work to support government departments in the delivery of their climate change adaptation actions. It also highlights the valuable skills and expertise that these sectors provide to support adaptation work planned and undertaken by government departments.

Multiple wildfires around the Hatchet Field, Black Mountain 2012

Photo credit: Belfast Hills Partnership

4. Civil Society and Local Government Delivery Plans (Annex 1):

Civil Society and Local Government NICCAP2 Delivery Plans have been developed for each NICCAP2 outcome objective. The plans⁶ set out a summary of the relevant projects and associated adaptation actions planned by civil society and local government, which will contribute to the delivery of the relevant outcome objective. Delivery plans detail the risks and opportunities (from the NI Evidence Report 2017) that each project and associated action addresses. Implementation timescales for the projects and actions are included, along with a list of collaborating organisations and funders.

6: Adaptation actions listed in the delivery plans are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.



NICCAP online platform

An online NICCAP platform hosted on the Climate NI website will be developed during the first year of this programme.

The platform will aim to raise awareness of good practice climate change adaptation work across NI and encourage coordinated action across all sectors. It will also present⁷ the methods, progress and outcomes of the work completed as civil society and local government undertake the adaptation activities outlined in this programme.

Monitoring and reporting of Progress

Climate NI will facilitate a mid-programme review and an end of programme evaluation (2021 and 2023). During this review, workshops will be facilitated by Climate NI at which civil society and local government contributors to this chapter will be asked to present information on the progress of implementing their NICCAP2 actions, and to illustrate how these actions have contributed to delivering the relevant NICCAP2 outcome objectives.

The mid-programme review process will also provide an opportunity to gather information on additional climate change adaptation work being undertaken in NI and include these as actions in NICCAP2.

Based on findings of the mid-programme review, Climate NI will prepare a report and update NICCAP2.

Climate NI will also provide an end of programme evaluation of the delivery of NICCAP2 actions outlined in this chapter, and their contribution to delivery of the NICCAP2 outcome objectives.

Input to future Climate Change Risk Assessments

As required by the Climate Change Act 2008, during the lifetime of this programme, a third CCRA will be prepared. Climate NI will continue to work alongside government departments, civil society and local government stakeholders to encourage development and sharing of the vital climate change evidence required to inform this risk assessment.

Exposed reservoir bed and bridge at Spelga Reservoir during 2018 heatwave

Photo credit: Claire Mullaly

7: Further information on activities will be provided on the Climate NI website by agreement of the organisations and individuals involved.



Civil Society Adapts: Adaptation Actions

Community and voluntary organisations, the private sector and academics play a significant role in shaping politics, society and local communities. They bring a wealth of knowledge, expertise and experience to climate change adaptation work.

While government planning and actions are vital for providing a strategic approach to climate change, it is imperative that civil society is engaged at an individual, organisational and strategic level in planning for, and adapting to, climate change risks and opportunities. It is also important that their contributions are recognised as a vital part of the collaborative climate change resilience effort. Many NI civil society stakeholders are already experiencing, documenting and carrying out actions to adapt to the impacts of climate change.

Civil society stakeholders in NI have planned a variety of climate change adaptation actions over the lifetime of this programme.

This section outlines how the following civil society sectors plan to contribute to the NICCAP2 objectives:

- Academic Sector,
- Community and voluntary organisations, and
- Private Sector.

For each stakeholder group, planned projects for the period 2019–2024 are listed which will address the risks and opportunities outlined in the NI Evidence Report 2017. A delivery plan⁸ for each of these projects is included in Annex 1. Case studies are included to illustrate the outcomes of previous efforts by civil society to increase resilience to the impacts of climate change across NI.

Claudy Bridge, Co. Tyrone, destroyed in August 2017

Photo credit: Mark Wilson, Ulster University

⁸: Adaptation actions listed in the delivery plans are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.

Case Study Map

Case Study 1: Investigating the groundwater flow regime of the Sherwood Sandstone Aquifer (pg. 22)

Case Study 2: Documentation for Integrated Hazard Assessment and Sustainable Management (pg. 24)

Case Study 3: Ballinderry Freshwater Pearl Mussel Rescue Project (pg. 25)

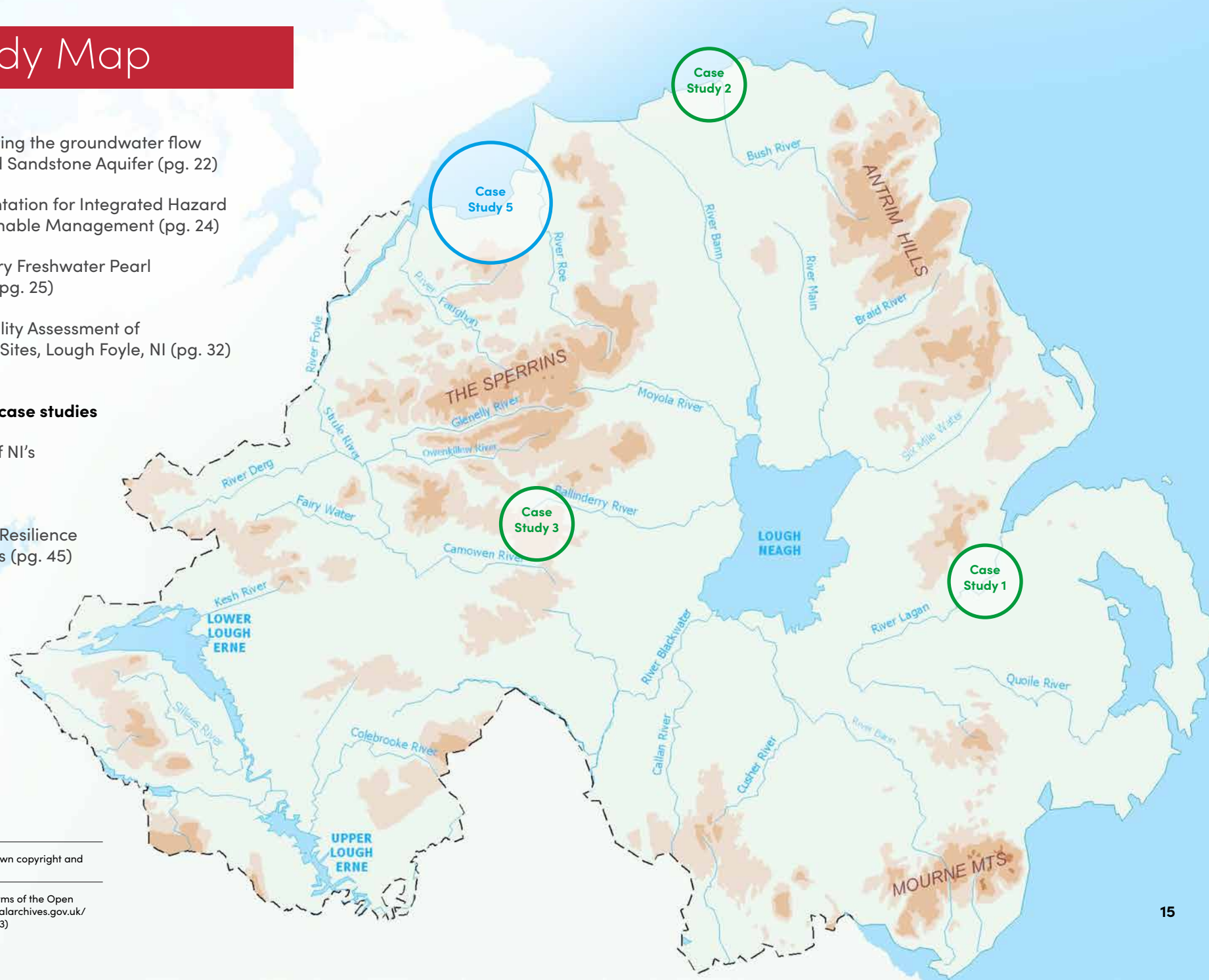
Case Study 5: Vulnerability Assessment of Coastal Archaeological Sites, Lough Foyle, NI (pg. 32)

Northern Ireland-wide case studies

Case Study 4: Review of NI's Sea Defences and Coastal Data (pg. 30)

Case Study 6: Business Resilience Toolkit for Dairy Farmers (pg. 45)

Case Study 7: Queen's University Belfast Nexus Project (pg. 49)



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Civil Society Adapts – Adaptation Actions

Outcome Objective NC1 Vision:

We will have
species, habitats
and water bodies
that are resilient
to the impacts of
climate change

Academic Sector

Research Project:

NC1.1: Maritime, Ocean Sector and Ecosystem Sustainability (MOSES)

NI Responsible Organisation

**Dr Wesley Flannery,
Queen's University Belfast**

Collaborating Organisations

National University of Ireland, Northern and Western Regional Assembly, Fundacion ATZI, Institut français de recherche pour l'exploitation de la mer, FORO MARITIMO VASCO, Centro Interdisciplinar de Investigação Marinha e Ambiental, Euskal Herriko Unibertsitatea, and Universidad del País Vasco

The project will quantify blue growth⁹ for key marine sectors and develop a common methodology for the quantitative assessment of sectoral pressures on the marine environment and the vulnerability of marine and coastal areas. The methodology will contribute to the joint implementation of integrated marine industry sustainability assessment toolkits across the Atlantic region. The outputs will assist regional authorities and policy makers in monitoring progress vis-à-vis the Atlantic Action Plan¹⁰. This will enable policymakers to better understand and quantify the impact of climate change on the social and economic structures of the Marine sector such as marine and coastal tourism, shipping, aquaculture and the fishing industry.

Research Project:

NC1.2: Mitigating Animal Health Impacts of Climatic Variation

NI Responsible Organisation

**Professor Eric Morgan,
Queen's University Belfast**

Collaborating Organisations

Newcastle University, University of Bristol, University of Liverpool, University of Calgary (Canada), Livestock Helminth Research Alliance, Star-IDAZ International Research Consortium, Sustainable Control of Parasites in Sheep and Control of Worms in Cows Sustainably

This research will improve upon methods of forecasting parasite transmission from weather data to generate computer models for use by farmers and their advisors. Models will be disseminated across industry bodies and made available to guide the updating of strategic plans for parasite control.

9: Blue Growth is the long term EU strategy to support sustainable growth in the marine and maritime sectors as a whole. For further details of the EU's Blue Growth strategy, please see: https://ec.europa.eu/maritimeaffairs/policy/blue_growth_en

10: The Atlantic Action Plan sets out priorities for research and investment to drive the 'blue economy' forwards in the Atlantic area, while also ensuring the environmental and ecological stability of Europe's largest and most important ecosystem.

Academic Sector

Research Project:

NC1.3: SALine INtrusion in coastal Aquifers: Hydrodynamic Assessment and Prediction of Dynamic Response (SALINA)

NI Responsible Organisation

**Dr Raymond Flynn,
Queen's University Belfast**

Collaborating Organisations

Imperial College London, Brunel University London and University College Dublin

Carry out an experimental investigation on saline intrusion at a coastal site in NI, to gain an indication of the processes and signals that arise when saline intrusion occurs. The resulting data will be used to produce an early warning mechanism to prevent salt water from contaminating coastal aquifers and provide evidence of how (and if) risks are changing. This early warning mechanism will be a device that will be placed in the well and will measure a (self potential) signal. The approach has been successfully piloted in a chalk aquifer in the south of England. A key aspect of the project will be to assess how well it performs in other geological environments.

¹¹ This is a tool, based on scientific principles, that allows very variable hydrological conditions, encountered in the Irish landscape, to be simulate.

¹² These are areas where any damage to peatland would have a far greater impact on flow and/or water quality than elsewhere in a bog.

Research Project:

NC1.4: Towards Quantification of Blanket Bog Ecosystem Services to Water (QUBBES)

NI Responsible Organisation

**Dr Raymond Flynn,
Queen's University Belfast**

Collaborating Organisations

University College Dublin, Ohio State University, National University of Ireland and Dundalk Institute of Technology

Investigation of links between vegetation and blanket bog hydrology using a previously developed numerical model¹¹. This will enable identification of links between vegetation maps and hydrological processes to allow critical source areas¹² in blanket bogs to be identified where restoration measures can be implemented for optimal impact on ecological networks. Information gained will inform improved decision-making and reduce the risk of lock-in to unsustainable future pathways. Areas where alternative economic activity, such as forestry or upland grazing, may occur with minimal impact to water courses will also be defined.

