

All Island Disaster Risk Reduction

Build Back Better

Advancing a Focused All-Island and Cross-Border Approach to Planning for Recovery in Strategic Emergency Management

Final Report
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Comhairle Contae Mhuineacháin
Monaghan County Council



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ABBREVIATIONS

AEP	Annual Exceedance Probability
AFA	Areas for Further Assessment
APSFR	Areas of Potential Significant Flood Risk
BCE	Before the Common Era
BBB	Build Back Better
BBC	British Broadcasting Corporation
CAWT	Cooperation and Working Together
CARO	Climate Action Regional Office
CBEMG	Cross Border Emergency Management Group
CCG NI	Civil Contingencies Group Northern Ireland
CLC	Corine Land Cover
CRGs	Community Resilience Groups
DAERA	Department of Agriculture Environment and Rural Affairs
DCC	Donegal County Council
DCEE	Department of Climate, Energy and Environment
DCSDC	Derry City and Strabane District Council
DECC	Department of Environment, Climate and Communications
DHLGH	Department of Housing, Local Government & Heritage
DAFM	Department of Agriculture, Food and the Marine
Dfi	Department for Infrastructure
DRR	Disaster Risk Reduction
EFFIS	European Forest Fire Information System
EGFF	Expert Group on Forest Fires
EIA	Environmental Impact Assessment
EU	European Union
FRMP	Flood Risk Management Plan
FWI	Fire Weather Index
GAA	Gaelic Athletic Association
GHGs	Greenhouse Gases
HFPGS	Homeowner Flood Protection Grant Scheme
HSE	Health Service Executive
HRA	Habitats Regulations Assessment
ICLRD	International Centre for Local and Regional Development
IVI	Innovation Value Institute
LGCC	Local Government Civil Contingencies
MEABC	Mid and East Antrim Borough Council
MOU	Memorandum of Understanding
MUSSI	Maynooth University Social Sciences Institute
NbS	Nature-based Solutions
NDFEM	National Directorate of Fire and Emergency Management
NECG	National Emergency Coordination Group
NHA	Natural Heritage Area
NI	Northern Ireland
NIEA	Northern Ireland Environment Agency

NIFRA	Northern Ireland Flood Risk Assessment
NIFRS	Northern Ireland Fire and Rescue Service
NMDDC	Newry Mourne and Down District Council
NPWS	National Parks and Wildlife Service
NSMC	North South Ministerial Council
OECD	Organisation for Economic Co-operation and Development
OEP	Office of Emergency Planning
OPW	Office of Public Works
PAC	Planning Appeals Commission
PFRA	Preliminary Flood Risk Assessment
PHA	Public Health Agency
QUB	Queens University Belfast
RBD	River Basin District
RCG	Recovery Coordination Group
RCRG	Regional Community Resilience Group
SA	Sustainability Appraisal
SEA	Strategic Environmental Assessment
SEM	Strategic Emergency Management
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SUDS	Sustainable Urban Drainage Systems
TAPSFR	Transitional Areas of Potential Significant Flood Risk
TRAM	Transport and Road Asset Management
UK	United Kingdom
UN	United Nations
UNDDR	United Nations Office for Disaster Risk Reduction
WDPD	Water and Drainage Policy Division
WUI	Wildland-Urban Interface
YMCA	Youth Men's Christian Association

FOREWORD

In an era marked by shared challenges – ranging from pandemics and climate change to geopolitical instability – the need for resilient, inclusive, and sustainable recovery strategies has never been more urgent. The Build Back Better (BBB) approach is not merely a framework for recovery; it is a call to action for transforming adversity into opportunity, crisis into collaboration, and damage into durable progress.

This report represents an effort in fostering cross-border cooperation to strengthen systems, communities, and infrastructure in the face of multifaceted risks. By drawing on lessons learned from diverse contexts and integrating best practices across borders, we seek to chart a path that transcends traditional recovery models. Our goal is to rebuild not as we were, but as we aspire to become—more equitable, more climate-resilient, and better prepared for the complexities of tomorrow.

BBB is a post-disaster recovery concept that aims to not only restore what was lost but to improve resilience, inclusivity, and sustainability. Spatial planning plays a critical role in this process, as it provides the framework for organising land-use, infrastructure, and development in ways that reduce future risks and enhance long-term well-being.

Crucially, this report recognises that no country or community exists in isolation. The interconnected nature of today's risks requires coordinated, inclusive solutions that respect local contexts while embracing broader commonality. Through partnerships that span governments, civil society, public and private sectors, and international institutions, we can co-create a future that is safer, stronger, and more sustainable for all.

We extend our deepest gratitude to the contributors, experts, and stakeholders who have made this report possible. Their insights, innovation, and commitment to a better future are the foundation upon which this vision is built.

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EXECUTIVE SUMMARY

The Scope and Purpose of this Report

Disasters do not recognise borders. Therefore, it is critical that there is a growing cross-border commitment to not only preparedness, prevention and emergency response but also to post-incident recovery and resilience. This report focuses on the scope and potential for applying a 'Building Back Better' (BBB) approach, integrating climate adaptation and disaster risk reduction (DRR) in the recovery phase to enhance the resilience of society, infrastructure and technical systems. The report contributes to developing a better understanding of existing policy and practice with respect to recovery, assessing the extent of cross-border coherence in the recovery phase, drawing lessons from recent experiences with inland flooding and wildfire management as well as from international good practice; and finally developing context-specific recommendations for post-incident recovery. The relationship between the strategic and the operational levels in emergency management is at the core of BBB. This report thus does not focus exclusively on strategic emergency management (SEM) but is also concerned with operational matters, and in particular, the role of local authorities. Following the BBB approach, this study makes recommendations on how policymakers and practitioners in Ireland and Northern Ireland, engaged in planning for the recovery phase, can deliver positive outcomes for border communities and the entire Island.

Climate Change Adaptation and Strategic Emergency Management

Human-induced climate change poses fundamental challenges to society, both locally and globally. Transformative change is necessary to enhance the resilience of social, economic, environmental and infrastructural systems. Climate change mitigation and adaptation must be built into wider agendas for sustainable development and regeneration, recognising that the impacts of environmental change disproportionately affect the most vulnerable and disadvantaged. Consequently, closer integration between emergency planning, DRR and climate change adaptation is required. Climate change is associated not only with an increase in the severity and frequency of extreme events but also with increased uncertainties with regard to current and future environmental risks. Disaster risk management requires holistic approaches founded on community engagement, stakeholder consultation and the integration of local place-based knowledge, in addition to technical and scientific expertise.

Building Back Better

The Building Back Better (BBB) approach, endorsed by the UN Sendai Framework, calls for the recovery phase to be used strategically to enhance the resilience of both physical and social systems. Cross-sectoral dialogue, coordination and multi-stakeholder partnership are thus at the core of the BBB agenda. At the heart of a BBB approach is an appraisal of a range of alternative recovery options that may go beyond a 'return to normality'. BBB requires timely strategic reflection to identify the preferred option not just for building back, but for building

back better. This capacity for strategic reflection is dependent on the parameters set at central government level (e.g. budgets, lead agencies, high level priorities), but must also directly involve local authorities and other actors with operational competences. Effective public engagement requires clear communication on the division of responsibilities between the state, civil society, businesses and homeowners.

BBB calls for increased integration between disaster risk reduction, climate change adaptation and strategic forward planning for the built environment. Reactive emergency response measures must be embedded within long-term proactive frameworks with the aim of enhancing preparedness, resilience and adaptive capacity. National climate change policies in both Ireland and Northern Ireland identify the need for a cross-sectoral approach to climate change adaptation, focused on building resilience and the integration of short-term emergency response with longer-term disaster risk management.

BBB requires dedicated financing. Careful consideration must be given to the development of criteria for the allocation of public funds to ensure both short-term and longer-term needs are given due consideration. Post-incident recovery funds should be responsive to the needs of public sector bodies and community organisations, as well as private households and businesses. High-level recognition that BBB may require a greater level of initial public investment than alternative recovery options with a short-term focus, or more narrowly defined scope, is required. BBB works towards ensuring higher resilience, adaptive capacity and enhanced public benefits within a longer-term perspective. Decisions on financing and funding allocation criteria should not be made on an *ad hoc* basis in the initial response phase. Rather, such financial planning considerations should be embedded within contingency planning for severe events.

Flood Risk Management

Internationally, there is a shift towards holistic and cross-sectoral approaches to flood risk management with an enhanced role for spatial planning and a growing emphasis on public and stakeholder engagement. Spatial approaches to flood risk management seek to ‘keep the rain where it falls’, reducing downstream impacts. International experience with severe flooding events highlights the need for BBB and resilience-enhancing principles to inform the criteria governing the allocation of reconstruction and recovery funding. Financial planning, resource allocation, and spatial planning need to go hand in hand, with sufficient regard for both short-term needs and long-term requirements for building resilience and reducing future flood risk. Recent experiences with flood events on the island of Ireland highlight the need for enhanced coordination between spatial (land-use and infrastructural) and emergency planning during the recovery phase. Whereas planning authorities in both jurisdictions have adopted a precautionary approach to planning consent in floodplain areas, there is an evident need for greater attention to the implementation and maintenance of flood prevention and adaptation measures such as sustainable urban drainage schemes (SUDs) and nature-based solutions (NbS).

Wildfire Management

Wildfire risk is increasing significantly in Ireland and internationally as a result of a combination of both climatic and land management practices. Wildfires present a challenge to the response capacity of fire stations, particularly in rural areas, and thus require a coordinated response at regional and/or strategic levels. Good practice examples of local multi-agency wildfire partnerships have emerged in both jurisdictions in recent years, supporting the monitoring, mapping and response to wildfires, as well as seeking to identify underlying causes. International good practice (e.g. Spain and Portugal) provides key pointers for enhancing cross-border cooperation in wildfire management to ensure an effective response to incidents in border areas.

Key Recommendations¹

- The research calls for closer integration between emergency planning, disaster risk reduction (DRR) and climate change adaptation at the strategic level via an inter-jurisdictional island of Ireland approach.
- This report recommends the strengthening of the legislative framework for flood risk and wildfire management in both jurisdictions, providing needed additional clarity on central government funding commitments and the division of responsibility between state agencies, local authorities and private individuals.
- Flood risk management requires dedicated long-term funding and a clear allocation of responsibilities and competences to ensure the required flood protection measures at each potentially affected location are implemented within a timely manner.
- There is a growing need to view the landscape through a ‘fire risk’ lens – similar to the approach currently being adopted around flood risk. Consideration will need to be given to how fire- and flood-resistant or vulnerable our landscapes are, and the implications of this for where we live and how we build. At a local level, there is a growing urgency in flooding and wildfire prevention becoming a priority in landscape planning.
- The role of spatial planners in post-incident recovery needs to be strengthened. Here a balance must be sought between short-term needs (return to normality) and longer-term objectives with the aim of achieving greater resilience and preventing a cycle of disaster-repair-disaster.

¹ For the full list of recommendations and further details, please see Chapter 5.

- Strategic emergency management must take greater account of local circumstances. Post-incident reviews are critical to assess the risk of a repeat event at the same location. Reviews should include consideration of all relevant human and environmental risk factors, including the potential for climate change to increase the frequency and/or severity of a potential repeat event. Post-incident reviews and associated learning processes are fundamental to ensuring that cycles of disaster-repair-disaster are replaced with adaptive, resilience-enhancing recovery following a building back better (BBB) approach.
- The responsibility for the coordination and delivery of post-incident psychological supports must be clarified and the adequate resources put in place to ensure supports reach affected individuals and groups.

1 INTRODUCTION

It is widely recognised by scientists, policymakers and practitioners that anthropogenic (human-induced) climate change poses fundamental challenges to society, both locally and globally. Transformative change is necessary to enhance the resilience of social, economic, environmental and infrastructural systems. Climate change mitigation and adaptation must be built into wider agendas for sustainable development and regeneration, recognising that the impacts of environmental change disproportionately affect the most vulnerable and disadvantaged. Efforts to reduce disaster risk, and at the same time, adapt to climate change impacts have thus become a priority at the highest levels internationally. Consequently, closer integration between emergency planning, disaster risk reduction and climate change adaptation is required.

Climate change is associated not only with an increase in the severity and frequency of extreme events but also increased uncertainties with regard to current and future environmental risks. Climate change acts as an accelerator of natural and anthropogenically derived variance in physical conditions (Lawrence, 2016; Paterson & Guida, 2021). Environmental risk can be understood as the potential for adverse consequences where something of value is at stake and the outcome is uncertain (Paterson & Guida, 2021). It is the product of both physical and social factors. Relevant social factors include public awareness, societal perceptions (of both hazards and what is of value), preparedness and the vulnerability of different groups within society. Disaster risk management thus requires holistic approaches founded on community engagement, stakeholder consultation and the integration of local place-based knowledge, in addition to technical and scientific expertise.

1.1 Climate Change Adaptation, Resilience and Building Back Better

Climate change adaptation refers to actions taken to manage the impacts of climate change by reducing vulnerability and exposure to its harmful effects while exploiting any potential benefits (IPCC, 2018, 51). It requires planning ahead in advance of projected climate change effects (O’Dwyer et al, 2018; Scott et al, 2022). Climate change mitigation, on the other hand, encompasses all measures to reduce greenhouse gas emissions (GHGs), consolidate and increase carbon sinks in order to achieve ‘net zero’ or carbon neutrality – a balance between emissions and removals of GHGs by mid-century. Mitigation and adaptation should not be considered independent strategies. They are both necessary steps to enhance resilience, and adaptation and mitigation measures can overlap, producing synergy effects. Mitigation measures, no matter where they are implemented, have global impacts. Adaptation, on the other hand, is specific to local contexts and circumstances and requires local, place-based

approaches. Adaptation is critical to reducing the (additional) risks associated with an increased frequency and severity of extreme events attributed to climate change.

We can usefully distinguish between grey, green and soft forms of adaptation (following Scott et al, 2022):

- Grey adaptation: including technical, engineering and design solutions – e.g. flood defences, building-scale design modifications, retrofitting existing residential and commercial building stock, and consideration of climate change adaptation in building design to allow for strengthening of defences in the future, as needed;
- Green adaptation: using ecological properties to increase adaptive capacity, also known as nature-based solutions (NbS) – e.g. restoring coastal dunes to act as a buffer against storm damage, incorporating green roofs and walls in the design of the built environment to reduce overheating, reducing the intensity of flood runoff in urban areas through sustainable urban drainage systems (SUDS) and other forms of green infrastructure; and
- Soft adaptation: involving an alteration in behaviour, regulation or systems of management – e.g. planning regulations to reduce exposure to flood risk, and precautionary behaviour in response to forecasted extreme weather events.

It is generally recognised that a combination of grey, green and soft adaptation measures is required and the three categories should be viewed as complementary rather than as competing approaches. Many adaptation measures can have multiple benefits. For example, urban greenspace may be designed to mitigate local flood risk, provide cooling benefits, enhance biodiversity, and provide opportunities for recreation. In some cases, the benefits of green or grey adaptation measures may occur some distance away from the site of implementation (e.g. measures implemented upstream of an urban area to reduce flood risk along a watercourse). For this reason, careful planning and extensive community engagement is needed so that individuals and/or communities do not feel they are required to shoulder an unfair share of the burden of adaptation.

Resilience refers to a system's capacity to adapt and respond to external shocks or stresses. From an engineering perspective, resilience can be interpreted as the capacity of a system to 'bounce back' following a disaster event. Increasingly, however, this idea of 'bouncing back' is questioned. Rather, it is suggested that systems should respond, adapt to, and learn from the experience of change (e.g. Davoudi et al 2013, Scott et al 2022). A recent example of this is the discussion around a shift to a 'new normal' in the aftermath of the COVID-19 pandemic. The concept of resilience is relevant for critical infrastructure (where a technical engineering perspective may be most appropriate) as well as for communities and governance systems (where a holistic perspective is required). There is a risk that the idea of fostering resilient communities is misused as a rationale for shifting responsibility for preparedness, recovery

and adaptation from the state to the community and voluntary sector. Rather, community-level resilience must be viewed as part of an overall public sector-led strategy.

The concept of Building Back Better (BBB) has been developed and promoted internationally as a strategic and holistic approach to recovery management whereby disasters are viewed as offering an opportunity for enhancing resilience and adaptation. In accordance with the *UN Sendai Framework on Disaster Risk Reduction* (UNDDR 2015), BBB is defined as

The use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies and the environment (UNDDR, 2017).

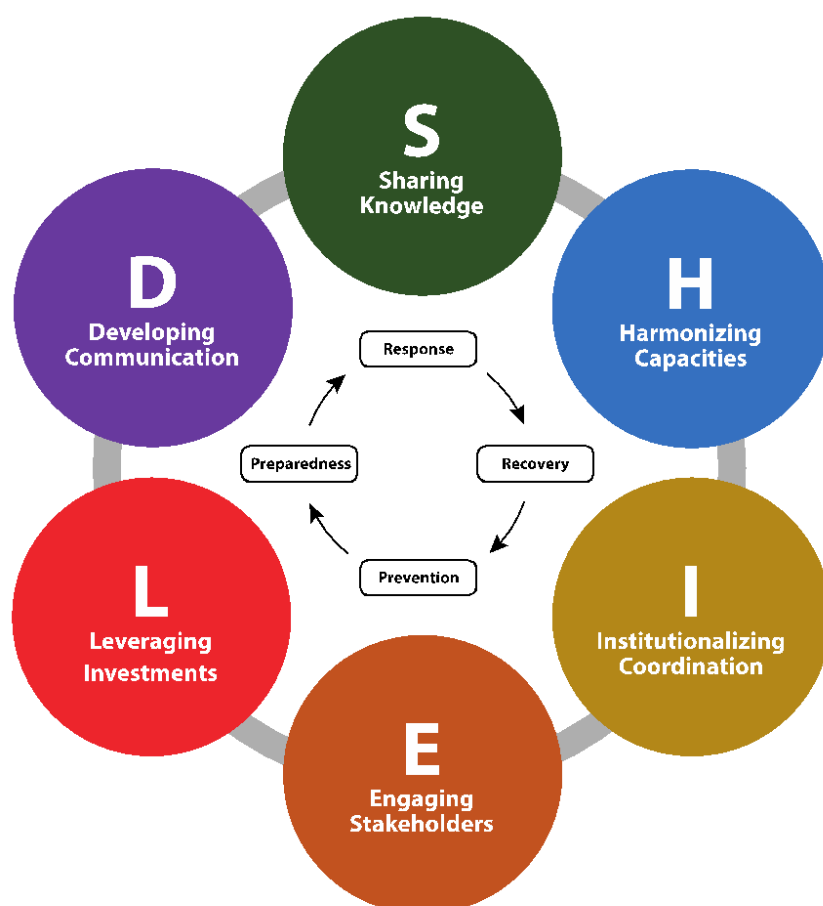
The BBB approach thus explicitly links post-incident recovery to the resilience of both physical and social systems. BBB applies to both physical measures (e.g. considering alternative locations or flood-resilient design for flood-damaged residential and commercial buildings) and social aspects (e.g. provision of psychological and community supports). Recognising the increased frequency and severity of severe weather events due to anthropogenic climate change, increased integration between emergency management and climate adaptation is called for. Cross-sectoral dialogue, coordination and multi-stakeholder partnership are thus at the core of the BBB agenda. The Sendai Framework calls for the recovery phase to be utilised in a strategic manner to:

develop capacities that reduce disaster risk in the short, medium and long term, including through the development of measures such as land-use planning, structural standards improvement and the sharing of expertise, knowledge, post-disaster reviews and lessons learned and integrate post-disaster reconstruction into the economic and social sustainable development of affected areas (UNDDR, 2015, 33 (j)).

The SHIELD model (Figure 1.1) developed under the European ESPREsSO project (Lauta et al, 2018), encompasses a set of general recommendations for enhancing risk management capabilities through disaster risk governance within a BBB approach. The six domains revolve around the four traditional disaster risk management phases; response, recovery, prevention and preparedness. Given the rapid pace and increased uncertainty of contemporary environmental change, continuous monitoring is required to ensure that disaster risk is minimised and resilience is maintained despite a higher frequency and severity of extreme events. For this reason, disaster risk reduction is best understood in terms of a risk management cycle, whereby risk assessment and hazard analysis inform pre-incident preparedness, response and recovery, and lessons learnt from the experience with and response to hazard events, in turn, informs the assessment of future risks, their mitigation

and response. The risk management cycle thus constitutes a dynamic, iterative learning process where short-term actions are embedded within a long-term, future-oriented perspective.

Figure 1-1: SHIELD Model for the Integration of Disaster Risk Management and Climate Change Adaptation



(Source: Lauterbach et al 2018, in Medway et al. 2021)

BBB calls for increased integration between disaster risk reduction, climate change adaptation and strategic forward planning for the built environment. From this perspective, it becomes clear that reactive emergency response measures must be embedded within long-term proactive frameworks with the aim of enhancing preparedness, resilience and adaptive capacity. The relevance of urban and regional planning for enhancing resilience in the Irish context has been highlighted by Scott et al (2022: 1):

The built environment represents a key “opportunity space” for creating climate-resilient pathways in Ireland, with the spatial planning system, building regulation performance requirements, industry standards and building design specifications providing key decision points that can potentially erode or build future resilience.

1.2 The Policy Context in Ireland and Northern Ireland

Cross-border regions face specific sets of challenges when it comes to emergency management. Legislative, institutional and policy differences in neighbouring jurisdictions contribute to a situation where effective and coherent responses to emergency incidents are dependent on the depth and quality of cross-border interaction and cooperation. Public authorities must ensure that the people living in border regions – namely 37.5% of the EU population – are not disadvantaged by where they live. This requires an ongoing commitment to, and monitoring of, response times and other indicators of emergency preparedness and response. On the island of Ireland, cross-border cooperation on emergency planning is embedded as one of the cooperation areas identified under the terms of the Good Friday/Belfast Agreement of 1998. Accident and emergency services and planning for major emergencies are all encompassed within health, one of six high-level cooperation areas under the aegis of the North-South Ministerial Council (NSMC), in which cooperation is taken forward. In the Irish cross-border region, Cooperation and Working Together (CAWT) and, more recently, the Cross Border Emergency Management Group (CBEMG) has laid the groundwork for inter-jurisdictional cooperation (see Joyce & McCaffrey, 2015; ICLRD, 2024) at the operational level. Strategic coordination across jurisdictions is led by the Office of Emergency Planning in the Department of Defence in Ireland and the Executive Office in Northern Ireland.

The *United Nations Sendai Framework for Disaster Risk Reduction* (2015) emphasises the importance of international, transboundary and bilateral cooperation. The Sendai Framework furthermore stresses the need for ‘all-of-society’ engagement and partnership based on inclusive, non-discriminatory practices and coordination across all relevant sectors and stakeholders. The Sendai Framework explicitly recognises the role of local government in disaster risk reduction, stating that local authorities and local communities must be empowered to reduce disaster risk and build resilience through the allocation of resources, incentives and decision-making responsibilities, as appropriate (see also Medway et al, 2022). This is significant as pre-existing EU policies on civil protection (Union Civil Protection Mechanism) focus only on actions by Member States (Soldi, 2016). In both Ireland and Northern Ireland, responsibility for disaster risk management is partially decentralised. There is a long-standing tradition of mutual assistance between the emergency services on both sides of the Irish border. These arrangements between individual emergency services in both jurisdictions continue to operate and are supported through the CBEMG. It is nevertheless the case that distinct legislative and policy frameworks persist in each jurisdiction with potential implications for the coherence of emergency response and public safety communication at a local level². The key national policies in both jurisdictions (namely the *Major Emergency Management Framework* (Government of Ireland, 2006), *Strategic Emergency Management: National Structures and Framework* (Department of Defence,

² For further details, please see ICLRD (2024).

2017), and more recent guidance documents, and the *Northern Ireland (NI) Civil Contingencies Framework* (The Executive Office, 2023) do not reference the UN Sendai Framework or the BBB concept.

Northern Ireland

The Northern Ireland Civil Contingencies Framework recognises recovery to be a complex process involving multiple interdependent strands that is often the least understood of the four phases of emergency management. The document identifies four themes for which specific guidance ‘theme sheets’ has been produced (Figure 1.2). The activation of the Recovery Coordination Group (RCG) is recommended as one of the first priorities during the respond phase as it enables recovery plans to be developed early and with good visibility of the likely impacts. The Framework further recognises good practice identified from global disasters that state the lead government department for the recovery phase should differ from that of response phase. The membership of an RCG is not prescriptive but based upon the initial impact assessment and priorities.

