



Strengthening the resilience of EU border regions

Mapping risks & crisis management tools and identifying gaps

Case Studies

Written by Technopolis Group, CMCC, and Nordregio
March – 2024

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group 



Nordregio

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E-mail: REGIO-D2-CROSS-BORDER-COOPERATION@ec.europa.eu

*European Commission
B-1049 Brussels*

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Abbreviations

Abbreviation	Description
AGIF	Agência para a Gestão Integrada de Fogos Rurais (Agency for Integrated Rural Fire Management)
ANEPC	Autoridade Nacional de Emergência e Proteção Civil (National Emergency and Civil Protection Authority)
ARMONIA	Real-time accelerometric monitoring network of sites and buildings in Italy and Austria (INTERREG project)
ARSO	Slovenian seismological network of the Office of Seismology of the Environment Agency of the Republic of Slovenia
BORIS	Cross-border risk assessment for increased prevention and preparedness in Europe (UCPM project)
CBC	Cross-border cooperation
CCINIF	Centro de Coordinación de la Información Nacional sobre Incendios Forestales (National Forest Fire Information Coordination Centre)
CE3RN	Central and East European Earthquake Research Network
CENEM	Centro Nacional de Seguimiento y Coordinación de Emergencias (National Centre for Emergencies)
CG	Czech Globe
CHL	Chlorophyll content
CHMU	Czech Hydro-Meteorological Institute
ChyM	Cetemps Hydrological Model
CI3R	Italian Centre on Research on Risk Reduction
CJSU	County Committee for Emergency Situations (Romania)
CLIF	Comité de Lucha contra Incendios Forestales (National Forest Fire Fighting Committee)
CROSSIT SAFER	Cross-border cooperation between Slovenia and Italy for a safer region (INTERREG project)
CTS	Commission technique de surveillance
CZ	Czech Republic
DanubeHIS	Danube Hydrological Information System
DES	Department of Emergency Situations (Romania)
DFFWS	Danube Flood Forecasting and Warning System
DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations

Abbreviation	Description
DGPCE	Dirección General de Protección Civil y Emergencias (Directorate-General for Civil Protection and Emergencies)
DM WG	Disaster Management Working Group
DNK	Directorate for Emergency Communication
DREAL	Regional Directorate for Environment, Planning and Housing
DRM	Disaster Risk Management
DRMKC	Disaster Risk Management Knowledge Center
DRPC	The Danube River Protection Convention
DSB	Direktoratet for samfunnssikkerhet og beredskap
DSS	Decision support system
DST	Italian Department of Earth Sciences of the University of Trieste.
DUS	Drought user service
EBA	European Burns Association
EDF	Electricity of France
EEA	European Economic Area
EFAS	European Flood Awareness System
EFFIS	European Forest Fire Information System
EGTC	European Grouping of Territorial Cooperation
EMRIC	EUregio Meuse-Rhine Incident Response and Crisis Management
ENEL	Ente Nazionale per l'Energia Elettrica
ENI	European Neighbourhood Instrument
ENLETS	European Network of Law Enforcement Technology Services)
ERCC	Emergency Response Coordination Centre
ERDF	European Regional Development Fund
EUMETNET	European Network of National Meteorological Services
EUSDR	EU Strategy for the Danube Region
EUSDR PA5	EU Strategy for the Danube Region Priority Area 5
EWRS	European Warning and Response System
FAST	Forest Fire-fighting Assessment and Advisory team
GGD	Gemeentelijke Gezondheidsdienst (Municipal Health Service)

Abbreviation	Description
GIES	General Inspectorate for Emergency Situations (Romania)
GIS	Geographic Information System
GWIS	Global Wildfire Information System
ha	Hectare
HAREIA	Historical And Recent Earthquakes in Italy and Austria (INTERREG project).
HERA	Health Emergency Preparedness and Response Authority
HNS	Host Nation Support
ICNF	Instituto da Conservação da Natureza e das Florestas (Institute for Nature and Forest Conservation)
ICPDR	The International Commission for the Protection of the Danube River
IKIC	International Knowledge and Information Centre
INGV	National Institute of Geophysics and Volcanology
INPI	Instituto Nacional da Propriedade Industrial (Portuguese Institute of Industrial Property)
IPA	Instrument for Pre-Accession Assistance
ISF	Internal Security Fund
ISI	Information Security Infrastructure)
JRC	Joint Research Centre
KPI	Key Performance Indicator
LCMS	Landelijk Crisismanagement Systeem (National Crisis Management System)
LP	Lead Partner
MBCI	Mass Burn Casualty Incident
MENDELU	Mendeleev University in Brno
MoIA	Ministry of Internal Affairs (Romania)
MoU	Memorandum of Understanding
MSB	Swedish Civil Contingencies Agency
MSB	The Swedish Civil Contingencies Agency (Myndigheten för samhällsskydd och beredskap)
NCMC	National Crisis Management Centre (Bulgaria)
NDGDM	National Directorate General for Disaster Management (Hungary)
NGO	Non-governmental organisation

Abbreviation	Description
Nordhel	Nordic public health preparedness agreement
OEPM	Oficina Española de Patentes y Marcas (Spanish Patent and Trademark Office)
OGS	National Institute of Oceanography and Experimental Geophysics
PAC	Priority Area Coordinators
PCFVG	Civil Protection of the Friuli Venezia Giulia Region
PLEGEM	Plan Estatal General de Emergencias de Protección Civil (National Civil Protection Emergencies Plan of Spain)
PNEPC	Plano Nacional de Emergência de Proteção Civil (National Emergency Plan for Civil Protection)
POCTEP	INTERREG VI A Spain-Portugal Programme
PoE	Point of entry
PP	Project Partner
ReLUIS	Network of the University Laboratories of Seismic Engineering
RIMACOMM	Risk Management and Communications on Local and Regional level (INTERREG project)
RNPV	Rede Nacional de Postos de Vigia (National Lookout Network)
SAV	Slovak Academy of Science
SDIPC	Inter-ministerial Service for Civil Defence and Protection
SFRS	State Fire and Rescue Service (Slovakia)
SHMU	Slovak Hydro-Meteorological Institute
SIOPS	Sistema Integrado de Operações de Proteção e Socorro (Integrated Protection and Relief Operations System)
SK	Slovakia
SOP	Standard Operating Procedures
TETRA	Terrestrial Trunked Radio
ToT	Training of trainers
TSM	Total suspended matter
UCPM	Union Civil Protection Mechanism
WFD	EU Water Framework Directive
WMO	World Meteorological Organization
ZAMG	Austrian Department of Geophysics of the Central Institute for Meteorology and Geodynamics

Glossary

Concepts and terminology	Description
Border region	Region comprised in the NUTS 3 classification with a land border and NUTS 3 regions where more than half of the population lives 25 km from a land border.
Cross-border region	Territory comprised by two or more contiguous border regions on different sides of at least one national border.
Cross-border territory	Territory composed of the cross-border regions along the entire border.
Basin area	Whenever interventions in border areas is not necessarily based on a precise distance (e.g. 25 km) but rather on practical geographical considerations (e.g. concrete forests, the concrete flooding area, etc.).
Disaster risk	The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society, or a community in a specific period, determined probabilistically as a function of hazard, exposure, vulnerability, and capacity.
Disaster Risk Management	Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses. It covers four main phases: prevention, preparedness, response, and recovery and lessons learnt.
Exposure	The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.
Hazard	A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption, or environmental degradation. Also referred to as “risk” in the study.
Probability	Degree of likelihood for an event to occur.
Risk management capability	The ability of a Member State or its regions to reduce, adapt to or mitigate risks (impacts and likelihood of a disaster), identified in its risk assessments to levels that are acceptable in that Member State. Risk management capability is assessed in terms of the technical, financial, and administrative capacity.
Vulnerability	The conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards.

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1. Fighting Forest Fires along the Spain/Portugal Border

1.1. Executive summary

This study shows **how cross-border cooperation can increase resilience to address the risk of wildfire**. It focuses on the collaborative efforts made by Spain and Portugal to combat this challenge. Over the past three decades, Spain and Portugal have witnessed a surge in wildfire frequency and intensity due to climate change. The 2022 wildfire season, for instance was particularly severe, with both countries being heavily affected, collectively accounting for a quarter of the burnt area in Europe that year. The geographic proximity of those countries and their shared landscapes emphasise the importance of cross-border collaboration in prevention, preparedness, and response efforts.

The **main disaster and risk management components addressed by this case study** are:

- Planning, prevention measures planning, response contingency planning, financial planning investments, pooling of response resources;
- Early warning, public warning, situational awareness, real-time data exchange;
- Response cooperation, structures/arrangements for joint response, training/exercises;
- Innovation using new technologies, digital tools;
- Comprehensive approaches for cooperation over a longer period.

The study examines the legal frameworks, national and regional initiatives, and joint projects that have been established to combat wildfires, providing valuable insights for regions facing similar challenges. The approach showcased sets a clear example for **replicability** in other cross-border contexts with similar topography, and shared risks, such as Italy, Greece, France, Slovenia, Croatia, and Bulgaria. The collaborative efforts demonstrated by Spain and Portugal, particularly in patents and data sharing, also showcase the potential for successful use of technology to address shared challenges. This innovative approach, encompassing early warning systems and joint technology research, can be seamlessly adopted by other areas, that, apart from the essential prerequisites of willingness to collaborate and dedicated efforts in technology, innovation, and research, these solutions do not necessitate complex cross-border conditions.

Similarly, the role played by INTERREG and EU funding in facilitating effective cross-border initiatives has been evident. Regions confronting analogous challenges can explore and leverage these funding mechanisms to build the foundation and frameworks needed for increased capacity to manage wildfire risks collaboratively and comprehensively.

1.2. Introduction

Spain and Portugal, both situated at the forefront of the European Union's battle against climate change, share a compelling common concern: the increasing risk of forest fires. Over the past three decades, these two Member States have borne witness to an alarming surge in the frequency and intensity of wildfires. Nevertheless, the number of days per year with a high to extreme wildfire danger is projected to increase nearly everywhere in Europe due to global warming, resulting from higher temperatures and more frequent periods of

dryness. The Joint Research Centre (JRC) PESETA IV study¹ concludes that the **wildfire danger is expected to particularly worsen in southern European regions** and suggests that mitigation measures alone will not be sufficient to manage them.

In terms of geographical distribution, data from the [Global Wildfire Information System \(GWIS\)](#) ranging from 1st of January 2021 to 1st of October 2023, suggests that the wildfire-affected burnt cross-border areas were all predominantly situated between Northern Portugal (Região do Norte) with Spain's regions of Galicia, Castilla y León and Extremadura, with some hotspots visible between Algarve and Andalucía, making it among the most severely affected cross-border wildfire areas of Europe. See Figure 1 for illustrative details below.

Figure 1 Current situation viewer of burnt cross-border areas 2021-2023



Source: Global Wildfire Information System

According to the recent statistical data from the [European Forest Fire Information System \(EFFIS\)](#) published in the 2022 annual report², 2022 was the second-worst wildfire season in the European Union since 2000 when the EFFIS records began. Spain was the most affected by wildfires, with a total of 315,705 hectares (ha) burnt, which is three-and-a-half times more than in 2021, including 13,329 ha burnt within Natura2000 sites. Likewise, Portugal was the third most affected EU country, with a total of 112,063 ha burnt, out of

¹ <https://op.europa.eu/en/publication-detail/-/publication/c707e646-99b7-11ea-aac4-01aa75ed71a1/language-en>

² <https://publications.jrc.ec.europa.eu/repository/handle/JRC133215>

which over a third of the area, 41,089 ha, was within Natura2000. Together, these two countries account for over a quarter of the total area burnt in Europe in 2022.

All things considered, the geographical proximity of Spain and Portugal, combined with their shared landscapes and topographies, alongside the exacerbating effects of wildfires and climate change more broadly, highlights the particular importance of systemic and holistic cross-border collaboration covering all aspects of prevention, preparedness, and response efforts. This case study, therefore, closely examines the cooperative efforts of Spain and Portugal, explores the legal frameworks and procedural protocols these countries have established individually and bilaterally, and sheds light on practical and effective tools and initiatives developed through their joint endeavours to combat wildfires.

These collaborative practices not only reflect the dedication of both nations but also serve as valuable examples for regions facing similar challenges in navigating recurring and increasing wildfires.

1.3. Presentation

1.3.1. Leveraging National Frameworks and Agreements for Enhanced Cooperation

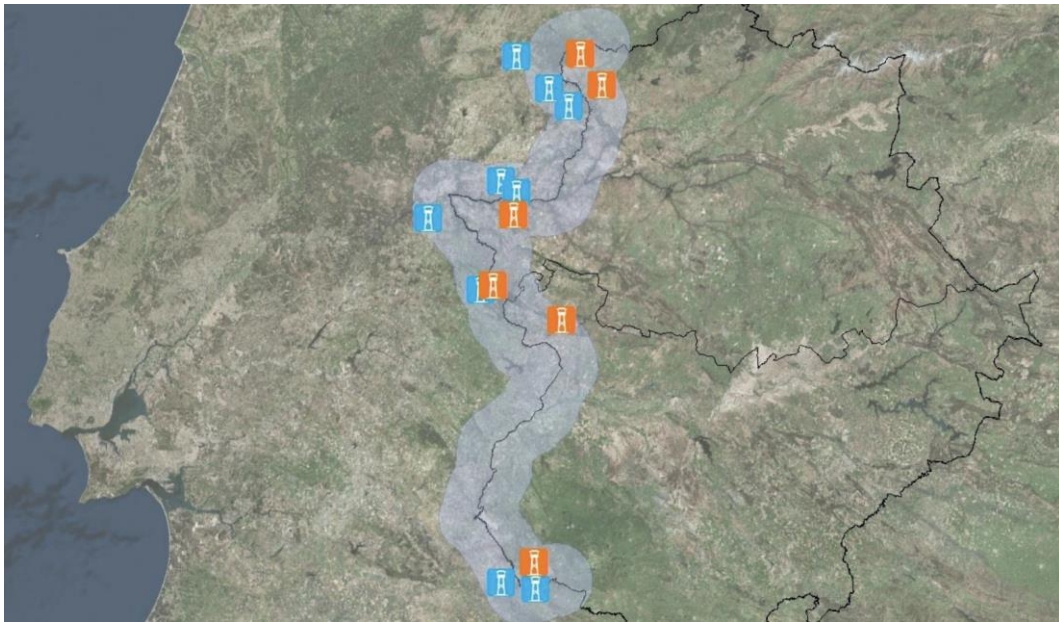
The National Civil Protection Emergencies Plan of Spain (PLEGEM)³ and that of Portugal (PNEPC)⁴ recognise the **transborder dimension of forest fires risk** and acknowledge it as a **primary cross-border threat** shared between the two countries. This recognition not only provides a solid legal foundation to more granular risk assessment on regional and municipal levels (see more in section 1.3.2) and attention to the interconnection of the forest fires risk at the highest levels of national legislation, but also facilitates robust, coordinated, and communicative national monitoring and transnational coordination systems.

For instance, Spain's [National Emergency Monitoring and Coordination Centre](#) (CENEM) offers an illustrative case of how satellite technology can be harnessed to identify fire hotspots, offering early warnings and predicting potential fire spread, while also sharing invaluable data internationally, including with its Portuguese counterpart. In contrast, Portugal adds strength to these efforts through an extensive national network of fire lookout towers ([RNPV](#)), covering over 70% of visible areas and complementing those of Spain as well as other data collection efforts as part of its [Integrated Protection and Relief Operations System \(SIOPS\)](#).

³ https://www.interior.gob.es/opencms/pdf/archivos-y-documentacion/documentacion-y-publicaciones/publicaciones-descargables/proteccion-civil/PLEGEM_126210029_web.pdf

⁴ <http://planos.prociv.pt/Documents/130313331474961281.pdf>

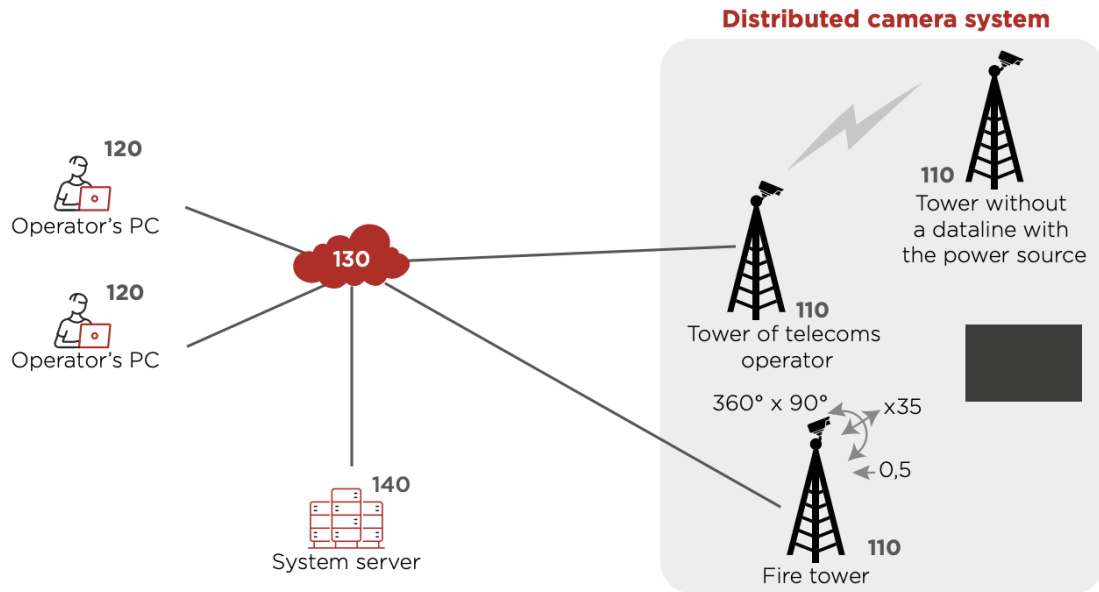
Figure 2 Distribution of cross-border observation towers between Spain and Portugal bordering Extremadura region in Spain with Alentejo and central regions in Portugal.



These networks and structures not only ensure a comprehensive approach to fire prevention and early detection nationally but also enhance preventive measures that both countries can mutually benefit from for managing the wildfires risk in the border territories. Technological and data-related collaboration is also highlighted by the Iberian study “Patents and forest fire control”⁵, carried out jointly by the [Portuguese Institute of Industrial Property \(INPI\)](#) and the [Spanish Patent and Trademark Office \(OEPM\)](#), which highlights **the most promising technologies (that present an associated patent document) in the realm of firefighting** and control of rural fires, disclosing the crucial role that Industrial Property takes on in encouraging innovation and assisting the collaboration between Spain and Portugal in this regard. The study was based on technical information provided by patents on the sustainable management of the forest, the fight against desertification, the prevention of the soil degradation and the loss of biodiversity, and its focus was the analysis of the evolution of patents related to the control of rural fires. It also analysed the evolution of patent applications directly related to forest fire control, highlighting Spain as the European Union country which has submitted the highest number of patent applications in forest fires between 2010 and 2021. To expand on these numbers, Spain published 6.20% of total worldwide patent applications in fire detection and prevention technologies, 6.88% in fire extinguishing technologies. Those figures are 0,73% and 0.91% for Portugal respectively. See figures below for examples of submitted patent application schemes on both fire prevention technology (Figure 3) and fire extinguishing technology (Figure 4).

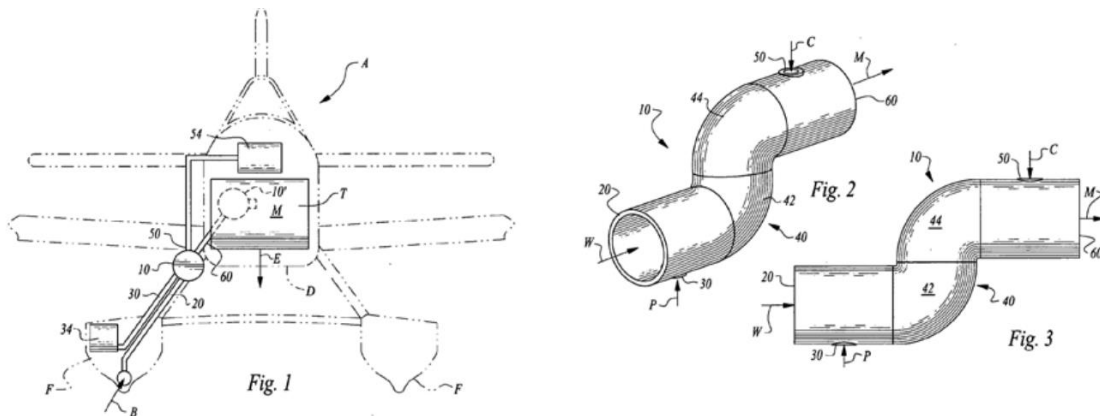
⁵ https://www.oepm.es/export/sites/oepm/comun/documentos_relacionados/Publicaciones/Estudios-Articulos/Patentes_y_control_de_incendios_forestales_ingles.pdf

Figure 3 Scheme from patent application WO2015094014



Source: Patents and forest fire control 2022

Figure 4 Figures from patent document WO2013070258



Source: Patents and forest fire control 2022

Overall, these collaborative initiatives set good examples of how countries can independently pursue their interests while, at the same time, leveraging their respective strengths as well as public and private mechanisms for mutual gain when shared risks exist.

The focus on forest fires and the importance of robust prevention and preparedness mechanisms are further highlighted by the presence of **dedicated competent entities and units in both countries**. These entities complement the work and competences of central bodies in matters of civil protection and emergencies, with a strong focus on integrated spatial planning, observation, monitoring, preparedness, and response to in relation to wildfires risk. In Portugal these structures are exemplified by the areas of work of the key wildfire risk-focused institutions such as the [Agency for Integrated Management of Rural Fire \(AGIF\)](#) and the [Institute of Conservation of Nature and Forests \(ICNF\)](#). These institutions demonstrate their competence through the designated research of forests and forest ecosystems, establishment of national guidelines for integrated rural fire management policies and strategies, providing valuable input and **corrective measures for national plans and legislation**, facilitating the development of financing instruments for rural fire management, assessing annual budget proposals, and actively participating in

the definition of training plans for entities of ANEPC as well as training plans for the operational use of different equipment and tools.

- Among one of the examples illustrating those competent entities and units in Spain are the [National Forest Fire Information Co Cooperation protocol Coordination Centre \(CCINIF\)](#), which serves as the national body responsible for coordinating forest fire-fighting efforts and disseminating vital information related to fire risk, resources, ongoing fires, and preventive measures. This body **facilitates collaboration between state and regional administrations**, ensuring seamless coordination of state firefighting resources and their mobilisation, emphasising a comprehensive and unified approach to forest fire prevention and combat. [Forest Fire-fighting Assessment and Advisory team \(FAST\)](#) (also registered in the European Civil Protection Pool) contributes with the consolidation of these expertise at the international level providing services to country or organisation in need on ongoing forest fire emergencies, as well as comprehensive assessments and advice on a wide range of aspects, including firefighting strategies, risk assessment, prevention policies, training, and research.