This action also contributes to objective NC3. See page 34 for details.

**Sister project to 'Weathering Below Blanket Bogs'*

Community and Voluntary Organisations

Practical Project:

NC1.5: Ancient Woodland Restoration and New Woodland Creation

NI Responsible Organisation

Woodland Trust

Collaborating Organisations

Forestry Agents, Land Owners, Royal Forestry Society and Local Councils

The Woodland Trust are the leading partner in the UK-wide Charter for Trees, Woods and People¹³ raising awareness about the importance of trees for wildlife and people. The Woodland Trust will continue to create new woodlands, secure, restore and protect existing ancient woodlands and thus ensure that these habitats are resilient to climate change. Assessments will be undertaken to identify vulnerable woodlands and suitable areas for woodland creation. Guidance on the strategic planting of native species will be provided through coordination and collaboration with landowners and forestry agents. Uptake of sustainable land management practices will be encouraged, such as strategic riparian woodland creation to protect, restore and improve the condition and extent of ecological networks.

This action also contributes to objective NC3. See page 34 for further details.

Strategic Project:

NC1.6: Co-operation Across Borders for Biodiversity (CABB)

NI Responsible Organisation

RSPB NI

Collaborating Organisations

BirdWatch Ireland, RSPB Scotland, NI Water, Butterfly Conservation and Moors for the Future

Support the restoration of important habitats across three sites in NI¹⁴. Develop and publish Conservation Action Plans for the Garron Plateau special area of conservation (SAC), Montiaghs Moss SAC in County Antrim, and the Pettigo Plateau SAC in County Fermanagh. This project aims to implement measures to improve the habitats for birds, butterflies and other species, and maintain security of water supply through supporting the production of drinking water (at a lower cost).

This action also contributes to objective NC3. See page 34 for further details.

13: Initiated in 2015 by the Woodland Trust in response to the crisis facing trees and woods in the UK, the Charter for Trees, Woods and People sets out 10 principles for a society in which people and trees can stand stronger together.

14: The Garron Plateau SAC, Montiaghs Moss SAC in County Antrim, and the Pettigo Plateau SAC in County Fermanagh.

Community and Voluntary Organisations

Practical Project:

NC1.7: Collaborative Action for Natura Network (CANN)

NI Responsible Organisation

Ulster Wildlife reporting on behalf of Newry, Mourne and Down District Council

Collaborating Organisations

Armagh City, Banbridge and Craigavon Borough Council, East Border Region, Ulster University, Golden Eagle Trust, Institute of Technology Sligo, Monaghan County Council, Scottish Natural Heritage, Argyll & the Isles Coast and Countryside Trust (ACT)

The aim of this project is to help improve the condition of peatland and wetland habitats in SAC, part of the European Natura 2000 network, in Ireland, NI, and western Scotland¹⁵. By addressing and managing climate and non-climate related risks, guided by the development of 27 Conservation Action Plans¹⁶, species that rely on these habitats will also be helped.

This action also contributes to objective NC3. See page 34 for further details.



Sundew – insectivorous sundew on one of the Fairy Water Bogs.

Photo credit: Simon Gray

Strategic Project:

NC1.8: Living Seas work including Sea Deep

NI Responsible Organisation

Ulster Wildlife

Collaborating Organisations

SeaSearch and Queen's University Belfast

Ulster Wildlife¹⁷ will continue to map and monitor marine and coastal ecosystems to identify changes and potential impacts including climate change, to provide evidence for implementing conservation adaptation actions and identify any additional or alternative actions to be taken.

Sea Deep will focus on the data gap around elasmobranch species such as sharks¹⁸. Evidence from all the living seas projects will be used to influence policy change with the aim of encouraging the development and management of an ecologically coherent network of Marine Protected Areas (MPAs) and to achieve good environmental status (GES) as transposed in the Marine Strategy Regulations 2010.

This action also contributes to objective NC2. See page 27 for further details.

15: SAC sites: NI- Ballynahone Bog, Curran Bog, Garry Bog, Peatlands Park, Cranny Bogs, Fairy Water Bogs, Moneygal Bog, Tully Bog, Turmennan, Lecale Fens; Republic of Ireland- Bolevbrack, Lough Arrow; Cross-border SAC sites- Cuilcagh Mountain, Sliabh Beagh, Magheravee/Kilroosky Lakes; Scotland- Rinn of Islay, Eilean na muice duibhe, Ben Nevis, Ben Alder, Cockinhead Moss, Trotternish Ridge, Kirkcowan Flow, Glen Coe Moffat Hills, Mochrum Lochs.

16: These plans cover habitats given the highest level of protection under European law and are fully in line with the aspirations and guidance provided by other plans such as 'Valuing Nature - A Biodiversity Strategy for NI to 2020' and the various action plans for the priority peatlands habitats.

17: Ulster Wildlife's vision for Living Seas is where species which have declined can become common again; fish stocks and sustainable; and healthy, marine habitats to support the life within them and us. It means environmentally sustainable use of our seas' resources and active management plans in place to safeguard coastal and marine species and habitats in NI including mitigating for the impacts of climate change.

18: Elasmobranch species are a cartilaginous fish of a group that comprises the sharks, rays, and skates.

Community and Voluntary Organisations

Strategic Project:

NC1.9: Northern Ireland Marine Task Force (NIMTF)

NI Responsible Organisation

Ulster Wildlife

Collaborating Organisations

National Trust, RSPB, NI Environment Link, Friends of the Earth, Wildfowl and Wetlands Trust (WWT), World Wide Fund for Nature (WWF), and Marine Conservation Society, Keep NI Beautiful and Irish Whale and Dolphin Group.

The NIMTF¹⁹ will continue to collate evidence and commission research for implementing conservation adaptation actions in relation to climate change and other factors, and to identify any additional or alternative actions to be taken. Evidence will be used to influence policy change with the aim of encouraging the development of an ecologically coherent network of MPAs, an ecosystem based approach to Marine Spatial Planning, sustainable fisheries, and to achieve GES as transposed in the Marine Strategy Regulations 2010.

¹⁹: The NIMTF provides an effective joined-up voice from the environmental non-governmental sector calling for our seas to be “clean, healthy, safe, productive and biologically diverse”. They campaign for comprehensive marine legislation and active management in place to safeguard coastal and marine species and habitats in NI.

Strategic Project:

NC1.10: Shifting Shores – Playing our Part on the Coast

NI Responsible Organisation

National Trust

Collaborating Organisations

Coastal Local Authorities in NI, Ulster University and local community representatives

Promote partnership working and develop coherent strategies to deal with risks to NI’s coastal aquifers, habitats and landscape character from salt water intrusion caused by increasing sea level rise and increasing tidal surges.

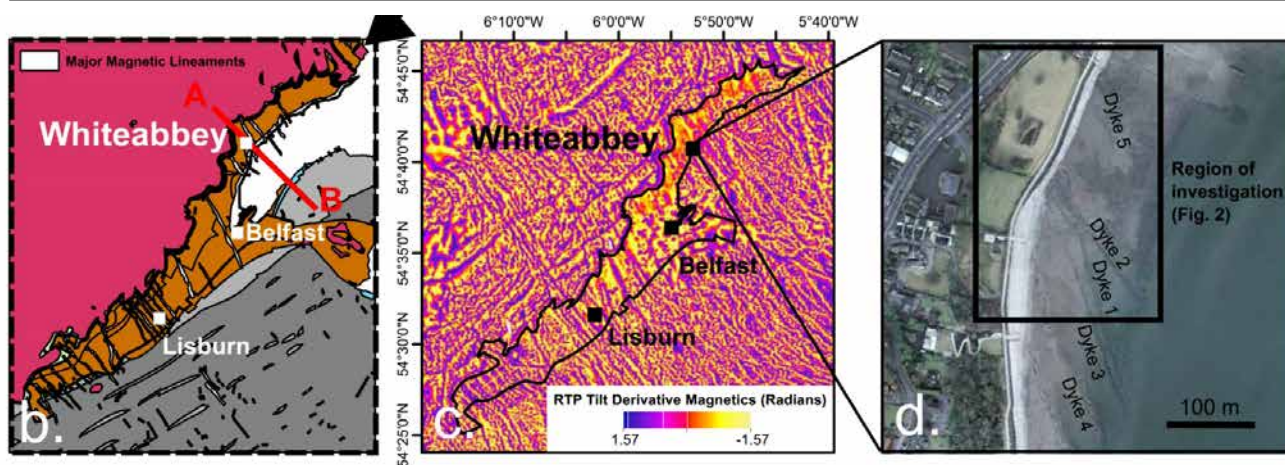
This action also contributes to objective NC2. See page 27 for further details.



Giant's Causeway World Heritage Site - Recent mass movement (slips, slides, slumps and rock falls) at the Giant's Causeway. Whilst these are natural coastal processes, rainfall plays a significant role in mass movement within coastal cliffs.

Photo credit: Fiona Bryant, National Trust

NC1 Case studies



(b) detailed view of the geology of the Lagan valley with location of major magnetic lineaments from the interpretation of airborne magnetic maps, (c) tilt derivative transformation of airborne magnetic map highlighting magnetic lineaments related to volcanic dyke

swarms, (d) Google Earth aerial photo of the Whiteabbey site showing individual dykes outcropping in the tidal flat.

Comte, J.-C., Wilson, C., Offerdinger, U., and González-Quirós, A. (2017)

Case Study 1

Investigating the groundwater flow regime of the Sherwood Sandstone Aquifer

Keywords

Aquifers, agricultural land, habitats, saltwater intrusion, water availability

Location: Sherwood Sandstone Aquifer, Lagan Valley

Collaborating Organisations: University of Aberdeen, Université de Neuchâtel (Switzerland) and the Geological Survey of NI

Date: 2014–2018

Project funder: Study part-funded through Department of Employment and Learning PhD Studentship

Reported by: Dr Ulrich Offerdinger, Queen's University Belfast

Aim: To evaluate the impact of dolerite dyke intrusions on regional water availability and identify the impact of saline intrusion into the freshwater Sherwood Sandstone aquifer.

Introduction

This project investigated the groundwater flow regime of the major Sherwood Sandstone Aquifer across the Lagan Valley. Multi-scale geophysical methods²⁰ were used to improve numerical groundwater flow and transport models.

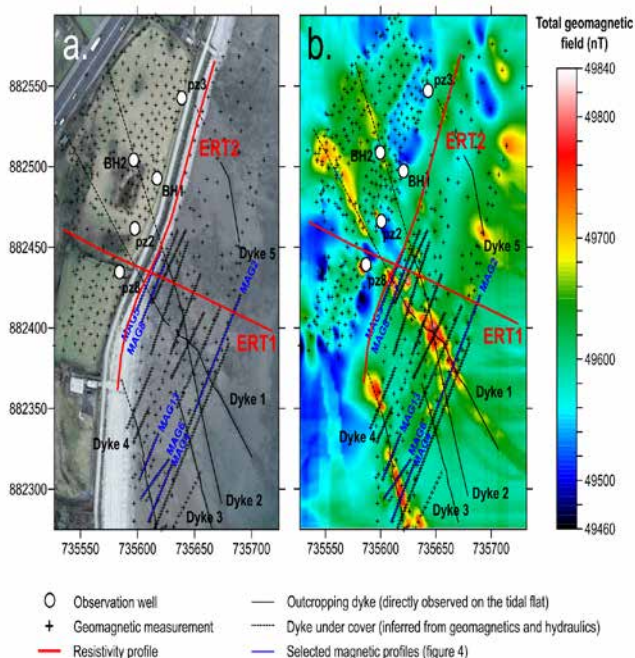
Key Research Findings

- low-permeability structures as small as 1–2 m wide are sufficient to generate preferential pathways and relative aquifer compartmentalization
- compartmentalisation of the aquifer with poor connectivity across dykes results in high hydraulic and salinity gradients at dyke locations
- dykes are shown to act as relative barriers to flow and saltwater transport
- angle and continuity of dykes inland important factor for freshwater accumulation

²⁰: Combination of geophysical survey methods applied across varying spatial scales of investigation, including borehole logging methods, ground-based survey methods and airborne or satellite-based geophysical survey methods. Examples include: combining geoelectrical borehole logging methods, measuring formation resistivity at the decimetre scale with ground-based electrical resistivity tomography (ERT) techniques, measuring formation resistivities at scales ranging from the metre to multiples of 100m scale; or combining ground-based electromagnetic (EM) techniques at the metre to 10's metre scale with airborne EM surveying techniques measuring subsurface properties at 10's to 100's metre scale.