Figure 1-2: Four Themes of Northern Ireland's Civil Contingencies Framework



(Source: The Executive Office, 2021)

Ireland

The *Strategic Emergency Management: National Structures and Framework* (Department of Defence, 2017) sets out arrangements for the strategic coordination of the post-incident recovery phase. In the transition from the response to recovery phase, responsibility transfers from the National Emergency Coordination Group (NECG) to a lead government department or public agency. Recovery is understood to involve the coordination of national-level efforts and processes used to bring about the restoration and rehabilitation of communities affected by the emergency. The focus here is thus on national-level coordination. If required, a Cross-Departmental Recovery Group may be established. Specific national-level responsibilities in the recovery phase include monitoring and oversight, appraisal of budgetary requirements

and reporting to Government. In the absence of a central government contingency fund for emergency response and recovery, budgets may need to be negotiated with the Department for Public Expenditure and Reform. This document is currently under review.

The *Major Emergency Management Framework* (Government of Ireland, 2006) calls for the coordination of the recovery phase via the continuation of a local, regional or national coordination group from the response phase, with the option of appointing a Recovery Working Group. Anticipated issues relevant to the recovery stage include the following:

- Support and long-term care of victims and their communities;
- Strategies for smooth transition from response to recovery stage, particularly where there is a co-ordinated approach to service delivery in areas such as welfare, traffic arrangements, dealing with relatives of deceased, etc.;
- Establishing specialist teams to plan and oversee long-term recovery;
- Assignment/secondment of staff with specific skills to recovery teams;
- Implementing mutual-aid arrangements;
- Resourcing issues; and
- Arrangements for dealing with legal and quasi-legal issues, such as inquiries, criminal investigation, inquests, reports, evidence, etc. (Government of Ireland, 2006: 94).

The principal response agencies with explicit responsibilities in the recovery phase in Ireland are as follows:

Local Authorities:

- Clean-up;
- Rebuilding the community and infrastructure;
- Responding to community welfare needs (e.g. housing); and
- Restoration of services.

Health Service Executive (HSE):

- Provision of health care and support for casualties and survivors;
- Support for relatives of casualties and survivors;
- Responding to community welfare needs; and
- Restoration of health services.

An Garda Síochána:

- Identification of fatalities;
- Preservation and gathering of evidence;
- Investigation and criminal issues;
- Dealing with survivors;
- Dealing with relatives of the deceased and survivors; and
- Provision of an appropriate response to the immediate public need.

The national emergency management policy framework in Ireland provides relatively limited specific guidance for the recovery phase. The focus is on operational issues and ensuring a return to a situation of normality rather than developing resilience or ensuring systematic learning from individual incidents. The role of local authorities in particular, in rebuilding community and infrastructure, remains underspecified. There is no reference to procedures for ensuring lessons are learnt from specific incidents or how post-incident recovery can inform better preparedness and resilience with respect to future events. In Northern Ireland, in contrast, the Civil Contingencies Framework sets out details on how to capture lessons learnt through all stages. Responsibility for infrastructure repair, furthermore lies with the Department of Infrastructure.

Climate Change Legislation and Policy

Through the *Climate Action and Low-Carbon Development Act 2015* and the 2021 amendment (Government of Ireland, 2015, 2021), national climate policy in Ireland aims, as a fundamental national objective, to achieve a transition to a low carbon, climate resilient and environmentally sustainable economy by 2050. As part of this policy, climate change mitigation and adaptation is addressed through two parallel national plans, the *Climate Action Plan 2024* (Government of Ireland, 2024a) and *National Climate Change Adaptation Framework* (Government of Ireland, 2024b). Both strategy documents have been prepared by the Department of the Environment, Climate and Communications (DECC)³ but explicitly adopt a whole of government approach. In each case, the text is prepared by the DECC / DCEE, but each government department signs off on the elements relevant to their sectors. The *National Climate Change Adaptation Framework* calls for the integration of climate change adaptation and disaster risk reduction into Irish emergency planning. It identifies

a need to better integrate emergency response planning with longer-term disaster risk management considering the known and projected risks arising from changing levels of climate change influenced hazards, and community exposure and vulnerability with their existing and future capacities for service provision and operational responsibilities (Government of Ireland, 2024b: 71).

Disaster risk reduction is also identified as a cross-cutting policy issue to be considered across all sectors when developing sectoral adaptation plans. The role of climate change adaptation measures is further addressed in *Strategic Emergency Management: Guideline 4 – Climate Change Adaptation* (Department of Defence, 2020). In this document, climate adaptation is understood to help minimise the response required and costs incurred in a potential emergency situation by enhancing resilience. The following adaptation measures are identified as relevant to emergency planning:

³ Now the Department of Climate, Environment and Energy (since June 2025).

- Community education and engagement to raise awareness of risk and promote protective action;
- Identifying vulnerable locations, groups and individuals;
- Deployment of early warning systems; and
- Facilitating data collation and data sharing between stakeholders in emergency planning and climate adaptation.

The above measures and the overall focus of the Guideline is on prevention and preparation. The potential role of post-incident recovery in advancing climate adaptation is not addressed.

The *Climate Change Act (Northern Ireland) 2022* (UK Government 2022) is concerned with climate change mitigation only, with climate change adaptation addressed through a separate adaptation programme. The *Northern Ireland Climate Change Adaptation Programme* (2019-2024) does not make specific reference to disaster risk reduction per se but the need to build resilience in response to severe weather events is noted as a priority for government actions, noting:

Climate change due to global warming is altering our environment, increasing the risk of extreme weather events such as heat waves and flooding incidents, rising sea levels and modified rainfall patterns. These impacts have the potential to give rise to multiple negative effects on communities, buildings and essential infrastructure, all of which are intimately linked to the health, safety and wellbeing of people... Building resilience to and living with a changing climate for our people and built environment will require taking effective action across a number of sectors. It will involve processes as diverse as planning, water, health, buildings, and infrastructure (Department of Agriculture, Environment and Rural Affairs, 2019: 45-46).

1.3 The Purpose and Scope of this Report

Between 1980 and 2016, natural disasters caused by weather and climate-related conditions accounted for approximately 83% of financial losses across EU Member States (European Committee of the Regions, 2019). These disasters recognise no borders. Therefore, it is critical that there is a growing cross-border commitment to not only preparedness, prevention and emergency response but also to post-incident recovery and resilience and, within this, Building Back Better (BBB). It is this latter dimension that is the core focus of this study, co-funded by the Department of the Taoiseach and the Department of Defence - Office of Emergency Planning under the All-Island Disaster Risk Reduction Shared Island Research on Emergency Planning Cooperation 2024 Programme. It has four key objectives, namely:

- To build a better understanding of existing policy and practice with respect to the recovery phase in relation to severe weather-related incidents;
- To assess the extent of cross-border coherence in the recovery phase, utilising the experiences of various stakeholders as they pertain to incidents of inland flooding and wildfire management;
- To draw learning from international good practice; and
- To develop context-specific recommendations for post-incident recovery that focus on the resilience of both social systems and physical infrastructure.

This research recognises that recovery following major emergency situations is recognised as a complex, multifaceted process that begins with first responders and local communities at the site of the incident. The recovery phase can extend over a period of many months or years, depending on the severity of the event and the effectiveness of the response measures introduced. In cross-border contexts, such as on the island of Ireland, a coordinated cross-border approach is necessary to ensure a coherent cross-sectoral approach to the strategic management of post-incident recovery. In Ireland, there is a clear distinction between the strategic and operational dimensions of emergency management, whereas in Northern Ireland, this distinction is less clear-cut. The relationship between the strategic and the operational levels in emergency management is, however, at the core of BBB, which seeks to foster a more strategic approach to the recovery phase. Against this background, this report does not focus exclusively on strategic emergency management (SEM) but is also concerned with operational matters, and in particular, the role of local authorities. Following the BBB approach, this study makes recommendations on how policy-makers and practitioners in Ireland and Northern Ireland, engaged in planning for the recovery phase, can deliver positive outcomes for border communities and the entire Island.

The research methodology has been designed to capture and document existing policy and practice with respect to the recovery phase in relation to two types of severe weather-related incidents [inland flooding and wildfires] in both Ireland and Northern Ireland. A mixed-methods approach was adopted to primary data collection, entailing the collection of qualitative data, consisting of an expert roundtable, a focus group and semi-structured one-to-one interviews, in addition to desk-based approaches that involved a review of academic literature, a review of legislation and policy in both jurisdictions, and drawing on international best practice. This suite of methods allowed for deeper insights into real-world experiences. The online all-island expert roundtable involved experts from key national organisations in Ireland and Northern Ireland as well as emergency management professionals from the border region, some of whom are also members of the Cross Border Emergency Management Group. The roundtable focused on examining the intersections between emergency management, climate adaptation, flood risk management, land management, planning and public health. The analysis of sectoral, professional and community perspectives comprised a focus group and a series of semi-structured interviews. See Appendix A for details of agencies engaged in the above methods.

This research has been undertaken by the International Centre for Local and Regional Development (ICLRD) research team at both Maynooth University and Ulster University. The ICLRD is a North-South-U.S. academic partnership established in 2006 to explore and expand the contribution that planning and the development of physical, social and economic infrastructures can make to improve the lives of people on the island of Ireland and elsewhere. For further details on the multidisciplinary ICLRD Research Team involved in this study, see Appendix B.

2 FLOOD RISK MANAGEMENT & SPATIAL PLANNING

2.1 Introduction – International and Island of Ireland Context

The management of both coastal and inland flood risk has a long history, with the earliest known dams dating to approximately 3000 BCE. Urban and rural societies have learnt to live with flood events, and in past centuries, many settlements were built on floodplains so that farmers could benefit from fertile soils built up through regular flood events. For low-lying countries such as the Netherlands, settlement has only been possible through proactive flood protection measures, including large-scale engineering projects. Whereas flood protection and water management have traditionally been the responsibility of public authorities or single-purpose agencies relying on engineering expertise and technical solutions, a shift towards a more holistic and cross-sectoral approach to flood risk management has occurred in recent decades. Flood risk management, as called for by the *EU Floods Directive* (2007) is characterised by an openness to nature-based solutions (NbS), a catchment-based approach, an enhanced role for spatial planning and a growing emphasis on public and stakeholder engagement (Table 2.1 below).

The *Floods Directive* calls for a river basin district (RBD) approach, giving explicit consideration to land-water interactions at the catchment scale. RBDs do not align with administrative boundaries and in some cases cross international borders, as is the case on the island of Ireland (Figure 2.1). In practice, spatial approaches to flood risk management are concerned with ‘keeping the rain where it falls’ (Thaler et al, 2020a: 105), recognising that hard engineering works in the past have often led to an increase in flood risk downstream. In many cases, land-use planning decisions have furthermore led to an increase in artificial surfaces and thus accelerated runoff with unintended consequences for river flooding. Specific spatial flood risk management measures may include the restoration of the natural course of river channels, provision of floodwater retention areas (e.g. low-intensity farmland or marshland) and, in certain cases, managed retreat whereby settlements or infrastructure in flood-prone areas is abandoned and/or relocated (see Walsh et al, 2023). Managed retreat refers to the strategic and planned relocation of people, infrastructure, and activities away from areas vulnerable to hazards such as flooding, sea-level rise, or wildfires.

Central to flood risk management is the consideration of alternative options for specific locations at a strategic level. These options may include, for example, grey infrastructure and/or green adaptation measures or a decision that certain locations cannot be protected for cost-efficiency and/or environmental reasons. As a consequence of the latter option, managed retreat may need to be considered as a viable response.

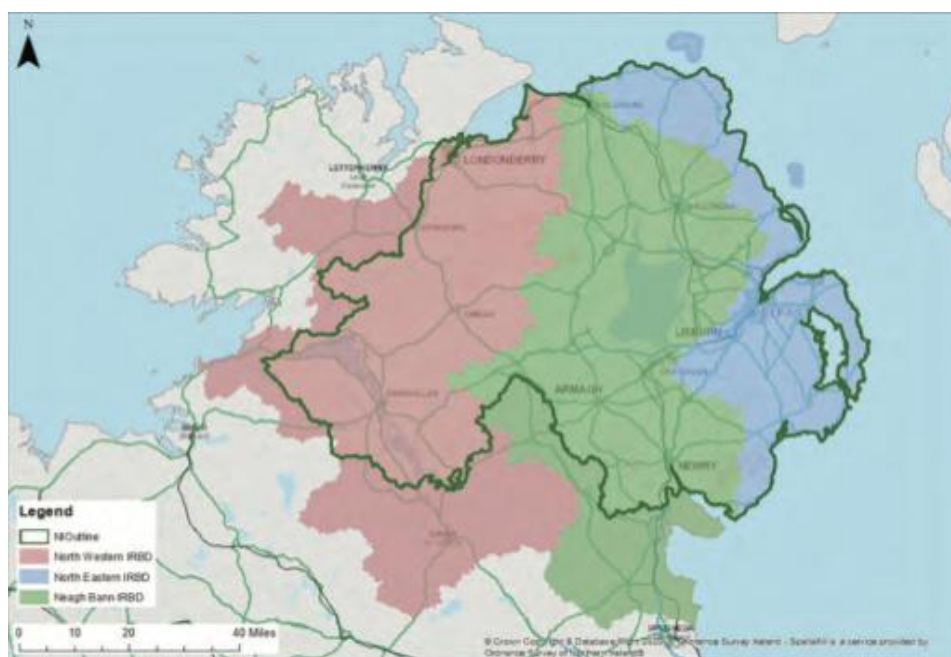
Table 2-1: Characteristics of Traditional Flood Protection and Flood Risk Management

Characteristics	Traditional Flood Protection	Flood Risk Management
Modus Operandi	Reactive - site-specific engineering works in response to repeated flooding at individual locations	Proactive - informed assessment of flood risk at catchment level, development and implementation of broad spectrum of risk reduction measures
Governance	Single-purpose authority, typically highly centralised and vertically-integrated	Multi-agency approach, specialised agencies working within a wider governance context
Range of flood protection measures	Focus on engineering solutions such as dams, dykes, levees and drainage channels	Engineering measures plus green infrastructure and catchment-based prevention measures. Increased emphasis on land-use management.
Flood management cycle	Narrow focus on flood protection and preparedness	Explicitly addresses flood risk management cycle encompassing prevention, preparedness, response and recovery in an adaptive learning approach
Engagement with the public	Focus on information provision and warning systems	Broader focus on building community resilience, gaining support for individual flood protection measures and wider risk management strategies
Role of spatial planning	Planning and consent for infrastructural works	Incorporating of flood risk management within spatial plans at multiple scales from regional strategies to local masterplans
Recognition of climate change impacts	Minimal recognition of need for adaptation	Embedding of climate change adaptation within all phases of flood risk management cycle.

(Source: Compiled by the authors of this study based on the international scientific and policy literature)

Managed retreat may involve compensation schemes and relocation plans and can be conducted at the scale of individual buildings or whole villages (Thaler et al, 2020b; Tubridy et al, 2021; Walsh et al, 2023). It is critically important that the division of responsibility between individual home or business owners and the state is made clear as early as possible (Tubridy & Lennon, 2021). As a general principle, where permission is granted for building at a certain location, and the developer/homeowner complies with the conditions of the permission, the planning authority (local or central government) can be assumed to bear a high share of responsibility. Flood risk management, through its cross-sectoral and strategic approach, has significant potential for alignment with a BBB perspective.

Figure 2-1: River Basin Districts across Northern Ireland and Ireland



(Source: Department for Infrastructure, 2021).

2.2 Flood Risk Management in Ireland

The Office of Public Works (OPW) is responsible for leading and coordinating national flood risk management policy. The key piece of legislation is the *Arterial Drainage Act (1945)*⁴. This Act, initially focused on drainage of agricultural land, was amended in 1995 to allow for the implementation of local flood relief schemes to provide flood protection for cities, towns and villages. According to OPW information, 95% of properties at risk within the communities assessed to be at significant risk from flooding can be protected by flood relief schemes. This figure, however, includes those schemes that are not yet operational (at design, construction or planning stages) (OPW, 2019). The *EU Floods Directive (2007/60/EC)* requires EU Member States to identify and map areas of flood risk, and to prepare and implement Flood Risk Management Plans on a catchment basis. Detailed flood risk management plans have been prepared for 29 river basins. Flood maps are prepared for areas of potentially significant flood risk. In Ireland, these are relatively small areas, focused on centres of population. They are referred to as Areas for Further Assessment (AFAs).

The *Climate Change Sectoral Plan for Flood Risk Management*, prepared under the National Adaptation Framework (OPW, 2019) recommends that climate change impacts (including sea-level rise and increased frequency of severe weather events) to be taken into account in the future planning of flood relief schemes, including assessments of economic costs and

⁴ <https://www.irishstatutebook.ie/eli/1945/act/3/enacted/en/html>

benefits. It does not, however, provide for the modernisation or retrofitting of existing schemes to allow for a higher frequency of severe flood events as a result of climate change.

Land-use management is recognised as a critical component in the reduction of flood risk prevention both internationally and within the Irish policy context (see OPW, 2004, 2019). In 2009, statutory guidelines on flood risk management were issued to planning authorities⁵ by the Department of Environment, Heritage and Local Government (DEHLG), prepared together with the OPW (DEHLG & OPW, 2009). The Guidelines require local authorities to introduce flood risk assessment as an integral part of local authority development plan preparation. Local authorities are required to ensure that development is not permitted in areas of flood risk, although certain exceptions are allowed for:

Planning authorities will ensure that development is not permitted in areas of flood risk, particularly floodplains, except where there are no suitable alternative sites available in areas at lower risk that are consistent with the objectives of proper planning and sustainable development. Where such development has to take place, in the case of urban regeneration for example, the type of development has to be carefully considered and the risks should be mitigated and managed through location, layout and design of the development to reduce flood risk to an acceptable level. (DEHLG & OPW 2009, v).

The effectiveness of this provision depends in part on what is considered an ‘acceptable level’ of flood risk. The Guidelines also seek to avoid new developments that increase flood risk elsewhere. This is an important objective which seeks to address the increased flood risk associated with surface water run-off from artificial surfaces which may lead to sharply increased river flows upstream of urban settlements. It is important to note that the planning system can only help mitigate the flood risks associated with new developments, not those related to existing land-uses and the legacy of past planning decisions.

2.3 Flood Risk Management in Northern Ireland

The Department for Infrastructure (DfI) is responsible for flood risk management in Northern Ireland. A Flood Risk Management Plan (FRMP) is a requirement of the *Water Environment (Floods Directive) Regulations (Northern Ireland)*. There is continued alignment with the *EU Floods Directive* post EU-exit. The current (second cycle) FRMP covers the period 2021-27 for the whole of Northern Ireland (Department of Infrastructure, 2021). Similarly, in Northern Ireland, the focus is on Areas of Potential Significant Flood Risk (APSFR) (Figure 2.2), although catchment-based solutions are proposed in addition to site-specific measures. The FRMP

⁵ <https://assets.gov.ie/static/documents/the-planning-system-and-flood-risk-management-guidelines-for-planning-authorities-nov-.pdf>

notes that increased precipitation rates for winter and increased frequency and intensity of extreme rainfall events are likely to lead to increased likelihood of inland flood events, whereas sea-level rise will lead to increased risk of coastal flooding. It is also recognised that land management, including urban expansion and changes in land drainage and reclamation, as well as micro-scale changes such as paving over gardens and driveways, can change the ability of land to absorb rainfall, exacerbating local surface water (pluvial) flooding and increasing riverine (fluvial) flood risk downstream.

Figure 2-2: Areas of Potential Significant Flood Risk in Northern Ireland



(Source: Department for Infrastructure 2021).

The Water and Drainage Policy Division (WDPD) of DfI is responsible for the development and coordination of flood management policy whereas DfI Rivers Development and Operations Directorates design and deliver capital schemes, work at an operational and emergency planning level to, (i) lead and respond to flooding emergencies, and (ii) inspect and maintain designated watercourses and flood defences. DfI is the Lead Government Department with responsibility for the strategic coordination of flooding emergencies. Local Councils also have a coordination and supporting role in emergency planning response with respect to flood events. DfI have three representatives – namely, Rivers Operations, Transport and Road asset Management (TRAM) and Emergency Planning – on the Civil Contingencies Group (CCG) in recognition of the relevance of flood risk operations and policy in strategic emergency management.

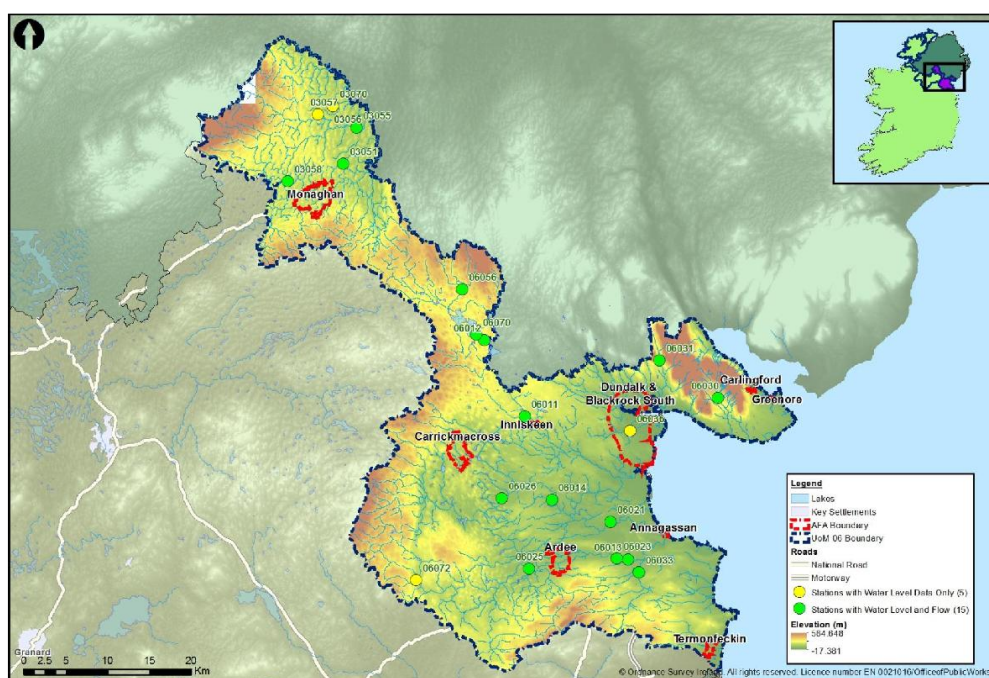
2.4 Cross-border Cooperation in Flood Risk Management

There is a long history of close cooperation between DfI Rivers Directorate (formerly the Rivers Agency) and the OPW as competent authorities for flood risk management and implementation of the *EU Floods Directive*. Coordination and information sharing is considered essential to ensure mitigation measures proposed in one jurisdiction do not significantly increase flood risk across the border. To facilitate the cooperation, the following groups have been established:

- **OPW - DfI Cross Border Implementation Group** – where staff at a senior level discuss policy issues of mutual interest;
- **DfI - OPW Operations - Technical Working Group** – focusing on cross-border operational and technical issues of mutual issues; and
- **Ireland National Floods Directive Coordination Group** – importantly, from a cross-border and strategic perspective, DfI is represented on this national-level steering group (DfI, 2021).

The principal RBD in the North East is the cross-border Neagh Bann River Basin District (Neagh Bann RBD), covering an area of 8,120 km² with approximately 1,779 km² of that area in Ireland. Separate Flood Risk Management Plans for the Neagh Bann RBD have been prepared in each jurisdiction following cross-border consultation and coordination. The AFAs in this RBD are Annagassan, Ardee, Carlingford, Carrickmacross, Dundalk & Blackrock South, Greenore, Inniskeen, Monaghan and Termonfeckin (Figure 2.3) (OPW, 2018).

