

Climate Change Research Programme (CCRP) 2007-2013 Report Series No. 28



Coastal Climate Adaptation in Ireland: Assessing current conditions and enhancing the capacity for climate resilience in local coastal management

Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Community and Local Government.

OUR RESPONSIBILITIES

LICENSING

We license the following to ensure that their emissions do not endanger human health or harm the environment:

- waste facilities (e.g., landfills, incinerators, waste transfer stations);
- large scale industrial activities (e.g., pharmaceutical manufacturing, cement manufacturing, power plants);
- intensive agriculture;
- the contained use and controlled release of Genetically Modified Organisms (GMOs);
- large petrol storage facilities;
- waste water discharges;
- dumping at sea.

NATIONAL ENVIRONMENTAL ENFORCEMENT

- Conducting over 1200 audits and inspections of EPA licensed facilities every year.
- Overseeing local authorities' environmental protection responsibilities in the areas of - air, noise, waste, waste-water and water quality.
- Working with local authorities and the Gardaí to stamp out illegal waste activity by co-ordinating a national enforcement network, targeting offenders, conducting investigations and overseeing remediation.
- Prosecuting those who flout environmental law and damage the environment as a result of their actions.

MONITORING, ANALYSING AND REPORTING ON THE ENVIRONMENT

- Monitoring air quality and the quality of rivers, lakes, tidal waters and ground waters; measuring water levels and river flows.
- Independent reporting to inform decision making by national and local government.

REGULATING IRELAND'S GREENHOUSE GAS EMISSIONS

- Quantifying Ireland's emissions of greenhouse gases in the context of our Kyoto commitments
- Implementing the Emissions Trading Directive, involving over 100 companies who are major generators of carbon dioxide in Ireland.

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

- Co-ordinating research on environmental issues (including air and water quality, climate change, biodiversity, environmental technologies).

STRATEGIC ENVIRONMENTAL ASSESSMENT

- Assessing the impact of plans and programmes on the Irish environment (such as waste management and development plans).

ENVIRONMENTAL PLANNING, EDUCATION AND GUIDANCE

- Providing guidance to the public and to industry on various environmental topics (including licence applications, waste prevention and environmental regulations).
- Generating greater environmental awareness (through environmental television programmes and primary and secondary schools' resource packs).

PROACTIVE WASTE MANAGEMENT

- Promoting waste prevention and minimisation projects through the co-ordination of the National Waste Prevention Programme, including input into the implementation of Producer Responsibility Initiatives.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

MANAGEMENT AND STRUCTURE OF THE EPA

The organisation is managed by a full time Board, consisting of a Director General and four Directors.

The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

EPA Climate Change Research Programme 2007–2013

**Coastal Climate Adaptation in Ireland:
Assessing current conditions and enhancing
the capacity for climate resilience in local
coastal management
(2008-CCRP 3.6)**

CCRP Report

Prepared for the Environmental Protection Agency
by
Coastal and Marine Research Centre (CMRC)
Environmental Research Institute (ERI)
University College Cork (UCC)

Authors:

Maria Falaleeva, Stefan Gray, Cathal O'Mahony and Jeremy Gault

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle, Co. Wexford, Ireland

Telephone: +353 53 9160600 Fax: +353 53 9160699
Email: info@epa.ie Website: www.epa.ie

Disclaimer

Although every effort has been made to ensure the accuracy of the material contained in this publication, complete accuracy cannot be guaranteed. Neither the Environmental Protection Agency nor the authors accept any responsibility whatsoever for loss or damage occasioned or claimed to have been occasioned, in part or in full, as a consequence of any person acting or refraining from acting, as a result of a matter contained in this publication. All or part of this publication may be reproduced without further permission, provided the source is acknowledged.

The EPA CCRP Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

EPA Climate Change Research Programme 2007 – 2013

Published by the Environmental Protection Agency, Ireland

PRINTED ON RECYCLED PAPER

ISBN: 978-1-84095-512-5

Price: Free

09/13/50

Acknowledgements

This report is published as part of the Climate Change Research Programme, 2007 – 2013. The programme is financed by the Interdepartmental Committee for Strategy, Science, Technology and Innovation and the Department of Environment, Community and Local Government. It is administered on behalf of the Department of Environment, Community and Local Government by the Environmental Protection Agency which has the statutory function of co-ordinating and promoting environmental research.

The authors would like to gratefully acknowledge the efforts of all contributors who provided information and participated in the conduct of the research described here. We would like to thank the 35 interviewees from Irish coastal communities and national agencies and, in particular, to the local groups in Bantry Bay and Tralee Bay for their kind and energetic support and enthusiastic involvement. Sincere thanks to the members of the CLAD Steering Committee – Margaret Desmond (EPA) and Susanne Moser (Susanne Moser Research and Consultancy) whose professional and personal attitudes and inputs throughout the research helped to maintain an appropriate balance between the project's practical relevance and academic standards.

We gratefully acknowledge the vital funding provided by the Irish Environmental Protection Agency and its Climate Change Research Programme (2007–2013), and the guidance and support of colleagues from research groups in Ireland and internationally: Robert Devoy (UCC), Valerie Cummins (IMERC), participants of the EU IMCORE and CoastAdapt projects, ICARUS at NUI Maynooth and many others for fruitful discussions, support and feedback.

Finally, we would like to thank our colleagues in the Coastal and Marine Research Centre at University College Cork for useful feedback, technical assistance, and supportive cooperation throughout the project.

Details of Project Partners

Maria Falaleeva

Coastal and Marine Research Centre
Environmental Research Institute
University College Cork
Naval Base
Haulbowline
Cobh
Co. Cork
Ireland
Email: m.falaleeva@ucc.ie

Stefan Gray

Coastal and Marine Research Centre
Environmental Research Institute
University College Cork
Naval Base
Haulbowline
Cobh
Co. Cork
Ireland
Email: s.gray@ucc.ie

Cathal O'Mahony

Coastal and Marine Research Centre
Environmental Research Institute
University College Cork
Naval Base
Haulbowline
Cobh
Co. Cork
Ireland
Email: c.omahony@ucc.ie

Jeremy Gault

Coastal and Marine Research Centre
Environmental Research Institute
University College Cork
Naval Base
Haulbowline
Cobh
Co. Cork
Ireland
Email: j.gault@ucc.ie

Table of Contents

Disclaimer	ii
Executive summary.....	vii
1. Introduction.....	1
1.1. Climate change impacts on Ireland’s coastal systems: The need for an effective management approach.....	1
1.2. Enhancing capacities for coastal climate adaptation in Ireland	4
2. Climate adaptation in Irish coastal zones.....	7
2.1. Climate change adaptation	7
2.2. Multi-level governance of climate adaptation in Irish coastal zones	9
2.3. Barriers and opportunities for an integrated system of climate adaptation and coastal management in Ireland	18
2.4. Key findings: requirement for capacity building	20
3. Adaptive co-management – potential applications for coastal climate adaptation .	22
3.1. Adaptive co-management: the theory and application of the concept	22
3.2. Practical implementation of ACM	27
3.3. Experience of ACM application in other countries.....	29
3.4. Existing conditions for ACM implementation: ACM monitoring and evaluation....	31
3.5. Key findings: ACM-based criteria for coastal adaptation governance in Ireland and CLAD local adaptation process.....	31
4. CLAD case studies	36
4.1. Case selection and stakeholders	36
4.2. Methodology of the case-study research.....	38
4.3. Description of the case-study sites	40
5. Existing conditions pertaining to ACM implementation in Irish coastal climate adaptation	46
5.1. Problem framing (shared, reflective, area-based)	46
5.2 Decision-making (collaborative, field testing of decisions, social learning)	49

5.3. Policies and plans (cyclic processes, integration of interests, issues, sectors, levels and time scales)	51
5.4. Institutions (participatory, flexible, legitimate).....	53
5.5. Scientific support (contextual, complex, comprehensive)	56
5.6. Communication (vertical and horizontal flows, social networks, transparency)	60
5.7. Key findings: enabling an ACM approach for local climate adaptation in Ireland ..	63
6. CLAD Tool Kit – capacity building for effective climate adaptation in Irish coastal zones	65
6.1. CLAD Tool Kit: background, structure, design and evaluation	65
6.2. CLAD guidelines for local-scale coastal climate adaptation	67
6.3. iassess:coast software for participatory vulnerability assessment and scenario development	70
7. Conclusions and recommendations	74
Annex 1. Present status and needs for capacity building in coastal climate adaptation: CLAD Project recommendations	89
.....	89
Annex 2. Stakeholders’ shared models of the coastal social-ecological systems of Bantry Bay and Tralee Bay	92
Annex 3. Questions in stakeholder interviews	94
Annex 4. Evaluation of the stakeholder workshops.....	96

Executive summary

The National Climate Change Adaptation Framework (NCCAF) provides a clear mandate for authorities to address climate change adaptation in their planning activities. Coherently integrating coastal climate adaptation into existing and future planning will require substantial capacity-building at the local level. Given that the distribution of impacts and the resources are markedly different across coastal locations around Ireland, a centralised 'one-size-fits-all' management plan is unlikely to achieve optimum results. Equipping actors at local authority level to undertake adaptation in a manner responsive to local issues and sympathetic to local resources and abilities is therefore paramount.

The aims of the Coastal Climate Adaptation and Development (CLAD) Project were to assess the contextually specific demands of coastal adaptation in Ireland and provide the tools and resources that local authorities and coastal communities might use when initiating coastal adaptation at the local scale. The circumstances under which coastal climate adaptation in Ireland should proceed were explored and the potential for enhancing the capacity of coastal communities to develop resilient responses to changing climatic conditions was examined. The potential of new and emerging natural resource management approaches to support climate adaptation decision-making in particular, Adaptive Co-Management (ACM) was also considered. The project's main outputs include:

1. Assessment of coastal climate governance in Ireland;

The Key barriers to effective coastal climate adaptation in Ireland are:

- the fragmentation of institutions and administrative functions with respect to coastal governance
- ill-defined responsibilities among the actors and institutions involved in climate adaptation
- short-term planning horizons and linear, top-down management
- a lack of experience of cross-sectoral cooperation and stakeholder involvement.

Opportunities to progress adaptation successfully are also evident:

- emerging national and EU policies supporting more integrated approaches to coastal management and climate adaptation
- a relatively high level of trust in official governance structures, enabling coordination and support for decisions taken at the local level
- existing capacity to cope under adversity and adjust to changing circumstances
- a growing body of scientific information to support adaptation planning.

2. Assessment of the conditions for practical application of ACM for local adaptation planning;

The ineffectiveness of existing management structures for addressing the challenges of integrated coastal adaptation governance is recognised by practitioners. New approaches are now needed to deliver successful adaptation and build resilience of coastal communities under conditions of uncertainty and complexity. The application of an ACM approach may bring significant benefits for coastal climate adaptation in both the short and long terms. However, capacities must be built to introduce elements of the new approach into existing decision-making practices.

3. CLAD Tool Kit to support local adaptation planning

In response to the need for practical capacity building at the local level, the CLAD Tool Kit was developed and piloted in several coastal case study locations. The Tool Kit consists of three pillars:

- Practitioner Guideline document and accompanying software “Ireland’s Adaptive Social Ecological System Simulator” (IASSESS) for local scale coastal climate adaptation;
- Website, CoastalResilience.ie, with supporting information adapted for non-specialist audiences;
- Irish Coastal Resilience Network, a pilot initiative combining stakeholders and practitioners at different levels involved in adaptation planning and management.

The Tool Kit may support local authorities in meeting their obligations under the NCCAF. However, it should be considered a pilot and further evolution of its contents and approach will be required to fully overcome the barriers and exploit the opportunities to advance adaptation that the project has identified.

Recommendations

The key recommendations of this study focus on the necessity for capacity-building initiatives using ACM to enable local level climate adaptation:

- Problem framing-Adaptation should be framed as a local issue and a strategic factor for community development, it should also form an integral part of effective coastal management;
- Decision making should be responsive to uncertainty by incorporating the means to

alter the adaptation course as scientific understanding of climate change impacts matures;

- Policies and plans in response to climate change must be led at a national level, providing a clear mandate on the part of those acting to implement climate policy at the local scale. Coordinating institutions and networks which serve to support policy/plan implementation locally should be organised and where necessary funded nationally;
- Institutions must be functionally integrated across all scales of governance, with those in positions of authority at the national scale cognisant of the challenges and barriers faced locally, and vice versa. Strong formal and informal linkages among actors involved in climate policy formulation and implementation are essential to effective adaptation;
- Scientific support must be rigorous yet tailored to end-user needs with respect to the language employed, formatting and level of complexity entered into. The utilisation of communication techniques and media appropriate to the decision context in question is critical;
- Communication regarding climate impacts and adaptation should employ existing social, occupational and expert networks wherever possible, harnessing levels of trust and social capital established over the long term.

Conclusions

Given the relatively early stage at which the theory and practice of adaptation to climate change currently stand, the project’s tools and findings provide a vital contribution to local level coastal adaptation in Ireland. By employing the CLAD Tool Kit and adopting the project’s experimental approach, local authorities and the

communities they serve may be equipped to take the difficult first steps in overcoming uncertainty to enhance the future climate resilience of coastal management practice.

1. Introduction

This report summarises the findings of the Coastal Climate Adaptation and Development (CLAD) project conducted under the EPA Climate Change Research Programme 2007–2013. The project was undertaken by the Coastal and Marine Research Centre, University College Cork (CMRC UCC). The aims were to enhance capacity for coastal climate adaptation in Ireland by exploring the possibility for new management methods for effective adaptation. Reflecting the complexity of the issue, the project was wide-ranging, spanning the analysis of coastal and climate governance in Ireland, assessment of the theoretical grounds for employing new management methods, analysis of capacity-building requirements across governance levels and the formulation of recommendations as to how these could be met, and the design and testing of a set of practical tools and guidelines for local adaptation.

The report is, therefore, aimed at a broad audience of practitioners: national agencies, local authorities, coastal resource managers and planners; as well as the research community, and others interested in understanding the barriers and opportunities involved in enhancing the resilience of Irish coastal areas in the face of environmental stressors, in particular climate change. It provides a comprehensive picture of the present state and challenges facing actors and organisations engaged in the governance of coastal climate adaptation in Ireland. Each section addresses a specific aspect of the adaptation issue and can be used as a standalone resource offering relevant insights and findings. The objectives of the project, structure of the report and contents of each chapter are described at the conclusion of this introductory chapter.

1.1. Climate change impacts on Ireland's coastal systems: The need for an effective management approach

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) indicated that human activities (particularly associated with greenhouse gas emissions) combined with natural climate fluctuations are triggering global climate change (IPCC 2007). Average global surface temperature has increased by 0.74°C in the period 1906–2005, and, in the northern hemisphere, the 1990s were the hottest decade of what had been the hottest century for a millennium (IPCC 2007). In Europe, warming has exceeded the global average. The average temperature over continental Europe has increased by 1.2°C, and a 1°C rise has been registered for the whole region, including the ocean (Jol et al. 2009). The surface of the ocean has also warmed significantly, with a global average 0.10°C rise recorded, to a depth of 700 m, during the latter half of the 20th century (Bindoff et al. 2007).

The evidence of climate change continues to mount, and due to the latency of natural systems its impacts will be 'locked in' for some decades to come, even if contemporary actions taken to mitigate anthropogenic emissions of greenhouse gases are successful in minimising human impacts on the global climate system. Accordingly, the issue of adaptation to climate change has risen on both the scientific and public policy agendas. With respect to policy and management responses, efforts are beginning to be made to prepare economies and societies for what are increasingly rapidly changing environmental conditions (IPCC 2007; Swart et al. 2009).

Conflict, complexity and uncertainty are ever-present factors in deliberations on climate-related issues (Moser and Dilling 2007), yet the urgency of these issues requires immediate action to be taken. Traditional management approaches to the framing of social and ecological dilemmas are increasingly seen as inadequate given the complexity and scope of the sustainability challenges currently faced (Folke 2006; Biermann 2007; Moser 2008; Biermann et al. 2009). Thus innovative approaches are required to complement traditional instruments and to reinforce implementation of existing and new regulations if scientists and public policy practitioners are to optimise the efficacy of climate adaptation measures (Tompkins and Adger 2004; Olsson et al. 2006; Armitage et al. 2009).

The CLAD project undertook the development of capacity-building tools and governance recommendations for innovative approaches to climate change adaptation in Irish coastal zones. A natural resource management approach known as adaptive co-management (ACM), involving the combination of experimentation in environmental management with the extension of participatory decision-making, formed a key building block of this innovative approach. ACM provided a conceptual framework for the analysis of coastal management issues under conditions of complexity and uncertainty, allowing coastal management practitioners to harness knowledge and resources at a scale appropriate to their adaptation needs in responding to the challenges of long-term sustainability posed by climate change uncertainty. A number of recommendations have been developed for coastal climate adaptation and capacity building in Ireland. These were based on an analysis of coastal and climate governance in Ireland, an extensive series of stakeholder interviews, close cooperation with authorities and stakeholders at

multiple levels, and the development and evaluation of key elements of an ACM-based climate adaptation tool kit in three coastal case study locations. The outcomes can be extrapolated beyond the coastal context, enabling local authority managers and civil society stakeholders to develop their adaptive capacities, increase the resilience of their social-ecological systems in the face of a changing climate, and meet the requirements of European and national climate adaptation policy.

Climate impacts on the Irish coast

Due to its location at the western edge of continental Europe, the climate of Ireland is influenced by the migratory path of Atlantic cyclones which bring intense precipitation, high wave energy and frequent severe storms, particularly to Ireland's western and northern coasts (Fealy 2003; Füssel 2007; Devoy 2008; Sweeney and Fealy 2008; Desmond et al. 2009). The prevalence of these climatic conditions, combined with an increase in land and sea temperatures, confirms the central role climate change will play in the geophysical evolution of the coastal systems of Ireland, and in the magnitude and severity of associated risks faced by coastal communities.

In line with global trends (Seneviratne et al. 2012), the Irish climate will warm significantly in the coming decades (McGrath et al. 2009). During the past 110 years, the mean air temperature increased by approximately 0.8°C (Dwyer 2012). A temperature increase of 3°C to 4°C is expected by the end of the century (McGrath et al. 2009), while the current trends (0.76°C increase in 1997–2007) suggest the possibility of an even greater rate of warming (Sweeney and Fealy 2008). Autumn and winter are projected to become wetter, with an 11–17% average increase in precipitation by 2080, while

summers will be drier, with a 14–25% average decrease predicted by 2080 and a maximum rate of up to 30–40% precipitation decrease along the southern and eastern coasts. Mean wind speed is unlikely to change (McGrath et al. 2009), while the frequency and patterns of extreme events may alter at the global scale (Seneviratne et al. 2012), including the potential for increasing intensity of storms and floods in Ireland (Füssel 2007; McGrath et al. 2009). Projected sea surface temperature and sea level rise mirror global trends. Since the 1980s, observations show an increase in sea surface temperature of about 0.3–0.4°C per decade at the Atlantic edge and an even more rapid warming rate of 0.6–0.7°C per decade for the Irish Sea (McGrath et al. 2009). Sea level rise in the marine territories surrounding Ireland was observed at approximately 1.7 cm per decade in the period from 1916 to the present (Dwyer 2012); however, this rate is accelerating and is likely to increase substantially, which is projected to rise to 60 cm to 2100 (Desmond et al. 2009).

Coastal areas are complex social-ecological systems susceptible to a range of impacts arising from climate change on land and at sea, affecting the day-to-day life and economic sustainability of coastal communities (fishing, transport, agriculture, tourism, etc.). Coastal land use and development depends on not only the availability of land for human activity, but also the ecosystem services provided by natural habitats and ecological communities which can be impacted by sea level rise, erosion and flooding (Doody 2004; Fletcher and Pike 2007; IPCC 2007; Gibbs 2009). The major areas of concern for Irish coastal communities include effects of climate change on:

- sea level
- sea surface temperature
- salinity and acidification

- storminess and wave height
- weather conditions (air temperature and precipitation regime)

and associated impacts of these changes on:

- society (frequency of floods and extreme events, extent and severity of coastal erosion)
- environment (loss of sensitive habitats due to changing weather conditions and coastal squeeze, decreasing water quality due to salinisation and eutrophication in warmer climate)
- Economic activities (conditions for fishing and aquaculture, tourism, agriculture).

The impacts of climate change will vary in magnitude for different locations and for different sectors of the coastal economy. The increased risk of damage to housing and infrastructure, potential losses of land for human activity and natural habitats, increased risk of flooding and other disastrous events, and increased risk of water pollution and loss of biodiversity (including traditionally exploited commercial fish species) are among the potential consequences of climate change for coastal areas. However, the impacts of climate change should not only be considered as threats, but rather as dynamic changes in the environment that may also provide opportunities for coastal economies. Among the possible opportunities for Irish coastal communities are improved potential for renewable energy (wind and wave), better conditions for tourism, higher productivity of ecosystems, new species available for commercial fishing and aquaculture, and better conditions for navigation in some ports. As a result, resilience to climate change may provide significant economic advantages, while vulnerability to climate change is increasingly considered a function of the preparedness of

society to adapt, rather than simply the outcome of exposure to climate hazards (Green and McFadden 2007; Moser 2008; IPCC 2012).

Coastal climate adaptation in Ireland

Recent academic studies and policy documents present climate change adaptation as a complex social process aimed at enhancing the resilience of social-ecological systems, reducing risks and harnessing opportunities by means of technology, strategic planning, policy and behavioural change (Adger et al. 2005b; Füssel 2007; Kireyeu and Shkaruba 2009; Desmond and Shine 2011; Gupta et al. 2010; Moser 2010; Moser and Ekstrom 2010; Carter and Sherriff 2011; Biesbroek et al. 2013). Fortunately, those seeking to formulate climate adaptation responses do not face the challenge in isolation. Increasingly, research and practice demonstrate the necessity of policy integration to stimulate synergetic effects between climate policies, sectoral economic strategies and spatial planning (Adger et al. 2005b; Janssen and Ostrom 2006; Vogel et al. 2007; Moser 2008).

Management of coastal resources in Ireland is delineated by a range of policy and planning instruments, including local development plans, sectoral regulations (e.g. infrastructure, energy, fisheries, agriculture) and national and international development and environmental policies. As is the case in many coastal contexts, the fragmentation of governance structures, ambiguous distribution of responsibilities of key stakeholders at land and sea, and the mismatch between short-term objectives and the necessity for longer-term strategic vision are barriers to the achievement of more sustainable modes of coastal governance (Cummins et al. 2004; Falaleeva et al. 2011). Climate change adds considerable complexity, and in many respects urgency, to the search for an effective resolution

of coastal management issues. No clear and coherent policy suite or framework of governance has yet emerged under which coastal climate adaptation can be fostered in a timely and effective manner.

The recently published National Climate Change Adaptation Framework (NCCAF) (DECLG 2012) provides high-level direction and mandates local and sectoral administrations to develop climate adaptation responses.¹ However, the efficacy of these adaptive actions will be largely dependent upon the ability of local authorities to integrate climate adaptation considerations into economic and development planning, addressing uncertainty and maintaining coherence between local, regional and national planning, and in some cases meeting international obligations. Although the NCCAF provides a framework for local and sectoral adaptation strategies to be undertaken under, it is not intended to provide guidance on how to negotiate the complexities and inherent uncertainties of climate adaptation.

1.2. Enhancing capacities for coastal climate adaptation in Ireland

CLAD project – a detailed overview

The project explored the potential of adaptive co-management to support climate adaptation decision-making, and the integration of innovative, strategic thinking into the existing institutions and policy practices of coastal management. The project aimed to enhance the integration of climate governance across scales and levels of governance in order to link local efforts on climate adaptation to national climate policy by drawing on the strengths of political and scientific trends at the EU and international levels.

¹ The NCCAF was published in December 2012, with the Climate Bill likely to follow late in 2013.

The project's methods of research and capacity building involved:

- literature and documentary study
- extensive semi-structured interviews with stakeholders at various management levels – local, regional (county), national (37 interviews in 2010–2011)
- the development and testing of participatory vulnerability assessment and scenario analysis methodologies, conducted in either one-to-one sessions or group workshop settings
- policy analysis resulting in policy and management recommendations.

The research focused on three primary case study sites – Tralee Bay (Co. Kerry), Bantry Bay (Co. Cork) and Portrane (Co. Dublin) – which were selected as representative of the variety of geographical and socioeconomic conditions to be found on Ireland's coast. Additional information was obtained from secondary sites including Cork Harbour (Co. Cork) and Lough Swilly (Co. Donegal), in cooperation with the IMCORE project. The project's participatory vulnerability assessment and scenario development methodology was also tested in the Western Isles of Scotland, in cooperation with the CoastAdapt project.

The project's broad objectives were to:

- i. analyse the existing system of decision-making on climate adaptation in Irish coastal zones by:
 - a. Identifying barriers and opportunities for the integration of coastal and climate governance
 - b. exploring possible synergies between existing policies and management strategies (including integrated coastal

zone management (ICZM)) and national climate governance

- ii. analyse the potential of ACM as a model for multi-level governance and capacity building for climate adaptation in Irish coastal zones and suggest management strategies and guidelines for practical ACM implementation
- iii. design a decision-support resource for effective coastal climate adaptation utilising the insights and governance structures of ACM to:
 - a. provide mechanisms for effective stakeholder participation in coastal management and climate adaptation
 - b. provide tools and methodologies that build capacity at the local level to plan for and adapt to coastal climate change
 - c. facilitate experimentation in the design and implementation of coastal climate adaptation measures
 - d. link coastal and climate governance across scales through social networks.

This report introduces and summarises the findings and outputs of the CLAD Project.

Chapter 2 focuses on the requirements and conditions for coastal climate adaptation in Ireland by identifying policies in support of, and management barriers to, effective adaptation. The key findings and recommendations, addressing national and international policies, cross-level and cross-sectoral integration, will be of interest to agencies and managers at the national level.

Chapter 3 reflects on ACM, its origin, applicability and requirements, and presents the potential benefits and limitations of the ACM approach for climate adaptation, referring to international examples of ACM application under similar contexts. Criteria and qualitative indicators have been developed to serve as

ACM benchmarks – describing the governance requirements necessary for successful ACM application in Irish coastal climate adaptation. The developed set of ACM criteria can also be applied in other geographical or problem areas by managers and researchers who wish to harness the benefits of adaptive and collaborative management methods.

Case study research is described in **Chapter 4**, including a description of the process of site selection, the identification of key stakeholder groups and an outline of the research methodology (which can be replicated by other academic and management projects). Additional materials, including interview guidelines, are provided in the annexes.

The theoretical framework described in Chapter 3 underpinned the analysis of the existing formal and informal institutions and management structures of coastal management in Ireland. The results of interview analysis, described in **Chapter 5**, reflect problems faced in many coastal locations in Ireland, and can therefore be utilised by all those attempting to gain insight into the formal and informal processes of multi-level decision-making in Irish coastal communities. (Also see summary in Annex 1.)

Chapter 6 presents the CLAD Tool Kit, including the ACM-based guidelines and software for local climate adaptation, the website Coastalresilience.ie and the Irish Coastal Resilience Network (ICRN). The CLAD Tool Kit is primarily aimed at local coastal practitioners and communities in Ireland; however, its tools and methods can be applied beyond an Irish and/or coastal context.

Chapter 7 concludes the report with policy and management recommendations. The recommendations are aimed at differing

audiences with an interest in the range of problems and opportunities related to coastal climate adaptation in Ireland. Specific recommendations within thematic areas – problem framing, decision-making, policies and plans, institutions, scientific support, and communication are included and may be of particular interest to the respective responsible agencies. (Also see summary in Annex 1.)

2. Climate adaptation in Irish coastal zones

Climate adaptation in coastal zones is a political and social process taking place at various interconnected scales and levels.² This chapter provides a review of the main principles and management approaches defining climate governance at national and international levels. It explores whether, and how, the current national and international trends in coastal and climate policies, as implemented in Ireland, can shape an integrated 'architecture' of coastal climate governance – an effective management system appropriately utilising capacities at different levels to achieve desired adaptation outcomes. It is aimed at those interested in exploring national and international policy and management processes defining climate adaptation in Irish coastal zones. Key findings regarding barriers, opportunities and prospects for capacity building may be of special interest to policy makers at the national level.

2.1. Climate change adaptation

The IPCC defines climate adaptation as the 'adjustments in natural and human systems in response to actual or expected climate change impacts, which moderate harm or exploit beneficial opportunities' (IPCC 2007). National governments have a key role to play in shaping how social, economic and environmental systems adapt to such changes. Nevertheless, the uniquely localised character of the effects of climate change (risks as well as opportunities), and available responses to address them on the

ground, mean that decision-making and adaptive capacities at the local level are important. Increasingly, the ability to integrate climate change into planning and environmental management systems supporting cross-sectoral and cross-level integration is seen as key to the successful implementation of adaptation actions (Cash and Moser 2000; Adger et al. 2005b; Cash et al. 2006).

The IPCC (2007) highlights the critical relationship between the impacts of climate change and the specific contextual vulnerabilities of a given region or community in determining the requirement for adaptation. Arriving at a workable method for assessing vulnerability to climate change has proved to be a complex and difficult task in itself (Adger 2006; Füssel 2007; O'Brien et al. 2007). Following an assessment of vulnerability, appropriate targets of adaptation – ideally those that are inherently flexible and responsive to new knowledge or changing circumstances – must be agreed (Moser 2008). In this regard, seeking to enhance the resilience of social-ecological systems to climate change rather than developing reactive adaptation responses is widely considered to offer the greatest potential for flexibility in the face of an uncertain future (Vogel et al. 2007; Saavedra and Budd 2009). The IPCC defines resilience as 'the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change' (IPCC 2007). Adaptation efforts have thus begun to focus on understanding the structure and function of the social-ecological systems that must adapt, subsequently seeking the means to enhance society's capacity to self-organise in the selection of workable routes to new desired states in the face of change (Adger 2006; Janssen and Ostrom 2006). However, the

² Following the terminology accepted in policy and governance research (Cash et al., 2006), this report uses the term 'scale' to describe spatial, temporal, or analytical dimensions of the problem, and 'levels' as units of analysis at different positions, including local, regional and national levels of management.

movement to such an approach for adaptation would necessitate a paradigm shift away from traditional linear management (e.g. predict-and-provide and top-down instruments) towards effective combinations of existing governance institutions and practices with new, innovative management methods, allowing the development and evaluation of adaptation options under a range of circumstances. Such management practices are likely to include combinations of predictive and exploratory scenario approaches, while also seeking an optimal distribution of roles, power and responsibilities between management levels to integrate top-down and bottom-up approaches coherently.

In general, a broad range of adaptation options, including behavioural, technological, regulatory, institutional or financial adaptation measures, are possible. Adaptation can take the form of autonomous and reactive measures, but such undirected adaptation is likely to be significantly less effective in achieving societal aims, and may incur greater levels of risk and cost compared with integrated and proactive approaches (IPCC 2007; Stern 2007). Academic research and policy documents suggest that there is an important role for public policy and planning in facilitating adaptation to climate change (Tompkins and Adger 2004; EC 2007; IPCC 2007). Resilience-oriented studies emphasise the importance of negotiating legitimate routes to the inclusion of adaptive (Tompkins and Adger 2004) and collaborative management arrangements (Burch et al. 2012; Kallis et al. 2009) in current and future modes of governance. Spatial and temporal scales play an important role in characterising climate impacts and responses (Adger et al. 2005b).

While it has long been accepted that legislation and policy at the national level provide an

essential capacity-enhancing framework for adaptation processes, the role of actors at the local level is increasingly identified as critical to the successful implementation of both mitigation and adaptation policies (Adger et al. 2005b; Biesbroek et al. 2009). It is at the local level that decisions are taken regarding land use and opportunities for public engagement in long-term, cross-boundary and cross-sectoral decision-making are most readily available and likely to succeed (Carter and Sherriff 2011). However, the temporal and spatial scales typically afforded consideration at the local level are often at odds with the strategic view taken in national policy (Adger et al. 2005b).

Principles and architecture of adaptation governance

It is increasingly recognised that 'good' adaptation planning and decision-making should be guided by a core set of principles (Prutsch et al., 2010):

- i. building a sound knowledge base
- ii. working with relevant stakeholders
- iii. acknowledging uncertainties
- iv. understanding climate exposure, vulnerability and adaptive capacity
- v. assessing and costing a wide range of adaptation options
- vi. modifying existing and new policies, plans and programmes as necessary.