Finally, [National Forest Fire Fighting Committee \(CLIF\)](#) working groups approach complements these efforts by **systemising recommendations made by competent units** on information, prevention, aerial means, operations, incident command system, training and security. One of the examples of its work is also highlighted as an exemplary case in the next page.

National Forest Fire Fighting Committee (CLIF) strategic guidelines

In 2022 CLIF issued strategic guidelines for wildland fire management in Spain, providing a unified framework that integrates all public and private actors, ensuring a coordinated response nationwide, comprehensive governance framework and institutional approach developed to effectively manage forest fires risk nationally and across the border. The lines of action to facilitate the implementation of this framework by all actors involved, incorporated in specific objectives of this document are:

- Promote sustainable rural landscapes amidst wildfires.
- Mitigate wildland fire risk through ecosystem adaptation and societal preparation.
- Integrate sectoral policies in wildland fire risk management.
- Enhance firefighting organizations for new scenarios and collaboration.
- Deepen understanding of wildland fires' ecosystem impact.
- Engage society and raise awareness in wildland fire management.
- Integrate technological advancements in wildfire prevention and suppression.

This common understanding of high and shared risks in regards to forest fires is also encompassed by a historical agreement between the two countries - **protocol between the Kingdom of Spain and the Portuguese Republic in Technical Cooperation and Mutual Assistance in the Matter of Civil Protection**, aka Protocol of Évora, signed in 1992 (with additional protocol signed in 2018⁶), allowing operational teams of both countries to act and intervene in each other's territory within 25 km from the border of each before a formal request of assistance is issued. The Protocol covers, among other aspects, scientific and technical cooperation between both countries; establishes that the competent authorities of both countries may, on a reciprocal basis, request help from the other party in

⁶ [https://www.boe.es/eli/es/ai/2018/11/21/\(1\)](https://www.boe.es/eli/es/ai/2018/11/21/(1))

cases of emergency or catastrophe (or in anticipation of these); and designates as executing bodies of the Protocol to the National Civil Protection Service (today ANEPC) on the Portuguese side and to the General Directorate of Civil Protection and Emergency (DGPCE) on the Spanish side. Likewise, it constitutes a **Joint Civil Protection Commission**⁷ (made up of representatives of the executing bodies) that meets periodically to discuss the programming of activities to be carried out and to monitor and control their development.

In 2021, this protocol was used when Spain's national government deployed two medium-capacity amphibians to assist in a fire in Miranda do Douro, located in Northeast Portugal. Regionally, Spain's Castilla y León intervened 12 times, Extremadura intervened in two fires, and Galicia intervened in one fire in Portuguese territories. This mutual aid protocol also facilitated reciprocal support, with Portugal intervening twice in Andalusia and once in Castilla y León and Extremadura each within Spanish territory⁸.

Figure 5 Firefighting fleet deployed from Spain to Portugal



Source: Spanish Ministry for the Ecological Transition and the Demographic Challenge

We could argue that this fruitful historical collaboration in cross-border aspects between the two countries in 2020 was also responsible for laying the groundwork for the **Joint Cross-border Development Strategy**⁹. In addition to encompassing various aspects of cross-border collaboration and territorial cohesion, it also establishes significant legislative foundations for even more comprehensive and holistic collaboration concerning civil protection matters, among which, fighting forest fires along the border territories.

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**. These specific actions are detailed in strategic objective 3 of the strategy, which advocates for joint management of basic services in civil protection, among other initiatives. The strategy also calls for the formulation of additional agreements to facilitate cross-border knowledge networks and cross-border healthcare cooperation, all laying foundations for even more comprehensive collaboration in prevention, preparedness, and response to the common risks, among which undoubtedly forest fires as well. See the figure below on Portuguese and Spanish territories covered by the Joint Cross-border Development Strategy.

⁷ <https://www.proteccioncivil.es/coordinacion/internacional/convenios-bilaterales/portugal>

⁸ <https://op.europa.eu/en/publication-detail/-/publication/de3cfde3-5e5a-11ed-92ed-01aa75ed71a1/language-en>

⁹ <https://www.miteco.gob.es/en/reto-demografico/temas/cooperacion-transfronteriza.html>

Figure 6 Geographical Scope of Joint Cross-border Development Strategy between Portugal and Spain



Source: Ministry for the Ecological Transition and the Demographic Challenge of Spain

1.3.2. Leveraging Regional Frameworks and Agreements for Enhanced Cooperation

In Spain, at the regional level the main prevention and preparedness measures for forest fires in autonomous communities' and cross-border areas are elaborated in the **special civil protection plans against the risk of forest fires** of the four Autonomous Communities with a land border with Portugal. Namely, these are [PLADIGA](#) in Galicia, [INFOCAL](#) in Castilla y Leon, [INFOCAEX](#) in Extremadura, and [INFOCA](#) in Andalucía. In Spain, Autonomous Communities are responsible for the direction and coordination of the emergencies in their territory, unless declared as a national emergency, the situation goes beyond the capacity of the autonomous community or if it affects other autonomous communities (in which case the Ministry of Interior may take over the overall coordination of the activities).

Although in Portugal the coordination of overall risk assessment and risk management planning is predominantly a responsibility of the Portuguese National Authority for Emergency and Civil Protection (ANEPC), the municipalities also develop risk assessments at the local level (see for instance Aveiro Municipal Civil Protection Emergency Plan¹⁰). The aim of the municipal risk assessments is to provide municipalities with a set of guidelines and rules for the action of various forces, to develop effective operational actions in response to an emergency. Restoring normality to affected areas is another of its objectives, to minimise the effects of a serious accident or catastrophe on lives, the economy, property, and the environment. At the local level Portuguese municipalities organise trainings and exercises with their counterparts across the border and do promote their own risk communication and awareness raising campaigns. A good example of the latter is

¹⁰ <https://www.cm-aveiro.pt/servicos/protecao-civil-gabinete-tecnico-florestal/protecao-civil/plano-municipal-de-emergencia-e-protecao-civil>

exemplified by the [Safe Village and Safe People campaigns](#) in Portugal which are aimed at protecting people located in the urban/forest interface through the implementation and management of protection areas and safe havens in the clusters, as well as raising their awareness for limiting risk behaviour and adopting self-protective measures and preparedness for wildfires. See the figure below illustrating a Safe Village campaign poster.

Figure 7 Safe Village communication campaign poster



Source: Portugal Chama

In terms of legal frameworks for cooperation, although the above-mentioned Protocol of Évora between the two countries serves as the main legal instrument for cross-border assistance and intervention in terms of the matters of emergencies and civil protection in relation to forest fires, a few bilateral agreements on a regional level are also in place to facilitate the creation of working groups for smooth collaboration on more systemic level in the areas such as cross-border infrastructure of transport, communication and environment – all serving to the smoother collaboration in matters of civil protection and risks, such as cross-border forest fires. See the document on cross-border cooperation carried out by the Spanish Territorial Entities¹¹ for the full list of regional and municipal level agreements between Spain and Portugal and some notable agreement examples, **covering all regional territories**, below:

- Agreement between the Xunta de Galicia and the Coordination Commission of the Northern Region of Portugal, constituting the “Galicia-Northern Region of Portugal” Working Community.

¹¹ https://mpt.gob.es/dam/es/porta/politica-territorial/internacional/cooperacion/Coop_Transfronteriza/2013_04_Informe_web_cooperacion_transfronterizax.pdf

- Agreement between the Community of Castilla y León and the Coordination Commission of the Northern Region of Portugal for the establishment of the Castilla y León-Northern Portugal Working Community.
- Cooperation protocol between the Community of Castilla y León and the Coordination Commission of the Central Region of Portugal, creating the "Castilla y León-Central Region of Portugal" Working Community.
- Cooperation protocol between the Extremadura Regional Government and the Coordination Commission of the Portuguese Alentejo Region.
- Cooperation protocol between the Extremadura Regional Government and the Coordination Commission of the Portuguese Central Region.
- Cooperation protocol between the Andalusian Regional Government and the Coordination Commission of the Algarve Region, creating the "Andalusia-Algarve" Working Community.
- Cooperation Protocol between the Junta de Andalucía and the Coordination Commission of the Alentejo Region for the creation of the "Alentejo-Andalucía" Working Community.

1.3.3. INTERREG POCTEP 2021-2027

While a solid foundation exists for national and regional structures and mechanisms facilitating cross-border cooperation between the two countries in matters of civil protection, the interviewees from the regional authorities in Spain unanimously noted that most of the cross-border regional collaboration primarily occurs through INTERREG-funded projects, mainly due to limited national and regional resources. EU funding has been instrumental in establishing and sustaining initiatives aimed at preventing, preparing for, and responding to forest fires that have allowed Spain and Portugal to leverage their resources and implement effective measures jointly. One of the most compelling illustrations of regional cooperation is exemplified by the [INTERREG VI A Spain-Portugal Programme \(POCTEP\)](#), funded by the [European Regional Development Fund \(ERDF\)](#). This programme stands as **the largest cross-border cooperation initiative in the EU**, boasting a substantial allocation of EUR 427 million, of which over EUR 320 million originates from the ERDF¹².

By building upon the **border orientation paper by DG REGIO**¹³, serving as the foundation for constructive dialogues within the cross-border regions and with the European Commission, the INTERREG POCTEP 2021-2027 strategy¹⁴ brings wildfires to the forefront of the pressing regional concerns. Objective 2.4 of the strategy lays out the programme's commitments during the 2021-2027 programming period to fund initiatives on cross-border collaboration regarding wildfires via thematic areas of adaptation to climate change, disaster risk prevention, and resilience, with a focus on ecosystem-based approaches. This will be further strengthened by monitoring the Key Performance indicators (KPIs) set for this objective, which include the protection of 1,070 ha of land against forest fires, 49 Strategies and jointly developed action plans as well as investments reaching close to MEUR 10 in new or improved monitoring, preparation, alert, and response systems.

The cross-border collaboration in this area will also be strengthened by the programme's commitments to enhance efficient public administration. This will be achieved through promoting legal and administrative cooperation among citizens, civil society representatives, and institutions, with the goal of addressing legal and administrative

¹² https://www.poctep.eu/wp-content/uploads/2023/05/04_Anexo2_ES.pdf

¹³ https://2007-2020.poctep.eu/sites/default/files/border_paper_es_pt.pdf

¹⁴ https://www.poctep.eu/wp-content/uploads/2023/05/poctep_2021_2027_es_05_08_2022.pdf

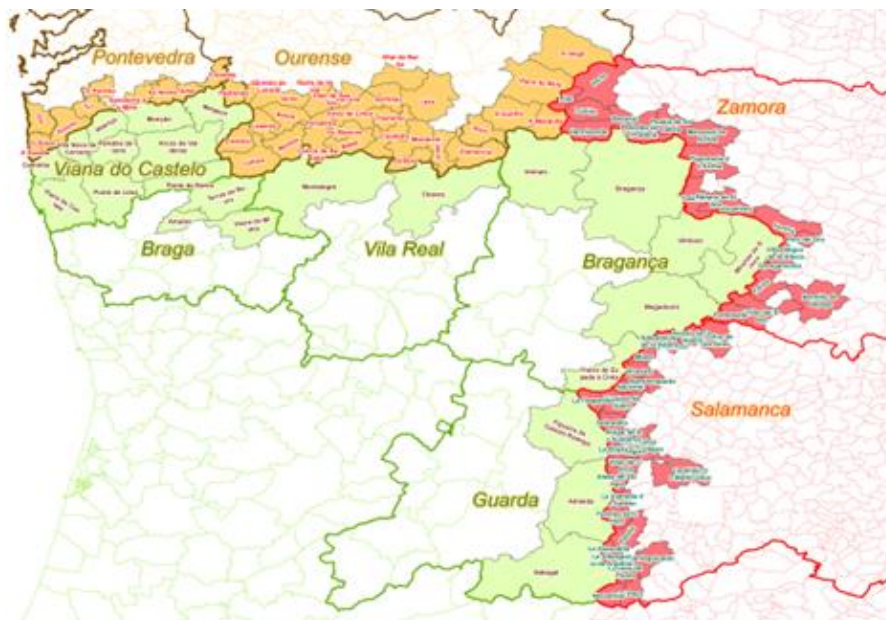
obstacles in the regions that impede cross-border collaboration between the two countries (specific objective INTERREG 2.1.1, action b), among which listed areas include transportation, emergencies, and fire prevention.

All things considered, the INTERREG POCTEP 2021-2027 program, with its resolute commitment to fostering cross-border collaboration between Portugal and Spain, provides a clear and promising framework for continued success. It carries forward the momentum generated during the previous programming period, offering much to celebrate and build upon. Among the examples of this collaboration in working on the cross-border issue of wildfires within POCTEP 2014 - 2020 are [ARIEM+](#), [Biofrontera I and II](#), [BIN-SAL](#), [GEFRECON](#), [CILIFO](#), [FIREPOCTEP](#) as well as an INTERREG SUDOE programme's projects such as [ForManRisk](#), [FireRS](#). Below, we present a few of those that exemplify the approach of setting the foundation for ongoing successful collaboration in this cross-border region. These cases encompass a wealth of good practices, some of which bear the potential to not only sustain but also establish a framework for operational networking, extending beyond the scope of INTERREG funding¹⁵.

ARIEM+

[ARIEM+](#) serves as a collaborative mechanism for coordinating resource management during critical emergencies in southern Galicia, Castilla-León, and Northern Portugal. It aims to:

- Establish a Single Operational Command for emergency management and coordination.
- Acquire region-specific emergency material and equipment.
- Conduct population-focused awareness campaigns.
- Standardise emergency response protocols and tactics.



ARIEM +



¹⁵ The case of FIREPOCTEP was developed by drawing insights from the interview with a representative from FIREPOCTEP, and Regional Operational Centre (COR INFOCA).

Knowledge sharing:

- [Territorial Plan for Cross-Border Emergencies \(PTET\)](#) including:
 - Inventory of resources.
 - Cross-border risk analysis.
 - Planning and forecasting.
 - Plan activation.
- [Awareness campaign and training.](#)

FOIL-CILIFO – First Fire Fighting Innovation Lab set up in collaboration between Spain and Portugal

Within the framework of CILIFO (Iberian Center for the Investigation and Fighting of Forest Fires), the platform Firefighting Open Innovation Lab-CILIFO (FOIL-CILIFO) has been set up as the first accelerator of companies and technologies in the prevention and fighting of forest fires.



It offers:

- A workspace in the CILIFO Center, in Seville/Huelva (Spain).
- Pilot tests for testing innovative technologies.
- Mentorship and funding advice for companies.
- Support in developing a proposal for EU funding.
- Support in the search for partners for replication and exploitation.
- Legal advice.



Knowledge sharing:

- Catalogue of supported companies and technologies ([2023 edition](#)) including
 - 39 supported companies and their outputs.
 - 9 collaborative entities and projects.
 - Firefighting StartUp Europe Awards (SEUA – CILIFO).

FIREPOCTEP

FIREPOCTEP under the leadership of [CILIFO](#), expanded the project's horizons. This time, its scope transcended the geographical scope of the southern Euroregion between Portugal and Andalusia **to encompass the entire border shared by Spain and Portugal**. The partnership also grew, now comprising **21 stakeholders**, with revised and more tangible objectives that build upon CILIFO's primary goals.

FIREPOCTEP activities include **intelligent forestry**, enhanced **emergency response**, and **community self-protection** against fires, promoting collaboration and best practices across borders. These efforts are supplemented by **rural empowerment** and the dissemination of project work, while a separate focus is on capitalising on knowledge and research into **financial sustainability for long-term project viability**.

Among **best practices** in the scope of FIREPOCTEP:

- University collaborations, shared data, and joint research studies.
- Joint protocols to harmonise equipment use between countries.
- Fire commander training facilitated by CILIFO and the FIREPOCTEP.
- Cross-border awareness campaigns to build common fire risk knowledge.
- Material, mobile offices, equipment, kits, and gear distributed to both sides.
- Iberian Congress on Strategic Management Zones in October 2022. The congress brought together over 100 specialists from various sectors in both countries to discuss policy and management actions and needs. The importance of this congress lies in the fact that the conclusions made will not only define the operational roadmap but also the political perspective that should be pursued in cross-border collaboration.



Interreg
España - Portugal

Fondo Europeo de Desarrollo Regional
Fundo Europeu de Desenvolvimento Regional



In terms of technology and digital innovation, the deployment of numerous **surveillance towers and sensors** ensures early fire detection. **Intelligence and analysis units** have been integrated to enhance fire spread prediction, while aerial teams equipped with **infrared and visible cameras** provide real-time fire information. **Drones**, particularly nocturnal ones, collect fire status and spread data and are being adapted for firefighting. In Andalusia, the FIREPOCTEP project introduced a **remote-controlled ground drone** and a **ground vehicle** with a 3,000-liter water tank. These additions enhance firefighting capabilities with their power, robustness, and self-protection systems.

The project continuity as **FIREPOCTEP PLUS** from 2024 has been officially approved to propel these developments forward under POCTEP 2021 – 2027.

1.4. Challenges

Despite exemplary case of cross-border collaboration in managing wildfire risk between Spain and Portugal, several challenges persist. One pressing challenge is the **room for improvement in overall forest management practices** in both countries^{16,17}. Effective wildfire prevention and mitigation strategies rely on a thorough understanding of the local ecosystems and environment, necessitating the development and implementation of joint, science-based approaches to land and forest management that would encompass both public and private actors.

Moreover, the **contrast in governance strategies** of both countries adds to the complexity. Portugal's centralised approach with more emphasis on “emergency response” contrasted with Spain's regional focus with a stronger emphasis on prevention showcase the disparity in tactics. Bridging this gap is crucial, requiring the creation of joint firefighting protocols that draw upon the strengths of both approaches. An interviewee from a regional authority in Spain also noted that contrasting governance strategies creates difficulties when it comes to collaboration in prevention and preparedness as different focus results in different data collection methods and their purposes; maps, data and calculations lack uniform approach and, as a result, uniformed utilisation. In terms of the on-the-ground operations, for instance, Spain has more aircraft and heavy machinery, while Portugal has more terrestrial equipment. Those also entail different ways of training, establishing protocols, and organising and executing firefighting operations on the ground. Additionally, **the lack of a common language**, particularly in the coordination of highly risky operations, has been noted as another critical problem.

A more centralised legislative approach has also been noted to present its own challenges. For instance, to trigger their collaboration protocol, Spanish and Portuguese regions must engage their central governments, introducing additional steps that might be difficult to accommodate for in certain emergencies. Some interviewees noted that, in some cases of emergencies, **informal agreements** based on goodwill are used instead. However, this does not exclude the need for more legislative and governance autonomy for the regions and municipalities to facilitate streamlined cross-border collaboration. Also, as unanimously echoed by the interviewees, most of the **cross-border cooperation relies on EU (mainly INTERREG) funding**. However, the dependence on EU funding poses its own challenges as projects funded by EU programs may struggle to maintain or keep their tools or resources updated once the funding ends, creating a financial dependency and stifling innovation in bilateral collaboration for governments.

Another aspect noted by the interviewees is that many of the agreements signed could benefit from an **up-to-date revisions and studies** that would quantify transborder risks with current scientific evidence, allowing for a better understanding of needed legislative and governance improvements in terms of cross-border cooperation.

Lastly, increasing awareness among society, politicians, and stakeholders responsible for risk management is another challenge. Climate change and its implications for changing wildfire circumstances demand a heightened sense of urgency and understanding. Public engagement and political support are vital components of the solution.

¹⁶ <https://doi.org/10.1016/j.foreco.2022.120526>

¹⁷ <https://www.jstor.org/stable/43739860>

1.5. Conclusions and lessons learnt

In conclusion, the cross-border collaboration between Spain and Portugal in managing the wildfire risk is a compelling case characterised by their shared risks over rising forest fire threats. Both countries have demonstrated their collaborative approach and commitment to addressing this common threat through legal frameworks, governance procedures and practical collaboration initiatives at the national and regional levels. From early warning systems to extensive fire prevention and response measures they have set valuable examples for regions dealing with similar challenges.

The success of the collaborative efforts between Spain and Portugal in managing the escalating wildfire risk along their shared border underscores the key role played by the financial support from EU funding, notably through Interreg initiatives. The allocation of funds, as exemplified by the Interreg VI A Spain-Portugal Programme (POCTEP) for 2021-2027, has facilitated the implementation of joint projects, the development of innovative strategies and tools, and the enhancement of regional resilience.

Nevertheless, while both nations have shown remarkable dedication to joint approach to cross-border risk of wildfires, several opportunities for improvement exist. First and foremost, both Spain and Portugal can jointly embrace enhanced forest management practices, enriching their wildfire prevention and mitigation strategies and deepening their understanding of local ecosystems. The distinct legal and governance approaches of these two EU Member States present a unique chance for collaborative innovation, with the potential to develop state-of-the-art protocols and complementary data collection methods. While EU funding has been pivotal, diversifying funding sources offers the prospect of long-term sustainability, allowing regions and other actors involved to uphold their tools and resources. Lastly, a commitment to using up-to-date revisions and studies to inform future policies can ensure that their collaborative agreements are grounded in the latest scientific evidence, thus supporting their collective response to the modern-day wildfires challenges.

Besides, by demonstrating how bilateral agreements and protocols can formalize and facilitate cross-border cooperation in emergencies, it sets a clear example for replicability in other cross-border contexts with similar topography, governing models, and shared risks, that could be potentially applicable to similar cross-border territories in Italy, Greece, France, Slovenia, Croatia, and Bulgaria.

The collaborative efforts demonstrated by Spain and Portugal, particularly in patents and data sharing, also showcase the potential for successful use of technology to address shared challenges. This innovative approach, encompassing early warning systems and joint technology research, can be seamlessly adopted by other areas, that, apart from the essential prerequisites of willingness to collaborate and dedicated efforts in technology, innovation, and research, these solutions do not necessitate complex cross-border conditions. Similarly, the role played by Interreg and EU funding in facilitating effective cross-border initiatives has been evident. Regions confronting analogous challenges can explore and leverage these funding mechanisms to build the foundation and frameworks needed for increased capacity to manage wildfire risks collaboratively and comprehensively.

In essence, the collaboration between Spain and Portugal represents a step in addressing the shared wildfire risk that is beyond common. To build upon this foundation and tackle the evolving challenges, continued cooperation, innovation, and adaptability as well as knowledge sharing, and capacity building are key.