Figure 2-3: Neagh Bann River Basin (Ireland)

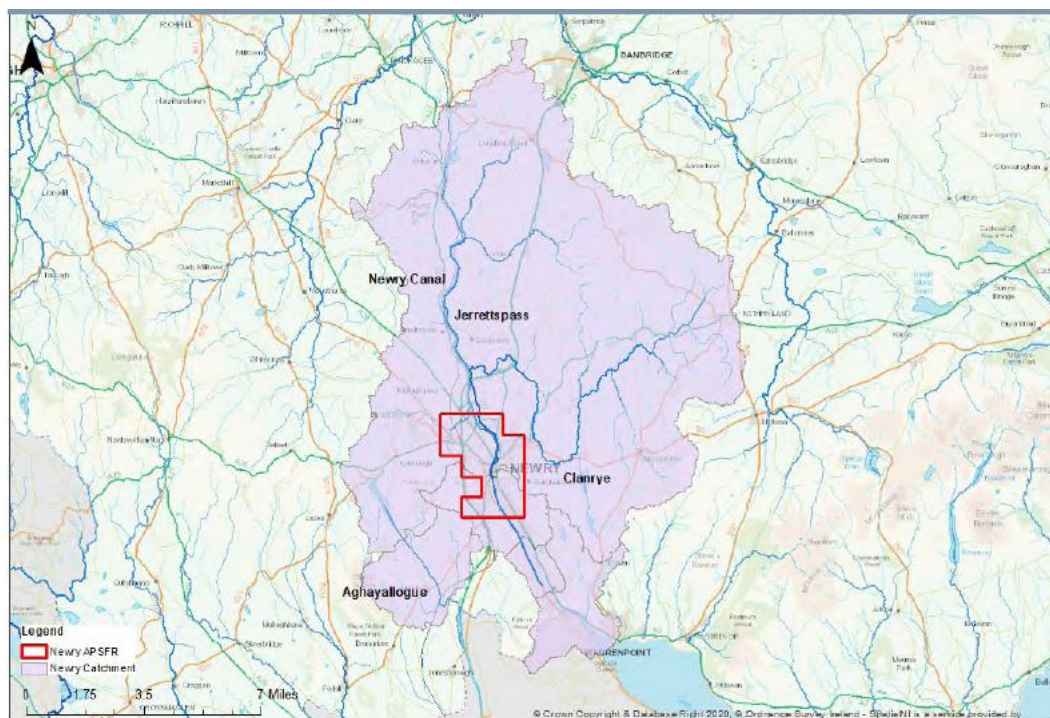


(Source: OPW, 2018)

The first cycle flood risk management plan for the Neagh Bann RBD in Northern Ireland was published in 2015 (Department of Agriculture and Rural Development, 2015) and identified both significant flood risk areas and areas for further study. The current second cycle flood risk management plan for Northern Ireland (DFI, 2021) addresses the three river basin districts in Northern Ireland within one document. This document does not, however, include maps of significant flood risk areas at the RBD scale, with an evident preference for detailed analyses of specific flood risk areas (i.e. potentially vulnerable settlements), within smaller-scale catchments. This functional territories approach may facilitate greater consideration of downstream effects and the potential for mitigation measures upstream of vulnerable settlements at a more appropriate scale. There is scope here for enhancing the interface between flood risk management and spatial planning at the river basin district/regional scale. In the case of Newry, for example, reference is made to the historical record of flooding in the area and the impact of flood events of recent decades, contributing to greater awareness of the potential impacts of future events (Figure 2.4).

The published plans make limited explicit reference to cross-border issues (e.g. the potential need for flood risk management measures in one jurisdiction to protect communities located downstream in the other jurisdiction), although reference is made to arrangements for cross-border coordination in both flood protection and emergency response.

Figure 2-4: Newry Area of Potentially Significant Flood Risk – Catchments



(Source: DFI, 2021)

2.5 Flood Risk Management and Building Back Better in Germany

Major flood events on the Rhein (1993, 1995), Oder (1997) and Elbe (2002) led to a reassessment of the causes and societal responses to such events (Felgentreff et al, 2012). More recently, the extreme flooding in the Ahr Valley in 2021 has provided further lessons in post-disaster recovery and reconstruction (Birkmann et al, 2023). In many cases, reconstruction efforts in Germany, as elsewhere, financed through public and private money, have led to the re-establishment of the state of flood risk that prevailed prior to the event, with ongoing vulnerability to repeat events. The dominant approach is often ‘continuing as before’, or ‘continuing as before with higher dikes’, as was the case on the Oder River in 1997. As a consequence, in some cases, the same households have been affected by multiple major flood events within a short space of time.

Funding for dike-building and other infrastructural works tends to be most readily available in the direct aftermath of a flood event. As a consequence, decisions are made within the immediate recovery phase with a short-term focus on resolving an emergency situation and a return to normalcy (e.g. reopening of schools and businesses, return to employment). The reconstruction or restoration of flood-damaged residential and commercial buildings may take significantly longer. The reconstruction phase thus takes significantly longer than the period of high media attention. Where substantial physical damage has occurred, the relocation of individual buildings or whole settlements to higher ground at some distance from the river banks may present itself as a logical option to reduce future flood risk. In practice, individual property rights and a range of other contextual factors tend to make rebuilding at the same location the most likely option. In the immediate aftermath of a flood event with a reported statistical probability of one in one hundred years or lower, the risk of a repeat event in the short- to medium-term can seem very low. Against this background, Tobin and Montz (1997) have coined the phrase “disaster-repair-disaster-cycle”, whereas Felgentreff et al (2012) have similarly referred to the ‘hydro-illogical cycle’ in reference to this pattern of events whereby reconstruction and recovery efforts do not lead to a significant reduction in vulnerability to future flood events.

The 2021 Ahr Valley flooding led to 134 fatalities along a 40 km stretch of river in Rhineland-Palatinate and 49 fatalities in the neighbouring state of North Rhine Westphalia in western Germany. In total, approximately 42,000 people were affected and more than 9,000 houses in the Ahr Valley alone were damaged or destroyed (Figure 2.5). The flooding occurred due to extreme rainfall. Unusually, minor water courses were impacted, not major rivers, with water levels rising to unprecedented levels in a very short space of time. The areas affected were predominantly rural; with economic losses estimated at €33 billion. The federal government of Germany and the two state governments provided €30 billion for loss and damage compensation and reconstruction, a significantly higher amount than was available following previous severe flood events in 2002 and 2013. Key factors that contributed to the scale of the disaster in this case included:

- Very high flood magnitude, with an estimated return period of more than 1000 years;
- High levels of exposure of settlements and infrastructure within a narrow river valley;
- Massive cascading effects due to the disruption of critical infrastructure services such as power supply, telecommunication, water supply, transportation etc.;
- Low levels of community awareness about flood exposure;
- High vulnerability due to an older age profile in the Ahr Valley; and
- Ineffective early warning systems and lack of knowledge about how to react (adapted from Birkmann et al, 2023).

This flood event was ‘off the scale’ in terms of magnitude with, at multiple locations, water levels beyond what river gauges could measure or withstand, but not unprecedented in the historical record (Roggenkamp et al, 2024). Retrospective attribution studies have estimated, however, that anthropogenic climate change makes a rainfall event of this magnitude up to 9 times more likely and that flooding events can be expected to occur with a frequency of more than once in 400 years within the wider region (i.e. western Germany, eastern France, Belgium, Netherlands, Luxembourg) (Tradowsky et al, 2023). This event highlights that unlikely events do happen and, can unfortunately, have very severe impacts.

Figure 2-5: Ahr Valley Flooding, 2021



(Source: Legal Tribune online, 17.10.2023⁶)

⁶ <https://www.lto.de/recht/nachrichten/n/ahr-flut-katastrophe-2021-gutachten-fahrtaessige-toetung>

The impact may be accentuated by reduced flood risk awareness and level of preparedness on the part of both the general public and relevant authorities. In the case of the Ahr Valley it is reported local officials did receive timely and accurate information in advance, but were slow to react because many did not believe the river levels could be as high as the technical information indicated (Dombrowsky, 2022; Silva et al, 2025). In many cases, when a decision to alert the public was reached, the failure of critical infrastructure such as telecommunications severely impacted the effectiveness of the public warning. Here a communication gap is evident which led to a lack of urgency in the immediate response.

A household survey conducted in the aftermath of the event showed that approximately 80% of households were unaware of their exposure to flood risk. The main objective of the government-funded recovery fund has been to compensate for actual loss and damage rather than facilitating BBB. Households were given the option to relocate with state-funding for 80% of the difference in value of the property pre- and post-flood. Within the Ahr Valley, however, building land is scarce. The requirement to cover 20% of the costs privately also presents a significant obstacle to many households. In other cases, in Germany and Austria, planned relocation has occurred on a smaller scale (Mayr et al, 2020, Walsh et al 2023). Studies have found, however, that social factors can play a very significant role in disaster recovery processes and need to be given more attention in any planned relocation initiatives. This is particularly the case where relocation risks compounding the trauma of the flood event itself, through a loss of community identity and sense of place attachment (Seebauer & Winkler, 2020; Thaler et al, 2020b).

The state of Rhineland-Palatinate issued new flood hazard maps, including the designated flood plain (HQ100) and a high-risk zone, within a few weeks of the event. These legally-binding maps include non-construction zones and influence the reconstruction process significantly. There is, however, insufficient clarity regarding the details of the required flood safety standards for critical infrastructure and the legal status of pluvial flood hazard maps in comparison to river flood hazard maps is contested. The official flood risk maps are also found to disregard other factors relevant to flood risk assessment, including velocity and flood depth, and do not adequately account for the influence of climate change on return periods (Birkmann et al, 2023). The high-risk zones, where no building is allowed, amount to 11% of the total area that was inundated in the 2021 flood. Flood risk at one location is, moreover, influenced by decisions further upstream (e.g. bridge-building, new housing or commercial areas). Consequently, cooperation among multiple municipalities along the water course is necessary to achieve a high standard of resilience, but can be difficult to achieve.

Some progressive changes in spatial planning and land-use management have occurred, however, particularly in relation to the reconstruction of critical and sensitive infrastructure. Overall, however, rebuilding in the Ahr Valley is perceived as slow and the deadline for accessing the reconstruction funds has been extended to 2026, as a majority of the funds had yet to be spent by the initial deadline of June 2023. At the same time, there is a growing

awareness that planning for flood-resilient recovery and sustainable reconstruction may take significantly longer than a more straightforward reconstruction according to previously valid standards. Researchers have found that where houses and other buildings were partially damaged and no planning permission was required, reconstruction was more likely to be limited to rebuilding as before without additional resilience measures. This right of continuance (rebuilding without new planning permission) also applies in the 100-year flood risk zone. More generally, the focus of the reconstruction scheme on compensation for loss and damages at a household or individual property level militated against an integrated catchment-wide approach that would be more aligned with a BBB approach. Birkmann et al (2023) also found that additional legal provisions are required for the planning of flood retention areas, with greater deliberation of multi-use considerations, particularly within urban areas. Questions of clean-up costs and responsibility also arise where a sports field or similar larger urban green space is deliberately allowed to flood to provide alleviation elsewhere.

A key conclusion of the study by Birkmann et al (2023) is that BBB and resilience-enhancing principles need to inform the criteria governing the allocation of reconstruction and recovery funding. Financial planning, resource allocation, and spatial planning need to go hand in hand, with sufficient regard for both short-term needs and long-term requirements for building resilience and reducing future flood risk.

3 INLAND FLOODING: LEARNINGS FROM THE NORTH-WEST & EASTERN CORRIDOR OF THE ISLAND OF IRELAND

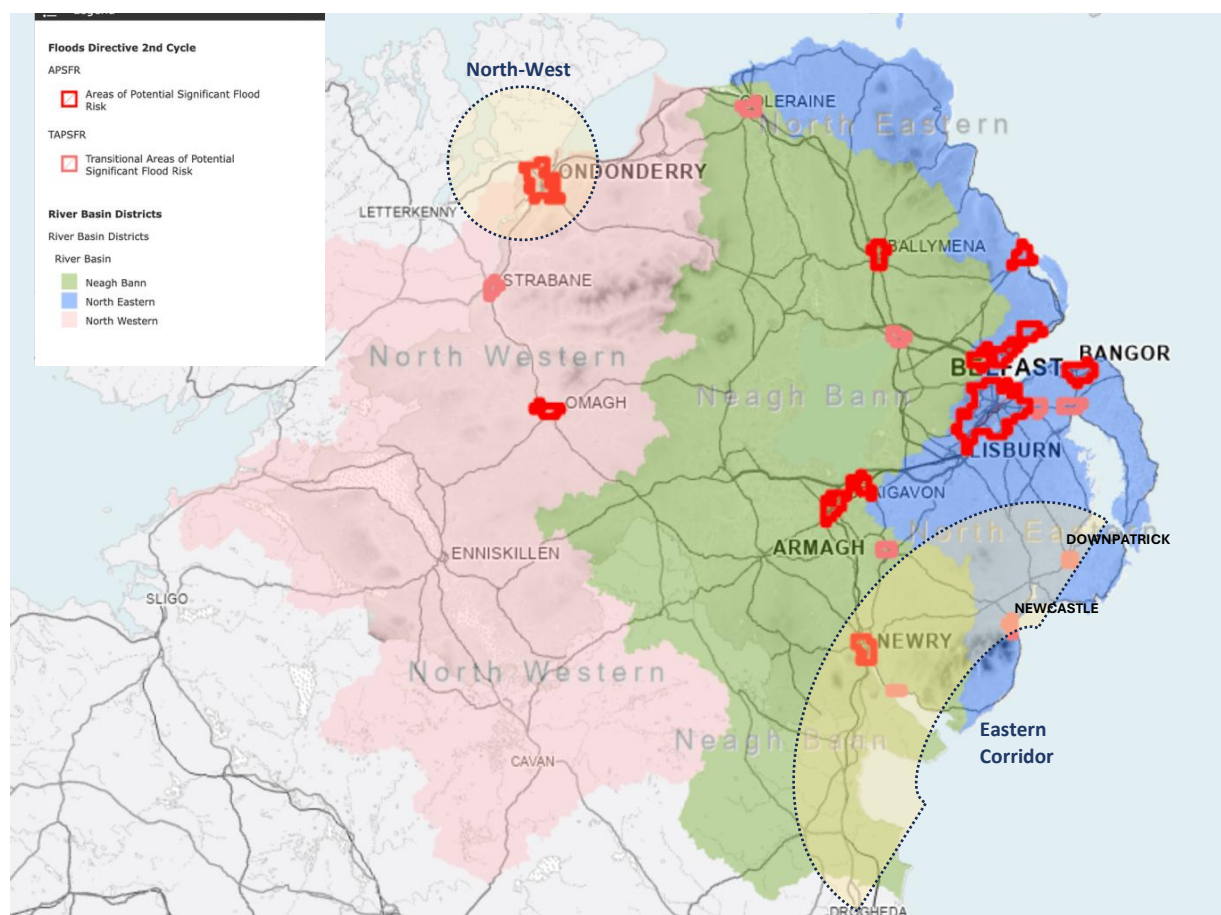
3.1 Introduction

Floods are becoming one of the most devastating natural phenomena across Europe. The European Environment Agency (2024) acknowledge that different regions will experience different changes in the patterns of extreme weather, with northern Europe likely to experience an increase in annual precipitation and rainfall intensity. Parts of the island of Ireland have begun to feel the effects of a changing climate, having experienced several significant flooding events in recent decades, primarily due to increased frequency and intensity of severe storms and associated heavy rainfall. While flooding can be considered one of the lower fatality rate risks of climatological hazards, compared to heatwaves, for example, the economic impact and psychological trauma make such instances a serious challenge that society will have to increasingly address.

For the purposes of this research, and the study parameters, the North-West cross-border region and the Eastern Corridor of Northern Ireland were selected as case studies (Figure 3.1) for the post-recovery insights they offer. The Northern Ireland Flood Risk Assessment (NIFRA) 2018 has identified 12 areas as Areas of Potential Significant Flood Risk (APSFR), which includes Derry (North-West) and Newry (Eastern Corridor), and 9 areas have been determined as Transitional Areas of Potential Significant Flood Risk (TAPSFR), which include Downpatrick and Newcastle (Eastern Corridor)⁷.

⁷ TAPSFRs are areas that were identified in the 2011 PFRA as APSFR. They have not been identified as APSFR in the NIFRA 2018. However, they have been classified as TAPSFR to ensure continuity between Flood Risk Management Plan cycles and facilitate the implementation of any outstanding commitments arising from delivery of objectives and measures within the 2015 – 2021 FRMPs (Source: DfI).

Figure 3-1: Location of Study Sites



(Source: Adapted from Department for Infrastructure, 2025)

3.2 North-West – Flooding Context and Impact

The flooding in the North-West cross-border region, covering County Derry/Londonderry, County Tyrone and County Donegal, on 22 and 23 August 2017 was severe, with exceptionally high levels of rainfall causing the worst flooding in this region in almost 30 years. The Met Office reported that 63% of the average August rainfall fell within just eight to nine hours (BBC News, 2017; DfI, 2018). As a result, the Faughan, Muff, and Burndennett Rivers in the North-West river basin exceeded previous flood levels, surpassing a previous record-high recorded in 1987.

While there was no loss of human life, significant impacts of the flooding were felt at both an individual and community level. The March 2018 *North-West Flooding Review*, published by the Department of Infrastructure and focusing chiefly on those areas within Northern Ireland, highlighted the following impacts:

- **Property Damage**
 - Approximately 400 homes were flooded, with water depths reaching up to 2m in some properties; and
 - Numerous businesses were affected.
- **Infrastructure Damage**
 - 210 roads were either closed or impacted;
 - 89 bridges required remedial action, with 5 bridges washed away; and
 - 2900m of flood defences were damaged across multiple locations.
- **Agricultural Damage**
 - 220 farm businesses were impacted, with fences washed away and over 300 sheep and a significant number of cattle drowned; and
 - Landslides in Glenelly Valley caused severe damage, with fields covered in debris. Experts classified the landslides as a 1 in 3000-year event.
- **Critical Infrastructure**
 - Approximately 600 Northern Ireland Electricity customers without electricity;
 - The A5 road remained closed for 3 days; and
 - City of Derry Airport was flooded and closed for nearly 2 days.
- **Environmental Impacts**
 - Spread of invasive species like Japanese Knotweed and Giant Hogweed due to floodwaters; and
 - Pollution risks from flooding of foul sewers.
- **Human and Emotional Impact**
 - No human lives were lost, but the flooding caused significant emotional trauma and mental health issues for affected residents; and
 - Elderly residents were particularly vulnerable, with some reluctant to seek help.

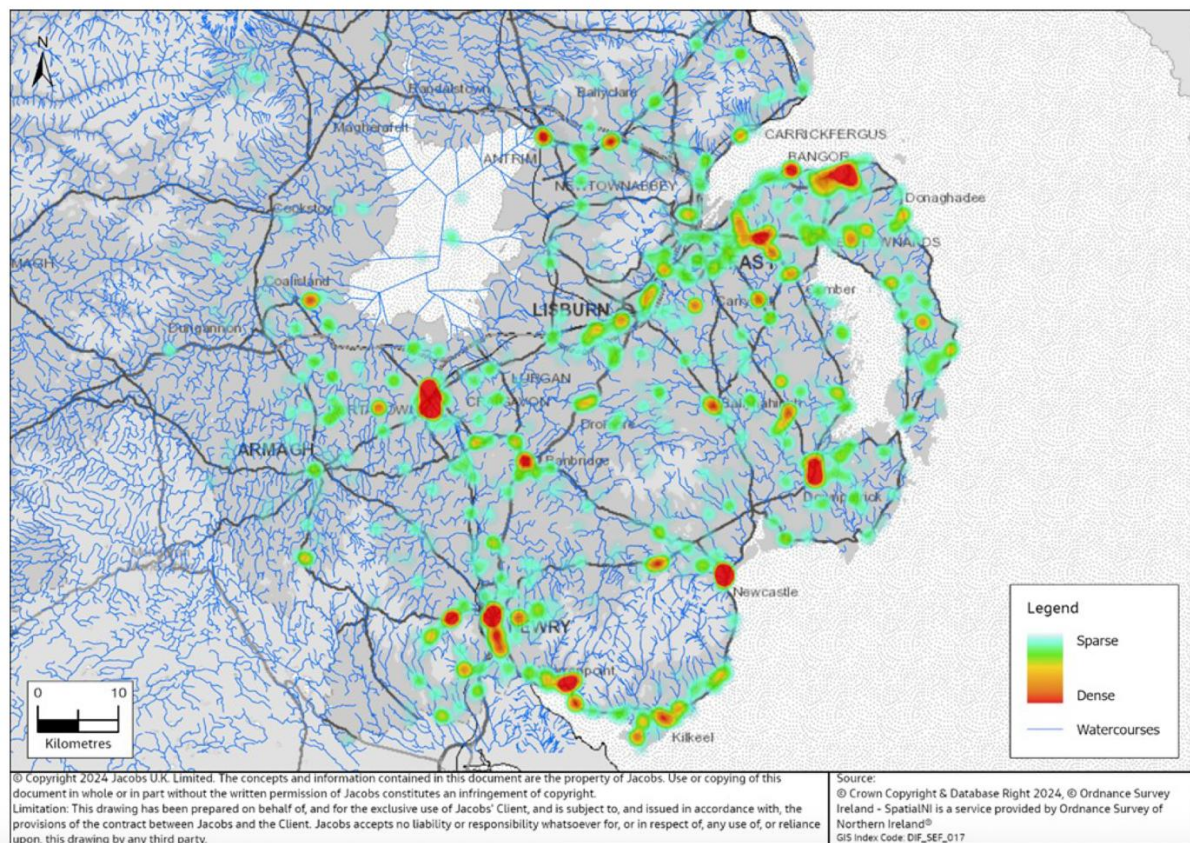
Subsequently, the Department of Infrastructure noted that the 2017 event in Eglinton was considered to be a 1 in 660 year flood event, and for Drumahoe this was a 1 in 300 year flood event. Yet these same communities were flooded again on 23 July 2022 when 70mm rain fell over 5 hours (Northern Ireland Executive, 26 July 2022).

The Inishowen peninsula in County Donegal was also affected by the August 2017 floods, with over 150 homes and 50 businesses affected (McNulty, 2017). Key infrastructure, including roads and bridges, was severely damaged, with over 1,600 homes in County Donegal without electricity, leaving many communities isolated. In some instances, floodwaters reached the windowsills of ground-floor properties. Several burst mains and damages to wastewater infrastructure due to flooding in County Donegal caused shortages in freshwater supply.

3.3 Eastern Corridor – Flooding Context and Impact

October 2023 was an exceptionally wet month for the South-East of Northern Ireland. The region experienced its wettest May-October on record since 1890. Heavy rainfall from Storm Babet occurred between 18 and 21 October 2023, with 100-150mm falling over the Mourne Mountains. However, it was the later, with heavier rainfall occurring between 26 October - 1 November, that triggered the Autumn flooding. The floods severely impacted Newry, Downpatrick, Newcastle and Portadown (Figure 3.2).

Figure 3-2: Extent of Reported Flooding in Eastern Corridor



(Source: Department of Infrastructure, 2024, 22)

Rainfall from Storm Babet resulted in saturated catchments and heightened river levels across the South-East of Northern Ireland, culminating in the Autumn 2023 floods. In Katesbridge, County Down, a total of 197mm of rain was recorded in October, more than double the monthly average. The analysis identified a critical 120-hour rainfall period with a probability of occurrence ranging from 1% to 3.33% for various catchments. Severe flooding was reported in several areas, including in the council areas of Newry, Mourne and Down, and Armagh, causing significant travel disruption as surrounding train lines, roads and some bus services were affected. Translink reported that the train line between Portadown and Newry had been closed due to flooding. The Department of Infrastructure's gauges had indicated the highest

flood levels in over 30 years. The severity of the flooding exhibited significant variance, with Annual Exceedance Probability (AEP) assessments ranging from 10% (1 in 10) and 0.5% (1 in 200). An indicative timeline of the flooding in this corridor associated with Storm Babet is available in Figure 3.3.

Figure 3-3: Indicative Timeline of Storm Babet Flooding



(Source: Department of Infrastructure, 2024, 26)

3.4 Post-incident Recovery Learning

3.4.1 Building Community and Business Resilience

The post-incident recovery efforts following major flooding events – in the North-West cross-border region and South-East of Northern Ireland – have clearly demonstrated a growth of community and business resilience. The first responders to any recovery tend to be from the local community. In particular, the North-West flooding served as a critical turning point that was the catalyst for nurturing more community-based resilience planning. This is demonstrated by the rollout of the learning captured from community resilience pilots in Derry City and Strabane District Council (DCSDC) and Mid and East Antrim Borough Council (MEABC), which has involved a series of interactive workshops to explore the meaning of resilience, how to understand and build resilience in a local area, with the intention of these pilots informing a regional approach to enabling communities and agencies to identify local strengths, assets and capabilities and ultimately, develop local community resilience plans.

The culmination of such work illustrates how greater recognition is emerging of the importance of community knowledge in managing risk and shaping effective local strategies. This illustrates the value of community training and response structures to facilitate the activation of local networks, so residents know whom to contact and how to mobilise quickly during an emergency. As of July 2025, the number of Community Resilience Groups (CRGs) has increased to 50 in Northern Ireland. Interestingly, as a result of the flooding in the South-East in Autumn 2023 the first business focused Flood Resilience Group in Northern Ireland was established in Newry. This approach brings commercial stakeholders into the resilience conversation, including the potential expansion of property level protection for businesses. Specific funding streams were also unlocked for business recovery.