These guiding principles should direct the integration of adaptation into policies, plans and programmes, with a view to enhancing resilience to climate change. However, such policy integration will have to take place under conditions of high uncertainty. Furthermore, the functional and spatial interdependence of issues to be addressed adds considerable complexity to policy integration, as does the necessity to

address different time scales. The potential hazards that climate change may carry add a considerable degree of urgency to the task. These challenges can nevertheless be addressed by developing a coherent ‘governance architecture’ – the interlocking web of widely shared principles, institutions and practices that shape decisions at all levels (Biermann 2007; Biermann et al. 2009). Four general principles – *credibility*, *stability*, *adaptiveness*, and *inclusiveness* – can be used as benchmarks for the effectiveness of the governance architecture (Biermann 2007) (Table 2.1).³

2.2. Multi-level governance of climate adaptation in Irish coastal zones

Policy and management context: Irish coastal climate adaptation

In Ireland, recognition that actors and groups spanning the national, regional/county and local levels require enhanced abilities to deal with impacts of current and future climate conditions (adaptive capacities) is gaining traction in the formulation of public policy. Following a number of recent extreme weather events, including episodes of severe flooding in the coastal areas of Dublin, Cork and south-eastern and western counties, coastal areas are coming to be viewed as particularly vulnerable to the effects of a changing climate. Predicting and mitigating climate-related risks and minimising any potential losses are increasing concerns of coastal communities and businesses. The scale and variety of potential impacts and issues has resulted in a situation where the effects of climate change (such as coastal erosion and water quality) are formally addressed by various policies and management instruments, while,

Criteria and description
<p><i>Credibility</i></p> <p>Actors perceive the governance structures and institutions to be legitimate and trustworthy, and are willing to support them by following rules, committing resources and offering reciprocity.</p>
<p><i>Stability</i></p> <p>Actions are consistent across different time scales; actors are able to rely on normative governance frameworks, notwithstanding political or other change (Tàbara et al. 2008; Biermann 2007), and are committed to adhering to decisions even if the expected outcome outlives their current interests and political or physical life span.</p>
<p><i>Adaptiveness</i></p> <p>Actors must have the ability to change governance elements to respond to new environmental and socioeconomic circumstances (predictable and unexpected) without harming either the credibility or the stability of the system, and be prepared to reflect constantly on the effectiveness of their governance interventions, correcting plans, actions and institutions as circumstances demand.</p>
<p><i>Inclusiveness</i></p> <p>Governance and planning processes should support the identification of relevant stakeholder groups (both direct and indirect stakeholders) and facilitate the involvement of different actors, views and knowledge in the decision-making and implementation process.</p>

Table 2.1. Evaluation criteria for potential integrated architecture of climate and coastal governance in Ireland based on Earth-System Governance (ESG) principles (full version: Falaleeva et al. 2011).

³ Similar principles can be found in a range of studies; for a more detailed discussion and relevant references see Falaleeva et al. (2011).

paradoxically, the understanding of these issues in the broader context of climate adaptation is missing. Until recently, there was no overarching policy framework to provide a general vision and mandate for adaptation planning, and climate adaptation adds an extra level of complication to the already fragmented realm of coastal management. (Fragmentation and controversies of coastal management in Ireland are widely discussed in the literature and academic reports; see e.g. O'Hagan and Cooper 2002; Devoy 2008; Cooper and Cummins 2009; O'Mahony et al. 2009; O'Hagan and Ballinger 2010; Falaleeva et al. 2011; Gault et al. 2011; Kopke and O'Mahony 2011.)

Table 2.2 provides a general overview of the policy and management background for climate adaptation in Irish coastal zones, including policy and management areas that may affect (directly

or indirectly) decisions and actions related to climate adaptation. The table outlines the complex multi-level policy environment within which coastal managers and communities must operate when planning and implementing adaptation actions.

The functional and spatial interdependence of issues, management strategies and responsibilities related to coastal climate adaptation in Ireland (Table 2.2) suggests the need for an integrated approach to coastal and climate governance. Such integrated planning and management initiatives have been undertaken by Ireland's coastal communities in the recent past, with notable successes achieved by those involved in pilot ICZM initiatives during the past decade (O'Hagan and Cooper 2002; Cummins et al. 2004).

	International / EU	National (Ireland)	Local
Governing frameworks for coastal climate adaptation	UN Framework Convention on Climate Change (UNFCCC); EU White Paper 'Adapting to climate change: Towards a European framework for action' COM (2009) 147; Policy Paper on Climate Change and Water, Coasts and Marine Issues (SEC(2009) 386); EU Adaptation Strategy published April 2013.	The National Climate Change Strategy (2007–2012); Review of National Climate Policy (2011); Roadmap for the Development of National Climate Policy and Legislation (2012); National Climate Change Adaptation Framework (NCCAF) (2012). <i>Forthcoming:</i> Climate Change Bill.	Individual local initiatives for adaptation planning and disaster management, e.g. Climate Change Strategy for Dublin City 2008–2012. <i>Forthcoming under NCCAF:</i> local authorities (LAs) responsible for implementing adaptation through Local Area Plans (LAPs) and County Development Plans (CDPs).

	International / EU	National (Ireland)	Local
Sectoral policies	<p>Sectoral regulations addressing the issues having an impact on, or impacted by, climate change (though not specifically CC-related):</p> <ul style="list-style-type: none"> • <i>Economy & Business:</i> fisheries (CFP), agriculture (CAP), transport, energy, etc. • <i>Communities & Environment:</i> biodiversity protection (Natura 2000, Birds and Habitats Directives, biodiversity action plans (BAPs), water management (Water Framework Directive; WFD), Floods Directive and Marine Strategy Framework Directive (MSFD), disaster and risk reduction, health, cultural heritage, etc. 	<p>Sectoral regulations addressing the issues having impact on, or impacted by, climate change (though not specifically CC-related):</p> <ul style="list-style-type: none"> • <i>Economy & Business:</i> fisheries/aquaculture, agriculture (<i>Food Harvest 2020</i>), transport (<i>Smarter Travel – A Sustainable Transport Future</i>), energy (e.g. National Energy Efficiency Action Plan 2009–2020), tourism (e.g. <i>Climate Change, Heritage and Tourism: Implications for Ireland’s Coast and Inland Waterways</i> (Heritage Council 2009). • <i>Communities & Environment:</i> biodiversity protection (National Biodiversity Plan), water management (River Basin Management Plans (RBMPs) and Catchment Flood Risk Assessment and Management (CFRAM), Water Services Investment Programme 2010–2012), housing (<i>Delivering Homes – Sustaining Communities</i>), disaster and risk reduction, health, cultural heritage; Framework for Major Emergency Management. 	<p>Local plans (LAPs, CDPs) integrating sectoral strategies and interests into local planning.</p> <p>Individual business strategies.</p>
Spatial planning and development (terrestrial & marine)	<p>SEA Directive; Environmental Impact Assessment Directive; Birds and Habitats Directives; Floods Directive; Water Framework Directive, etc;</p> <p><i>Marine only:</i> EU Integrated</p>	<p>Planning and Development Acts, 2000–2010; National Development Plan (2007–2013); National Spatial Strategy for Ireland (2002–2020) and National Spatial Strategy Update and Outlook Report (2010); Regional Planning Guidelines.</p>	<ul style="list-style-type: none"> • <i>Terrestrial only:</i> CDPs, LAPs (5 years) (LAs are responsible for planning, decision-making and management

	International / EU	National (Ireland)	Local
	Marine Policy (IMP); MSFD.	<i>Marine only:</i> Foreshore Acts (licensing and leasing of foreshore development).	of the area above the mean high-water mark). <i>Marine only:</i> permission for foreshore development adjoining the land: LA for private, An Bord Pleanála for LA and joint developments (Harbour Authorities have management responsibility for harbour areas).
Integrated management strategies (integrated coastal zone management, ICZM; RBMP; marine spatial planning, MSP)	EU Recommendation for ICZM; RBMPs under WFD; Regional Marine Strategies under MSFD.	<i>Harnessing Our Ocean Wealth – An Integrated Marine Plan for Ireland</i> (2012). Implementation of MSP is under consideration (by DECLG). Legislation transposing the MSFD has been enacted and an initial assessment is under way.	Voluntary commitments and experience of pilot ICZM projects; RBMPs developed and authorities established for several areas.
Local regulations and by-laws		Local Government Act contains a by-law-making provision. Also available under issue-related legislation: maritime safety, national monuments, casual trading, harbour, litter pollution, road traffic, etc.	LAs develop by-laws on specific issues of land-use and management (beach use, transport, pollution, etc.) where the issue in question is not covered by existing legislation.

Table 2.2. Policy and legislation with the potential to influence adaptation to coastal climate change in Ireland (Desmond and Shine 2011; O'Hagan and Ballinger 2010; Falaleeva et al. 2011; Kopke and O'Mahony 2011).

Notwithstanding the varying levels of longer term sustainability and the serious issues associated with the design and implementation of ICZM initiatives (e.g. uncertain legal status at the EU and national levels, lack of instruments and experience), such overarching frameworks are seen as promising tools for integrating climate adaptation into coastal management (O'Hagan and Ballinger 2010). As a prospective result of such integration, ICZM and climate adaptation policies can form essential elements of a common architecture of coastal climate adaptation, providing a strategic vision and the requisite instruments to facilitate the integration of interests and capacities of coastal sectors and stakeholders.

The (co-)evolution of Irish climate policy and integrated coastal management⁴

Irish climate policy

The initial driving force behind the development of national climate policy in Ireland was the requirement to meet international obligations under the UNFCCC Kyoto Protocol. The publication of *Ireland's Pathway to Kyoto Compliance* (DEHLG 2006) and a subsequent National Climate Change Strategy (NCCS) (DEHLG 2007) signalled an intention on the part of government to deal with climate issues in an integrated manner. Responding to further stimulus at the EU (COM (2009) 147/4 final) and national levels, the Irish Government undertook a commitment to produce a Climate Bill and a National Climate Change Adaptation Framework (DEHLG 2007) (Figure 2.1). The development of the Framework was guided by the EC White Paper on Adaptation to Climate Change (COM (2009) 147/4 final) and supported by the National Adaptive Capacity Assessment (Desmond and Shine 2012). The NCCAF was published in

December 2012 (DECLG 2012). The Climate Bill had been under consideration since 2009 (Labour Party Bill, January 2009), the Heads of the Bill have now been published, and it is likely to be debated later in 2013.

A number of nationally based studies have contributed to the understanding of climate change impacts, vulnerability and adaptation options in Ireland (Devoy 2000; Charlton et al. 2006; McElwain and Sweeney 2007; Fealy and Sweeney 2008; Sweeney et al. 2008; Sweeney and Fealy 2008; Desmond et al. 2009; IAE 2009; Kelly and Stack 2009; McGrath et al. 2009; Desmond and Shine 2012). Climate Ireland – Ireland's climate information platform (an EPA-funded project scheduled for completion in 2013) – summarises the existing body of climate knowledge and interprets climate data in support of robust evidence-based decision-making for resilient planning and development.

Notwithstanding these efforts, the practical implementation of adaptation responses in Ireland remains in its relative infancy. The NCCAF provides a mandate for local authorities and key sectors to integrate climate change adaptation into their planning. However, it does not provide guidance on how to implement adaptation, leaving the specifics of local and sectoral adaptation support to prior and ongoing funded national research, and work undertaken at European level that is applicable to Irish circumstances.

Coastal management and ICZM

In Ireland, coastal management is characterised by a sectoral approach, with no national policy framework for integrated coastal management (Cummins et al. 2004). The emergence of ICZM in the 1990s as a mechanism to progress sustainable management of coastal resources in Europe led Ireland to examine its potential for

⁴ For more detailed information see Falaleeva et al. (2011).

implementation at a national level. Parallel to Irish participation in the EC Demonstration Programme on ICZM in 1996–1999 (McKenna et al. 2000; McKenna and Cooper 2006), work was undertaken at the national level to review the potential for implementing a strategic framework for coastal planning and management (DMNR et al. 1996; Brady-Shipman 1997). The report *Coastal Zone Management: A Draft Policy for Ireland* (Brady-Shipman 1997) presented a series of recommendations on options to overcome the prevalent institutional and administrative barriers of the time: moving towards better integration in the decision-making process; overcoming the sectoral approach; and addressing a strong land/marine divide (Brady-Shipman 1997). A phased approach to the introduction of ICZM in Ireland was proposed.

However, the Draft Policy of 1997 was not formally adopted by any of the Government Departments involved, and ICZM in Ireland has continued to exist in a policy vacuum. In the intervening period, the concept of ICZM received indirect support through various commitments in policy and strategy documents of public bodies (DAF 1999; DMNR 2001; DECLG 2002; DCMNR 2005; Heritage Council 2006). However, delivery of ICZM became embedded in primarily local-scale initiatives (for examples see Falaleeva et al., 2011), which had no statutory basis and were exclusively project-based. Funding for ICZM projects was obtained under programmes such as the European Regional Development Fund (ERDF) (e.g. Cork Harbour), or through local government organisations, voluntary contributions and grant-aid for community and rural development (e.g. Dingle Harbour). Most of the ICZM initiatives did not have any formal mechanism for interaction or coordination. The establishment of the Coastal Communities

Network (2003) and the Irish Coastal Network (ICONET) (2006) provided platforms for interaction between communities and practitioners involved in ICZM in Ireland. Both networks were established and administered by researchers in third-level institutions as part of EU-funded projects. It should be noted that ICONET has been maintained post-project and continues to provide a conduit for dialogue on pertinent coastal issues.

Climate policy and coastal management – towards a common architecture?

Figure 2.1 outlines key milestones in the evolution of Irish coastal and climate policies. The diagram illustrates the strengths and weaknesses of the two subject areas, including the lack of official backing for ICZM (e.g. an absence of legally binding instruments and dedicated national policy), and the separation of the national climate policy processes from local practices.

In recognition of the need to develop an effective adaptation governance framework, the experience of ICZM at the local level may inform adaptation planning and support the mainstreaming of climate adaptation within local planning and management practice. Similarly, an increasingly formalised national climate governance framework may provide substantial support for ICZM. Based on an analysis of a range of projects on coastal management and climate adaptation, and a series of stakeholder interviews undertaken as a core component of this study, the following section outlines the barriers and opportunities for developing an integrated architecture of climate adaptation and coastal governance in Ireland using the criteria of credibility, stability, adaptiveness and inclusiveness (see Section 2.1).



Figure 2.1. Timeline of ICZM and climate policy milestones in Ireland at local, national and international levels.

2.3. Barriers and opportunities for an integrated system of climate adaptation and coastal management in Ireland

In recent years a number of academic and policy studies have been conducted that explore the barriers, limitations and opportunities that existing governance systems provide for climate adaptation. Biesbroek and colleagues (2013), having summarised a wide range of such research, concluded that understanding the nature of the barriers and especially the ways of overcoming them is an essential element of adaptation governance. Although a significant number of barriers reported in international studies are context-specific (e.g. dependent on local conditions, or specific sectors – water management, health, etc.), some can be identified across different contexts. These include barriers: (a) directly related to climate adaptation – the need (coupled with the lack of capacity) for dealing with long-term impacts of climate change versus the short-term dynamic of decision-making; the (absolute) reliance on scientific models to identify and understand the problem and propose solutions, with inherent

and cascading uncertainties of climate change; and (b) non-climate-specific barriers typical of political systems dealing with complex issues such as environmental governance – lack of policy guidance, limited coordination between levels, a lack of administrative resources and high turnover of management personnel preventing consistency of efforts and knowledge transfer (Biesbroek et al. 2013). Other important barriers relate to cultural, social and physiological characteristics of actors and communities involved in adaptation decision-making, including: (lack of) leadership, capacity to mobilise resources, ways of communication and deeply held values and beliefs (Moser and Ekstrom 2010; Biesbroek et al. 2013).

Significant research findings, as summarised by Biesbroek et al. (2013), emphasise the role of governance systems in creating and overcoming barriers and providing opportunities for climate adaptation. Below, the existing architecture of coastal and climate governance in Ireland is examined using the principles of Earth System Governance in order to identify the barriers and opportunities for climate adaptation. (For more detailed analysis see Falaleeva et al. 2011).

Credibility

Irish coastal stakeholders perceive political and administrative support for adaptation planning and actions at the national level as necessary conditions of credible governance. The assessment of climate risks and the design and implementation of management strategies are expected to be initiated and supported by national legislation, rather than be self-initiated by communities or local administrations. In the case of coastal management, despite European (2002/413/EC) and national (Brady-Shipman 1997) documents demonstrating the importance of ICZM, little progress has been made in operationalising this strategic vision, principally due to the absence of a legislative requirement (Rupprecht 2006; O'Hagan and Ballinger 2009). The NCCAF can provide a framework for climate adaptation while supporting integrated coastal management and local planning, particularly if adequate scientific and informational support can also be provided. The findings of the CLAD Project suggest that the EPA is seen as a credible source of information and guidance at the national level (see Chapter 5 for further details). Moreover, Expert Couplet Nodes (ECN) – a partnership of practitioners and research organisations developed to support ICZM at a number of coastal sites in Ireland and Europe (Ballinger et al. 2008; Cooper and Cummins 2009; O'Mahony et al. 2009) – could serve as suitable platforms to garner local support and progress the implementation of adaptation decision-making if rolled out more extensively.

Stability

Both ICZM and climate adaptation in Ireland have long failed to receive the legal and financial support required to enable the development of local strategies that extend beyond the duration of research and demonstration projects. Long-term financial commitment and ongoing monitoring are considered essential if such initiatives are to persevere beyond the life cycle

of a project. Experience gained through the Demonstration Programme on ICZM (EC 1999; McKenna, Cooper et al. 2008) had significant impact in terms of experimenting with new forms of integrated management and forming local networks. However, the full value of these outcomes is jeopardised by the current fragmentation and short-termist approaches to coastal governance, given that prospects for continued learning are lost when an unstable start–stop approach prevails. Conversely, the top-down approach to climate adaptation promises a certain degree of stability. As environmental decision-makers are obliged (under NCCAF) to undertake local-level adaptation, the process will undergo institutionalisation in the longer term.

Nevertheless, such promising perspectives are counter balanced by a number of risk factors, including potential deficits of implementation due to resource shortages and a lack of political commitment. From this perspective it is important to support a vision of climate adaptation as a vital part of the economic and social development of coastal areas, and to represent climate resilience as a way to minimise economic losses and take advantage of new and evolving opportunities. In a situation where financial support for local adaptation planning from the national budget is challenging to provide, integrated approaches to coastal and climate governance may bring the potential to harness resources more effectively and support greater management stability. Moreover, by considering the opportunities emerging under new conditions, effective adaptation strategies may bring financial benefits for communities.

Adaptiveness

A timely and adequate supply of knowledge and information is a key element of adaptation to

changing conditions (Folke 2006). A series of interdisciplinary scientific projects have been supported at the national level, including a comprehensive analysis of the effect of climate change in Ireland (Sweeney et al. 2008), an assessment of risks, and their perception, across different regions (McGloughlin 2009) and sectors (DCMNR 2007; TCD 2009), enhancing capacities for specific areas of coastal management (recreation, erosion management) to operate in changing climate conditions, as well as critically analysing the policies and procedures defining coastal management and climate adaptation (O'Mahony et al. 2009; Gault et al. 2011; Kopke and O'Mahony 2011). Nevertheless, a consistent system of data management and information supporting coastal management and climate adaptation has yet to be established. Similarly, formal mechanisms for monitoring and incorporating feedback into a policy context remain absent. Developing and maintaining monitoring and decision-support systems will require substantial political will, financial support and actors' commitment.

The present hierarchical system of governance provides limited flexibility (in terms of both procedures and the experience of managers) to integrate new information into decision-making. A new, more balanced approach and novel management methods are needed to provide room for flexible, strategic, locally based decision-making, operating within a nationally coordinated framework of coastal climate adaptation.

Inclusiveness

ICZM projects in Ireland have made an important contribution in demonstrating the benefits of a participatory approach. However, without sustained institutional support and efforts to continue capacity building, even successful

participatory practices usually end when the associated project finishes. The findings of extensive interviews suggest a profound lack of opportunities for meaningful knowledge exchange between agents in the various coastal sectors, and between practitioners, policy-makers and scientists. Lack of such exchange is perceived to be an important barrier to substantive participation by those involved in coastal management and climate adaptation planning. Moreover, the absence of experience or guidance on participatory decision-making processes prevents both managers and potential participants from being involved in these types of initiatives. Integration between the lower and upper levels of management and across sectors needs to be achieved, and mechanisms and institutions for such interaction need to be developed. Supported by EU policy documents on governance (COM (2001) 428 final) and Climate Adaptation (COM (2009) 147/4 final), the recently published NCCAF introduces elements of inclusiveness across governance levels. However, the practical mechanisms and tools for integration of Irish climate governance have still to be developed.

2.4. Key findings: requirement for capacity building

An analysis of the existing situation in coastal and climate governance in Ireland, based on a review of policy documents, current planning and management practices and supported by the findings of stakeholder interviews,⁵ reveals substantial barriers as well as opportunities for the development of an integrated approach

⁵ The interview materials supporting documentary study for national-level policy analysis (including materials of the workshops and informal communications with stakeholders) have been obtained from the projects: CoastAdapt, IMCORE, PhD project by Valerie Cummins, and the CLAD Project itself (see Chapters 4,5).

(architecture) for coastal climate adaptation. Conditions typical of climate adaptation initiatives worldwide include short-term decision-making, fragmentation of governance, lack of clear guidance and experience, and delays with implementation of climate legislation. There are also a number of barriers that are specific to the Irish context, such as a lack of integrity between coastal and terrestrial planning, local political barriers, and the evolving equity uncertainty resulting from the collapse of the property market for coastal businesses and homeowners. Similarly, endogenous opportunities include nodes of in-depth experience with participatory involvement in ICZM projects and the credibility of official structures as a source of information and guidance. Thus, the following issues must be addressed in order to build capacity for effective adaptation responses within Irish coastal communities.

- Legal and policy support at the national level is vital in order to initiate and sustain local action and prioritise climate adaptation, providing credibility and stability for adaptation efforts and integrating adaptation policies ('mainstreaming') into coastal management practice.
- Policy and institutional mechanisms need to be designed/amended in a way that supports an integrated approach to climate adaptation and coastal management to avoid fragmentation across sectors and levels, and to promote inclusiveness and adaptiveness in governance.
- Different time-scales of climate adaptation need to be addressed to overcome existing short-term planning and to support stability and long-term adaptiveness.
- Comprehensive background information, including projections for climate change and impacts, available methods for climate adaptation and related costs, and broader

contextual information (e.g. global and local socioeconomic scenarios), needs to be delivered to coastal managers and stakeholders. The information, presented in a transparent and user-friendly format, is essential to support participatory, evidence-based and adaptive decision-making.

- The existing institutions, networks and experience of integrated management and stakeholder participation can be used to support mainstreaming adaptation into strategic planning and coastal management. The expertise garnered under pilot institutions involved in participatory planning and knowledge integration (e.g. ECNs) could be replicated around the country, to start reducing the current deficit of inclusiveness of Irish climate policy.
- The vision of climate adaptation as a strategic factor of development providing both barriers and opportunities and requiring allocation of human, intellectual and financial resources at the national as well as at the local level needs to be promoted, e.g. through media, other communication channels and education programmes.
- Novel management approaches are required to coastal management practices, enabling stakeholders to operate under conditions of uncertainty and complexity.
- Tools for forward-thinking and flexible decision-making provided from the national level are essential if this level is to be perceived as a credible (though flexible) source of management guidelines, supporting adaptiveness and inclusiveness in coastal adaptation governance.

3. Adaptive co-management – potential applications for coastal climate adaptation

3.1. Adaptive co-management: the theory and application of the concept

The previous chapter illustrated that although traditional modes of management deliver important benefits such as legitimacy for actors, relatively well-defined mandates and responsibilities, and the systematic development of scientific knowledge, they also typically fail to operate optimally under conditions of non-linearity and system self-organisation (Folke 2006; Brunner 2010). One of the core indicators of success in traditional management systems is a cost-effective way to deliver and sustain a certain 'optimal' state of the system (e.g. based on maximum profit or maximum sustainable yield) (Merkle 1980). This assumption is however challenged in dynamic systems, where the costs of supporting the optimal state may vary significantly over time, as may the perception of what is the optimal state (Gunderson and Holling 2002; Moser 2008). To address the acknowledged complexity and uncertainty of social-ecological systems (which are core characteristics of coastal climate adaptation), new management approaches are needed that complement and where necessary replace traditional management practices (Young 2002; Folke 2006; Biermann 2007; Biggs et al. 2010).

ACM is a management approach providing an alternative to traditional, centralised and linear expert-based modes of governance. ACM is based on two key tenets (or narratives) – adaptive management and collaborative management (co-management), which have

been developed and applied in areas including business, policy science, technology, land-use planning and natural resource management (Carlsson and Berkes 2005; Folke et al. 2005; Armitage et al. 2009; Brunner 2010). This chapter provides an overview of ACM, its origins and core characteristics. It combines a review of the theoretical literature and practical experience of the implementation of ACM in order to identify its key benefits and issues, and subsequently to develop a framework against which the scale of deviation between existing conditions in coastal climate change in Ireland and those of an ideal ACM implementation can be assessed.

Adaptive management

The central tenet of *adaptive management* (or adaptive governance) can be described as 'learning by doing', where management is considered a form of experiment – a learning approach – with subsequent evaluation of the results of management intervention and adjustment of management strategies as appropriate (Pinkerton 2007). The concept has roots in earlier works on complex system theory, ecosystem ecology and natural resources management (Holling 1978; Walters 1986; Lee 1993) in response to deficits in traditional command-and-control, static management. Table 3.1 summarises and compares characteristics of adaptive and traditional approaches based on the study of climate adaptation governance in relation to decision-making, policy and the production of scientific knowledge (Brunner and Lynch 2010a). Figure 3.1 shows the adaptive management cycle.

Adaptive management is increasingly linked with the concept of social-ecological system resilience (Olsson et al. 2004, 2006; Folke 2006; Lebel et al. 2006; Plummer and Armitage 2007a, 2007b). Contrary to linear, target-oriented and disaster-response management, resilience-building focuses on the ability of systems to absorb disturbance and self-organise in

response to changing circumstances while maintaining desired attributes (Holling 1978; Folke 2006; Pinkerton 2007). Adaptive management provides a framework under which institutional and organisation responses (e.g. to climate change) are targeted toward resilience enhancement and the building of adaptive capacity.

Command-and-control management	Adaptive management
DECISION-MAKING	
<p>Centralised <i>Top-down management.</i> <i>Bureaucracies.</i> Policies are implemented through uniform and impersonal bureaucracies. <i>Expertise.</i> Experts develop integrated scientific assessments for central authorities.</p>	<p>Decentralised <i>Bottom-up management.</i> <i>Networks.</i> Successful policies can be distributed for voluntary adaptation through stakeholder networks. <i>Experience.</i> Local communities working in parallel with experts to field-test and adjust responses.</p>
POLICY	
<p>Technical rationality <i>Planning.</i> Policy and planning process is discrete and relying on formal metric to evaluate success and avoid failure. <i>Targets.</i> Reliance on science-based technologies to realise a given target efficiently and above politics. <i>Linear.</i> Research is oriented towards reducing uncertainty as a prerequisite for effective policy decisions.</p>	<p>Procedural rationality <i>Appraisal.</i> Policy processes and constant relying on appraisal for terminating failing policies and building on successful policies. <i>Interests.</i> Integrating balance of interests to advance common interests; politics is necessary. <i>Cooperative.</i> Scientists and policy-makers work cooperatively towards overlapping targets, sharing differently informed insights.</p>
SCIENCE	
<p>Extensive <i>Generalised.</i> Research generalised for results of broad national or international scope. <i>Predictive.</i> Stable and standard assumptions are integrated into numerical models making predictions, and reduce uncertainty. <i>Reductive.</i> Research selects separate parts from diverse systems relevant to a stable relationship or standard measure.</p>	<p>Intensive <i>Centred.</i> Enquiry focuses on understanding and reducing losses in particular cases; context matters. <i>Integrative.</i> Each factor is contingent to the whole case; gaps and inconsistencies in it prompt revision. <i>Comprehensive.</i> Enquiry strives to cover all the major interactive factors, human and natural shaping outcomes in the single case.</p>

Table 3.1. Comparison of the characteristics of traditional command-and-control management and adaptive management (adapted from Brunner, 2010)

At the operational level, adaptive management requires (Lee 1993):

- i. identification of alternative hypotheses
- ii. assessment of whether further steps are required to estimate value of additional information
- iii. development of models for future learning
- iv. identification of policy options
- v. development of performance criteria for comparing options; formal comparisons of options.

Co-management provides managers with an approach and instruments for cooperative actions, knowledge generation and integration, sharing power and responsibility, which enable decision-making during conditions of complexity. Co-management enables learning.

knowledge and capacities to the process, participating actors make adaptive management operational. Actors can be supported by 'locally evolved institutional arrangements' (Dietz et al. 2003), and 'flexible community-based systems of resource management tailored to specific places

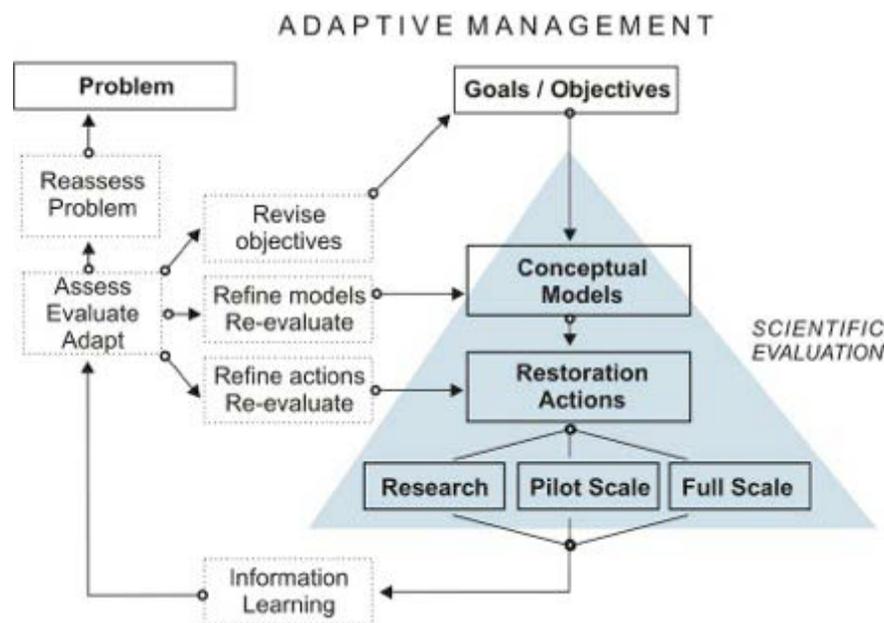


Figure 3.1. Adaptive management cycle (DRERIP 2012).

Adaptive management as an experiment could exist as a mere technocratic expert-led exercise based on learning about the system change. Several studies mention difference between 'technocratic' and 'non-technocratic' adaptive management (Huitema et al. 2009). Non-technocratic approaches (e.g. Lee, 1993) stress the importance of institutions and linkages between actors. Within complex systems, where multiple interests are involved, practising adaptive management requires the cooperation of various groups of actors (Folke, Hahn et al. 2005; Brunner 2010; Brunner and Lynch 2010b). By articulating their interests, and contributing

and situations' (Folke et al. 2005). This process of involvement can be supported by 'collaborative management', or co-management.

Co-management

Co-management is increasingly seen as an alternative to rigid, command-and-control approaches originating from official bureaucracies. In the most generic terms, co-management can be described as distributing the rights and responsibilities over a given resource among multiple stakeholders, including government and civil society (Plummer and

Interactive organisations	Flexible set of institutions (as opposed to rigid, hierarchical, top-down organisation) at multiple levels, able to adjust their functions to cope with dynamism and complexity; advisory organisations providing scientific and other support; balanced sharing of responsibility between the organisations at the local and national levels.
Local control	Institutions supporting and enabling local ownership and control; delegation and decentralisation of power following the principle of subsidiarity of institutions and optimal allocation of decision-making capacities and power.
Community support	Enabling participation and encouraging community collaboration.
Planned process	Goal-seeking as in establishing a common goal and developing a vision and strategy to move towards this; enabling long-term vision and strategic decisions; focus on developing adaptive capacities; knowledge-based decision-making.
Substantive diversity	Equity of actors and opinions; broader perspectives on economic development in the region; promoting sustainability.
Holism	Inclusiveness of different perspectives and views; integration across the issues and sectors and between individuals' perspectives.