Conclusion

Swarms of even relatively thin dolerite dyke intrusions can lead to distinct compartmentalisation of groundwater bodies, affecting the degree of saltwater intrusion and patterns of freshwater accumulation. Geophysical imaging techniques have been shown to be particularly useful in tracing saltwater intrusion and providing parameter values at relevant spatial scales to support numerical groundwater flow models for managing coastal water resources.

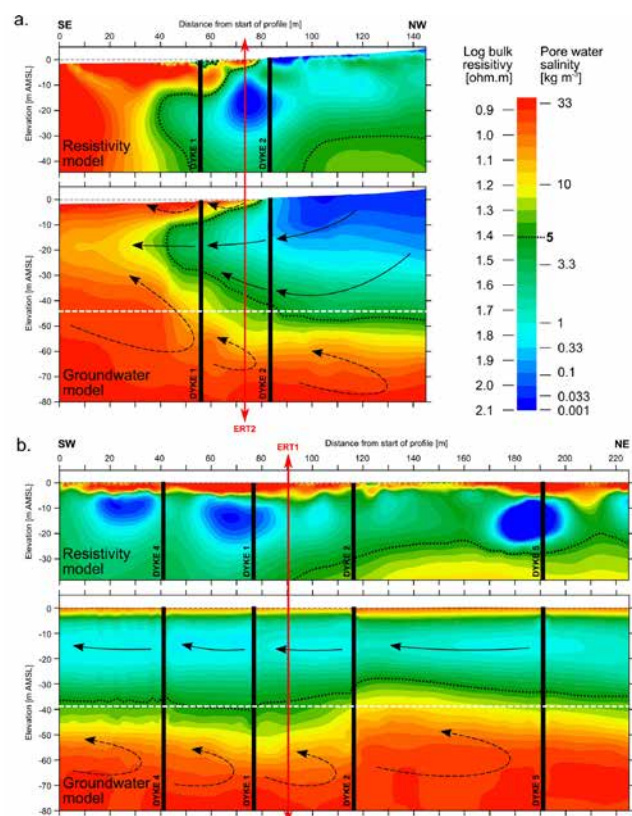


Map of the study site showing the well locations, dyke locations, magnetic profiles and the resistivity profiles (ERT1 & ERT2).

Image credit: Comte, J.-C., Wilson, C., Offerdinger, U., and González-Quirós, A. (2017)

Outcomes

- Study was published in leading international journal (Comte J.C., Wilson C., Offerdinger U., Quiros A., 2017)
- Study findings were provided to Geological Survey of NI and NI Environment Agency as stakeholders and management authorities for Sherwood Sandstone Aquifer
- Study supported both academic research (early career researchers) as well as provided case study for undergraduate and postgraduate teaching



Comparison of inverse Electrical Resistivity Tomography (ERT) models and 3-D groundwater model results illustrating groundwater – salt water interaction in the study area; cross section perpendicular to the shore coinciding with the line ERT1. Black vertical lines are dyke locations and vertical red arrows mark the intersection of the two cross sections (ERT1 & ERT2 below). Black arrow on the groundwater model sections are simplified groundwater flow paths (projected and unscaled); plain arrows for freshwater, dashed arrows for saltwater. The white dashed lines indicate the maximum depth imaged by the ERT profiles.

Image credit: Comte, J.-C., Wilson, C., Offerdinger, U., and González-Quirós, A. (2017)



Case Study 2

Documentation for Integrated Hazard Assessment and Sustainable Management

Keywords

Erosion, sea-level rise, landscape, historic environment, species, habitats

Location: Giant's Causeway

Collaborating Organisations: Giant's Causeway and Causeway Coast World Heritage Site Steering Group, Queen's University Belfast and the National Trust

Date: 2010–2015

Project funder: National Trust and Department of Employment and Learning

Reported by: Causeway Coast and Glens Heritage Trust

Aim: Document the Giant's Causeway to produce a high-resolution digital elevation model to assess the potential impacts of climate change on the natural heritage of the site.

Giant's Causeway World Heritage Site

Introduction

The Giant's Causeway and Causeway Coast World Heritage Site is a globally significant geological site, internationally important ecological reserve and NI's leading tourism attraction (EHS et al., 2005). Impacts on the geological, habitat and landscape values of the site result from the footfall of visitors and changes in climate leading to issues such as sea-level rise and changes in biodiversity.

Key Actions Taken

- Assessed and identified the potential climate risks and changes to the landscape and geology of the site.
- Assessed risks to natural species, namely the protected Narrow Mouth Whorl Snail (SAC feature).
- Assessed and identified the impact of slope failures and rock falls on visitation and visitor patterns within the site.

Outcome

Results of this study were used to develop strategic guidelines to guide practical conservation and management of dynamic natural sites in NI and the UNESCO World Heritage network. This included advice on seeking, documenting and integrating historic, contemporary and future data regarding natural processes and how best to use technology to support physical access to, and conservation of important natural heritage sites.



Case Study 3

Ballinderry Freshwater Pearl Mussel Rescue Project

Keywords

**Pearl mussel, habitats,
water temperature, flood risk,
conservation**

New stockproof fencing (right) with native willow saplings growing
between the fence and the river

Photo credit: Ballinderry Rivers Trust

Location: Upper Ballinderry River Special
Area of Conservation (SAC)

Collaborating Organisations: Queen's
University Belfast and Ulster University

Date: 2012–2015

Project funder: Heritage Lottery Fund and
NI Environment Agency (NIEA) Natural
Environment Fund

Reported by: Ballinderry Rivers Trust

Aim: To save the Ballinderry Freshwater
Pearl Mussel (one of the last six remaining
populations in NI) from extinction by
addressing the issues in the catchment
preventing natural reproduction and to
create a resilient habitat for the species to
thrive in the river.



Introduction

The project focused on the upper 127km² of the Ballinderry River catchment in County Tyrone, where the river channel is a designated SAC. Ballinderry mussels are genetically distinct from all the remaining populations in NI's rivers. It was predicted that, without intervention the Ballinderry freshwater pearl mussels would become extinct by 2098.

Key Actions

- Identified the sources of silt²¹ that were impacting on the ability of the freshwater pearl mussel to naturally survive and reproduce.
- Established a sanctuary population of freshwater pearl mussel in the river.
- Supported the delivery of silt remediation and river restoration work. This included: engagement with 76 landowners along the Upper Ballinderry River SAC; installation of over 26 kilometers of stock-proof fencing and alternative livestock watering facilities to reduce cattle trampling of riverbanks that are vulnerable to erosion during high flows; strategic planting of over 3000

native willow trees along the river banks to stabilise the banks and slow the flow during flood conditions. Trees planted with the aim to also reduce the impact of rising water temperatures and create the correct balance of light and shade for young fish and mussels to thrive in the river.

- Delivered a learning and outreach programme aimed at the wider public through a variety of outlets and resources.

Outcomes

There has been a positive impact on slowing the river flow during flood, bringing long-term environmental, societal and economic benefits. Improving the balance of light and shade has also helped reduce the impact of rising water temperature on the water-dependent wildlife of the river, including freshwater pearl mussel, trout and salmon.

A freshwater pearl mussel

Photo credit: Ballinderry Rivers Trust

21: Too much silt, arising from eroding river banks and poor land management practices, settles on gravel beds in the river and prevents oxygenated water from freely passing through them. Without this supply of oxygen, juvenile mussels cannot survive.

Civil Society Adapts – Adaptation Actions

Outcome Objective NC2 Vision:

We have coastal communities, habitats, landforms and infrastructure that are resilient to impacts of climate change

Academic Sector

Strategic Project

NC2.1: UrbanARK: Assessment, Risk Management, & Knowledge for Coastal Flood Risk Management in Urban Areas

NI Responsible Organisation

Dr Ulrich Offerdinger, Queen's University Belfast

Collaborating Organisations

University College Dublin, New York University, and the US-Ireland Research & Development programme

The project aims to develop immersive virtual reality (VR) applications²² to enhance emergency management and preparedness of urban communities, including infrastructure assets and networks that are at risk from coastal flooding events. Research activities will utilise mobile and airborne LiDAR²³ scanning (Mobile Lidar Systems/ Airborne Laser Scanning) with street-view imagery and airborne hyperspectral data to identify relevant underground structures such as commercial/residential basements and transport infrastructure in coastal urban centres. The project aims to use available hyperspectral remote sensing data which may provide information on the nature and type of ground conditions (for example paved or open ground surfaces) which in turn will help to derive surface properties such as surface roughness which will be used in the flood inundation models.

Community and Voluntary Organisations

Strategic Project

NC2.2: Living Seas work including Sea Deep

NI Responsible Organisation

SeaSearch and Queen's University Belfast

Map and monitor coastal and marine ecosystems, to identify risks, changes and potential impacts from ocean acidification, temperature shifts, invasive species, sea level rise and coastal erosion. Use information gained about risks and impacts to influence policy change, encourage action and risk management. Raise awareness among communities and promote local level action through the Community Engagement work.

This action also contributes to objective NC1. See page 16 for further details.



Belfast Lough

Photo credit: Rebecca Hunter

²²: Immersion into virtual reality is a perception of being physically present in a non-physical world, created by surrounding the user of the VR system in images and/or other stimuli that provide an engrossing total environment. In the context of the project, these applications will be aimed at providing communities in coastal urban centres with a more realistic perception of coastal flood risks.

²³: LiDAR means 'Light Detection and Ranging'.

Community and Voluntary Organisations

Strategic Project

NC2.3: Shifting Shores – Playing our Part on the Coast

NI Responsible Organisation

National Trust

Collaborating Organisations

Coastal Local Authorities in NI, Ulster University and local community representatives

Raise awareness of the impacts of climate change on the NI coastline. This will be achieved by promoting partnership working and developing coherent risk management strategies to deal with risks to habitats, heritage and coastal communities in the coastal zone, caused by increasing sea level rise, coastal erosion, and loss of natural protection and flooding.

This action also contributes to objective NC1. See page 16 For further details.

Private Sector

Strategic Project

NC2.4: Business Continuity Planning

NI Responsible Organisation

Belfast Harbour Commissioners

Belfast Harbour will continue incorporating projected climate change and information from modelling into their Business Continuity Planning process, risk management strategies, warning and informing system, operational controls and new developments.

This action also contributes to objective IF1. See page 38 for further details.



Erosion Scarp – Storm damaged sand dunes on Portstewart Strand, (Storm Gareth, March 2019)

Photo credit: Wilbert McIlmoyle, National Trust



NC2 Case studies

Case Study 4

Review of NI's Sea Defences and Coastal Data

Keywords

**Coast, habitats, heritage,
sea-level rise, erosion,
infrastructure, communities**

Annalong shows gabion baskets placed to reinforce the Mourne path.

Photo credit: Professor Andrew Cooper

Location: NI Coast

Collaborating Organisations: Professor Jackson, Ulster University and National Trust

Date: 2015–2016; 2017–2018

Project funder: National Trust

Reported by: Professor Andrew Cooper, Ulster University

Aim: Two studies assessed the distribution of sea defences in sheltered loughs and open seas around the NI Coast, and reviewed the accessibility of coastal data needed to inform decision making on adaptation measures (Cooper et al., 2016; Cooper and Jackson, 2018).



Introduction

NI ocean and sea-lough coasts face increasing risks from coastal erosion and marine flooding caused by the projected impacts of climate change. The coastal and ocean region is a valuable asset to NI, as the landscape is home to diverse coastal and marine habitats, whilst sustaining industrial, recreational and commercial activities.

Key Research Findings

- No systematic monitoring or assessment of physical coastal change is currently undertaken. The subsequent lack of data means that understanding of coastal behaviour and processes is limited
- Developments permitted at the coast where the dynamics of coastal processes are poorly understood will lead to direct environmental impacts and likely loss of natural amenities such as sandy beaches and dunes
- Lack of proper coastal and marine data means that planning for present and future infrastructure cannot rely on robust information.