3.4.2 Rethinking Communication and Coordination

There was consensus that innovation has occurred in relation to communication and coordination. The voluntary and community sectors were commended for the vital role they played in the recovery phase, particularly following Storm Éowyn (January 2025), and there exists the opportunity to build on the work to strengthen coordination channels for any future events. There is scope for enhancing a ‘whole of society’ approach that improves communication and actions both within agencies and outward to the public. As previous research has highlighted, clear and trustworthy information is necessary to help combat misinformation and guide those affected to essential resources/services (ICLRD 2024). The value of having ‘rest hubs’, ‘centralised information points’ or ‘Community Assistance Centres’ became apparent as, in addition to them being available to provide shelter, they are spaces within which trusted information can be shared, particularly when existing communication channels (such as mobile phone networks and broadband) have been disrupted. It was discussed that these spaces provided a safe environment for people impacted by the emergency and consideration should be given to these in future emergency

scenarios. It was recognised that a challenge exists in communicating the locations of such spaces to the public, as some citizens are unaware of the existence of this service. Additionally, in the event of a power or communication network outage, it is difficult to communicate to those who need these services most during a disruption.

Related to communication is a lack of public awareness of an area's potential to flooding and, perhaps, a degree of 'flooding amnesia'. While flood maps are publicly available, it is apparent that the motivation to get the public engaged in consulting such information or getting organised to proactively plan for a flooding event remains challenging. Currently most motivation tends to be more reactionary, in which responding to an event generates the need to seek help and orchestrate the necessary response services. While challenges remain in harmonising weather forecasting communication in each jurisdiction, aligning with the recommendations by DfI (2024) and ICLRD (2024) would see the development of a harmonised and comprehensive flood warning and severe weather forecasting systems; and it is understood work is progressing in this direction. Improved flood forecasting capacity could play a significant role in raising public awareness of potential risks and enhancing preparedness.

3.4.3 Detecting Synergies and Shared Policy Outcomes

While there is broad engagement from a range of government departments with various communities, there is a need to identify and better align where interaction is happening for detecting cross-departmental synergies and addressing current disconnections. In attempts to build back better (BBB), there is a need to harness collaborative potential across various teams and agencies to ensure local knowledge is shared to produce more integrated and resilient responses. For example, community development and community planning teams (particular to Northern Ireland) tend to have extensive and meaningful interactions with local communities. This offers an avenue for utilising local intelligence to establish and strengthen a more informed response. During a focus group held by ICLRD as part of this study, an insightful reflection considered how responding to severe weather might well be a catalyst for initiating community resilience behaviours, and in doing so, offer collective avenues for addressing other public policy goals, e.g. combating social isolation/loneliness, digital literacy and inclusion, climate change and flood risk awareness raising. Investing time and energy in nurturing cross-departmental exchanges and identifying linkages offers the potential to maximise an intervention's effectiveness in achieving multiple policy goals and outcomes.

3.4.4 Psychological Impacts of Flooding

The support and long-term care of those impacted and their communities aligns with the humanitarian assistance theme of the Northern Ireland Civil Contingencies Framework. The review of the North-West flooding incident acknowledged that the response from several groups, including the Red Cross, Men's Shed, Eglinton Community Group, and Drumahoe Young Men's Christian Association (YMCA), was invaluable and greatly appreciated (DfI, 2018). A recommendation within the North-West review focuses on providing immediate

and longer-term psychosocial support for those affected by future emergencies. This has become particularly pertinent given that many of the same communities were impacted by severe flooding again in 2022. The remit of the 2023 review of the South-East flooding did not extend to the psychological impacts of flooding; however, the recommendations do highlight the need to ensure residents and businesses are aware of the support available to them after a flooding incident. It is essential that the psychological impact of the floods on those living in areas affected by flooding and/or the individual experiences of those living with persistent flood risk be considered. International studies highlight the impacts of flood events on mental health such as posttraumatic distress (Foudi et al. 2017, Fothergill et al 2021). As part of this research, one interviewee remarked how mental health issues may have been exacerbated by the flooding event in the North-West, noting that there remains a sense of fear and anxiety at certain times of the year when it starts to rain.

Insights from the research focus group reveal that psychological considerations following an incident have received greater attention in recent years. The Red Cross was highlighted for advancing this line of work and for its valuable resources. Reflecting on the place-based responses in the case study locations, it was noted that professional support from the British Red Cross was provided in the aftermath of the 2017 North-West flooding event. Following the 2023 flooding event in the South-Eastern corridor support was delivered via the Recovery Co-ordination Group (RCG) by the Southern and South-Eastern Health and Social Care Trusts, Health Improvement Officers within the Public Health Agency (PHA) and the British Red Cross. Importantly, it is perceived that there is not uniformity in delivery across Northern Ireland. Uncertainty remains around access to such statutory services in Ireland also, as the example of a voluntary organisation (i.e. Gaelic Athletic Association - GAA) stepping in to provide community support following the Creeslough explosion. It is clear from discussions that greater clarity and focus is required on the 'who', but also the role, of statutory agencies responsible for helping those who have been involved in such traumatic events. There is agreement that such services and support are needed in the immediate aftermath but should also continue to be available in the long-term as some of those that have experienced such traumatic events may not be ready to talk or process what has happened until much later. This is a matter of climate justice. Many are unable to afford private counselling, and public services tend to have long waiting lists. There is the need to think about how to care for people in the aftermath. The idea of 'climate care'⁸ was raised as a valuable approach to help communities to understand and support mental health in the current climate and ecological crises. Such work focuses on not just getting a community physically ready, but also emotionally ready for climate change. In doing so, it aims to assist people to cope with the climate emergency and take meaningful climate action.

Concerns were discussed in the focus group about public perceptions of and response to warning information. Although many individuals still find such warnings helpful and act

⁸ Further information available at: <https://www.imperial.ac.uk/climate-cares/>

accordingly, research has revealed evidence of ‘alert fatigue’ during the COVID pandemic (White et al., 2024; Williams et al., 2021) and in the case of extreme temperatures, recent research found that while the UK public is increasingly aware of the threat of heatwaves, there has been a tendency for people to discount the seriousness of warnings and act in ways which exposed them to greater heat risk (Clayton, 2024; Howarth et al., 2025). This raises concerns about human perception and behaviour with increasing weather extremes associated with climate change. Examples were provided on how people respond to the downgrading from Red to Amber/Orange weather warning illustrates that some people do not appreciate the level of severity that being in an Amber/Orange level potentially brings, viewing it as a return to normal. Associated with this is the need to carefully consider, and better appreciate, the psychological impact of more regular alerts and warnings on people, particularly young people and children, given the growing issue of eco-anxiety. There is a need to consider ways to strike a balance between communicating the necessary information to empower people to make informed and timely decisions but not to instil fear.

3.5 Cross-border Cooperation

The level of cross-border cooperation and communication associated with the North-West flooding event was raised during the DfI review in 2018. Local Government Civil Contingencies (LGCC) advised that:

Donegal County Council had also been responding to a significant flooding event on the same dates. It was noted that cross-border liaison is ongoing and recommendations coming from their debriefing process will be considered, to determine if there is any learning that may inform this Review (DfI, 2018, 36).

The quote illustrates how this is a work in progress. Indeed, this study has captured that there is a degree of cross-border cooperation but it remains limited, with significant scope to expand and strengthen interactions to enhance mutual aid. Memoranda of Understanding (MoUs) are in place across various emergency services on either side of the border. Furthermore, learning from Northern Ireland’s South-Eastern corridor demonstrates practical solutions are occurring in providing sandbags when needed. Although the Cross Border Emergency Management Group (CBEMG) was referenced, and its well-established activation process for operational response acknowledged, many believed that cross-border systems could, and should, be improved. There appears to be an appetite to explore that multi-agency, mutual aid going forward. Nonetheless, there are structural differences with an asymmetry in where service responsibility lies, e.g. with a local authority or separate public agency. It is a complicated landscape with the counterparts on each side of the border not aligning, which presents challenges for strengthening sectoral interactions. This is positioned within a challenging backdrop, as participants commented on how it can be difficult to establish meaningful and productive working relationships across council departments and between councils within a jurisdiction, let alone on a cross-border basis. On many occasions, there

tends to be a reliance on a small number of individuals. One interviewee highlighted how the North-West Regional Development Group has tried to overcome such structural barriers in establishing a valuable network for nurturing strong working relationships between Derry City and Strabane District Council (DCSDC) and Donegal County Council (DCC). In effect, this underpins how cross-border cooperation should be guided by reciprocal government policy, with mutual alignment and commitment from both jurisdictions.

3.5.1 Engaging Planners in Emergency Responses

From the focus group and semi-structured interviews conducted as part of this research, there is some evidence that, internally within councils, learning from such extreme flooding events is taken on board and that it enhances preparation and preparedness for any future events. However, there is not a consistent or coherent approach as to how planning departments in councils interact with emergency planning functions. In the immediate aftermath of the 2017 and 2023 storms, as well as the associated flooding incidents, there was some variation in how planning department colleagues responded in both DCC and DCSDC in the North-West, and in Newry, Mourne and Down District Council (NMDDC) in the South-East. While both North-West planning authorities shared and reviewed relevant planning applications and datasets with their respective agencies (OPW/DfI Rivers Directorates), it was the Directors of Service within DCC who tended to be more directly involved than planning staff. In DCSDC, senior planning officers assisted environmental health colleagues in the immediate aftermath of the flooding to ensure that inspections of homes were carried out, facilitating the processing of severe inconvenience payments to householders as soon as possible after the event. In the South-East, assistance was not required from NMDDC planning colleagues, as the event had a limited impact on the residential sector. It was also noted that while there is awareness of the council's emergency planning team, there is limited interaction with planning colleagues.

3.5.2 Flood Risk Management in Planning Policy

Flood risk mitigation measures are considered within spatial planning, with such measures being considered in proposed housing developments as detailed in Chapter 2. The planning systems in both jurisdictions have tended to rely on advice supplied from government departments in relation to flood risk when assessing planning applications. However, the 2017 North-West flooding event appears to have heightened awareness for planning departments in both DCC and DCSDC, both of whom are now adopting a more precautionary approach to planning and development in areas at risk of flooding. The 2017 flooding made clear that the level of flooding outlined in the Flood Risk Management Plans could materialise in practice.

Reflecting on the 2017 flooding in the southeastern areas of Derry/Londonderry (i.e. Eglinton and Drumahoe), one interviewee commented on how a new development, which at the time of its proposal had incorporated the [then] Rivers Agency's recommendations in terms of the layout and the development of the site, still experienced severe flooding. In this particular

case, the measures implemented were not sufficient to provide adequate defence in the face of an extreme event. Learning from this event has influenced planning committee meetings as elected members have become increasingly aware of issues associated with flooding.

Another interviewee acknowledged how, particularly in DCC, this incident added a lot of impetus to inform the flood risk policy, positioned as a sub-section of Chapter 8 on *Infrastructure*, of the recently adopted *County Donegal Development Plan 2024-2030* (Donegal County Council, 2024). However, a challenge emerged with the dataset provided by the OPW, as it was still in draft form and under internal review at the time it was shared. As a result, the council was unable to use or publicly reference the information due to its provisional status. This limitation affected the council's ability to integrate the dataset into its policy formulation and planning processes. The EU Floods Directive (2007/60/EC), transposed into Irish law, mandates the assessment and management of flood risks be undertaken by local authorities. DCC commissioned external expertise [Roughan O'Donovan Consulting Engineers] to prepare a Strategic Flood Risk Assessment (SFRA) report that would inform plan preparation, both in terms of a suite of policy statements and mapping. The plan's adaptation measures include flood risk management, promotion of nature-based systems for water management services, and the enhancement and protection of green infrastructure and biodiversity. The planning authority and its development plan adopts the DEHLG & OPW (2009) sequential approach for the management of development in areas at risk from flooding – as outlined in *The Planning System and Flood Risk Management – Guidelines for Planning Authorities* – and which is broadly summarised as follows:

Avoid development in locations at risk from flooding; substitute a land use/development that is less vulnerable to flooding where avoidance is not possible; justify the proposed land use/development in accordance with a specific Justification Test where avoidance and substitution are not possible; mitigate any residual flood risks arising from the development to an acceptable level where the development has passed the justification test (DCC, 2024, 171).

DCC's development plan also stipulates developments do not reduce the natural storage capacity provided by flood plains, and developments do not increase surface water runoff over and above natural rates. An interviewee reflected on how this evidence-informed assessment and analysis created strong policy wording that influenced elected members thinking and decision-making, with members now less willing to react to developer pressure or those areas identified as significant flood risk. It remains uncertain, particularly in relation to Ireland, if local authorities will provide more baseline data on flooding over time associated with policies in recent plans and planning application data. Further complexity exists, with a gap at the regional level, and lack of consistency of research methodology at national level.

At the time of writing, the respective local development plans for DCSDC and NMDDC are at different stages within plan preparation. A review of DCSDC's adopted plan strategy identifies

an extensive range of strategic environmental policies, in Part E, with a dedicated Chapter 25 focusing on *Development and Flooding*. Within this chapter, there are objectives to ensure flood avoidance and management which represents substantial progress in relation to what was articulated in the previous Area Plan, dating back to 2011. With regards to acknowledging the need for inter-jurisdictional working, the development plan states that:

As the effects of flooding do not respect geographic boundaries, it is important to consider the potential impacts of development on flooding in other adjoining districts (and vice versa) including County Donegal. Therefore, similar policies apply elsewhere and appropriate consultation will be required including trans-boundary liaison and flood consideration in Environmental Impact Assessments (EIAs), SA / SEA and HRAs (DCSDC, 2025, 407).

Since conducting interviews with NMDDC planners, the council's *Local Development Plan 2035 Draft Plan Strategy* has been released, which contains a dedicated Chapter 20 on *Flood Risk and Drainage* (NMDDC, 2025). The suite of policies within this chapter corroborates with what was disclosed during interviews; with planners stating that "flood risk is very high on the agenda, given the effects of climate change, which we've seen first-hand in this council area", referring to the 2023 flood event and the extensive coastline of this council area. It was confirmed that the draft plan strategy has overarching strategic policies on flooding, sustainable development and climate change, alongside a range of operational policies on flood risk and developments at risk (associated with land instability due to coastal erosion and mining). It was confirmed that planners preparing the development plan liaised quite extensively with DfI, specifically its Rivers Directorate, who assisted with wording on the policy direction on flooding. Similar to DCSDC's plan strategy, NMDDC planners confirmed that their draft also includes a policy on SUDS, which is new to the council area's policy landscape.



A precautionary approach, with a suite of conditional policies, is necessary to deliver appropriate and resilient development. However, it is impossible to design out all risk,

so a potential cost remains. This raises concerns over the cost to the owner, or wider economy, versus the cost of prevention. Arguments need to be made on the willingness of interested parties to lose any financial gain in stopping a development versus the potential cost if it floods. The idea of more carefully quantifying and considering the financial cost of development versus not proceeding with it may need to be given greater attention in the future.

3.5.3 Nature-based Solutions

There is cross-sectoral awareness, support and policy alignment to prioritise viable nature-based solutions (NbS). This is evidenced by the inclusion, and strengthening, of various policies associated with flooding and mitigation in emerging local development plans in both jurisdictions. In Northern Ireland, DfI is continuing to apply the 'Living with Water' principles as departmental changes are underway that values more holistic ambitions, beyond solely hard engineering responses. This includes policies that prioritise dealing with surface water, SUDS, and flood water storage, and lobbying for new legislation to support upstream interventions to create upland storage in form of open water reservoirs. Tackling surface water remains even more challenging as it cuts across multiple government departments, e.g. in the case of Northern Ireland, that includes DfI Rivers Directorate, DfI TRAM (formerly Roads), NI Water, and inevitably central and local planning authorities that manage land-use and surface changes that influence runoff.

There is a wider educational element associated with NbS to highlight the benefits to various sectors. In particular, elected members need to appreciate the innovations and limitations of such designs/infrastructure and the evolving policy priority given to them, as in Northern Ireland, elected members on local council planning committees are the ultimate decision-makers on planning applications. This can be exacerbated by the short-termism associated with political cycles.

3.5.4 Maintenance of Flood Retention

Alongside development of policy is the need to consider aspects of implementation and maintenance of flood retention areas. The priority to identify mitigation measures and encourage developers to integrate these into developments need to be balanced with agreeing who will take responsibility for maintaining essential mitigation infrastructure, such as sustainable urban drainage systems (SUDS) and attenuation ponds. As one interviewee stated, councils have been legally advised to not undertake such additional responsibilities, and the matter of long-term maintenance is emerging as a significant challenge, particularly in Northern Ireland. Similarly, central government departments and agencies are reluctant to adopt such responsibilities either. As such mitigation infrastructure is required for addressing climate change, and reducing flood risk, there is the need to clarify where such responsibilities lie. In parallel, there remains resistance from the construction sector to incorporate soft flood prevention measures. Interviewees acknowledged that developers are not necessarily willing to bear the additional cost associated with softer mitigation measures like SUDS. However,

it is not the only concern with this aspect, as there is a challenge with the ability to source and secure professional expertise in SUDS and NbS on the island of Ireland – particularly outside of major urban areas – to support developers and the construction sector in incorporating such elements into proposals. It would appear that local government, and planning authorities, are dependent on individual developers to implement flood prevention measures. The extent to which post-approval monitoring, maintenance to ensure effectiveness, and take enforcement action, if necessary, remains unclear as the outworking of such new policies will take time to assess.

3.5.5 Retrofitting for Flood Resilience

While recent policy changes should prevent new developments in flood-prone zones or create better flood resilience infrastructure, a key challenge remains in those areas that are already developed, or considered for redevelopment. It is anticipated that regulations imposed through planning processes may be perceived as burdensome for applicants. Stakeholders are likely to express frustration, pointing out that neighbouring properties are not subjected to similar requirements. Therefore, the difficulty is striking a balance between protecting these areas and facilitating future development without imposing overly restrictive measures that could render projects financially unviable, or, in extreme cases, necessitate the complete overhaul of established areas. The retrofitting component is outside the remit of the planning system. In Northern Ireland, the Homeowner Flood Protection Grant Scheme (HFPGS) is a government scheme designed to encourage owners of residential properties that have flooded before to modify their properties to make them more resistant to flooding. There is scope to consider being more proactive and expanding beyond individual buildings to take into account other buildings on a street level basis, but a different funding model(s) would need to be explored.

Interviewees expressed frustration on the failure of social housing providers to incorporate flood protection measures after a flooding incident. For example, following the 2023 flooding in Portadown, public sector housing, which is not eligible under the HFPGS above, was impacted and, at present, does not install protective measures, which some of the interviewees viewed as a false economy. It is understood that this policy is being reviewed by some housing authorities. As it is not going to be possible to completely design out risk and there is going to be an element of living with water/flooding, new building regulations may offer cost-effective retrofitting solutions.

3.6 Conclusion

Lessons learnt from the 2017 flooding have helped shape the DfI's approach to flood risk management. Similarly, the recommendations of the 2023 flooding review are expected to inform policy across a number of Northern Ireland government departments in future years. The cross-department Flood Strategy Steering Group, together with the provisions of the Civil Contingencies Group ensure learning is captured in a systematic way. It is nevertheless

unclear to what extent lessons learnt from flood events have informed planning policy and practice going forward. It would seem that a more strategic approach to addressing implications for land management in both urban and rural areas is needed.

The flooding incidents highlight that unlikely events do happen and, can unfortunately, present challenges in creating design solutions that can respond to all extreme weather events. Nonetheless, greater attention is required in planning for extreme weather events, the immediate response, and the long-term recovery. Appreciating the psychological impacts and having access to essential care and support is becoming an important matter of climate justice. The discussion above illustrates that local authorities, central government and other agencies are embracing the learning and taking it forward, and is now being embedded within local policy and practice. Local authorities in both jurisdictions have adopted a precautionary approach to granting permissions on floodplains, reinforcing strategic regional policies to mitigate flood risks, and formulated new policies, such as those on sustainable drainage (SUDS) and NbS to address previous gaps in adapting to climate change impacts. Opportunities for shared learning and best practices between Northern Ireland and Ireland are acknowledged, though differences in government structures and funding streams pose challenges. Nevertheless, there is asymmetry in the policy landscape between both jurisdictions, a disconnect between role of planning and role of flood protection, and there remains a peripheral role for planning in emergency response.

4 WILDFIRES: SHIFTING POLICIES & MANAGEMENT STRATEGIES IN RESPONSE TO CLIMATE CHANGE

This chapter considers how climate change is resulting in a global shift in policy and management of wildfires. The term ‘wildfires’ is being used as it includes gorse and forest fires – and other fires out of control that may burn different land-cover types. Over the past three decades, but particularly the last decade, the frequency and scale of wildfires is increasing; such that wildfires are now considered a key driver for ecosystem change that in turn poses a significant threat and cost to society (Schoennagel et al, 2017).

4.1 Introduction

Globally, the first six months of 2025 has been synonymous with wildfires, leaving no doubt around their relationship to climate change and the importance of pre-planning and preparedness for such events. The California wildfires of January 2025 burned over 57,000 acres (23,000 ha), destroyed more than 18,000 homes and structures, killed at least 29 people and forced more than 200,000 people to evacuate (Figure 4.1). In March 2025, South Korea experienced its worst wildfires in its history, involving more than 20 separate blazes occurring simultaneously across the country. It led to several provinces being declared disaster zones, over 30 people being killed and around 6,400 facilities being destroyed.

Figure 4-1: Scale of Destruction by the Palisades Wildfire, January 2025



(Source: Mario Tama/Getty Image)

Wildfires have long been part of Europe’s history also, particularly around the Mediterranean and a growing frequency emerging in Central and Southern Europe. The growing frequency

and intensity of wildfires globally are being exacerbated by changes in (1) vegetative land cover, including a build-up of vegetation from the previous winter, (2) climate patterns, including drought conditions, low humidity and unusually high winds, (3) changing land management practices informed by both declining land management resources and an evolving policy context, and (4) demographic shifts (Carroll et al, 2021; European Commission, 2021). In 2021, the European Commission estimated that 85% of the land burned in Europe was located across the five countries of Portugal, Spain, France, Italy and Greece – and that each were experiencing an average of 500,000ha of land burn annually. By the end of July 2025, EU data indicated that around 629,000 hectares (1.6 million acres) of land has burnt across the bloc since the beginning of the year, with wildfires in Spain comprising around a quarter of that total (BBC News, 14 August 2025).

There is growing evidence to suggest that the wildfire season is starting earlier and ending later and that other countries, such as Ireland, are under increasing threat of a surge in wildfires. Moreover, as outlined by the OECD, “emissions from extreme wildfires fuel climate change, which in turn further increases the frequency, size, and severity of wildfire events, creating a feedback loop between climate change and extreme wildfires” (2023, 9).

4.1.1 The European Policy Context

Detailing and understanding the causes behind the growing trends in wildfires – in terms of frequency, intensity and distribution – is complex. According to the European Commission

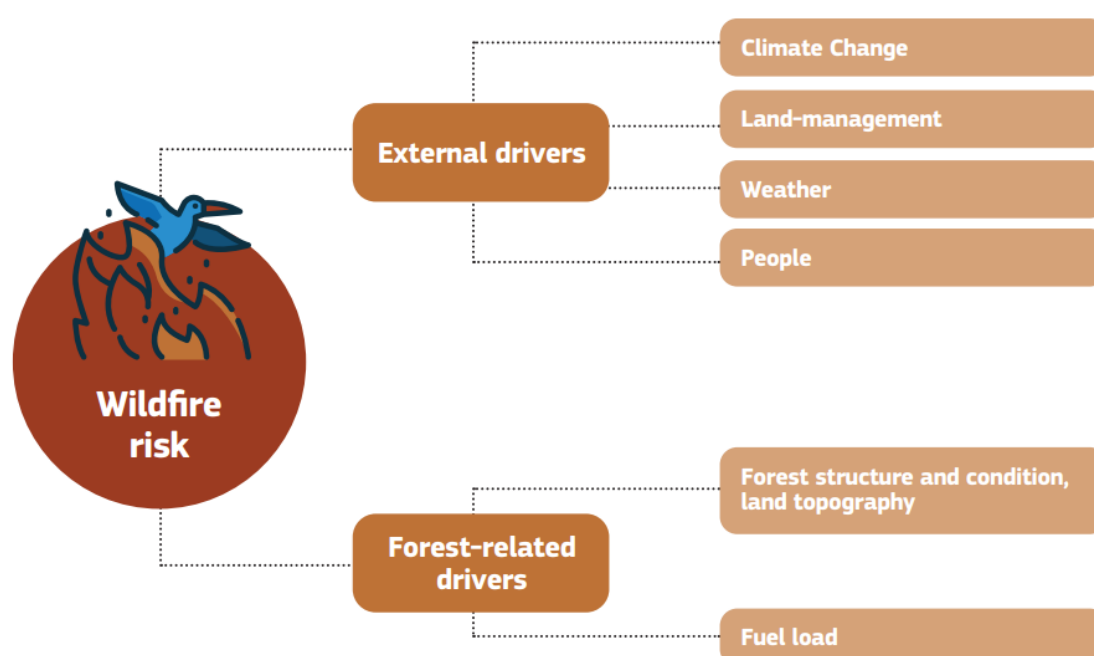
Climate change (especially new weather patterns), land management changes, social patterns such as rural abandonment and urban expansion, changing cultural traditions and leisure behaviours, and sub-optimal fire management policies have all influenced the fire impact in Europe (2021, 9).