Table 3.2. General requirements for institutions enabling co-management (Noble 2000)

FitzGibbon 2004). The idea of collaborative management become popular in the literature regarding the governance of the commons (Pinkerton 1989; Ostrom 2005), responding to calls for consideration of ethics and the democratic right to participation (WCED 1987; EC 2001; Fennell et al. 2008), as well as the pragmatic need to integrate knowledge and responsibility among actors to mitigate and resolve conflict. In natural resource governance, co-management is seen as enhancing functions of data gathering, resource use (e.g. time and amount of harvesting), decision allocation, protecting resources from damage, enforcement of regulations, enhancement of long-term planning and more inclusive decision-making (Noble 2000; Pinkerton 2007). Further developments of the theory and practice stress functions of co-management as power-sharing, institution building, trust building and a process involving social learning and problem-solving (Plummer and Fennell 2007; Berkes 2009).

The term 'co-management' represents both a result (with outcomes as power-sharing integrated in practices and institutions) and a process involving negotiation, deliberation, knowledge generation and social learning (Berkes 2009). The broad agenda and local specificity make institutional arrangement and strategies unique for each location. Table 3.2 describes a set of requirements for institutions to effectively enable co-management in fisheries management (Noble 2000).

The strategies to facilitate co-management processes include (Berkes 2009):

- *Bridging knowledge* and incorporating different knowledge systems (Eamer 2006; Berkes 2008)
- *Co-production of knowledge* by stakeholders including scientists and local communities, which neither party can do alone (Davidson-Hunt and O'Flaherty 2007; Berkes 2008)
- *Cooperation building tactics* including continuing physical presence, regular

contacts with decision-makers, maintenance of programmes for different groups, hyper-flexibility in resource allocation and schedules (Wollenberg et al. 2007).

- *Participatory research* that includes local communities as partners (Arnold and Fernandez-Gemenez 2007).
- *Collaborative monitoring* (Kofinas 2002).
- *Participatory scenario building* based in multiple perspectives (Bennett and Zurek 2006; Kok et al. 2007).
- *Devolution of power and responsibilities*, including monitoring and further supporting power distribution resulting from co-management initiatives (Bene and Neiland 2004, 2006).
- *Downward accountability* for the agencies at the national and regional levels to local user groups (Bene and Neiland 2004, 2006).

In common with adaptive management, co-management seeks to provide instruments that support social-ecological system resilience as a management objective. Cooperative planning and actions aim to provide the continuity, resources, commitment and legitimacy necessary for building and maintaining resilience (Moellenkamp et al. 2010).

Close links between the two approaches – adaptive management and co-management – have resulted in their natural coevolution towards an amalgamated management approach termed ‘adaptive co-management’.

Adaptive co-management (ACM)

Addressing complexity and uncertainty is put forward as the key strength of ACM, and is thus the main anticipated benefit of ACM for environmental governance and coastal climate adaptation.

Adaptive Co-management provides an approach and instruments for experimental adaptive management implemented through cooperative actions, based on social learning, shared power and responsibility. ACM enables stakeholders to take, and implement decisions, in the conditions of uncertainty and complexity.

ACM combines instruments of ‘donor’ approaches, i.e. the iterative learning dimension and experimental character of adaptive management, and the linkage dimension and resources of co-management (Olsson et al. 2004; Pinkerton 2007). ACM also provides its own unique properties and potential strengths (Table 3.3).

As noted by Berkes et al. (2007) ‘Adaptive

	Co-management	Adaptive management	Adaptive co-management
Linkages	Primary focus: vertical institutional linkages	Linking science and management for learning-by-doing	Horizontal and vertical linkages for joint learning-by-doing
Temporal scope	Short to medium: tends to produce snapshots	Medium to long: multiple cycles of learning and adaptation	Medium to long: multiple cycles of learning and adaptation
Organisational level	Bridging between local and government levels	Focus on managers’ needs and relationships	Multi-level, with self-organised networks
Capacity building focus	Resource users and communities	Resource managers and decision-makers	Needs and relationships of all partners

Table 3.3 Similarities and differences between co-management, adaptive management and adaptive co-management (Berkes 2009)

management without collaboration lacks legitimacy, and co-management without learning-by-doing does not develop the ability to address emerging problems ... Adaptive Co-Management is more closely attuned to the needs of resource users than is adaptive management, and more cognisant of learning and adapting than is co-management.'

Conceptual models of ACM

Unsurprisingly, ACM implementations draw on the methods applied by adaptive management and/or co-management. However, the growing number of practical applications of the ACM approach means there is a requirement for guidance and clarification, and this raises the question: 'is there general process of adaptive co-management?' (Pinkerton 2007; Cundill and Fabricius 2009; Plummer 2009). To date, there is no definitive model of ACM, although clarification of approaches and standardisation of methods is widely discussed in the literature (Armitage et al. 2007; Pinkerton 2007; Cundill and Fabricius 2009; Huitema et al. 2009; Plummer 2009).

One of the most popular approaches in understanding and conceptualising the application of ACM is derived from resilience theory (Gunderson and Holling 2002; Folke 2006; Walke et al. 2006) and the concept of 'panarchy' (Gunderson and Holling 2002). An understanding of system dynamics is garnered through analysis of iterative 'adaptive cycles', which consist of four phases: (1) growth or exploitation, (2) conservation, (3) collapse or release, (4) reorganisation.

A range of exogenous and endogenous variables influence the transition between these phases (see Section 3.2). Components and actors operate within the context of 'nested hierarchies' – different material or virtual systems with their own internal rules and dynamics – to

which the agents belong (usually to several systems at the same time) (Gunderson and Holling 2002). One of the tasks of management is therefore to understand and anticipate change and, where appropriate, facilitate transitions towards a desired state as well as to develop common understanding of the system and its dynamic by the actors (Figure 3.2).

The concept of an adaptive cycle represents a valuable and theoretically grounded framework for the analysis of system dynamics and adaptation, and can also be used as an overarching theory for the design of adaptation strategies. The model also points out that several management constraints (or 'traps') may occur at different stages of the cycle. For example, in Figure 3.2, a 'rigidity trap' refers to the tendency of the system (and the actors within it) to preserve the existing rules, practices and system conditions, which may in turn impede the system's transition to the state of 'release'; and a 'poverty trap' implies a perceived or real lack of resources barring entry to the 'reorganisation' phase of the cycle. Application of the theory in its pure form would require a high degree of familiarity with its conceptual underpinnings and terminology, and thus for the purposes of practical implementation will benefit from remapping onto the specific steps of a management strategy. At the management level, more specific guidelines tailored to the areas of application (geographical and sectoral, e.g. coastal management, forestry, urban planning) are required. The CLAD Project developed guidelines for Irish coastal communities that, among others, suggest addressing the management constraints described by mainstreaming the climate adaptation agenda into existing policies and practices, including using existing sources of funding in a more effective, synergetic way.

Figure 3.3 (Cundill and Fabricius 2009) illustrates a monitoring and management model based on a social learning approach that forms an appropriate model for ACM implementation.

When compared with the adaptive management cycle (Figure 3.1), the outer ring represents the co-management elements, which include monitoring, institutional development, communication and knowledge integration.

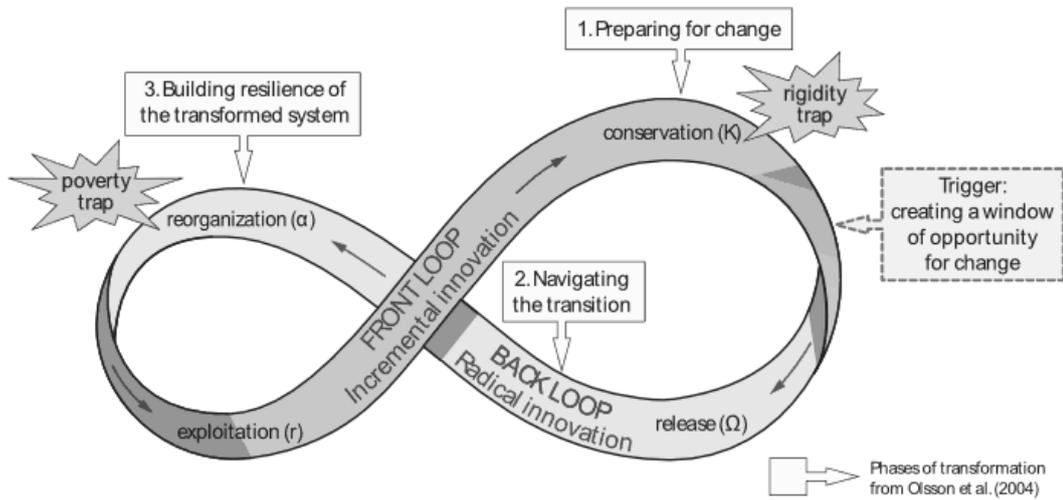


Figure 3.2. The adaptive cycle (Holling 2001; Gunderson and Holling 2002): a metaphor for understanding innovation in complex social-ecological system (SES) (Biggs, Westley et al. 2010).

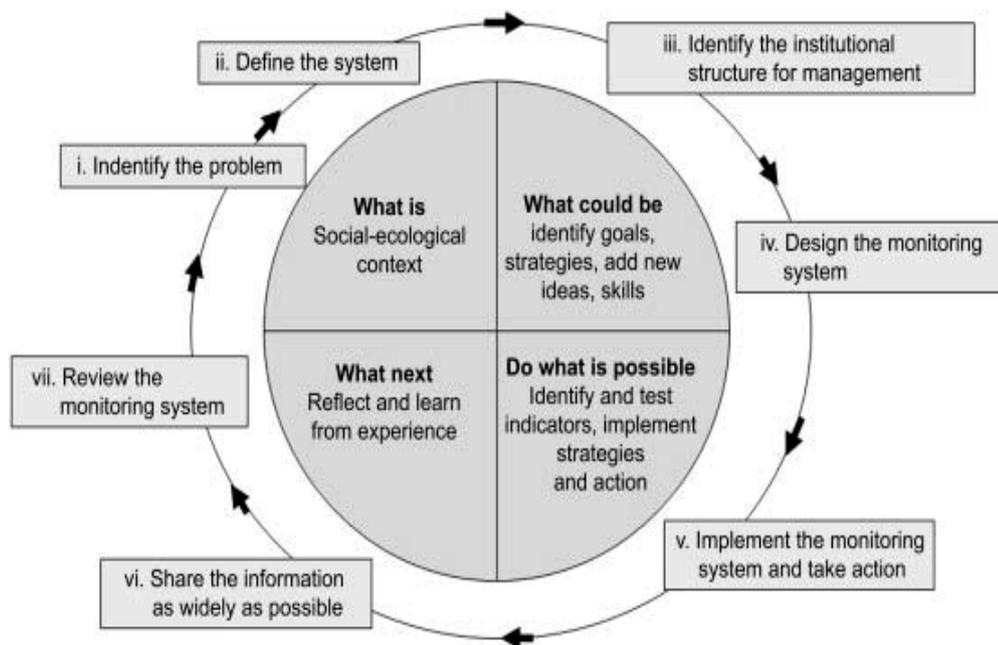


Figure 3.3. Social learning approach to monitoring as an example of ACM cycle (Cundill and Fabricius 2009).

3.2. Practical implementation of ACM

The practical implementation of a management strategy requires the use of tools and institutions to plan, organise, inform and implement decisions and actions. ACM suggests a new approach to decision-making; however, it should not be seen as a rigid alternative to existing institutions including traditional management frameworks or new approaches as a part of ICZM or MSP processes. The literature stresses that it is not possible to introduce ACM as a 'packaged strategy' (Ruitenbeek and Cartier 2001; Berkes et al. 2007; Berkes 2009) or immediately replace existing institutions and garner actors' support for new planning approaches. Rather, ACM represents a novel perspective on management under conditions of complexity and uncertainty, and existing policies and institutions 'ought to protect and contribute to the conditions of emergence of adaptive co-management as well as enhance the consciousness of agents in the system' (Ruitenbeek and Cartier 2001, cited by Berkes 2009). New, flexible management actions should draw upon and employ institutional structures in place alongside the development of specific institutions and methods supporting ACM (Berkes et al. 2007). ACM initiatives integrated within official decision-making should receive adequate support (e.g. legal and administrative); however, stakeholder groups are expected to seek and employ internal resources (e.g. financial) in order to reduce the dependence on official structures.

Institutions and methods

The collaborative and learning-oriented nature of the ACM approach emphasises both formal and informal institutions, as well as procedures they apply, as vital mechanisms for the delivery and maintenance of management processes and system resilience. Huitema and colleagues (2009) summarise the requirements for formal

and informal institutions supporting ACM as (a) polycentricity, (b) enabling participation, (c) enabling experimentation, and (d) supporting a bioregional approach, also pointing out that the practical implementation of these requirements is locally specific and may be difficult to achieve under conditions of rigidly top-down management. The major requirements for ACM-specific operational procedures are the ability to deliver and support continuous monitoring and vulnerability assessment, generate and integrate different types of knowledge, support participation and cooperation, and enable experimentation and learning (Noble 2000; Pinkerton 2007; Berkes 2009; Huitema et al. 2009).

'Bridging organisations' – as described in the co-management, resilience and wider assessment and science-practice literatures (Cash and Moser 2000; Folke et al. 2005; Folke 2006; Hahn et al. 2006; Olsson et al. 2006) – are often referred to as a model for ACM institutions operating alongside official structures. Bridging organisations are formal or informal institutions providing an 'arena for knowledge co-production, trust building, learning, vertical and horizontal collaboration, and conflict resolution. Bridging organisations can respond to opportunities, serve as catalysts and facilitators between different levels of governance and across resources and knowledge systems' (Berkes 2009). Experience indicates that to be successful, bridging organisations should have a clear statutory remit and combine official support with local initiative and commitment, also having access to scientific knowledge (Folke et al. 2005; Olsson et al. 2006). A number of examples of bridging organisations are provided in Section 3.3.

Participatory vulnerability assessment and scenario development (Wollenberg et al. 2000;

Robinson 2003; VanWynsberghe et al. 2003; Kok et al. 2007; Kok 2008; Dreyer and Renn 2011) involves elements of monitoring, experimentation and collaboration, which makes these methods particularly relevant for ACM applications. Participatory vulnerability assessment involves stakeholders in the assessment process, combining local knowledge with scientific information. Alongside knowledge integration, the process aims to build a shared vision of problems to resolve, enhance communication and build trust. Scenario development is one of the most effective methods to address uncertainty. Participatory scenario development aims to define and communicate factors contributing to uncertainty and possible outcomes for the system. Scenarios are not a prediction of the future, but they do provide information supporting the development of adaptive capacity in respect of potential future change and any associated vulnerabilities (Dreyer and Renn 2011). It should be noted that the wider use of scenarios may be limited by technical difficulties and a lack of experience and methodological support.

Factors influencing ACM applications

A wide range of environmental, economic, political and social factors influence ACM processes. A number of system variables should be taken into account when designing and conducting ACM initiatives. Based on an extensive literature review, Plummer (2009) identified the following exogenous and endogenous variables.

- *Exogenous variables:* (1) ecosystem changes or resources alteration that precipitate crisis; (2) legal mandates, policy prescriptions, and/or resources support (or reductions) by government; (3) social and political context including culture, knowledge systems and power; (4) social and economic

drivers that propel other variables such as population, international trade and globalisation.

- *Endogenous variables:* (1) properties of networks – connectivity, centrality (distribution of links) and structural importance (bridging, bounding); (2) assets employed by agencies, organisations and individuals – human, social, natural, physical and financial capital; (3) attributes of organisations and individuals – leadership, experience, capacity for learning and experiment, perceptions, values, attitudes, emotions and interpersonal skills; (4) variety of functions by individual and quality of performance – knowledge carriers, interpreters, networkers, stewards and leaders, visionaries and innovators, entrepreneurs, followers.

Barriers and limitations

The main barriers for ACM applications include (Plummer and Armitage 2007):

- i. unwillingness and inflexibility of state and resource managers to share power, and power asymmetries
- ii. insufficient commitment of resources (e.g. financial, human, technical)
- iii. underlying group dynamics: preconceived attitudes about stakeholders, unresolved conflicts and defensiveness, mistrust, domination of particular interests
- iv. lack of capacity and information asymmetries.

Overcoming these barriers is challenging and depends on a range of factors such as the national and local political and economic situation and leadership, and the availability of skills and resources (see above). Many of these (external) factors are beyond the control of ACM managers and may significantly limit the success

of any initiative. Other limitations are associated with the various elements of ACM, including the acknowledged limits of participatory processes (Moser 2008) and experimental management as compared to traditional planning approaches (Armitage et al. 2009; Brunner 2010).

Although ACM is unlikely to be an ultimate replacement for traditional management structures, integrating the principles and methods of ACM into routine and strategic decision-making can significantly advance sustainability and resilience management, addressing important knowledge and procedural gaps and enabling management under conditions of complexity and uncertainty. The examples in the following sections demonstrate both the benefits and the limitations of ACM.

3.3. Experience of ACM application in other countries

With respect to coastal management, ACM emerged initially in response to local natural resource management conflicts between indigenous communities engaged in traditional practices of resource use and actors supporting large-scale industrial exploitation. Most recently it has begun to enter more mainstream environmental management contexts as the demand for participatory and (ecosystem-based) adaptive management approaches has grown. Two such examples of ACM application in a coastal context are summarised below.

West Coast Vancouver Island Aquatic Management Board (AMB)

The West Coast Vancouver Island AMB, described by Pinkerton (2007), illustrates the critical role of a boundary organisation in successfully facilitating the implementation of ACM. The AMB was established in 2002 to advance integrated ecosystem-based

management of an area covering about 300 km of the West Coast of Vancouver Island (WCVI) coastline. Established as a consultative co-management initiative during the pilot stage of operation, the AMB ran into difficulty in finding agreement regarding the appropriate scope and scale of issues to be addressed. For example, national- and regional-level stakeholders preferred the AMB to have a narrow focus on issues that reside entirely within the WCVI coastal zone, while local representatives insisted on a broader geographical scope. Having secured the cooperation of the Canadian Department of Fisheries and Oceans (DFO) – the AMB’s principal funding body – the board has employed a model of consultative co-management that is a marked improvement on the previous top-down model. Moreover, the AMB operates at a geographical scale that is novel to the DFO, and involves a more complex cross-section of stakeholders. Thus the board has a wider scope of interests than the ‘traditional’ fisheries/sectoral interests with which the DFO usually consults. This approach has been deemed a (conditional) success by the involved parties, and has seen the AMB continue operation well beyond its initial three year pilot phase to the present day.

Key lessons applicable in an Irish context

The recipe for success in shifting governance from a top-down model to multi-sector co-management at the local coastal scale involves addressing behavioural ‘biases’ of traditional government agencies, which Pinkerton (2007) describes as the key barriers to ACM, as follows.

- *Preference for short-term rationality over long-term rationality:* The AMB overcame this tendency by creating a shared long-term future vision and then binding its activities to that vision, applying lobby pressure to see issues addressed. Activities are monitored

via indicators and performance measures. This 'policing' function provides an incentive for agents of governance to experiment.

- *Preference for competition over cooperation:* The AMB fulfils a mediatory role in conflicts between commercial and environmental interests and the DFO. It also serves as a bidirectional conduit of information between these interests and government, diminishing operational costs for all stakeholders and adding value to communication through the provision of (trusted) analysis. This clearinghouse function is a key element of best practice in ACM implementation.
- *Fragmentation of interests, values, responsibilities, authority, information and knowledge:* The AMB itself is the prime mechanism for overcoming many of these biases – simply bringing an institution into existence that spans scales and delves into complex cross-sectoral interactions within the WCVI coastal area. The construction of an online, open access data clearinghouse brings together all available datasets of the WCVI coastal area, and provides a means of empowering those previously marginalised by a lack of access to information. Due to budgetary constraints, the AMB does not involve itself in the day-to-day business of project work, but instead consults with and coordinates the work of other actors and bodies at different levels.

Coastal resource co-management in the Caribbean

A number of Caribbean coastal resource conflicts in four case studies described by McConney and colleagues (2007) focus on the harvesting of marine biomass (beach seine fisheries, sea cucumbers, etc.). Within these case studies, a mixture of traditional capture rights had been in play prior to the advent of co-management initiatives. In common with coastal

governance globally, the management of these fisheries is complex, involving multiple institutional bodies responsible for various (often overlapping) aspects of coastal resource management.

ACM initiatives in the region included the establishment of special management bodies – bridging organisations – that aimed to control and facilitate sustainable resource use. One of these organisations, the Barbados Fisheries Advisory Council (FAC), was established at a national level and is thus a legally legitimate body, tasked with advising the relevant ministry regarding the management of Barbadian fisheries. The FAC achieved successes at higher scales, as the relevance and quality of advice based on local knowledge regarding quota issues saw a reduction in conflicts and greater consideration given to ecologically sound resource management. However, the FAC has struggled to deliver its mandate at the local level due to being insufficiently equipped to respond to the demands of the fishing industry (e.g. post-catch processing issues, extracting greatest revenue from the resource).

The authors identify three phases of co-management and indicate that there may be several years between each one and the next, with possible regression and advancement, as follows.

- *Pre-implementation:* Realisation of the need for change, meetings and discussions regarding how change might be brought about, development of new management drivers, modes and institutions.
- *Implementation:* New management is trialled, education in its new roles and demands is undertaken, adjustments are made and decisions taken as the costs and

benefits of the new system of management are considered.

- *Post-implementation:* The most effective elements of the new system are maintained, conflicts are resolved and new rules enforced, and new standard practices are adopted and mainstreamed.

Key lessons applicable in an Irish context

Even when formed as a result of a top-down call for change, co-management initiatives must be sufficiently institutionally empowered to be responsive to stakeholder needs across all levels.

There is no blueprint to achieve transitions to new management methods, because each circumstance will require a bespoke approach and ingredients determined by locally specific issues.

3.4. Existing conditions for ACM implementation: ACM monitoring and evaluation

Translating an ACM approach into practical decision-making requires clear guidance based on an initial analysis of local capacities and evaluation of local successes in coastal resource management. Armitage et al. 2007, describe the demand for evaluation and monitoring as an important research challenge: 'If ACM is to be a possible governance approach, its economic and legal requirements should be identifiable and accountable ... identification of opportunities and constraints surrounding the emergence of ACM involves the examination of the adequacy of existing policy instruments ... and the development of recommendations aimed at creating an enabling policy environment.'

Although many attempts have been made to develop criteria to define and evaluate ACM, it is not possible to design universal indicators. Various perspectives on ACM objectives (e.g. social learning, resolving conflicts, achieving certain benchmarks) create different visions of 'what an effective ACM process is' (Pinkerton 2007; Plummer 2009). Evaluation criteria and indicators represented in the literature (see Table 3.4) can be broadly divided into three groups:

- i. general characteristics of an idealised ACM initiative: *where should we aim to go?*
- ii. assessing the conditions required for implementation: *what is needed?*
- iii. effectiveness of specific projects: *what are the desired outcomes?*

Notwithstanding these general standards, the requirements and benchmarks for specific ACM applications may vary. Developing and monitoring parameters and indicators for success should therefore be a distinct component of the ACM process. The following section presents a system of criteria and indicators developed by the CLAD Project for the analysis of local conditions prior to ACM implementation for coastal climate adaptation in Ireland.

3.5. Key findings: ACM-based criteria for coastal adaptation governance in Ireland and CLAD local adaptation process

Based on theoretical studies and practical examples, the CLAD Project developed an analytical framework for analysing benchmark conditions for ACM application in coastal communities in Ireland.

1. Where should we aim to go?

- Build robustness to overcome challenges, e.g. ecological, economic, legal.
- Design processes of evaluation/monitoring of management through reflection, learning and subsequent modifications of processes and actions.
- Enhance conservation/sustainable resource use and ecosystem health.
- Build a process in which stakeholders and government develop, implement, learn, and make adjustments in pursuit of a more resilient socio-ecological system.
- Empower the actors involved, fostering ecological and social justice, and achieving credible sustainability objectives, e.g. poverty alleviation, future options, and inclusion and effective participation in the process.

2. What is needed?

- A well-defined resource system.
- A small-scale resource use context.
- Clear and identifiable social entities with shared interests.
- Reasonably clear property rights (e.g. fisheries, forest).
- Access to a flexible and readily adaptable portfolio of management measures.
- A commitment to support a long-term institution-building process on the part of all stakeholders.
- The provision of training, capacity building and resources for local-, regional- and national-level stakeholders.
- Groups and individuals initiating change in the management process.
- Openness of participants to share and draw upon a plurality of knowledge systems and sources.
- A national and regional policy environment explicitly supportive of collaboration management efforts.

3. What are the desired outcomes? *Selected criteria from an example of specific initiative*

Process

- Multiple types of stakeholders involved (government, resource users, industry); diversity of interests represented.
- Development of a shared understanding; dialogue building consideration and appreciation; perspectives exchanged and modified via communication.
- Decisions are reached through dialogue; diverse inputs present in decision-making; equity and efficiency promoted; connections across multiple scales (local, regional, watershed, etc.).
- Multiple types of information accepted via multiple systems of knowledge (e.g. traditional ecological knowledge).
- Shared actions (experiments) are undertaken; modifications are made from an ongoing process of reflection (reflexivity).
- Responses are made to: routine errors (single-loop learning); responses are made to values and policies from which routines stem (double loop-learning); active questioning of the governing norms and protocol in which values and policies are embedded (triple-loop learning).

Outcomes

- *Tangible*: resource management plans; resolution of conflict and/or agreement regarding resource issue; codified statement of actions; agreement on sanctions; new or modified institutional arrangement(s) (formal and/or informal) – policies, strategies, organisation, etc.
- *Intangible*: enhanced legitimisation for policies and actions; greater adaptive capacity; social and human capital; creative ideas for solving problems; encouraged contemplation and questioning of routines, values and governance.

Table 3.4. Key findings: ACM-based criteria for coastal adaptation governance in Ireland and CLAD local adaptation process

ACM-based criteria and indicators for multi-level adaptation governance of Irish coastal zones

Six criteria and related qualitative indicators formed the analytical framework to analyse the existing situation in Irish coastal and climate governance as enabling/disabling an ACM approach. These criteria were derived from an extensive review of the literature evaluating institutions and practices for adaptive management, co-management and ACM (Noble 2000; Olsson et al. 2006; Plummer and Armitage 2007a,b; Armitage et al. 2009; Huitema et al. 2009; Plummer 2009; Brunner 2010; Brunner and Lynch 2010a,b), social-ecological system resilience (Moser 2008), and climate adaptation governance and coastal management (Adger et al. 2005b; McKenna et al. 2008; Tribbia and Moser 2008). Further, information elicited via stakeholder interviews (2010–2011) allowed the authors to clarify criteria and qualitative indicators and adjust them in line with the conditions of climate adaptation and coastal management in Ireland.

Following a baseline analysis of the existing institutions and conditions for coastal management and climate adaptation in Ireland, each group of criteria has been considered also as a focus area for capacity building. Thus, this analysis informed the design of the Tool Kit and subsequent policy recommendations for developing capacities for, and introducing elements of, ACM to multi-level governance of coastal climate adaptation in Ireland.

CLAD local adaptation process

The six-step CLAD local coastal adaptation cycle is based on theoretical studies and end-user requirements studied during the stakeholder interviews. Figure 3.4 illustrates the main

elements of the cycle, which form the basis of the CLAD guidelines for local adaptation and are described in more detail in Chapter 6.

Criteria characteristics	Indicators
<p>Problem framing</p> <p><i>Shared</i> <i>Reflective</i> <i>Area-based</i></p>	<ul style="list-style-type: none"> ○ Are the issues of climate change and need for adaptation perceived by stakeholders in a similar way? ○ Is climate adaptation perceived as a linear management process or are stakeholders aware of uncertainties and the need to address these using flexible management approaches? ○ Is there evidence that stakeholders clearly understand the effects that climate change could have on their local area and their future development?
<p>Decision-making</p> <p><i>Collaborative</i> <i>Field testing of the decisions</i> <i>Social learning</i></p>	<ul style="list-style-type: none"> ○ Is there evidence of present or past experience of stakeholder involvement in decision-making? ○ Is there evidence of radical changes/amendment of management decisions or practices based on the results of the previous initiatives?
<p>Policies and plans</p> <p><i>Cyclic process</i> <i>Integrative (interests, issues, sectors, level, time)</i></p>	<ul style="list-style-type: none"> ○ Are the current policies and plans related to coastal management and climate adaptation integrated to a rate that considers a sufficient range of interests, capacities/responsibilities at different levels (local, regional, national) and time horizons? ○ Do the existing planning and policy processes provide a mechanism for monitoring and iterative reconsideration (feedback) of the decisions taken? ○ Are the existing feedback loops that cover policy implementation, monitoring and amendments perceived as sufficient by stakeholders?
<p>Institutions (formal/informal)</p> <p><i>Participatory</i> <i>Flexible</i> <i>Legitimate</i></p>	<ul style="list-style-type: none"> ○ Do the existing (formal) institutions imply stakeholders' involvement and integration of stakeholders' views, and at what levels? Is there perceived need for more/less participatory involvement? ○ Do existing (formal) institutions integrate mechanisms for altering decisions and procedures (e.g. delegating tasks to other institutions/groups)? ○ Are the existing formal and informal institutions perceived as having capacities and legitimate right to take decisions on coastal management and climate adaptation?
<p>Scientific support</p> <p><i>Contextual</i> <i>Complex</i> <i>Comprehensive</i></p>	<ul style="list-style-type: none"> ○ Is scientific information available regarding the climate change, coastal management and socio-economic trends at the local, national and global levels? ○ Are stakeholders (including those not connected to academic institutions) aware of availability of scientific information and its potential use for decision-making? ○ Are there mechanisms in place to regularly collect and deliver diverse information about the system state and any expected changes (in short- and long-term perspectives)?
<p>Communication</p> <p><i>Vertical and horizontal flows</i> <i>Social networks,</i></p>	<ul style="list-style-type: none"> ○ Are there practices and (formal/informal) institutions in place to support vertical flow of the information between stakeholders at different levels (local, regional, national) and within organisations? ○ Are there practices in place to support horizontal flow of the information between stakeholders within the region?

Criteria characteristics	Indicators
<i>transparency</i>	<ul style="list-style-type: none"> ○ Are stakeholders aware of the possibilities and means of communication with the other groups? ○ Are robust social networks available and could these be used to support environmental agendas?

Table 3.5. ACM-based criteria and indicators for effective multi-level adaptation governance of Irish coastal zones.

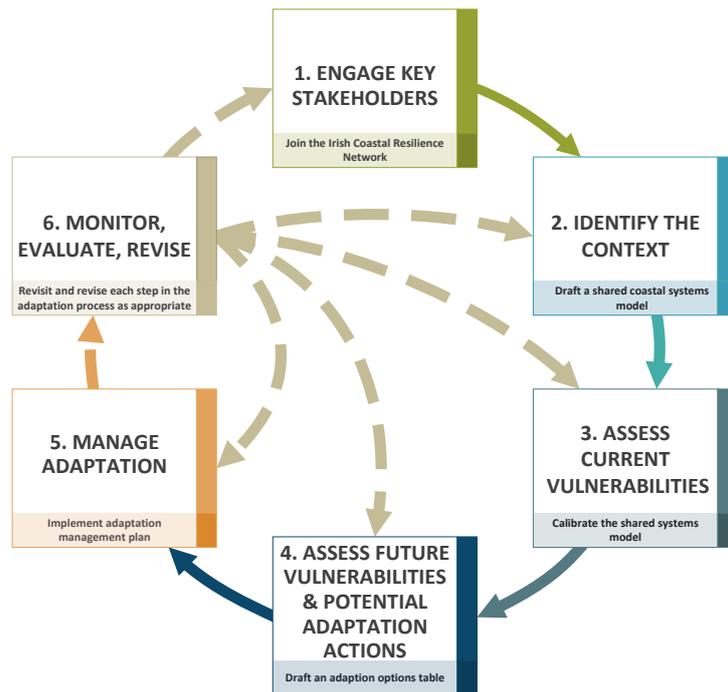


Figure 3.4. CLAD local coastal adaptation cycle.

4. CLAD case studies

This chapter describes the research methodologies and activities conducted at each of the CLAD coastal case-study sites. This work informed subsequent theoretical analysis, the development and testing of the CLAD Tool Kit, and formulation of policy recommendations. In particular, the objectives of the case study research were to:

- i. provide background information on current practices and future requirements for coastal climate adaptation in Ireland
- ii. provide information on the current barriers to, and opportunities for, the introduction of the principles of adaptive co-management for climate adaptation and coastal management in Ireland
- iii. test methodologies of participatory vulnerability assessment and participatory scenario analysis as tools that could facilitate the implementation of an ACM approach to coastal climate adaptation
- iv. ground the development and testing of the Tool Kit.

In addition, the case studies served as a platform for capacity building and training. Stakeholder groups involved in the scenario exercises formed the pilot units of the Irish Coastal Resilience Network (ICRN) – an informal institution aiming to support the participatory integration of climate adaptation into coastal management practices, employing an explicitly ACM-oriented approach.