1.6. Bibliography

- ANPC, Plano Nacional de Emergência de Proteção Civil (PNEPC), 2018, <http://planos.procivil.pt/Documents/130313331474961281.pdf>
- Câmara Municipal de Aveiro, Plano Municipal de Emergência de Proteção Civil (PMEPC), <https://www.cm-aveiro.pt/servicos/protECAo-civil-gabinete-tecnico-forestal/protECAo-civil/plano-municipal-de-emergencia-e-protECAo-civil>
- DG REGIO, Border Orientation Paper Spain-Portugal, https://2007-2020.poctep.eu/sites/default/files/border_paper_es_pt.pdf
- European Commission, Joint Research Centre, Feyen, L., Ciscar, J., Gosling, S. et al., Climate change impacts and adaptation in Europe – JRC PESETA IV final report, Ibarreta, D.(editor), Soria, A.(editor), Publications Office, 2020, <https://data.europa.eu/doi/10.2760/171121>
- European Commission, Joint Research Centre, San-Miguel-Ayanz, J., Durrant, T., Boca, R. et al., Advance report on forest fires in Europe, Middle East and North Africa 2022, Publications Office of the European Union, 2023, <https://data.europa.eu/doi/10.2760/091540>
- European Commission, Joint Research Centre, San-Miguel-Ayanz, J., Durrant, T., Boca, R. et al., Forest fires in Europe, Middle East and North Africa 2021, Publications Office of the European Union, 2022, <https://data.europa.eu/doi/10.2760/34094>
- INTERREG POCTEP, Documento de Programa POCTEP 2021-2027, 2022, https://www.poctep.eu/wp-content/uploads/2023/05/poctep_2021_2027_es_05_08_2022.pdf
- INTERREG POCTEP, Documento de Programa Poctep 2021-2027, Anexo II: Creditos financieros total por fondo y cofinanciacion nacional, 2022, https://www.poctep.eu/wp-content/uploads/2023/05/04_Anexo2_ES.pdf
- Ministerio del Interior, Convenios bilaterales España – Portugal, <https://www.proteccioncivil.es/coordinacion/internacional/convenios-bilaterales/portugal>
- Ministerio para la transición ecológica y el reto demográfico, Estrategia común de desarrollo transfronterizo España – Portugal, <https://www.miteco.gob.es/en/reto-demografico/temas/cooperacion-transfronteriza.html>
- Ministry of Foreign Affairs, European Union and Cooperation, Additional protocol between the Kingdom of Spain and the Portuguese Republic on mutual aid in border areas, done in Valladolid on November 21, 2018, adopted under the terms of article 8 of the Protocol on technical cooperation and mutual assistance in matters of civil protection, done in Évora on March 9, 1992., 2019, [https://www.boe.es/eli/es/ai/2018/11/21/\(1\)](https://www.boe.es/eli/es/ai/2018/11/21/(1))
- OEPM and INPI, Patents and forest fire control, 2022, https://www.oepm.es/export/sites/oepm/comun/documentos_relacionados/Publicaciones/Estudios-Articulos/Patentes_y_control_de_incendios_forestales_ingles.pdf
- Secretaría de Estado de Política Territorial y Función Pública, Secretaría General de Coordinación Territorial, La Cooperación Transfronteriza Realizada por las Entidades Territoriales Españolas, 2021, https://mpt.gob.es/dam/es/portal/politica-territorial/internacional/cooperacion/Coop_Transfronteriza/2013_04_Informe_web_cooperacion_transfronterizax.pdf

- Secretaría General Técnica. Ministerio del Interior, Dirección General de Protección Civil y Emergencias, Plan Estatal General de Emergencias de Protección Civil (PLEGEM), 2020, https://www.interior.gob.es/opencms/pdf/archivos-y-documentacion/documentacion-y-publicaciones/publicaciones-descargables/proteccion-civil/PLEGEM_126210029_web.pdf
- Vadell, E., et al. Forest management practices in Spain: Understanding past trends to better face future challenges, *Forest Ecology and Management*, Volume 524, 2022, <https://doi.org/10.1016/j.foreco.2022.120526>.
- Valente, S., et al. Sustainable Forest Management in Portugal: Transition from Global Policies to Local Participatory Strategies, *The International Forestry Review*, vol. 17, no. 3, 2015, pp. 368–83. JSTOR, <http://www.jstor.org/stable/43739860>.

2. EMRIC – Euregio Meuse-Rhine Incident Response and Crisis Management

2.1. Executive Summary

This study examines how methods and regulations can be aligned through intense and structured cross-border cooperation to ensure effective disaster management and emergency response. The focus is on the case of a trinational network in the Euregio Meuse-Rhine, located in the border area between Belgium, the Netherlands and Germany.

The main disaster and risk management components addressed by this case study are:

- Planning, prevention measures planning, response contingency planning, financial planning investments, pooling of response resources.
- Early warning, public warning, situational awareness, real-time data exchange.
- Response cooperation, structures/arrangements for joint response, training/exercises.
- Comprehensive approaches for cooperation over a longer period.

The special case of the high border density in the Euregio Meuse-Rhine led to situations in which emergency forces from the other side of the border arrived on the scene faster than forces from their own side. It was obvious that this could be an advantage in case of disaster. However, it is a challenge to bring organisations together from three countries with different languages and cultures as well as different standards on rescue and civil protection service. For this, these local governments, their rescue services, and fire departments founded EMRIC (Euregio Meuse-Rhine Incident Response and Crisis Management) as a network to share information and to harmonise operational procedures.

This study illustrates the salient features of this network and of its collaboration against the background of the respective legal frameworks and agreements. It shows that local agreements and intensive personal contacts are the necessary condition to build a joint platform. This case also shows that such a platform facilitates the organisation of joint exercises, the establishment of a regional-wide early warning and monitoring system and the building of a cross-border supply chain for protective equipment.

All the measures illustrated are replicable in similar areas and strategies, e.g. macro-regions.

2.2. Introduction

As one of the oldest European regions, the Euregio Meuse-Rhine, which encompasses the border triangle of Germany, Belgium, and the Netherlands, has a long tradition of cross-border municipal cooperation. Starting with the establishment of a working group in the 1970s, the Euregio has launched several projects to support the, at that time, economically weaker region¹⁸. Projects in the fields of labour market, culture or economy have led to progressive integration of the five partner regions (NL-Limburg, Liège, German-speaking Community, Aachen, and BE-Limburg) involved and made the Euregio a success story. Nevertheless, there was hardly any structural cooperation in the emergency services sector until the early 2000s.

¹⁸ <https://euregio-mr.info/de/ueber-uns/geschichte/>

However, experience from around Europe has shown that risks can be better managed if emergency services can provide support on both sides of a border. For example, in 2005 a wildfire destroyed areas of sedge over a width of one kilometre in the High Fens. It took 150 firefighters from Germany supporting the Belgian emergency forces to bring the fire under control.¹⁹ Another characteristic of this cross-border region is that foreign emergency services are often on the scene faster than local services. This fact underlines the importance of cross-border cooperation.

With regards to regional cooperation and preparedness for disasters, several support agreements have been signed between municipalities. For example, the City of Aachen and the Municipality of Vaals have a support agreement in place to ensure mutual aid in firefighting and rescue services.²⁰ Another example is the bilateral assistance agreement between the provinces of Dutch Limburg and Belgian Limburg. The agreements regulate the procedures for requesting assistance; who is the head of operations; the procedure in case of disagreement between the commander of the support unit and the head of operations; as well as cost-sharing of emergency operations and the exchange of information. In this way, they facilitate mutual assistance in various emergency cases and reaffirm the commitment of the local authorities to cross-border cooperation and the efficient sharing of resources during times of crisis.

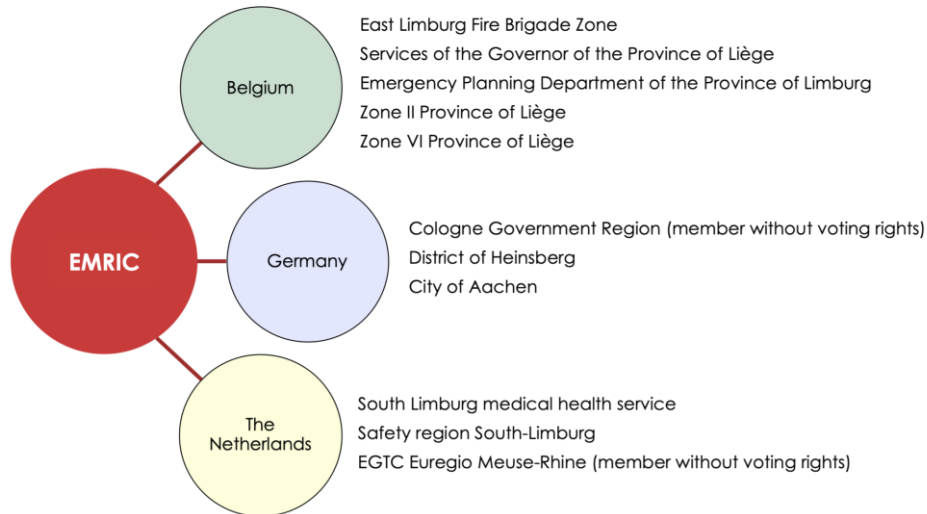
It must be mentioned, however, that such agreements are necessary but not sufficient. The three countries have notably different methods, systems, and laws governing emergency services. From experience, it was concluded that a platform for coordination and development of further cooperation would be needed. With the founding of [EMRIC](#), which stands for Euregio Meuse-Rhine Incident Response and Crisis Management, such a platform was created in 2005. EMRIC brings together various government departments and services from the three countries.

The main organisations involved in this initiative include the Fire Brigade of the city of Aachen, the office of public order of the Districts of Heinsberg and Aachen in Germany, the Provinces of Limburg and Liège in Belgium, and the safety region (Veiligheidsregio) and GGD Zuid-Limburg in the Netherlands (for a complete listing of the main partners see Figure 8). These organizations not only collaborate but also fund the EMRIC bureau in Sittard. In addition to these main partners, more than 30 other services and government entities work together within the EMRIC partnership. Today, about 900 ambulances cross the border every year, and in about 300 cases, fire brigades from different countries work together to deal effectively with emergencies.

¹⁹ Ramakers, Bindels, Wellding: Grenzüberschreitende Hilfeleistung in der Euregio Maas-Rhein (S. 126)

²⁰ "Vereinbarung zwischen der Stadt Aachen und der Gemeinde Vaals über gegenseitige Hilfeleistung bei der Brandbekämpfung und Rettungsdienst" from 1994;
https://www.aachen.de/de/stadt_buerger/politik_verwaltung/stadtrecht/pdfs_stadtrecht/375.pdf

Figure 8 Stakeholders involved



2.3. Interesting and innovative aspects

In terms of disaster preparedness, an important element of EMRIC is the biennial EMREX training and exercise cycle. An illustrative example of this occurred during the exercise held on November 9th, 2018, at Aachen West station. This large-scale exercise brought together 450 firefighters and rescue workers from Belgium, Germany, and the Netherlands. It was designed to create a highly realistic simulation of a disaster scenario involving a goods train carrying hazardous materials and a passenger train.

Figure 9 Exercise of November 9th 2018²¹



Other examples of preparedness measures are the development of the joint crisis management system called Paragon, the establishment of an EU regional early warning and monitoring system for epidemics and the building of a supply chain for medical protective equipment²² (see Section 4). In the event of a disaster, the participating organisations can rely on a system for exchanging information, especially in case of cross-border floods and infection outbreaks. This is possible via a web interface like the [Early warning](#)

[and control dashboard](#) of PANDEMERIC or – in case of emergency – the National Crisis Management System ([Landelijk Crisismanagement Systeem](#) - LCMS). In addition, information is exchanged by telephone via fixed contact persons. The organisations have also access to a shared pool of equipment in case of emergency. An example of such a pool of materials provided by the partners can be seen in Figure 10 below. Depending on the needs, the partners provide some of their equipment on request.

²¹ Zimmermann: Dreiländerübung: 450 Einsatzkräfte üben den Ernstfall (BRF; Link: <https://brf.be/regional/1227439/>)

²² https://gouverneur.provincedeliege.be/sites/default/files/media/7813/PANDEMERIC_factsheet_DE.pdf

Figure 10 List of materials for support of the EU region by the City region of Aachen, the city of Aachen and of the neighbouring districts (as of 2012)

Teilnehmer	EMRIC I	EMRIC II	EMRIC III
Anforderung über die Leitstelle (LST) Stadt Aachen / StädteRegion Aachen	1 bis 3 Löschfahrzeuge (LF) oder Spezialmaterial/ Spezialeinheiten	1 bis 3 Löschzüge (einer jeweils pro StädteRegion, kreisfreie Stadt oder Kreis) <ul style="list-style-type: none"> • Standardlöschzug (LZ) ELW und 2 LF • Löschzug Rettung (LZ-Rett) ELW, 2 LF, DLK • Löschzug technische Hilfe (LZ-TH) ELW, 2 LF, RW • Löschzug Löschwasserpörderung (LZ-W) ELW, 2 LF, SW • Löschzug Gefahrgut (LZ-CBRN) ELW, 2 LF, CBRN Trupp, RW 	Bereitschaften der Bezirksregierung Köln 4 Züge 1 Zug Logistik Zusatzmodule: <ul style="list-style-type: none"> • Waldbrand • Hochwasserschutz • Technische Hilfeleistung • CBRN • Instandsetzung

Source: Städtereion Aachen: Feuerschutzkonzept, 2012.

2.4. Establishment and development

Besides the national borders between Belgium, Germany and the Netherlands, several district and provincial borders run through the Euregio Meuse-Rhine. On Belgian side there are the Provinces Limburg, Liège, and the German-speaking Community, on German side the districts of Heinsberg, Düren and Euskirchen and the City region of Aachen. On the Dutch side, the province of South Limburg is part of the Euregio (see Figure 11).

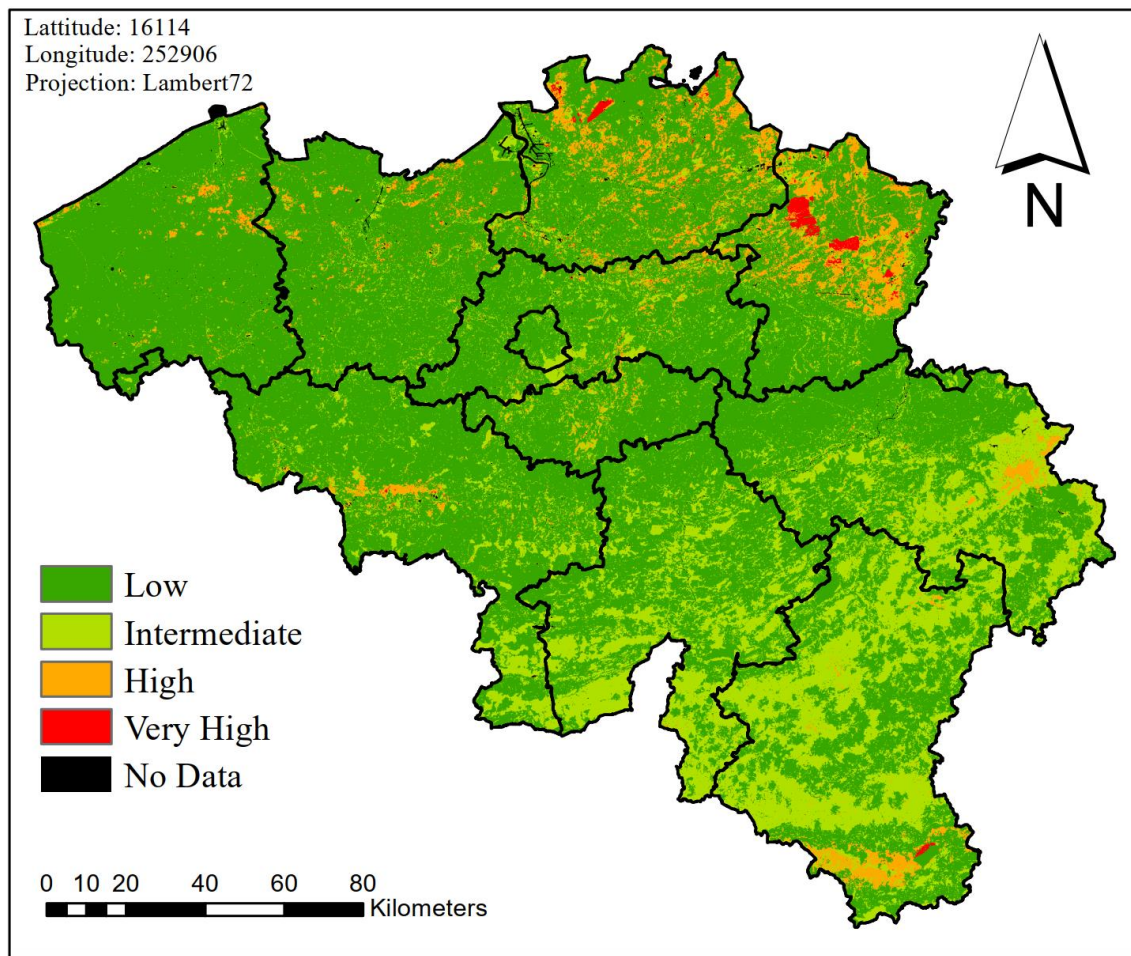
Figure 11 Meuse-Rhine Euregio (purple: Germany, green: Belgium, yellow: Netherlands) ²³



²³ Ramakers, Bindels, Wellding: Grenzüberschreitende Hilfeleistung in der Euregio Maas-Rhein

The region faces a variety of hazards. Examples for extreme weather events are the hurricanes Kyrill in 2007²⁴, Jeanett in 2002²⁵, and Daria in 1990²⁶. The COVID-19 crisis confronted not only the region but also the whole world with the possibility of potential deadly infection events. Due to climate change, heavy rain events will be more likely in future, which means a flood like the one in summer of 2021 poses a recurring threat²⁷. And the probability of wildfires, particularly in the High Fenn region, has become high in the spring and summer months (see Figure 12). Furthermore, the high density of industrial activities, especially in the neighbouring Ruhr area and the Chemelot industrial park in Geleen, carries an increased risk in case of industrial accidents. All these disasters challenged the regional civil protection as well as the health sector. It is therefore important to think holistically about appropriate solutions.

Figure 12 Probability map of wildfires in Belgium; the High Fens is marked with a red square.²⁸



²⁴ Kettle: Supplement of Storm Kyrill and the storms of mid-January 2007: Societal and Energy Impacts in Europe

²⁵ Deutsche Rück: Sturmdokumentation Deutschland

²⁶ German Weather Service (DWD): „Die Orkanserie im Jahre 1990 - Ein Vergleich mit Februar 2022 (Link: https://www.dwd.de/DE/wetter/thema_des_tages/2022/2/28.html)

²⁷ Deutschlandfunk (DLF): Klimawandel, Flut an Ahr und Erft – und die Frage nach dem Verschulden (Link: <https://www.deutschlandfunk.de/studie-zeigt-zusammenhang-klimawandel-flut-an-ahr-und-erft-100.html>)

²⁸ Depicker, De Baets, Baetens: A first wildfire risk assessment for Belgium

2.5. Initial situation: Legal framework and existing agreements

Legal framework in Germany

The [State Ministry of the Interior](#) holds the oversight in matters of civil protection and the training of emergency response managers, fire protection, and assistance.²⁹

The municipalities and independent cities are responsible to provide a comprehensive emergency service which includes both fire and rescue services. The state of North-Rhine Westphalia distinguishes between different types of fire brigades. These include professional fire brigades, volunteer fire brigades, compulsory fire brigades, and plant fire brigades. In the entire Euregio, only the city of Aachen has a professional fire brigade. Fire and rescue services share a common operation centre.¹⁴

Initially, in the case of disaster events, the districts and independent cities must execute emergency measures. In comparison to their Belgian and Dutch colleagues, the German emergency forces have extensive powers. The head of operations which is appointed by the highest administrative officer has the responsibility of coordinating all forces involved, ensuring a well-organised response. For that, he can demand additional forces for support or to provide equipment and vehicles. He is also allowed to park devices and vehicles on private property if this is necessary for the success of the operation and does not unnecessarily put anyone in danger. Owners of private property, buildings and ships which are directly affected by a disaster must leave them when they are instructed to do so by the head of operations. If it is necessary, he may also order the removal of trees and buildings or parts of them.³⁰

Legal framework in Belgium

In Belgium, the mayors of each municipality are required to develop comprehensive municipal emergency response plans. The content of these plans is laid down in royal decrees. In contrast to the German side, the National Ministry of the Interior coordinates the preparation and implementation of necessary civil protection measures including fire and rescue services. The cities and municipalities are responsible for the implementation and organisation of these services locally.¹⁵

Competence allocation is a key element in the Belgian civil protection strategy. Emergency situations are categorised based on their regional dimension. In the municipal phase, local mayors take the lead in addressing local emergency situations within the boundaries of a single municipality. The provincial phase comes into play when the consequences of an emergency extend beyond municipal boundaries or when the complexity of the situation requires management by the governor. The federal phase is activated when emergency situations cross provincial borders, require high-level coordination at ministerial level, or become a larger regional or even national scope.¹⁵

Legal framework in the Netherlands

Like Belgium, in the Netherlands the Ministry of the Interior is responsible for supervising municipalities, provinces, and fire brigades in fulfilling their duties related to fire service provision and damage control.¹⁵

²⁹ Ramakers, Bindels, Wellding: Grenzüberschreitende Hilfeleistung in der Euregio Maas-Rhein

³⁰ Idem.

In the Netherlands, the municipal council is responsible for the organisation and administration of municipal fire brigades. Every municipality is obliged to either maintain its own municipal fire brigade or establish suitable arrangements for cooperation with neighbouring municipalities. Additionally, the country's firefighting efforts are complemented by the formation of regional fire brigades, each responsible for a specific region. These regions are identical with the security regions (Veiligheidsregio). The distribution of competencies in this system is contingent on the necessity for support during emergency situations. Emergency medical assistance in the Netherlands is provided by the GHOR (Geneeskundige Hulpverlening bij Ongevallen en Rampen), which is divided into regional organisations. The respective regional GHOR is part of the security region together with the regional fire brigade and the police for better cooperation. For this purpose, they share a common operation centre.¹⁵

Should the regional fire brigade responsible for a municipality become overstretched and unable to manage the crisis effectively, the mayor of the affected municipality has the authority to request assistance. This request is directed to the King's commissioner (CvdK) of the province in which the municipality is located. In the Dutch political system, the CvdK is the head of the province and is appointed by the Dutch government. If the need for support goes beyond the provincial level or if the provincial resources are insufficient, the CvdK can request additional support from the Ministry of the Interior.¹⁵

If it is necessary to fulfil their task, the commanders of the municipal and regional fire brigades, the emergency forces in the field, mayors and officials authorised by the Minister of the Interior have free access to all locations. If there is no access, they also may gain access through the police. They are also authorised to bring all necessary equipment and supplies to the scene and to use them.³¹

Existing agreements and potential issues

There exist several regional and even national agreements on mutual assistance in the event of disasters. The content of these agreements is similar. They clarify e.g., who is authorised to request support, who coordinates the respective operation and how to share the costs:

- Agreement between the city of Aachen (DE) and the municipality of Vaals (NL) on mutual assistance in firefighting and rescue services.
- Agreement between the city of Aachen and the municipality of Kelmis on mutual assistance in firefighting and rescue services.
- Agreement between the Federal Republic of Germany and the Kingdom of the Netherlands on mutual assistance in the event of disasters, including serious accidents (1988).
- Agreement between the Land of Lower Saxony, the Land of North Rhine-Westphalia, the Federal Republic of Germany and the Kingdom of the Netherlands on Cross-Border Cooperation between Territorial Authorities and Other Public Bodies of 23 May 1991.
- Agreement between the municipality of Raeren, the town of Eupen and the municipality of Roetgen on mutual assistance in firefighting and assistance in the event of accidents.
- Agreement between the town of Monschau, the municipalities of Büllingen and Bütgenbach on mutual assistance in fighting fires and aiding in emergencies.