With a growth in frequency and intensity of wildfires, many European countries are challenged by response capacity. This is particularly the case for rural fire stations where the majority of firefighters may be retained. Response capacity will be further tested by the emerging pattern of the wildfire season starting earlier and finishing later in the year.

Additional challenges exist around (i) the number of people potentially being affected by the increase in both the number and intensity of wildfires – a 3°C global temperature increase would see a further 15 million Europeans potentially exposed to fire danger for at least 10 days per year (European Commission, 2021); and (ii) the significant increase in social, economic and environmental damage resulting not only from the wildfires but also from secondary natural hazards such as landslides, rockfalls, etc. In addition to these far-reaching implications, wildfires also represent “a significant threat to human health and security” (Fernandez-Anez et al, 2021, 7).

While climate and meteorological conditions are one factor impacting on the frequency and severity of wildfires, other factors include landscape and anthropogenic characteristics (Fernandez-Anez et al, 2021). These drivers are closely inter-linked (Figure 4.2) – mainly through land management practices and planning. As argued by the European Commission, “Fire management is land management and vice versa” (2021, 17). There is growing evidence that changing demographics including rural depopulation and an ageing farming population is generating landscapes that are more prone to wildfires through the lack of people to manage the fuel load. In other situations, urban expansion has resulted in people moving into areas that are wildfire-prone, with new residents often having little knowledge of land management practices or fire risk. This urban growth in some countries has been correlated to higher rates of human-caused ignition (Gonzalez-Mathiesen et al, 2021).

Figure 4-2: Wildfire Drivers



(Source: European Commission 2021)

In terms of geo-spatial location, wildfires generally occur in scrublands and forests. Across the EU, forests cover 38% of total EU land cover; with percentage forest cover per member state ranging from 66% in Finland to 1.5% in Malta. Across the island of Ireland, the percentage woodland/forest cover stands at approximately 20.3% (11.6% in Ireland⁹ and 8.7% in Northern Ireland¹⁰). Recognising that changes in climate, land-use and land management are

⁹ <https://www.gov.ie/en/publication/57d2a-forestry-facts-and-news/>

¹⁰ <https://irishriverproject.com/wp-content/uploads/2023/06/Forest-Service-woodland-register-and-basemap-Stakeholder-summary-report.pdf#:~:text=Presently%2C%20the%20woodland%20register%20and%20basemap%20estimates%20the,LGD%20is%20available%20via%20the%20woodland%20register%20link2.>

increasing the probability and severity of wildfires (Fernandez-Anez et al, 2021), and responding to the growing strain being experienced by EU forests, the European Commission launched the *New EU Forest Strategy for 2030* in July 2021¹¹. The strategy, aligned to the EU Green Deal and the EU Biodiversity Strategy, sets a vision and concrete actions to improve the quantity and quality of EU forests¹² and aims to adapt Europe's forests to the new conditions, weather extremes and high uncertainty brought about by climate change.

In addition to strategies, the European Commission has a long history of working on forest fires; from the setting up of the Expert Group on Forest Fires (EGFF) in 1998 to the establishment of the European Forest Fire Information System (EFFIS) in 2000¹³. Since 2015, the EFFIS has been part of the EU Copernicus Programme, under Emergency Services Management; with a key component of its work being a European Fire Database which centralises the national fire data that countries collect through their national forest fire programmes. This includes details on location, time, size and cause (European Commission, 2022; European Commission, 2021). As a resource, the EFFIS provides daily fire danger maps as well as maps of the latest active fires and wildfire perimeters. It also provides forecasts of fire danger for up to 10 days in advance and post-fire evaluations of damage (European Commission, 2022). As a tool in the management and prevention of wildfires, EFFIS can be accessed at: <https://forest-fire.emergency.copernicus.eu/>

4.1.2 The Language of Fire

While wildfires are part of the natural dynamics of most terrestrial ecosystems on Earth, they are usually considered as a threat that must be managed (Fernández-García et al, 2023). The language of fire, more often than not, is negative in its connotations. Fire is both perceived and portrayed as being destructive and dangerous; something to be battled, feared and fought. As noted by one interviewee as part of this research,

The language of fire is a language of warfare. It's a language of attacks. You look at the language of fire, firefighting - it's a language of fighting (Interview).

This leads to the view that all fire is bad. But there is a counter-argument to this.

4.1.3 Good v. Bad Fire: Fire as a Land Management Tool

The use of fire as a land management tool in support of "sustainable grazing practices, landscape health and weed or invasive species management" (Carroll et al, 2021, 400) has a long and well-established history across a number of countries including Ireland. However, the literature advises that there is a poor understanding amongst the broader public as to

¹¹https://eur-lex.europa.eu/resource.html?uri=cellar:0d918e07-e610-11eb-a1a5-01aa75ed71a1.0001.02/DOC_1&format=PDF

¹² The forest management angle of fire prevention is the sole competence of Member States.

¹³ The EFFIS was established jointly by the European Commission services (Directorate-General for Environment DG ENV, and the Joint Research Centre), the relevant fire services in the EU member states, other non-EU European countries and Middle East and North African countries (Forest Services and Civil Protection Services) (European Commission, 2022).

what constitutes agricultural burning vis-à-vis a wildfire. This, together with evolving climate conditions, changing social contexts, increasing landscape fragmentation and tensions over land-use are rendering burning increasingly controversial (Carroll et al, 2021; Barbero et al, 2015). Controversy also relates to the timing of prescribed burns relative to potential impacts on biodiversity versus the impacts of a short burning season and reduced levels of grazing on vegetation build-up (Carroll et al, 2021).

...as sheep stocking levels have been reduced and burning restricted, succulent vegetation has been outcompeted by woody vegetation in many places creating a vicious cycle making future pasture burning both more important from their [farmers] perspective and more difficult to carry out safely (Carroll, et al, 2021, 406).

There is also a perspective that fire is an ecological process, albeit a very poorly understood one, especially from a legislative perspective. Across the literature and indeed in wildfire management plans, there is a recognised role for fire within ecosystem services (Schoennagel et al, 2017) and as a land management tool. Such prescribed burning has a long tradition in many countries as a land management tool, with practices passed down through generations (Carroll et al, 2021). It is also argued that it's impact on delicate ecosystems is less destructive than that of more modern techniques and machinery. As noted by one interviewee

There is no machine can produce the delicate treatment that a fire can produce on the types of delicate surfaces and delicate land types that we're dealing with, particularly on peat. Driving equipment on to peat is a challenge in its own right. The scale of machinery, all of that comes into play and we have lots of spaces where the terrain simply dictates you cannot and will not ever bring a machine here. It's just not possible physically, but we can bring, we can bring fire into those spaces to produce good outcomes, but we're not, we're not....we don't have the opportunities to show that or demonstrate that (Interview).

Research into forest fire management in Germany identifies, what appear to be initially, two conflicting belief sets: a human-centred narrative which argues that forests need human support/intervention to keep them healthy and that fire risks can be mitigated through more intensive land management, versus a nature-based narrative which centres on ecosystem services and calls for more regulations to enable the forest to self-recover (Tietzei et al, 2023). Neither, however, stand in isolation of each other; with both dependent on local conditions and knowledge co-production drawing from multiple disciplines – science and non-science.

4.1.4 The Human Impact

While human-induced ecosystem degradation is a key driver behind growing wildfire risk, there is also a human impact to wildfires. As reported by the OECD (2023), the human cost of wildfires extends far beyond lives lost. Wildfires also lead to long-term health impacts that

can lead to both respiratory and cardiovascular diseases caused by wildfire induced air pollution. It is estimated that the cardiovascular and respiratory impacts of wildfires are associated with 340,000 premature deaths per year. They can also lead to neurological disorders and psychological impacts; the traumatic impact of being caught in a wildfire, for example, can lead to major psychological trauma and post-traumatic stress disorder. There are also the added traumas of populations being displaced and the loss of homes, livelihoods and belongings.

4.1.5 The Environmental Impact

Wildfires have significant impacts on ecosystems. By way of example, the 2019-2020 Australia wildfires destroyed over 10 million hectares of forest (Arango et al, 2024a) and resulted in:

- The death or displacement of an estimated 3 billion animals;
- Burning of over 50% of the habitat of 70 threatened species;
- Nine times more damage to the tree cover compared to the 2018 fires; and
- Damage to freshwater ecosystems with record fish mortality in estuarine zones downstream of burned areas (OECD, 2023, 13).

Wildfires also affect drinking water quality and increase water-related risks. As noted by the OECD (2023), they can also exacerbate drought and flood risk as burned soils tend to absorb less water.

4.1.6 The Economic Impact

While acknowledged as difficult to estimate, the OECD reports that between 2000 and 2017, wildfires have caused approximately €3 billion of direct economic losses every year in the European Union – a figure that does not take into account lost tax revenue, reduced property values or business interruptions. Wildfires in the municipality of Pedrógão Grande in Portugal in 2017 are believed to have resulted in over €523 in direct costs; with an estimated social cost of €613 million (Arango et al, 2024a). More recently the 2023 wildfires in Maui, Hawaii is estimated to have given rise to \$5.5 billion repair bill for damaged areas (Arango et al, 2024a).

Together, these social, environmental and economic costs and impacts are leading to increasing pressure on national governments to strengthen their wildfire policies, particularly in the area of prevention. Research conducted for the European Parliament by the Pau Costa Foundation following the 2022 wildfire season contends that “An estimated €1 investment in prevention could save €4 to €7 in response and recovery expenses” (2023, 9). This is resulting in widespread calls for increased national investment in training, capacity building, and proactive measures such as fuel management, prescribed fire application, and forest health (European Parliament, 2023, 9).

4.2 Wildfires across the Island of Ireland

The Island of Ireland's location in North-West Europe adjacent to the North Atlantic Ocean produces a mild oceanic climate. The high level of precipitation experienced is anecdotally presumed to suppress wildfire; however recent data suggest that fire has been increasing in the Irish landscape in recent years (Nugent, 2015, quoted in Hawthorne & Mitchell, 2018, 59). Future climate predictions for Ireland indicate that temperatures are to continue to increase, and summers are to become drier with up to a 20% reduction in precipitation (Gleeson et al., 2013). This will increase the vulnerability of the Irish landscape to wildfire. In addition, individual site conditions such as topography, soil type, vegetation and meteorological conditions significantly influence fire occurrence.

Wildfires across the island of Ireland are most commonly associated with periods of dry weather. Many are considered to be the result of controlled burns that have a long tradition in farming practice - to remove unwanted vegetation and improve forage quality for livestock (Carroll et al, 2021) - and which become uncontrolled, with others started accidentally. Other farming practices around drainage, monocultural forestry practices and peat-cutting have transformed lands from being fire resistant to fire prone ecosystems (Brongersma, 2021). It is expected that rising air temperatures and a decrease in summer precipitation will further create a more fire prone ecosystem (Canaleta et al, 2021). In an attempt to limit the number of uncontrolled burn events, setting fire to vegetation is prohibited between 1st March and 31st August each year in Ireland¹⁴ and between mid-April and 31st August in Northern Ireland. In the South, the Department of Agriculture, Food and the Marine (DAFM) issue Forest Fire Risk Warnings¹⁵ during the main wildfire season (February to September) based on weather patterns. Similar warnings are issued for Northern Ireland by the Natural Hazards Partnership. But even with these prohibitions and warnings, large wildfires can occur e.g., the 2017 Cloosh Valley Fire in Galway, the Frayne bog fire in Meath in June/July 2018, the large Dublin Mountains and Wicklow Mountains gorse fires in February 2019, and the Mourne wildfires in April 2021 and April 2025.

4.2.1 The Landscape as Fuel

Fuel is one of the three main factors that affect how fires behave, along with weather and the layout of the land. The type of fuel available to burn will directly influence the wildfire propagation. The impacts of wildfires, and indeed the behaviour of wildfires is affected by the type of vegetation fuel encountered by fire – including its physical and chemical attributes and phenology (European Commission, 2022). Wildfire behaviour is also affected by whether the vegetation fuel is horizontal and/or vertical in nature, and the interconnection among them; the management of the vegetation and “its suitability/resistance/reliance to the changing bioclimatic conditions of the local habitat” (European Commission, 2022, 21).

¹⁴ The Wildlife Act 1976 as amended in 2000.

¹⁵ In Ireland, these risk warnings are generally based on daily Met Eireann Fire Weather Index (FWI) and the European Forest Fire Information System (EFFIS) outputs.

Monocultural forestry is particularly susceptible to wildfires and storm damage (Puettmann, 2021; see Box 4.1). The recently published consultation report by the Northern Ireland Environment Agency (NIEA) on *Wildfire in Northern Ireland – A Strategic Way Forward* highlights the need for a greater focus on fuel/land management in reducing wildfire risk (2025). This is regarded as critical to meeting the strategic goal of “To build resilience into those landscapes and habitats most susceptible to wildfire and reduce the risk and/or severity of wildfires”. The report, in drawing out a number of responses to the consultation process, notes:

There is no “one size fits all” when it comes to fuel management techniques and methods and it is clear that the need to manage habitats / fuel on a site or across a landscape will need to be assessed on an individual basis to ensure the best result for the least impact on the environment (NIEA, 2025, 24).

Data and technology has a key role to play in enabling countries to better understand the location and level of risk/vulnerability to wildfires. Tools such as Corine Land Cover (CLC) collections and the EFFIS Wildfire Risk Index are critical to providing harmonised insights into wildfire risk over wide spatial areas (European Commission, 2022).

Box 4.1: Storm Eowyn and Woodland Management

Storm Eowyn in January 2025, among other impacts, led to wind-blow damage to 24,000 hectares of woodland in Ireland, approximately 50% of which is managed and owned by the semi-state company Coillte. Recent efforts have focused on the removal of dead and damaged trees, at high cost and with low expected commercial return. Large-scale wind-blow events such as this, are associated with knock-on risks including fire risk and bark beetle infestation. Vulnerability is enhanced by a range of factors, including low species diversity, trees being of similar age and the shallow roots of Sitka spruce. In short, monocultural forestry is much more susceptible to both wind-blow and wildfires than biodiverse woodland. In the aftermath of Storm Eowyn, critical questions can be asked about whether it makes sense to remove the dead trees and continue with short-term monocultural commercial forestry on these lands, or whether a mixed-species approach might lead to greater resilience and potentially a better balance between biodiversity and commercial objectives. From a biodiversity and climate change perspective, leaving the deadwood where it is could be a viable option leading to natural regeneration over time, but would require a paradigm shift in Coillte management objectives (see also The Irish Times, 18 January 2024). In this case, a severe event provides a potential opportunity for reflection on management principles, where short-term recovery objectives might become recalibrated as longer-term priorities shift.

The period of March-May 2025 (at time of writing) has witnessed an unprecedented number of wildfires for this time of year, with media reporting large-scale wildfires in counties Donegal, Mayo, Tipperary, Kerry, Monaghan, Tyrone, Down, and Antrim, to name but a few. Between the 4-7 April, the Northern Ireland Fire and Rescue Service (NIFRS) responded to 146 wildfires (BBC News, 7 April 2025). On 7-8 May, fire crews from County Monaghan and the NIFRS jointly tackled a large cross-border gorse fire spanning over 5,500 acres of Slieve Beagh, with other agencies in attendance, including the Northern Ireland Forestry Service, the

Environment Agency, and the British Red Cross. A dry spring following two particular wet years – and reduced controlled burning – has resulted in a build-up of unmanaged vegetation that has now turned into ‘fuel’ and created a flammable landscape. The likelihood of this happening was widely discussed at the 2024 conference of the International Association of Wildland Fire, held in Tralee (The Irish Times, 17 April 2024b). Delegates at this conference also heard that Ireland’s flammable landscape must be managed in a proactive rather than reactive way. In Portugal, traditional methods of controlled burning are once again being encouraged to create “a mosaic of landscapes”; the argument being that this mix of landscapes will protect from large-scale fires. The need to control rewilding in part stems from the rise in number of farms being abandoned as a result of an ageing population (The Irish Times, 17 April 2024b). Other measures being pursued in Portugal include the construction of communal fire shelters in remote communities and an awareness campaign on the use of fire nets, cleaning gutters and removing vegetation close to houses (The Irish Times, 17 April 2024b).

The challenge of rural land abandonment as a major driver of wildfire risk is increasingly recognised internationally; including in Northern Ireland (Northern Ireland Environment Agency, 2023). Across the Iberian Peninsula, land abandonment is considered a critical challenge in land and forest management and by association, wildfire management (Arango et al, 2024a). As argued by Duane et al. (2021), land abandonment is particularly prevalent in mountainous and hilly areas – this is largely due to their unfavourable farming conditions. The resulting afforestation of these abandoned lands “can reshape fire-climate-vegetation relationships in coming decades” (p.43). Such patterns are becoming increasingly common across a number of counties on the island of Ireland.

4.2.2 Social and Geographic Considerations

Similar to countries such as Australia and New Zealand, the settlement pattern across the island of Ireland has created a morphology of low-density urban sprawl and dispersed rural developments that encroach into increasingly fire-prone landscapes. As expressed by one interviewee,

Obviously large scale urban development is planned and large-scale buildings are planned with fire in mind from the outset....but I don't know what the and how much thought goes into fire engineering when it comes to one off rural housing in the same way you would look at with a block of apartments or a larger multiple housing development (Interview).

An analysis of national and regional policy as it relates to climate change, future socio-economic growth and development finds little to no reference to wildfires or wildfire management. In Ireland, the only reference to wildfires in the *Climate Action Plan 2025* (Government of Ireland, 2025a) is to note the occurrence of large-scale fires across parts of Europe in 2024 and to link these to accelerated warming and severe weather events. The

National Planning Framework, First Revision, adopted in April 2025 (Government of Ireland, 2025b) makes no reference to wildfires or fires, and in the context of future land management, the most pertinent reference outside of those focused on regeneration and development is to the role of rural communities as custodians of the landscape, particularly those engaged in farming at various scales. Similarly, the soon-to-be replaced *Our Rural Future* (Government of Ireland, 2021) makes little or no reference to wildfires, fire or active land management. On a more positive note, both these latter plans are quite strong on climate change and biodiversity – with multiple references and policy objectives to both throughout. In Northern Ireland, an analysis of the *Regional Development Strategy 2035* (Department for Regional Development, 2012), the *Strategic Planning Policy Statement for Northern Ireland* (Department of Environment, 2015) and the *Rural Policy Framework for Northern Ireland* (Department of Agriculture, Environment and Rural Affairs, 2022) a similar pattern emerges – from little or no reference at all to key words such as wildfire, fire or land management vis-à-vis a strong commitment to addressing biodiversity loss and climate change.

While this is acknowledged as a light-touch policy analysis, it does highlight that the threat of wildfires is not yet part of the island of Ireland’s dialogue on disaster risk reduction (DRR) – and the interrelationship between this and spatial planning policy and land management practices is not yet joined-up.

4.2.3 Wildfire Planning – A Local Agenda

Across the island of Ireland, there is a growing onus being placed on local authorities and their associated fire services to actively engage in wildfire management. This includes the establishment of wildfire partnerships (as in counties Kerry and Cork) and local wildfire groups (as in Belfast Hills and the Mourne), and the development of wildland fire plans (as in counties Monaghan and Cavan). The core objective of these initiatives is to enable improved information exchange, public and agency awareness and enhanced fire prevention and response capabilities between the key stakeholders, from national to local level.

The Kerry Wildfire Partnership, for example, was first established in 2012 as a response to rising levels of wildfire incidence in Co. Kerry, and increasingly adverse impacts on civil protection, economic land management and conservation arising from fire in the county. The partnership consists of local level Agriculture, Forestry, Local Authority, Garda, Fire Service and National Parks and Wildlife Service (NPWS) officers, and also incorporates representatives of the main farming organisations. Through the partnership, Kerry Fire and Rescue Service worked closely with the Department of Agriculture Food and the Marine (DAFM), Teagasc and farming representatives in the development of prescribed fire training for landowners within current legislative limits.

In a similar vein, the Belfast Hills Partnership supports DAERA in the delivery of Belfast Hills Wildfires Project¹⁶ by continuing to map wildfires in the Belfast Hills and to monitor the impacts and quantify/identify recovery rates wildfire events have on vegetation and other wildlife (biodiversity and ecosystem service). The continuation of reporting on wildfire events also supports a speedy response to these incidents. The Partnership also aims to identify key causative factors with the objective of identifying highly vulnerable areas and promoting good management for risk reduction. It also encourages research to identify carbon loss/gain due to wildfires. Led by DAERA and NIEA, the partnership also works closely with NIFRS and site managing bodies such as Belfast City Council and the National Trust Society, and Queen's University Belfast (QUB).

In Monaghan, the wildland fire plans focus on planning and preparedness, warning and alerts, activation and recovery. There is also a commitment to capacity building and response both of the fire-fighters themselves but also on the role of the community in being resilient and safe. A strong emphasis is placed on engagement with all stakeholders, and to this end, providing wildland fire safety education and promoting effective land management practices to reduce incidences of wildland fires. A central noted objective is the rescue and protection of vulnerable persons first and foremost, followed by critical/heritage infrastructure and property. Similar in nature to the Kerry Wildfire Partnership, the *Wildland Fire Plan for Eshbrack Bog NHA and Sliabh Beagh SPA, 2022-2025*, calls for the establishment of a Wildland Fire Group, representing all stakeholders; noting this is necessary to “maintain effective communication and implementation of this wildland fire plan” (Monaghan County Council, 2022, 9). As a starting point, the plan includes a listing of identified essential stakeholders in the area, including on a cross-border basis. This Group has been established and the process of developing a wildland fire community plan has commenced, along with exploring various resource and funding options.

Within the wildland fire plans, there is an acknowledgement of the limitations that operating under a retained fire service model may have on the implementation of the recommendations contained within. Training for wildfires is currently part of the annual drill programme of fire services. This includes a review of risk assessment procedures and policy for ‘Fighting fires in rural areas’, familiarisation with location and operation of wildland fire specific equipment, and review of fire-fighting mediums and communications. Recognising the increasing importance of training and capacity building involving all key stakeholders, the first EU Civil Protection Mechanism MODEX exercise, focused on wildfires, took place in Ireland in March 2025 (see Box 4.2. below).

¹⁶ For further information, see <https://climatenorthernireland.org.uk/site/wp-content/uploads/2022/02/NC3-Belfast-Hills.pdf#:~:text=Belfast%20Hills%20Partnership%20will%20aim%20to%20support%20DAERA%E2%80%99s,vegetation%20and%20other%20wildlife%20%28biodiversity%20and%20ecosystem%20service%29.>

Box 4.2: MODEX Wildfire Exercise 2025

As part of a week-long exercise, the first EU Civil Protection Mechanism MODEX exercise in Ireland, focused on wildfire, took place in County Wicklow on 26 March 2025. Bringing together over 100 responders from across Ireland and Europe to test emergency preparedness and response capacity on both an operational, tactical and strategic level, the large-scale urban search and rescue training event simulated a wildfire near Turlough Hill in the Wicklow Mountains National Park. The advisory mission was organised by the National Directorate of Fire and Emergency Management (NDFEM) in conjunction with Wicklow County Council and the Eastern Emergency Response Group, and included emergency response agencies such as Dublin and Wicklow Fire services, An Garda Síochána, the Defence Forces, Coillte, the National Parks and Wildlife Service (NPWS), the Irish Coastguard, the Air Corp, Mountain Rescue and the Civil Defence. The mission involved evaluating current policies, operational capabilities, available resources and inter-agency coordination mechanisms while also sharing best practice and testing the use of, and place for, advanced technologies in such large-scale emergency responses (Figure 4.3).