- Around 32% of the coast is currently armoured, which is damaging to the natural environment (causing, for example, beach narrowing, scouring, creation of knock-on effects down drift, loss of amenity).

Conclusion

In conclusion, adaptation efforts on the coastline are hampered by a reliance on hard defences in response to coastal change (which is damaging to the natural landscape, whilst also incurring costs of installation and ongoing maintenance), a lack of suitable coastal baseline data, and the absence of a strategic shoreline management plan.

Outcomes

Submitted a report outlining findings and recommendations to relevant government departments in 2018 which states that there is a need for NI to adopt a strategic approach to shoreline management and coastal defence designation, which would inform climate change adaptation plans.

West Strand Portrush, shows the sea defences being protected by additional rock armour. The beach here has lowered and a high tide beach is often absent since the sea walls were built.

Photo credit: Professor Andrew Cooper



Case Study 5

Vulnerability Assessment of Coastal Archaeological Sites, Lough Foyle, NI

Keywords

Coast, historic environment, landscape, erosion, sea-level rise, archaeology

Eroding sand cliff showing toppled WW2 defences (concrete blocks and metal posts for barbed wire) in the foreground, and another concrete block still in situ but exposed at the top of the cliff. Darker layers are exposed bands of peat.

Photo credit: Dr Kieran Westley

Location: Lough Foyle

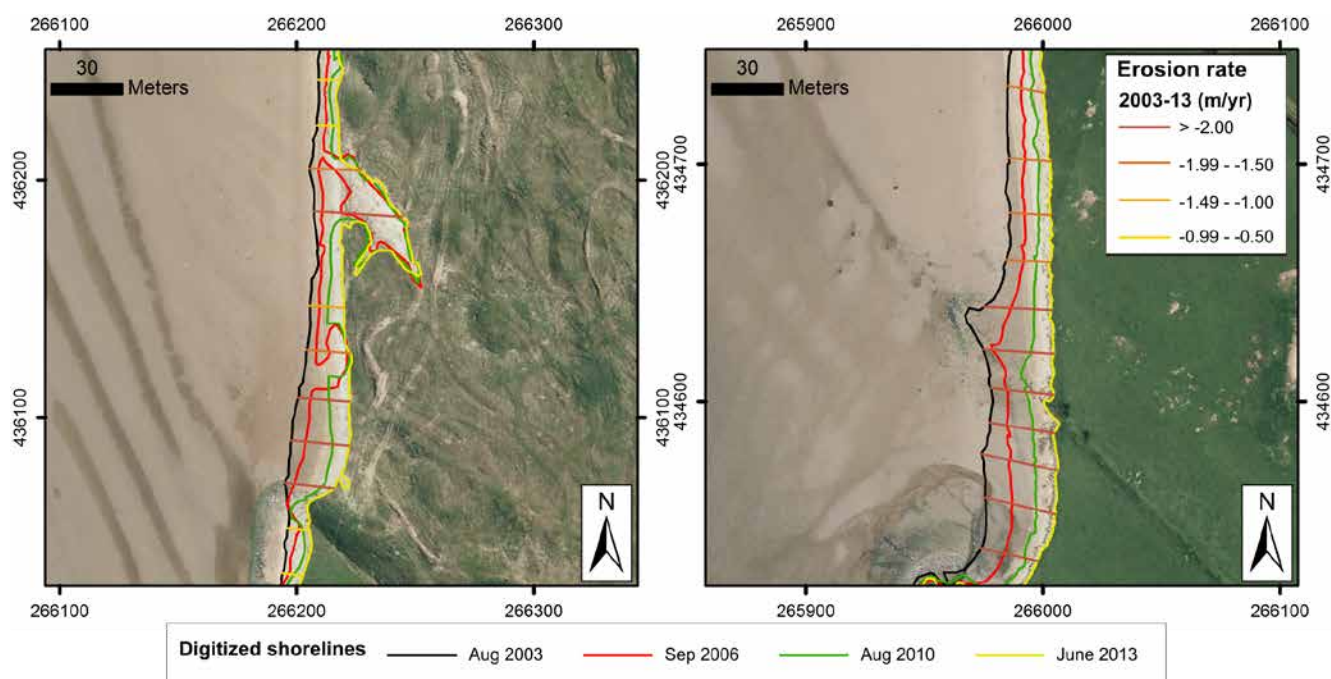
Collaborating Organisations: Mr Rory McNeary (Formerly Ulster University, currently NI Department for Communities), Ulster University

Date: 2011–2013; 2014–2015; 2016–2017

Project funder: NI Environment Agency (NIEA)

Reported by: Dr Kieran Westley, Ulster University

Aim: A series of research studies aimed to identify and assess the quality of the strategic risk mapping of recorded historic sites and monuments located along the Lough Foyle coastline (Westley, 2018; Westley, 2015; McNeary & Westley, 2013).



Examples showing zones of major retreat (c. 20–30m) within the 10 years. Base image is a 2013 orthophoto, digitized shorelines for 4 orthophoto rounds are superimposed with transects showing calculated erosion rate

Photo credit: Orthophoto © Crown Copyright 2017; image from Westley (2018)

Introduction

Studies initially undertook extensive desk-based research across the province to provide a strategic mapping overview of climate change-related risks. Subsequent follow-up desk-based research and field survey aimed to quantify past and potential climate change impacts to the historic environment and the landscape along the Lough Foyle shoreline in NI.

Key Research Findings

- The Lough Foyle shoreline has a complex pattern of change, with zones of significant erosion interspersed with areas of stability.
- Evidence suggests that ongoing and future climate change impacts, such as enhanced coastal erosion driven by intensified storms and sea-level rise, will be destructive or problematic for coastal archaeological heritage along Lough Foyle.
- This however is partly mitigated by the relatively low archaeological significance of many of the historic sites located along the Lough Foyle shoreline.

Outcomes

A series of reports were prepared which outline risks, impacts and recommendations. These reports were submitted to the NIEA (Historic Environment Directorate). The latest research undertaken between 2016 and 2017, led to a methodological discussion on identifying ways to better understand and refine coastal erosion risks to historic sites and landscapes caused by climate change. This information enabled the informing and prioritisation of adaptation actions.

Civil Society Adapts – Adaptation Actions

Outcome Objective NC3 Vision:

We have soils and
woodland that
are resilient to the
impacts of climate
change

Research Project

NC3.1: Towards Quantification of Blanket Bog Ecosystem Services to Water (QUBBES)

NI Responsible Organisation

**Dr Raymond Flynn,
Queen's University Belfast**

Collaborating Organisations

*University College Dublin, Ohio State University,
National University of Ireland and Dundalk
Institute of Technology*

Establish a baseline for assessing hydrological processes, against which impacts on more damaged bogs may be evaluated. Identify critical source areas in blanket bogs, where land use/blanket bog restoration measures, including soil conservation, creating new woodlands in appropriate locations and natural flood management (NFM) can be implemented to restore peatlands and limit losses of dissolved (and sequestered) organic carbon.

This action also contributes to objective NC1. See page 16 for details.

**Sister project to 'Weathering Below Blanket Bogs'.*

24: Blanket bogs contain large stocks of organic carbon. Loss of carbon through weathering of the sequestered carbon in bogs through oxidation can give rise to increased greenhouse gas losses (CO₂ and methane) along with elevated levels of dissolved organic carbon (DOC). Elevated levels of DOC in water influence climate as they (a) ultimately degrade to greenhouse gases, (b) require expensive treatment technologies for their removal, (c) impact inorganic weathering rates.

Research Project

NC3.2: Weathering Below Blanket Bogs

NI Responsible Organisation

**Dr Raymond Flynn,
Queen's University Belfast**

Collaborating Organisations

Environmental Protection Agency

The aim of the project is to quantify the capacity of blanket bogs to regulate climate. Based on investigations in drinking water catchments to date, results demonstrate that the economic benefits of blanket bog²⁴ restoration can have significant cost savings over alternative land use practices such as upland grazing. Most natural freshwaters in Ireland are not very acidic. This contrasts with more acid-rich waters seeping from Irish bogs. These more aggressive waters can dissolve minerals more quickly from rocks and soils underlying bogs. This process forms part of a wider process called inorganic weathering. The elements released from inorganic weathering can assist in sequestering atmospheric CO₂. How much is dissolved is suspected to depend on the condition of the bog and how much water seeps from the bottom of the peat. In cases where this is hindered, water flows more rapidly to streams, thus elevating the risk of flooding. This project explores the impact of the dissolved organic carbon, which helps make bog waters acidic, on inorganic weathering rates in bogs, by investigating the impacts of land use on ecosystem services to water.

**Sister project to 'Towards Quantification of Blanket Bog Ecosystem Services to Water (QUBBES)'.*

Community and Voluntary Organisations

Strategic Project

NC3.3: Ancient Woodland Restoration and New Woodland Creation

NI Responsible Organisation

Woodland Trust

Collaborating Organisations

Forestry Agents, Land Owners, Royal Forestry Society and Local Councils

Woodland Trust will share information with relevant stakeholders and encourage the uptake and implementation of sustainable land management practices to restore and improve woodland areas and associated habitats.

This action also contributes to objective NC1. See page 16 for further details.

Practical and Strategic Project

NC3.4: Co-operation Across Borders for Biodiversity (CABB)

NI Responsible Organisation

RSPB NI

Collaborating Organisations

BirdWatch Ireland, RSPB Scotland, NI Water, Butterfly Conservation and Moors for the Future

Improve the conditions and restore blanket bogs, fens and raised bogs across three sites in NI through drain blocking, erection of predator fencing, implementation of grazing regimes, rush cutting, and scrub control. Include restoration and protection measures in the Conservation Action Plans for the Garron Plateau SAC, Montiagh's Moss SAC in County Antrim, and the Pettigo Plateau SAC in County Fermanagh.

This action also contributes to objective NC1. See page 16 for further details.



Community and Voluntary Organisations



Cranny - Mass flowering of cotton grass on Cranny Bogs SAC, Tyrone, following a wildfire on the bog the previous year. Burning is a threat to raised bogs and can cause substantial carbon loss. Drain blocking proposed as part of the CANN project by Ulster Wildlife should re-wet these bogs and make them less vulnerable to burning.

Photo credit: Trish Fox

Practical Project

NC3.5: Collaborative Action for Natura Network (CANN)

NI Responsible Organisation

**Ulster Wildlife reporting on behalf of
Newry, Mourne and Down District Council**

Collaborating Organisations

AFBI, Armagh City, Banbridge and Craigavon Borough Council, East Border Region, Ulster University, Golden Eagle Trust, Institute of Technology Sligo, Monaghan County Council, Scottish Natural Heritage, Argyll & the Isles Coast and Countryside Trust (ACT)

Co-ordinate and implement targeted soil conservation and peatland restoration to improve the conditions of soils and peatlands within the SAC sites and to protect natural carbon stores. Healthy peatlands not only store more carbon but are more resilient to the effects of a changing climate. Conservation Action Plans to include an outline of these measures.

This action also contributes to objective NC1. See page 16 for further details.

Civil Society Adapts – Adaptation Actions

Outcome Objective IF1 Vision:

We have transport
and network
services that are
resilient to the
impacts of flooding
and extreme
weather



Academic Sector

Research Project

IF1.1: Investigate the impact of flooding on the stability of small single and multi-span masonry arch bridges

NI Responsible Organisation

Dr Brian Solan, Ulster University

Collaborating Organisations

*Professor Robert Ettema,
Colorado State University*

Investigate the impact of flooding on the stability of small single and multi-span masonry arch bridges²⁵. Research undertaken will quantify climate change impacts, including projected increases in heavier and more frequent rainfall events and bridge scour risk. It will also consider the impact of adaptation measures and relevant maintenance regimes already underway. Results will be disseminated to advise long-term renewal programmes for bridge maintenance, earthworks and embankment.

Claudy Bridge, Co. Tyrone, destroyed in Aug 2017

Scour at the front of the central pier led to scour-induced failure of an arch bridge (Ballynameen Bridge) over the River Faughn near Cladys, Northern Ireland.