³¹Idem.

- Agreement from 06 November 1980 between Federal Republic of Germany and the Kingdom of Belgium on Mutual Assistance in the Event of Disasters or Serious Accidents.
- Agreement on neighbourly assistance between the municipalities of NL-Sittard and D-Selkant concerning mutual assistance in firefighting and assistance in the event of accidents.
- Joint Declaration by the Minister and the State Secretary for the Home Affairs and Kingdom Relations of the Netherlands and the Minister of the Interior of the Land of North Rhine-Westphalia concerning cross-border cooperation of 16 January 2001.
- Neighbourhood assistance agreement between the municipalities of Schinnen (NL) and Selkant (DE) on mutual assistance in fighting fires and assisting in accidents.

The agreements regulate basic procedures and only make it possible for rescue workers from neighbouring countries to request help directly. However, these are bilateral agreements that also leave many questions of operational deployment open. As mentioned above, the three countries have different methods, systems, and laws governing emergency services.

In the Netherlands for the fire brigade services there are nationwide operational and equipment guidelines - unlike in Belgium, where there is no uniform standard, so each fire brigade can choose its own way of working and equipment. Therefore, significant coordination and cooperation are required to enable the seamless crossing of borders with ambulances and fire trucks.

In contrast to the Netherlands, where ambulance personnel provide first aid, in Belgium and Germany emergency doctors perform this role as part of a rescue team. This affects the legal (national) framework in Belgium and Germany, so it is an issue that cannot be solved by local agreements.

On the technical side, most of the difficulties were in the field of communication. In the initial phase of EMRIC, the challenge for the German forces was that their communication system was not compatible with the Belgian and Dutch systems. There were also some areas on the Belgian side where it was impossible to connect to the operations centre on the German side. The reason for this problem was that the Belgian and the Dutch rescue services have been using digital broadcasting since the early 2000s - while the Germany forces were still using the old analogue technology. Even today the rescue services of the region of Aachen are still in a transition phase to a digital solution but fortunately they are very close to complete the implementation.

Another field of conflict is the range of powers of the respective emergency services. Ramakers, Bindels and Wellding describe in their study³² a situation between a German fire brigade unit and Belgian police forces. As they were used to do so, the firefighters secured the traffic at the scene on their own before the police arrived. The Belgian police had issues with that because the German firefighters regulated the traffic according to German rules.

From single projects to a joint platform – INTERREG IIIA (2005 – 2007)

Forerunner initiatives

Prior to 2005, there were no formal trilateral agreements for regular medical assistance in the Euregio Meuse-Rhine region. However, various initiatives and projects were undertaken to foster collaboration and enhance the provision of healthcare services across borders.

³² Idem.

One of these initiatives was the joint use of the rescue helicopter Christoph Europa 1 since 1975. The helicopter, stationed in Würselen, has an operating radius of 70 km, and covers large parts of Limburg and Liège.

Another project was the “Rescue Service” which ended in 2005 and was part of the broader “Cross-border Healthcare” initiative, jointly led by the Stichting Euregio Maas-Rhein and the hospitals and health insurers within the Euregio Meuse-Rhine.

The Eumed project, a collaborative effort involving the [Municipal Health Service \(GGD\) Zuid-Limburg](#), Department GHOR³³, the Province of Liège, and the Regio Aachen, comprised two sections: “Eumed Ambu” is a comprehensive euregional rescue service assistance plan which come into effect if a rescue service required additional vehicles during an operation. “Eumed Hospital” is an euregional plan for the distribution of injured persons to be used in the event of a disaster or major incident to optimise the use of available hospital capacities in the Euregio Meuse-Rhine.

Additionally, the Eucrew Euregio Meuse-Rhine was founded as a working group involving the Health Inspectorate (Gezondheidsinspectie) of the Belgian provinces of Limburg and Liège, the ADAC, the City region of Aachen, the German-speaking Community of Belgium, the GGD Zuid Limburg and several training institutes specialised in emergency medical care in the Euregio Meuse-Rhine. The aim of this working group is to develop cross-border education and training opportunities, to promote the exchange of knowledge and to intensify cooperation in emergency medical care in the Euregio Meuse-Rhine.³⁴

These existing cooperation as well as various personal contacts led to EMRIC finally being founded as a permanent cooperation network.

Establishment and development of EMRIC

EMRIC started as a two-year INTERREG III project and was extended as EMRIC+ until 2013. In this cooperation network, which focused on the exchange of information, thematic focus groups and the steering group, which advise the European Grouping of Territorial Cooperation (EGTC) Euregio Meuse-Rhine on strategic issues, were established in 2013. Furthermore, the EMRIC office was founded as coordinating centre to support the network. The work results of the focus groups flow into the respective planning processes of the network partners for cross-border cooperation. Since then, the cooperation has been deepened more and more and brought offshoot projects like [PANDEMERIC](#) and [Marhetak](#).

EMRIC addresses all the EU Disaster Resilience Goals and is aligned with their priorities. The information exchange within the focus and working groups allows to gain in-depth knowledge and to identify new risks faster. Within EMRIC, in case of disaster, officials have fixed contact persons on the other sides of the borders (so called “warm” contacts). And with the [International Knowledge and Information Centre](#) (IKIC), the Euregio has established a project linked to EMRIC that brings together universities, research institutes and education institutes for education of rescue personnel and for research activities.

The preparedness aspect is covered by joint trainings like biennial [EMREX](#) training. Not only the system of direct contacts, e.g. in case of fire or accidents, but also tools like the early warning and control dashboard of [PANDEMERIC](#) in case of epidemics enable emergency and health services to react rapidly. To this end, data is collected at the level of the EU region to derive trends and estimate the probability of an outbreak event. This data includes the number of new infections per 100,000 inhabitants in the last 14 days, the hospitalisation rate due to COVID-19 infections and the vaccination rate. EMRIC strengthens the response capacity of the emergency services in the Euregio through the joint procurement of equipment, compatible communication systems and hardware

³³ Regional Medical Assistance Organisations.

³⁴ Ramakers, Bindels, Wellding: Grenzüberschreitende Hilfeleistung in der Euregio Maas-Rhein.

interfaces (e.g. vehicle couplings) and coordinated operational protocols. And the goal of safety is achieved through coordinated work processes and responsibilities in the control centres.

Even with these structures and arrangements, EMRIC has no formal corporate form, neither under national nor European law. In fact, the network is sustained through personal contacts between the member organisations and through exchanges at the same level. The success of EMRIC is therefore based on mutual trust, based on intensive networking before the start of the project and has been continued ever since.

EMREX

EMREX is a biennial exercise programme which includes all aspects of disaster management:

- Training of major incidents under realistic conditions;
- Involvement of emergency services from all three countries of the Euregio;
- Exercise of joint emergency response plans;
- Training through e-learning courses;
- Evaluation of the cooperation.



2.6. Impact

One of the main objectives of EMRIC is the harmonisation of procedures and the preparation of emergency forces, to improve cross-border operations. The EMREX training program, encompasses various measures, e.g. control centre exercises, the training on the

LCMS information sharing platform (which will be replaced by Paragon in 2024³⁵), exercises and e-learning programme.

Several initiatives have been launched to harmonise cross-border emergency response. The EMRIC and Eumed emergency response plans serve as reference documents and are constantly updated. Additionally, trilingual request for assistance forms have been developed. These forms, which also include a list of the common equipment pool, make it possible to draw on additional equipment when needed. One interviewee pointed out that there are now also joint emergency plans for an incident at the Chemelot chemical park.

EMRIC has set its sights on enhancing coverage within the region. An example of this is the situation in Raeren, Belgium, where emergency calls are traditionally routed to the Liège rescue centre. Despite this arrangement, Aachen's emergency response teams are often much closer to the location and can offer swifter assistance, raising a question by one of the interviewees: "Who is faster, Eupen or Aachen?"

This scenario finds parallels on the Dutch side of the border region. However, to achieve this objective, critical questions related to liability and costs must be addressed. One of the interviewees confirms that these matters have been resolved in the Euregio, thanks to the efforts of EMRIC, thus clearing the path for improved coverage and more efficient emergency response services within the region.

2.6.1. Project Marhetak

During the flood disaster of July of 2021, the network partners needed their own capacities for disaster response, so crisis management was handled independently by the respective local emergency services. Even though, the information sharing between the partners functioned. However, it became evident that measures of risk interpretation and flood-related measures was needed. The partners have recognised that the previous cooperation through EMRIC is not sufficient to respond to large-scale flood events.

To address these concerns and ensure more effective coordination in the future, Marhetak was launched as an offshoot project of EMRIC in 2022. The project aims to develop a common crisis management tool to enhance the overall efficiency of cross-border emergency response in case of a flood event.

2.6.2. Project PANDEMERIC

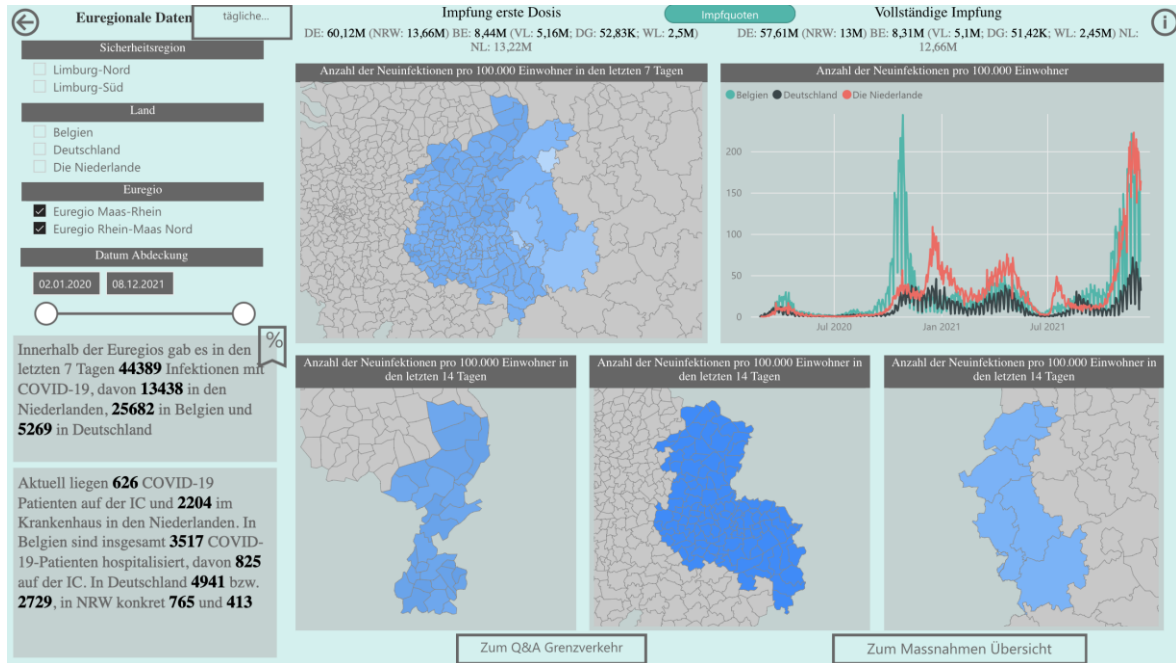
EMRIC has played an important role in the Euregio in addressing the challenges posed by the COVID-19 pandemic.

Network partners published and updated an overview of protective measures to contain the spread of infection in the region during the pandemic. In addition, EMRIC produced a FAQ to answer citizens' questions to increase public understanding and confidence. This initiative led to the launch of the PANDEMERIC project, in which information was pooled and communication between intensive care units in the Euregio Meuse-Rhine and Euregional outbreak management was facilitated via a common platform.

Since then, new information products were developed and included a dedicated website featuring an interactive overview dashboard on COVID-19 statistics among EMRIC partners (see Figure 13). This resource allowed for real-time data sharing and enabled a comprehensive understanding of the pandemic's impact across the region. Furthermore, the establishment in the Euregio of a digital learning wall enhanced education and awareness about COVID-19 and its implications.

³⁵ <https://centredecrise.be/fr/partenaires/outils-contrats-cadres/paragon/quest-ce-que-paragon>

Figure 13 Early warning and control dashboard of PANDEMRIC³⁶



2.6.3. Potential for replication

A project like EMRIC, known as ERMWIC (Euregional Rhine-Meuse-Waal Incident Response and Crisis Management)³⁷, has been initiated in July 2023. This project is situated further north of the EMRIC region and is funded by the INTERREG VI program until 2027. One of the interviewees emphasized that EMRIC serves as a model for such initiatives.

ERMWIC emerged from a project group established in 2017 in the context of a collaborative agreement in disaster management between the municipalities of Kleve and Viersen and the neighbouring Dutch partner, the security regions Limburg-Noord, Gelderland-Zuid, Gelderland-Midden, and Noorden Oost-Gelderland. The partners within ERMWIC have realised the importance of personal relationships - a lesson learned from EMRIC's success. Because of this, there is a special working group for this topic. Other working groups are focused on key topics such as disaster medicine (particularly the collaboration during cross-border mass casualty incidents), fire protection (including wildfire fighting) and multidisciplinary crisis management.

2.7. Challenges

Within EMRIC, language and culture play a significant role. The region comprises three different languages, and this linguistic diversity is mirrored in the steering group. Participants communicate in their own language, and to facilitate mutual understanding, some members have undertaken language courses or rely on interpreters when necessary. The diverse cultural backgrounds and perspectives inherent in the region further enrich the dialogue and collaboration.

³⁶ <https://pandemic.info/de/pandemic-examines-the-benefits-of-euroregional-cooperation-during-health-crises-deutsch/> (State: 10.10.2023)

³⁷ <https://www.kreis-kleve.de/de/aktuelles/kreis-kleve-baut-grenzueberschreitende-zusammenarbeit-im-bevoelkerungsschutz-aus/> (State: 07.06.2023)

Another challenge are the competence structures on each side of the border. In Germany, responsibilities of rescue service provision, disaster relief, crisis management, and infection control are all under one roof at the district level. In contrast, the Netherlands and Belgium divide these responsibilities. This distinction results in an increased need for coordination during disasters, given the presence of several contact persons. To address this, EMRIC has established, as already mentioned above, fixed contact persons to streamline communication and response efforts.

In this context, a problem arises for EMRIC: one concern highlighted in the interviews is the age of the current generation. In a network like EMRIC, which relies heavily on personal relationships, informal arrangements and established relationships, the existing trusted connections need to be continued by successors. However, today it is difficult to find young experts for the rescue service and civil protection.

Besides this challenge, EMRIC's status as a network brings with it several challenges. For example, no INTERREG applications can be submitted from within EMRIC itself. Consequently, projects such as PANDEMERIC and Marhetak are officially declared as Euregio-Meuse-Rhine projects. Furthermore, there are operational constraints due to legal restrictions. For example, drone operations are regulated differently in the three countries and border crossing is not allowed, which makes cross-border operations difficult. To overcome this, [Paragon](#) serves as a "bridge" for the transmission of images, allowing them to be uploaded and shared within the EU. It is the opinion of the interviewee that solving such legal challenges could be facilitated within the framework of an autonomous entity or as a European grouping of territorial cooperation (EGTC) within the Euregio. However, the disadvantage of such an EGTC solution would be a higher complexity compared to today's structure and working method. When setting up an EGTC, three national legal systems must be considered in addition to the EGTC regulation. In addition, there are different interpretations of regulations and different implementations of the EGTC regulation in national law.³⁸

An interviewee raised concerns regarding the resulting duplication of structures that could arise with new initiatives like EMRIC. Each additional body introduces complexity into the existing legal and operational constructs. Member states can already request support from other EU states through the Union Civil Protection Mechanism, and joint civil protection initiatives provide training measures, exchange platforms, and joint exercises. It is therefore questionable what the benefit for civil protection is. But this view is not shared by the partners participating in EMRIC. Both from the corresponding interview and from the reports, the exchange at local level is seen as enriching. It enables quick reactions in the event of a disaster.

Paragon

[Paragon](#) is a platform for coordinating emergency response planning and crisis management. It is a proprietary development of the Belgian National Crisis Centre and includes the following functions

- Application of Big Data methods and predictive models;
- Combination of different data sources for visualisation through digital twins;
- Integration of Microsoft 365 and geo-information systems;
- Multilingual multi-user platform.

³⁸ See <https://www.bbsr.bund.de/BBSR/DE/forschung/programme/moro/studien/2017/evtz-vorbereitung/01-start.html>



2.8. Conclusions and lessons learnt

EMRIC is a remarkable example of the potential of international cooperation at the cross-border level. The partners of the Euregio have found a way to work together across borders to ensure the safety and well-being of citizens by aligning methods and regulations to ensure effective disaster management and emergency response, notably in the areas of preparedness and prevention. This is achieved on the one hand through permanent coordination processes and joint training, but also through strategic advice to the political level, which leads even to new agreements. Thereby the network addresses diverse risks, ranging from (industrial) accidents to forest fires and epidemics, in the field of preparedness and response.

However, this study has shown that there is room for improvement. First, the network is only as strong as the personal connections of its members. This makes EMRIC both a notable instance for European spirit and an example that borders still exist. For even if the will exists, national regulations restrict a progressive integration of emergency services in the field of cross-border civil protection, as the example of drone deployment illustrates. One way forward could be the harmonisation of national legislation. Another (existing) way could be the establishment of an EGTC which, however, brings new challenges because of the complexity of such a construction. For the further development of such networks, discussions are needed on suitable, low-threshold legal forms.

The EMRIC example also shows that the INTERREG programme is suitable as an enabler for new projects. Not only did it provide the initiative for EMRIC and EMRIC+ in 2005 and 2007, but it also enabled the spin-off of further projects like PANDEMERIC and Marhetak. The example of the launch of ERMWIC also shows that projects such as EMRIC can serve as living labs and models of how the European idea can be concretely transferred into practice.

2.9. Bibliography

- Anon.: Verheerender Brand im Hohen Venn, 15th March 2012 (Luxemburger Wort: <https://www.wort.lu/international/verheerender-brand-im-hohen-venn/538358.html>)
- Depicker, A.; De Baets, B.; Baetens, J. M.: A first wildfire risk assessment for Belgium, September 2018 (https://www.researchgate.net/publication/327799812_A_first_wildfire_risk_assessment_for_Belgium)
- Deutsche Rück: Sturmdokumentation Deutschland, March 2005 (https://www.deutscherueck.de/fileadmin/Downloads/Sturmdoku_1997_2004_web.pdf)
- EMR2020 Steering Group: *EMR2020 - Eine Zukunftsstrategie für die Euregio Maas-Rhein*, March 2013
- EMRIC Steering Group: *Jahresbericht 2019*
- EMRIC Steering Group: *Jahresbericht 2020*
- EMRIC Steering Group: *Jahresbericht 2022*
- EMRIC Steering Group: *Mehrjahresplan 2024-2028*, August 2023 (https://emric.info/uploads/documents/mehrjahresplan_2024_2028_1693310837.pdf)
- EMRIC Steering Group: *Mehrjahresübersicht EMRIC 2014-2019*
- EMRIC: Evaluierung EMREX Räder auf dem Weg Übung vom 9. November 2018 (https://gremieninfo.staedtregion-aachen.de/bi/___tmp/tmp/45-181-136/QfE7LwYvsoouuxw46g8bOUwif0Yfk7M1ZLt6cVjr/aqgunfuR/17-Anlagen/01/2020_0118_EMREX_Evaluierung_Anlage_1.pdf)
- EVTZ Euregio Maas-Rhein: *Jahresbericht 2020* (https://euregio-mr.info/euregio-mr-wAssets/docs/Jahresberichte/EMR_Rapport-annuel-2020-DE-web.pdf)
- Federal Institute for Research on Building, Urban Affairs and Spatial Development: *Europäische Verbände der territorialen Zusammenarbeit – Unterstützung bei der Vorbereitung* (<https://www.bbsr.bund.de/BBSR/DE/forschung/programme/moro/studien/2017/evtz-vorbereitung/01-start.html>)
- Government of North Rhine-Westphalia: *Kleine Anfrage 1063: Die Fortführung der grenzüberschreitenden Zusammenarbeit mit den BENELUX-Staaten und die Rolle der Bezirksregierungen im Bereich Katastrophenschutz*, 22nd February 2023
- Kettle, A. J.: Supplement of Storm Kyrill and the storms of mid-January 2007: Societal and Energy Impacts in Europe, 2023 (<https://adgeo.copernicus.org/articles/58/135/2023/adgeo-58-135-2023-supplement.pdf>)
- Marhetak: *Anforderungen der öffentlichen Krisenmanagement-Organisationen in der EMR an die Wasser-, Wetter- und Bodendienste bei Überschwemmungen*, March 2023 (<https://marhetak.info/de/home-deutsch/download/6257/?tmstsv=1697875390>)
- Ramakers, M.: *Eumed - Grenzüberschreitende Zusammenarbeit bei dringliche Medizinische Hilfeleistung in der Euregio Maas-Rhein* (https://www.regbas.ch/de/assets/File/downloads/PPT_Ramakers.pdf)

- Ramakers, M.; Bindels, T.; Wellding, J.: *Grenzüberschreitende Hilfeleistung in der Euregio Maas-Rhein*, August 2007 (https://www.staedteregion-aachen.de/fileadmin/user_upload/A_32/Dateien/Rettungswesen_Bevoelkerungsschutz/Rettungsdienst/Grenzueberschreitende_Zusammenarbeit/Grenz_Zus_arbeit.pdf)
- StädteRegion Aachen: *Feuerschutzkonzept 2012* (https://www.staedteregion-aachen.de/fileadmin/user_upload/A_32/Dateien/Rettungswesen_Bevoelkerungsschutz/Brandschutz/Feuerschutzkonzept_2012.pdf)
- StädteRegion Aachen: *Feuerschutzkonzept*, June 2017 (https://www.staedteregion-aachen.de/fileadmin/user_upload/A_32/Dateien/Rettungswesen_Bevoelkerungsschutz/Brandschutz/FSK_Stand_Juni_2017_-_Druckversion_Extern.pdf)
- Vansevenant, D.: *Paragon: ein neues und nachhaltiges Krisenmanagement-Tool* (https://centredecrise.be/sites/default/files/Comm_Paragon_NewsLetter1_DE.pdf)
- Zimmermann, E.; Ganser, M.: *Dreiländerübung: 450 Einsatzkräfte üben den Ernstfall*, 10th November 2018 (<https://brf.be/regional/1227439/>)

3. Flood management in the Danube Basin

3.1. Executive Summary

This case study shows how cross-border cooperation can contribute to enhance resilience against flood prevention, strengthening preparedness, and response in transboundary areas. It also highlights practical and effective tools and initiatives developed through joint endeavours to address floods, mostly within the framework of territorial cooperation projects. The focus is on flood management approaches and mechanisms in the Middle and Lower Basins of the Danube with particular emphasis on areas where the river serves as the international border (Hungary/Slovakia, Serbia/Romania, and Romania/Bulgaria).