During the event, drone technology from Maynooth University was piloted as was its newly developed Wildfire Common Operational Picture platform, DecaMap; high-tech software which compiles data to predict wildfire movement and provide accurate information for emergency responders. In addition, the possibility of deploying aircraft from other EU states was also examined.

On the final day of the mission, funded by the European Commission, two draft reports were presented to the Irish Government. The timeliness of this event was not lost on those participating; with the spate of wildfires in March and April 2025 putting huge pressure on the resources of the fire services. The exercise was viewed as an opportunity to learn from those with more experience in tackling major wildfires across Europe. A short video on the advisory mission is available at:

https://www.youtube.com/watch?v=U_P1yqa2OEQ

A final report on the mission, when published, will provide expert guidance and, where appropriate, will also support the development of approved strategies and capabilities, particularly concerning the possible deployment of EU fixed-wing assets such as Canadair aircraft.

(Sources: RTE, 2025; Irish Independent, 2025; Emergency Services Ireland, 2025).

Figure 4-3: Multi-agency Cooperation during the MODEX Exercise



(Source: EU MODEX via The Journal, 26 March 2025¹⁷)

Such exercises are essential as there can be conflicting visions between stakeholders in wildfire management (Brongersma, 2021), and these trainings can

through integrated management and interdisciplinary work, synergies can be made and resources can be combined, benefitting multiple stakeholders. Links should therefore be made between environmental, economic and social objectives. Engagement can grow through the use of demonstrations, the feeling of peer pressure and the presence of a common goal and shared values of risk (Brongersma, 2021, 28).

4.2.4 The Cross-Border Dimension

Land fires do not respect or adhere to geographical boundaries, resulting in wildfire management in the Irish border region requiring “a complex interaction between people, climate and landscape” (Brongersma, 2021, 5). With both jurisdictions having different legal, political and organisational backgrounds, there is a recognised need for cross-fertilisation of knowledge and practices in both land and wildfire management and an enhanced commitment to cooperation between all affected parties, from strategic policy makers to landowners. While there are challenges, service to service mutual aid agreements are in place. The Cross Border Emergency Management Group (CBEMG) has, for example, assisted building relationships and connections necessary to promote a coordinated response to a range of cross-border emergencies, including wildfires.

Research by the Pau Costa Foundation in 2021 identified a number of cross-border locations on the island of Ireland where the risk of wildfire was a particular concern. One such site was Slieve Beagh, spanning the Monaghan-Tyrone border.

Uncontrolled burning and wildfires are a big conversation concern in Slieve Beagh. The site is facing the following problems and challenges: land ownership, agriculture and grazing, forestry, peat cutting, tourism and wind farms; each influencing the wildfire risk management of the area (Canaleta et al, 2021)

It is widely accepted that wildfire management is a very emotive issue as wildfires, by their very nature and unpredictability, have “different implications per sector” (Brongersma, 2021, 13). Importantly, research by the Pau Costa Foundation indicates that there is widespread acceptance of the need for wildfire management plans – albeit further consideration is needed around how they are framed and presented so that they are understandable to a wide an audience as possible. Other challenges in their design and implementation centre around land ownership, sense of urgency (or not), alignment with stakeholders’ existing business

¹⁷ <https://www.thejournal.ie/wildfire-simulation-forest-fire-wicklow-mountains-forest-fires-6659341-Mar2025/>

plans and seasonality of the issue. While the UK's EU Exit has not yet caused any challenges around wildfire management, there do appear to be differing cross-jurisdictional views on wildfires (Brongersma, 2021).

By their very nature, wildfire plans, strategies and policy cannot be static – they must be continuously updated and adapted with changing circumstances. This highlights the need for ongoing and more in-depth research into wildfires on the island of Ireland. A review of literature as part of this research, together with stakeholder interviewees, highlights potential challenges resulting from the different structure of the fire services across the island of Ireland. This was also inferred in the NIEA's consultation report on *Wildfires in Northern Ireland: Draft Strategic Way Forward* (July 2025).

Interestingly, the border is not seen as being a hindrance to engagement between stakeholders; rather it is seen as complicating implementation. Political support can also vary for cross-border cooperation depending on jurisdiction (Brongersma, 2021) – which also can have implications for implementation. Successful wildfire management, including on a cross-border basis, is dependent, therefore, on:

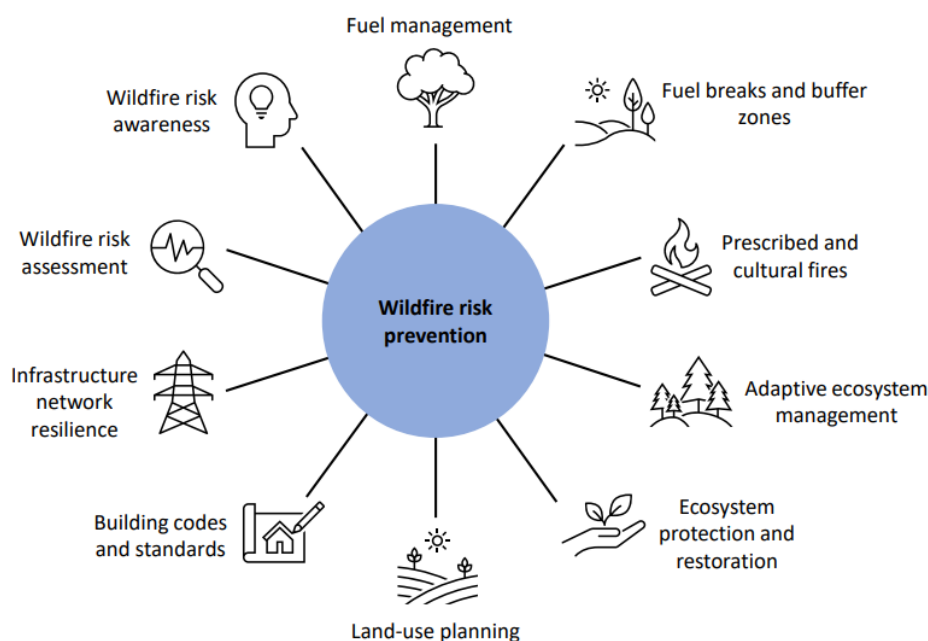
- Strengthening of existing structures, such as the Cross Border Emergency Management Group to assist enhancement of cross-border preparedness, response and recovery;
- Establishment of new structures with a commitment to resourcing and a strong policy footing, to consider cross-border themes such as wildfire management;
- Ensuring stakeholder engagement is built into the process from the very outset;
- Building strong leadership, particularly in circumstances where not all stakeholders will feel an equal sense of responsibility;
- Resourcing both in terms of personnel and funding; with such resources identified from the very outset as these are a key determinant of what exactly is possible;
- Up-to-date policy – from national to local level; this too has implications for what is possible and feasible;
- A rolling programme of nationally co-ordinated and funded training and exercises in wildfire management, including on a cross-border basis;
- The establishment and maintenance of a database – not only of wildfire events but also details on key stakeholders, landowners, location of support resources, etc.; and
- An ongoing programme of research to support the policy-praxis interface of wildfire management.

4.3 Learning from Good Practice: Lessons from Europe

Wildfires are an annual reality in many European countries such as Spain, Portugal, Greece and Bulgaria. As a result those countries with a longer history of wildfire response and

recovery are adapting and improving their wildfire management practices, particularly as they relate to emergency preparedness, including prevention, and response capacities. The EU Civil Protection Mechanism has played a critical role in this respect while also providing expertise and firefighting equipment (OECD, 2023). The aforementioned EFFIS also plays a critical role in near real-time wildfire monitoring. The following sections (4.3.1 and 4.3.2), are adapted from the OECD report, *Taming Wildfires in the Context of Climate Change* (2023), and provide insights to some of the main adaptive measures employed across Europe in wildfire management – from physical measures to organisational measures (Figure 4.4)

Figure 4-4: Reducing the Risk of Extreme Wildfires through Prevention Measures



(Source: OECD, 2023)

4.3.1 Physical Measures of Prevention

Preventive measures can include structural or physical measures that aim to manage fuel loads as well as ecosystem protection, restoration and adaptive management. In Switzerland, a system of sensors is used to provide hourly information on fuel moisture in selected forest patches to assist in detecting wildfires early. In Greece and Portugal, a text message system has been introduced whereby anyone with cellular reception, including residents and visitors, will receive a text message notifying them of imminent wildfires. In Portugal, legislation has been put in place which mandates the maintenance of ten-metre-wide buffer zones around main roads to ensure sufficiently large escape routes and access routes for fire fighters. Buffer zones are also mandatory around new and existing buildings in wildland-urban interface (WUI) areas. In Greece, legislation requires land tenants and owners in high-risk areas to remove excess vegetation and other flammable materials such as firewood from the

perimeter surrounding their assets before the start of the wildfire season. The managing of fuel accumulation and continuity is regarded as particularly critical to reducing wildfire risk.

In Portugal, there are also programmes, such as the Condomínio de Aldeia programme, which actively promotes land management and community engagement. This programme, for example, provides funding for managing fuel loads around properties and settlements. Agricultural practices also play a key role in supporting fuel breaks. Controlled grazing for fuel management is particularly common in Mediterranean countries such as France, Portugal and Spain; with the latter two promoting these practices through payment-for-ecosystem-services schemes. Such schemes reward local shepherds for undertaking grazing actively in public forests or exposed settlements.

4.3.2 Organisational Measures for Prevention

Organisational measures are also critical for reducing wildfire risk; these include regulations such as land-use planning, building codes and standards, and the fire-resilient management of infrastructure. The integration of wildfire hazard information into land-use decisions can directly reduce the exposure and vulnerability of people and assets. In Portugal, the construction of new permanent buildings is forbidden in areas characterised by ‘high’ and ‘very high’ wildfire hazard; with exceptions only granted in very specific cases and where risk reduction measures such as buffer zones are implemented. In France, wildfire risk prevention plans regulate development in fire-prone areas, going so far as to ban development where property protection is impossible. Research has also shown that the use of high quality non-flammable building materials can reduce fire risk and the likelihood of being destroyed. During the Attica Fires in Greece in 2018, the village of Neos Voutzas suffered limited damage due to the high quality building materials used. The neighbouring village of Mati was not so fortunate, with 80% of constructions completely destroyed¹⁸. Across Greece and Portugal, legislation mandating structural protection measures and fire-proof building design, including the use of non-flammable materials and non-flammable roofs and fences, is in place.

It is well documented that wildfires can have negative impacts on infrastructure by destroying or damaging exposed assets and interrupting infrastructure services. At the same time, poorly planned or managed infrastructure can increase wildfire risk. In response, there are documented cases whereby,

To build infrastructure resilience to wildfires, countries have adapted regulations mandating infrastructure operators to abide by safety rules and develop contingency plans that can reduce wildfire risk and impacts (OECD, 2023, 97).

In Portugal, the Climate Change Adaptation Action Plan lays out the country’s ambition to have 50% of its transport infrastructure companies develop an adaptation or contingency plan

¹⁸ Research has shown that a large number of these buildings did not have building permits and construction materials and methods left them more prone to wildfire hazard – and subsequently destruction.

for extreme events by 2030. In addition, critical infrastructure managers are legally required to manage wildfire risk around their assets. Energias de Portugal, the country's largest generator and provider of energy, has developed its own wildfire hazard reduction plan which includes interventions on fuel management, asset management, wildfire surveillance and awareness raising activities. Since 2010, the plan has contributed to reducing the burned areas in the Sabor Valley from an average of 210 hectares per year to 14 hectares per year.

With respect to wildfire risk assessment, the OECD reports that risk maps are currently available for most countries. While wildfire risk projections do exist for Portugal, they are not integrated into wildfire models, broader risk assessment efforts or planning processes. In response, the Portuguese Environmental Agency is currently updating projections of climate-induced wildfire risk and providing guidance on how to best integrate them into risk maps and other planning instruments.

4.3.3 A Cross-Border Dimension: Bi-Lateral Cooperation between Spain and Portugal

The risk of wildfires is recognised as a primary cross-border threat between Spain and Portugal at the highest levels of national legislation in both countries¹⁹; thus facilitating “robust, coordinated and communicative national monitoring and transnational coordination systems” (European Commission, 2024). Both countries share one of the longest land borders in Europe, stretching to 1,200km. Both countries also have similar landscapes and orography, with most of the border region being rural in nature (Arango et al, 2024a). In recognition of these shared and high risks in regard to forest fires/wildfires, agreements between both countries, dating back over 40 years to 1980, and more recently the 1992 Evora Protocol²⁰, allows for operational teams of both countries to act and intervene in each others' territory in the event of an emergency or serious incident. Under current arrangements²¹, this includes a 25km intervention zone on both sides of the border whereby the entering fire service is only required to inform the receiving country (see Appendix C). A formal request for assistance is required outside of this zone. There are 3 levels of intervention, namely:

1. *Controllable intervention* by regional forest fire services which is based on a mutual understanding where no charge is incurred. Normal between 10-15 per year;
2. *Large intervention* with multiple regional forest services with national direction which is reimbursed by the State; and

¹⁹ In Spain, this is the Plan Estatal General de Emergencias de Protección Civil (PLEGEM) which was published in December 2020 and can be downloaded at https://www.interior.gob.es/opencms/pdf/archivos-y-documentacion/documentacion-y-publicaciones/publicaciones-descargables/proteccion-civil/PLEGEM_126210199_web.pdf (2nd edition). In Portugal, this is the Plano Nacional de Emergência de Proteção Civil (PNEPC), published in 2022 and available to download at <https://planos.prociv.pt/Documents/130313331474961281.pdf>

²⁰ Protocol on technical cooperation and mutual assistance in the field of civil defence, Signed at Evora on 9 March 1992; see https://www.preventionweb.net/files/61731_i130en.pdf?startDownload=true

²¹ Updated under the Additional Protocol of Valladolid as signed on 21 November 2018; see <https://www.boe.es/boe/dias/2019/09/10/pdfs/BOE-A-2019-12928.pdf>

3. European Civil Protection Mechanism.

Implementation of the Protocol is the responsibility of the Ministry of Foreign Affairs in both Spain and Portugal; with the executing agencies being the National Civil Defence Service of Portugal and the Civil Defence Authority of Spain. The Protocol, last updated in 2018, aims to “allow rapid intervention and mutual assistance in the event of wildfires in the border area, whenever the urgency of the situation requires” (Arango et al, 2024a, 6). Figure 4.5 details the collaborative arrangements for wildfire emergencies, including details of key agencies, in the border region of Spain-Portugal. The bilateral agreement ensures a high level meeting annually and regional meetings monthly which, at various scales, plays a key role in building trust among respective authorities and harnessing personnel knowledge.

While the main focus of the long-standing collaboration has been on suppression and emergency actions, attention is increasingly turning to coordination, sharing of data and experiences to ensure actions are more effective, and to address the recognised on-going challenges for cross-border collaboration. These include:

- *Governance*: institutional complexity and poor joint actions between the entities in charge;
- *Infrastructure and mobility*: weak development of jointly managed cross-border public transport services;
- *Digitalisation*: differences between their connectivity and digital services; and
- *Hazard management*: lack of prevention and protection projects (Arango et al, 2024b).

A Joint Cross-Border Development Strategy between both countries, published in 2020, encompasses various aspects of cross-border collaboration and territorial cohesion, including more indepth cooperation on civil protection matters, including fighting of forest fires/wildfires along the border territories²². As noted in the European Commission’s report on *Strengthening the Resilience of EU Border Regions*,

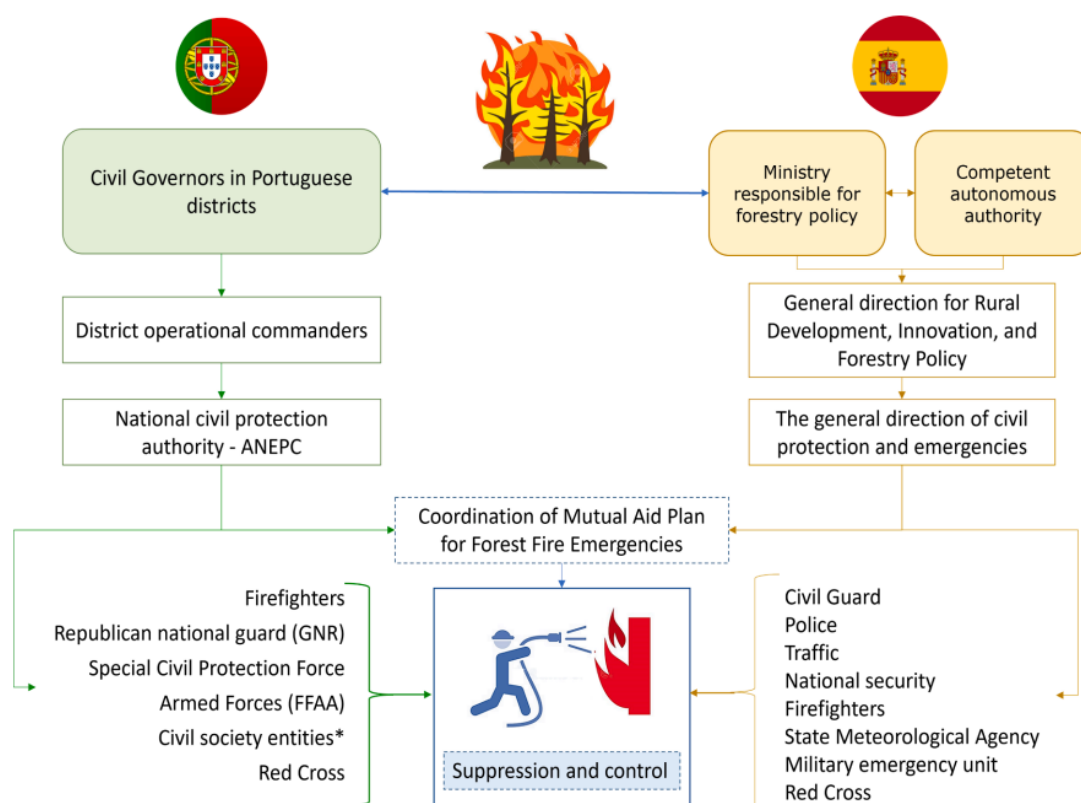
The strategy not only urges both countries to continue cooperating on forest fires within the framework of existing protocols and through existing national and regional channels but also includes planned actions, such as the necessity to adapt the action protocols of fire and emergency teams on both sides of the border (2024, 25).

In addition to the joint commitments at a national legislative and policy level to collaborate around the threat of wildfires, the recognised importance of having robust prevention and preparedness mechanisms in place is further evidenced by the establishment of dedicated, competent entities and units in both countries whose role is to complement the work and

²² See https://www.miteco.gob.es/content/dam/miteco/es/reto-demografico/temas/cooperacion-transfronteriza/documentoecd_t_es_finalseptiembre2020-es-en-r-c_tcm30-524267.pdf

competences of central bodies in matters of civil protection and emergency management response. This includes a strong focus on not only preparedness but also observation, monitoring and response and, from the perspective of this research study, a focus also on integrated spatial planning (European Commission, 2024).

Figure 4-5: Collaborative Arrangements for Wildfire Emergencies in the Border Area of Spain-Portugal



(Source: Arango et al, 2024a).

Under the Evora Protocol, a Joint Civil Defence Commission has been established, composed of representatives of the aforementioned executing agencies. The central remit of this Joint Commission is to discuss, plan and deliver scheduled activities, and propose changes and adaptations as they deem appropriate. In addition, the Joint Commission can add further protocols to this Protocol, covering such matters as frontier-crossing formalities, detailed requirements for intervention, leadership and coordination guidelines, and information and communication systems.

To date much of the cross-border regional collaboration around wildfires has occurred primarily through INTERREG-funded projects. Under the cross-border INTERREG Spain-Portugal (POCTEP) programme, which actively promotes cooperation in disaster prevention,

a total of 11 projects have been funded that address wildfires directly (European Parliament, 2023 50). With limited national and regional resources, this EU funding has been instrumental in establishing and sustaining initiatives aimed at preventing, preparing for, and responding to forest fires/wildfires – ensuring a balance in focus on both proactive (prevention, protection) and reactive (detection, suppression) measures.

Drawing on over thirty years of collaboration in wildfires and other areas of emergency management and response, this cross-border region recognises that there is a constant need to evolve the structures and mechanisms in place to keep pace of the demands on the system – not least within the context of changing risks due to climate change. These include:

- *Territorial Authorisation:* As risks become more complex, there is an acknowledgement that the current limit of 25km entry into each other's country (and the associated interventions by firefighters and police²³) may be insufficient into the future.
- *Tactical Alignment:* Portugal's centralised approach to emergency response contrasts with Spain's regional focus and its stronger emphasis on prevention. Bridging this gap to ensure greater alignment in approach is crucial; creating opportunities for the development of joint firefighting protocols that build on the strengths of both approaches. This should include a stronger focus on defining roles and responsibilities across various scenarios; as well as the adoption of uniform approaches to mapping and data collation and analysis.
- *Funding:* There is a recognised need that funding sources will need to be diversified to address a potential over-reliance on INTERREG programmes.

4.4 Spatial Planning in Operationalising Wildfire Risk Management

As argued by Gonzalez-Mathiesen et al, "Spatial planning can contribute to operationalising wildfire risk reduction considerations in a territorial manner" (2021, 2). Given the growth in recognition of the impact of settlement characteristics, location and design on both the likelihood and consequences of wildfires, disaster policy in Australia, for example, recognises spatial planning as a critical player for reducing wildfire risk. It is recognised that spatial planning can play an "important role in operationalising disaster resilience by including wildfire risk considerations when directing settlement growth, use and design" (Gonzalez-Mathiesen et al, 2021, 2). Of course, this emphasis on future growth places a focus on future development rather than existing settlements. Nevertheless, it represents a "strengthening of a coordinated governance structure and cross-sector collaboration of spatial planning and DRR institutions interacting vertically, horizontally and functionally" (Gonzalez-Mathiesen et al, 2021, 2).

²³ The police are only authorised to enter each other's country up to 10km before a formal request is required.

The State of Victoria, located in south-east Australia, is home to large fire-prone areas where both settlement patterns have affected both the frequency and severity of wildfires. As noted by Gonzalez-Mathiesen et al,

The critical role that land-use planning could play in wildfire risk reduction, by designating fire-prone areas, was reinforced by research and inquiries following the Ash Wednesday wildfire that impacted Victoria in 1983. Following this, Australia's first National Inquiry into wildfires highlighted the inadequate attention given by the states to wildfire risk in land-use planning frameworks across Australia and recommended urgent action to address this (2021, 4-5).

From the late 1980s onwards, a set of guides and standards were developed which operationalised wildfire risk management into planning instruments in Victoria while, at a national level, the first construction standards for building in wildfire-prone areas were published in 1991. At the same time, wildfire considerations for spatial planning were being translated into local planning instruments; with plans incorporating wildfire regulations pertaining to water provision, site separation, access and building and site design. In 1997, the state of Victoria published the Wildfire Management Overlay, the first state-wide wildfire specific statutory planning tool as part of the overall restructuring of the planning system. Each council within the state was charged with adopting the Overlay into its planning scheme through mapping wildfire-prone areas. A further state-level review following the Black Saturday wildfire in 2009 resulted in further adjustments to the planning requirements for wildfire areas in 2011, resulting in “new institutional arrangements and instruments that integrate the work and decision-making processes of different sectors” (Gonzalez-Mathiesen et al, 2021, 8). Significant funding (AUD 750 million) was also made available to reduce wildfire risk from powerline ignition by investing in the upgrade of the electricity distribution network and regulating infrastructure management in high-risk areas (OECD, 2023).

While the integration of spatial planning and wildfire management policy is still evolving across Australia, it is clear that there is a need for policy integration in support of disaster risk reduction and BBB practices. It is also clear that there is a need to consider the “different and dynamic spatial and temporal dimensions when integrating wildfire management and spatial planning” (Gonzalez-Mathiesen et al, 2021, 8). There is also a growing recognition of the need to consider those areas not currently considered wildfire-prone but which, through climate change impacts, may become so in the future. Over the past thirty plus years, the role of spatial planning in wildfire management in Australia has been strengthened by the willingness and commitment to learn from experience and to learn from different disciplines, contexts and events. This, together with an ongoing commitment to adapt the planning system to “consider the temporal dimension of wildfire and their changing behaviour” (Gonzalez-Mathiesen et al, 2021, 8) are key take-aways for the island of Ireland.