4.1. Case selection and stakeholders

In order to ensure a balanced representation of the issues related to coastal climate adaptation in Ireland, three groups of criteria were designed for selection of the sites, as follows.

- *Physical geography and climate characteristics:* Natural environment; projected climate change impacts.
- *Socio-economic and institutional factors:* Socio-economic characteristics; awareness/experience of climate adaptation; resources available to effect adaptation; character of governance and division of responsibilities; participatory credentials; degree of conflict.
- *Capacities available:* Pre-existing knowledge and data; experimental capacity; links to other projects.

A series of meetings with senior research staff at the Coastal and Marine Research Centre were held to conduct a first-order screening of potential case-study sites. A selection of five viable locations representing a variety of climate change impacts, natural and economic environments, social structures and geographical locations was agreed, from which three were to be selected as primary case studies for the CLAD Project. These sites were Bantry Bay, Lough Swilly, Tralee Bay, Cork Harbour and Portrane (Fingal Coast). Of these, Bantry Bay, Tralee Bay and Portrane were selected as primary case-study sites, with Cork Harbour and Lough Swilly offering supporting research input (Figure 4.1).

Over the course of the project, a full research programme was implemented in Bantry Bay and Tralee Bay. In Portrane, following initial baseline interviews and the formation of a local coastal resilience group, two key individuals were reluctantly forced to withdraw from further participation in the project due to changes in personal circumstances. Unfortunately this meant that further participation in the vulnerability assessment and scenario-planning aspects of the research could not be accommodated. The site nevertheless provided

valuable information and has remained a secondary node in the research network despite being unable to contribute primary research material.

A number of activities in the primary and secondary sites were conducted in close cooperation with the INTERREG IVB, Northern Periphery Programme funded CoastAdapt Project (Tralee and Bantry) and INTERREG IVB, North West Europe Programme funded IMCORE Project (Lough Swilly and Cork Harbour). In collaboration, these three projects determined the five sites to be broadly representative of the range of coastal conditions encountered in Ireland, suggesting that any research findings could be legitimately extrapolated (within reason) to other areas. This coverage, and the involvement of stakeholders at different levels, maximised the value of each project's outputs and broadened the outreach potential of research findings.

The following broad stakeholder groupings were identified from desk research of the literature and participatory research experience on the part of the research team and partner projects. These groups provided the framework for an initial purposive survey design (Oliver 2012):

- local authorities (officers responsible for engineering, planning, piers and harbours, environment, water management, cultural heritage and biodiversity)
- national-level agencies (i.e. DECLG, EPA, National Parks & Wildlife Service (NPWS))
- community civic groups: area or issue-led groups, local leaders, political bodies and representatives, (e.g. Transition Towns, Sustain West Cork)
- port and harbour authorities
- biodiversity and conservation organisations (NPWS, others)
- cultural heritage organisations

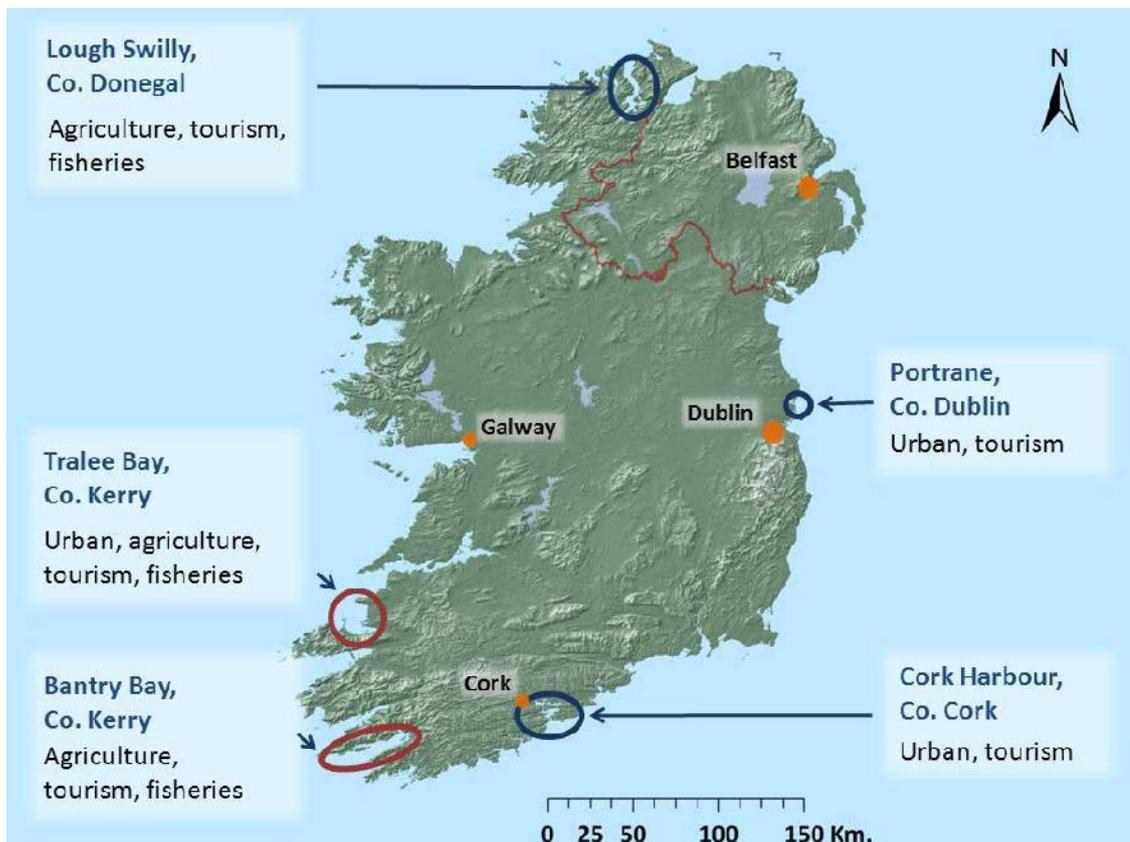


Figure 4.1. CLAD case studies: primary (red) and secondary (blue) sites.

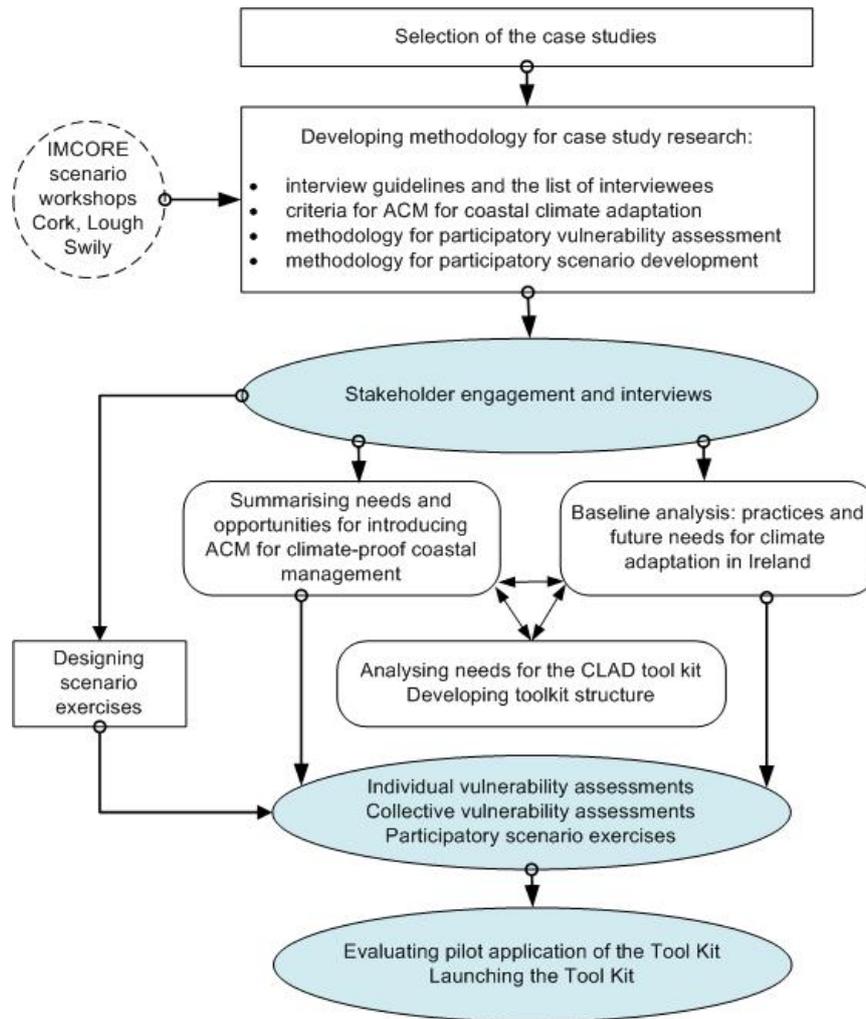


Figure 4.2 CLAD case studies research programme

- farming associations and individual actors
- fisheries/aquaculture associations and individual actors
- tourist operators
- business associations and actors
- research institutions
- education providers (schools and universities).

Further information regarding the identity of relevant stakeholders emerged during the course of the interview process, facilitating the use of ‘snowball’ sampling (Chromy 2012). The process of interviewing stakeholders was also instrumental in identifying local coastal experts and community leaders at each case-study site

to participate in subsequent vulnerability assessment and scenario work.

4.2. Methodology of the case-study research

The research programme conducted at each primary case study site is illustrated in Figure 4.2. The core activities involving local stakeholders included stakeholder interviews, a participatory vulnerability assessment and participation in scenario planning exercises. This aspect of the project was also utilised to evaluate the prototypical application of core elements of the Tool Kit.

Baseline stakeholder interviews

35 interviews were conducted in 2010–2011 with representatives of the main stakeholder groups in four case studies (Bantry Bay, Tralee Bay, Portrane and Cork Harbour), and stakeholders at the national level. The main purpose of the interviews was to:

- i. obtain baseline information on the current perception of climate change and the barriers and opportunities for planning and actions on coastal climate adaptation
- ii. ascertain the expectations and possibilities for changing management practices, including introducing elements of an ACM approach
- iii. identify whether there was a need for decision-making support and, if so, what elements it should contain – in particular end-user requests regarding the composition of the Tool Kit.

Each semi-structured interview lasted from 30 to 90 minutes and included five groups of questions (Annex 3). At the beginning of the interview each respondent completed a brief questionnaire reflecting their familiarity (on a Likert scale) with the topics of climate adaptation and coastal management, and their perception of the importance of key climate impacts such as sea level rise, temperature and precipitation changes and alterations in the frequency and intensity of storm activity. The questionnaires served to initiate discussion, and provided a degree of quantitative supporting material for the (mainly qualitative) interview findings. The quantitative data also provided a benchmark against which future changes in stakeholder perception might be measured.

The interview material was analysed using NVivo software. The interviews (transcripts and recordings) have been coded according to the

six groups of ACM benchmark criteria and related indicators (see Chapter 3); requirements related to the Tool Kit have been analysed separately. The resultant materials – quotations related to each criterion/indicator – underpinned the analysis of existing barriers and opportunities for coastal climate adaptation and ACM, and subsequent policy recommendations.

Vulnerability assessment and scenario workshops

To assess climate change vulnerability at the local level at each of the primary case-study sites, a participatory modelling methodology was employed. The methodology involved a number of steps and incorporated individual and group workshop activities (see the CLAD practitioner guideline document for a complete breakdown of work undertaken).

Initially, a group of five to eight stakeholders was identified at each site. This group was assembled from individuals (identified during the interview process) whose professional expertise and extensive local knowledge would provide an appropriate pool of information for the legitimate analysis of local climate change impacts. These individual stakeholders were invited to form a local coastal resilience group. Each group in turn has formed a node in a wider Irish Coastal Resilience Network (ICRN). During the completion of the local vulnerability assessment, the ICRN supported the more technically demanding aspects by providing local groups with access to national-level experts in climate change impacts, adaptation and coastal management.

Prior to convening local members to meet in plenary, the research team met with each member of the local coastal resilience group individually to explain the process of local scale vulnerability assessment that was to follow. As

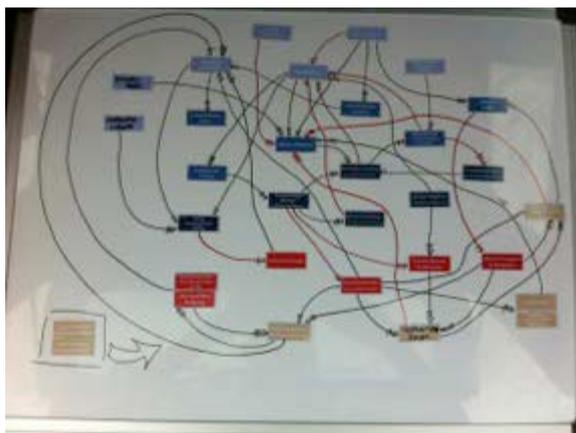


Figure 4.3. An individual's local-scale social-ecological system model.

part of this introductory meeting, individuals were given a demonstration of how to build a social-ecological systems model using a participatory modelling technique called fuzzy cognitive mapping (FCM). By selecting from various system elements (identified via prior interviews and an extensive literature review), and defining the nature and strength of the relationships between them, each stakeholder was given the opportunity to characterise the local coastal social-ecological system as he or she saw it, developing his/her own personal model of the coastal system (Figure 4.3).

At each case-study site, these individual models were collated into a single, draft *group model of the local coastal system*. This draft model was then presented to the group in plenary at a facilitated workshop (Figure 4.4). Stakeholders were invited to comment on this shared view of the system, and to come to an agreement regarding amendments to be made to the model. Amendments to the model were suggested and debated by the group, with the aim of increasing the accuracy of the model in representing the group's shared view of the coastal system. Once agreed, it was made clear that this group model would then be utilised as the basis for assessing current and future vulnerabilities.



Figure 4.4. Agreeing amendments to a group model of Bantry Bay.

At a second facilitated workshop, scenarios of climate and socioeconomic change were illustrated using the group model, giving stakeholders the opportunity to explore the impacts of climate change at the scale of their local coastal system. Using the group model, participants discussed and then agreed on a number of adaptation options, and assessed their efficacy in overcoming the climate vulnerabilities under a range of potential future scenarios.

Evaluating the pilot implementation of the Tool Kit

As part of the interview process and the various stakeholder workshops and meetings, the specific requirements of decision-support at the case-study sites were noted, and substantial effort was made to tailor the CLAD Tool Kit to these end-user requirements. Although the time span of the project does not allow the conduct of an in-depth, evidence-based evaluation of the Tool Kit, internal feedback and stakeholder evaluation were obtained during the series of workshops, through follow-up questionnaires and one-to-one conversations (Annex 4).

4.3. Description of the case-study sites

Table 4.1 provides a description of the primary and secondary sites in line with the criteria

applied during case-study selection: physical geography, socio-economic factors and capacities available. Annex 2 contains the collective models of the coastal social-ecological systems and vulnerabilities to climate change in the primary case studies Tralee Bay and Bantry Bay. These shared system views were developed over a series of one-on-one interviews and stakeholder workshops during 2011/12.

Table 4.1.
Descriptions of
CLAD primary (*)
and secondary
case studies.

		TRALEE BAY*	BANTRY BAY*	PORTRANE	CORK HARBOUR	LOUGH SWILLY
						
PHYSICAL GEOGRAPHY	Natural environment	<ul style="list-style-type: none"> ○ SW Ireland (KERRY) ○ Meso-tidal (2–4 m tidal range) bay/headland ○ High wave energy ○ Ria coast ○ Mudflats and wetlands 	<ul style="list-style-type: none"> ○ SW Ireland (WEST CORK) ○ Broad meso-tidal inlet ○ Blanket bogs and cliff habitats ○ High wave energy ○ Ria coast 	<ul style="list-style-type: none"> ○ E Ireland (DUBLIN) ○ Open meso-tidal headland ○ Soft sedimentary beaches ○ Low wave energy ○ Crenellate coast 	<ul style="list-style-type: none"> ○ SE Ireland (EAST CORK) ○ Meso-tidal estuary ○ Deep-water harbour, protected bird habitats/wetlands ○ Medium wave energy ○ Fringing barrier coast 	<ul style="list-style-type: none"> ○ NW Ireland (DONEGAL) ○ Narrow meso-tidal inlet ○ Med wave energy ○ Fjord-type coast
	Projected CC impacts	<ul style="list-style-type: none"> ○ Increased risk of winter flooding ○ Increased risk of drought ○ Increase in max. height of storm surges ○ Potential increase in rates of coastal erosion ○ Increased risk of coastal inundation ○ Biogeographical migration of commercially/culturally valued marine species ○ Increased risk of spread of invasive species 	<ul style="list-style-type: none"> ○ Increased risk of winter flooding ○ Increased risk of drought ○ Increase in max. height of storm surges ○ Increased risk of coastal inundation ○ Biogeographical migration of commercially/culturally valued marine species ○ Increased risk of spread of invasive species 	<ul style="list-style-type: none"> ○ Increased risk of winter flooding ○ Increased risk of drought ○ Limited storm surges ○ Potential increase in rates of coastal erosion ○ Increased risk of coastal inundation ○ Biogeographical migration of commercially/culturally valued marine species ○ Increased risk of spread of invasive species 	<ul style="list-style-type: none"> ○ Increased risk of winter flooding ○ Increased risk of drought ○ Potential increase in rates of coastal erosion ○ Increased risk of coastal inundation ○ Biogeographical migration of commercially/culturally valued marine species ○ Increased risk of spread of invasive species 	<ul style="list-style-type: none"> ○ Increased risk of winter flooding ○ Increase in max. height of storm surges ○ Potential increase in rates of coastal erosion ○ Biogeographical migration of commercially/culturally valued marine species ○ Increased risk of spread of invasive species

		TRALEE BAY*	BANTRY BAY*	PORTRANE	CORK HARBOUR	LOUGH SWILLY
SOCIO-ECONOMIC & INSTITUTIONS	Socio-economic characteristics	<ul style="list-style-type: none"> ○ Mixed urban/rural ○ Agricultural ○ Fisheries and tourism key contributors to local economy ○ Ethnic homogeneity ○ Low pop. density ○ Port of Fenit key economic resource ○ Relatively economically undeveloped; local knowledge and informational resources unknown ○ Small-scale tourism ventures increasing in number and contribution to local economy/employment 	<ul style="list-style-type: none"> ○ Rural ○ Agricultural ○ Some nationally significant infrastructural development (oil) ○ Aquaculture and fisheries remain important ○ Ethnic homogeneity ○ Low pop. density 	<ul style="list-style-type: none"> ○ Mixed peri-urban/rural ○ Intensive coastal development ○ Dormitory town for Dublin city ○ Horticulture and fisheries key sectors ○ Med. pop. density ○ Relative economic strength ○ Within commutable distance of employment opportunities of Dublin 	<ul style="list-style-type: none"> ○ Urban ○ Industrial ○ Relatively intensive development ○ Significant industrial presence ○ Significant migrant population ○ Mixed pop. density from high in urban area to low at harbour entrance 	<ul style="list-style-type: none"> ○ Rural ○ Agricultural ○ Textiles and fisheries/aquaculture key employers ○ Relatively high unemployment and low tertiary education completion rates ○ Ethnic homogeneity ○ Low pop. density ○ Financial position perhaps weaker than in urban areas
	Awareness and/or experience of climate adaptation/participatory governance	<ul style="list-style-type: none"> ○ Kerry Council is financially constrained but takes reactive adaptation actions where possible ○ A public meeting on the issue was well attended and positively received (2010) 	<ul style="list-style-type: none"> ○ ICZM experience is high, so methods of conflict resolution and participation in coastal decision-making are relatively well understood ○ The above remains to be tested in an adaptation 	<ul style="list-style-type: none"> ○ Fingal Council is reasonably proactive in publicising issues of coastal conservation, among which climate change impacts feature ○ Prior CMRC projects have involved substantial 	<ul style="list-style-type: none"> ○ EU COREPOINT and IMCORE projects have identified issues among stakeholders ○ Previous adaptation research has raised questions of admin. organisation in Cork 	<ul style="list-style-type: none"> ○ EU IMCORE project presence, University of Ulster, has raised issue with stakeholders. There is not a constituency of high-level stakeholders engaging with the subject ○ Inishowen Development

	TRALEE BAY*	BANTRY BAY*	PORTRANE	CORK HARBOUR	LOUGH SWILLY
	<ul style="list-style-type: none"> o Planning issues and the imposition of nature protection (special areas of conservation – SACs) have been locally contentious; consultation rather than participation is the norm 	<ul style="list-style-type: none"> context o Bantry Bay Charter in place since 2001 (consensus-driven form of stakeholder participation under ICZM) 	<ul style="list-style-type: none"> stakeholder consultation o Established community ‘champion’ in place as biodiversity officer 	<ul style="list-style-type: none"> County Council (CCC) and other local bodies with a view to changing approaches o COREPOINT ICZM strategy o IMCORE ECN o Cork Harbour Management Focus Group 	<ul style="list-style-type: none"> Partnership o IMCORE project stakeholder events
Key actors and institutions	<ul style="list-style-type: none"> o LOCAL AUTHORITY: Kerry County Council o Financially constrained, to some extent limited in capacity/local mandate to maintain expenditure on ‘environmental’ issues 	<ul style="list-style-type: none"> o LOCAL AUTHORITY Cork County Council o Fisheries sector historically dominant, though in decline o Aquaculture and tourism increasingly influential 	<ul style="list-style-type: none"> o LOCAL AUTHORITY Fingal County Council (FCC) o Plurality of influences and interests o Cooperation of some sections of FCC with small community groups long-standing 	<ul style="list-style-type: none"> o LOCAL AUTHORITIES: CCC & Cork County Council o Plurality of influences and interests 	<ul style="list-style-type: none"> o LOCAL AUTHORITY: Donegal County Council o Complex and challenging political history o Local experiences/sensitivities result in a political culture substantially different from that found in other counties

		TRALEE BAY*	BANTRY BAY*	PORTRANE	CORK HARBOUR	LOUGH SWILLY
CAPACITIES AVAILABLE	Pre-existing research/data/networks	<ul style="list-style-type: none"> ○ UCC/CMRC made preliminary investigations: coastal erosion; impacts of floods ○ Strong relation to research institutions (CMRC) ○ Links to projects: EU NPP CoastAdapt 	<ul style="list-style-type: none"> ○ Ex-ICZM demonstration site ○ Strong relation to research institutions (UCC, CMRC) ○ Coastal GIS created, now outdated ○ Links to projects: Much prior project work, though little ongoing 	<ul style="list-style-type: none"> ○ Relation to research institutions: recent coastal management/dune protection project ○ Links to projects: CoCoNET Project (completed), Living Coasts/Living Seas ○ Strong informational support through Fingal County Council 	<ul style="list-style-type: none"> ○ Strong relation to research institutions (UCC, CMRC) ○ Harbour Management Focus Group activities influential ○ Links to the projects: EU IMCORE; many projects ○ Well-established institutions of stakeholder communication (i.e. COREPOINT; CHFG; IMCORE ECN) ○ Data lacking on economic and to some degree physical characteristics under way/complete 	<ul style="list-style-type: none"> ○ Relation to research institutions (University of Ulster, UCC) ○ Links to projects: Case study for EU IMCORE project ○ University of Ulster provides an ECN for local adaptation expertise

5. Existing conditions pertaining to ACM implementation in Irish coastal climate adaptation

The material garnered from stakeholder interviews was analysed against ACM criteria (i.e. benchmark requirements for introducing ACM for coastal climate adaptation), which reflect the need for, and preparedness of, Irish coastal stakeholders to introduce novel management methods, in particular ACM. These interviews ascertained the stakeholders' understanding of existing decision-making processes, institutions and their ability to facilitate new management approaches as well as capacities required at different management levels (national, regional/county, local). The semi-structured interview approach adopted (Chapter 4, Annex 3) fostered open discussions and did not allow for statistical analysis of the opinions provided. Instead, analysis of stakeholders' views reflected the most commonly held viewpoints and concerns regarding climate change and the present challenges for coastal climate adaptation in Ireland. The issues identified and statements made are supported by anonymous quotations reflecting the views at different management levels, i.e. *LC* – representatives of local communities, including groups, individuals, businesses; *LA* – local authorities, the officers for engineering, planning, environment, biodiversity, and heritage; *NA* – national agencies including Government Departments, e.g. Environment, Community and Local Government (DECLG), and state agencies – EPA and NPWS. These three generalised groups were identified based on more specific stakeholder groups, as described in Chapter 4. The respondents were requested to provide their personal opinion based on their past and present professional experience. As a result,

the views expressed by respondents should not be considered the official positions of the agencies they represent.

This chapter presents the results of the interview analysis and outlines the existing situation (e.g. requirements for climate adaptation and preconditions for ACM implementation) as seen by interviewees only. The research team, where possible, restrained its input in formulating the main messages for each indicator/criterion and summarising key findings in the concluding section of the chapter.

5.1. Problem framing (shared, reflective, area-based)

Are the issues of climate change and need for adaptation perceived by stakeholders in a similar way?

The interview data clearly demonstrate that there is a general awareness of climate change among all stakeholder groups. However, the understanding of the mechanisms of cause and effect of climate change, in particular the links between global processes and the expression of local impacts for Irish coastal communities, varied significantly. Unsurprisingly, these perceptions influence attitudes regarding the urgency of actions and need to adapt.

Recent events (floods in Cork, Dublin and several other coastal areas in 2009–2012, drop in winter temperatures and snow storms in 2010–2011) had a notable impact on the perception of weather-related risks and served as evidence to a number of respondents of the necessity for adaptation. For others, examples provided during the interview made it possible to connect the terms 'climate change' and 'climate adaptation' to the local situation. In conjunction with recent extreme events, the perception of a gradual alteration in

weather patterns (e.g. referring to the living memory covering periods of 30–50 years) was cited as evidence of changing conditions. The majority of the respondents provided clear examples of both risks and opportunities associated with changing climate based on their personal and professional experience, as well as information received through the media.

The impacts of climate change mentioned by the interviewees included: observed changes in seasons (e.g. wetter summers, warmer winters, increased precipitation), flooding, increased storm activity, increase of sea water temperature, changes in fish stocks (e.g. abundance, migration, species).

With respect to ecosystem change, respondents cited immediate effects (e.g. caused by dune loss) and long-term changes such as shifts in the acidity and chemical composition of the ocean, availability and quality of fresh water, and coastal erosion resulting in observed damage to infrastructure at land and sea. Those living in low-lying areas and coasts characterised by soft sediment were mentioned among the societal groups most vulnerable to climate impacts. Economic impacts and repetitive disastrous events were cited as possible triggers of migration from affected areas. The potential benefits of climate change were considered to include increasing possibilities for the tourism sector (higher air and water temperature, stronger winds for surfing and sailing, changes of tourist flows from southern regions of Europe), increasing development of the renewable energy sector and biofuel production, and increasing population due to an influx of climate refugees from other regions of Europe. Among the groups to potentially benefit, consultancies carrying out environmental impact assessments and advising on the strategies for adaptation were identified.

Respondents at various levels of governance acknowledged that successfully minimising the risks and taking advantage of the opportunities presented by climate change will depend on the ability of society to adapt: *'the consequences are huge but maybe if we manage correctly, we can do quite well ...'* (NA), *'the people who benefit are those that are first to adapt'* (LC). The majority also agreed that planned strategic adaptation is necessary, although it was unclear how such adaptation would be organised: *'We do need planning approach for low-lying areas and we have started to impose restriction. For me, it is climate adaptation, but I don't see it happening much'* (NA), *'I won't say we pay climate change lip service but we really don't know what to do about it ... It needs someone to coordinate all this material and tie it together'* (LA). Conversely, some of the interviewees (mostly at the local level) took the position that observed changes are attributable to natural cycles and that the human contribution to global climate change, and thus the necessity for planned adaptation, has been overstated. According to these respondents, adaptation will happen naturally on an individual level: *'I suppose we have to wait and see what's happening, but people seem to be resilient and adaptable'* (LC). Historical experience of adaptation by farmers and fisherman to changing natural conditions were highlighted as examples of naturally occurring adaptation by some respondents. The lack of finance and economic priorities in other areas were mentioned as the main barriers to initiating adaptation planning and actions. In particular, this was a concern reported with respect to long-term planning and investments in strategic adaptation initiatives.

Is climate adaptation perceived as a linear management process or are stakeholders aware of uncertainties and the need to address these using flexible management approaches?

It was evident that, at present, management of weather-related risks and conditions associated with climate change mostly occurs in a retrospective and reactive manner. Examples of this approach are obvious in flood prevention efforts, protecting property and infrastructure against coastal erosion and sea level rise, and minimising the effects of snow storms. Traditional linear management based on environmental impact assessments within 5-year local development plans, and engineering solutions (rock armouring of the coasts, constructing flood barrages and dikes, etc.) are in most cases viewed as the most realistic options: *'The most immediate action is rock armouring and supporting renewable energy'* (NA). Nevertheless, there is a growing recognition that the existing procedures of short-term local planning and fragmented coastal governance fail to deliver the management necessary for dealing with the long-term and flexible goals of climate adaptation: *'They're going to come up with an engineering solution for Skibbereen but if they get the money to build it I would be amazed'* (LC). Alternative strategic approaches are necessary: *'[Actions for adaptation] need to be pulled more together ... I think we need to be planning'* (LA). Several respondents acknowledged that previous mistakes in planning (especially extensive construction at the coast line) contributed to the present vulnerability of coastal ecosystems and communities. However, more strategically oriented planning measures are typically unpopular due to a lack of immediate effect, the interests of private property ownership and development, and the prolonged timescale of return on investment.

Many of the respondents showed a general understanding of the uncertainties related to climate change: *'the problem with climate change is that it can be gradual and catastrophic. It can go both ways'* (LC), and possible 'cascade effects: *'It's like when a wall starts to fall down – it all falls down fairly rapidly afterwards because it is weak then'*

(LA). At the same time, the notion of 'uncertainty management' as dealing with uncertainty in a systematic way is for the most part absent. As noted by a respondent at local level *'it will always be short term because that's how the State deals with these things here'* (LC). Nevertheless, at the higher management levels the recognition is growing that introducing uncertainty management is necessary: *'We should realise it will never be certain and it does not mean they [local authorities] can wait when the information will be there, it is conditions where they will need to make their planning'* (NA).

Is there evidence that stakeholders clearly understand the effect climate change could have on their local area and their future development?

Respondents at different levels note that current communication on climate change presents it as a global problem 'from TV' rather than a local issue to be addressed at the level of community planning and action. Communication about local effects is seen as vital for increasing awareness and making climate adaptation a political and investment priority. The lack of localised information tailored to the needs of the public is also noted (see Section 5.5).

Nevertheless, a significant number of the respondents were able to clearly articulate potential effects on their communities and the risks associated with changes in weather/climatic conditions (e.g. possible intensification of erosion due to increased storm activity, potential impacts of rising temperature on agriculture and fisheries). Several respondents noted that measures should be taken in an integrated manner, optimising the interaction of different sectors of the economy in achieving sustainable coastal management outcomes. The importance of a local perspective is also recognised at the national level: *'at the local level, the level of detail is too high for someone from Dublin to understand'* (NA). However, for the

majority of the respondents it is unclear whether and how such complex management can be organised in the existing system of decision-making (see Sections 5.2, 5.3).

Problem framing: Irish stakeholders at different levels of coastal governance have a general understanding of the importance of climate adaptation (though not necessarily understood in such terms), and are concerned by the uncertainties and complexities associated with climate change. However, there is a need to systematically communicate the causes and effects of climate change as well as its *local impacts* in order to bring stakeholders' perceptions to the level of *shared understanding* and *reflective decision-making*. There is also a general recognition of the necessity of integral planning (e.g. mainstreaming adaptation into planning and information systems at different levels) although little clarity exists on how such integration can be achieved.

5.2 Decision-making (collaborative, field testing of decisions, social learning)

Is there evidence of present or past experience of stakeholders' involvement in decision-making?

The necessity for participatory involvement in environmental and coastal management (including coastal climate adaptation) is recognised by respondents at different levels. Their rationales for participation include:

- Legal requirements (EU and national): *'if you don't have legislation [for participation] in Ireland, nothing happens. This is a cultural thing'* (NA).
- Democratic procedures: *'the only people that get to decide are the people who live in this area'* (LG), which, however, may lead to formalised participation: *'usually at this stage*

[final stage of planning] you know what the issues are and you don't need this message again, but we live in democracy and it is essential to know people's opinion' (NA).

- Making informed decisions: *'[people] need an opportunity to find out about it, learn about it and then make an informed decision'* (LG).
- Practical implementation: *'to get it implemented properly, you would need a local connection'* (NA).