Photo credit: Mark Wilson, Ulster University

25: This work is a continuation of an initial research project that was completed in April 2017. A journal and conference paper have been prepared, and a workshop was held in January 2019 (<https://www.engineersireland.ie/groups/regions/northern/events/workshop-exploring-the-vulnerability-and-managemen.aspx>) as part of this work. The conference paper was submitted to the Civil Engineering Research Association of Ireland (CERAI) 2018 conference (Solan, B., Ettema, R., Watters, C., Hamill, G., & Ryan, D. (2018) Scour and the Stability of Short-Span, Masonry Arch Bridge: findings from a diagnostic, flume study. CERAI 2018 Conference; 29th to 30th August 2018, University College Dublin, Ireland).

Private Sector

Strategic Project

IF1.2: Belfast City Airport: Safety and Emergency Planning

NI Responsible Organisation

Belfast City Airport

Review, assess and amend risks assessments on a quarterly basis in compliance with the EU Aviation Safety Agency, to protect the safety of aircraft in the vicinity and on the ground from increasing frequency of extreme weather events including extreme heat, high winds and lightning.

This action also contributes to objective P1. See page 41 for further details.

Strategic Project

IF1.3: Business Continuity Planning

NI Responsible Organisation

Belfast Harbour Commissioners

Belfast Harbour to identify, review and assess extreme weather risks to port operations as part of the interdependent infrastructure network. Information to support emergency planning and to be shared by Belfast Harbour to other relevant port stakeholders.

This action also contributes to objective NC2. See page 27 for further details.

Strategic Project

IF1.4: Smart Port Initiative

NI Responsible Organisation

Belfast Harbour Commissioners

Collaborating Organisations

As appropriate

Smart Port project to utilise off grid power, micro-generation, energy storage and micro grid solutions to improve the resilience of the Harbour to energy shocks and disruptions. When linked with intelligent demand controls this will significantly enhance the operational resilience and efficiency of port energy infrastructure. Modelling of sedimentation risk from coastal change, hydrographic flows and sedimentation will offer accurate projections to inform operational decision-making for long-term action on port infrastructure and operations including navigational safety.

Civil Society Adapts – Adaptation Actions

Outcome Objective P1 Vision:

We have people,
homes, buildings
and communities
that are resilient
to the impacts
of flooding and
extremes of
weather

Academic Sector

Research Project

P1.1: Impact of 20mph Speed Limits on Health (including modelling of climatic changes)

NI Responsible Organisation

Dr Ruth Hunter, Queen's University Belfast

Collaborating Organisations

Dr Ruth Jepson (University of Edinburgh), Dr Andrew Williams (University of Exeter), Dr Andy Cope (Sustrans), Dr Charlie Foster (University of Bristol), Dr Graham Baker (University of Edinburgh), Dr James Woodcock (University of Cambridge), Dr Karen Milton (University of East Anglia), Dr Paul Kelly (University of Edinburgh), Mr Neil Craig (NHS Scotland), Professor Frank Kee (Queen's University Belfast) and Professor Michael Kelly (University of Cambridge)

The aim of the research project is to assess the impact of the 20mph speed limits on air quality in Belfast and Edinburgh city centres. The estimated change in air pollution will then be modelled to show changes in risk to health. Modelling will consider climatic changes such as increasing temperatures, changing wind patterns and blocking episodes, which could impact on air pollution levels.

Community and Voluntary Organisations

Practical Project

P1.2: Health and Wellbeing Network- Information Platform

NI Responsible Organisation

Climate NI Health and Wellbeing Network

Provide centralised platform for information and guidance on the impacts of climate change in current and future Health and Social care delivery. Encourage and support online stakeholder engagement to enable adaptation knowledge sharing and identification of climate impacts across the health and wellbeing sector.

Strategic Project

P1.3: Belfast City Airport- Safety and Emergency Planning

NI Responsible Organisation

Belfast City Airport

Continue to engage with the Belfast Resilience Group and review data from flood maps provided by the Department for Infrastructure to identify the level of flood risk. Flood maps to inform safety and emergency planning of the airport including implementation of flood protection measures.

This action also contributes to objective IF1. See page 38 for further details.

Civil Society Adapts – Adaptation Actions

Outcome Objective B1 Vision:

We have businesses
that can adapt to
impacts of climate
change and
extreme weather



Bales of Hay

Strategic Project

Strategic Business Resilience Toolkit for Dairy Farmers

NI Responsible Organisation

Lakeland Dairies NI

Collaborating Organisations

Climate NI

Developed in co-ordination with Climate NI, this toolkit is based on the UK Farm Resilience Health Check tool created by the Environment Agency. This tool will enable farmers to practically consider their risk and options on issues from flood risks and employee productivity, to reduced access to capital and disruption of supply chains. It was disseminated to Lakeland Dairies NI farmers in September 2018 and the number of farmers using the tool will be monitored for understanding of resilience planning among the 30% of dairy farms covered by Lakeland Dairies NI.



B1 Case Study

Case Study 6

Business Resilience Toolkit for Dairy Farmers

Keywords

**Farming, business resilience,
toolkit**

Photo credit: Lakeland Dairies

Location: NI

Collaborating Organisations: Climate NI

Date: 2017-2018

Project funder: Lakeland Dairies

Reported by: Dr Kieran Westley, Ulster
University

Aim: Provide guidance and support to dairy
farmers in NI to address and adapt to the
current and projected impacts of climate
change.



Introduction

Lakeland Dairies, a dairy cooperative society whose members produce approximately 30% of all Northern Irish milk, worked with Climate NI to adapt a Farm Business Resilience Toolkit produced by Environment Agency and National Farmers Union (NFU) in England, for use in NI. The adapted toolkit enables farmers to assess the risks facing the continuity of their business, including risks posed by climate change.

Key Research Findings

- Created a focused version of the English based toolkit which worked within the context of Northern Irish law and regulatory bodies. Both online and hardcopy methods were provided.

- Piloted initial version with a small number of farmers and used findings to adapt tool for a wider pilot study.
- Finalised tool for pilot study shared with Lakeland Dairies farmers across NI in September 2018.

Outcomes

Lakeland Dairies NI will monitor the number of farmers using the tool and gather information about the usability of the tool.

An action outlining next steps for use of the tool has been outlined in the 'Private Sector proposed activities' section, see page 48 for further details.

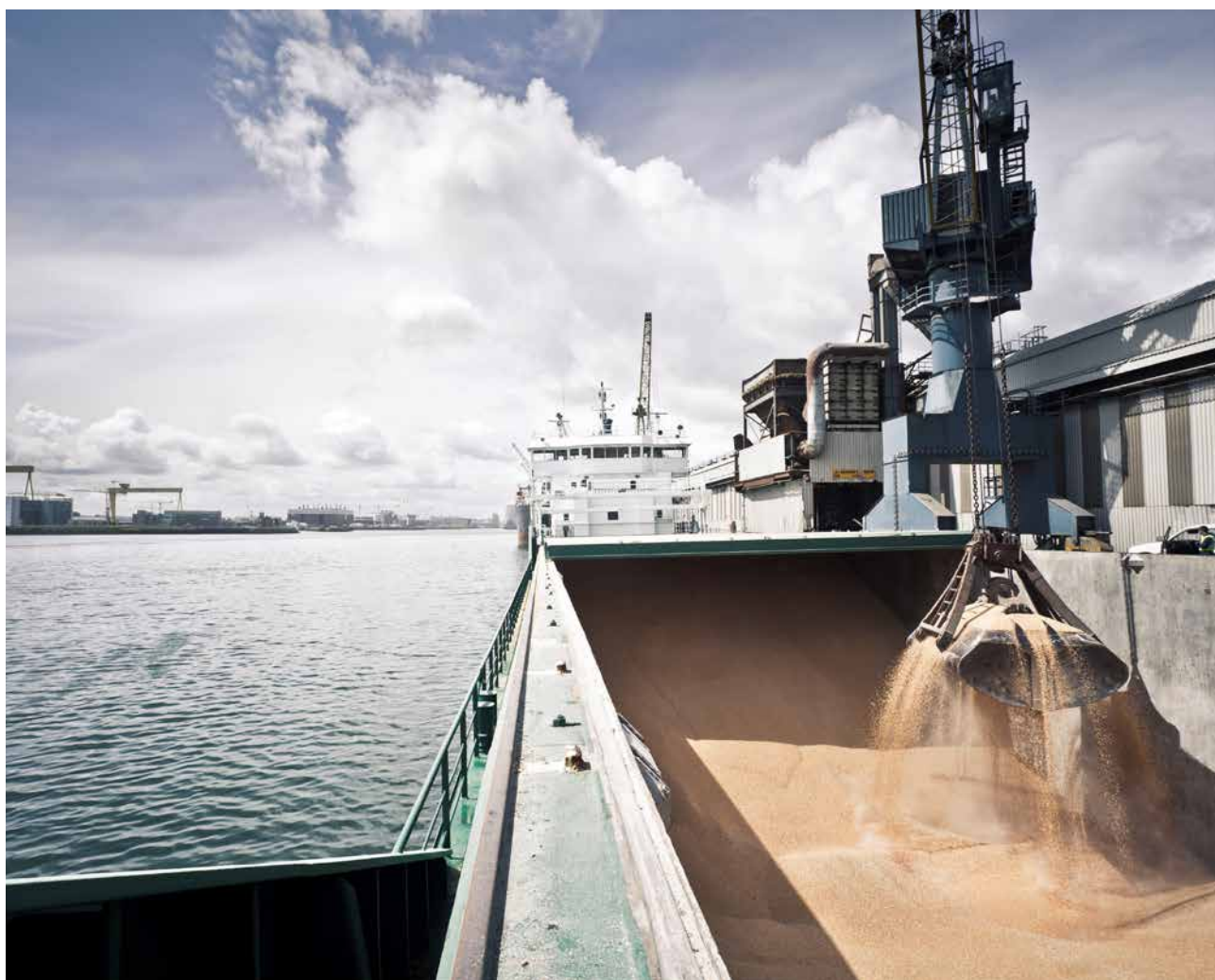
Photo credit: Lakeland Dairies

Civil Society Adapts – Adaptation Actions

Outcome Objective I1 Vision:

We have a food
system resilient to
impacts of climate
change

Private Sector Adaptation Actions



Strategic Project

Improving the Safety and Security of the Food Chain

NI Responsible Organisation

Food Fortress Ltd

Collaborating Organisations

Institute of Global Food Security (IGFS) at Queen's University Belfast and NI Grain Trade Association

Grain Discharge

Photo Credit: Robert Durston

Food Fortress²⁶ to continue strategic risk based surveillance and prediction of emerging risks in imported and home grown food materials and finished feeds- covering the major contaminants in the food chain. Annually review and update risk assessments to improve the safety and security of the food chain²⁷. Provide coordination of a rapid expert advice mechanism for members, regulators and industry partners to respond to risks.

26: The Food Fortress is a network of companies engaged in the importation of feed materials and in the manufacturing of animal feeds. It is supported by the IGFS at Queen's University Belfast

27: Risk assessments are guided and supported by IGFS



11 Case study

Case Study 7

Queen's University Belfast Nexus Project

Keywords

Farming, business resilience, toolkit

Location: NI

Collaborating Organisations: Institute for Global Food Security, Friends of the Earth NI, and Belfast Food Network

Date: 2016–2017

Project funder: 7th Economic & Social Research Council (ESRC) /Nexus Network

Reported by: Dr Wayne Foord, Queen's University

Aim: Address potential impacts of climate change and future energy availability on food security in NI.

Introduction

To explore perceptions of NI food sustainability in the context of domestic and global impacts of climate change. Interviews and scenario planning workshops were held with a wide range of key stakeholders within the food and farming sector. Key concerns expressed by participants, included:

- Risks and uncertainties associated with Brexit
- Lack of political leadership
- Increasing frequency of extreme weather events
- Rising levels of food poverty



Key Proposed Actions

- Post-Brexit farm subsidies focused on environmental protection
- A shift to non-intensive farming methods and local supply chains, in order to increase resilience to global food or energy shocks exacerbated by climate change
- Diversification of the farm sector to increase climate resilience
- Adoption of a rights-based approach to food
- An integrated, inclusive approach to food policy-making and governance
- Rights-based approach to food – enshrining right to food in legislation; guiding principle for food policy and planning.
- Independent NI Environment Agency – distinct support and enforcement roles.
- Government-led diversification of agricultural production – across sector and within farm enterprises – resilience to climate change, market volatility and economic shocks.