The main disaster and risk management components addressed by this case study are:

- Planning, prevention measures planning, response contingency planning, financial planning investments, pooling of response resources;
- Early warning, public warning, situational awareness, real-time data exchange;
- Response cooperation, structures/arrangements for joint response, training/exercises;
- Risk communication with population, civic engagement in resilience building, volunteering;
- Nature based solutions, working with natural processes including building partnerships with stakeholders;
- Comprehensive approaches for cooperation over a longer period.

Due to the complexity of the Danube River Basin, which spans multiple countries with diverse economic and environmental management requirements, coordinated basin management is essential.

The case study sheds light on the policy and strategic instruments and frameworks for cooperation on transboundary water management in the Danube River Basin such as the Danube River Protection Convention (DRPC), the EU Strategy for the Danube Region (EUSDR)³⁹. Special focus is put on the International Commission for the Protection of the Danube River (ICPDR) for its role in triggering stronger coordination including in border areas through the Danube River Basin Management Plan and the Danube Flood Risk Management Plan. Issues of interaction between national and regional approaches, as well as international frameworks are also addressed.

The role of transnational cooperation in the Danube Region for addressing flood risk is emphasized with particular focus on the legacy of the EU Danube Transnational Programme 2014-2020 exemplified by several projects. The collaborative practices that are showcased, not only reflect the dedication of the Danube countries but also serve as valuable and potentially replicable examples for regions facing similar challenges in addressing floods.

3.2. Introduction

This case study delves into flood protection approaches and mechanisms in the Danube basin countries, with a specific focus on the Middle and Lower Basins of the Danube. The

³⁹ <https://danube-region.eu/>

examination is particularly concentrated on instances where the Danube is also a national border. The case study investigates the cooperative efforts of Danube countries in Central and Eastern Europe and explores the legal frameworks and procedural protocols these countries have established individually and bilaterally. The case study sheds light on practical and effective tools and initiatives developed through their joint endeavours to address floods.

These collaborative practices not only exemplify the commitment of the Danube countries but also provide valuable examples for other regions confronting similar challenges in addressing floods. Finally, the case study addresses issues of interaction between national and regional approaches, the role of international stakeholders such as the International Commission for the Protection of the Danube River (ICPDR) and frameworks.

The Danube River is the second longest river in Europe (2,857 km) and its basin covers 817,000 square kilometres. The Danube passes through numerous large cities – including four national capitals: Vienna; Bratislava; Budapest and Belgrade and is an international border between Hungary and Slovakia; Serbia and Romania; and Romania and Bulgaria.

The river is also critical for the generation of hydropower, navigation, agriculture, recreation, water supply and the natural environment. The high risk of flood damage is a major challenge across the Danube River Basin, particularly along the Tisa River and its tributaries. Additionally, the Danube, the Mura-Drava and the Sava River Basins are flood prone areas. Major flood events in the Danube River Basin of the recent past occurred in 2002, 2005, 2006, 2009, 2010, 2013 and 2014. Many of the floods that affect the Danube region are transboundary in nature and can have significant impacts on multiple countries.

Figure 14 Flood hazard and floodings scenarios



Source: <https://www.efas.eu/en/news/danube-flood-risk-management-plan-2021-and-efas>

The Danube River Basin can, based on its gradients, be divided into three sub-regions: the upper basin, the middle basin, and the lower basin (including the Danube Delta). The Upper Basin extends from the source of the Danube in Germany to Bratislava in Slovakia. The

Middle Basin is the largest of the three sub-regions, extending from Bratislava to the dams of the Iron Gate Gorge on the border between Serbia and Romania. The lowlands, plateaus and mountains of Romania and Bulgaria form the Lower Basin of the River Danube. Finally, the river divides into three main branches, forming the Danube Delta, which covers an area of about 6,750 km².

Coordinated management of the basin is necessary given the complexity of the Danube River Basin, which encompasses many countries with widely differing economic and environmental management needs, EU member states and accession countries. This becomes especially crucial considering the increasing frequency of major flood events in the Danube River Basin. It is of particular importance that all aspects of prevention, preparedness and response efforts are covered as part of the systemic and holistic cross-border collaboration. A coherent approach with river basin management planning is promoted by the Danube Flood Risk Management Plan which includes flood hazard maps and flood risk maps prepared for the catchments with an area larger than 4000 km². These maps illustrate the potential adverse consequences associated with different flood scenarios and serve as an effective tool for information, as well as a valuable basis for priority setting and further technical, financial, and political decisions regarding flood risk management (Figure 14 above).

3.3. Presentation

This section presents the policy frameworks relevant to transboundary water management in the Lower Danube River Basin, along with the institutions established to encourage transboundary basin-wide management and improve co-ordination at the river basin scale. These frameworks and institutions build upon existing national administrative arrangements which are also detailed below.

3.3.1. International policy and strategic frameworks

The Danube River Protection Convention (DRPC)⁴⁰ forms the overall legal instrument for co-operation on transboundary water management in the Danube River Basin. The Convention was signed in 1994 in Sofia (Bulgaria) by eleven of the Danube Riparian States – Austria, Bulgaria, Croatia, the Czech Republic, Germany, Hungary, Moldova, Romania, Slovakia, Slovenia, and Ukraine – and the European Community. The Convention came into force in 1998. Its objective is to ensure the sustainable and equitable management and use of surface waters and groundwater within the Danube River Basin. This includes the implementation of preventive measures to control hazards arising from accidents involving floods. The signatories to the DRPC have agreed to co-operate on fundamental water management issues by taking "*all appropriate legal, administrative and technical measures to at least maintain and where possible improve the current water quality and environmental conditions of the Danube River and of the waters in its catchment area, and to prevent and reduce as far as possible adverse impacts and changes occurring or likely to be caused.*"⁴¹

In line with these initiatives and to further strengthen the cooperation of the Danube countries in addressing common challenges, **the EU Strategy for the Danube Region (EUSDR)**⁴² was developed and endorsed by the European Council in 2011. This macro-regional strategy aims to create synergies and coordination between existing policies, including with the DRPC through the **International Commission for the Protection of the Danube River (ICPDR)** and initiatives occurring across the Danube Region. The Action

⁴⁰ <https://www.icpdr.org/about-icpdr/framework/convention>

⁴¹ idem

⁴² <https://danube-region.eu/>

Plan of the EUSDR outlines specific measures and project examples in 12 thematic Priority Areas (PAs), with PA 5 (Environmental Risks) dedicated to addressing the common challenges of the region. This should be achieved by increasing the effectiveness of policies at EU, national and local level through improved cooperation. Concerning PA 5 (Environmental Risks), the identification of main issues is largely based on previous work conducted by the ICPDR.

With the Interreg Danube Transnational Programme, 2014-2020, new transnational cooperation in relation to flood risks has started. Currently, the Interreg Programme Danube Region 2021-2027 is one of the financing instruments of the EUSDR. The specific objectives of the programme address the need to strengthen transnational water management and flood risk prevention, forecast and response. Building on the legacy of the predecessor Danube Transnational Programme 2014-2020, the Interreg Programme Danube Region 2021-2027 will support transnational solutions for harmonizing flood and ice forecasting systems and creating integrated water and flood risk management plans.

Synergies across the thematic Priority Areas of EUSDR

There are opportunities for cooperation between PA 5 (Environmental Risks) and other priorities areas of EUSDR. Within the Danube Transnational Programme synergies have been explored between PA 5 and PA4 (Water Quality), which aims to ensure integrated water management and good quality of waters in the Danube River Basin. This was facilitated through capitalization process involving projects that addressed different water management issues from the 1st and 2nd calls of the Danube Transnational Programme (e.g. CAMARO-D, DanubeSediment, DriDanube and JOINTISZA, SIMONA, Danube Floodplain, Dareffort and MEASURE). PA 5 Environmental Risks also has linkages to PA 6 Biodiversity especially with regards to the promotion of nature-based approach to flooding and the role of floodplains for their potential to retain flood water. One of the Actions of the PA 6 Biodiversity focuses on stimulating the management and the ecological restoration of wetlands, particularly in the Danube delta.

Source: https://waterquality.danube-region.eu/wp-content/uploads/sites/13/sites/13/2019/11/Success_Stories_2017-2019_vegleges_compressed.pdf

3.3.2. Institutional landscape

The International Commission for the Protection of the Danube River (ICPDR)⁴³

The ICPDR is a transboundary river basin organization - established by the Danube River Protection Convention (DRPC) - that works to ensure the sustainable and equitable use of freshwater resources in the Danube River Basin for the benefit of over 80 million people. Since its establishment in 1998 by the Danube River Protection Convention, the ICPDR has served as a platform for the integrated management of water resources across the Danube River Basin.

The ICPDR is actively working to increase the safety of Danube communities by facilitating collaborative efforts among countries to reduce various risks including those associated with flooding. It is to be noted that the ICPDR does not specifically focus on border regions, which are typically addressed by bilateral commissions.⁴⁴ In 2000, the ICPDR contracting parties nominated the ICPDR as the platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). The ICPDR received a similar

⁴³ <https://www.icpdr.org>

⁴⁴ Interview.

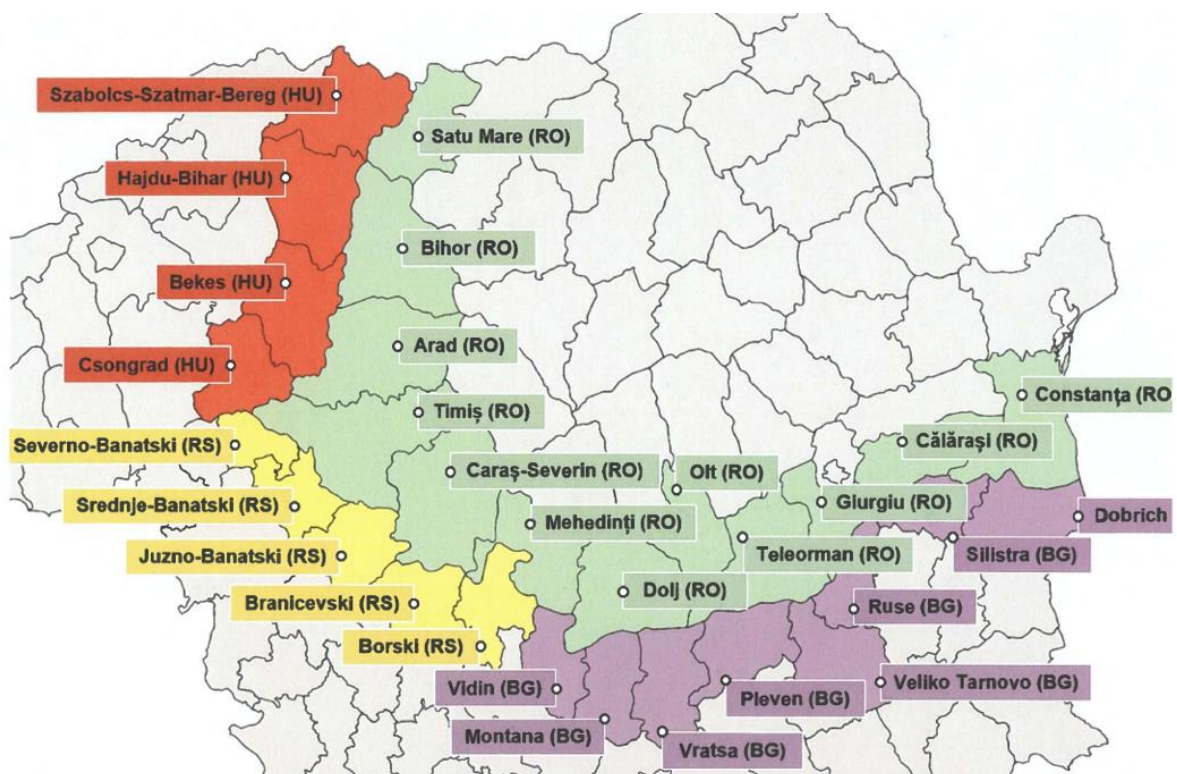
mandate in 2009 to support the coordination of the implementation of the EU Floods Directive.

In addition, the ICPDR provides guidance on the integration of climate change adaptation into ICPDR planning processes. This is addressed in the ICPDR Strategy on Adaptation to Climate Change⁴⁵ which advocates for collaborative action in a multilateral and transboundary context. The strategy serves as reference document influencing national strategies and activities related to climate change adaptation.

Country-level institutions⁴⁶

The national disaster risk management institutional landscape is typically coordinated by a central body or agency, which is responsible for overseeing the overall management of disaster risks in the country including flood risks. This central agency works closely with other agencies and organisations, both within and outside government, to ensure that the country is prepared for any type of disaster or emergency. The following section provides an overview of the national disaster management systems of the countries in the Danube Region presented in the case study.

Figure 15 Counties of Romania bordering Hungary, Serbia, and Bulgaria



Source: Expert input from the Ministry of Internal Affairs, Romania.

The disaster management system in **Bulgaria** is organized and coordinated by the National Crisis Management Centre (NCMC), which is part of the Ministry of Interior. The NCMC is responsible for the prevention, preparedness, response, and recovery efforts related to disasters and emergencies in the country. The Regional Governors of Vidin, Pleven, Ruse, Veliko Tarnovo, and Silistra organise and manage the disaster management in the border area, assisted by Regional Disaster Risk Reduction Councils. Voluntary formations

⁴⁵ https://www.icpdr.org/flowpaper/viewer/default/files/nodes/documents/icpdr_climatechangeadaptationstrategy_2.pdf

⁴⁶ https://environmentalrisks.danube-region.eu/wp-content/uploads/sites/7/sites/7/2022/10/Towards-a-macro-regional-disaster-management-framework-in-the-Danube-Region_v2.pdf

established at municipal level are under the direct authority of the mayor. They are created on a territorial basis and make an integral part of the Unified Rescue System.

In **Hungary**, the Ministry of Interior is responsible for coordinating disaster management efforts at the national level. The main agency responsible for implementing disaster management measures at the operational level is the National Directorate General for Disaster Management (NDGDM) which is responsible for developing and implementing disaster preparedness and response plans, providing support to affected communities, and coordinating the deployment of rescue and relief personnel and resources. In case of emergency, national or territorial defence committees coordinate the overall response activities with the involvement of relevant organizations. Also, Hungary has set up water committees with all neighbouring countries which serve as a platform for cooperation and coordination.⁴⁷

Integrating volunteers in disaster risk management activities was also one of the goals set for NDGDM to increase the efficiency of interventions and its ability to respond. Municipal volunteer rescue organisations with around 6,000 members were established and began to operate in more than 400 settlements. Rescue organisations trained to intervene independently mostly take part in technical rescue activities during heavy rain and storms.

The crisis management system in **Slovakia** is divided geographically, with each level of public administration playing its part in the system. The Ministry of Interior cooperates with other state authorities, self-governing regions, municipalities, legal entities, individuals and with public-legal institutions with the humanitarian mission that in case of emergency are deployed in rescue operations. Regional departments of civil protection and crisis management (at the district offices) plan, manage, and provide the activities relative to the protection of civil population in the case of an emergency. The volunteer system for disaster management is coordinated by the Ministry of Interior, through the State Fire and Rescue Service (SFRS). The SFRS is responsible for managing and coordinating emergency response and recovery efforts in the country.

In **Romania**, a central role in the system is played by the Ministry of Internal Affairs and its subordinated structure, the General Inspectorate for Emergency Situations (GIES) under the Department of Emergency Situations (DES). MoIA plays lead role in developing policies, and centralising assessments per legislation under the responsibility of other line ministries. At national level, the National Committee for Emergency Situations – CNSU (inter-institutional body) - is responsible for emergency management. At strategic level, the Department for Emergency Situation (DES) has coordinating powers for prevention and management of emergencies. The General Inspectorate for Emergency Situations (GIES) as integrator of the National Emergency Management System, ensures the integrated coordination of all prevention activities and management of emergency situations. At county and local level both the County Committee for Emergency Situations (CJSU), County Councils, the Local Committee for Emergency Situations (CLSU), Local Councils (municipality, town, and commune councils) including those in border areas, are responsible for coordination activities before, during or after flooding.⁴⁸

In **Serbia**, the Ministry of Interior is responsible for coordinating disaster management efforts at the national level, and the Serbian Armed Forces also play a role in disaster response. The main agency responsible for implementing disaster management measures at the operational level is the Sector for Emergency Management (SEM), which is responsible for developing and implementing disaster preparedness and response plans, providing support to affected communities, and coordinating the deployment of rescue and relief personnel and resources.

⁴⁷ Interview.

⁴⁸ <https://inundatii.ro/en/flood-risk-management/>

3.3.3. Danube-basin regional coordination frameworks

The sustainable management of flood risks is one of the key areas in which the ICPDR is active, assuming a key role in coordinating countries' efforts and activities also in border areas. In conjunction with its contracting parties, ICPDR has developed two management plans for the Danube River Basin, both of which were updated in 2021:

The **Danube River Basin Management Plan** aligned with the EU Floods Directive, focuses on the strategic management of flood risks across the entire river basin. The plan complements the national flood risk management plans, which provide more detailed information on measures such as flood maps.

The Danube Flood Risk Management Plan provides comprehensive information about flood risk management measures to be implemented in the Danube River Basin. The following objectives of the DFRMP were agreed upon by the ICPDR in 2015 and continue to form the backbone of the updated plan as of 2021: avoidance of new risks; reduction of existing risks; strengthening resilience; raising awareness and promoting the solidarity principle designed to prevent countries from simply exporting their flood problems to downstream neighbours.

To consistently support the implementation of the Danube Flood Risk Management Plan, the **Environmental Risks Priority Area (PA5)** has been set-up under the EU Strategy for the Danube Region (EUSDR). PA5 triggered the establishment of the Disaster Management Working Group (DM WG), which focuses on the emergency response and preparedness aspects of managing environmental risks. The DM WG actively supports the development of standards, procedures, training, and networking. It does not duplicate other services and instead serves as a complementary support in case of regional emergencies.

The Floods Directive with its requirement for transboundary coordination for river basins, has spurred enhanced collaboration in the management of floods among the Danube basin countries. This is evident, for example, in the preparation and updating of flood risk management plans which included regular exchange of information on bilateral basis with neighbouring country.

3.3.4. Bilateral legal and other cooperation mechanisms

The transboundary aspects of flood risk management between the neighbouring countries are addressed in the bilateral agreements and are regularly dealt with by the bilateral commissions. The comprehensive governance framework within the countries has been in place for several decades despite the political changes in the region.

Coordination activities concerning civil protection, including in relation to floods in cross-border areas of the Danube basin, are regulated through bilateral agreements with neighbouring countries. These agreements encompass protection against both natural and man-made disasters, as well as emergency situations. Additionally, there are bilateral agreements specifically addressing water management in cross-border areas. These agreements focus on issues related to prevention, preparedness, and intervention during emergency situations. Coordination is facilitated by bilateral thematic working groups set up within the framework of these agreements. In instances where agreements are pending finalisation, cooperation is arranged through a Memorandum of Understanding (MoU), as is the case with Bulgaria and Serbia. Under the MoU, coordination is carried out through a joint commission with focus on the monitoring programmes and assessment of the status of transboundary water bodies, programmes of measures concerning shared river basins and groundwater bodies, collaboration on joint projects in this field, etc.

Table 1 Bilateral agreements on flood risk management

Border	Bilateral agreements on flood risk management
Romania-Hungary	<p>An agreement between Romania and the Republic of Hungary on cooperation for the protection and sustainable use of water in the border region (Budapest, September 15, 2003), ratified by Government Decision no. 577/15.04.2004.</p> <p>Applies to the following rivers: Tur, Somes, Crasna, Barcau, Ier, Crisul Repede, Crisul Negru, Crisul Alb and Mures by hydrotechnical Romanian-Hungarian Commission.</p> <p>For carrying out the agreement, the Commission has established the following standing Subcommittees areas: 1. Coordination and development cooperation Subcommittee; 2. Subcommittee on Water Management and Hydrometeorology; 3. Subcommittee on water quality; 4. Subcommittee on flood defence.</p>
Romania-Serbia	<p>Cooperation is achieved until 2020 under the Agreement between the Romania and RPF Yugoslavia on hydraulic problems in hydraulic systems and watercourses that cross the border or are the border.</p> <p>On 5 June 2019, a new agreement regarding cooperation on sustainable cross-border water management was signed and entered into force on 1 September 2020. The agreement applies to the following rivers: the Danube, Nera, Moravita, Aranca, Bega Veche, Bega Channel, Timis, Caras and Nera by hydrotechnical Romanian-Serbian Commission.</p> <p>For carrying out the agreement, the Commission has established the following standing Subcommittees areas: 1. Subcommittee for water quality; 2. Subcommittee on hydrometeorology and quantitative water management; 3. Subcommittee on flood defence and ice.</p> <p>A special agreement regarding Iron Gates I and II exists also, named” The Convention between the Government of Romania and the Federal Government of the Federal Republic of Yugoslavia on the operation and maintenance of hydropower and navigation systems of Iron Gates I and II” signed in Drobeta-Turnu Severin in 1998.</p>
Romania-Bulgaria	<p>An agreement between the Ministry of Environment and Water Management of Romania and the Ministry of Environment and Water of the Republic of Bulgaria on cooperation in the field of water management (Bucharest, November 12, 2004), ratified by Government Decision no. 2419/21.12.2004.</p> <p>The agreement applies to the Romanian-Bulgarian Joint Commission through the following three working groups: 1. Working Group for river basin water management; 2. Working Group on Danube; 3. Working Group on the Black Sea.</p>
Bulgaria-Serbia	<p>A draft bilateral agreement is available and entitled “Agreement between the Ministry of Environment and Water of the Republic of Bulgaria and the Ministry of Agriculture and Environmental Protection of the Republic of Serbia on Cooperation in the Field of Water Management”.</p>
Slovakia-Hungary	<p>Intergovernmental agreement since 1978 inherited with partners after the formation of the Slovak Republic (SR) in 1993. The Treaty between SR and Republic of Hungary is ratified.</p> <p>Contracts between Slovakia and Hungary on regime and cooperation in common state border.</p>
Slovakia-Austria	<p>Treaty since 1970 inherited with partners after the formation of the SR in 1993. Treaty between Slovakia and Austria currently in the ratification process).</p>

Source:https://disastermanagement-danube.net/wp-content/uploads/2022/06/dfrrmp_update_2021_annexes_2-5.pdf

In some cases, cooperation takes place on a trilateral basis. For example, Serbia, Hungary, and Croatia manage cross-border ice control and protection through an international trilateral agreement. This agreement addresses events such as floods, ice-drift, or pollution in the section of the river known as the “section of common interest”, where such occurrences impact all three countries.⁴⁹

In 2000, the governments of Bulgaria, Romania, Ukraine, and Moldova signed the Lower Danube Green Corridor Agreement. This agreement aims to establish a green corridor along the entire length of the Lower Danube River (~1,000 km). Its goal is to protect and restore wetlands along the river reconnecting it to its natural flooding areas. This approach helps mitigate the risks of major flooding in the areas.