Opinions regarding the traditions and motives for participation vary. Respondents at different management levels stated that Irish society has a strong culture of personal networking and relying on personal/family/community contacts for communication and support; nevertheless 'organised' networking and traditions of official participatory decision-making remain weak: *'Ireland has good informal processes, individuals contact individuals. But at the official level it is not very good'* (NA).

Bottom-up initiatives addressing the issues of coastal management and environmental governance are not unprecedented. A number of respondents were aware of, or represented, locally based and national groups operating on a self-organised and self-sustaining basis. Several groups were organised around specific problems (local dune restoration, seafood safety, harbour management, Transition Towns groups, etc.). Consultation on local area plans, organised by County Councils, is cited as one of the most typical forms of participation. The experience of organising broader forums (e.g. on general issues of coastal management involving a wide range of stakeholders) shows that in the absence of official support these initiatives face difficulties in sustaining their activities. People may find discussions useful and the experience of participation satisfying, but the lack of direct practical interests and experience of self-organisation prevents them from active

involvement. *'You have to find issues which will bring people together. Climate change is important but not immediate'* (NA).

A lack of organised structures and of a legal basis for participation are seen as important barriers: *'Participation is very sporadic. There is no route through which people can participate'* (NA); *'local people would cooperate ... but they need a bit of direction. The direction seems to be lacking'* (LG). Other obstacles include a lack of experience, finance and information which often results in a poor response to official participatory initiatives. Those seeking to utilise the outputs of participatory processes also note that broadly targeted participatory events often fail to accurately represent mainstream stakeholder views: *'Public consultation processes are not very satisfactory; the response is poor enough too ... you seldom get the silent majority in the middle and they are the people who you are hoping will develop the place'* (LA).

Nevertheless, positive experiences and realistic expectations regarding potential outcomes spur further interest in participatory initiatives at the local scale: *'some can turn out very good and others very bad. It really depends on the commitment of the groups to do it right'* (LA). A majority of respondents agreed that climate adaptation would potentially benefit from participatory processes. However, new initiatives should draw on the experience of the existing structures, including participation for the implementation of the WFD, issue-based groups and international examples: *'People need to be given examples; the WFD can be used as an example. Capacities also have to be developed. Participation is a skill that not many people have'* (NA).

Is there evidence of radical change/amendment of management decisions or practices based on the results of the previous initiatives?

Regular updating of the local development plans (every 5 years) by County Councils serves as the main instrument for the revision of planning and management decisions at the local level. The guidelines and procedures for development of local plans are regulated at the national level. The most recent examples of amendments include introduction of flood risk assessment as part of local planning. The current absence of guidance on climate adaptation is perceived by local administrations as a critical barrier to action.

Local authorities learn to adapt their daily management and practices in reaction to changing conditions and disastrous events – e.g. by introducing by-laws and measures for beach protection and coastal erosion, training personnel and establishing procedures for preventing ice on roads, and changing the type of road cover to tolerate higher air temperatures. At the community level, ad-hoc groups have been mentioned in several locations as having responsibility for dune restoration, mitigating coastal erosion, minimising the effects of snow falls, protecting vulnerable community members, etc. These practices will continue if severe weather conditions recur: *'we are learning, and we are learning because of the greater intensity and frequency of these issues. Something has happened over the last 10, 15, 20 years to cause this to be a big problem for us'* (LA). Learning to adapt at the individual level also involves reaction to weather conditions: *'after another cold winter we insulated the attic and bought a dryer. We heard it from other people. This is the way other people here did as well'* (LC), and longer trends: *'I keep records myself of where I get fish and at what time of the year'* (LC).

At the same time, learning and reflectively changing practices is seen as an issue affected by

administrative inertia and political interests: *'when you see the de-zoning process you wonder have the politicians learned anything at all'* (LC). In several cases, respondents considered prior practices to have been replaced by less effective ones: *'the farmers will refer to that [current management of the waterways] as the major deficiency and neglect ... Back in the 50s and 60s we were better at doing that'* (LA). On the level of individual adaptation, sporadic uncoordinated action can be less effective and can result in adverse effects such as increasing use of electricity for heating.

Decision-making for climate adaptation among Irish coastal communities may benefit by drawing upon emerging experiences of *collaboration* and *participation*. However, stakeholder involvement in participatory initiatives requires support from official procedures (legal requirements and guidelines) and capacity-enhancing measures and programmes (information, institutions, experience). Existing 'linear', top-down forms of decision-making do not facilitate *field testing of decisions*; however, examples of learning and adjusting decisions to changing conditions provide grounds for confidence that new approaches, including adaptive management, may be well received. *Learning* at administrative and individual levels is taking place mostly as a reaction to impacts, and would benefit from a more systematic approach and the coordination and collaboration of key actors across and between administrative hierarchies.

5.3. Policies and plans (cyclic processes, integration of interests, issues, sectors, levels and time scales)

Are the current policies and plans related to coastal management and climate adaptation integrated to an extent that considers a sufficient range of interests, capacities/responsibilities at

different levels (local, regional, national) and time horizons?

Climate adaptation within coastal areas is addressed by a range of policy and planning documents, the complexity and functions of which are mentioned by respondents at different management levels. Area plans composed by County Councils and aiming to integrate aspects of local development were cited among the most influential planning documents with primary relevance to climate adaptation planning. Strategic planning also takes place at the level of sectors, in business, infrastructure provision and environmental stewardship. The ongoing fragmentation of policies and plans, the absence of an integrated approach to coastal management, and a lack of legal grounds for climate adaptation are seen by stakeholders as obstacles for strategic adaptation planning: *'One thing about coastal governance is it does not exist. There is no home for coastal governance in the Government. In the last 10 years Government separated elements of coastal governance – transport, environment, etc.'* (NA). *[For climate adaptation] we will go along with whatever the national policy is. I certainly don't wake up in the morning and say 'Climate change is here'* (LA).

Respondents expressed concerns regarding the current lack of integration between:

- *sectors (horizontal integration): 'As long as we don't have regulations [for coastal governance] in place, the sectors will be competing for resources'* (NA)
- *management priorities and levels of governance (vertical integration): 'There is a different standard of maintenance going on between the national roads and the regional roads, which, again, causes huge problems because people live on regional roads'* (LC). *'You have to have one law for everyone, regardless of they are a big company or a small man'* (LC).

- *Time scale of planning: 'I would have to say that it may be necessary for it to be long term, but that's not the reality' (LC).*

Recent experience of introducing environmental assessments into official planning procedures (e.g. flood risk assessment) has fostered an understanding of the necessity for policy integration: *'The advantage for a local authority is that those guidelines [flood risk management] are national guidelines which we are obliged to implement.'* (LA). *'There was a time when you dealt with waste separately and somebody else dealt with energy and transport, and now climate change is almost an umbrella, a term, for lots of environmental problems'* (LA).

The forthcoming Climate Change Bill is expected to provide a legal basis for climate policy: *'Unless there is a Bill or some coordinating body to make things happen I cannot see them happening'* (NA); however, the time frames and conditions for adopting the new legislation are uncertain. The recently published NCCAF provides an overarching adaptation planning document for sectors and local authority regions: *'Each department will be responsible for creating its own adaptation plan in conjunction with mitigation'* (NA). *'We know that [local authorities] are short of staff, but [the NCCAF tells you] – you have to do this'* (NA).

Therefore, the respondents link the effectiveness of adaptation actions to the quality of individual, sectoral and regional responses and their ability to address complexity, uncertainty and different time horizons: *'It is [sectors] who will be looking at impacts. We are not going to interfere'* (NA). *'LA are important because they are making plans and nothing will happen without them'* (NA). Alternatively, effective adaptation will depend on the ability of the higher national agencies (e.g. DECLG) to guide, coordinate and control these efforts: *'We hope vulnerability assessment will give us an idea of how to prioritise what we are going to do ... I don't*

think we should go with one sector, we should do them together' (NA). *'It needs someone to coordinate all this material and tie it together'* (LA). The need for a coordinated but flexible approach supported by general guidance was recognised across management levels: *'It is hard to manage local authorities; we feel there is a need for guidance or a template for what they will be doing.'* (NA); yet strategies for such coordination are yet to be forthcoming: *'We haven't decided if it should be part of a local plan or regional plan'* (NA), *'Somebody needs to give LA power to ensure that plans are made and decisions incorporated'* (NA).

Do existing planning and policy processes provide a mechanism for monitoring and iterative reconsideration (feedback) of decisions taken?

Updating and revision of local and county development plans is considered as the main instrument for the reconsideration and updating of planning decisions: *'Every local authority is under the same obligation to bring up a planning document every 5 years and review it. We are supposed to start the review process after 3 years and every year to do a report on the objectives of the plan ... We don't have any longer term guiding document. We certainly have Area Action Plans for smaller areas ... and they don't have any statutory time periods ...it stays there until the area is developed'* (LA). The review process is supported by risk assessments conducted by local authorities or contracted to professional consultancies. Public consultation organised by local authorities takes place during the preparation of local development plans; however, uptake of the recommendations may vary depending on the local situation and organisation of the participatory process.

Are existing feedback loops that cover policy implementation, monitoring and amendments perceived as sufficient by stakeholders?

The interview data reflect significant limitations of existing feedback mechanisms for planning and

policy implementation. The main concerns expressed by stakeholders are:

- current ad-hoc, reactive planning – *‘Ireland is not great to do a sequence of things such as making plans for the long term and then implementing it. We do it when we have to do it’ (NA). ‘It needs to be pulled more together. Unless there is a threat of flooding, they do not want to spend the money on preventive measures’ (LA). ‘I don’t think the structure has changed because the regime as it is tends to react to whatever is the most important thing, in case we will get fined from the EU’ (LC).*
- lack of efficient coordination and division of responsibilities between administrative levels (e.g. national and local) – *‘Government is supposed to do strategic planning of the water but they do not do it. It means that some local towns do plan in the absence of national plan. It is bad way to do it’ (NA). ‘It should be governmental departments setting up indicators ... Also adaptation should be at the local level, because LAs are responsible for planning’ (NA).*

The respondents mention the necessity to improve feedback processes through participatory processes and more effective institutional structures.

Policies and plans regulating coastal zone management and climate adaptation in Ireland involve a wide range of initiatives including sectoral strategies and regional development plans. Policy fragmentation and the absence of legal grounds and *integrative* approaches to coastal management and climate adaptation create obstacles for strategic adaptation planning. Existing feedback processes allow regular revision of policies and actions; however, they are unable to facilitate constant *cyclic monitoring and revision* of decisions across management levels and for different periods of time (e.g. longer or shorter than those addressed by official planning procedures).

5.4. Institutions (participatory, flexible, legitimate)

Do existing (formal) institutions facilitate stakeholder involvement and the integration of stakeholders’ views, and if so, at what levels? Is there a perceived need for more/less participatory involvement?

The existing institutional hierarchy of Irish coastal and climate governance formally considers integration of stakeholder views at national and local levels. At the national level, the DECLG aims to integrate sectoral views: *‘The Department can connect the sectors, overlook and coordinate research, arrange meetings. They know the door is open here’ (NA).* At the local level, communities provide their input through their local administrations (Town and County Councils): *‘We [local group] cooperate with, say, Kerry County Council ... We would link with the national level to a lesser extent because the county structures would be our first port of call’ (LC).* Alongside these official structures, the EPA collects and integrates stakeholder views at different levels through its related research projects (e.g. via the Climate Research Programme), as part of implementation and monitoring of national and EU legislation (e.g. WFD, Biodiversity Directive) and supporting cooperation within professional and issue-based platforms (e.g. Association of County and City Councils, fisheries organisations).

Notwithstanding some positive experience of local involvement in decision-making institutions at the upper management levels – *‘all the county committees that deal with anything we do we would be part of’ (LC)* – there is strong criticism regarding the effectiveness of existing institutions, including (ineffective) connections between management levels: *‘At the national level they are just not interested. If you go local, they have more interest in their local community’ (LC).* *‘Within the*

county councils, agencies, the government, the EPA, it is very hard for the public to get a handle on it [decision-making process]' (LC).

Creating integrated management structures for climate adaptation is necessary for coordinating the efforts of different groups: *'It shouldn't be just one group, it should be cooperative. Local authorities – it's fair enough. It should also be various departments ... the IFA [Irish Farmers' Association] ... landowners, farmers ... It would have to be an inclusive umbrella of people'* (LA). *'When writing a Climate Bill it should be communicated that it is fantastic idea to have a small coordinating group on top, but it should go down to small groups. You need both'* (NA). Although such institutions would integrate efforts across governance levels, respondents expected the national agencies to take a lead and responsibility: *'We would see an Expert Advisory Body as a part of Climate Bill, an independent body at the national level, with representatives of business etc. They will be able to take decisions about contracting research and other actions'* (NA). *'Ideally somebody like the EPA [should take a lead on] bringing sectors together, but also experts and top-ranked people to make things happen. Some groups working down to the level of the LAs'* (NA).

Do existing (formal) institutions integrate mechanisms for altering decisions and procedures (e.g. delegating tasks to other institutions/groups)?

Methods for revising and correcting decisions within the existing institutional system, as well as delegating tasks and sharing responsibilities, are based on standard procedures and practices of decision-making and participation. The concerns expressed by stakeholders regarding the efficiency of existing institutions at different governance levels include the following.

- Regular organisational reconfiguration within civil and political structures does not facilitate continuity of planning and consistency of management approach, though changes in the Government may provide windows of opportunity for policy and institutional changes: *'The turnover at the Government is 5 years. The parties may have said in the beginning that something needs to be done, and in the middle of the government term it can be developed and revised'* (NA).
- Inefficiency of bureaucratic structures and the continuous turnover of personnel do not support the effective communication required for continuous monitoring and altering decisions: *'The offices in the Government do not respond quickly. They have done a lot of personnel changes – they're replacing people all the time'* (LC).
- Fragmented institutions are unable to support communication and information supply: *'It's the fact that with so many organisations involved, there is no one place you can go and clarify anything. That's failing of a lot of areas, not just climate change'* (LA).
- The lack of an integrated approach, methods and guidelines may prevent action: *'There is no point for one [place] heading down one path and another place another path. Maybe we should all be adapting with a similar method'* (LA). The NCCAF aims to provide such guidance; however, the format and provision of guidelines on how to go about the process of adaptation remain to be clarified: *'We will provide general guidelines, what should work and what should not'* (NA). *'I don't think we came to a conclusion what is the best way to do it on the regional level'* (NA).
- The necessity to develop indicators and a system for progress monitoring and reporting: *'[LAs] would be put into such a basis that they would review indicators every 5–10 years. Once the White Paper will move forward in*

2012, there will be eventually necessity for reporting' (NA).

A solution suggested by several respondents at the regional/county and national levels for improving the effectiveness of the institutional structures implies creating an official coordinating body for climate adaptation and developing a system of indicators to support planning: *'Ideally, if the Bill goes ahead we would see the expert advisory body providing advice on sectoral plans'* (NA).

Are existing formal and informal institutions perceived as having capacity and legitimate right to take decisions on coastal management and climate adaptation?

The majority of the interviewees see the existing administrative hierarchy as a legitimate source of power and decision-making, although the operation and organisation of official structures is a frequent target of criticism. At the national level, the EU represents an important driving force: *'National processes on adaptation started before EU regulation, but when the EU legislation came out that was very helpful and forcing all the issues'* (NA). For local administrations, DECLG often serves as the primary source of guidance: *'We take our guidance through the Department of Environment who are our bosses ... There is no point [for a town council] to come up with some measure on its own'* (LA). At the lower levels, local authorities operate as a *'first port of call'* (LC) for the communities.

Trust between stakeholders and institutions is perceived as an important issue of communication and cooperation. Although the existing official institutions are seen as the primary source of decision-making power, their capacity for equal and balanced representation of the interests of all stakeholder groups was called into question by interviewees. The national agencies are often seen

as pursuing political agendas in implementing policies and submitting information: *'I don't think the Department of Environment can communicate the message to farmers. They don't trust us. They trust the IFA ... Business organisations are more pragmatic; they would take what we say and look at it'* (NA). At the lower levels cooperation between the communities and administrations can be undermined by local political interests: *'The obvious answer would be a local authority, but I am not so sure they're the best people to do it. Just because they are associated with so many different elements of society ... People may or may not have faith in them'* (LC). In several cases stakeholders are also not confident regarding the capacity of the local administration to deal with emerging problems: *'No, we wouldn't be confident that the support agencies would have the capacity to sort the problems [snow storms] here, so we are putting an emergency plan ourselves for the next year'* (LC).

Summarising the results of the interviews, a trusted governance hierarchy for the implementation of coastal climate adaptation must include the following.

- **A coordinating agency at the national level** (e.g. based within DECLG or the EPA) ensuring compliance with legal requirements, supporting vertical communications between institutions and experts at the national level and local administrations and communities at the local level, and horizontal links between the sectors: *'The EPA and the local authorities are very strong at the moment from the environmental section point of view ... and it's a good thing. They [EPA] will prosecute a local authority if they are not doing their job properly which was probably unheard of before. So they probably need to play a much greater role'* (LA).
- **Local authorities as the main coordinating point for planning, decision-making and**

action: *'If LAs will not have a certain say on responses it is not going to be effective'* (NA). The majority of respondents agree on the role of local authorities as a point of connection between the stakeholders and administrations. However, opinions are divided regarding whether or not they should have primary power and responsibility for climate adaptation planning or facilitate and support an independent stakeholder platform(s) for adaptation and coastal management: *'I think our planners should be responsible'* (LA). *'[Local authorities] can be very political – so probably have them involved but not leading it. Sometimes an outside group ... is a critical aspect to [effective cooperation]'* (LC).

- **Independent group(s) specifically focused on coastal climate adaptation**, possibly operating as advisory bodies at the level of local authorities, serving as a 'bridging organisation' to provide connections between stakeholders and supporting information exchange: *'The idea of EU policy or national policy being implemented without consultation in the local area is dynamite as well ... What I have seen working is the local people having their own organisation which they own'* (LC).
- **Local groups and individuals providing local information for decision-making**, with substantive involvement in implementing adaptation actions on the ground: *'What comes from government and local authority might be a certain amount of engineering expertise and money, but the knowledge of the local area is on the ground anyways'* (LC); *'We are the buffer between the state and the local community, and there is no community group in the country that wouldn't be happy to facilitate the process because that would be what we're here for. And if we were not, we should'* (LC).

Institutional structures regulating coastal management and climate adaptation in Ireland are seen by the majority of stakeholders as *legitimate*, though not always effective. The criticism includes unclear division of the responsibilities, fragmentation, lack of legally binding but *flexible* guidance and leadership from the national level, and ineffective mechanisms for *participation* at the lower levels. The important prerequisites are that a degree of trust be accorded to the existing institutions, and recognition of the need for their modernisation to support flexible management and cross-level cooperation.

5.5. Scientific support (contextual, complex, comprehensive)

Is there scientific information available regarding climate change, coastal management and socio-economic trends at the local, national and global levels?

Scientific data and knowledge on the effects of climate adaptation and different aspects of coastal management are produced and distributed by a number of national research institutions and agencies, i.e. national universities and associated research centres and groups (e.g. University College Cork – Coastal and Marine Research Centre; University College Dublin – Palaeoclimate Research Group; National University of Ireland at Maynooth – Irish Climate Analysis and Research Units; National University of Ireland at Galway – Ryan Institute), specialised national agencies that also undertake research (e.g. Marine Institute, Met Éireann, Teagasc), research departments of sectoral agencies and local administrations (see Chapter 2). The data and information on global changes are obtained from and through cooperation with international research agencies and centres, which also provide facilities for modelling and the interpretation of Irish data: 'So

far downscaling was the result of cooperation between research centres including at the international level ... Met Éireann was involved in a number of projects ... There are big international centres with lots of capacities and funding' (NA).

The EPA is seen by stakeholders as a major knowledge provider coordinating research on different aspects of environmental problems and protection. The EPA provides informational support and enforces the implementation of environmental regulations by local authorities and communities (e.g. WFD, MSFD) as well as supporting connections with global and EU research agencies and programmes (e.g. European Environment Agency). The scientific information supplied by the EPA is mostly seen as trustworthy, notwithstanding certain criticisms: *'It is up to [the DECLG] to go to the EPA and ask for research. They do documents like an EPA report [summary report on national climate impacts] which is comprehensive and easy to read' (NA), 'The EPA may not be totally neutral, [but] on climate change I would trust them' (LC).*

At the local level, data collected by the local authorities and local operatives of national agencies include the monitoring of environmental and social-economic data: *'We report rainfall statistics here every year' (LA).* However, consistent collection and utilisation of this data requires adequate organisation and centralised guidance: *'There is a fund of knowledge within the local authorities: historical and current. The local authority is a critical element of it, but it has to be driven nationally' (LA).*

In conjunction with official agencies, independent consultancies are often considered as a reliable source of environmental information, providing professional decision-making support and vulnerability assessments for individual businesses and local authorities: *'We use an engineering company for all that information ... we would expect the engineering consultant to engage in*

that activity, and gather this information to feed back to us, rather than us going looking for it' (LC), 'You know the consultancy agency there to prepare a plan [flood prevention plan], and this was funded by the Council without other support' (LA).

For local communities, lectures and talks by national experts are an important resource for delivering scientific information and raising awareness of scientific issues. To date, such events are mostly limited to single initiatives by local authorities or the scientific community (often conducted under the auspices of research projects): *'We had [an academic lecturer] down and he was saying it is pointless to pump money into protecting the Maharees or Rossbeigh ... And he had a full house that night, and that kind of shocked a lot of people' (LA), 'We had [an academic lecturer]. He got everybody talking ... I think he did more to raise awareness than any other single event we've had' (LA).*

Notwithstanding the significant quantity of scientific data and information available, its fragmentation and lack of consistency are perceived as barriers for comprehensive information supporting climate adaptation planning and actions: *'I wouldn't say that the responses are there, but we could plan for it of course. The information is out there but it needs to be compiled' (LA), 'The EPA has information about quality and quantity of water resources and we are starting to integrate climate information with that. We don't have a huge amount of information; we are only starting now. With the Marine Institute we've started to plan and model coastal changes, sea level rise and others ... We need more capacities in this area' (NA).*

Local contextualisation and downscaling of scientific information is an important issue repeatedly raised by stakeholders: *'It is difficult to get information specifically on Ireland, to have it clear and concise without going through 10*

different websites to get outdated information' (LC). Nevertheless, the opinion has been expressed (mostly at the national level) that decision-making processes should be based on the assumption that climate information will always include an element of uncertainty: '[With downscaling of information] people will never get info at the level they require. For robust decision-making people will have general ideas ... but they will never have information on what is going to happen on [a] particular point of landscape in 600 years' (NA).

Are stakeholders (including those not connected to academic institutions) aware of the available scientific information and its potential uses in decision-making?

According to interviewees, stakeholders at the regional/county and national levels are generally aware of the availability of scientific information, although its content and format could be organised more effectively to address the needs of practical decision-making: *'That would be great to have a method for preparing a vulnerability report' (NA). 'The information is out there but it needs to be compiled' (LA).* At the community level, the awareness of scientific data and availability of information is much lower: *'I wouldn't be aware of major local schemes or people in the area with the expertise to explain on the ground what is happening in our community here' (LC). 'From what I understand, there is very little data available ... The historical through to the present data does not exist' (LC).* Yet a number of respondents at local and regional/county levels admit that scientific data in a comprehensive and accessible form might be necessary for adaptation planning and coastal management (see Section 5.5 above) as well as to justify political and financial decisions related to climate adaptation: *'I don't see Tralee getting €500 million to implement a tidal barrier when it hasn't been flooded in the last 20 years. If more information and modelling could be done, we*

could really look at it as a way that can benefit others as well' (LA).

A minority of respondents fail to see the benefit of using scientific information: *'I don't think that climate data would be of any benefit to anyone' (LC).* However, even in such cases of scepticism, the respondents usually agree with the necessity of ecological and economic data for supporting decisions, although they would not consider such information as 'scientific': *'I keep records myself where I get fish and at what time of the year ... I see the changes and need to think where the fish going to be' (LC, same respondent).*

The main issues raised by stakeholders at different management levels include accessibility, transparency and local contextualisation of scientific data and information, in particular the following.

- Narrowly focused scientific information should be presented in a more accessible (yet still comprehensive) manner in order to be understood and readily utilised by practitioners and the general public: *'A lot of information is very technical. Lots of departments use the EPA report [summary report on national climate impacts] because it takes science and puts it in human language' (NA), 'It has to be diluted down, it shouldn't be too technical, and something that the general public can look at themselves, rather than someone with scientific knowledge be required to interpret it' (LA). 'It might be the easiest way to use map-based GIS, you would be able to overlay other data, update it and mark the relevance' (LC).*
- Evidence of changes in climatic conditions and the coastal environment should be given to illustrate the potential risks and benefits of climate change and to explain the necessity of adaptation by local communities: *'I think if you are making an argument to anybody, particularly fishermen you need to back it up with evidence' (LC).*

- Information needs to be interpreted for the local context and directly linked to the local environment, and social and economic conditions: *'If you did a study and found that the water level was to rise by 300 mm and which areas of town is going to flood, then we would have people's attention very quickly'* (LA); *'an information resource, absolutely ... and if somebody could explain what happened last December on a website, every house in this area would be looking at it straight away'* (LC).

Are there mechanisms in place to regularly collect and deliver diverse information about the system state and any expected changes (in short- and long-term perspectives)?

The existing top-down mechanisms for delivering and updating information are seen by the majority of stakeholders as legitimate, yet not always effective: *'If there had been an assessment carried out, as if somebody in a boat had gone around the coastline and had checked it, may be that [a local severe erosion event] could have been predicted ... But nobody is doing this kind of assessment on a regular basis'* (LA).

National and local agencies are expected to take a lead on informational support including the monitoring of coastal systems: *'I think the Department of Environment would be a government agency responsible to prepare documents [assessment, strategies], especially in relation to coastal issues. Or someone who would do on their behalf'* (NA). *'[Fishermen] are operating with a culture of management where they would expect to have certain information delivered to them. For climate information they would expect to have access to that and use it'* (LC). Recent changes in legislation and understanding of the complexity of environmental issues promote a more equal distribution of the responsibilities for monitoring and data collection across scales: *'[The*

Department of Environment] needs to know high-level information; LA would like to see more regional information. Sectors should be able to use the information themselves' (NA). *'In the zoning of land ... assessment is carried out in the context of SEA process ... and that would not have been done before. That's a whole new area of expertise for us. And there is a lack of knowledge in that regard'* (LA).

In addition to official structures, significant resources exist at the local level including local (tacit) knowledge and the capacity for continuous monitoring of ecosystem change: *'[People] can feel that changes in their landscape or in their community ... If you are conscious of that happening then you have a watchdog at that point – somebody monitoring it locally'* (LA). However, the current lack of structures and procedures for local monitoring and data collection prevents local administrations from harnessing this potential: *'The maintenance of the data could be done locally but initially it would have to be generated nationally. If they could generate the template for it, hand it to local authorities and work with it from there ... it could be updated on a regular basis'* (LC). *'You can buy a data logger now for €30. Should we be saying we should be putting one of these in each of the bays? For example, the co-op that grows scallops in Valentia or oysters in Tralee, you are empowering them to monitor sea change. They have become part of the monitoring process. You need to have a structure to disseminate information and a point in doing it'* (LC).

Collection of data on ecosystem status and change is a part of daily routine of many individual businesses (e.g. fishermen and farmers) and local residents: *'if I want to do an outdoor event ... I won't go to the Met Éireann website, I'll ask farmers – and they'll always be right. They have always been adapting'* (LC). However, the attitude to data sharing and involvement in organised monitoring programmes may vary from support –

'We would do it [environmental monitoring by a local community] no problem if we knew what was required of us, if we got guidance or a structured plan – you need to do a, b, c, d.' (LC) – to outright rejection of cooperation on commercial grounds: *'I keep records myself of where I get fish at what time of the year ... No, I'm not going to share that information with anyone. I don't care who they are because it has taken me years to build this up'* (LC).

Scientific and informational support for coastal management and climate adaptation is provided by a number of research institutions, administrative agencies and independent consultancies. Notwithstanding the significant amount and quality of information, there is a need for a more *integrated* approach, making the information *comprehensive* and transparent to all and linking the data to the *local context*. Capacities for data collection and monitoring exist at different management levels and should be enhanced through national coordination, supporting procedures and guidelines.

5.6. Communication (vertical and horizontal flows, social networks, transparency)

Are there practices and (formal/informal) institutions in place to support vertical flows of information between stakeholders at different levels (local, regional, national) and within organisations?

Communication between actors, groups and organisations across management levels takes place within the existing institutional framework, based on official procedures for decision-making, stakeholder involvement, institutional organisation and informational support. As a result, stakeholders report that vertical communication is impaired by fragmented responsibilities, insufficient

feedback procedures and limited engagement. The high level of rotation of administrative personnel interrupts established communication channels and has been mentioned as a particular concern: *'They come and they leg it. You don't really get them to stay. Anyone who did stay, we've tapped into them already'* (LC).

However, potential strengths include relatively high levels of trust in the official hierarchy and the information they deliver, and positive experiences were cited by respondents regarding existing communication structures: *'I know who the local environmental officer is. If I have an issue I need to bring to his attention, I have all the contact information'* (LC).

Are there practices in place to support horizontal flows of information between stakeholders within the region?

Horizontal communication between actors at the local level is mostly based on spontaneous and informal contacts between individuals and groups, or has been established through specific projects and initiatives. Notwithstanding strong traditions for personal networking in Irish communities and recent initiatives (see below), horizontal communication and cooperation between stakeholder groups on matters of local planning or business is still relatively rare, though the potential benefit of such communication is recognised: *'In coastal management you want all players to play'* (LC). *'I think there could be better cooperation between the fishing industry and the local restaurants in terms of marketing'* (LC).

Among the most successful (though still rare) examples are local networking initiatives organised by leading organisations or individuals for different purposes, including strengthening the connections within local communities, increasing visibility of certain activities and businesses (tourism, sport, etc.): *'We did a club awareness programme where*

we brought all the clubs – football, sailing, swimming, fishing, kayaking – all together under one roof. We funded that through a coastal community program, Interreg IV’ (LC). Established informal networks often result in longer cooperation on various issues, including those related to the environment and local development (which can be initially out of the direct scope of the event): ‘We did one phase of that and it was reasonably successful; we intended keeping that up, building on that ... There was a professor coming over to give us a talk about eco-tourism. We are inviting all different clubs to listen to this talk ... It will be touching on climate change as well’ (LC, same respondent). Yet effective local communications need to pursue a balance between, on one hand, addressing the broad complexity and geographical scale of the issues (e.g. climate adaptation) and, on the other, supporting an issue-oriented practical focus: ‘Kerry is a very big county. It is very difficult to mobilise a county on a particular route. In a smaller area, that is a lot easier to share a vision’ (LA). ‘It’s up to all of us, but if you become a climate change bore, people switch off from you. Sometimes you have to find what people are interested in, for example, gardening, bee-keeping or surfing, because people won’t care unless they think it affects them’ (LC).

Are stakeholders aware of potential value in (and appropriate means of) communication with other groups?

According to the interviews, stakeholders involved in communication and cooperation at the local level are reasonably aware and confident with the means of communication they use. Communication may include: (a) information outreach to the broader community, (b) education and awareness raising. The medium of delivery of information may vary depending on the groups to be addressed, location, age, education and professional affiliation.

In rural areas, radio, newspapers and personal connections remain the most effective ways of information exchange and networking: *‘In rural Ireland, the local radio stations and the local papers are very much still the prime sources of distribution of knowledge and communicating with the people’ (LA). ‘We’ve also a weekly column in Kerryman – climate change would often feature in that’ (LA). The internet provides new ways of communication, particularly targeted at younger generations: ‘A web portal is vital for communication’ (NA). ‘I have access to the internet which I find very useful as well as a teaching tool [in school], so I would use that [website with information about climate change at Irish coasts] on a regular basis’ (LC). Combining different methods is essential for effective outreach: ‘We do a newsletter once a year, due to time constraints. We are on Facebook. We have a database of e-mails. We have public notices; we have posters in all the pubs because that is where people congregate – in the church as well, and so we would use all those mediums, but the best one of all is to walk out there on the side of the road’ (LC).*

Awareness-raising by local groups and activists is taking place in several communities, but often requires additional informational and administrative support: *‘The information needs to represent facts, photographs, etc., but not too much’ (NA). ‘Powerpoint presentations with very clear information: graphs, pictures – as pictorial as possible, without too much scientific bumph ... Posters, booklets, websites, even things like pull-up displays – we have them in reception all the time’ (LC). Communication materials can be distributed by supporting official agencies and made available through a variety of media, e.g. thematic websites.*

Respondents across governance levels stress the importance of education (primary and secondary schools) for environmental awareness, in particular when communicating the long-term effects of

climate change: *'I think education is very important, particularly for young people'* (LA). Alongside imparting knowledge to future generations, children may exert influence over the current practices of their parents. However, adequate information and methodological support should be provided to teachers and climate change references integrated into school curricula: *'12 year-olds in 10 years time will start to do something if they are told something now. But if there is no scientific basis for it you are in a very difficult situation to teach that in school'* (LC). *'Within the school programme there is a reference to climatic change, but it is more on a world scale than on a local scale ... Maybe creating awareness amongst the school children will then filter out to people at home'* (LC).