Proposals for strategic/collaborative initiatives included:

- Regional distributed energy supply based on larger-scale CHP plants, providing district heating, and fueled with indigenous biomass crops, agricultural and arboricultural wastes, food waste.
- Network of food hubs/community-supported agriculture (CSA) schemes around Belfast and urban centers.
- Reinvigorated, collaborative research capacity– linking research and farmer support functions of AFBI, College of Agriculture, Food and Rural Enterprise (CAFRE) and universities.
- Soil health research and advocacy network, with emphasis on biological health and carbon sequestration.

The project report and transition plan was presented at a final public conference, circulated to participants and other stakeholders, and presented to a few interested groups, including Climate NI.

Conclusions

Engagement with stakeholders indicated that, across all sectors, there is a shift in thinking towards greater strategic emphasis on quality of produce, environmental standards, resilient farming, and away from production growth and economies of scale.

Outcomes

Key proposed actions suggested for policy innovation and resilience-building initiatives, were drafted into a strategic transition plan. Proposals for policy change included:

- Integrated food system planning at regional and council levels, joining-up food policy areas: agrifood strategy and land management, climate change mitigation/adaptation, energy security, household food security, waste/resource management.

Civil Society Adapts – Adaptation Actions

Local Government Adapts:

Adaption Actions

Local Government Adapts: Adaptation Actions

Local government plays a central role in shaping local places and providing essential services. The 11 NI local councils have a range of roles and responsibilities across their geographical areas, from economic development and park management, through to emergency planning and waste services.

Under the reformed two-tier planning system, local councils are responsible for the determination of the majority of planning applications, development planning and enforcement duties. In addition, councils have responsibility for community planning in partnership with other public sector agencies. It is this connection between local and strategic governance, as well as the management of both short-term and long-term development, which makes the work of local councils vital to climate resilience.

The NI Evidence Report 2017 outlines many climate change impacts which are relevant to the responsibilities and services delivered by Local Government. For example, local councils lead local action to protect communities and businesses from risks posed by severe weather events and are responsible for protecting local areas from development which could increase vulnerability to flooding.

This 'Local Government Adapts' section is presented in the following two stages:

- Introduction to Local Council Adaptation Planning - This provides information about the process of adaptation planning, and the tools which will be available to guide councils through this process, and
- Strategic actions - Actions required to provide the context within which local government can undertake adaptation planning and activities.

Climate change adaptation work underway

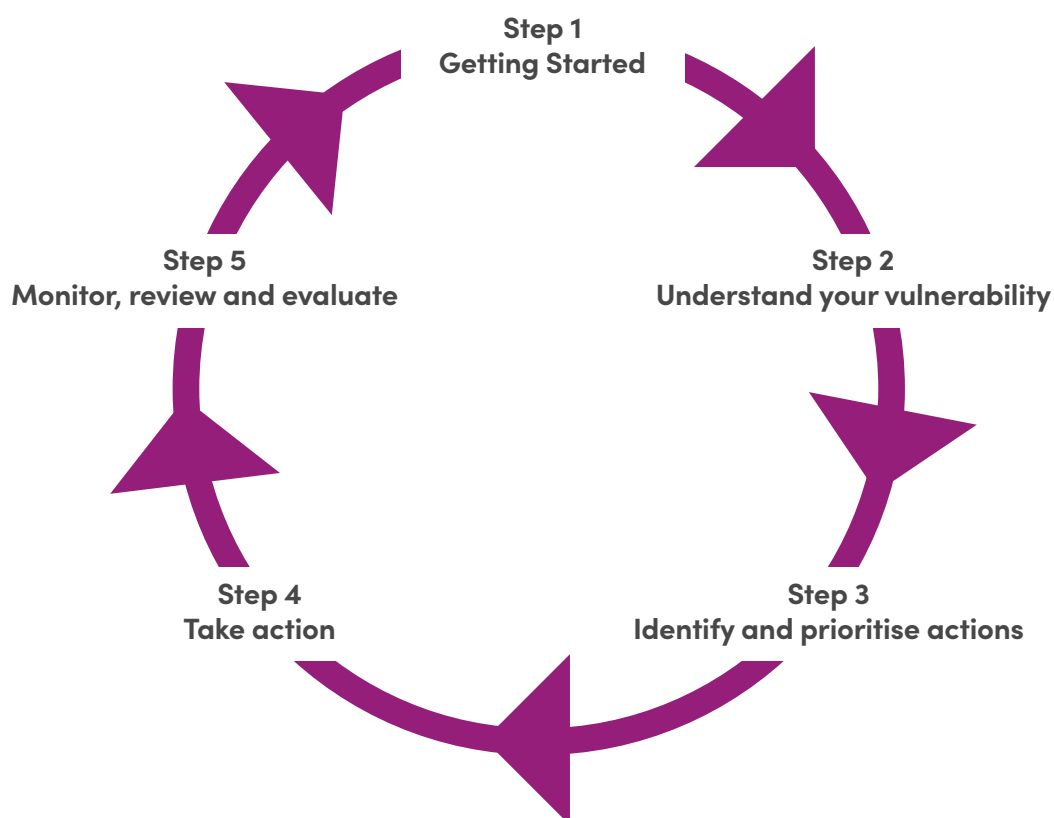
During the development of the Civil Society and Local Government Adapts chapter, an engagement and information gathering exercise was undertaken to map the adaptation activities that local government is already taking. It is clear that local councils already recognise many of the risks posed to their organisations and services, and are taking vital action. Many local council strategies and activities are increasing climate change resilience across built and natural environments, and local communities. See below for some examples of this work:

- Local councils develop Biodiversity Actions Plans under the Biodiversity Duty²⁸. These outline measures to encourage resilient species, habitats and water bodies, and
- Local councils are currently preparing their Local Development Plans (LDPs) which will help shape future development and growth as well as provide a local planning policy framework for decision-taking. In bringing forward local planning policies, councils must take account of the Strategic Planning Policy Statement (SPPS) for NI which identifies climate change considerations.

These are only a small number of examples of the many local council activities which are increasing resilience to the impacts of climate change. A key aim of this programme is to showcase this valuable work.

28 Biodiversity Duty comes under the Wildlife and Natural Environment Act (NI) 2011. For further details, please see: <http://www.legislation.gov.uk/nia/2011/15/section/1>

Local Government Adapts: Adaptation Actions



Showcasing local council climate change adaptation

The NICCAP Civil Society and Local Government online platform (detailed at the beginning of this chapter) will showcase climate change adaptation work undertaken by local councils during this programme. It will also provide an opportunity to present and share good practice and lessons learned.

Introduction to Local Council Climate Change Adaptation Planning

This programme aims to increase the profile of climate change adaptation across councils in NI, and to encourage and support each local council to develop a strategic climate change adaptation plan. Climate change adaptation is an ongoing cycle of activities and adjustments to prepare and adapt to climate risks which will work toward a resilient society in the context of a changing climate. The adaptation cycle shown in figure one illustrates a series of steps which a local council could follow to increase their resilience to the impacts of climate change.

Figure 1: Adaptation Cycle²⁹

Step 1 Getting Started

(Define objectives, assemble team and put in place any required procedures)

Step 2 Understand your vulnerability

(Consider your vulnerability to past weather event and projected climate)

Step 3 Identify and prioritise actions

Step 4 Take action

Step 5 Monitor, review and evaluate

This approach enables climate change adaptation planning and action alongside an ongoing monitoring and review process, which is necessary to respond to updates in scientific evidence.

29: As NI councils begin to follow the adaptation cycle, the steps may be adapted to suit the NI context.



Pilot project

Derry City and Strabane District Council (DCSDC) is leading the way with the development of the first local council climate change adaptation plan in NI.

This work is facilitated through the Interreg VB C.L.I.M.A.T.E. project in partnership with Northern Ireland Environment Link (NIEL), the organisation that delivers the Climate NI programme, and other EU partners. This pilot project will deliver the Derry City and Strabane District Council adaptation plan alongside an adaptation tool for local councils in the Northern Peripheries and Arctic (NPA) region. The tool will guide a step-by-step process for local councils in the NPA region to undertake adaptation planning and will help them identify the most appropriate route to adaptation planning within the contexts of regional and local policy, available resources and climate data.

This project will enable piloting of the tool in three local councils across Europe, including Derry City and Strabane District Council. The project partners will develop good practice guidance and tools for local council adaptation planning and climate adaptation communication.

Learning from this project, and links to the adaptation guidance and support tools developed for Northern Periphery and Arctic regions, will be made available on the Climate NI website and the C.L.I.M.A.T.E. project website.

Green Infrastructure and Climate Change Conference, The Guildhall, Derry (March 2019)

Photo credit: Derry City & Strabane District Council

Pilot project

Northern Ireland Adaptation Cycle Support Tool

A local council climate change adaptation guidance and support tool developed specifically for the NI context will be made available by Climate NI in 2020. This will provide step-by-step guidance to enable local councils to follow the adaptation cycle and will be tailored to the policy, scientific knowledge and resource context of NI. This tool will be based on guidance and good practice from adaptation support services in other regions and the tools and resources developed through the C.L.I.M.A.T.E. Interreg NPA project. This work will be guided and supported by the Climate NI steering group.

Strategic Actions

To encourage and support local councils to engage in strategic climate change adaptation planning, the following actions are planned.

These strategic actions aim to develop a context within which local councils are able to play a key role in raising public awareness and increasing local resilience to the impacts of climate change.

No.	Action	Reporting partners	Implementation Timeline
1	Work with local councils to embed the adaptation cycle across local council planning with the aim of encouraging councils to complete a minimum of step 1 by 2021 and step 4 by 2024	NILGA, Climate NI, Sustainable NI supported by SOLACE ³⁰	By 2024
2	Explore the capacity needs within local councils to enable delivery of Action 1 (above) and develop support mechanisms	Climate NI, Sustainable NI, NILGA	By 2024
3	Develop and pilot a 'monitoring and reporting process' which can be used by local councils to undertake Step 5 of the adaptation cycle	Climate NI, Sustainable NI	By 2021
4	Share learning from CLIMATE NPA Interreg project on adaptation cycle planning with local councils	Climate NI and DCSDC	By 2021
5	In bringing forward their LDPs, Councils will take account of climate change adaptation considerations as indicated in the Strategic Planning Policy Statement	Local councils	Ongoing

Table 2: Strategic Actions

³⁰: SOLACE is the Society of Local Authority Chief Executives

Supporting and collaborating with government

This section aims to provide an indication of the valuable skills and expertise contributed by civil society and local government to NICCAP2 actions led by government. Delivery of these actions will contribute to meeting the relevant outcome objectives of NICCAP2. The descriptions presented in the tables below are listed under the outcome objectives to which they aim to contribute.

Outcome Objective NC1 Vision:

We will have species, habitats and water bodies that are resilient to the impacts of climate change

Woodland Trust’s Contribution to the Environmental Farming Scheme

Action Ownership and Lead Organisation

DAERA

Information provided by

Woodland Trust

Other Organisations:

NI Water, Heart of the Glens Landscape Partnership Scheme (LPS) and Patrick Casement Support

Woodland Trust will aim to support DAERA’s delivery of the Environmental Farming Scheme by providing guidance and support to farmers on sustainable farming and land management practices in order to safeguard and improve ecosystem goods and services delivered by species and habitats. They will also encourage the uptake of green infrastructure elements such as hedgerow planting, pond creation, sward diversification in order to improve biodiversity and landscape resilience.

Woodland Trust’s Contribution to the Forest Expansion Scheme

Action Ownership and Lead Organisation

DAERA

Information provided by

Woodland Trust

Other Organisations

Forestry agents such as NI Farm Forestry, Scottish Woodlands and Indiwoods. Heart of the Glens LPS, Ring of Gullion LPS, Mourne Heritage Trust, and NI Water

Woodland Trust will aim to support DAERA’s delivery of the Forest Expansion Scheme by providing guidance and support to farmers on sustainable farming and land management practices in order to safeguard and improve ecosystem goods and services delivered by species and habitats. They will also encourage the uptake of green infrastructure elements such as hedgerow planting, pond creation, sward diversification in order to improve biodiversity and landscape resilience.