At the national level on the borders Romania/Hungary, Bulgaria/Romania, and Serbia/Romania there are bilateral agreements related to disaster risk and emergency management. Consequently, joint activities such as exercises, training sessions, and workshops are occasionally organised between the neighbouring countries. These events aim to test the intervention capabilities and operational procedures of the involved parties to prevent disasters and respond effectively to emergency situations. The joint efforts contribute to improving the overall resilience of the region against potential hazards. Additionally, such initiatives foster cooperation and mutual support between neighbouring countries, establishing a robust and reliable network of emergency responders in the region.⁵⁰

3.3.5. Data exchange and floods forecasting

Reliable hydrologic data provides the basis for a dependable flood forecasting system in the Danube Basin. Sharing of hydrological data is essential, particularly in cross-border areas. Countries participate in conventions for the exchange of hydrological data and other information related to transboundary waters. Additionally, bilateral exchange of hydrological information is common, given the importance of such collaboration for the management of international river basins.

Danube Flood Forecasting and Warning System (DFFWS)

An integral part of ICPDR flood risk management is the Danube Flood Forecasting and Warning System (DFFWS), a regional network of flood forecasting and warning centres, coordinated by the EC JRC in cooperation with ICPDR. The DFFWS aims to improve flood forecasting and warning in the Danube region by sharing data and expertise among the participating countries. Additionally, it focuses on the development and implementation of common flood forecasting and warning procedures.

Source: [Extending the range of flood forecasting | ICPDR - International Commission for the Protection of the Danube River](#)

While having a proper emergency plan is crucial in the countries most affected by the flood risk, an even more important aspect is the establishment of a robust forecasting system. The main objective of Interreg Danube **DAREFFORT project**⁵¹ is to develop a forecasting system based on the cooperation between the Danube Basin countries. The project delivered an overview of the present status of the national forecasting capabilities and outlined visions for future improvement.

⁴⁹ https://disastermanagement-danube.net/wp-content/uploads/2022/06/dfrmp_update_2021.pdf

⁵⁰ Expert analysis

⁵¹ <https://www.interreg-danube.eu/approved-projects/dareffort>

Table 2 Overview of future development plans of some of the Danube River forecasting services

Country	Future plans
Bulgaria	Hydrological forecasting process development (new early warning system, model development), automatic hydrometric stations development (i.e. more stations).
Hungary	Hydrological forecasting system development (e.g., new 1D hydraulic model), ice forecasting development.
Romania	Flash flood forecasting and warning development, development of snow water equivalent and rainfall grid data, use of ensemble forecasting, hydrological model development, hydraulic model development.
Serbia	Hydrological modelling of additional catchment, hydraulic model development, hydrological and meteorological gauging network development (e.g., number of stations).
Slovakia	Forecasting system development (e.g., hydrological models' development, use of probabilistic models).

Source: https://www.interreg-danube.eu/uploads/media/approved_project_output/0001/44/792bd0a7f7e56262de60d7875563df4357776ec8.pdf

3.3.6. Flood awareness

The European Flood Awareness System (EFAS)⁵² plays a key role in improving overall flood risk management in the Danube River Basin. The system facilitates knowledge exchange and promotes data sharing among national hydro-meteorological authorities. Developed in close collaboration with the ICPDR and the national hydro-meteorological services sharing the Danube River Basin, EFAS seeks to gain time for preparedness measures ahead of major flood events, particularly for large trans-national river basins such as the Danube.

The European Flood Awareness System (EFAS)

EFAS is the first operational European system dedicated to monitoring and forecasting floods across Europe. It provides complementary, added value information (e.g. probabilistic, medium range flood forecasts, flash flood indicators or impact forecasts) to relevant national and regional authorities. The EFAS medium-range flood forecast provides an overview of anticipated flood events for the next 10 days, including potential impacts. Updated twice daily EFAS forecasts are instrumental in sending flood notifications to EFAS partners when a high risk of flooding is predicted. Moreover, EFAS has the capability to warn the On-Demand mapping component to enable a faster mapping of a flood through pre-tasking.

Source: www.efas.eu

⁵² www.efas.eu

The Danube FLOODRISK project

The Danube Atlas is part of the Action Programme for Sustainable Flood Protection in the Danube River Basin of the ICPDR and, therefore is a significant contribution to the implementation of the EU Strategy for the Danube Region as well as to the implementation of the European Spatial Development Perspective. The main goal of this atlas is to raise citizens' awareness along the Danube River regarding their exposure to floods. The Danube Atlas represents areas exposed to flood hazard, along with the associated flood risk and the potential damages. The atlas, therefore, supports the prioritisation of measures within the Flood Action Programme, thereby advancing the goal of reducing the residual risk.

Source: <https://environmentalrisks.danube-region.eu/projects/danube-floodrisk/>

3.3.7. Aligning procedures

Commonly agreed standards, known as Standard Operating Procedures (SOP), play an essential role in enhancing the interoperability of the various regional units in case of floods. SOPs, specific for the Danube region, provide a framework for effective disaster management. They provide clear guidance on how to respond to an emergency, how to conduct response activities safely, and how to comply with legal and regulatory requirements. This aspect remains challenging for transboundary areas although efforts have been made to develop common procedures and frameworks. For instance, the Agreement between Bulgaria and Romania on cooperation in the field of emergency situations outlines procedures for facilitated border crossing for rescue teams as well as for the affected population in the event of large-scale disasters, necessitating the evacuation to neighbouring territory. The agreement also includes the use of aircraft and vessels for assistance. Additionally, provisions are in place regarding the transit of teams from one country through the territory of the other to assist a third country. The agreement extends to activities aimed at achieving interoperability of early warning systems.⁵³

Another example is the Agreement for collaboration in the protection and sustainable use of border waters between Romania and Hungary. The agreement establishes common regulations for the management of floods and accidental pollution in the shared border waters between the two countries. There are also examples of procedures/methodologies developed at local level across the borders as part of territorial cooperation projects. Some of these are presented below in Table 3.

Table 3 Examples of procedures developed at local level targeting cross-border areas

Type	Countries	Focus
Joint intervention plan	Bulgaria/Romania	Based on an Agreement between Giurgiu county (RO) and Ruse Regional directorate of firefighters and civil protection (BG); covers several types of risks among which floods.
Four common intervention methodologies in case of risks with cross-border impact; a collaboration agreement for emergency situations signed by the Caras-Severin County Council (RO) and the	Romania/Serbia	Covers a cross-border area represented by Cara -Severin and Timi counties from Romania and South Banat district from Serbia; part of the Sustainable Joint Network of Emergency Situations in Banat under Interreg-IPA CBC Romania -Serbia Programme; aimed to strengthen the operational and institutional capacity of

⁵³ Expert analysis

Municipality of Vrsac Serbia (RS), and a Green IT Platform - Warning Joint Network Emergency		local authorities responsible for emergency and disaster prevention.
Joint intervention rules in case of floods and earthquakes	Romania/Serbia	Developed as part of the project Strengthening the capacity of the Romanian and Serbian authorities to react in case of floods and earthquakes.
Common standard operating procedures of the Romanian-Serbian disaster mechanism	Romania/Serbia	The procedure covers Mehedinti county in Romania and Borski district in the Republic of Serbia.

Source: Expert analysis

3.3.8. Innovation

The role of innovation and technology to support disaster response (VR, drone, IT solutions, mapping) is essential including in transboundary areas. At the same time there is potential for flood management practitioners across the Danube River region to deepen and broaden their Research, Development, and Innovation (RDI) related collaboration.

DAREnet project: improving flood resilience through innovation

Financed by the EU Horizon2020 programme DAREnet (Danube River Region Resilience Exchange Network) project built a multi-disciplinary community of practitioners, operating in a network of civil protection organizations, and supported by a broad range of stakeholders from policy, industry, and research. DAREnet presented a regularly updated RDI Roadmap that highlighted promising innovation opportunities to cope with the main challenges in the region and improve flood resilience in the future. The project drew upon synergies with the modules and facilities of the UCPM and the regional strategies for flood prevention and risk management of the ICPDR and EUSDR.

Source: https://environmentalrisks.danube-region.eu/wp-content/uploads/sites/7/sites/7/2022/10/Towards-a-macro-regional-disaster-management-framework-in-the-Danube-Region_v2.pdf

3.3.9. Capacity building

Field exercises and trainings

Overall, training is an essential aspect of disaster management, as it helps to ensure that rescue staff volunteers are well-prepared, equipped, and capable of responding effectively to disasters, in a coordinated and efficient manner.

There are inspiring Initiatives at local level, such as the establishment of a regional cross-border training centres for integrated preparedness for interventions in case of emergencies located in the Bihor Hajdu-Bihar cross-border area between Romania and Hungary. The activities also included the installation of the Virtual Environment Training Platform and the training of internal staff who will use the training platform to ensure preparedness at local level. Additionally, there is a training programme designed for both professionals and volunteers. Another example is the PROFOUND project, as presented in the following box.

The PROFOUND project - establishing a common framework for capacity building and training

The PROFOUND (Procedures of Rescue Organizations in Flood Operations Unified in the Danube Region) project aimed to improve the cooperation of NGOs on flood response in Hungary, Slovakia, and Romania, and also their neighbouring countries in the Danube Region. With funding from the EU, participating organizations had the opportunity to establish a common framework for capacity building and trainings, to improve their SOPs, and coordinate with the UCPM.

The full-scale field exercise was designed to test macroregional flood response at multiple locations by simulating the escalation of the scenario from local through cross-border to regional/EU levels. Exercise scenarios were developed to recreate the complexity of real-life emergency situations, drawing from past events and identification of local risks and hazards along the Danube, Tisa and Somes Rivers.

Key findings about the possibilities of future cooperation include:

- There are many experienced rescue divers in the Danube Region, and their knowledge should be shared across the entire regional rescue community through common training and exercising;
- There is still no internationally agreed-upon minimum standard for rescue diving. Initiating an EU-wide discussion, supported by DG ECHO, is crucial to establishing common requirements for rescue divers and developing a standardized system, at least for minimum standards;
- Developing a common communication platform is essential for effective coordination;
- Capacity building efforts are needed to reach the minimum standards of international deployments;
- Raising awareness and implementing safety and security procedures are important measures for improving overall preparedness;
- Host Nation Support should provide interpreters to assist foreign teams.

Source: Interview and http://darenetproject.eu/wordpress/wp-content/uploads/2023/04/Towards-a-macro-regional-disaster-management-framework-in-the-Danube-Region_v2.pdf

PA5 already started capacity-building activities, by organising a large-scale field exercise in the Upper-Tisa River. Over 100 participants took part and trained together in this participant-driven exercise, providing a platform for the responders to improve their interoperability and readiness for floods.⁵⁴

Education

The Danube Flood Risk Management Plan⁵⁵ includes measures related to flood protection education and proposes the development of an education network based on the experience in this field. In 2016, under the coordination of the Danube Region Strategy (EUSDR PA5) the National University of Public Service Hungary signed a Collaboration Framework Agreement with German, Slovakian and Serbian universities. The objective was to develop an international curriculum on flood protection engineering. Subsequently, the University of

⁵⁴ Study-on-operative-flood-management-plus.pdf

⁵⁵ https://disastermanagement-danube.net/wp-content/uploads/2022/06/dfrmp_update_2021_annexes_2-5.pdf

Public Service of Hungary launched a Master of Arts programme in International Water Governance and Water Diplomacy for the academic year of 2020. This programme offers up-to-date, practice-oriented education for professionals engaged in transboundary or global environmental issues.

Volunteer capacity for disaster prevention and response

Frequently, language barriers and different rules and regulations hinder the establishment of efficient cross-border or international joint forces and volunteer networks. The CODE VDIC project, presented below, addresses this problem and in particular the need to strengthen emergency preparedness and response. The project focuses on creating new volunteer capacity in a form of a cross-border network. It stands as an interesting example of developing a complex, innovative, local level disaster intervention recovery logistics, and prevention system on the most endangered segment of the border area of Hungary, Slovakia, Romania, and Ukraine.

CODE VDIC project - building cross-border volunteer capacity

The ENI and ERDF co-funded CODE VDIC project stands for “Common Development of Volunteer Intervention Capability”. The project brings together partner organisations from Hungary, Romania, Slovakia, and Ukraine that face common disaster risks across the borders. These risks include also floods particularly in the border area of the four countries, which is part of the Tisa River basin - a main tributary of the Danube.

The new regional disaster management methodology developed by the project comprises a minimum set of priority interventions required for each county in the programme area. This methodology aims to assist in establishing the necessary enabling environment and capacities to manage disaster risks. CODE VDIC focuses on developing easily transferable capacity building methodologies and setting up a transnational network, laying the foundation for a trans-border protocol for civil disaster management volunteer organizations. Also, the project aims to formulate common procedures to be shared by all potential actors involved in risk prevention and disaster management at macro-regional level.

By elaborating a joint methodology and common tools, the project helps to improve the capacity to respond effectively to disasters. The innovative aspect of the project is the application of a new risk assessment technology for cross-border disaster management capacity building.

Source: Interview; <https://keep.eu/projects/23034/Common-Development-of-Volun-EN/>

3.3.10. Nature based solutions in flood management

In the Danube basin climate change is expected to exacerbate flood risk particularly in former floodplains, which have been drained and cut off from their rivers to allow for human settlement and agriculture.

Figure 16 A potential floodplains restoration area analysed under the Danube Floodplain project. The Lower Danube River around Belene, close to BG-RO border.



Source: <https://interreg.eu/interreg-highlights/cooperation/cross-border-cooperation-when-floods-cross-borders/> (WWF-Romania)

While flooding cannot be prevented, restoring rivers to a more natural state, and implementing sustainable measures across the basin can significantly reduce the frequency and damage caused by floods. (ICPDR, 2015). The Danube Flood Risk Management Plan Update 2021 gives special attention to measures targeting areas which have the potential to retain flood water, such as natural floodplains as well as the other areas enabling controlled flooding.⁵⁶ Key lessons drawn from the 2010 floods have shown that the risk of flood damage could be dramatically reduced by creating dry polders, revitalising floodplains and providing regular maintenance of river channels to ensure unhindered flow during extreme flooding events. These solutions are equally relevant for cross-border areas, and transnational cooperation contributed with new ideas that partners are applying in their respective territories.

⁵⁶ <https://www.icpdr.org/about-icpdr/framework/4th-icpdr-ministerial-meeting-2022-icpdr-contracting-parties-renew-their>

Danube Floodplain project

Based on a nature-based approach to flooding, Interreg Danube project Danube Floodplain provides solutions to reduce the risk of floods in urban areas by reconnecting the river to its floodplains. The project focuses on improving transnational water management and flood risk prevention while maximizing benefits for biodiversity conservation. It developed tools for ministries, river basin authorities and other stakeholders in Danube River basin for floodplain restoration. Using a Geographic Information System (GIS) tool called Danube Floodplain GIS, the project identified areas best suited for this purpose. These were areas with natural capacity to retain floodwaters, while concurrently having potential for biodiversity improvement and delivering benefits to local economies, for example through fisheries and recreation.

Source: <https://interreg.eu/interreg-highlights/cooperation/cross-border-cooperation-when-floods-cross-borders>

3.4. Conclusions and lessons learnt

International agreements for better water and river management have been a powerful tool for initiating change in the Danube River Basin. Over the past decades, the ICPDR has been entrusted with a clear mandate to coordinate flood risk management on Danube River Basin District based on the Danube River Protection Convention (DRPC) and the EU Floods Directive. The transboundary aspects of flood risk management among neighbouring countries are addressed by bilateral agreements and the respective bilateral commissions.

The territorial cooperation projects, supported under the Danube Transnational Programme 2014-2020, along with other cross-border cooperation programmes, contributed to strengthening the cooperation on all aspects of flood protection, prevention, and mitigation for transboundary or bordering rivers. The EUSDR PA5 has also provided a mechanism for developing related projects on flood risk management. Progress has been achieved in the international exchange of meteorological and hydrological data, the harmonisation of the flood alert and warning systems in transboundary basins with the neighbouring countries, and the preparation of joint procedures related to communication in case of emergency, intervention, monitoring and notification, border crossing procedure, etc.

In the pursuit of increased resilience, countries have garnered valuable experience in applying nature-based solutions in transboundary areas, by improving the natural capacity to retain and release peak floods. The findings from the studies conducted in pilot locations as part of the Danube Floodplains project⁵⁷ provide valuable insights and recommendations for similar restoration projects in other floodplains along the Danube and its tributaries.

Interreg Danube Region Programme 2021-2027 aims to continue the cooperation building on the achievements to date. Despite the funding of valuable projects in the field of flood risk management along with the developed and tested solutions, strategies and tools, there are still challenges that need to be tackled. Bilateral disaster risk management is an area where improvements are still needed, as highlighted by the EUSDR Environmental Risks Priority Area:

- The development of a flood-defence related data exchange system will be important for the Danube countries, including cross-border areas. The establishment of the Danube Hydrological Information System (DanubeHIS) represents a fundamental

⁵⁷ <http://www.interreg-danube.eu/approved-projects/danube-floodplain>

step towards flexible and sustainable data exchange, enhancing access to recorded hydrologic and ice data;⁵⁸

- Improved coordination is essential, involving the development of joint plans and procedures for flood management and civil protection. This includes evacuation plans and procedures, emergency rescue plans, etc. with a focus on leveraging the benefits of civil protection systems for shared flood basins or stretches of common interest to better use the available resources;
- Identification of pilot areas for coordinated action is important, as well as regular organization of cross-border exercises for flood and civil protection;
- Building cross-border volunteer capacity is achievable through the exchange of knowledge and experience, along with joint trainings for common disaster management.

3.5. Links to other possible activities

A comprehensive list of transboundary projects supporting Danube Flood Risk Management Plan is available in Annex 2 of the Plan prepared by ICPDR⁵⁹.

The projects or project proposals/ideas presented were developed by the ICPDR and/or EUSDR PA51 and they shall among other things:

- Reflect the objectives and priorities set in this Danube Flood Risk Management Plan;
- Have a transboundary character;
- Help to address the identified needs.

There is no ranking or prioritization of these projects, they are all considered as supportive to the implementation of the Danube Flood Risk Management Plan.

3.6. Bibliography

- 1st Danube River Basin Flood Risk Management Plan, including Annex 1 (Flood hazard and flood risk maps) available at [icpdr.org/sites/default/files/nodes/documents/1stdfrmp-final.pdf](https://www.icpdr.org/sites/default/files/nodes/documents/1stdfrmp-final.pdf)
- 2020, Study on flood operative management plans available at Publications - PA 05 (danube-region.eu)
- CODE VDIC project
- Danube Flood Risk Management Plan (DFRMP) Update 2021 available at https://www.icpdr.org/sites/default/files/nodes/documents/dfrrmp_update_2021_hires_0.pdf
- Danube Floodplain project
- DANUBE FLOODRISK project

⁵⁸ DAREFFORT project, interview.

⁵⁹ https://disastermanagement-danube.net/wp-content/uploads/2022/06/dfrrmp_update_2021_annexes_2-5.pdf

- Danube Region Programme 2021-2027 available at <https://www.interreg-danube.eu/uploads/media/default/0001/54/b5605371ce8b4dd872b8ccd77f66da9ca806c033.pdf>
- Danube River Basin Management Plan, Update 2021 available at https://www.icpdr.org/sites/default/files/nodes/documents/ic231_drbmp_update_2021_draft_v10.pdf
- DAREFFORT project
- Expert input from the Ministry of Internal Affairs, Romania.
- https://codevdic.polgvedsujhely.hu/wp-content/uploads/2020/09/CODE-VDIC_NEWSLETTER-no-1_2020_August.pdf
- <https://danube-region.eu/>
- <https://www.interreg-danube.eu>
- ICPDR, Lessons from the Danube available at [lessons-from-the-danube-a-world-leader-in-transboundary-river-basin-management.pdf](https://www.icpdr.org/sites/default/files/nodes/documents/lessons-from-the-danube-a-world-leader-in-transboundary-river-basin-management.pdf) (icpdr.org)
- Interview with representative from National DG of Water Affairs, EUSDR PA5, Hungary
- Interview with representative from ICPDR
- Interview with representatives from Faculty of Environmental Science and Engineering, Babes-Bolyai University, Romania
- IRMO, Biodiversity cross-cutting issues through Priority Areas of the European Strategy for the Danube Region, 2022, available at <https://nature.danube-region.eu/wp-content/uploads/sites/9/sites/9/2022/12/Biodiversity-cross-cutting-issues-through-PAs-of-the-EUSDR.pdf>
- PROFOUND project
- Success stories 2017-2019 EU Strategy for the Danube Region priority areas 4&5, available at https://waterquality.danube-region.eu/wp-content/uploads/sites/13/sites/13/2019/11/Success_Stories_2017-2019_vegleges_compressed.pdf
- Towards a macro-regional disaster management framework in the Danube Region available at https://environmentalrisks.danube-region.eu/wp-content/uploads/sites/7/sites/7/2022/10/Towards-a-macro-regional-disaster-management-framework-in-the-Danube-Region_v2.pdf
- www.icpdr.org

4. Digital tools and communication systems for Disaster Risk Management

4.1. Executive Summary

This case study shows how digital applications and tools can make cross-border cooperation and communication more effective in enhancing the capability to manage risks. The study illustrates three inspiring examples of collaboration, i.e. in the development of warning systems and improving response efficiency to various hazards in Norway, Finland, and Sweden; in the management of insect-related health risks between Romania and Bulgaria; and regarding the integrated hydro-meteorological risk management framework established between Italy and Croatia. The main disaster and risk management component addressed by this case study is Innovation using new technologies; and digital tools.

The **Haga Cooperation**, involving five Nordic countries, has been instrumental in initiating and fostering cross-border radio communication cooperation. The extensive border between Norway, Finland and Sweden highlights the need for uninterrupted communication to ensure timely interventions during emergencies. The TETRA technology offers valuable features for emergency services, including group communication and interoperability with other systems. The ongoing migration from TETRA to 4G and 5G technologies is a significant development, with potential benefits for mission-critical solutions. Success factors include committed partners, high visibility through the Haga declaration, adequate funding, and continuous engagement with end-users. Regulatory alignment is also identified as a crucial factor for successful cross-border cooperation. The alignment with EU policy is evident through the BroadNet project, contributing to a pan-European system of national Mission Critical broadband systems. Interconnecting emergency communication networks contributes to EU Disaster Resilience Goals by enhancing warning systems and improving response efficiency to various hazards. Lessons learned from the interconnected networks are shared in the "Mission Critical Communications" expert group. Challenges include navigating different legislation, roles, and systems among countries, necessitating ongoing discussions and knowledge sharing. The transition to 4G and 5G technologies is viewed positively for its potential to provide comprehensive coverage and address communication challenges in mission-critical scenarios.