Are robust social networks available and could these be used to support the environmental agenda?

Personal networks are mentioned among the strongest and the most reliable source of communication in Irish communities: *'A lot of it is personal communications'* (LA). These traditions also support cooperation between the newly emerging environmental and civic groups and networks around the country: *'The Cultivate Centre in Dublin is very helpful. They seem to coordinate a lot of [informational support]'* (LC). Social networking is seen as an important resource for environmental actions as well as communication between the actors at different levels: *'I am a graduate of UCC myself ... We may put a class project together to show the effect of climate change and how it affects the town'* (LA). *'It was good to go to Dublin, because they train you in, and there was a bit of solidarity. I would feel more comfortable now to go and talk to people in power because before you would be nervous'* (LC). However, the power of networks and collective opinion can also impede actions by environmentally aware individuals and

organisations. Several respondents mentioned that the position adopted by a 'third party' organisation or independent individual with no history of involvement in long-standing local conflicts can sometimes be considered more trustworthy when raising an issue than a local resident: *'If you are local here, you open people's door and they look straight away which party or clan you belong to. They think "what is your interest?"'* (LC).

Environmental and social groups involved in local community actions and education provide valuable resources for coastal climate adaptation through their established contacts and reputation. The experience of these organisations should also be used for creating new networks specifically focused on climate adaptation: *'We just knocked the doors and rang people. There was no booklet saying what to do – we just make it up. And one thing leads to another. Our main thing was education – not just standing in a room doing issues-based things; it was practical skills. We developed a good network locally'* (LC).

Communication, both horizontal and vertical, between stakeholders and organisations is impaired by the fragmentation of institutions and decision-making processes and a lack of participatory experience and feedback mechanisms. Nevertheless, strong traditions of *social networks* in Irish coastal communities provide a basis for effective communication, particularly at the local level (*horizontal flows*), providing capacities for co-management and self-organisation for climate adaptation planning and actions. These capacities, however, need to be enhanced by supporting local groups with relevant information and (flexible) coordination from the upper management levels.

5.7. Key findings: enabling an ACM approach for local climate adaptation in Ireland

The analysis of formal and informal rules, institutions and informational support for coastal management and climate adaptation in Ireland undertaken here demonstrates a number of important limitations in the existing hierarchical management system when addressing the core issues of effective climate adaptation – e.g. uncertainty, complexity and different temporal scales of planning. The introduction of new management methods for climate adaptation, in particular ACM, faces a number of barriers, including:

- limited awareness of climate change impacts, the potential vulnerabilities of coastal communities and necessity for adaptation; relatively low priority of climate adaptation in local development and planning agendas (see Section 5.1)
- inflexible 'linear' systems of decision-making and the fragmentation of policies and institutions (e.g. for coastal management), which are in turn unable to foster strategic, long-term planning, or provide a secure political environment for the field-testing of experimental adaptive interventions or more substantive stakeholder involvement in decision-making (see Sections 5.2, 5.3, 5.4, 5.6)
- lack of official guidance for new management methods (including strategic planning and stakeholder participation); current lack of legal grounds for climate adaptation (see Sections 5.2, 5.3, 5.4, 5.5)
- limited information on the scientific evidence of climate change and its effects on communities available to local stakeholders; lack of experience and schemes for integrating

scientific information into collective and personal decision-making (see Sections 5.1, 5.5).

At the same time, the current situation provides a number of opportunities, as follows.

- Growing concern at all levels regarding climate change and related impacts and vulnerabilities, including impacts on coastal communities, can serve as a trigger for greater commitment to an adaptation agenda (see Section 5.1).
- Existing experience of stakeholder cooperation and participation (e.g. in coastal management) and experience of learning from recent extreme weather-related events (see Section 5.2) can be used to enhance co-management (e.g. involvement in decision-making based on shared responsibility and mutual learning) and promote adaptive management.
- Policy processes at national and EU levels supporting climate adaptation planning and new management methods (e.g. participatory planning) and reasonable levels of trust in official administrative structures as a legitimate source of power and information can be harnessed to provide (flexible) coordination of adaptation planning and actions from the national level and support consistency of adaptation efforts across the country (see Sections 5.3, 5.4, 5.5).
- Scientific data and information on climate change becoming more readily available from research institutions and agencies and the growing potential for local data collection and local monitoring systems can significantly strengthen the knowledge base for climate adaptation (see Section 5.5).
- Strong traditions of social cohesion and communication in Irish coastal communities provide an adaptive capacity in themselves; existing environmental and development

networks and organisations may support planning and actions on climate adaptation (see Section 5.6).

These key findings of stakeholder perceptions influenced the determination of the policy recommendations as presented in Chapter 7. These were designed to enhance capacity for coastal climate adaptation and introduce appropriate elements of ACM to existing decision-making procedures. Among the specific areas of attention are:

- informational support for communities regarding the effects of climate change and the potential risks/opportunities associated with it
- recommendations and guidelines enabling novel, integrated strategic approaches to coastal climate adaptation and compatible with the existing political and planning structures
- enhanced communications between stakeholders and experts across governance levels and sectors
- facilitation of stakeholder involvement and the provision of platforms for experimental and collaborative management.

Chapter 6 presents the CLAD Tool Kit – a set of instruments designed to address these issues and enable coastal stakeholders to foster strategic and informed decisions on climate adaptation. Where possible, the Tool Kit structure and design addressed the requests of potential end-users (as articulated during the interviews).

6. CLAD Tool Kit – capacity building for effective climate adaptation in Irish coastal zones

6.1. CLAD Tool Kit: background, structure, design and evaluation

The need for capacity development in coastal communities designing and implementing climate adaptation plans has been clearly articulated via the preceding analysis of conditions under which coastal and climate governance in Ireland is formed at different management levels – national, regional/county and local. The CLAD Tool Kit has thus been designed to specifically meet these needs, drawing upon leading theoretical research findings of the resilience and ACM literature, and practical examples of the effective implementation of new modes of natural resource governance at the local scale. The structure and recommendations of the CLAD Tool Kit have been tailored to best enhance the decision-making practices of Irish coastal communities, drawing upon the end-user requirements studied during stakeholder interviews. The Tool Kit thus addresses:

- growing evidence of climate change, its associated risks and the need for an integrated approach to coastal management and climate adaptation
- the obligation on the part of local authorities to meet policy obligations for local climate adaptation under the NCCAF
- the need to ensure compatibility of new governance approaches, i.e. flexible, experimental planning (adaptive management) and expanded stakeholder involvement (co-

management), with existing decision-making practices

- how best to harness internal community resources and capacities for planning and implementing adaptation measures
- how to utilise existing informational, social and technical resources, at various scales of activity and levels of governance, to support the development of new capacities necessary for effective climate adaptation and resilience enhancement in coastal communities.

The CLAD Tool Kit includes informational materials, descriptions of management methods and supporting instruments (guidelines and software), and links to external resources that can support local managers and coastal communities in:

- assessing vulnerability to climate change at the local scale
- designing and implementing adaptation responses
- mainstreaming adaptation into coastal management plans and practices, and
- enhancing the resilience of coastal communities in the face of change.

The Tool Kit's suggested tools and methods are based on the principles of ACM and allow coastal managers to gradually introduce elements of the new approach, with the pace of change dependent on existing levels of preparedness and resources available for the community to undertake transition.

The CLAD Tool Kit consists of three pillars (Figure 6.1), as follows.

1. **Methodological: Guidelines and software** for local-scale coastal climate adaptation, including: defining the main elements and connections of the local coastal social-ecological system; setting up and conducting

local participatory vulnerability assessments; developing scenarios of change and formulating management interventions; mainstreaming adaptation into coastal management and developing local adaptation plans; adjusting management process to changing conditions (see Sections 6.2, 6.3).

2. **Informational: Website CoastalResilience.ie** including: supporting information – climate change projections and their impacts for Irish coasts, adapted to non-specialist audience; climate policy background; case studies of successful adaptation; an introduction to the ACM approach; external adaptation resources; hosting of methodological outputs – guidelines and software; communicating platform for stakeholders and ICRN (see Section 6.4).
3. **Institutional: Irish Coastal Resilience Network (ICRN)** – a pilot network initiative consisting of local nodes and a National Advisory Panel of experts, combining stakeholders and practitioners involved in vulnerability assessment, planning and implementation of local adaptation programmes (see Section 6.5).

The evaluation and evolution of the Tool Kit

During the Tool Kit design period, its core elements were piloted at the case study sites and discussed in detail with potential end-users. The content and structure of the website coastalresilience.ie was informed principally by stakeholder interviews. Local ICRN nodes have been formed in Tralee Bay, Bantry Bay and Portrane. Tralee and Bantry nodes took part in vulnerability assessment and scenario exercises conducted by the research team during the period July 2011–March 2012 (Figure 6.10). Feedback received through evaluation questionnaires distributed at each session and in follow-up communications allowed clarification of the applicability of the methods and tools trialled. A majority of the participants found the methods useful to address the complexity and uncertainty of local climate adaptation. Nevertheless, many of them also had concerns as to whether local communities, without further assistance, could replicate the methods demonstrated, and how the results could be compatible with the existing linear top-down management and short-term planning. This feedback and the views expressed have been integrated in the present version of the Tool Kit as follows.

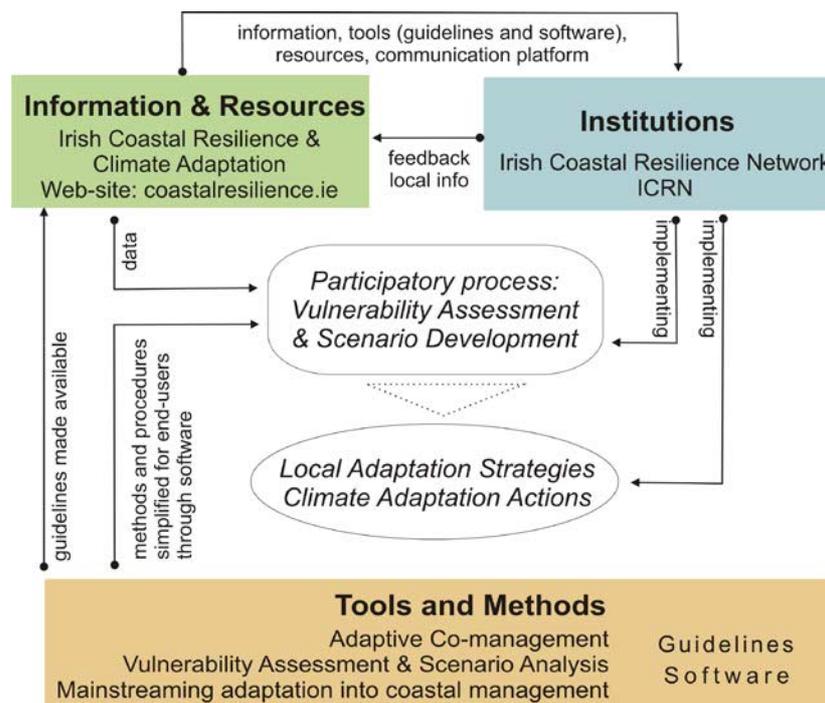


Figure 6.1. Structure of the CLAD Tool Kit.

- A software programme has been designed and introduced to the Tool Kit to simplify the process of participatory vulnerability assessment and scenario development, allowing local practitioners and communities to conduct the exercise without the additional training and assistance of a research team.
- The final version of the Guidelines (specifically Steps 5 and 6) explain how the results of vulnerability assessment and scenario exercises can be translated into a practical adaptation management cycle, integrating elements of the new approach into existing policy and planning structures, with little or no additional resources needed.
- Step-by-step guidance includes practical suggestions and tips for organising participatory exercises based on the experience of the research team and feedback of the participants (regarding such issues as composition of the group, preliminary preparation, workshop agenda and practicalities).

The following sections introduce the elements of the Tool Kit in more detail.

6.2. CLAD guidelines for local-scale coastal climate adaptation

Who should use the CLAD guidelines

The CLAD 'Local Scale Coastal Climate Adaptation: Practitioner Guidelines' (Figure 6.2) have been written for local coastal management practitioners, noting that the CLAD Project team takes a broad view of who can be considered 'coastal management practitioners'. In most cases this group comprises local authority employees whose remit encompasses such activities as planning, environmental education and/or compliance, biodiversity conservation, engineering, coastal recreation and transport. The guidelines

can also be used by local groups and individuals willing to initiate or be involved in climate adaptation planning in the region.

How the CLAD guidelines should be used

The guidelines are based on a six-step process (Figure 6.3) aiming to identify vulnerabilities and opportunities related to climate change, design local climate adaptation plans and actions, and set up implementation mechanisms to progress adaptation. The CLAD coastal climate adaptation process has tailored key elements of ACM theory and practice to form a framework for climate adaptation at the local scale. As ACM seeks first and foremost to enhance social-ecological system resilience in the face of change, each of the steps in the CLAD process has been designed to enhance the resilience of coastal systems by:

- providing a framework for action to be taken to contextually assess and respond to vulnerability to climate change at the local scale
- enhancing the adaptive capacities of local stakeholders faced with climate change.

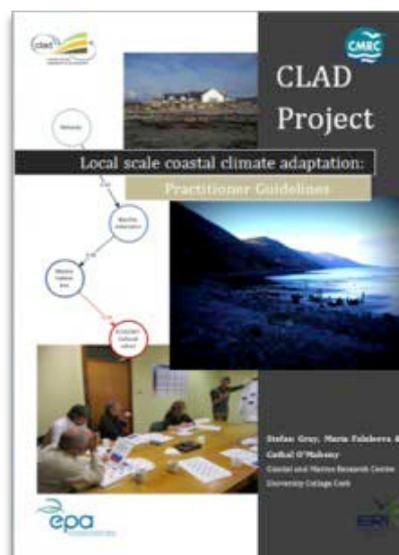


Figure 6.2. Guidelines for local scale coastal adaptation.

The adaptation process described in the guide has been designed for implementation in a step-wise manner, and involves the use of some techniques,

methods and tools that are likely to be new to coastal management practitioners and stakeholders alike. The project team thus **strongly suggest beginning from Step 1 and working through each step** successively during the first iteration of an adaptation process. Having completed the process once, it is possible (and indeed advisable) to go back to any of the steps to review and revise progress as appropriate. Alongside the description of the process, actions and expected outputs, each step also contains advice, practical tips, links and materials to be used during implementation.

Moreover, each step of the guidelines may also be considered as relatively independent, and used to inform a certain stage of any adaptation process. For example, if a community already had a clear understanding of its contextual vulnerabilities, scenarios of development and possible adaptation measures (Steps 1–4), they might benefit from recommendations on adaptation management and planning (Steps 5–6). Otherwise, a community may choose to utilise the **iasess:coast** software tool for vulnerability assessment and choose its own ways of designing a local adaptation plan. In such cases, the guidelines can inform the process and actions giving useful tips and practical advice; however, the effectiveness of entire adaptation planning may be lower.

The six sections of the guide are laid out using the following common format.

- **Objectives, key tasks, and outputs:** providing details of the core objectives, tasks and outputs of the section
- **Background:** information that will provide contextual reference points for the work undertaken in each section
- **Methods:** the specific techniques, tools and approaches to employ at each stage of the adaptation management cycle

- **Completion checklist:** a brief recap of the section outlining the essential and desired elements and tasks to have completed before moving on with the process

How the CLAD climate adaptation process works

The process of coastal climate adaptation designed and described in the CLAD guidelines consists of six steps, as follows.

- **Step 1. Engage key stakeholders.** Step 1 sees the appointing a local manager–administrator responsible for the adaptation planning project and **formation of a local group** to harness the benefits of local expertise, bridging the divide between key actors in local government and civil society, and in so doing beginning the process of building a local constituency in support of adaptive management. Through linking local efforts to actors at the national scale, the ‘goodness of fit’ between the capacity to act and the scale of adaptation issues tackled can be optimised.
- **Step 2. Identify the context.** In support of legitimate and sustainable adaptive management, the experience and knowledge of each member of the local resilience group is codified through the construction of a **coastal systems model**. The modelling process serves to develop a systemic view of the coast, broadening the horizons of participants and allowing them to query their own beliefs and perceptions regarding the system’s key structures and functions. This process of reflection and hypothesis formation is the first step towards taking an explicitly adaptive approach to the management of coastal issues.
- **Step 3. Assess current vulnerabilities.** Reaching a shared conception of how the system under scrutiny is structured and functions is a critical step towards agreeing

how adaptation should proceed. A **shared system model**, which has been aggregated from the outputs of Step 2, is discussed, amended and validated at a stakeholder workshop. The baseline scenario output of this shared model then provides insight into the system's **existing vulnerabilities and adaptive capacities** (informing the subsequent selection of adaptation actions).

- **Step 4. Assess future vulnerabilities and potential adaptation options.** The **implications of scenarios** of future climate and socioeconomic change are evaluated at a second stakeholder workshop, using the amended and validated shared model as a test

environment. Stakeholders then formulate a number of **potentially appropriate adaptation actions** in response to the future circumstances each scenario presents, culminating in the production of a **preliminary adaptation actions table**.

- **Step 5. Manage adaptation.** The adaptation actions put forward for possible implementation are assessed against both contextually specific (outputs of Steps 2, 3 and 4) and generic **screening/prioritisation** criteria. Those actions, categorised as viable, desirable and 'no-regrets' by the screening/prioritisation process, are entered into a detailed **Adaptation Management Plan**

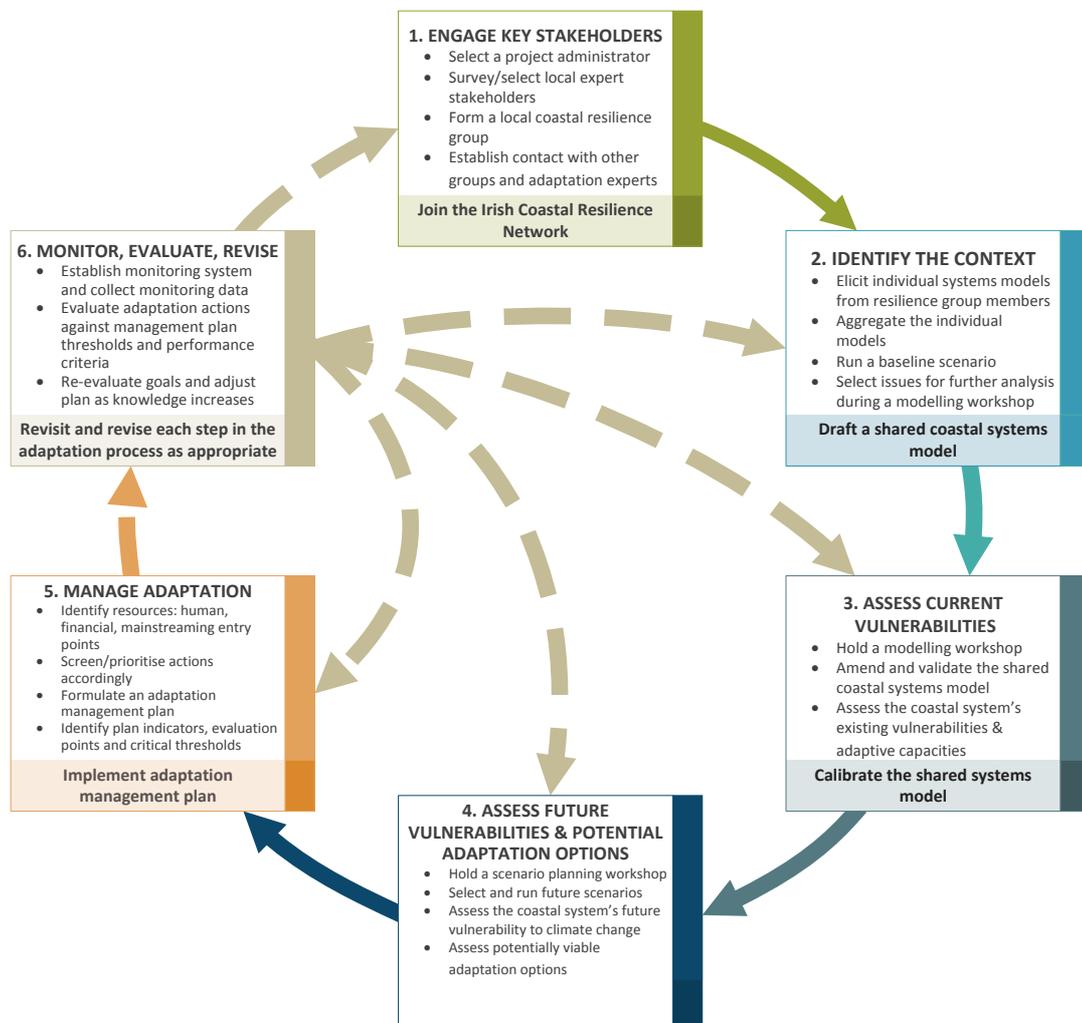


Figure 6.3. The CLAD local scale coastal climate adaptation process

(AMP). The AMP outlines the ways for mainstreaming adaptation into coastal management through policy and planning entry points, co-implementation, co-financing and shared responsibility for adaptation actions. The AMP includes indicators of implementation and effectiveness, temporal and value-driven evaluation points, and the description of thresholds of concern. Implementation of the AMP is coordinated by local coastal resilience group members and supported by the ICRN.

- **Step 6. Monitor, evaluate, and revise.** A **monitoring system** is designed to provide the type, quantity and quality of data required to measure adaptation action performance against indicators of implementation and effectiveness, evaluation points and thresholds of concern. As data are collected and knowledge of the system (and the impact of adaptation actions implemented) increases, all steps taken in the adaptation management cycle become subject to re-evaluation and revision as deemed appropriate.

6.3. iasess:coast software for participatory vulnerability assessment and scenario development

The **iasess:coast** software tool has been developed to assist project administrators and community groups to conduct participatory vulnerability assessment and scenario



Figure 6.4. The iasess:coast home screen

development exercises. The software (Figure 6.4) provides user-friendly interfaces to facilitate Steps

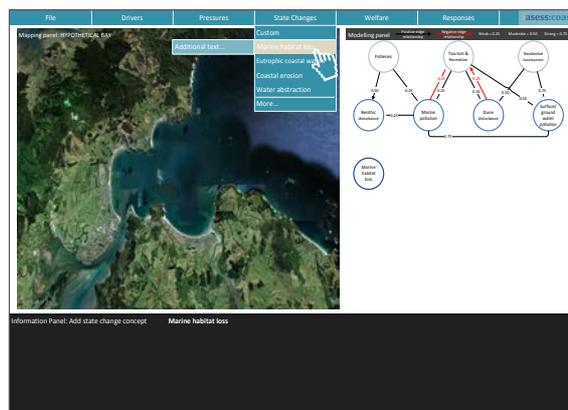


Figure 6.5. The iasess:coast individual modelling interface: selecting a model element.

2, 3 and 4 of the CLAD adaptation process:

- **individual modelling interface** (Step 2) – allows any number of individual models to be built and stored in the program’s database (Figure 6.5)

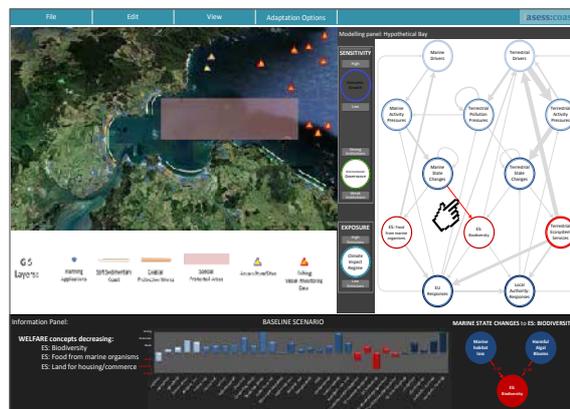


Figure 6.6. The iasess:coast group modelling interface: exploring relations between the elements.

- **shared modelling interface** (Step 3)- which uses the database to aggregate the individual models and visually present a shared model for discussion at group meetings (Figure 6.6)
- **scenario interface** (Step 4)- which allows scenarios of future change to be selected and run on the shared model, generating outputs

for use in workshop settings and in adaptation planning (Figure 6.7)

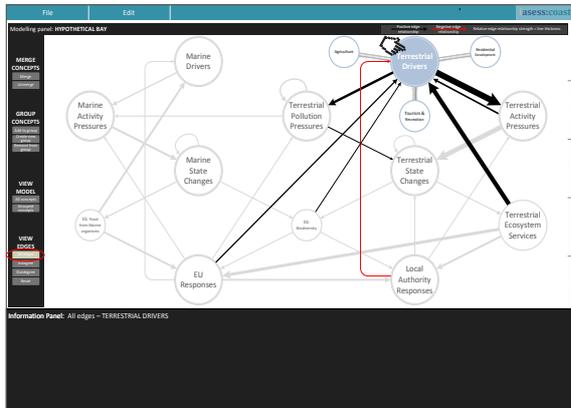


Figure 6.7. The iasess:coast scenario interface: running scenario for a coastal socio-ecosystem.

The Practitioner Guideline document gives a detailed description of how to use the software. The program also includes a tutorial explaining how to navigate between interfaces and begin using the program.

6.4. Website: coastalresilience.ie

The website coastalresilience.ie (Figure 6.8) has been designed as an informational pillar of the CLAD Tool Kit. The site's content is designed to fulfil the informational support requirements for local climate adaptation planning and capacity building. The website presents ACM as an approach to building resilience of coastal communities and mainstreaming climate adaptation into coastal management, and hosts methodological guidance and tools such as the CLAD Practitioner Guidelines, iasess:coast software and links to the ICRN.

The structure and content of the website has been informed by an assessment of end-user requirements that emerged during the stakeholder interview process, including:

- representing data and information in formats appropriate to non-scientific audiences

The screenshot shows the website 'COASTAL RESILIENCE AND CLIMATE ADAPTATION IRELAND'. Several callout boxes highlight specific content areas:

- Objectives and approaches to climate adaptation: why adapt and how? Introduction to ACM**
- CLAD Guidelines for local coastal climate adaptation iasess:coast software**
- Policy frameworks and documents (links) for coastal management and climate adaptation in Ireland and EU.**
- ICRN area: contact information, local ICRN pages (restricted access), adaptation practitioners forum.**
- Materials and links on external resources: climate change, integrated coastal management, stakeholder engagement and community work, financing local adaptation and development projects, national and international groups. List of adaptation measures Glossary**
- National and international case studies on coastal management, climate adaptation and/or adaptive co-management approach**
- Key messages: impact of climate change on Irish coastal communities**
- Essential information about climate change: global trends and projections, climate change in Ireland, adaptation and mitigation. Climate change impacts on coastal areas: sea level rise, water temperature, salinity, acidification, coastal erosion, storm activity, impacts on ecosystems, etc. Climate change impacts on coastal areas in Ireland: trends and projections for different impacts, risks and opportunities for communities.**
- Site map and user guide**
- News feed**

Figure 6.8 Structure and content of the website Coastalresilience.ie.

- providing information on local impacts, threats and opportunities for coastal communities
- providing materials and resources (informational, legal, financial) to be used by practitioners and community groups for climate adaptation planning, resilience enhancement and awareness raising
- describing case studies and providing contacts for other groups in Ireland and abroad
- creating a one-stop resource to give coastal practitioners and stakeholders the information and/or links to other sources they require to address adaptation.



Figure 6.9: ICRN local node developing group model of coastal socio-ecosystem in Bantry Bay.

6.5. The Irish Coastal Resilience Network

Acknowledging that undertaking climate adaptation can be intimidating, the CLAD Project team has created a specifically tailored institution to provide the practical and technical support that practitioners at the local level require. The **ICRN** was designed to function as a pilot institution supporting coastal stakeholders in Tralee Bay, Bantry Bay and Portrane in conducting local-scale vulnerability assessments (Figure 6.9). It proved a valuable resource in transferring lessons learned between the various case study sites, allowing the methodologies of modelling and scenario analysis that underpinned local-scale vulnerability assessment to be simplified and refined.

Participation in the ICRN also offered local nodes in the network access to specialist knowledge and policy guidance through the **National Resilience Advisory Panel** of experts. Members of the panel included leading authorities on climate change and coastal management in Ireland. The inter-linkages across local and national scales provided useful feedback and knowledge exchange in both directions and, vitally, served to reassure local coastal management practitioners that their efforts to adapt were not at odds with higher-level policies or foreseeable legislative change.

The ICRN - Network structure

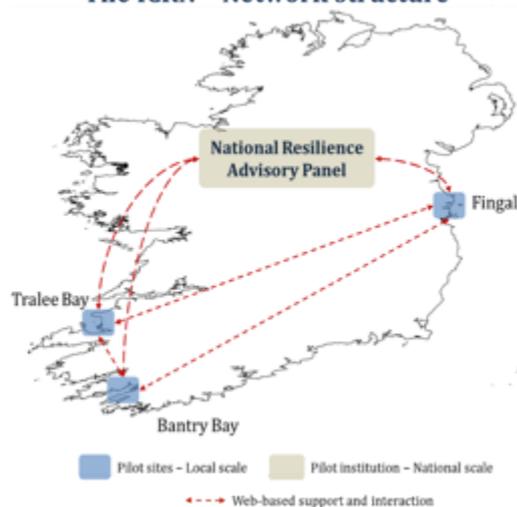


Figure 6.10: The structure of the ICRN in its pilot stage

After the project completion, the lessons learned from the design and implementation of the ICRN have been analysed to support further networking efforts on Irish coastal communities (see key messages in this chapter and Chapter 7). The role that the ICRN has fulfilled in transferring knowledge and experience across nodes in a network will be instrumental in successfully bringing the CLAD vulnerability assessment methodology to new coastal areas. The network's experience will be particularly important in supporting local project administrators to familiarise themselves with the tools and methods required of vulnerability assessment at the local scale.

6.6. Key messages: application of the CLAD Tool Kit

The CLAD Tool Kit supports the six-stage CLAD coastal adaptation management cycle, itself derived from an extensive review of adaptation best practice and the principles of ACM. The Tool Kit has been designed to allow local practitioners to build incrementally the critical adaptive capacities required to adapt sustainably to climate change.

Adopting an explicitly systems-oriented approach to coastal management and climate adaptation allows the coherent integration of social, economic and environmental considerations into adaptation decision-making. Although this aspect of the CLAD adaptation management cycle is likely to be novel and relatively challenging for coastal management practitioners to undertake, its use of thought provoking and engaging tools facilitates ready debate and communication of the complex issues adaptation raises.

The methodological, informational and institutional pillars of the CLAD Tool Kit aim to equip coastal managers and communities in Ireland to meet the challenges of system-oriented adaptation planning. The pilot application of the CLAD Tool Kit has provided several lessons and recommendations for further capacity building, as follows.

- Future-oriented thinking is necessary for adaptation planning; however, to encourage application of new scientifically based methods (such as scenario planning), adequate support is necessary. This may include user-friendly software (e.g. *iasess:coast*) and professional support for training and (if necessary) facilitation of local adaptation planning processes. Sustaining project outputs (e.g. further development of *iasess:coast*, supporting the informational website, providing training for LAs) may require further support and coordination from

the national agencies (e.g. EPA). However, these are essential efforts to secure uptake of the project's findings and outputs, in particular the successful experience of the pilot Tool Kit application.

- Supporting cooperation and communication between local practitioners and national experts (e.g. using the ICRN model) requires continuous efforts and dedication, which cannot be quarantined to the local level.

Initiatives from local adaptation implementers and a commitment on the part of communities to a continuous adaptation management process are essential for effective climate adaptation and the building of resilience at the local level. Nevertheless, these efforts need to be supported and facilitated from the national level, and the EPA may play an essential role in coordinating efforts and supplying LAs with adequate tools, networks and institutional structures as well as providing training and consulting, e.g. based on the materials and experience of the CLAD Tool Kit.

7. Conclusions and recommendations

The governance of natural resources involves a high level of complexity and encompasses a wide range of perspectives (social environmental and economic), operationalised through multi-level interactions of institutions and actors. The management of natural and social systems is increasingly associated with uncertainty and requires consideration of different time-scales of planning. In complex and dynamic social-ecological systems such as coastal areas these issues become particularly evident, while the effects of climate change exacerbate uncertainty, complexity and risk.