4.5 Conclusion

Countries and regions traditionally considered low-risk for wildfires are increasingly finding themselves grappling with large-scale fires and extreme fire behaviour (European Parliament, 2023). While it has been hypothesised that the wildfire season on the island of Ireland will become longer and more intense, there is already evidence that this is happening. Patterns of wildfire are changing and their frequency is increasing. Future climate predications for the island of Ireland indicate that temperatures will continue to increase with summers becoming drier. In addition to climate change, future wildfires will be driven by unsustainable land practices, environmental degradation and human activity. Emissions from wildfires are creating a feedback loop, increasing the propensity for, and intensity of, wildfires. The resulting impacts of wildfires are complex and diverse – resulting in significant environmental, social and economic disruptions.

Healthy ecosystems are more resilient and less prone to wildfires. Building such ecosystems must be a priority across the island of Ireland – with actions including the protection and restoration of degraded forests, a move away from mono-forestry planting, the restoration and rewetting of peatlands, and the increased promotion and uptake of sustainable agricultural techniques and farming methods. Simultaneously, wildfires need to be tackled at their source by scaling up prevention action. This includes better monitoring and management of fuel loads, the integration of wildfire risk assessments into land-use decisions and the scaling-up of climate change adaptation measures (OECD, 2023). Resourcing and funding is critical – not only in detection and response, but also in building long-term resilience, nature preservation, and roll-out of prevention measures (European Parliament, 2023).

Land-use planning policies and standards need to adopt a stronger ‘fire lens’ to both policy design and adoption, and decision-making processes. Such standards are critical to protecting lives and economic assets (OECD, 2023), including critical infrastructure which, often due to their location in upland areas, are at heightened risk from wildfires.

A whole-of-government and whole-of-society approach to wildfire management is essential to enhance both preparedness and prevention. To this end, government departments, forestry and land management bodies, agricultural agencies, spatial planning bodies, local governments, meteorological services, civil protection units and private land owners all have a critical contribution to make – not only in coordination of activities and responses but also in knowledge exchange. While there are growing opportunities for professionals (e.g. emergency response agencies) to make more and sustained connections with local communities – tapping into the local knowledge base – this needs to happen in a more integrated, coordinated, and joined-up manner.

5 JOINING THE DOTS: STRATEGIC EMERGENCY MANAGEMENT & BUILDING BACK BETTER

5.1 Fostering Cross-Sectoral and Cross-Border Dialogue: An All-Island Expert Roundtable

On 13th November 2024, ICLRD together with Monaghan County Council hosted an online expert roundtable under the title *“Joining the Dots: From Emergency Management to Resilience and Adaptation”*. This half-day event brought together leading practitioners and academic experts from the fields of emergency planning, flood risk management, spatial planning and climate change adaptation, both North and South. Key speakers and panellists included the following:

- Eve Leonard, Office of Emergency Planning, Department of Defence;
- Dr. Stephen Flood, Climate Change Advisory Council;
- Derek Whelan, National Directorate for Emergency Management;
- Gary Quinn, Department for Infrastructure, NI;
- Dr. Andrew McClelland, University of Manchester;
- Dr. Darren Clarke, Dublin City University Centre for Climate and Society;
- Padraig Maguire, Meath County Council;
- Cathy Burns, Derry and Strabane District Council;
- Breda Maher, Eastern and Midlands Climate Action Regional Office (CARO);
- Joan McCaffrey, Local Resilience Team, Northern Ireland; and
- Robert Burns, Monaghan County Council.

The focus of the roundtable was on the strategic level and how the various sectors can better ‘speak to each other’ on an all-island basis, asking the question of whether and how post-incident recovery can provide an opportunity for building back better (BBB) at strategic and operational levels. It was noted that international and national policy frameworks call for integration of climate change adaptation and disaster risk reduction into emergency planning and vice versa, but that in some cases, the modalities for integration require further definition. Roundtable participants stressed the need for a proactive planning approach to adaptation in place of ad hoc reactive measures. Key aspects addressed included the need to expand the skills base for flood risk management from its traditional civil engineering focus to a wider range of technical and non-technical skillsets. More broadly, the discussion highlighted the challenges of combining the interpersonal dimension of community engagement recognised as key to fostering resilience with the equally necessary technical and expert-driven discussions required to support effective disaster risk reduction, progress climate adaptation and enhance resilience of both societal and technical systems.

Recent experience with flood events in particular across the island of Ireland, have demonstrated the value of a multi-stakeholder ‘whole-of-society’ approach in the recovery phase, but also some of the risks inherent in an over-reliance on local community organisations and in some cases, a small number of individuals.

Participants emphasised how key aspects of flood risk management, climate adaptation and disaster risk reduction (DRR) are integrated into everyday work of spatial and community planning at local authority level while recognising the need to do more, with respect to vulnerable groups and to protect small businesses. The long-term social, psychological and health impacts of flood (and other severe) events were stressed, with individual participants indicating that further research is required to know more about long-term impacts. The premise of BBB, that ‘building back’ is appropriate in all situations, was questioned. With respect to flood risk management, both inland and coastal, BBB must encompass difficult conversations around relocation and managed realignment. Whereas the risk of creating unnecessary anxiety about potential future events was acknowledged, participants agreed on the need to tackle complacency and to create greater public awareness of the risks associated with severe weather events.

The importance of building relations across the international border, at both formal and informal levels, was emphasised as key to effective and coherent cross-border response to emergency events. Speakers noted what has been achieved to date in this regard across the island of Ireland, while pointing to the need for greater alignment and coordination to move beyond existing silos at strategic, tactical and operational levels. It was evident that the roundtable discussion was the starting point for a longer conversation that will need to continue at a number of different levels, informing the development and operationalisation of BBB approaches to climate adaptation and DRR on the island of Ireland. The insights from the roundtable provided a strong foundation for this study, informing in particular the conclusions drawn in the subsequent sections of this chapter and the formulation of recommendations. The conclusions set out below are furthermore informed by the previous chapters of this report, including the examples of international good practice that have been drawn upon. The explicit emphasis on cross-sectoral coordination and integration, notwithstanding, this report also identifies the need for greater clarity with regard to sectoral responsibilities and resourcing.

5.2 Climate Change Policy and Strategic Emergency Management

Climate change mitigation and adaptation must be built into wider agendas for sustainable development and regeneration, recognising that the impacts of environmental change disproportionately affect the most vulnerable and disadvantaged. Efforts to reduce disaster risk, and at the same time, adapt to climate change impacts have thus become a priority at the highest levels internationally. Consequently, closer integration between emergency planning, DRR and climate change adaptation is required.

Mitigation and adaptation should not be considered independent strategies. They are both necessary steps to enhance resilience, and adaptation and mitigation measures can overlap, producing synergy effects. Mitigation measures, no matter where they are implemented, have global impacts. Adaptation, on the other hand, is specific to local contexts and circumstances and requires local, place-based approaches. Adaptation is critical to reducing the (additional) risks associated with an increased frequency and severity of extreme events attributed to climate change. In some cases, the benefits of green or grey adaptation measures may occur some distance away from the site of implementation (e.g. measures implemented upstream of an urban area to reduce flood risk along a watercourse). For this reason, careful planning and extensive community engagement are needed so that individuals or communities do not feel they are required to shoulder an unfair share of the adaptation burden.

The concept of BBB has been developed and promoted internationally as a strategic and holistic approach to recovery management whereby disasters are viewed as offering an opportunity for enhancing resilience and adaptation. Cross-sectoral dialogue, coordination and multi-stakeholder partnership are thus at the core of the BBB agenda. Reactive emergency response measures must be embedded within long-term pro-active frameworks with the aim of enhancing preparedness, resilience and adaptive capacity.

Enhanced coordination and multi-level dialogue are required to ensure all phases of emergency management are in a position to take greater account of local circumstances. While local circumstances, in accordance with the subsidiarity principle, need to be catered for through local coordination mechanisms, there is also a need for experience on the ground in responding to specific incidents to feed into national policy and processes at the level of strategic emergency management (SEM). Critical aspects here, may include, local perceptions of risk and levels of public awareness, preparedness and community engagement which may vary significantly from one regional context to another. Location-specific risk profiles are influenced by socio-economic and demographic as well as physical factors. These local or regional differences may substantially affect the level of assistance required from central government to ensure effective recovery. At the heart of a BBB approach is an appraisal of a range of alternative recovery options that may go beyond a 'return to normality'. BBB requires timely strategic reflection to identify the preferred option not just for building back, but for building back better. This capacity for strategic reflection is dependent on the parameters set at central government level (e.g. budgets, lead agencies, high level priorities), but must also directly involve local authorities and other actors with operational competences.

Post-incident reviews are critical to assess the risk of a repeat event at the same location. Reviews should include consideration of all relevant human and environmental risk factors, including the potential for climate change to increase the frequency and/or severity of a potential repeat event. Post-incident reviews and associated learning processes are

fundamental to ensuring that cycles of disaster-repair-disaster are replaced with adaptive, resilience-enhancing recovery following a BBB approach.

BBB requires dedicated financing. Careful consideration must be given to the development of criteria for the allocation of public funds to ensure both short-term and longer-term needs are given due consideration. Post-incident recovery funds should be responsive to the needs of public sector bodies and community organisations, as well as private households and businesses. High-level recognition that BBB may require a higher level of initial public investment than alternative recovery options with a short-term focus or more narrowly defined scope is required. BBB works towards ensuring higher resilience, adaptive capacity and enhanced public benefits within a longer-term perspective. Decisions on financing and funding allocation criteria should not be made on an *ad hoc* basis in the initial response phase. Rather, such financial planning considerations should be embedded within contingency planning for severe events. This is particularly important in reducing the risk of politically motivated reactive responses to public sentiments in the immediate aftermath of individual events. The concept of BBB furthermore explicitly recognises that disaster events commonly affect vulnerable and marginalised groups in society most severely. This applies both at the global scale and within regional and local contexts. The burden of recovery financing placed on individuals, private households and small businesses must remain affordable.

5.3 Spatial Planning and Land-use Management

It is increasingly evident that spatial planning plays a central role in DRR. As detailed in Chapters 2, 3 and 4, this is true for both flood risk and wildfire management. Spatial planning provides a framework to consider the potential impacts of proposed new developments (whether commercial, residential or public infrastructure and amenities) and changing land-uses within their wider local and regional contexts. Larger-scale developments provide an opportunity to ensure climate adaptation measures are built into the design from the outset. This can be a cost-effective approach for local planning authorities, replacing the need for public sector investment. It is essential, however, that adequate provision is made for long-term maintenance and inspection, and that on-site measures are coherent with off-site measures, whether on neighbouring properties or on public lands.

A catchment approach to flood risk management requires holistic consideration of the relationship between diverse existing and planned land-uses and water flows at the scale of a river catchment. In many cases, this requires close coordination across local authority boundaries, and in some cases necessitates cross-border cooperation. Within individual catchments, the role of low-intensity farmland located within river floodplains as floodwater retention areas should be given explicit consideration. Consultation and dialogue with individual landowners may be necessary to ensure that such areas are allowed to flood in the event of severe flood events. This is particularly relevant, where settlements or infrastructure with a high flood exposure are located downstream. Similarly, wildland fire risk management

requires landscape-scale assessments taking into account vegetation patterns, risks to properties and protected ecosystems. The accessibility of individual properties to the emergency services in the event of a fire, may also be an important consideration in comparatively remote locations.

Spatial planning furthermore has a key role in ensuring that the potential multiple benefits of both public and private spaces are realised. This is particularly relevant with respect to urban green spaces that can have an important drainage function in addition to their amenity value. Riverside wetlands (e.g. bog or marsh), whether in public or private ownership, are important for reducing flood risk to downstream settlements and, in many, cases, have high biodiversity value. In the island of Ireland context, characterised by dispersed low density development patterns, there is a need for close monitoring of the cumulative (rather than site-specific alone) impacts of one-off rural housing from both a flood risk and fire safety perspective. In the aftermath of severe incidents, spatial planning expertise needs to inform the recovery phase from the outset. This is particularly the case where reconstruction and/or relocation are considered as potential options.

In the aftermath of severe events, on-site reconstruction may be possible and desirable for some properties, whereas for others, relocation may be the only viable or most appropriate option. International experience shows that a myriad of individual and societal factors inform the decision to stay and rebuild or relocate. Where on-site reconstruction is possible, planning permission may not be required, whereas neighbours may face what are perceived to be stringent conditions attached to planning permission to rebuild off-site. These and similar issues can compound the psychological impact of a severe event. Consequently, a nuanced approach based on clear communication and extensive public engagement may be required. Where large-scale reconstruction or relocation are considered as potential options, the planning authority should prepare a local area plan (or equivalent) that takes explicit account of BBB measures aimed at reducing future risk and enhancing resilience.

5.4 Inland Flood Risk Management

In addition to the planning and land-use management measures detailed above, effective flood risk management is dependent on dedicated engineering works and green adaptation measures provided on a proactive basis by the relevant flood management authorities. These are the Office of Public Works (OPW) in Ireland and the Department for Infrastructure (DfI) in Northern Ireland. These measures must be embedded within long-term plans with sufficient funding provision to ensure their implementation (e.g. building on the Asset Management Plan approach in Northern Ireland). Consideration should be given to strengthening the legislative framework for flood risk management in both jurisdictions, providing needed additional clarity on central government funding commitments and the division of responsibility between the state, local authorities and private individuals. Transparent communication is key to ensuring all potentially affected parties are aware of the

risks at specific locations and the measures that are planned and committed to by the state to mitigate these risks. Flood prevention measures must be considered as part of the rebuilding process following a severe flood event. Infrastructural measures and/or appropriate green adaptation measures must be incorporated within the reconstruction planning process, with input from the relevant competent authorities.

The catchment-based approach to flood risk management in Northern Ireland (at a level below that of river basin districts) enhances the scope for consideration of spatial planning and land-use management issues in flood risk management at an appropriate spatial scale. There is scope for improved coherence and consistency with respect to flood risk management mapping at a cross-border level with the potential for more explicit consideration of transboundary catchments (e.g. the Foyle river catchment).

5.5 Wildfire Risk Management

There is an evident need for a more holistic approach to the management of wildfire risk with a shift in focus towards proactive risk reduction. Reducing fire risk requires context-sensitive landscape management and spatial planning perspectives, recognising the risks associated with different types of vegetation such as heathland, forestry and scrub. A shift from short-term monocultural forestry to mixed woodland, could, for example increase fire resilience and improve biodiversity. Without due attention to neighbouring land-uses and prevailing winds, the risks of spill-over from otherwise contained domestic fires may be underestimated. In low-density rural locations, access routes and times for fire and emergency services must be factored into decision-making at an early stage in the planning process. Further work is required to ensure greater public awareness of wildfire risk, taking into account an expected higher frequency of drier, warmer weather at certain times of the year as a result of climate change. As wildfire risk continues to rise, consideration must be given to the establishment of bi-lateral North/South collaboration at a strategic level to minimise formalities and ensure a speedy and effective response to emergencies while, to the mutual benefit of both jurisdictions, ensuring the best use of resources.

5.6 Recommendations

No.	Disaster Risk Reduction and Climate Change Adaptation – Strategic Level	Potential Key Stakeholders
1.	Ensure closer integration between emergency planning, DRR and climate change adaptation at the strategic level via an inter-jurisdictional island of Ireland approach , with particular reference to the relationship between the Office of Emergency Planning and the Executive Office.	Central Government ²⁴ , LAs, emergency services
2.	As argued by the European Committee of the Regions (2019), there is a recognised need for a more robust multi-level governance approach to achieve the objectives of the <i>Sendai Framework for Disaster Risk Reduction 2015-2030</i> . Consideration on the establishment of multi-disciplinary and cross-jurisdictional working groups involving key departments and representatives from agencies such as LGMA, AILG, NILGA, with an initial emphasis on joint and collaborative approaches to flood and wildfire risk management respectively.	Central Government, LA representative organisations.
3.	Cross-sectoral dialogue, coordination and multi-stakeholder partnership are thus at the core of the BBB agenda. Reactive emergency response measures must be embedded within long-term pro-active frameworks with the aim of enhancing preparedness, resilience and adaptive capacity.	Central Government, LAs, emergency services;
4.	Both climate change mitigation and adaptation are necessary to enhance resilience . Synergies can be found between mitigation and adaptation measures, but they are not inevitable. Adaptation measures are critical to reducing the risks associated with an increased frequency and severity of extreme events.	Central Government, LAs, emergency services
5.	Adaptation measures may lead to an actual or perceived unequal sharing of the ‘burden’ , where the benefits occur at some distance from the point of intervention. Careful planning and extensive community engagement is thus needed to ensure public support for individual measures. There is an opportunity to enhance community engagement in the design and roll-out of adaptation measures.	Central Government, LAs, emergency services
6.	Central government should develop guidance for wildland fire management within their strategic emergency management frameworks	Central Government, LAs, emergency services

²⁴ Note ‘central government’ refers to all government departments and their agencies, at national level in Ireland, and at regional level with respect to Northern Ireland.

	Disaster Risk Reduction and Climate Change Adaptation – Legislative and Funding	
7.	The legislative framework for flood risk and wildfire management in both jurisdictions should be strengthened, providing needed additional clarity on central government funding commitments and the division of responsibility between state agencies, local authorities and private individuals.	Central Government; emergency services
8.	The building regulations of both jurisdictions should be reviewed and updated to increase flood and fire resilience .	Central Government; emergency services
9.	Flood risk management requires dedicated long-term funding and a clear allocation of responsibilities and competences to ensure the required flood protection measures (typically a combination of grey, green and soft adaptation) at each potentially affected location are implemented within a timely manner.	Central government; public sector agencies
10.	There is an evident need for clearer direction on and funding support for, the maintenance of soft flood prevention measures . The current reliance on private developers to provide and maintain nature-based solutions (NbS) and schemes such as SUDS needs to be lessened with state agencies playing a stronger role. This may be require legislative change (see Recommendation 7 above).	Central government; planning authorities
	Disaster Risk Reduction and Climate Change Adaptation – Data and Communications	
11.	Greater commitment and investment is required at national level to the harmonisation of data gathering as it pertains to the pre- and post-conditions of flooding (inland and coastal) and wildfires at both spatial and temporal scales.	Central government; public sector agencies
12.	Greater transparency and clearer lines of communication are required to ensure that the public and local stakeholders have the knowledge necessary to make informed decisions. This pertains, in particular, to the planning and delivery of flood engineering works and NbS.	Central government; public sector agencies
13.	Digitalisation has a growing role to play in all phases of emergency management as demonstrated by Dublin Fire Brigade’s Digital Twins for Emergency Response (DTER) initiative, the potential use of drones and Maynooth University’s DecaMap. Consideration must be given to the role of these technologies as helpful decision-making tools for emergency personnel to strengthen the continuity of emergency management before, during, and following a disaster situation.	Central government

	Disaster Risk Reduction and Climate Change Adaptation – The Role of the Planning System	
14.	From a spatial planning perspective , there is a growing need to view the landscape through a ‘fire risk’ lens – similar to the approach currently being adopted around flood risk. Consideration will need to be given to how fire- and flood-resistant or vulnerable our landscapes are, and the implications of this for where we live, how we build, etc. This also has implications for the location of critical infrastructures such as electricity sub-stations, phone masts, radar stations – not only in terms of their geographical location but also the landscape in which they sit. Consideration should be given to the preparation of Guidelines for Planning Authorities on wildfire management.	Central government; local authorities
15.	At a more local level, there is a growing urgency in flooding and wildfire prevention becoming a priority in landscape planning . In the case of flooding, this requires a focus on green adaptive measures such as NbS, SUDS, etc. In the case of wildfire prevention, this includes introducing buffer zones, and taking into account relevant species selection and management practices to increase resistance and resilience in wildlands, forests and woodlands.	Central government; local authorities
16.	The role of spatial planners in post-incident recovery needs to be strengthened. Here a balance must be sought between short-term needs (return to normality) and longer-term objectives with the aim of achieving greater resilience and preventing a cycle of disaster-repair-disaster.	Central government; local authorities
	Disaster Risk Reduction and Climate Change Adaptation – Post-Incident Supports and Management Strategies	
17.	Strategic emergency management must take greater account of local circumstances . Post-incident reviews are critical to assess the risk of a repeat event at the same location. Reviews should include consideration of all relevant human and environmental risk factors, including the potential for climate change to increase the frequency and/or severity of a potential repeat event. Post-incident reviews and associated learning processes are fundamental to ensuring that cycles of disaster-repair-disaster are replaced with adaptive, resilience-enhancing recovery following a BBB approach.	Central government; local authorities
18.	The responsibility for the coordination and delivery of post-incident psychological supports must be clarified and the adequate resources put in place to ensure supports reach affected individuals and groups.	Central government; public sector agencies

19.	Policies on managed relocation based on international good practice need to be developed to ensure that decisions are not made on an ad-hoc basis in the case of an extreme event where relocation may be the most appropriate response.	Central government; local authorities
20.	Effective wildland fire management can not only reduce combustion risks but also contribute to the improvement and conservation of ecosystems. With the majority of large scale wildfires in Ireland happening on public lands and in national parks, there is a growing onus on agencies such as Coillte and the National Parks and Wildfire Service (NPWS) to develop fuel management strategies for their lands on a multi-annual basis. Other stakeholders/partners to this process include local fire services, local authorities and relevant government departments such as DAFM (Ireland) and DAERA (Northern Ireland).	Central government; public sector agencies

APPENDIX A: LISTING OF CONSULTED AGENCIES

As part of this study, and associated primary research, the following agencies were consulted:

- Armagh City, Banbridge and Craigavon Borough Council
- Belfast City Council
- Climate Change Advisory Council
- Climate NI
- Coillte
- Cork City Council
- Cross Border Emergency Management Group
- Department of Agriculture, Environment and Rural Affairs (NI)
- Department of Agriculture, Food and the Marine (IE)
- Department for Infrastructure (NI)
- Derry City and Strabane District Council
- Donegal County Council
- Dublin City University
- Eastern and Midlands Climate Action Regional Office
- Fermanagh and Omagh District Council
- Health Service Executive
- Louth County Council
- MaREI Centre
- Meath County Council
- Met Éireann
- Mid and East Antrim Borough Council
- Monaghan County Council
- National Directorate for Fire and Emergency Management, Department of Housing, Local Government and Heritage
- Newry Mourne and Down District Council
- North South Ministerial Council
- Sligo County Council
- University of Manchester

APPENDIX B: THE ICLRD RESEARCH TEAM

Dr. Cormac Walsh

Cormac is a senior research associate with the International Centre for Local and Regional Development (ICLRD) and principal investigator on this project. He is an independent researcher and consultant, based in Hamburg, Germany (<https://cormacwalsh-consult.eu/>) and is also employed as a researcher at the University of Oldenburg Germany, working on environmental governance topics. He received his PhD from the School of Geography, Planning and Environmental Policy, University College Dublin in 2010 and has since then gained expertise on a range of issues in both an academic and applied research capacity, including environmental risk management, climate adaptation, marine spatial planning, coastal management and transboundary cooperation.

Ms. Caroline Creamer

Caroline is Director of the International Centre for Local and Regional Development (ICLRD) and a Research Fellow with the Social Sciences Institute (MUSSI) and the Innovation Value Institute (IVI) at Maynooth University. She is Facilitator of the All-Ireland Smart Cities Forum and ESPON Contact Point for Ireland. She has worked in a research and management capacity on a number of funded projects and action research programmes - at various scales - for over 25 years. She has been actively involved in the co-design and delivery of capacity building training with councils, and in the creation of learning networks for different sectoral interests. A qualified town planner, Caroline's research interests include spatial planning practice and policy, leadership in placemaking and place shaping, regional and local development and regeneration, collaborative and participative decision-making and inter-territorial and cross-border development.

Dr. Gavan Rafferty

Gavan is a Lecturer in Spatial Planning and Development and Course Director of the BSc/MSci Planning, Regeneration and Development programme at Ulster University. Gavan's research spans cross-border spatial planning, the relationship between spatial planning and community planning (public service delivery), healthy urban planning and inclusive engagement in planning. Recent research projects include Belfast THRI[VES], with Belfast City Council, examining the relationship between public spaces and liveability, and InPLACE: Investigating Place, Planning and Commuting, examining how potential work trends (pre- and post-COVID) impact settlements and their communities across the island of Ireland. Gavan is a member of the Association of European Schools of Planning (AESOP), Fellow of the Higher Education Academy, chartered member of the Royal Town Planning Institute (RTPI), past chair of the RTPI Northern Ireland Executive Committee, and is a NILGA Facilitator and Assessor for their Elected Member training programmes.