The **INSECTRISK** project serves as a model for effective cross-border cooperation in addressing insect-related health risks. The cross-border region between Romania and Bulgaria, intersected by the Danube River, faces increasing challenges due to the proliferation of mosquitoes and ticks, exacerbated by climate and environmental changes. The resultant spread of diseases, including exotic viruses like Zika, necessitates urgent and coordinated efforts. The INSECTRISK project, initiated in response to these concerns, introduced the "Joint Strategy on the Sustainable Management of Excessive Insect Proliferation in the Cross-Border Region Romania-Bulgaria". This collaborative strategy, formulated in 2017 by the Association of Danube River Municipalities and NGO Natura Vie, aims to address insect-related health risks. The project involves 72 municipalities committed to sharing information on a Geographic Information System (GIS) platform. This facilitates effective planning for insect treatments, a crucial component of the project success. The initiative focuses on three key objectives: strengthening cross-border risk management; enhancing knowledge management through GIS; and fostering better cooperation among relevant institutions in insect-related risk management. The success of the INSECTRISK project is attributed to a robust partnership, built on previous collaborations. Transparency and accountability are fundamental principles of the partnership. Aligned with EU policies, particularly the Danube Region Strategy, the project addresses environmental risks in the region. Despite challenges related to political instability, the COVID-19 situation, and regional disparities, the project's resilience is maintained through corrective measures.

The **AdriaMORE** project, funded by the EU through the INTERREG A Italy-Croatia Programme, unites four partners from Croatia and Italy. Its primary focus is the enhancement of the integrated hydro-meteorological risk management platform along the Adriatic coast, building on the accomplishments of previous initiatives such as ADRIARadNet and CapRadNet. These initiatives aimed at establishing a cross-border infrastructure for observing and forecasting systems dedicated to civil protection. AdriaMORE's key objectives encompass strengthening the existing monitoring system, integrating maritime environmental data with hydrometeorological information, improving hydro-meteo-marine risk forecasting, and evaluating the impact of coastal floods on various parameters. Notably, the project addresses the need for historical flood data, leveraging hydrological modelling from prior projects to assess hydro-meteorological risks. A significant innovation is the integration of a hydro-meteo-marine forecast system into the existing ICT framework, marking a pioneering effort for civil protection applications. Key achievements include the development of a decision support system for observing and forecasting high hydro-meteorological risk scenarios. This involves the creation of a weather radar composite software, an enhanced hydrological model (CHyM) for coastal flood prediction, an air-sea coupled prediction system for the Adriatic area, and a satellite data processing procedure for environmental bio-chemical indicators. Aligned with EU policies, especially the Flood Risk Management Plan, AdriaMORE aims to contribute to long-term efforts in reducing flood risks in Croatia and Italy through advanced forecasting systems.

The solutions featured in the areas of cross-border communication, in the management of challenges such as insect proliferation to safeguard public health, and to address hydro-meteorological risks are potentially replicable in other areas of the European Union.

4.2. Introduction

The case study represents an overview of different digital tools used for Disaster Risk Management (DRM) across Europe. It will feature innovative solutions identified during the development of the study "Strengthening the resilience of EU border regions: Mapping risks & crisis management tools and identifying gaps" commissioned by DG REGIO at the end of 2022 and implemented by a consortium led by Technopolis Group, together with CMCC and Nordregio.

The goal of the case study will be to feature several digital solutions and governance models which are originally implemented in certain border areas, but which could be replicated or inspire other border areas to implement them.

4.3. Presentation

In this case study the following solutions will be presented:

- Sweden, Norway, and Finland robust and secure communications;
- INSECTRISK project: Development and adoption of a joint institutionalized partnership on risk management on excessive proliferation of insects affecting public health and safety within the cross-border region Romania-Bulgaria;
- AdriaMORE: Adriatic DSS exploitation for MOonitoring and Risk management of coastal Extreme weather and flooding.

Table 4 presents a summary of the key features of the solutions discussed in this case study.

Table 4 Key features of the solutions presented in the case study

Solution	Brief description
Nordic cooperation in communications	<p>Specific Objective: Facilitating cross-border communication in the context of public safety and emergency services</p> <p>Total budget: this information is not publicly available</p> <p>Partners: Nødnett (Norway), VIRVE (Finland), Rakel (Sweden)</p> <p>Start/End date: From 2009 (First Haga cooperation), the collaboration is ongoing</p> <p>Website : https://www.nodnett.no, https://www.erillisverkot.fi/en/, and https://www.rakel.se</p>
INSECTRISK	<p>Specific Objective: To improve joint risk management in the cross-border area of Romania and Bulgaria</p> <p>Total budget: EUR 1 212 474.94</p> <p>EU funding: EUR 1 030 603.70 (ERDF)</p> <p>Partners: the Association of Danube River Municipalities (Bulgaria) and the NGO Natura Vie (Romania)</p> <p>Start/End date: 03.02.2016 - 02.02.2018 (24 months)</p> <p>Funding instrument: INTERREG V-A Bulgaria- Romania 2014-2020</p> <p>Website: http://www.bugis-robq.eu/</p>
AdriaMORE	<p>Specific Objective: Improve an existing integrated hydro-meteorological risk management platform focusing on the Adriatic coastal areas of Italy and Croatia</p> <p>Total budget: EUR1.150.000 €</p> <p>EU funding: EUR 977.500 € (ERDF)</p> <p>Partners: Abruzzo Region (Italy – Lead), Dubrovnik and Neretva Region (Croatia), Meteorological and Hydrological Service (Croatia), Institute of Atmospheric Sciences and Climate (Italy)</p> <p>Start/End date: 01.2018 – 06.2019 (18 months)</p> <p>Funding instrument: INTERREG V-A Italy – Croatia 2014-2020</p> <p>Website: http://cetemps.aquila.infn.it/adriamore/</p>

Source: Websites of the solutions presented. For precision, the Nordic cross-communication is undertaken by the three national agencies and not in the framework of one dedicated project.

It is interesting to highlight the fact that the digital solutions featured are diverse in terms of geographical scope covered and the types of risks addressed, including cross-border communication and the management of challenges such as insect proliferation to safeguard public health and hydro-meteorological risks.

4.3.1. Sweden, Norway, and Finland robust and secure communications

Sharing information and experience across national borders is important at the political, strategic, and operational levels. **Nødnett** is connected to its counterparts in Finland (**VIRVE**) and Sweden (**Rakel**), using the **TETRA** standard ISI (Inter System Interface). ISI allows communication between different networks and makes it possible to migrate with radio terminals to other networks. The box below presents a small definition of the key actors and concepts for the case study.

Presentation of key actors and concepts for the case study

- **Nødnett** is a digital public safety radio network used in Norway. It is a dedicated communication network designed for emergency and public safety services, including police, fire departments, ambulance services, and other agencies responsible for public safety and emergency response. The term "Nødnett" translates to "emergency network" in English. Nødnett provides secure and reliable communication for these critical services, allowing them to coordinate their efforts, share information, and respond effectively to various emergencies, disasters, and incidents. The network is designed to ensure robust and resilient communication, even in challenging conditions, such as natural disasters or large-scale emergencies. The system is operated and maintained by the Directorate for Emergency Communication (DNK); a government agency responsible for ensuring that public safety agencies have access to the necessary communication tools to perform their duties effectively. Nødnett is an important part of Norway's overall emergency preparedness and response infrastructure.
- **VIRVE** is a dedicated digital mobile communication network used by various public safety and emergency services in Finland. It is similar in purpose to Nødnett in Norway or Rakel in Sweden. It is designed to provide secure, reliable, and efficient communication for public safety agencies, including the police, fire departments, medical services, and other government authorities involved in emergency response and public safety. It allows these agencies to coordinate their efforts, share critical information, and communicate effectively during various emergency situations, including natural disasters, accidents, and other incidents. The network is operated and maintained by the Finnish government and is a crucial part of Finland's public safety and emergency response infrastructure. It offers features and capabilities specifically tailored to the needs of first responders and other emergency services.
- **Rakel (Radio Communication for Public Safety)** is a digital communication network used for public safety and emergency services in Sweden. Rakel also provides secure and reliable communication capabilities for various agencies involved in public safety and emergency response, such as the police, fire departments, ambulance services, and other government authorities. The network is operated and maintained by the Swedish government and is an integral part of Sweden's national infrastructure for public safety and emergency services.
- **The Terrestrial Trunked Radio (TETRA)** is a digital mobile radio communication standard used primarily for public safety and emergency services, as well as for other critical communication needs such as transportation, utilities, and industrial applications. TETRA provides secure, reliable, and efficient two-way communication for various organizations and agencies. The TETRA ISI (Information Security Infrastructure) standard is used to ensure the security of TETRA networks, including encryption, authentication, and access control. These security measures help protect the confidentiality and integrity of communications in cross-border scenarios. TETRA is considered as a mission-critical technology for public safety and emergency services.

Cross-border communication and cooperation among Norway, Finland, and Sweden, particularly in the context of public safety and emergency services, are essential to address emergency situations and ensure effective responses in the northern regions of Europe. The cooperation between these countries involves various aspects of public safety and communication. Indeed, for an efficient use of the TETRA networks, **joint exercises and trainings** are often organised. This ensures that their public safety personnel are familiar

with cross-border communication protocols and can effectively collaborate during crises. Norway, Finland, and Sweden also collaborate by **sharing real time information** between Nødnett, VIRVE and Raket. This includes sharing situational awareness, incident data, and other relevant information. This is critical during emergencies that affect border regions.

It is important to highlight that the **Haga cooperation** played a key role in launching the cross-border radio communication cooperation between Norway, Finland, and Sweden. The Haga cooperation is a framework for collaboration among five Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) that aims to strengthen their ties and foster cooperation on various issues, particularly in crisis management, during emergency situations that may affect the region. Cooperation on emergency communication is a priority for the Haga cooperation, future areas of interest identified by Nordic Ministers responsible for civil protection and preparedness include civil-military cooperation, hybrid threat and the importance of the Nordic/Arctic region in the fight against climate change.

As mentioned during the interview conducted with a representative from the Swedish Civil Contingencies Agency, MSB, there is a long border between Sweden and Norway and people cross it every day. It is important to note that the border regions are sparsely populated, and it might take additional time for ambulances to come.

Figure 17 Map outlining the shared borders between Norway, Sweden, and Finland



Source: authors

Interconnecting the emergency communication systems is the best way to intervene faster and more efficiently to save lives. Indeed, on numerous occasions the Swedish rescue services crossed the border to intervene in Norway (and vice-versa). In this situation, the operator that answers the call in Sweden makes the decision to involve the Norwegian authorities if needed. Regulatory and legislative alignment is key for cross-border cooperation. In this specific example, when the Swedish police crosses the border, they are required by the Norwegian authorities to lock their firearms. The various end users (such as police, fire departments, medical services, etc.) are trained and aware of the different regulation and requirements to follow when crossing each border, which makes their intervention more efficient and targeted.

The key stakeholders involved in connecting the emergency communication networks of Norway, Finland and Sweden are the three emergency networks at the national level (Nødnett, VIRVE and Raket). The largest groups of end users are the police, fire departments, ambulance services, and other government authorities.

The TETRA technology offers several useful features such as group communication, enabling users to talk to predefined groups of users simultaneously. This feature is especially valuable for emergency services and public safety organizations. Furthermore, TETRA networks can be designed to be interoperable with other communication systems, making it possible for different agencies to communicate with each other during joint operations or emergencies.

One of the key developments in the area is the migration from TETRA to 4G & 5G technologies. As stressed by the interviewee, this migration is a demanding process that will take several years. During the migration period, operations must continue without any breaks or service level deviations. This is particularly important in public safety and other

critical organisations and processes. This is why the end-users' needs must drive the planning⁶⁰. Many countries within the EU are doing this transition in the upcoming years within different timeframes. While Sweden and Norway intend to complete the migration to 4G and 5G systems by 2028-2029, Finland is ahead in the process. The diverging timeframes are a vital aspect to consider as cross border functionality needs to be up and running during the transition. Furthermore, there are ongoing discussions about adding Denmark (Sine) to the communication cross-border functionality, however this will only be possible once the transition is completed (using 4G and 5G technology and not the TETRA networks). Other EU countries are trying to replicate the example of Norway, Finland and Sweden and are assessing how to be interconnected with the 4G and 5G systems.

Key success factors include committed partners and high visibility (especially through the Haga declaration in the framework for the Haga cooperation). This highlights the strong governmental commitment and political will from Norway, Finland and Sweden having common goals. An interviewee has also identified adequate funding as an important factor of success as well as continuous end-user engagement. Indeed, involving end-users is very central as they are the ones using the TETRA networks daily and will be key in fine-tuning the transition towards 4G and 5G technologies. The regular training and exercises at the operational level, along with policy-level meetings, ensure alignment and smooth cooperation among all parties involved.

In terms of alignment with EU policy and enabling factors, it is important to highlight the key role played by the project BroadNet that could be considered a first step towards a pan-European system of national Mission Critical broadband systems⁶¹. In total, 15 countries were involved in this initiative (including Norway, Finland, and Sweden), as well as France, Italy, Greece, or Spain. The European Commission (DG Home) has been the primary funder and supporting organisation since they called for proposals for a study Horizon 2020 DRS-18-2015 "Communication Technologies and interoperability topic 1: interoperable next generation of broadband radio communication system for public safety and security". In March 2022, additional support was provided by DG Home as a part of Internal Security Fund (ISF), temporarily working as a distinct work package of the ENLETS (European Network of Law Enforcement Technology Services) 2.0 programme.

Interconnecting the emergency communication networks between Norway, Finland and Sweden can have a major contribution to the EU Disaster Resilience Goals, and more specifically of the Alert mechanism as it contributes to enhancing the effectiveness and interoperability of warning systems. Furthermore, it allows a more efficient response to various hazards (search and rescue needs, wildfire, and floods, etc.). This interconnected communication system is secure as it safeguards that emergency systems remain operational 24/7 during and after a disaster, when it is most needed.

The lessons learned from the interlinked emergency communication networks between Nødnett, VIRVE and Rakel are shared during the meetings of the expert group "Mission Critical Communications Group". The aim of this expert group is to help establish the critical communications system within the EU; improve the public communications infrastructure; and ensure responsiveness in times of crisis. It is also intended to improve operational cooperation in the framework of internal security, as well as to improve a timely and coordinated response in emergency situations.

It is interesting to note that, at this stage, there are no monitoring or tracking systems in place to measure the impacts of the interconnected communication networks. However, as highlighted by the interviewee, this initiative has contributed to saving lives and enhancing civil mechanism capabilities by providing quicker support.

⁶⁰ <https://www.securelandcommunications.com/blog/tetra-to-4g-5g-broadband-migration-14-ways-to-ensure-success>

⁶¹ <https://www.broadway-info.eu/broadnet-preparation/>

In terms of challenges identified, each country has different legislation, different roles and systems. It is important for key stakeholders including implementing agencies and agencies to discuss on a regular basis and share knowledge. Furthermore, there can be challenges related to confidentiality issues and the fact of sharing sensitive information between countries. As explained by an interviewee, Rakel is looking forward to the next generation of 4G and 5G technologies as it provides a lot of new functionalities. There are several benefits of the 4G & 5G technologies as mission critical solutions. The advantages of the latter would be immediate comprehensive coverage, as well as increased redundancy. "They also have frequency, so we can leverage that," the interviewee says. "Plus, they can solve issues with indoor coverage."⁶²

4.3.2. INSECTRISK: Development and adoption of a joint institutionalized partnership on risk management on excessive proliferation of insects affecting public health and safety within the cross-border region Romania-Bulgaria

A big share of the cross-border area between Romania and Bulgaria is intersected by the Danube River, providing favourable environments on its shores for the development of mosquito fauna (Culicidae) and other vector arthropods. Both Romania and Bulgaria have consistently struggled with the presence of various insects, which thrive in abundant populations due to the conducive habitats in the region. Recently, there has been an **increase in their proliferation**, attributed to climate and environmental changes, resulting in the expanded spread of diseases carried by these vectors. This can lead to various **health problems**. Exotic viruses like Zika have even appeared in the area, emphasizing the urgent need for better coordination in addressing this common issue.

An interviewee emphasised the significance of the project for people living in the cross-border areas where mosquito proliferation is a prevalent issue.

The identification of potential risks prompted the initiation of the project and the development of the "Joint Strategy on the Sustainable Management of Excessive Insect Proliferation in the Cross-Border Region Romania-Bulgaria". This strategy, drafted in 2017, is a collaborative effort between the project implementers: the Association of Danube River Municipalities for the Bulgarian side and the NGO Natura Vie for the Romanian side.

To facilitate the project success, an agreement has been established with 72 municipalities. These municipalities commit to sharing information on a GIS platform regarding the timing, type, and chemicals used in their treatments for ticks and mosquitoes. This shared information enables effective planning. The project partners convene annually to exchange knowledge and discuss lessons learned. Notably, beekeepers benefit from knowing when treatments are applied. The programme's indicators are established based on population size, with an ambitious goal of targeting the entire area. The ultimate beneficiaries are the 3.2 million people within the target population.

The project aims at achieving **the following three objectives**:

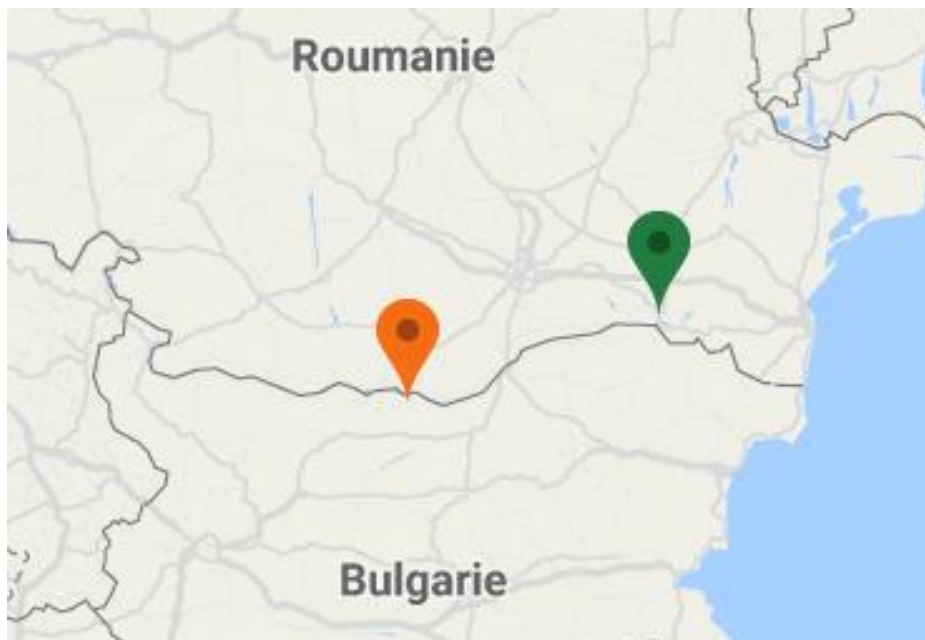
- A strengthened process of **cross-border risk management** regarding impact proliferation through better cross-border coordination.
- Improving the **knowledge management** process at cross-border level through the GIS and updating it and involving relevant actors.

⁶² <https://www.criticalcomms.com/features/a-period-of-transition-mission-critical-comms-in-the-nordics>

- **Better cooperation** of all competent institutions and stakeholders in the field of insect-related risk management.

The project INSECTRISK spans across a **broad region** between Bulgaria and Romania as presented in the map below.

Figure 18 Map of the area and location of partners



Source: <https://keep.eu/projects/17909/Development-and-adoption-of-EN/>

The project can be considered innovative, offering a unique solution through an online platform available to public authorities for corrective and preventive actions. The platform usage is tracked, with some information accessible to a broader audience, such as municipalities, and the ability for users to ask questions.

Indeed, the Joint Geographic Information System (GIS) is a key project output as it plays a crucial role in controlling insect populations in the cross-border region. This is necessary because the region's geography and climate create conditions favourable to the spread of mosquitoes, ticks, and other insects. BuGIS, a WebGIS product, is specifically designed to identify, visualise, and present information about insect distribution areas, treatment zones, measures taken, and control effectiveness. It operates entirely on the internet, requiring no additional software. BuGIS functions as an interactive web map showcasing risk areas in the Romania-Bulgaria cross-border region and provides information and report generation capabilities. The GIS application is regularly updated with data by designated representatives from member institutions and validated by partnership members.

Furthermore, the common strategy on control over insect population in cross-border area stands out as another key primary output of the project. The strategy for sustainably monitoring risks caused by insects in the Romania-Bulgaria cross-border areas aims to reduce and maintain population density at levels low enough to eliminate the risk of disease transmission and ensure the well-being of the population. As part of the project, 14 round tables and one conference were organised, bringing together representatives from various institutions and organizations involved in managing and controlling insect populations. Additionally, two surveys were deployed to assess the perceived effectiveness of joint risk management strategies addressing the excessive increase in insect populations in the Romania-Bulgaria area.

The Surveillance Body and the Support Forum monitor the overall implementation of the strategy. The main project indicators are listed below:

Table 5 Main project indicators for INSECTRISK

Impact indicators	Result indicators	Output indicators
<ul style="list-style-type: none"> - N° of risk areas - N° of notifications/ updates in GIS 	<ul style="list-style-type: none"> N° of identified risk situation 	<ul style="list-style-type: none"> - N° of warnings issued by the partnership - N° of informed institutions about the risk situations - N° of interventions following the warnings issued

The project has been under monitoring for five years, and the partners have consistently worked together in harmony, showcasing the enduring functionality of the partnership and the continual utilisation of the platform. Conversations with beneficiaries indicate that collaborative efforts have extended beyond the project's initial scope. According to the project website, some 4,770,000 people are benefiting from actions of risk management.

The project was successful thanks to a robust partnership as the implementing partners had previously collaborated on projects other than INSECTRISK. Cross-border collaboration thrives as both parties rely on each other, making considerable efforts to reach out to the end-user (e.g. through dissemination campaigns). Transparency and accountability are also fundamental principles of the partnership.

The INSECTRISK project is aligned with EU policies, and more specifically with the Danube Region Strategy that addresses a wide range of issues. These are divided among four pillars and 12 priority areas. Each priority area is managed by two countries as Priority Area Coordinators (PACs). There is a direct link between the project and the PAC 5 related to environmental risks.

In terms of challenges encountered, the project faced issues linked to political instability, which hindered the implementation and buy-in of municipalities in the area. Additionally, challenges related to the COVID-19 situation and the war in Ukraine were encountered. The geographical scope of the project (which is the Danube area) may be considered too broad. From a monitoring perspective, the focus was not evenly distributed across all areas, potentially limiting the impact. The Bulgarian Danube Association holds strong political influence, while the Romanian association does not wield the same power. The user distribution is somewhat imbalanced among municipalities, with 56 from Bulgaria and 16 from Romania. Recommendations were formulated by INTERREG to the partners, who subsequently implemented corrective measures.