Outcome Objective NC2 Vision:

We have coastal communities, habitats, landforms and infrastructure that are resilient to impacts of climate change

Professor Derek Jackson, Ulster University's Contribution to Marine Protected Area Management and Monitoring (MarPAMM)

Action Ownership and Lead Organisation

Agri-Food & Biosciences Institute (AFBI)

Information provided by

Professor Derek Jackson, Ulster University

Other Organisations:

Marine Scotland Science (MSS), the Marine Institute (MI), Scottish Natural Heritage (SNH), BirdWatch Ireland (BWI), the Scottish Association for Marine Science (SAMS), and University College Cork (UCC)

Professor Derek Jackson is leading the coastal processes work package as part of a project to develop cross-border (Scotland, Ireland, and NI) capacity for the monitoring and management of marine protected areas and species, a coastal processes model will be developed for County Down and Co. Louth. These will guide the development of management plans³¹ for marine protected areas, including Sound of Barra (Co. Down) and Carlingford Lough (Co. Down). The research project will examine scenarios and modelling of future shoreline behaviour in the context of projected climate and sea level changes in NI. This work will help indicate future extents of coastal flooding and erosion potential. To examine a series of flood potential scenarios using storm (and surge) modelling of processes to elevate water levels over the current coastal hinterland. Longer-term (IPCC) predictions of sea level rise will also be modelled.

31 Management plans to be developed for: Outer Hebrides: East Mingulay SAC Flannan Isles special protection area (SPA) Inner Hebrides & the Minches SAC Loch Maddy SAC Loch Roag Lagoons SAC Mingulay & Bernary SPA Monach Isles SAC, SPA & nature conservation marine protected areas (NC MPA) Shiant Islands SPA Sound of Barra SAC Co. Down – Co. Louth: Carlingford Lough SPAs (Republic of Ireland & NI) Dundalk Bay SAC Dundalk Bay SPA

We have soils and woodland that are resilient to the impacts of climate change

Belfast Hills Partnership's Contribution to Belfast Hills Wildfires Project

Action Ownership and Lead Organisation

DAERA NIEA

Information provided by

Belfast Hills Partnership

Other Organisations:

NI Fire and Rescue Service and site managing bodies such as Belfast City Council and the National Trust Society, and Queen's University Belfast

Belfast Hills Partnership will aim to support DAERA's delivery of Belfast Hills Wildfires Project by continuing to map wildfires in the Belfast Hills to monitor the impacts and quantify/identify recovery rates wildfire events have on vegetation and other wildlife (biodiversity and ecosystem service). Identify key causative factors to recognise highly vulnerable areas and promote good management for risk reduction. The continuation of reporting on wildfire events is to also support speedy response to these incidents. Encourage partnership research to identify carbon loss/gain due to wildfires. The data gained could be shared to update accounts of the state of relevant carbon stores.

Woodland Trust's Contribution to the Forest Expansion Scheme

Action Ownership and Lead Organisation

DAERA

Information provided by

Woodland Trust

Other Organisations

Forestry agents such as NI Farm Forestry, Scottish Woodlands and Indiwoods. Heart of the Glens LPS, Ring of Gullion LPS, Mourne Heritage Trust, and NI Water

Woodland Trust will aim to support DAERA's delivery of the Forest Expansion Scheme by assessing suitability of land for potential plantation and expansion of woodlands. Based on assessment results, provide advice to landowners on good practices for plantation of new trees, improving conditions of land and soil, and implementation of sustainable management practices such as natural flood management (NFM) if needed.

Conclusion

Moneygal Bog

Photo credit: Simon Gray

Civil Society and Local Government Adapts

 **Climate**
Northern Ireland

Conclusion

This document illustrates the growing body of climate change adaptation expertise, planning and action within NI. There is still much work to be done to identify and assess future climate risks, to make necessary plans and take action. Climate NI will continue to work with civil society and local government to support the transition to a society resilient to impacts of climate change.

Acknowledgements

Climate NI thanks all organisations and individuals who participated in the development of the Civil Society and Local Government Adapts chapter and the NICCAP2 Supporting Document, and looks forward to working with them, and further contributors over the lifetime of this programme.

For further information on how to participate in this programme going forward or the next Climate Change Risk Assessment, please contact info@climatenorthernireland.org.uk.

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Annex 1:

Delivery Plans



Glider Bus, Belfast City Centre

Civil Society and Local Government Adapts

Climate
Northern Ireland



Glenariff Forest Park

Photo credit: Jane McCullough

Civil Society Outcome Objective NC1 Delivery Plan

Key Priority Area

NC – Natural Capital, including Terrestrial/Coastal/Marine/ Freshwater ecosystems, soils and biodiversity

Outcome Objective NC1 Vision

We will have species, habitats and water bodies that are resilient to the impacts of climate change

Associated NI Evidence Report Risks & Opportunities

Ne1 Risks to Species and habitats due to inability to respond to changing climatic conditions

Ne2 Opportunities from new species colonisations

Ne6 Risks to agriculture & wildlife from drought & flooding

Ne7 Risks to freshwater species from higher water temperatures

NE9 Risks to agriculture, forestry, landscapes and wildlife from pests, pathogens and invasive species

Ne11 Risks to aquifers, agriculture land & habitats from salt water intrusion

Ne13 Risks to & opportunities for marine species, fisheries & marine heritage from ocean acidification & higher water temperatures

Ne14 Risks & opportunities from changes in landscape character

Pb13 Risks to health from poor water quality

Pb14 Risk of household water supply interruptions

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action ³²	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Academic Contribution					
NC1.1	Ne13	Research Project: Maritime, Ocean Sector and Ecosystem Sustainability (MOSES) Develop a common methodology for the quantitative assessment of sectoral pressures on the marine environment and the vulnerability of marine and coastal areas.	Dr Wesley Flannery, Queen's University Belfast National University of Ireland, Northern and Western Regional Assembly, Fundacion ATZI, Institut français de recherche pour l'exploitation de la mer, FORO MARITIMO VASCO, Centro Interdisciplinar de Investigação Marinha e Ambiental, Euskal Herriko Unibertsitatea, and Universidad del País Vasco	INTERREG Atlantic Area Cooperation Programme	By end of 2021
NC1.2	Ne9	Research Project: Mitigating Animal Health Impacts of Climatic Variation Improve upon methods of forecasting parasite transmission from weather data.	Professor Eric Morgan, Queen's University Belfast Newcastle University, University of Bristol, University of Liverpool, University of Calgary (Canada), Livestock Helminth Research Alliance, Star-IDAZ International Research Consortium, Sustainable Control of Parasites in Sheep, and Control of Worms in Cows Sustainably	European Commission's 7th Framework Programme (FP7), H2020 and Biotechnology and Biological Sciences Research Council (BBSRC)	By end of 2021
NC1.3	Ne11	Research Project: SALine INtrusion in coastal Aquifers: Hydrodynamic Assessment and Prediction of Dynamic Response (SALINA) Produce an early warning mechanism to prevent salt water from contaminating coastal aquifers and provide evidence of how (and if) risks are changing.	Dr Raymond Flynn, Queen's University Belfast Imperial College London, Brunel University London and University College Dublin (UCD)	Engineering and Physical Sciences Research Council	By end of 2020
NC1.4	Ne1	Research Project: Towards Quantification of Blanket Bog Ecosystem Services to Water (QUBBES) Identify links between vegetation maps and hydrological processes to allow critical source areas ³³ in blanket bogs to be identified where restoration measures can be implemented.	Dr Raymond Flynn, Queen's University Belfast UCD, Ohio State University, National University of Ireland, Dundalk Institute of Technology	Environmental Protection Agency and Queen's University Belfast	By end of 2019

32: Adaptation actions listed are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.

33: These are areas where any damage to peatland would have a far greater impact on flow and/or water quality than elsewhere in a bog.

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Community and Voluntary Contribution					
NC1.5	Ne1 Ne2 Ne7 Ne9	Practical Project: Ancient Woodland Restoration and New Woodland Creation Create new woodlands, secure, restore and protect existing ancient woodlands.	Woodland Trust Forestry Agents, Land Owners, Royal Forestry Society and Local Councils	Heritage Lottery Fund and Corporate Sector funders	Ongoing
NC1.6	Ne1 Ne2 Ne14	Strategic Project: Co-operation Across Borders for Biodiversity (CABB) Develop and publish Conservation Action Plans for the Garron Plateau SAC, Montiagh Moss SAC in County Antrim, and the Pettigo Plateau SAC in County Fermanagh.	RSPB NI BirdWatch Ireland, RSPB Scotland, NI Water, Butterfly Conservation and Moors for the Future	European Regional Development Fund, NI Executive, Republic of Ireland government, RSPB Scotland and Mines Restoration Limited	By end of 2021
NC1.7	Ne1 Ne2	Practical Project: Collaborative Action for Natura Network (CANN) Improve the condition of peatland and wetland habitats in Special Areas of Conservation.	Ulster Wildlife reporting on behalf of Newry, Mourne and Down District Council AFBI, Armagh City, Banbridge and Craigavon Borough Council, East Border Region, Ulster University, Golden Eagle Trust, Institute of Technology Sligo, Monaghan County Council, Scottish Natural Heritage, ACT	EU INTERREG VA Programme, DAERA, Department of Housing, Planning, Community, Local Government in Ireland, and Scottish Natural Heritage Trust	By end of 2021
NC1.8	Ne1 Ne9 Ne13	Strategic Project: Living Seas Work including Sea Deep Map and monitor marine and coastal ecosystems to identify changes and potential impacts including climate change, to provide evidence for implementing conservation adaptation actions.	Ulster Wildlife SeaSearch and Queen's University Belfast	Esmee Fairbairn	Ongoing
NC1.9	Ne1 Ne9 Ne13	Strategic Project: NI Marine Task Force (NIMTF) Collate evidence and commission research for implementing conservation adaptation actions. Identify any additional or alternative actions to be taken.	Ulster Wildlife National Trust, RSPB, NIEL, Friends of the Earth, WWT, WWF, and Marine Conservation Society, Keep NI Beautiful, and Irish Whale and Dolphin Group.	Esmee Fairbairn	Ongoing
NC1.10	Ne11 Ne14	Strategic Project: Shifting Shores – Playing our Part on the Coast Promote partnership working and develop coherent strategies to deal with risks to NI's coastal aquifers, habitats and landscape character.	National Trust Coastal Local Authorities in NI, Ulster University and local community representatives	National Trust and other funders as appropriate	Ongoing



Strangford Lough

Civil Society Outcome Objective NC2 Delivery Plan

Key Priority Area

NC – Natural Capital, including Terrestrial/Coastal/Marine/Freshwater ecosystems, soils and biodiversity

Outcome Objective NC2 Vision

We have coastal communities, habitats, landforms and infrastructure that are resilient to impacts of climate change

Associated NI Evidence Report Risks & Opportunities

Ne12 Risks to habitats & heritage in the coastal zone from sea-level rise: & loss of natural flood protection

In3 Risks to infrastructure services from coastal flooding & erosion

Pb6 Risks to the viability of coastal communities from sea level rise

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action ³⁴	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Academic Contribution					
NC2.1	In3 Pb6	Research Project: UrbanARK: Assessment, Risk Management, & Knowledge for Coastal Flood Risk Management in Urban Areas Develop immersive virtual reality applications ³⁵ to enhance emergency management and preparedness of urban communities, including infrastructure assets and networks.	Dr Ulrich Offerdinger, Queen's University Belfast UCD, New York University, and US-Ireland Research & Development programme	NI Department for the Economy (for Queen's University Belfast) & Science Foundation Ireland (for UCD) & US National Science Foundation (for New York University)	By end of 2022
Community and Voluntary Contribution					
NC2.2	Ne12	Strategic Project: Living Seas Work including Sea Deep Map and monitor coastal and marine ecosystems, to identify risks, changes and potential impacts from ocean acidification, temperature shifts, invasive species, sea level rise and coastal erosion. Raise awareness among communities and promote local level action.	Ulster Wildlife SeaSearch and Queen's University Belfast	Esmee Fairbairn	Ongoing
NC2.3	Ne12 Pb6	Strategic Project: Shifting Shores – Playing our Part on the Coast Promote partnership working and develop coherent risk management strategies to deal with risks to habitats, heritage, and coastal communities.	National Trust Coastal Local Authorities in NI, Ulster University and local community representatives	National Trust and other funders as appropriate	Ongoing
Private Sector Contribution					
NC2.4	In3	Strategic Project: Business Continuity Planning Incorporate projected climate change and information from modelling into the Business Continuity Planning process, risk management strategies, warning and informing system, operational controls and new developments.	Belfast Harbour Commissioners	Belfast Harbour Commissioners	Commenced and Ongoing

³⁴ Adaptation actions listed are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.