Dr. Tadhg MacIntyre

Tadhg is an environmental psychologist leading Ireland's first postgraduate programme in Environmental Psychology at Maynooth University where he is affiliated with the Innovation Value Institute. In 2019, he co-edited *Physical Activity in Natural Settings* (Routledge) and more recently was co-editor of the Routledge Handbook on Mental Health in Elite Sport. He is a visiting Professor at the Inland University of Applied Sciences in Norway. Currently, he coordinates GoGreenRoutes a €10.5m four-year Horizon project on urban health which targets six European cities and has global outreach with its 40 partners (2020-2024) and GoGreen Next (2024-2028), a Horizon Europe project on climate change impacts on urban health.

APPENDIX C: ADDITIONAL PROTOCOL OF VALLADOLID

The Additional Protocol between the Kingdom of Spain and the Portuguese Republic on Mutual Assistance in Border Areas, done at Valladolid on 21 November 2018, adopted under the terms of Article 8 of the Protocol on Technical Cooperation and Mutual Assistance in the Field of Civil Protection, done at Évora on 9 March 1992, has two key objectives:

- To increase the border action zone from 15 to 25 km respectively; and
- To extend the modalities for the implementation of mutual assistance operations in forest fires to other cross-border risks in that area, recognising the need for more flexible procedures than those generally established which should allow for rapid intervention and mutual assistance when the urgency of the situation makes it advisable.

This additional protocol takes account of the importance for both States of emergency management in the border area between Spain and Portugal while also giving due consideration to Decision 1313/2013/EU of the European Parliament and of the Council of the European Union of 17 December 2013 on an EU Civil Protection Mechanism.

Article 5 of the Additional Protocol of Valladolid sets out the rationale and criteria for extending the border areas of special consideration to twenty-five kilometres on both sides of the common border.

A transcript of Article 5 is as follows:

Article 5 Special procedure for the initial attack on forest fires less than twenty-five kilometres from the border.

The special procedure for the initial attack on forest fires less than twenty-five kilometres from the border shall apply in accordance with the following criteria:

- a) In cases of urgent need as provided for in Article 3.1, when a fire is first detected by a competent authority in a neighbouring country, and provided that it is less than twenty-five kilometres from the border and there is a high probability that the fire will spread from one country to another in a short period of time, that authority may decide to deploy its country's firefighting services to contain it, with no requirements other than prior notification to the competent authority of the country where the fire originated, so that the latter is aware of the situation and can arrange for firefighting operations to begin from its own country.
- b) Such intervention shall be conditional, in all cases, on the availability of resources in the country providing the assistance.

- c) These competent authorities shall immediately inform, in Portugal, the National Civil Protection Authority, and in Spain, the Directorate-General for Civil Protection and Emergencies and, if it has not already done so, the Directorate-General for Rural Development, Innovation and Forestry Policy. As intervention in these circumstances is not in response to a request, it shall not be necessary to use the forms referred to in Article 4.1 of this Protocol, unless it is necessary to extend the intervention of the assistance resources beyond the initial attack on the fire.

The full text of the Additional Protocol of Valladolid can be downloaded at:
<https://www.boe.es/boe/dias/2019/09/10/pdfs/BOE-A-2019-12928.pdf>

REFERENCES

- Arango, E., Jiménez, P., Nogal, M., Sousa, H.S., Stewart, M.G., and Matos, J.C. (2024a) Enhancing infrastructure resilience in wildfire management to face extreme events: Insights from the Iberian Peninsula, *Climate Risk Management*, 44, 100595.
- Arango, E., Nogal, M., and Jiménez, P. (2024b) *Strengthening Infrastructure Resilience in Cross-Border Wildfire Management*, Climate Action Festival 2024, TU Delft.
- Barbero, R., Abatzoglou, J.T., Larkin, N.K., Kolden, C.A. & Stocks, B. (2015) Climate change presents increased potential for very large fires in the contiguous United States, *International Journal of Wildland Fire*, Vol. 24, pp.892-899.
- BBC News (2025) *EU sends wildfire help to Spain as death toll rises*, 14 August 2025, Authors: Asya Robins, <https://www.bbc.com/news/articles/ckg4k7ppmnko>
- BBC News (2025) *Wildfires are Rural Arson, says Minister*, 7 April 2025, Authors; Hayley Halpin & Russ McKee, <https://www.bbc.com/news/articles/c2kv5y354edo>
- BBC New (2017) *Northern Ireland floods: More than 100 people rescued*, <https://www.bbc.co.uk/news/uk-northern-ireland-41019610>
- Birkmann J., Schüttrumpf, H., Handmer, J. et al. (2023) Strengthening resilience in reconstruction after extreme events – Insights from flood affected communities in Germany, *International Journal of Disaster Risk Reduction*, 96, 103965, <https://doi.org/10.1016/j.ijdrr.2023.103965>
- Brongersma, R. (2021) *Stakeholder Engagement and the Development of Wildfire Management Plans: Trends identified on the border between Northern Ireland and the Republic of Ireland*, Barcelona: Pau Costa Foundation.
- Canaleta, G., Ballart, H., & Prat-Guitart, N. (2021) *Wildfire Management for Sliabh Beagh SAC, Eshbrack Bog NHA, Sliabh Beagh SPA and Slieve Beagh-Mullaghfad-Lisnaskea SPA, Final Report*. Barcelona: Pau Costa Foundation.
- Carroll, M.S., Edgeley, C. M. & Nugent, C. (2021) Traditional use of field burning in Ireland: history, culture and contemporary practice in the uplands, *International Journal of Wildland Fire*, Vol. 30, pp.399-409.
- Clayton, S. (2024) A social psychology of climate change: progress and promise, *British Journal of Social Psychology*, 63, 1535–1546, <https://doi.org/10.1111/bjso.12749>
- Davoudi, S., Brooks, E. & Mehmood, A. (2013) Evolutionary Resilience and Strategies for Climate Adaptation, *Planning Practice and Research*, 28 (3), 307-322.
- Department of Agriculture, Environment and Rural Affairs (2022) *Rural Policy Framework for Northern Ireland*, Belfast: DAERA.
- Department of Agriculture, Environment and Rural Affairs (2019) *Northern Ireland Climate Change Adaptation Programme 2019-2024*, <https://www.daera->

ni.gov.uk/sites/default/files/publications/daera/Northern%20Ireland%20Climate%20Change%20Adaptation%20Programme%202019-2024%20Final-Laid.PDF.

Department of Agriculture and Rural Development (2015) *Neagh Bann Flood Risk Management Plan*, Belfast: Rivers Agency.

Department of Defence (2020) *Strategic Emergency Management: Guideline 4 – Climate Change Adaptation*, see <https://assets.gov.ie/static/documents/strategic-emergency-management-guideline-4-climate-change-adaptation.pdf>

Department of Defence (2017) *Strategic Emergency Management National Structures and Framework*, see <https://assets.gov.ie/static/documents/strategic-emergency-management-national-structures-and-framework-0df8d74f-9a27-49a6-9b.pdf>

Department of Environment (2015) *Strategic Planning Policy Statement*, Belfast: DoE.

DEHLG & OPW – Department of Environment Heritage and Local Government and Office of Public Works (2009) *The Planning System and Flood Risk Management: Guidelines for Planning Authorities*, <https://www.opw.ie/wp-content/uploads/2019/08/2009-Planning-System-Flood-Risk-Mgmt-1.pdf>.

Department of Infrastructure (2025) *Northern Ireland Flood Risk Assessment (NIFRA) 2018 ArcGIS Online Maps*, <https://dfi-ni.maps.arcgis.com/apps/webappviewer/index.html?id=40fd71604e5747408fd2b8bca1486f6d>

Department of Infrastructure (2024) *Review of South-East Flood, Autumn 2023*, Belfast: Northern Ireland Executive. <https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/review-of-south-east-flooding-report-1aug24.pdf>

Department of Infrastructure (2021) *Second Cycle: Northern Ireland Flood Risk Management Plan 2021-2027*, <https://www.infrastructure-ni.gov.uk/publications/second-cycle-northern-ireland-flood-risk-management-plan-2021-2027>.

Department of Infrastructure (2018) *North-West Flooding Review: Report on Flooding in the North-West – 22nd and 23rd August 2017*.

Department for Regional Development (2012) *Regional Development Strategy (RDS) 2035 – Building a Better Future*, Belfast: DRD.

Derry City and Strabane District Council (2025) *Local Development Plan 2032 – Plan Strategy*, <https://www.derrystrabane.com/subsites/ldp/ldp-plan-strategy-%E2%80%93-adopted-2025>

Dombrowsky, W.R. (2022) *Learning from the catastrophe in the German Ahr Valley, Development and Cooperation*, <https://www.dandc.eu/en/article/flooding-july-2021-could-have-been-less-disastrous-if-authorities-had-learned-past-and>.

Donegal County Council (DCC) (2024) *County Donegal Development Plan 2024-2030*, <https://www.donegaldevplan.ie/>

Duane, A., Castellnou, M., and Brotons, L. (2021) Towards a comprehensive look at global drivers of novel extreme wildfire events, *Climatic Change*, 165: 43, pp.1-21.

Emergency Services Ireland (2025) *Wicklow Mountain Exercise Tests Response to Large Wildfires*, 29 March 2025, Accessed 8 May 2025. <https://www.emergency-services.ie/wicklow-mountain-exercise-tests-response-to-large-wildfires/>

European Commission (2024) *Strengthening the Resilience of EU Border Regions: Mapping Risks and Crisis Management Tools and Identifying Gaps*, Luxembourg: Publications Office of the European Union.

European Commission (2022) *Pan-European Wildfire Risk Assessment*, JRC Technical Report, Luxembourg: Publications Office of the European Union.

European Commission (2021) *Land-Based Wildfire Prevention: Principles and experiences on managing landscapes, forests and woodlands for safety and resilience in Europe*, Luxembourg: Publications Office of the European Union.

European Committee of the Regions (2019) *Cross-Border Dimension in Disaster Risk Reduction (DRR)*, Opinion, 135th Plenary Session, 26-27 June 2019, NAT-VI/036.

European Environment Agency (2024) *Extreme weather: floods, droughts and heatwaves*. <https://www.eea.europa.eu/en/topics/in-depth/extreme-weather-floods-droughts-and-heatwaves?activeTab=fa515f0c-9ab0-493c-b4cd-58a32dfaae0a>

European Parliament (2023) *Forest Fires of Summer 2022: Lessons to Draw from the Cohesion Policy Response*, Brussels: DG Regio

Felgentreff, C., Kuhlicke, C., Westholt, F. (2012) Naturereignisse und Sozialkatastrophen, *Schriftenreihe Sicherheit Nr. 8.*, Forschungsforum Öffentliche Sicherheit, Freie Universität Berlin, https://www.sicherheit-forschung.de/forschungsforum/schriftenreihe_neu/8/index.html.

Fernandez-Anez, N., Krasovskiy, A., Muller, M., Vacik, H., Baetens, J., Hukic, E., et al, (2021), Current wildland Fire Patterns and Challenges in Europe: A Synthesis of National Perspectives, *Air Soil and Water Research*, Vol. 14, pp.1-19.

Fernández-García, V., Beltrán-Marcos, D. & Calvo, L. (2023) Building patterns and fuel features drive wildfire severity in wildland-urban interfaces in Southern Europe, *Landscape and Urban Planning*, Vol. 231, 1-11.

Fothergill, L.J., Disney, A.S., Wilson, E.E. (2021) A qualitative exploration of the psychological impacts of living with the uncertainty of persistent flood risk, *Public Health*, 198, 141-145. <https://doi.org/10.1016/j.puhe.2021.07.016>.

Foudi, S., Osws-Eraso, N., Galarraga, I., (2017) The effect of flooding on mental health: Lessons learned for building resilience, *Water Resources Research*, 53 (7), 5831-5844, <https://doi.org/10.1002/2017WR020435>.

Gleeson, E., McGrath, R. & Treanor, M. (2013) *Ireland's Climate – The Road Ahead*, Dublin: Met Éireann.

Gonzalez-Martiesen, C., Ruane, S. & March, A. (2021) Integrating wildfire risk management and spatial planning – A historical review of two Australian planning systems, *International Journal of Disaster Risk Reduction*, 53, 1-9.

- Government of Ireland (2025a) *Climate Action Plan 2025*, Dublin: The Stationery Office.
- Government of Ireland (2025b) *National Planning Framework, First Revision*, Dublin: The Stationery Office.
- Government of Ireland (2024a) *Climate Action Plan 2024*, <https://assets.gov.ie/static/documents/climate-action-plan-2024-8ccbde73-e288-4241-8b26-6b4922389f25.pdf>.
- Government of Ireland (2024b) *National Adaptation Framework: Planning for a Climate Resilient Ireland*, <https://assets.gov.ie/static/documents/national-adaptation-framework-2024-0fa761a3-84e5-4bcf-ac40-0f91f6431ae8.pdf>.
- Government of Ireland (2021) *Climate Action and Low Carbon Development (Amendment) Act, 2021*, no. 32, https://www.irishstatutebook.ie/eli/2021/act/32/enacted/en/html?q=Climate+Action+and+Low+Carbon&search_type=all.
- Government of Ireland (2021) *Our Rural Future, Rural Development Policy 2021-2025*, Dublin: The Stationery Office.
- Government of Ireland (2015) *Climate Action and Low Carbon Development Act, 2015*, no. 46, <https://www.irishstatutebook.ie/eli/2015/act/46/enacted/en/html>.
- Government of Ireland (2006) *A Framework for Major Emergency Management*, <https://assets.gov.ie/static/documents/a-framework-for-major-emergency-management.pdf>.
- Hawthorne, D. and Mitchell, F.J. (2018) Investigating patterns of wildfire in Ireland and their correlation with regional and global trends in fire history, *Quaternary International*, 488, pp.58-66.
- Howarth, C., Zamzow, H., McLoughlin, N. & Shreedhar, G. (2025) Gaps in public perceptions of extreme heat highlight UK's lack of preparedness, *Environmental Science and Policy*, 170, <https://doi.org/10.1016/j.envsci.2025.104101>
- ICLRD (2024) *Advancing a Focused Cross-Border Approach to Public Service Messaging in Emergency Management*, International Centre for Local and Regional Development (ICLRD), <https://monaghan.ie/advancing-a-focused-cross-border-approach-to-public-service-messaging-in-emergency-management/>.
- IPCC (Intergovernmental Panel on Climate Change) (2018) *Special Report: Global Warming of 1.5°C*. Available online: <https://www.ipcc.ch/sr15>
- Irish Independent (2025) *Multi-agency Wicklow Wildfire Exercise will assess Ireland's Preparedness for Large Forest Fires*, 25 March 2025, Author: Eoin Mac Raghnaill, <https://www.independent.ie/regionals/wicklow/wicklow-district/multi-agency-wicklow-wildfire-exercise-will-assess-irelands-preparedness-for-large-forest-fires/a49674355.html>
- Joyce, F. and McCaffrey, J. (2015) Emergency management on the island of Ireland – Recent Cross-border developments, *Administration*, 63, (3), 41-64.

- Lauta, K. C., Albris, K., Zuccaro, G., & Grandjean, G. (2018). *ESPREsSO Enhancing Risk Management Capabilities Guidelines*. European Union.
- Lawrence, J. (2016) Implications of Climate Change for New Zealand's Natural Hazards Risk Management. *Policy Quarterly*, 12(3). <https://doi.org/10.26686/pq.v12i3.4605>
- Mayr, B., Thaler, T., Hübl, J. (2020) Successful Small-Scale Household Relocation after a Millennial Flood Event in Simbach, Germany 2016, *Water*, 12 (1), 156.
- McNulty, C. (2017) Inishowen Flooding: Miracle Escapes on a Peninsula Devastated, *Donegal Daily*, https://www.donegaldaily.com/2017/08/24/inishowen-flooding-miracle-escapes-on-a-peninsula-devastated/?utm_source=chatgpt.com
- Medway, P., Flood, S. Cubie, D. & Le Tissier, M., (2021) Enhancing Integration of Disaster Risk and Climate Change Adaptation into Irish Emergency Planning, in Flood, S. Jerez Columbie, Y., Le Tissier, M., & O' Dwyer, B., (eds) *Creating Resilient Futures: Integrating Disaster Risk Reduction, Sustainable Development Goals and Climate Change Adaptation Agendas*, Palgrave Macmillan, Springer Link, 83-128.
- Monaghan County Council (2022) *Wildland Fire Plan Eshbrack Bog NHA and Sliabh Beagh SPA 2022-2025*, Monaghan: Monaghan County Council Fire and Civil Protection Services.
- NMDDC - Newry, Mourne and Down District Council (2025) *Local Development Plan 2035 - Draft Plan Strategy*, <https://www.newrymournedown.org/draft-plan-strategy>
- Northern Ireland Environment Agency (2025) *Wildfires in Northern Ireland – Draft Strategic Way Forward Consultation Report*, July 2025, Belfast: Department of Agriculture, Environment and Rural Affairs
- Northern Ireland Environment Agency (2023) *Wildfires in Northern Ireland – Draft Strategic Way Forward*, Belfast: Department of Agriculture, Environment and Rural Affairs
- Northern Ireland Executive (2022) *O'Dowd visits North-West communities affected by floods*, Press Release 26 July 2022. <https://www.northernireland.gov.uk/news/odowd-visits-north-west-communities-affected-floods>
- Nugent, C. (2015) Stamping out fires saves more than just money, Department of Agriculture F.a.t.M (Eds). *Wildfire Management*, Forest Service.
- O'Dwyer, B., Hashemi, M. and Gault, J., (2018) *The Development of an Irish Climate Information Platform (ICIP) – Phase 3 (2015–2017)*. EPA Report 258. Environmental Protection Agency, Johnstown Castle, Ireland.
- OECD – Organisation for Economic Co-operation and Development (2023) *Taming Wildfires in the Context of Climate Change*, Paris: OECD Publishing.
- OPW – Office of Public Works (2019) *Flood Risk Management: Climate Change Sectoral Adaptation Plan – Prepared under the National Adaptation Framework*, <https://assets.gov.ie/static/documents/climate-change-sectoral-adaptation-plan-41821a92-b67e-4e22-bafa-6bf3b078aed0.pdf>.

OPW- Office of Public Works (2018) *Flood Risk Management Plan: Neagh Bann*, <https://www.floodinfo.ie/publications/?t=22&a=643>.

OPW – Office of Public Works (2004) *Report of the Flood Policy Review Group*, <https://assets.gov.ie/static/documents/report-of-the-flood-policy-review-group-2004.pdf>.

Paterson, S.K. & Guida, K. (2022) Bridging Gaps: Connecting Climate Change Risk Assessments with Disaster Risk Reduction and Climate Change Adaptation Agendas, in Flood, S. Jerez Columbie, Y., Le Tissier, M., & O' Dwyer, B., (eds) *Creating Resilient Futures: Integrating Disaster Risk Reduction, Sustainable Development Goals and Climate Change Adaptation Agendas*, Palgrave Macmillan, Springer Link, 65-82.

Puettman, K.J. (2021) Extreme Events: Managing Forests When Expecting the Unexpected, *Journal of Forestry*, 2021, 422–431, https://www.cof.orst.edu/cof/fs/kpuettmann/Puettmann2021_JoF.pdf

Roggenkamp, T., Herget, J. & Roggenkamp, T. (2024) Flood reconstruction, - The unexpected rather frequent event at River Ahr in July 2021, *Global and Planetary Change*, 240, 104541.

RTE (2025) *Simulation in Wicklow to assess Irish ability to deal with large wildfires*, 26 March 2025, Author: Samantha Libreri, <https://www.rte.ie/news/2025/0326/1504011-forest-fire-exercise/>

Schoennagel, T., Balch, J.K., Brenkert-Smith, H., Dennison, P.E., Harvey, B.J., Krawchuk, M.A., Mietkiewicz, N., Morgan, P., Moritz, M.A., Rasker, R., Turner, M.G., & Whitlock, C. (2017) Adapt to more wildfire in western North American forests as climate changes, *Perspective*, Vol. 114, No. 18, May 2017, pp.4582-4590.

Scott, M., Burns, L., Lennon, M., Kinnane, O. (2022) *Built Environment, Climate Resilience and Adaptation*, EPA Research Report No. 418, Dublin: EPA.

Seebauer, S. & Winkler, C. (2020) Should I stay or should I go? Factors in household decisions for or against relocation from a flood risk area, *Global Environmental Change*, 60, 102018.

Silva, A. F. R., Eleutério, J. C., Apel, H., and Kreibich, H. (2025) Assessing the impact of early warning and evacuation on human losses during the 2021 Ahr Valley flood in Germany using agent-based modelling, *Nat. Hazards Earth Syst. Sci.*, 25, 1501–1520, <https://doi.org/10.5194/nhess-25-1501-2025>,

Soldi, R. (2016) *Implementation of the Sendai Framework at the EU level: the take-up of resilience measures by Local and Regional Authorities*, European Union Committee of the Regions, <https://cor.europa.eu/en/engage/studies/Documents/Implementation%20of%20the%20Sendai%20Framework%20at%20the%20EU%20level.pdf>

Thaler, A., Doorn, N. & Hartmann, T. (2020a) Justice of compensation for spatial flood risk management – comparing the flexible Austrian and the structured Dutch approach, *Die Erde*, 151, (2-3), 104-115.

Thaler, A., Seebauer, S. & Schindelegger, A. (2020b) Patience, persistence and pre-signals: Policy dynamics of planned relocation in Austria, *Global Environmental Change*, 63, 102122.

The Executive Office (NI) (2023) *Building Resilience Together - NI Civil Contingencies Framework* - updated December 2023, <https://www.executiveoffice->

ni.gov.uk/sites/default/files/publications/ofmdfm_dev/The%20Northern%20Ireland%20Civil%20Contingencies%20Framework%20%28Revised%202023%29.pdf.

The Irish Times (2024a) Forestry: The strong case for moving away from monoculture, 18 January 2024, Author: Pádraic Fogarty, <https://www.irishtimes.com/environment/climate-crisis/2024/01/18/forestry-the-strong-case-for-moving-away-from-monoculture/>

The Irish Times (2024b) *Ireland's 'flammable landscape' must be managed to avoid increased wildfire risk, expert says*, 17 April 2024, Author: Anne Lucy, <https://www.irishtimes.com/ireland/2024/04/17/irelands-flammable-landscape-must-be-managed-to-avoid-increased-wildfire-risk-expert-says/>.

Tietzei, N., Gerhold, L. & Ibisch, P.L. (2023) Policy narratives in forest fire management, *Environmental Research Letters*, 18, November 2023

Tobin, G.A. and Montz, B.E. (1997) *Natural hazards: explanation and integration*. Guilford Press, New York, London.

Tradowsky, J.S., Philip, S.Y., Kreienkamp, F. et al. (2023) Attribution of the heavy rainfall events leading to severe flooding in Western Europe during July 2021. *Climatic Change* 176, 90, <https://doi.org/10.1007/s10584-023-03502-7>

Tubridy, F. and Lennon, M. (2021) Flood risk management, (un)managed retreat and the “relocation fix”: examining shifting responsibilities and compounding risks through two Irish case studies, *Local Environment: The International Journal of Justice and Sustainability*, 26 (4), 517-533.

Tubridy, F., Scott, M., & Lennon, M., (2021). Managed retreat in response to flooding: lessons from the past for contemporary climate change adaptation. *Planning Perspectives*, 1–20.

United Nations Office for Disaster Risk Reduction (UNDRR) (2017) *The Sendai Framework Terminology on Disaster Risk Reduction. "Build back better"*. Available online at: <https://www.undrr.org/terminology/build-back-better>.

UNDRR (United Nations Office for Disaster Risk Reduction) (2015) *Sendai Framework for Disaster Risk Reduction*. Available online: <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

UK Government (2022) *Climate Change Act (Northern Ireland)*. Available online: <https://www.legislation.gov.uk/nia/2022/31/contents/enacted>.

Walsh, C., Lennon, M., Scott, M., & Tubridy, F. (2023) Spatial imaginaries in flood risk management: insights from a managed retreat initiative in upper Bavaria. *Journal of Environmental Planning and Management*, 66 (13), 2668-2690.

White, B.K., Ishizumi, A., Lavery, L., Wright, A., Foley, T., O'Neill, R., Rambaud, K., Sreenath, R.S., Salvi, C., Takahashi, R., D'Agostino, M., Nguyen, T., Briand, S. and Purnat, T.D. (2024) Expressions of pandemic fatigue on digital platforms: a thematic analysis of sentiment and narratives for infodemic insights, *BMC Public Health*, ;24 (1), 705. doi: 10.1186/s12889-024-17718-4. PMID: 38443914

Williams, S.N., Armitage, C.J., Tampe, T., and Dienes, K.A. (2021) Public perceptions of nonadherence to pandemic protection measures by self and others: A study of COVID-19 in the United Kingdom. *PLoS ONE* 16 (10), <https://doi.org/10.1371/journal.pone.0258781>.

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