For coastal communities in Ireland faced with increasing evidence of climate change, such as sea-level rise, changing weather patterns and temperature and precipitation regimes, climate adaptation has become a vital element of building resilience and supporting the local economy and social well-being. The effects of a changing climate may increase the risk of coastal erosion, flooding, leading to infrastructural damage, and habitat loss, but may also bring opportunities for renewable energy, agriculture and tourism. Adaptation to climate change – a complex forward-looking socio-economic process – aims to minimise the risks and take advantage of the opportunities that new conditions may bring. However, in the absence of an integrated approach to coastal governance, with insufficient interaction between the management levels and short-term local planning, proactive climate adaptation represents a considerable challenge to coastal managers.

Barriers and opportunities for coastal climate adaptation in Ireland

The conduct of coastal climate adaptation in Ireland is delineated by a number of policies at

different levels (international/EU, national and local) in the areas of terrestrial and marine spatial planning, sectoral development, environmental regulations, social strategies and national frameworks (NCCAF). Official regulations, together with informal rules and institutions, form a complex 'architecture' of coastal climate governance. The current governance architecture presents barriers for effective adaptation, the most important of which are:

- **fragmentation of coastal governance** including lack of coherence between terrestrial and maritime regulations and management responsibilities that prevent an integrated approach, lack of inclusiveness (involvement of different sectors and actors) and the instability of adaptation management
- **short-term planning and 'linear' top-down management** which does not encourage stability, inclusiveness and adaptiveness of long-term planning decisions and cannot address uncertainty related to climate change
- **lack of experience of cross-sectoral cooperation and stakeholder involvement**, which impedes the creation of inclusive management structures and cooperation between sectors and levels of coastal management.

At the same time, the existing architecture does provide a number of **opportunities** for coastal adaptation management, such as:

- **emerging national and EU regulations supporting** integrated approaches to coastal management and climate adaptation, and promoting more adaptive and inclusive management methodologies and approaches
- the **high level of trust of official structures**, which are seen as a credible sources of power and the information they possess can enable coordination and support for decisions taken at

the local level, and may secure a more informed and stable approach to local climate adaptation across the country

- **established local capacity** that can be employed for planning and implementing local adaptation, and making coastal management more inclusive and adaptive through social networks, experience of involvement in participatory initiatives (e.g. ICZM projects) and possibilities of co-financing adaptation actions
- the **substantial amount of high-quality scientific information** currently available, which when combined effectively with local knowledge can support adaptation planning, if adequate support is provided to assist in data interpretation for local end-users (for scientific data) and data collection and transfer to decision-makers (for local knowledge).

Interviews with stakeholders involved in coastal management and climate adaptation demonstrate a growing recognition of the ineffectiveness of existing management structures for addressing the challenges of integrated coastal adaptation governance. New approaches are now needed to deliver successful adaptation and build resilience of coastal communities under conditions of uncertainty and complexity.

Adaptive co-management – potential for application and capacity-building requirements

The ACM approach applied by the CLAD Project provides a methodology and instruments for experimental adaptive management, implemented through cooperative actions and based on social learning, shared power and responsibility. International examples illustrate that ACM may enable stakeholders to take and implement decisions in the conditions of uncertainty and complexity, thereby developing local capacities

and enhancing the resilience of social-ecosystems at the local level.

The analysis of the present conditions and requirements of practitioners and stakeholders in Irish coastal communities shows that the consistent and pragmatic application of an ACM approach may bring significant benefits for coastal climate adaptation in both the short and long terms. However, capacities must be built to introduce elements of the new approach into existing decision-making practices. Based on theoretical studies, stakeholder interviews and participatory exercises, the CLAD Project identifies six **key areas of capacity building** and related **recommendations** as described in Table 7.1 (also see Annex 1).

CLAD Tool Kit

The CLAD Tool Kit has been developed to enhance the capacity of local communities in Ireland for integrated planning and actions on coastal climate adaptation and socio-ecosystem resilience. The Tool Kit design was based on theoretical studies, international experience and end-user requirements, and consists of three pillars (available online):⁶

1. **guidelines and software** for local-scale coastal climate adaptation based on the six-step CLAD local coastal adaptation cycle: (1) Engaging key stakeholders, (2) Identifying the context for climate adaptation, (3) Assessing current vulnerabilities, (4) Assessing future vulnerabilities and potential adaptation options, (5) Managing adaptation, (6) Monitoring, evaluation, revision
2. **website coastalresilience.ie**, with supporting information adapted to non-specialist audience, case studies, and introduction to the ACM approach, external resources; provides hosting for the guidelines, software, and acts as a communicating platform for stakeholders (ICRN)

⁶Website: coastalresilience.ie

Capacity-building area	Recommendations and management targets
Problem framing	<p>Use national and local communications to present climate adaptation as a strategic factor for community development and an integral part of effective coastal management.</p> <p>Systematically communicate the causes and effects of climate change to local communities while emphasising local impacts.</p> <p>Communicate short- and long-term risks and benefits (environmental, social, economic) and uncertainties associated with climate change and adaptation to key stakeholders at all levels – local managers, regional planners, etc.</p> <p>Avoid representing climate adaptation as a separate management and funding area; instead present successful adaptation as effective distribution of available resources and promote co-financing and co-ownership of adaptation actions.</p>
Decision-making	<p>Enable decision-making procedures and regulations to revise/correct management decisions, adjusting targets to changing conditions and the effectiveness of any measures taken, thus addressing the uncertainty of scientific data and appropriately utilising local data and knowledge.</p> <p>Support systematic learning at administrative and individual levels, e.g. through communicating best practices and facilitating actors' collaboration. Ensure adequate records and transfer of knowledge between the stakeholder groups and through time, e.g. to avoid loss of experience with moving administrative personnel.</p> <p>Use local experience and social networks to encourage stakeholder involvement in adaptation planning.</p> <p>At national level:</p> <ul style="list-style-type: none"> • provide tools and guidelines for forward-looking experimental approaches enabling local practitioners and communities to develop proactive adaptation responses utilising local capacity • provide support for stakeholder involvement by strengthening regulations for local participation and clarifying roles and responsibilities of national and local coastal actors.
Policies & plans	<p>Through national legislation such as Climate Bill and policies such as NCCAF, provide coordination and enforcement for climate adaptation planning, while still providing the option for local decision-making to integrate specifics of community development, risks and opportunities.</p> <p>Enable integration of climate adaptation to sectoral policies and plans through vulnerability assessments (e.g. EIA and SEA).</p> <p>Enable coordination of policies and regulations in coastal, marine, and terrestrial planning in order to support a consistent planning approach and provide space for effective mainstreaming of climate adaptation into policies and plans.</p> <p>Introduce mechanisms and procedures for integrating different time horizons into local policies and plans and supporting integrated approaches to climate adaptation and coastal management (e.g. by using by-laws and additional planning initiatives).</p>
Institutions (formal/informal)	<p>Establish an official, multi-level coordinating institution/group for coastal climate adaptation combining capacity and power at the national level and community outreach at the local level. Local authorities should be assigned a key role in facilitating multi-level climate</p>

	<p>adaptation planning.</p> <p>Build on existing formal and informal institutions and their experience of integrated management (e.g. ICZM ECNs) and stakeholder participation to support mainstreaming adaptation into strategic planning and coastal management.</p> <p>Through institutions at different levels, encourage local coordination of climate adaptation and ICZM, e.g. through independent 'bridging organisations' representing different interests and serving as advisory boards for local administrations.</p>
Scientific support	<p>Present scientific information to coastal managers and stakeholders in a user-friendly format adapted for non-academic audiences. Disseminate scientific information to communities in accessible formats including public lectures from leading scientists, online presentations and video material.</p> <p>Where possible provide climate change projections and information on impacts and associated risks in a local context and for different time horizons.</p> <p>Maintain and utilise different sources of knowledge (e.g. local knowledge about contextual effects of climate change) and provide necessary infrastructure, including guidance and technical support for local monitoring.</p>
Communication	<p>Build on established strong social networks in Irish communities and local communication channels (radio, newspapers, personal communications) for communicating information and awareness-raising.</p> <p>Support involvement of local groups and individuals working in the areas of coastal management and community actions, providing coordination, networking and informational support.</p>

Table 7.1. Capacity-building areas and associated recommendations to enable local coastal climate adaptation in Ireland using ACM

3. **guidelines and software** for local-scale coastal climate adaptation based on the six-step CLAD local coastal adaptation cycle: (1) Engaging key stakeholders, (2) Identifying the context for climate adaptation, (3) Assessing current vulnerabilities, (4) Assessing future vulnerabilities and potential adaptation options, (5) Managing adaptation, (6) Monitoring, evaluation, revision
4. **website coastalresilience.ie**, with supporting information adapted to non-specialist audience, case studies, and introduction to the ACM approach, external resources; provides hosting for the guidelines, software, and acts as a communicating platform for stakeholders (ICRN)
5. **Irish Coastal Resilience Network ICRN** – a pilot network initiative consisting of local nodes

and a National Advisory Panel of experts, combining stakeholders and practitioners involved in planning and implementing local adaptation programmes.

The Tool Kit adopts a participatory, systems-oriented approach to vulnerability assessment, scenario development and adaptation management based on the principles of ACM. It provides coastal communities with a comprehensive but practical and pragmatic tool for climate adaptation planning based on local resources, and also aims to support local administrations meeting their new obligations under the NCCAF.

Further development and application of the CLAD Tool Kit will require additional support from official structures (e.g. EPA), including improvement and

application of the tools and networks and promoting new approaches and methods, perhaps most effectively via the Climate Information Platform. Notwithstanding these required efforts, actual success and sustainability of local climate adaptation is largely dependent on local initiatives, cross-sectoral coordination and continuing efforts at all levels of coastal and climate governance in Ireland.

Future steps and research directions

The CLAD Project was among the first research initiatives in Ireland to address climate adaptation decision-making as a strategic issue of local planning. Based on the research conducted under the Project, we conclude that there is an urgent necessity for follow-on research and capacity-building initiatives, specifically including the following.

- a. Further **studies and experimentation with future-based planning (e.g. scenario approaches)** are required, including design and application of user-friendly tools enabling local practitioners to address uncertainty in adaptation decision-making. The CLAD Tool Kit (guidelines and iasess:coast software) will require support and experimentation beyond the project lifetime to secure uptake of the pilot results.
- b. **Training programmes for local authorities and communities** are necessary for effective adaptation management, including risk assessment and flexible adaptation planning (e.g. using the principles of ACM and based on the best use of available information and resources), identifying barriers and opportunities for adaptation and mainstreaming adaptation actions into local planning. The design and implementation of training programmes based on existing knowledge and tools (e.g. developed by CLAD, CoCoAdapt, CoastAdapt) is an essential step for practical implementation of the NCCAF.
- c. **Networking activities and stakeholder cooperation** across levels (e.g. using ICRN model) require adequate support, including continuous and consistent coordination. Such coordination requires dedicated staff, and national agencies may take a lead role supporting further development and functioning of the ICRN (or other boundary organisation or community of practice building on the ICRN experience). **Social network research** is required to inform and support cooperation activities.
- d. Research is required on **perception, communication and reaction to the risks** associated with climate change and adaptation by society, including cultural conditions (values and beliefs), motivations for behavioural change, power of social networks and others. Such studies will indicate cultural and climate drivers for communities, groups and individuals acting at different levels and will provide grounds for informed and systematic capacity building.
- e. Further research and activities are required in **analysing the needs for informational support** and coordination of the delivery of information from different sources, including climate projections, monitoring of change and the effectiveness of adaptation measures (e.g. based on the EPA's Irish Climate Information Platform).
- f. **Communication and education strategies** need to be designed for specific social and stakeholder groups and introduced at national and local levels. In particular, youth education (e.g. secondary school level) should be considered as an important channel for behavioural change. Climate change modules should be integrated to the national curricula, with special attention to climate adaptation in the most affected (e.g. coastal) areas.

g. Research is required on **economic aspects of climate adaptation** and cost–benefit analysis of adaptation actions. The tools and methods for such analysis should be developed and adapted for practitioners and stakeholders at the local level. Economic analysis, however, should not be limited by conventional (e.g. monetary) evaluation only, but should take a broader view on non-monetary value of the resources and ecosystem services, intrinsic value of the environment and society, and future development of communities.

The CLAD Project was undertaken at a time of economic and political upheaval, with public and policy attention focused squarely on the deepening financial crisis in Ireland and wider Europe. Nevertheless, the simultaneous worsening economic and societal impacts of severe weather encountered in Ireland in recent years provided a degree of leverage for the project to engage with actors at the local scale on the subject of climate change. Introducing modes of management that were explicitly experimental and offered scope for dealing with future uncertainty was perhaps timely in this troubling environment, with many of the stakeholders involved in the project reflecting an all too acute awareness of the fact that change is a constant in social as well as ecological systems.

Exploiting this window of opportunity to effect transition to a more adaptive and collaborative approach to climate-resilient coastal management will require sustained effort and perseverance. However, effective and consistent adaptation may bring substantial benefit to the communities – not only as reduced loss but also as economic and social gains from the emerging opportunities. The project has provided a firm foundation on which these efforts can be built, with the goodwill of key actors at various scales of coastal and climate governance in Ireland secured, and a sound knowledge base regarding the challenges and

benefits of adaptive and collaborative management established among the pilot sites engaged in the research. Harnessing this momentum and moving on with the process of adaptation can and should be a key priority of future research efforts in the field in Ireland.

References

- Adger, W. N. (2006). 'Vulnerability.' *Global Environmental Change* **16**(3): 268–281.
- Adger, W. N., N. W. Arnell and E. L. Tompkins (2005a). 'Adapting to climate change: perspectives across scales.' *Global Environmental Change* **15**(2): 75–76.
- Adger, W. N., N. W. Arnell and E. L. Tompkins (2005b). 'Successful adaptation to climate change across scales.' *Global Environmental Change* **15**(2): 77–86.
- Armitage, D., F. Berkes and N. C. Doubleday (2007). Introduction: moving beyond co-management. *Adaptive co-management: collaboration, learning, multi-level governance*. D. Armitage, F. Berkes and N. C. Doubleday. Vancouver, UBC Press: 19–38.
- Armitage, D., R. Plummer, F. Berkes, R. I. Arthur, A. T. Charles, I. J. Davidson-Hunt, A. P. Diduck, N. C. Doubleday, D. S. Johnson, M. Marschke, P. McConney, E. W. Pinkerton and E. K. Wollenberg (2009). 'Adaptive co-management for social-ecological complexity.' *Frontiers in Ecology and the Environment* **7**(2): 95–102.
- Arnold, J. and M. Fernandez-Gemenez (2007). 'Building social capital through participatory research: an analysis of collaboration on Tohono O'odham tribal rangelands in Arizona.' *Society & Natural Resources* **20**: 481–495.
- Ballinger, R., V. Cummins, A. M. O'Hagan and M. Philippe (2008). *The point of COREPOINT: improving capacity for integrated coastal zone management in North West Europe*. Cork, Corepoint.
- Bene, C. and A. E. Neiland (2004). 'Empowerment reform, yes... but empowerment of whom? Fisheries decentralization reforms in developing countries: a critical assessment with specific reference to poverty reduction.' *Aquatic Resources, Culture and Development* **1**: 35–49.
- Bene, C. and A. E. Neiland (2006). *From participation to governance*. World Fish Centre, Penang CGIAR Challenge Program on Water and Food, Colombo.
- Bennett, E. and M. B. Zurek (2006). Integrating epistemologies through scenarios. *Bridging scale and knowledge systems*. W. V. Reid, F. Berkes, T. Wilbanks and C. D. Washington, DC, Millenium Ecosystem Assessment and Island Press: 275–293.
- Berkes, F. (2008). *Sacred ecology*. New York, Routledge.
- Berkes, F. (2009). 'Evolution of co-management: role of knowledge generation, bridging organizations and social learning.' *Journal of Environmental Management* **90**(5): 1692–1702.
- Berkes, F., D. Armitage and N. Doubleday (2007). Synthesis: adapting, innovating, evolving. *Adaptive Co-management: collaboration, learning and multi-level governance*. D. Armitage, F. Berkes and N. Doubleday. Vancouver, UBC Press: 308–327.
- Biermann, F. (2007). 'Earth system governance as a crosscutting theme of global change research.' *Global Environmental Change* **17**: 326–337.
- Biermann, F., M. M. Betsill, J. Gupta, N. Kanie, L. Lebel, D. Liverman, H. Schroeder and B. Siebenhuner (2009). Earth system governance: people, places, and the planet – science and implementation plan of the Earth System Governance Project. *International Human Dimensions Programme on Global Environmental Change*. Bonn, The Earth System Governance Project. 1.
- Biesbroek, R., J. E. M. Klostermann, J. A. M. Termeer Catrien and P. Kabat (2013). 'On the nature of barriers to climate change adaptation.' *Regional Environmental*

- Change*: in press. DOI: 10.1007/s10113-013-0421-y
- Biesbroek, R., R. J. Swart and W. G. M. van der Knaap (2009). 'The mitigation-adaptation dichotomy and the role of spatial planning.' *Habitat International* **33**(3): 230–237.
- Biggs, R., F. R. Westley and S. R. Carpenter (2010). 'Navigating the back loop: fostering social innovation and transformation in ecosystem management' *Ecology and Society* **15**(2).
- Bindoff, N. L., J. Willebrand, V. Artale, C. A. J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C. K. Shum, L. D. Talley and A. Unnikrishnan (2007). Observations: oceanic climate change and sea level. *Climate Change 2007: the physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. S. Solomon, D. Qin, M. Manning et al. Cambridge and New York, Cambridge University Press.
- Brady-Shipman, M. (1997). Coastal zone management: a draft policy for Ireland. Dublin, Government Publications Office.
- Brunner, R. (2010). 'Adaptive governance as a reform strategy.' *Policy Sciences*: 1–41.
- Brunner, R. and A. Lynch (2010a). *Adaptive governance and climate change*. Boston, American Meteorological Society.
- Brunner, R. D. and A. H. Lynch (2010b). Adaptive governance: proposals for climate change science, policy and decision making. *Adaptation and Mitigation Strategies for Climate Change*. A. Sumi, K. Fukushi and A. Hiramatsu, Osaka, Springer Japan: 269–284.
- Burch, S., S. Sheppard, A. Shaw, D. Flanders and S. Cohen (2012). Planning for Climate change in a Flood-prone Community: Municipal Barriers to Policy Action and the Use of Visualizations as Decision-support Tools. *Climate Impacts and Adaptation Science. Planned Adaptation to Climate Change*. (1): 93-121.
- Carlsson, L. and F. Berkes (2005). 'Co-management: concepts and methodological implications.' *Journal of Environmental Management* **75**(1): 65–76.
- Carter, J. G. and G. Sherriff (2011). *Spatial planning for climate change adaptation: identifying cross cutting barriers and solutions*. Manchester, Centre for Urban and Regional Ecology, The University of Manchester.
- Cash, D. W., W. N. Adger, F. Berkes, P. Garden, L. Lebel, P. Olsson, L. Pritchard and O. R. Young (2006). 'Scale and cross-scale dynamics: governance and information in a multilevel world.' *Ecology and Society* **11**(2): 8.
- Cash, D. W. and S. C. Moser (2000). 'Linking global and local scale: designing dynamic assessment and management processes.' *Global Environmental Change* **10**: 109–120.
- Charlton, R., R. Fealy, S. Moore, J. Sweeney and C. Murphy (2006). 'Assessing the impact of climate change on water supply and flood hazard in Ireland using statistical downscaling and hydrological modelling techniques.' *Climatic Change* **74**(4): 475–491.
- Chromy, J. R. (2012). 'Snowball sampling.' *Encyclopedia of Survey Research Methods* Retrieved 18 December, 2012, from <http://srmo.sagepub.com/view/encyclopedia-of-survey-research-methods/n535.xml?rskey=FWOFYY&row=3>
- Cooper, J. A. G. and V. Cummins (2009). 'Coastal research and policy integration in northwest Europe. The COREPOINT project.' *Marine Policy* **33**(16): 869–870.

- Cummins, V., C. O'Mahony and N. Connolly (2004). *Review of integrated coastal zone management and principals of best practice*. Cork, The Heritage Council.
- Cundill, G. and C. Fabricius (2009). 'Monitoring in adaptive co-management: toward a learning based approach.' *Journal of Environmental Management* **90**(11): 3205–3211.
- DAF (1999). *Ensuring the Future – A Strategy for Rural Development in Ireland: A White Paper on Rural Development*. Dublin, Department of Agriculture and Food.
- Davidson-Hunt, I. J. and R. M. O'Flaherty (2007). 'Researchers, indigenous people and place-based learning communities.' *Society and Natural Resources* **20**: 291–305.
- DCMNR (2005). *Statement of Strategy 2005–2007*. Dublin, Department of Communications, the Marine and Natural Resources.
- DCMNR (2007). *Government White Paper: Delivering a Sustainable Future for Ireland – The Energy Policy Framework 2007–2020*. Dublin, Department of Communications, the Marine and Natural Resources.
- DECLG (2002). *National Spatial Strategy for Ireland 2002–2020: People, Places and Potential*. Dublin, The Stationery Office.
- DECLG (2012). *National Climate Change Adaptation Framework: Building Resilience to Climate Change*. Dublin, Department of the Environment, Community and Local Government.
- DEHLG (2006). *Ireland's Pathway to Kyoto Compliance – Review of the National Climate Change Strategy*. Dublin, Department of the Environment, Heritage and Local Government..
- DEHLG (2007). *Ireland – National Climate Change Strategy 2007–2012*. Dublin, Department of the Environment, Heritage and Local Government.
- Desmond, M., P. O'Brien and F. McGovern (2009). A summary of the state of knowledge on climate change impacts for Ireland. *CCRP Report No. 1*. Wexford, Environmental Protection Agency.
- Desmond, M. and T. Shine (2011). Integrating Climate Change Adaptation into Sectoral Policies in Ireland. *CCRP Report No. 10*. Wexford, Environmental Protection Agency.
- Desmond, M. and T. Shine (2012). National Adaptive Capacity Assessment. *CCRP Report No.17*. Wexford, Environmental Protection Agency.
- Devoy, R. (2000). *Implications of accelerated sea-level rise (ASLR) for Ireland*. SURVAS Expert Workshop on European Vulnerability and Adaptation to Impacts of Accelerated Sea-Level Rise (ASLR), Hamburg, SURVAS.
- Devoy, R. (2008). 'Coastal vulnerability and the implications of sea-level rise for Ireland.' *Journal of Coastal Research* **24**(2): 325–341.
- Dietz, T., E. Ostrom and P. C. Stern (2003). 'The struggle to govern the commons.' *Science* **302**(12 December): 5.
- DMNR (2001). *Making the Most of Ireland's Marine and Natural Resources. Strategy Statement 2001–2003*. Dublin, Department of the Marine and Natural Resources.
- DMNR, DEHLG and DENI (1996). *Environmentally Friendly Coastal Protection – ECOPRO. Ireland – Code of practice for environmentally friendly coastal management*. Dublin, The Stationery Office.
- Doody, J. (2004). "'Coastal squeeze" – an historical perspective.' *Journal of Coastal Conservation* **10**(1): 129–138.
- DRERIP. (2012). *Delta Regional Ecosystem Restoration Implementation Plan. Adaptive Management*. Retrieved 7 June

- 2012 from
www.dfg.ca.gov/ERP/adaptive_management.asp
- Dreyer, M. and O. Renn (2011). 'Participatory approaches to modelling for improved learning and decision-making in natural resource governance: an editorial.' *Environmental Policy and Governance* **21**(6): 379–385.
- Dwyer, N. (2012). *State of Ireland's Climate 2012*. Johnstown Castle, Co. Wexford, Ireland, Environmental Protection Agency.
- Eamer, J. (2006). Keep it simple and be relevant: the first ten years of the Arctic Borderlands Ecological Knowledge Co-op. *Bridging scales and knowledge systems*. W. V. Reid, F. Berkes, T. Wilbanks and D. Capistrano. Washington, DC, Millenium Ecosystem Assessment and Island Press: 185–206.
- EC (1999). *Lessons from the European Commission's Demonstration Programme on Integrated Coastal Zone Management (ICZM)*. Brussels, Commission of the European Communities.
- EC (2001). *European Governance: A White Paper*, COM(2001) 428 final. Brussels, Commission of the European Communities.
- EC (2007). *Adapting to Climate Change in Europe – Options for EU Action. Green Paper*. COM(2007) 354 final. Brussels, Commission of the European Communities.
- Falaleeva, M., C. O'Mahony, S. Gray, M. Desmond, J. Gault and V. Cummins (2011). 'Towards climate adaptation and coastal governance in Ireland: Integrated architecture for effective management?' *Marine Policy* **35**(6): 784–793.
- Fealy, R. (2003). The impacts of climate change on sea level and the Irish coast. *Climate change: scenarios and impacts for Ireland*. J. Sweeney. Johnstown Castle, Co. Wexford, Ireland, Environmental Protection Agency/NUI Maynooth.
- Fealy, R. and J. Sweeney (2008). Climate scenarios for Ireland. *Climate change – refining the impacts for Ireland*. J. Sweeney, F. Albanito, A. Brereton et al. Johnstown Castle, Co. Wexford, Ireland, Environmental Protection Agency: 1–4.
- Fennell, D., R. Plummer and M. Marschke (2008). 'Is adaptive co-management ethical?' *Journal of Environmental Management* **88**(1): 62–75.
- Fletcher, S. and K. Pike (2007). 'Coastal management in the Solent: the stakeholder perspective.' *Marine Policy* **31**(5): 638–644.
- Folke, C. (2006). 'Resilience: the emergence of a perspective for social-ecological systems analyses.' *Global Environmental Change* **16**(3): 253–267.
- Folke, C., T. Hahn, P. Olsson and J. Norberg (2005). 'Adaptive governance of social-ecological systems.' *Annual Review of Environment and Resources* **30**(1): 441–473.
- Füssel, H. M. (2007). 'Adaptation planning for climate change: concepts, assessment approaches, and key lessons.' *Sustainability Science* **2**(2): 265–275.
- Gault, J., A. M. O'Hagan, V. Cummins, J. Murphy and T. Vial (2011). 'Erosion management in Inch beach, South West Ireland.' *Ocean and Coastal Management* **54**(12): 930–942.
- Gibbs, M. T. (2009). 'Resilience: what is it and what does it mean for marine policymakers?' *Marine Policy* **33**(2): 322–331.
- Green, C. and L. McFadden (2007). 'Coastal vulnerability as discourse about meanings and values.' *Journal of Risk Research* **10**(8): 1027–1045.
- Gunderson, L. H. and C. S. Holling, Eds. (2002). *Panarchy: understanding transformations*

- in human and natural systems.*
Washington, Island Press.
- Gupta, J., C. Termeer, J. Klostermann, S. Meijerink, M. van den Brink, P. Jong, S. Nooteboom and E. Bergsma (2010). 'The Adaptive Capacity Wheel: a method to assess the inherent characteristics of institutions to enable the adaptive capacity of society.' *Environmental Science & Policy* **13**(6): 459–471.
- Hahn, T., P. Olsson, C. Folke and K. Johansson (2006). 'Trust-building, knowledge generation and organizational innovations: the role of a bridging organization for adaptive comanagement of a wetland landscape around Kristianstad, Sweden.' *Human Ecology* **34**(4): 573–592.
- Heritage Council (2006). *Conserving Ireland's maritime heritage*. Kilkenny, An Chomhairle Oidhreachta/The Heritage Council.
- Holling, C. S. (1978). *Adaptive environmental assessment and mangement*. New York, Willey.
- Holling, C. S. (2001). 'Understanding the complexity of economic, ecological, and social systems.' *Ecosystems* **3**: 390–405.
- Huitema, D., E. Mostert, W. Egas, S. Moellenkamp, C. Pahl-Wostl and R. Yalcin (2009). 'Adaptive water governance: assessing the institutional prescriptions of adaptive (co-)management from a governance perspective and defining a research agenda.' *Ecology and Society* **14**(1).
- IAE (2009). *Ireland at risk: critical infrastructure*. Dublin, Irish Academy of Engineers.
- IPCC (2007). Climate change 2007: synthesis report. *Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, Cambridge University Press.
- IPCC (2012). Summary for policymakers. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. C. B. Field, V. Barros, T. F. Stocker et al. Cambridge and New York, Cambridge University Press: 1–19.
- Janssen, M. A. and E. Ostrom (2006). 'Resilience, vulnerability, and adaptation: a cross-cutting theme of the International Human Dimensions Programme on Global Environmental Change.' *Global Environmental Change* **16**(3): 237–239.
- Jol, A., F. Raes, B. Menne and T. Wolf (2009). *Impacts of Europe's changing climate – 2008 indicator based assessment*. Copenhagen, EEA.
- Kallis, G., M. Kiparsky, et al. (2009). "Collaborative governance and adaptive management: Lessons from California's CALFED Water Program." *Environmental Science & Policy* **12**(6): 631-643.
- Kelly, B. and M. Stack (2009). *Climate change, heritage and tourism: implications for Ireland's coast and inland waterways*. The Heritage Council of Ireland Series. Dublin, An Chomhairle Oidhreachta and Failte Ireland.
- Kireyeu, V. and A. Shkaruba (2009). *Climate change and forest ecosystems in Belarus: integration of exposure and institutional adaptability*. Volendam, The Netherlands, IOP Conference Series: Earth and Environmental Science.
- Kofinas, G. (2002). Community contribution to ecological monitoring: knowledge co-production in the US–Canada Arctic Borderland. *The Earth is faster now*. I. Kupnik and D. Jolly. Fairbanks, AK, Arctic Research Consortium of the United States: 54–91.
- Kok, K. (2008). 'The potential of fuzzy cognitive maps for semi quantitative scenario development, with an example from

- Brazil.' *Global Environmental Change* **19**: 122–133.
- Kok, K., R. Biggs and M. B. Zurek (2007). 'Methods for developing multi-scale participatory scenarios: insights from southern Africa and Europe.' *Ecology and Society* **13**(1):8.
- Kopke, K. and C. O'Mahony (2011). 'Preparedness of key coastal and marine sectors in Ireland to adapt to climate change.' *Marine Policy* **35**(6): 800–809.
- Lebel, L., J. M. Anderies, B. Campbell, C. Folke, S. Hatfield-Dodds, T. Hughes and J. Wilson (2006). 'Governance and capacity to manage resilience in regional social-ecological systems.' *Ecology and Society* **11**(1):12.
- Lee, K. N. (1993). *Compass and gyroscope: integrating science and politics for the environment*. Washington, DC, Island Press.
- McConney, P., R. Mahon, and R. Pomeroy (2007). Challenges facing coastal resource co-management in the Caribbean. Pages 105–124 in D. Armitage, F. Berkes, and N. Doubleday, editors. *Adaptive co-management: collaboration, learning and multi-level governance*. University of British Columbia Press, Vancouver, British Columbia, Canada.
- McElwain, L. and J. Sweeney (2007). *Key meteorological indicators of climate change in Ireland*. Johnstown Castle, Co. Wexford, Ireland, Environmental Protection Agency.
- McGloughlin, J. (2009). *Co-ordination, communication and adaptation for climate change in Ireland: an integrated approach*. Retrieved 26 November 2012 from <http://icarus.nuim.ie/coco-adapt>
- McGrath, R., S. Dunne, J. Hanafin, P. Lynch, E. Nishimura, P. Nolan, J. V. Ratnam, T. Semmler, C. Sweeney, S. Varghese and S. Wang (2009). *Ireland in a warmer world – scientific predictions of the Irish Climate in the twenty-first century*. E. P. Agency. Dublin, Met Éireann and University College Dublin.
- McKenna, J. and J. A. G. Cooper (2006). 'Sacred cows in coastal management: the need for a cheap and transitory model.' *Area* **38**: 421–431.
- McKenna, J., J. A. G. Cooper and A. M. O'Hagan (2008). 'Managing by principle: a critical analysis of the European principles of integrated coastal zone management (ICZM).' *Marine Policy* **32**(6): 941–955.
- McKenna, J., M. MacLeod, J. Power and J. A. G. Cooper (2000). *Rural beach management: a good practice guide*. Lifford, Ireland: Donegal County Council.
- Merkle, J. A. (1980). *Ideology and management: the legacy of the international scientific management movement*. Berkeley, CA, University of California Press.
- Moellenkamp, S., M. Lamers, C. Huesmann, S. Rotter, C. Pahl-Wostl, K. Speil and W. Pohl (2010). 'Informal participatory platforms for adaptive management. insights into niche-finding, collaborative design and outcomes from a participatory process in the Rhine Basin' *Ecology and Society* **15**(4).
- Moser, S. and L. Dilling, Eds. (2007). *Creating a climate for change: communicating climate change and facilitating social change*. Cambridge, Cambridge University Press.
- Moser, S. C. (2008). *Resilience in the face of global environmental change*. CARRI Research Report 2, Oak Ridge, TN, Community and Regional Resilience Initiative.
- Moser, S. C. (2010). 'Now more than ever: the need for more societally relevant research on vulnerability and adaptation to climate change.' *Applied Geography* **30**(4): 464–474.