³⁵ Immersion into virtual reality is a perception of being physically present in a non-physical world, created by surrounding the user of the VR system in images and/or other stimuli that provide an engrossing total environment. In the context of the project, these application will be aimed at providing communities in coastal urban centres with a more realistic perception of coastal flood risks.



Ballynahone Bog

Photo credit: Trish Fox

Civil Society Outcome Objective NC3 Delivery Plan

Key Priority Area

NC – Natural Capital, including Terrestrial/Coastal/Marine/Freshwater ecosystems, soils and biodiversity

Outcome Objective NC3 Vision

We have soils and woodland that are resilient to the impacts of climate change

Associated NI Evidence Report Risks & Opportunities

Ne4 Risks to soil from increased soil aridity & wetness

Ne5 Risks to natural carbon stores & carbon sequestration

Ne8 Risks of land management practices exacerbating flood risk

Ne3 Risks and opportunities from changes in agricultural and forestry productivity and land suitability

Ne10 Risks to agriculture, forestry, wildlife & heritage from change in frequency and/or magnitude of extreme weather and wildfire events

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action ³⁶	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Academic Contribution					
NC3.1	Ne3 Ne4 Ne5 Ne8	Research Project: Towards Quantification of Blanket Bog Ecosystem Services to Water (QUBBES) Identify critical source areas in blanket bogs, where land use/blanket bog restoration measures can be implemented to restore peatlands and limit losses of dissolved (and sequestered) organic carbon.	Dr Raymond Flynn, Queen's University Belfast UCD, Ohio State University, National University of Ireland and Dundalk Institute of Technology	Environmental Protection Agency and Queen's University Belfast	By end of 2019
NC3.2	Ne4 Ne5 Ne8	Research Project: Weathering Below Blanket Bogs Quantify the capacity of blanket bogs to regulate climate.	Dr Raymond Flynn, Queen's University Belfast Environmental Protection Agency	Queen's University Belfast	By end of 2020
Community and Voluntary Contribution					
NC3.3	Ne4 Ne8	Strategic project: Ancient Woodland Restoration and New Woodland Creation Provide advice to landowners on good practices for plantation of new trees, improving conditions of land and soil, and implementation of sustainable management practices.	Woodland Trust Forestry Agents, Land Owners, Royal Forestry Society and Local Councils	Heritage Lottery Fund and Corporate Sector funders	Ongoing
NC3.4	Ne5 Ne4	Practical and Strategic Project: on Co-operation Across Borders for Biodiversity (CABB) Improve the conditions and restore blanket bogs, fens and raised bogs across three sites in NI. Include restoration and protection measures in the Conservation Action Plans for the Garron Plateau SAC, Montiaghs Moss SAC in County Antrim, and the Pettigo Plateau SAC in County Fermanagh.	RSPB NI BirdWatch Ireland, RSPB Scotland, NI Water, Butterfly Conservation and Moors for the Future	European Regional Development Fund, NI Executive, Republic of Ireland government, RSPB Scotland and Mines Restoration Limited	By end of 2021
NC3.5	Ne4 Ne5	Practical Project on Collaborative Action for Natura Network (CANN) Co-ordinate and implement targeted soil conservation and peatland restoration.	Ulster Wildlife reporting on behalf of Newry, Mourne and Down District Council AFBI, Armagh City, Banbridge and Craigavon Borough Council, East Border Region, Ulster University, Golden Eagle Trust, Institute of Technology Sligo, Monaghan County Council, Scottish Natural Heritage, ACT	EU INTERREG VA Programme, DAERA, Department of Housing, Planning, Community, Local Government in Ireland, and Scottish Natural Heritage Trust	By end of 2021

³⁶ Adaptation actions listed are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.



Rathlin Harbour

Photo credit: Jane McCullough

Civil Society Outcome Objective IF1 Delivery Plan

Key Priority Area

Infrastructures Services

Outcome Objective IF1 Vision

We have transport and network services that are resilient to the impacts of flooding and extreme weather

Associated NI Evidence Report Risks & Opportunities

In1 Risks of cascading failures from interdependent infrastructure networks

In2 Risks to infrastructure services from river, surface water and groundwater flooding

In4 Risks of sewer flooding due to heavy rainfall

In6 Risks to transport networks from slope & embankment failure

In5 Risks to bridges and pipelines from high river flows & bank erosion

In11 Risks to energy, transport & digital infrastructure from high winds & lightning

In9 Risks to public water supplies from drought and low river flows

In13 Risks to transport, digital and energy infrastructure from extreme heat

In14 Potential benefits to water, transport, digital and energy infrastructure from reduced extreme cold events

In7 Risks to hydroelectric generation from low or high river flows

In8 Risks to subterranean & surface infrastructure from subsidence

In10 Risks to electricity generation from drought & low river flows

In12 Risks to offshore infrastructure from storms and high waves

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action ³⁷	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Academic Contribution					
IF1.1	In5 In6	Research project: Investigating the impact of flooding on the stability of small single and multi-span masonry arch bridges Quantify climate change impacts, including projected increases in heavier and more frequent rainfall events and bridge scour risk.	Dr Brian Solan, Ulster University Professor Robert Ettema, Colorado State University	Royal Society	Initial research completed in April 2017, with conference paper (Civil Engineering Research Association of Ireland 2018) and Journal paper published in 2018. Further research to continue (Ongoing)
Private Sector Contribution					
IF1.2	In11 In13	Strategic project: Belfast City Airport: Safety and Emergency Planning: Belfast City Airport Review, assess and amend risks assessments on a quarterly basis in compliance with the EU Aviation Safety Agency.	Belfast City Airport	None	Ongoing
IF1.3	In1	Strategic Project: Business Continuity Planning Identify, review and assess extreme weather risks to port operations as part of the interdependent infrastructure network. Information to support emergency planning and to be shared by Belfast Harbour to other relevant port stakeholders.	Belfast Harbour Commissioners	Belfast Harbour Commissioners	Commenced and Ongoing
IF1.4	In1	Strategic Project: Smart Port Initiative Modeling sedimentation risk from coastal change, hydrographic flows and sedimentation will offer accurate projections to inform operational decision-making for long-term action on port infrastructure and operations.	Belfast Harbour Commissioners Other partners as appropriate	Belfast Harbour Commissioners	By end of 2025

³⁷ Adaptation actions listed are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.



Belfast City Hall

Civil Society Outcome Objective P1 Delivery Plan

Key Priority Area

P – People and Built Environment

Outcome Objective P1 Vision

We have people, homes, buildings and communities that are resilient to the impacts of flooding and extremes of weather

Associated NI Evidence Report Risks & Opportunities

Pb4 Potential benefits to health & wellbeing from reduced cold

Pb1 Risks to health & wellbeing from high temperatures

Pb5 Risks to people, communities & buildings from flooding

Pb7 Risks to building fabric from moisture, wind & driving rain

Pb8 Risks to culturally valued structures & the wider historic environment

Pb9 Risks to health and social care delivery

Pb10 Risks to health from changes in air quality

Pb11 Risks to health from vector-borne pathogens

Pb2 Risks to passengers from high temperatures on public transport

Pb3 Opportunities for increased outdoor activities from higher temperatures

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action ³⁸	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Academic Contribution					
P1.1	Pb10	Research Project: Impact of 20mph Speed Limits on health (including modelling of climatic changes) Assess the impact of the 20mph speed limits in Belfast (within the context of changing wind patterns and blocking episodes) on air quality and associated risks to health.	Dr Ruth Hunter, Queen's University Belfast Dr Ruth Jepson (University of Edinburgh), Dr Andrew Williams (University of Exeter), Dr Andy Cope (Sustrans), Dr Charlie Foster (University of Bristol), Dr Graham Baker (University of Edinburgh), Dr James Woodcock (University of Cambridge), Dr Karen Milton (University of East Anglia), Dr Paul Kelly (University of Edinburgh), Mr Neil Craig (NHS Scotland), Professor Frank Kee (Queen's University Belfast), Professor Michael Kelly (University of Cambridge)	National Institute for Health Research	By the end of 2020/2021
Community and Voluntary Contribution					
P1.2	Pb9	Practical Project: Health and Wellbeing Network-Information Platform Provide online platform for the provision of information and guidance on the impacts of climate change in current and future Health and Social care delivery.	Climate NI Health and Wellbeing Network	Other funders as appropriate	By end of 2019
Private Sector Contribution					
P1.3	Pb5	Strategic Project: Belfast City Airport: Safety and Emergency Planning: Belfast City Airport Review data from flood maps to inform safety and emergency planning of the airport. Implementation of flood protection measures.	Belfast City Airport	None	Ongoing

³⁸: Adaptation actions listed are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.



Civil Society Outcome Objective B1 Delivery Plan

Key Priority Area

B – Disruption to Businesses and Supply Chains

Outcome Objective B1 Vision

We have businesses that can adapt to impacts of climate change and extreme weather

Associated NI Evidence Report Risks & Opportunities

Bu1 Risks to business sites from flooding

Bu2 Risks to business from loss of coastal locations & infrastructure

Bu5 Risks to business from reduced employee productivity, due to infrastructure disruption & higher temperatures in working environments

Bu3 Risks to business operations from water scarcity

Bu6 Risks to business from disruption to supply chains & distribution networks

Bu4 Risks to business from reduced access to capital

Bu7 Risks & opportunities for business from changes in demand for goods & services

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action ³⁹	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Private Sector Contribution					
B1.1	Bu1 Bu3 Bu4 Bu5 Bu6 Bu7	Strategic Project on Business Resilience Toolkit for Dairy Framers Monitor the number of farmers using the Business Resilience toolkit to provide understanding of resilience planning among the 30% of dairy farmers covered by Lakeland Dairies in NI.	Lakeland Dairies NI Climate NI	Lakeland Dairies NI	Ongoing

³⁹: Adaptation actions listed are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.



Civil Society Outcome Objective I1 Delivery Plan

Key Priority Area

I1- Food Security/Global Food Production

Outcome Objective IF1 Vision

We have a food system resilient to impacts of climate change

Associated NI Evidence Report Risks & Opportunities

It1 Risks from weather related shocks to international food production & trade


It2 Imported food safety risks

It3 Risks & opportunities from long-term climate-related changes in global food production

Pb12 Risk of food borne disease cases / outbreaks

No.	NI Evidence Report Risks and Opportunities to be addressed	Adaptation Action ⁴⁰	NI Responsible Organisation (in bold) and Collaborating Organisations	Funder	Implementation Timeline
Private Sector Contribution					
I1.1	It2	Strategic Project: Improving the Safety and Security of the Food Chain Annually review and update risk assessments to improve the safety and security of the food chain. Provide coordination of a rapid expert advice mechanism for members, regulators and industry partners to respond to risks.	Food Fortress Ltd. Institute of Global Food Security (IGFS) at Queens University Belfast and NI Grain Trade Association.	Self-sustaining and funded via membership	Ongoing

⁴⁰: Adaptation actions listed are excerpts from the text submitted by contributors. Please see the relevant project description outlined in this Supporting Document for the full details of each action.



Lurgan Park

Local Government Delivery Plan

Civil Society and Local Government Adapts

 **Climate**
Northern Ireland

Local Government Delivery Plan

No.	Adaptation Action	NI Responsible Organisations	Implementation Timeline
1	Work with local councils to embed the adaptation cycle across local council planning with the aim of encouraging councils to complete a minimum of step 1 by 2021 and step 4 by 2024	NILGA, Climate NI, Sustainable NI supported by SOLACE	By 2024
2	Explore the capacity needs within local councils to enable delivery of Action 1 (above) and develop support mechanisms	Climate NI, Sustainable NI, NILGA	By 2024
3	Develop and pilot a 'monitoring and reporting process' which can be used by local councils to undertake Step 5 of the adaptation cycle	Climate NI, Sustainable NI	By 2021
4	Share learning from C.L.I.M.A.T.E. NPA Interreg project on adaptation cycle planning with local councils	Climate NI & DCSDC	By 2021
5	In bringing forward their LDPs, Councils will take account of climate change adaptation considerations as indicated in the Strategic Planning Policy Statement	Local councils	Ongoing