- Moser, S. C. and J. Ekstrom (2010). 'A framework to diagnose barriers to climate change adaptation.' *Proceedings of the National Academy of Sciences of the United States of America* **107**(51): 22026–22031.
- Noble, B. F. (2000). 'Institutional criteria for co-management.' *Marine Policy* **24**: 69–77.
- O'Brien, K., S. Eriksen, et al. (2007). "Why different interpretations of vulnerability matter in climate change discourses." *Climate Policy* **7**: 73-88.
- O'Hagan, A. M. and R. Ballinger (2009). 'Coastal governance in North West Europe: an assessment of approaches to the European stocktake.' *Marine Policy* **33**: 912–922.
- O'Hagan, A. M. and R. C. Ballinger (2010). 'Implementing integrated coastal zone management in a national policy vacuum: Local case studies from Ireland.' *Ocean and Coastal Management* **53**(12): 750–759.
- O'Hagan, A. M. and A. Cooper (2002). 'Spatial variability in approaches to coastal protection in Ireland.' *Journal of Coastal Research* (Special Issue 36): 544–551.
- Oliver, P. (2012). 'Purposive sampling.' *The SAGE dictionary of social research methods*. Retrieved 18 December 2012 from <http://srmo.sagepub.com/view/the-sage-dictionary-of-social-research-methods/n162.xml>
- Olsson, P., C. Folke and F. Berkes (2004). 'Adaptive comanagement for building resilience in social–ecological systems.' *Environmental Management* **34**(1): 75–90.
- Olsson, P., L. H. Gunderson, S. R. Carpenter, P. Ryan, L. Lebel, C. Folke, and C. S. Holling (2006). 'Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems.' *Ecology and Society* **11**(1).
- O'Mahony, C., J. Gault, V. Cummins, K. Köpke and D. O'Suilleabhain (2009). 'Assessment of recreation activity and its application to integrated management and spatial planning for Cork Harbour, Ireland.' *Marine Policy* **33**(6): 930–937.
- Ostrom, E. (2005). *Understanding institutional diversity*. Princeton, NJ, Princeton University Press.
- Pinkerton, E. (1989). *Co-operative management of local fisheries*. Vancouver, University of British Columbia.
- Pinkerton, E. (2007). Integrating holism and segmentalism: overcoming barriers to adaptive co-management between management agencies and multi-sector bodies. *Adaptive co-management: collaboration, learning, multi-level governance*. D. Armitage, F. Berkes and N. C. Doubleday. Vancouver, UBC Press: 105–124.
- Plummer, R. (2009). 'The adaptive co-management process: an initial synthesis of representative models and influential variables.' *Ecology and Society* **14**(2): 24.
- Plummer, R. and D. Armitage (2007a). 'Charting the new territory of adaptive co-management: a Delphi study.' *Ecology and Society* **12**(2): 10.
- Plummer, R. and D. Armitage (2007b). 'A resilience-based framework for evaluating adaptive co-management: linking ecology, economics and society in a complex world.' *Ecological Economics* **61**(1): 62–74.
- Plummer, R. and D. Fennell (2007). 'Exploring co-management theory: prospects for sociobiology and reciprocal altruism.' *Journal of Environ Management* **85**: 944–955.
- Plummer, R. and J. FitzGibbon (2004). 'Some observation on the terminology of co-operative environmental management.' *Journal of Environmental Management* **70**: 63–72.

- Prutsch, A., T. Grothmann, et al. (2010). "Guiding principles for adaptation to climate change in Europe." *ETC/ACC Technical Paper* **6**.
- Robinson, J. (2003). 'Future subjunctive: backcasting as social learning.' *Futures* **35**(8): 839–856.
- Ruitenbeek, J. and C. Cartier (2001). *The invisible wand: adaptive co-management as an emergent strategy in complex bio-economic systems*. Bogor, Indonesia, Center for International Forestry Research.
- Rupprecht (2006). *Evaluation of integrated coastal zone management (ICZM) in Europe*. Cologne, Rupprecht Consult–Forschung & Beratung GmbH.
- Saavedra, C. and W. W. Budd (2009). 'Climate change and environmental planning: working to build community resilience and adaptive capacity in Washington State, USA.' *Habitat International* **33**(3): 246–252.
- Seneviratne, S. I., N. Nicholls, D. Easterling, C. M. Goodess, S. Kanae, J. Kossin, Y. Luo, J. Marengo, K. McInnes, M. Rahimi, M. Reichstein, A. Sorteberg, C. Vera and X. Zhang (2012). Changes in climate extremes and their impacts on the natural physical environment. *Managing the risks of extreme events and disasters to advance climate change adaptation: a special report of Working Groups I and II of the Intergovernmental Panel on Climate Change*. C. B. Field, V. Barros, T. F. Stocker. et al., Cambridge and New York, Cambridge University Press: 109–203.
- Stern, N. (2007). *The economics of climate change: the Stern review*. Cambridge and New York, Cambridge University Press.
- Swart, R., R. Biesbroek, S. Binnerup, T. R. Carter, C. Cowan, T. Henrichs, S. Loquen, H. Mela, M. Morecroft, M. Reese and D. Rey (2009). Europe adapts to climate change: comparing national adaptation strategies. *PEER Report No 1*. Helsinki, Partnership for European Environmental Research.
- Sweeney, J., F. Albanito, A. Brereton, A. Caffarra, R. Charlton, A. Donnelly, R. Fealy, J. Fitzgerald, N. Holden, M. Jones and C. Murphy (2008). *Climate change – refining the impacts for Ireland*. EPA STRIVE Programme 2007–2013. Johnstown Castle, Co. Wexford, Ireland, Environmental Protection Agency/NUI Maynooth.
- Sweeney, J. and R. Fealy (2008). Global and Irish trends in climate. *CLIMATE CHANGE – Refining the Impacts for Ireland. Climate change – refining the impacts for Ireland*. EPA STRIVE Programme 2007–2013. Johnstown Castle, Co. Wexford, Ireland, Environmental Protection Agency/NUI Maynooth: 1–4.
- Tàbara, D., F. Cots, X. Dai, M. Falaleeva, Z. Flachner, G. Jia, P. Kazner, D. McEvoy, I. Làng, Y. Sun and S. Werners (2008). *Appraising long-term regional climate policies in Inner Mongolia, the Tisza floodplain and the Guadiana river basin*, Berlin, Free University of Berlin.
- TCD (2009). *Phenology – School of Natural Sciences*. Retrieved 26 November 2009 from www.tcd.ie/Botany/phenology
- Tompkins, E. L. and W. N. Adger (2004). 'Does adaptive management of natural resources enhance resilience to climate change?' *Ecology and Society* **9**(2).
- Tribbia, J. and S. C. Moser (2008). 'More than information: what coastal managers need to plan for climate change.' *Environmental Science & Policy* **11**(4): 315–328.
- VanWynsberghe, R., J. Moore, J. Tansey and J. Carmichael (2003). 'Towards community engagement: six steps to expert learning for future scenario development.' *Futures* **35**(3): 203–219.
- Vogel, C., S. C. Moser, R. E. Kaspersen and G. D. Dabelko (2007). 'Linking vulnerability,

- adaptation, and resilience science to practice: pathways, players, and partnerships.' *Global Environmental Change* **17**(3–4): 349–364.
- Walker, B., L. Gunderson, A. Kinzig, C. Folke, S. Carpenter and L. Schultz (2006). 'A handful of heuristics and some propositions for understanding resilience in social-ecological systems.' *Ecology and Society* **11**(1): 13.
- Walters, C. J. (1986). *Adaptive management of renewable resources*. New York, Macmillan.
- WCED (1987). *Our common future*. Oxford and New York, World Commission on Environment and Development.
- Wollenberg, E., D. Edmunds and L. Buck (2000). 'Using scenarios to make decisions about the future: anticipatory learning for the adaptive co-management of community forests.' *Landscape and Urban Planning* **47**(1–2): 65–77.
- Wollenberg, E., R. Iwan, G. Limberg, M. Moeliono, S. Rhee and M. Sudana (2007). 'Facilitating cooperation during times of chaos: spontaneous orders and muddling through in Malinau District, Indonesia ' *Ecology and Society* **12**(1): 3.
- Young, O. R. (2002). *The institutional dimensions of environmental change: fit, interplay, and scale*. Cambridge, MA, MIT Press.

Annex 1. Present status and needs for capacity building in coastal climate adaptation: CLAD

Project recommendations

*Implementation

Primary action level

L local **R** regional (county) **N** national

Time horizon/urgency of actions

-  actions need to be started/implemented immediately (0–5 years)
-  actions to be implemented/sustained in mid-term (5–10 years); may require preparatory action and research
-  strategic actions to be implemented/sustained in long term (10–20 years); require preparatory actions and research

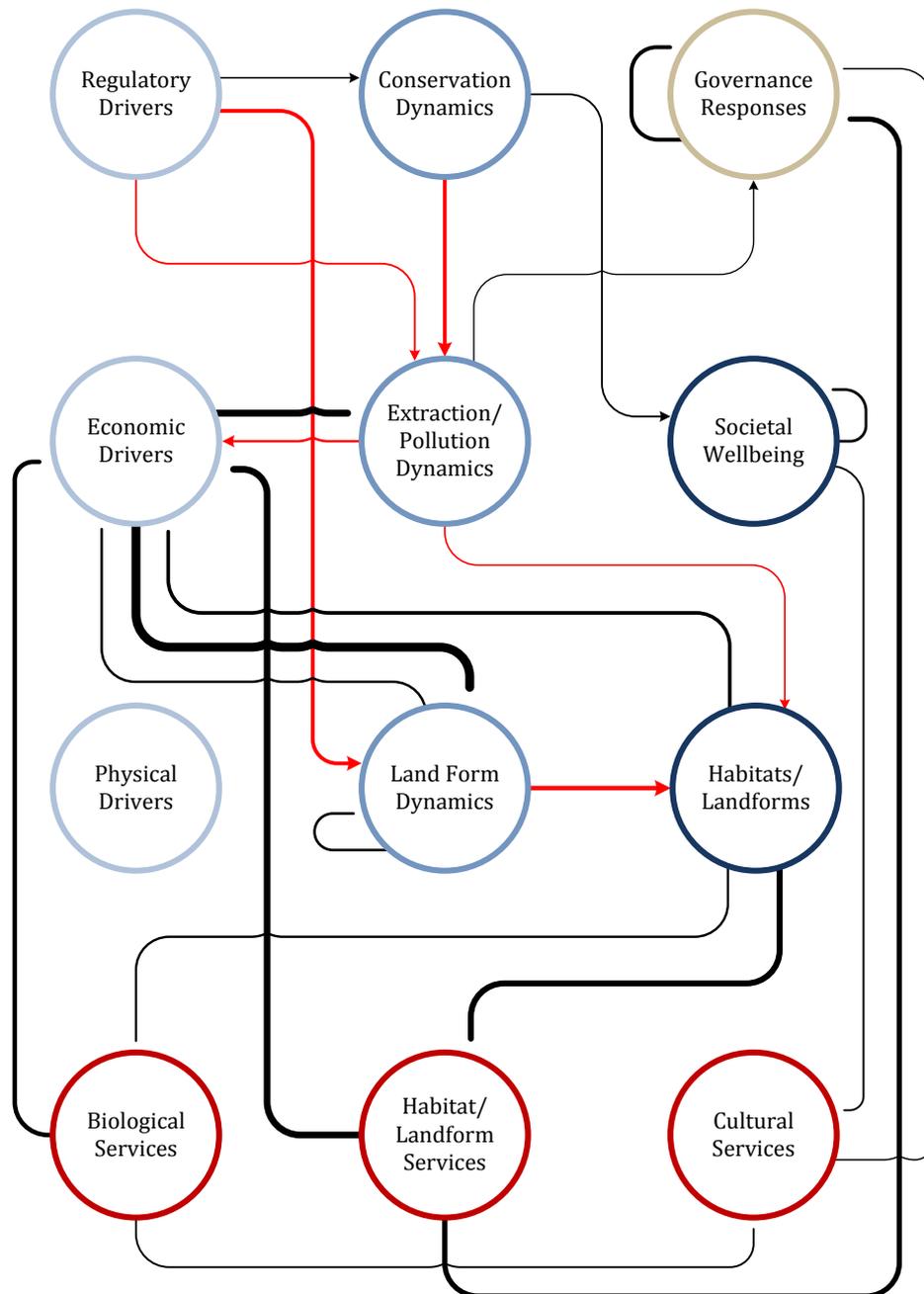
Capacity building area	Present status (based on stakeholders' interviews)	Recommendations and management targets	Implementation
Problem framing	<p>General understanding (by stakeholders) of the importance of adaptation, though not necessarily understood in 'climate adaptation' terms.</p> <p>General stakeholders' concern regarding the uncertainties and complexities associated with climate change.</p> <p>Need for integral planning is recognised, though little clarity exists on how it can be achieved.</p> <p>Lack of systematic dialogue on the causes and local impacts of climate change.</p>	<ul style="list-style-type: none"> o Use national and local communications to present climate adaptation as a strategic factor for community development and an integral part of effective coastal management. o Systematically communicate the causes and effects of climate change to local communities, emphasising local implications of the impacts. o Communicate short- and long-term risks and benefits (environmental, social, economic) and uncertainties associated with climate change and adaptation to key stakeholders at all levels, e.g. local managers, regional planners. o Avoid representing climate adaptation as a separate management and funding area; instead present successful adaptation as effective distribution of available resources and promote co-financing and co-ownership of adaptation actions. 	<p>R N  </p> <p>L R </p> <p>L R </p> <p>L R N  </p>
Decision-making	<p>Experiences of collaboration and participation emerge, though more</p>	<ul style="list-style-type: none"> o Enable decision-making procedures and regulations to revise and correct management decisions adjusting targets to changing conditions, thus addressing 	<p>R N  </p>

	<p>systematic approach is needed to support actors' collaboration across the levels. Official support of stakeholder involvement is required (legal requirements and guidelines). 'Linear' top-down decision-making does not facilitate field testing of decisions. Learning at all administrative and individual levels is mostly reactive, though several local learning examples support new proactive approaches.</p>	<p>the uncertainty.</p> <ul style="list-style-type: none"> ○ Support systematic learning at administrative and individual levels, e.g. through communicating best practices and actors' collaboration, to ensure transfer of knowledge between the stakeholders' groups and reduce the potential for loss of experience resulting from the regular redeployment of administrative personnel. ○ Use local experience and social networks to encourage stakeholder involvement in adaptation planning. ○ Provide tools and guidelines for forward-looking approaches enabling local practitioners to develop proactive adaptation responses utilising local capacity. ○ Provide support for stakeholder involvement by strengthening regulations for participation and clarifying roles and responsibilities of coastal actors. 	   
<p>Policies & plans</p>	<p>Policy fragmentation and the lack of integrative approaches to coastal management and climate adaptation create obstacles for strategic adaptation planning. Existing feedback processes involve revision of planning, but are unable to facilitate constant monitoring of effectiveness of the measures across management levels and at different periods of time.</p>	<ul style="list-style-type: none"> ○ Through Climate Bill and NCCAF, provide coordination and enforcement for adaptation planning, while supporting local decision-making to integrate community specifics. ○ Enable integration of climate adaptation to sectoral policies and plans through vulnerability assessments (e.g. EIA and SEA). ○ Enable coordination in coastal, marine, and terrestrial planning to provide room for mainstreaming of climate adaptation into coastal management. ○ Introduce mechanisms for integrating different time horizons into local planning and support integrating adaptation measures into local plans (e.g. by using by-laws). 	   
<p>Institutions (formal/informal)</p>	<p>Present institutions for coastal management and adaptation are seen by stakeholders as legitimate, though not always effective, e.g. due to unclear responsibilities and fragmentation. There is a need for institutional</p>	<ul style="list-style-type: none"> ○ Establish an official, multi-level coordinating institution/group for coastal climate adaptation combining national-level capacity and local-level community outreach. Local authorities to be assigned a key role in facilitating multi-level adaptation planning. ○ Build on existing formal and informal institutions and their experience of integrated management (e.g. ICZM ECNs) and stakeholder participation to support 	 

	modernisation to support flexible management and cross-level cooperation.	<p>mainstreaming adaptation into strategic planning and coastal management.</p> <ul style="list-style-type: none"> ○ Through institutions at different levels, encourage local coordination of climate adaptation and integrated coastal management, e.g. through independent 'bridging organisations'. 	
Scientific support	<p>Several research agencies provide information on coastal management and adaptation; more integrated approach and locally-specific information is required; Capacities for data collection and monitoring exist at different levels, but need to be enhanced.</p>	<ul style="list-style-type: none"> ○ Present scientific information to coastal managers and stakeholders in a user-friendly format adopted for non-academic audience. Disseminate scientific information to community, e.g. through public lectures, online presentations and video material. ○ Where possible provide climate change projections and information on impacts and associated risks at a local context and for different time horizons. ○ Utilise different sources of knowledge (e.g. local knowledge) and provide necessary infrastructure including guidance and technical support for local monitoring. 	  
Communication	<p>Stakeholder communication is impaired by fragmented institutions, lack of participatory experience and feedback mechanisms. Strong social networks provide a basis for self-organisation at the local level, but these capacities need to be supported.</p>	<ul style="list-style-type: none"> ○ Build on established strong social networks in Irish communities and local communication channels (radio, newspapers, personal communications) for communicating information and awareness-raising. ○ Support involvement of local groups and individuals working in the areas of coastal management and community actions, providing national- and regional- level coordination, networking and informational support. 	 

Annex 2. Stakeholders' shared models of the coastal social-ecological systems of Bantry Bay and Tralee Bay

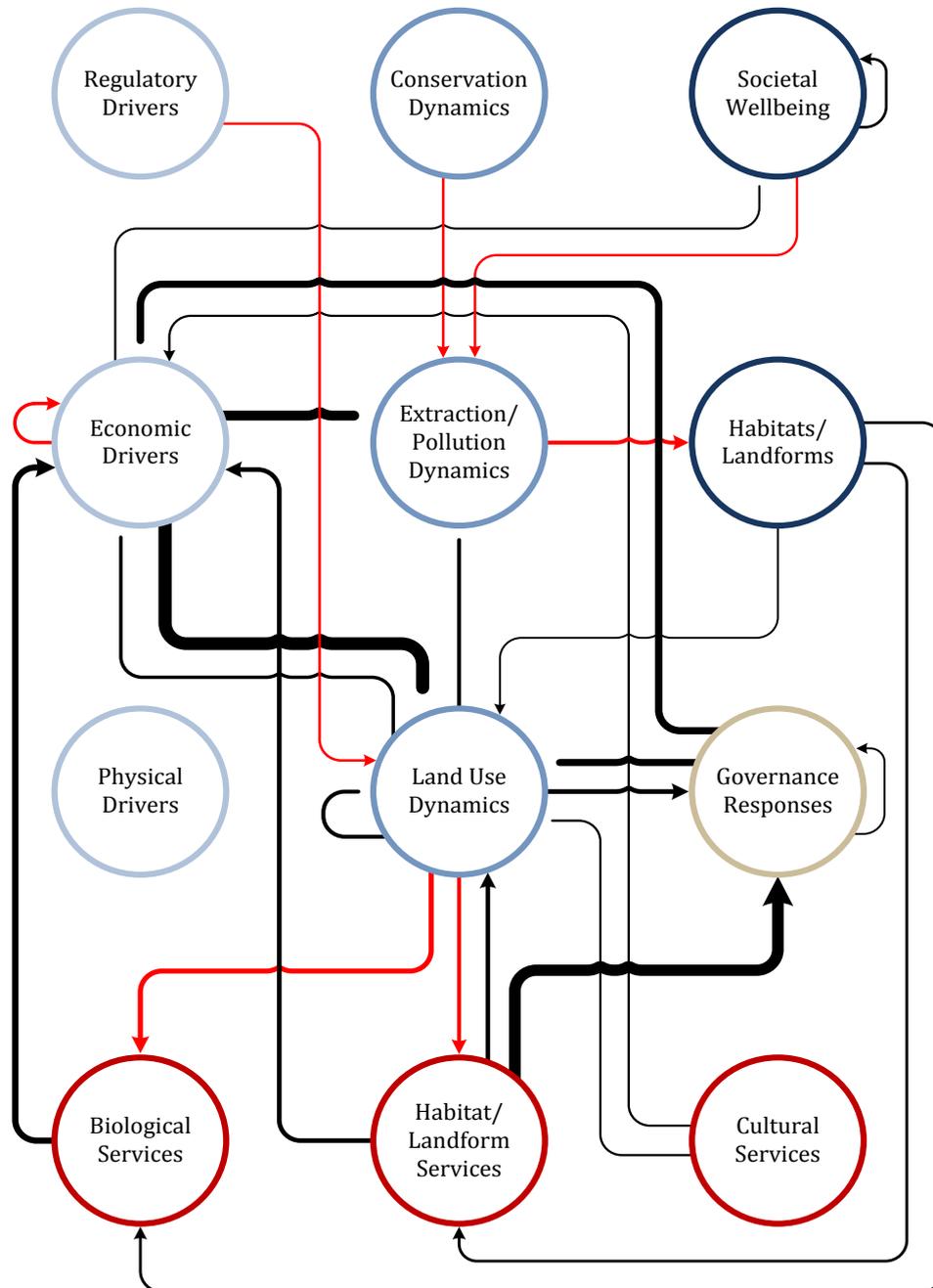
Tralee Bay: Shared Model



KEY:  Exerts force to increase
(strength of relationship indicated by line weight)

 Exerts force to decrease
(strength of relationship indicated by line weight)

Bantry Bay: Shared Model



KEY: Exerts force to increase
(strength of relationship indicated by line weight)

Exerts force to decrease
(strength of relationship indicated by line weight)

Annex 3. Questions in stakeholder interviews

Baseline information – Climate Change and Coastal Management

1. What would you consider to be the main issues related to management of coastal areas in your area?
2. What would you consider to be the main consequences, good or bad, of climate change in your area?
3. In your opinion, which groups of people in your area are the most *vulnerable* to climate change? Why?
4. In your opinion, are there any groups of people in your area that might *benefit* from climate change? Why?
5. Do you think people in your region have a basic understanding of the need to prepare for climate change (in the short- and long-term)?

Adaptation Actions and Planning

6. Are you aware of, involved with, or planning any activities that could support climate change adaptation for your region (especially related to coastal zones but not exclusively)?
7. In your opinion, what kind of adaptation actions would be relevant for your region over the short-term (within 5 yrs), medium-term (within 30 yrs) and long-term (50-100 yrs); and in areas/sectors – coastal, urban areas, agriculture, water management, others.
8. Do you think adaptation to climate change is relevant to your professional activity (or the group you are representing)? If so, how?
9. In your opinion, who is currently taking responsibility for adaptation to climate change in your region?
10. In your opinion, who should be taking responsibility for adaptation to climate change in your region (including your group if applicable)?
11. Do those with a responsibility for adaptation to climate change have all they require to develop and implement actions and plans?

Information

12. In your opinion, what kind of information is needed to support adaptation to climate change in your community? Who should generate/provide this information? Who should use it?
13. Do you (or your group) currently use scientific data/information in your activities and planning for future? If so, where do you get it from and in what format?

Participation [Not Limited to Climate Change]

14. Have you (or your group) actively worked with other groups/people in the region and relevant other groups (i.e. at higher administrative levels)? If yes, on which issues?
15. How would you describe your experience of this cooperation?
16. Specifically for *climate change adaptation*, who do you think should cooperate and how? Who should be organising/leading on such cooperation?
17. How do you (or your group) communicate with other groups in the area (personal communication, organised network, internet forums etc.)?

CLAD Tool Kit

The EPA plans to develop an informational resource to support climate adaptation planning in coastal areas. The resource will include information about the effects of climate change and guidelines for community to help them to design and implement climate change plans and actions.

18. Do you think you would use a free online resource of this type in your work? What kind of specific information / supporting material should it include to be useful to you?

19. Would you use an online platform (i.e. a blog or social networking media) for linking with other people in your area and beyond?

Concluding Remarks

20. If you were to change one thing in current planning and management practices in your region (related to coastal zones but not only) what it would be?

21. Who else should we talk to?

22. Are there any questions you would like to ask us regarding the project on climate adaptation?

Annex 4. Evaluation of the stakeholder workshops

Adaptation to climate change on the coast of Ireland

Thank you for participating in the 2nd Irish Coastal Resilience Network scenario workshop.

ICRN and the workshop you just took part in is a pilot initiative. In case of success, the guidelines for replicating the experience will be developed and EPA will recommend the methods and approaches we used for other coastal communities. Therefore it is extremely important for us to get a feedback on our work. We would greatly appreciate your answers on the questions below and encourage you to use the ICRN blog at www.coastalresilience.ie for further comments and discussion. The answer is anonymous.

1. Please mark different aspects of the workshop and its preparation from 1 to 10.

a. Practical value of the exercise itself (useful/not useful).

Comments (if any):

No use at all			To some extent				Very useful		
1	2	3	4	5	6	7	8	9	10

b. Clarity of the goals and procedures of the workshop.

Comments (if any):

Not clear			To some extent				Very clear		
1	2	3	4	5	6	7	8	9	10

c. Communication with the team prior to the workshop.

Comments (if any):

Not effective and unclear			Satisfactory				Very effective and clear		
1	2	3	4	5	6	7	8	9	10

d. Communication between the participants during the workshop.

Comments (if any):

Not effective at all			Satisfactory				Very effective		
1	2	3	4	5	6	7	8	9	10

e. Facilitation by the team.

Comments (if any):

Not effective			Satisfactory				Very effective		
1	2	3	4	5	6	7	8	9	10

f. Clarity about the follow-up activities.

Comments (if any):

Not clear			Somewhat clear				Very clear		
1	2	3	4	5	6	7	8	9	10

g. Room arrangements.

Comments (if any):

<i>Not suitable at all</i>			<i>Suitable</i>				<i>Very good</i>		
1	2	3	4	5	6	7	8	9	10

2. Do you think you had enough information to fulfil the tasks during the workshop?

a) yes

b) additional information would be helpful, but I felt confident with the tasks based on my knowledge and information provided

c) it was difficult to fulfil the tasks based only on my knowledge and information provided, additional information would be needed.

If your answer in this question is b) or c), could you please specify what kind of information would be helpful:

3. Do you think the simplified version of the integrated model based on the results of Workshop 1 reflected well the connections within the coastal system?

<i>Not at all</i>			<i>To certain extent</i>				<i>Yes, reflects very well</i>		
1	2	3	4	5	6	7	8	9	10

Comments (if any):

4. Do you think the scenarios of the coastal system changes produced by the research team prior to the workshop can inform strategic discussion and decision-making on climate adaptation?

<i>Not at all</i>			<i>To certain extent</i>				<i>Yes, can inform well</i>		
1	2	3	4	5	6	7	8	9	10

Comments (if any):

5. Do you think the scenarios and adaptation options discussed by the ICRN participants can inform strategic decision-making and developing local Climate Adaptation Strategy?

<i>Not at all</i>			<i>To certain extent</i>				<i>Yes, can inform well</i>		
1	2	3	4	5	6	7	8	9	10

Comments (if any):

6. Can you say that your vision of the needs for local climate adaptation, possible approaches and methods changed during the workshop?

<i>Not at all</i>		<i>To certain extent</i>						<i>Significantly changed</i>	
1	2	3	4	5	6	7	8	9	10

Comments (if any):

7. What kind of information and support you personally (or other actors) would require to make decisions on climate adaptation?

8. Please use the space below for any additional comments.

An Ghníomhaireacht um Chaomhnú Comhshaoil

Is í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntimid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomhnithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil, Pobal agus Rialtais Áitiúil.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreaíl;
- scardadh dramhuisce;
- dumpáil mara.

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí chomhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRSCIÚ AR AN GCOMHSHAOIL

- Monatóireacht ar chaighdeán aer agus caighdeáin aibhneacha, locha, uisce taoide agus uisce talaimh; leibhéal agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdeán aer agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le plannanna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

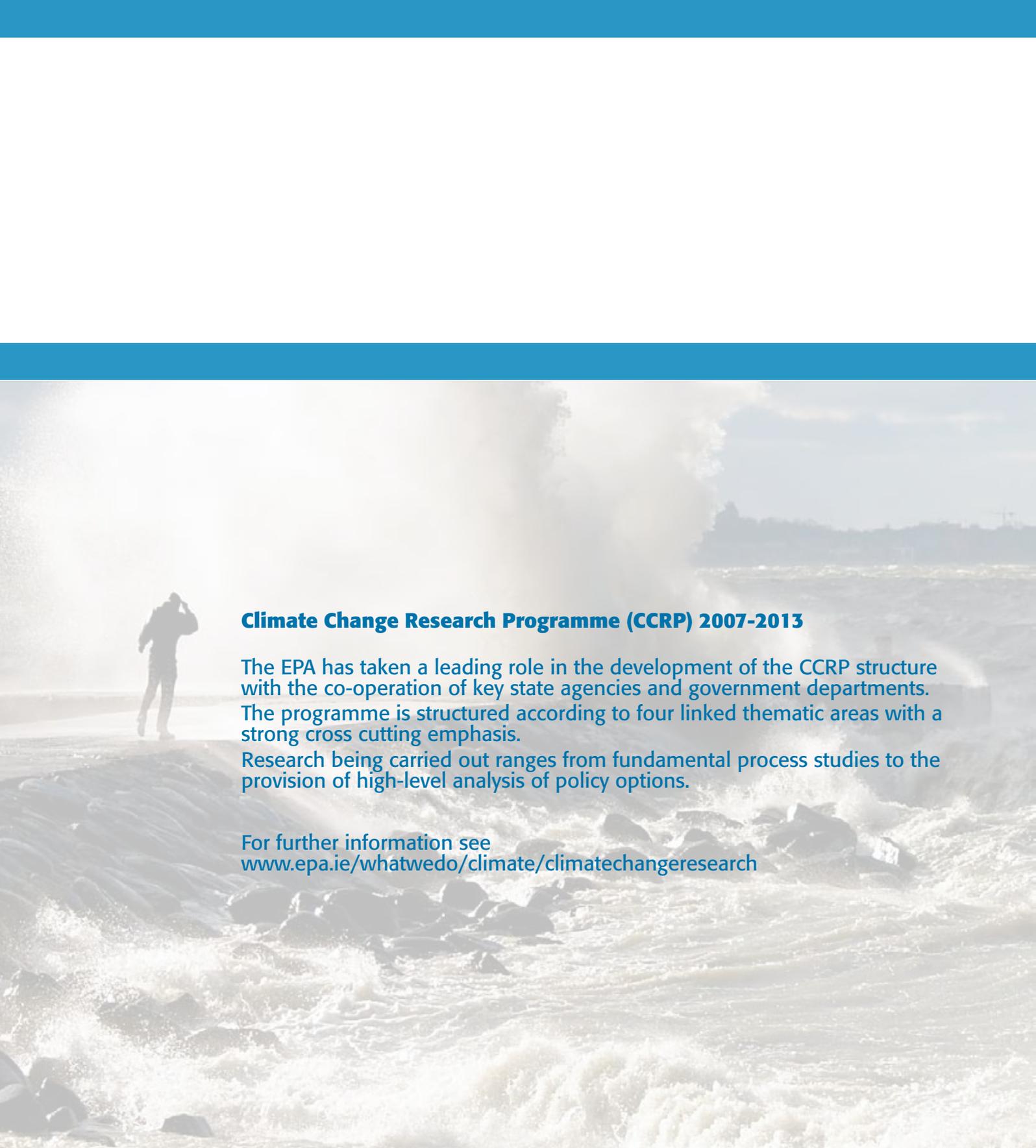
STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Ghníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstíúrthóir agus ceithre Stíúrthóir.

Tá obair na Ghníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar inní iad agus le comhairle a thabhairt don Bhord.



Climate Change Research Programme (CCRP) 2007-2013

The EPA has taken a leading role in the development of the CCRP structure with the co-operation of key state agencies and government departments. The programme is structured according to four linked thematic areas with a strong cross cutting emphasis.

Research being carried out ranges from fundamental process studies to the provision of high-level analysis of policy options.

For further information see
www.epa.ie/whatwedo/climate/climatechangeresearch



ENVIRONMENTAL PROTECTION AGENCY
PO Box 3000, Johnstown Castle Estate, Co. Wexford, Ireland
t 053 916 0600 f 053 916 0699
LoCall 1890 33 55 99
e info@epa.ie w <http://www.epa.ie>