4.3.3. AdriaMORE: Adriatic DSS exploitation for Monitoring and Risk management of coastal Extreme weather and flooding

AdriaMORE is a project co-funded by the EU through INTERREG A Italy-Croatia Programme. AdriaMORE is the acronym of the "Adriatic DSS exploitation for Monitoring and Risk management of coastal Extreme weather and flooding" and brings together four partners from Croatia and Italy: **Abruzzo Region** (Lead Partner), **Dubrovnik-Neretva Region** (Partner), **Croatian Meteorological and Hydrological Service** (Partner) and the Institute of atmospheric sciences and climate (Partner).

The AdriaMORE project goal is to improve an existing integrated hydro-meteorological risk management platform focusing on the Adriatic coast areas of Italy and Croatia capitalising the major achievements of the ADRIARadNet and the CapRadNet projects. These projects, successfully completed under the Adriatic IPA CBC Program, were dedicated to creating a cross-border infrastructure of observing and forecasting systems for the civil protection purpose. In this respect, the general objectives of the AdriaMORE project are:

- Reinforcing the existing monitoring system;
- Fostering and integrating the maritime environmental data in a coherent way with the hydrometeorological information;
- Improving the hydro-meteo-marine risk forecast capabilities;
- Assess the impact of coastal flood on geomorphological and biochemical parameters and coastal environment.

The project can be considered highly relevant, as many Italian and Croatian river basin authorities have recognised the limited availability of past flood data for events occurring more than 100 years ago. The subsequent calculation of the return flow may pose a significant challenge, making it a lengthy and uncertain process. Thus, there is a need to leverage the hydrological modelling products already developed in the ADRIARadNet and CapRadNet projects, with a focus on coastal dynamics, to better assess hydro-meteorological risks and address the knowledge gap arising from the lack of historical data.

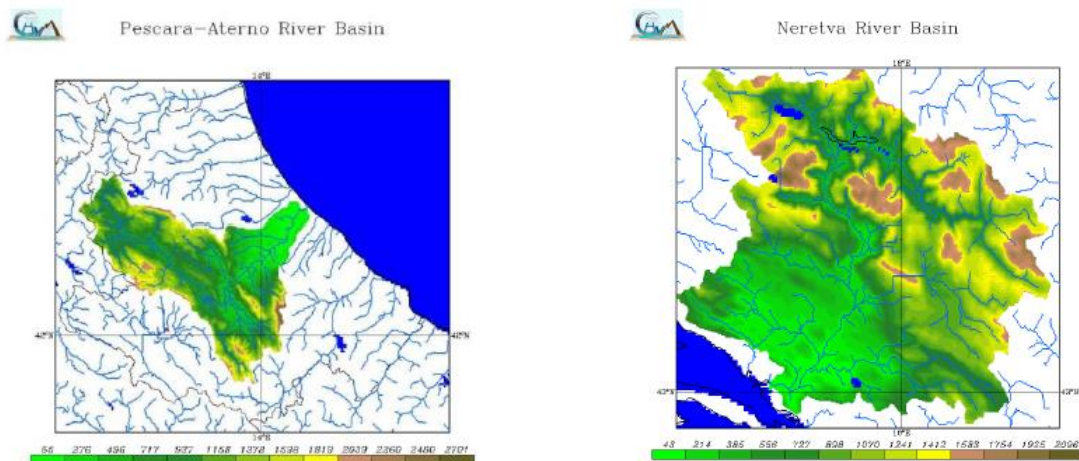
The innovative aspect of the AdriaMORE project is that it managed to build a hydro-meteo-marine forecast system integrated into the existing ICT system. This system fulfils the need for establishing a comprehensive hydrometeorological-maritime monitoring and forecasting system for the Adriatic Sea coastlines in the presence of flooding and extreme weather hazards. This represents a pioneering study for civil protection applications.

In terms of key achievements, the project AdriaMORE developed a decision support system (DSS) to observe and forecast possible scenarios at high hydro-meteorological risk for civil protection purposes. More specifically, the project has developed:

- A weather radar composite software able to ingest and process data from systems with different features has been developed and its assessment has been conducted on case studies utilizing Italian and Croatian radar data. A web interface has been created, where the instantaneous rainfall estimates for the Croatian and Italian composites are displayed in real-time.
- A new version of the hydrological model (CHyM), to be used operationally for coastal flood prediction on the Pescara and Neretva river basins has been designed. The CHyM model can read sea level measurements in input, to modify the friction of the river flow in the river outlet, enhancing the coastal flood prediction capability.
- An air-sea coupled prediction system was built in the Adriatic area that, previously tested within two case studies, one for the Abruzzi Region and one for Croatia, is now functioning in an operational mode, allowing to forecast the most important meteorological and marine variables⁶³.
- A satellite data processing procedure to evaluate environmental bio-chemical indicators of coastal seawaters in Adriatic Sea, like total suspended matter (TSM) and Chlorophyll content (CHL) has been performed. These indicators provided information about coastline morphology (erosion-sedimentation dynamical balance) and eutrophication trends of the marine coastal ecosystem.

⁶³ Meteorological and marine variables include the 3h accumulated precipitation, the 2m air temperature, the 10m wind, the sea level and wave height. In this system a procedure that "ingests" (by means of the so-called 3D-Var variational assimilation technique) surface and radio sounding data available in the area covered by the domain was also developed.

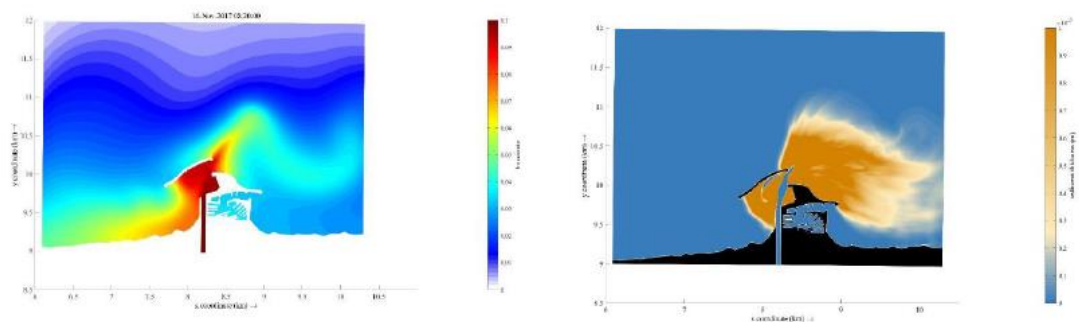
Figure 19 Target catchments altitudes (shaded colours) and their drainage network (blue lines) as rebuilt by the cellular automata techniques used in the CHyM model



Source: Report on the achievements of AdriaMORE after 18 months

- Numerical model simulations of transport and dispersion in the Adriatic Sea basin were developed. As far as coastal flow modelling is concerned, a 3D hydrodynamical model was implemented and set-up for upcoming applications to the pilot studies (e.g. Pescara River interaction with the harbour area) on the last leg of the project.

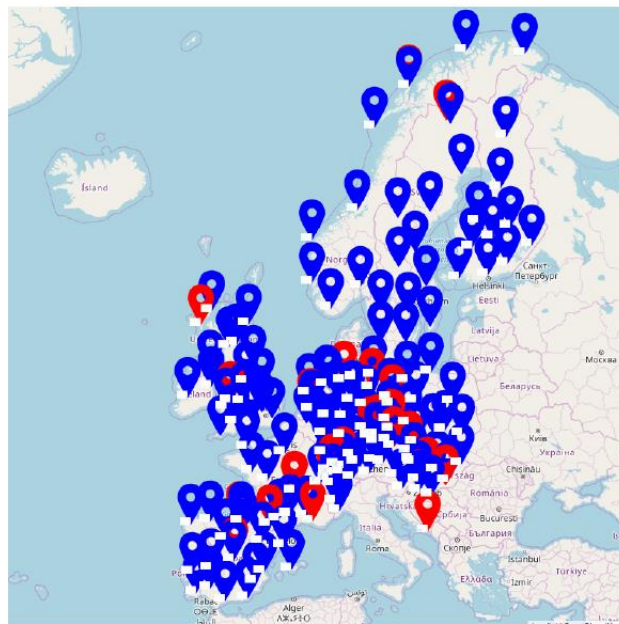
Figure 20 Examples of output data computed from model simulations for a Pescara river case study: passive tracer distribution (left) and sediment deposition map (right)



Source: Report on the achievements of AdriaMORE after 18 months

- Moreover, the wind profiles site has been chosen in the Dubrovnik area and the related infrastructure work completed. The instrument has been installed and the first operational tests performed, it will be used to improve wind monitoring and forecast. Currently, wind speed and direction data are available each 15 minutes up to about 4 to 7 kilometres above ground. These data are, since 28 May 2019, operationally available to all AdriaMORE Project Partners as well as to World Meteorological Organization (WMO) members via WMO and EUMETNET (European Network of National Meteorological Services) telecommunication lines.

Figure 21: Wind vertical profile observation by weather radars (blue colour) and wind profiles (red colour) within e-profile of EUMTNET



Source: Report on the achievements of AdriaMORE after 18 months

- A firefighting boat has been acquired and is currently stationed in Dubrovnik. The vessel is dedicated to firefighting operations and plays a crucial role in monitoring the challenging-to-reach southernmost part of the Adriatic. Due to its size and capabilities, the boat is not only well-suited for firefighting tasks but is also equipped to address pollution incidents. This includes the deployment of floating dams and rapid interventions using chemical methods to address minor sea surface pollution. The procurement of this firefighting boat, under the AdriaMORE project, has significantly enhanced the level of fire protection in the coastal area, particularly benefiting the Mljet National Park.

In terms of alignment of the project with EU policies, the AdriaMORE project will contribute to the implementation of the Flood Risk Management Plan and its overall long-term objective of reducing flood risks throughout Croatia and Italy to an acceptable level, by the development of forecasting systems.

According to the project team, the only challenge that the project faced were procurement and administrative issues that were resolved. AdriaMORE benefited from a smooth project implementation.

4.4. Conclusions and lessons learnt

The **collaborative efforts among Norway, Finland, and Sweden** in establishing cross-border emergency communication networks, involving joint exercises, training, and real-time information sharing, are essential for addressing emergency situations in the northern regions of Europe. The Haga cooperation framework plays a crucial role, underscoring the importance of Nordic collaboration, particularly in crisis management. The interconnected emergency communication networks, utilizing TETRA technology, have proven indispensable, with stakeholders like Nødnett, VIRVE, and Rakel playing integral roles. However, the ongoing migration from TETRA to 4G and 5G technologies poses a significant challenge, requiring careful planning and alignment with end-users' needs. The joint communication collaboration holds the potential for replication in other European countries.

Ongoing discussions about including Denmark (Sine) in the communication cross-border functionality are underway, contingent upon the completion of the transition to 4G and 5G technology, moving away from the TETRA networks. It is crucial, for the success of similar initiatives, to draw on the lessons learned from this collaboration. Insights gained from the interlinked emergency communication networks between Nødnett, VIRVE, and Rakel are shared during the meetings of the expert group "Mission Critical Communications Group." This group aims to establish a critical communications system within the EU, enhance public communications infrastructure, and ensure responsiveness in times of crisis. Notably, there are currently no monitoring or tracking systems in place to measure the impacts of the interconnected communication networks. Incorporating a monitoring system to track achieved impacts would be a valuable addition to the initiative. Furthermore, for the success of similar initiatives, it is vital to ensure strong political will and governmental commitments from key actors, along with adequate funding and continuous user engagement. Overall, the cooperation among Norway, Finland, and Sweden serves as a model, showcasing the potential for advanced cross-border emergency communication systems.

Initiated to address the risks associated with mosquito and insect proliferation in the Danube area, the **INSECTRISK** project led to the development of the "Joint Strategy on the Sustainable Management of Excessive Insect Proliferation in the Cross-Border Region Romania-Bulgaria". A key strength of the project lies in its collaborative efforts, engaging over 72 municipalities committed to sharing information on a Joint Geographic Information System (GIS) platform. The project has significantly contributed to enhancing the coordination of cross-border risk management, improving knowledge management through GIS, and fostering better cooperation among institutions in insect-related risk management. BuGIS, a WebGIS product, is an interesting tool that can be reused in other areas in Europe, designed to identify, visualise, and present information about insect distribution areas, treatment zones, measures taken, and control effectiveness. Over the course of five years, continuous monitoring has been crucial for implementing corrective measures. Regular monitoring proved pivotal, especially as the project faced challenges such as political instability, the impact of COVID-19, and the war in Ukraine, affecting project implementation and municipal engagement. The project's broad geographical scope raised monitoring concerns, with noted imbalances in political influence and user distribution (56 municipalities from Bulgaria and 16 from Romania). INTERREG V-A Bulgaria-Romania has extracted key lessons from this project to guide the design of future initiatives, emphasising the importance of selecting an appropriate geographical scope and implementing partners.

The **AdriaMORE** project, co-funded by the EU through the INTERREG V-A Italy-Croatia Program, stands out as a pivotal initiative in coastal risk management. Bringing together partners from Croatia and Italy, the project aims to enhance an integrated hydro-meteorological risk management platform along the Adriatic coast. One notable contribution of the project is addressing the knowledge gap related to the limited availability of historical flood data, particularly for events occurring over 100 years ago. The project's innovation lies in the development of a comprehensive hydro-meteo-marine forecast system, representing a pioneering effort in civil protection applications. It is noteworthy that AdriaMORE successfully leveraged the achievements of previous projects, ADRIARadNet and CapRadNet, to strengthen monitoring systems, integrate maritime environmental data, improve risk forecasting, and assess coastal flood impacts. Drawing on lessons learned from prior initiatives, the project effectively navigated procurement and administrative challenges, ensuring a smooth implementation process.

4.5. Bibliography

Project-initiative	Sources
Nordic cooperation in communications	<ul style="list-style-type: none"> • ERrillisverket & Dsb (2019) Guidelines for cross-border cooperation – Communications instructions radiotelephone procedures, link : https://www.msb.se/contentassets/52a695d30c9b4cd797c73fbc2e5cd27/guidelines-for-cross-border-cooperation-using-rakel-and-virve.pdf • The Haga declaration I & II, link: https://www.msb.se/en/about-msb/international-co-operation/nordic-co-operations/ • TCCA, Nordic Countries Expand Cross-Border TETRA Communication, link https://tcca.info/nordic-countries-expand-cross-border-tetra-communication/
INSECTRISK	<ul style="list-style-type: none"> • INSECTISK project monitoring reports • Project RISK: Development and adoption of a joint institutionalized partnership on risk management on excessive proliferation of insects affecting public health and safety within the cross-border region Romania-Bulgaria, link: https://www.interregrobg.eu/en/15-3-1-016-development-and-adoption-of-a-joint-institutionalized-partnership-on-risk-management-on-excessive-proliferation-of-insects-affecting-public-health-and-safety-within-the-cross-border-region-romania-bulgaria.html
AdriaMORE	<ul style="list-style-type: none"> • AdriaMORE, Newsletter n°1 : Mitigation & Managing Hazards in the Adriatic, January-June 2018, link: https://www.regione.abruzzo.it/system/files/progetti-europei/145644/adriamore-newsletter-no1.pdf • AdriaMORE, Newsletter n°2: Mitigation & Managing Hazards in the Adriatic, July-December 2018, link : https://klima.hr/razno/projekti/The_AdriaMORE_Newsletter_No2.pdf • AdriaMORE, Newsletter n°3: Mitigation & Managing Hazards in the Adriatic, January-September 2019, link : https://klima.hr/razno/projekti/The_AdriaMORE_Newsletter_No3.pdf • AdriaMORE application form to INTERREG

5. Nordred Cooperative Framework

5.1. Executive Summary

Nordred, established in 1989, serves as an overall regulatory framework for a Nordic co-operation in civil protection involving Norway, Denmark, Sweden, Finland, and Iceland. Its primary objective is to enable borderless rescue services, ensuring the prompt response of the nearest rescue unit, irrespective of the national border.

The regular occurrence of incidents related to air and mountain search, and rescue operations, medical emergencies requiring ambulance services, and extreme weather events, such as wildfires in the border regions underlines the critical need for such kind of co-operation.

Recognizing the need for a comprehensive legal and operational framework, the Nordred Framework Agreement was established in 1989. It includes both articles that regulate co-operation and States' responsibilities, as well as operational guidelines to follow when receiving and providing support. The agreement forms the basis for the Nordred co-operation at the national level, with the Nordred Group, a steering committee comprising representatives from each of the member countries' central government agencies responsible for rescue services, overseeing this collaboration.

Nordred's significance is particularly pronounced at regional and local levels, where its implementation is operationalised through three Border Rescue Councils and numerous bilateral Nordred sub-agreements between border municipalities and counties. These agreements represent an example of good practice as they enable tailored cross-border rescue assistance at regional and local level independent of national authority intervention and facilitate planning for rescue operations across the national borders.

The practical outcome of Nordred is the realisation of borderless rescue services. For the communities living in the border regions, this means potentially faster response times during accidents and emergencies. For local rescue authorities, the Nordred collaborative to pool resources, personnel, equipment, enhances mutual understanding of roles and responsibilities, as well as the efficiency and effectiveness of response to cross border civil protection emergencies.

5.2. Introduction

In the border regions, in the case of an accident or emergency, the nearest ambulance, police or other rescue services might belong to the neighbouring country. This geographical proximity means that in times of crisis, the most efficient and effective response could be provided by a neighbouring country's emergency services.

The civil protection authorities in each Nordic country are faced with complex and novel challenges, highlighting the need for robust cross-border cooperation. Historically, the Nordic countries have established a strong tradition of cross-border co-operation across several sectors and areas. However, until the 1980s, a notable gap existed in the legal framework regarding Nordic cross-border rescue services and, as a response, a greater political focus was placed on enhancing cooperation between them. In 1983, at a Nordic rescue services meeting, it was proposed that co-operation in the field of rescue services between the Nordic countries should be formalised. This resulted in the creation of **Nordred⁶⁴, a Nordic co-operation for civil protection involving Denmark, Norway,**

⁶⁴ <https://www.nordred.org/>

Finland, Sweden, and Iceland⁶⁵. Nordred was specifically designed to address the challenges and fill the legal gaps in cross-border rescue operations, which was a significant step forward in cross-border civil protection and coordination of emergency response across the borders.

Nordred's primary **objective** is to enable borderless rescue services, ensuring the prompt response of the nearest rescue unit, irrespective of the national border. It promotes cooperation between the member states' rescue services, both in terms of *operational* cooperation during rescue operations and emergencies, and *joint efforts to develop the rescue services*⁶⁶.

Nordred focuses on **several types of hazards** requiring rescue service, contingency planning, and mutual assistance in the event of accidents or disasters. Examples are incidents related to sea, air and mountain search and rescue operations, medical emergencies requiring ambulance services, and wildfires (MSB, 2019a). Thereby it aims to prevent or limit damage to people, property, or the environment in the event of an accident or immediate threat of an accident.

This case study explores the Nordred Framework Agreement and its implementation at the local level, highlighting the purpose behind it, actors involved, impacts and challenges. Nordred not only reflects the dedication of national authorities to create structures for borderless rescue services, but also serves as a practical and valuable model for how cross-border rescue services can effectively operate across national borders and function in practice with the involvement of regional and local authorities.

5.3. Presentation

The Nordred framework agreement, established in 1989, forms the basis for the Nordred co-operation. Initially it came into force between Norway and Denmark in 1989, Sweden and Finland joined in 1992, followed by Iceland in 2001.

Recognising the need for a comprehensive legal and operational framework, Nordred Framework Agreement was established to address key aspects such as legal, structural, financial, and organizational factors, and to supplement existing bilateral and multilateral agreements between the participating countries. The agreement obliges countries to adapt their national laws and regulations to remove obstacles to cooperation as much as possible. Under this agreement, all Nordic countries commit to providing support to each other in the event of an accident or an immediate risk of an accident⁶⁷.

The Agreement outlines ten articles detailing how the legislation of signatory countries should facilitate cross-border operations, the nature and extent of assistance required under the agreement, and other crucial aspects. It further regulates several practical issues related to cross-border assistance, such as the management responsibility, liability, elimination of import and export barriers for rescue equipment, and the compensation of costs and damages caused by the assistance operation. The signatories are obliged to inform each other on their national legislation and organisation of rescue services. They are expected to contribute to the development of cooperation in this field and to maintain direct contact regarding the practical implementation of the agreement⁶⁸.

The agreement outlines specific operational procedures for requesting and aiding related to management, cooperation, provision of food and accommodation, transport, and

⁶⁵ Nordred. Accessed on 27 September 2023 at: <https://www.nordred.org/sv/>.

⁶⁶ Idem.

⁶⁷ Om Nordred. Accessed on 27 September 2023 at: <https://www.nordred.org/sv/om-nordred/>.

⁶⁸ Nordred-avtalet. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/nordred-avtalet/>

finances. To facilitate the process of requisitioning, checklists are available for both the requesting and supporting countries⁶⁹.

At regional and local levels, the practical implementation of Nordred is realised through the Border Rescue Councils and **bilateral cross-border agreements between bordering municipalities and counties** in Sweden, Finland, Norway, and Denmark (MSB, 2022).. These local agreements provide a more concrete and detailed operational framework for assistance modalities, addressing various aspects, for example, financing, damage control, roles, and responsibilities. Thus, while the Nordred framework agreement serves as an overarching umbrella agreement, the local agreements are more of an operational kind⁷⁰. Thanks to tailored border municipal agreements, municipalities can assist each other with, for example, direct cooperation between the rescue forces, especially equipment, larger quantities of extinguishing agents, unique rescue equipment, technical know-how, special skills and other expert efforts, as well as information in the event of a health and environmentally hazardous release that threatens the other municipality or in the event of a forest fire with a risk of fire spreading across the municipal border.

5.3.1. Actors involved

Actors at the national level

To fulfil the obligations set forth by the Nordred Framework Agreement, a **coordination body** known as the **Nordred Group** has been appointed. The Nordred Group acts as a joint body for addressing Nordic civil protection issues related to the cooperation in the framework of Nordred at the national level.

Composition of the group and role: The group consists of representatives from each of the member countries' central government agencies which oversee rescue services. Its primary objective is to coordinate civil protection efforts at the Nordic level and to improve the conditions and frameworks necessary for the co-operation and assistance outlined in the Nordred framework agreement (MSB, 2019b).

The group has the following composition⁷¹:

- Sweden: represented by the Swedish Civil Contingencies Agency (*Myndigheten för samhällsskydd och beredskap, MSB*⁷²).
- Denmark: represented by the Chief of Police (*Rigspolitichefen*⁷³) and the Danish Emergency Management Agency (*Beredskabsstyrelsen*⁷⁴).
- Norway: represented by the Joint Rescue Coordination Centres (*Hovedredningssentralen*⁷⁵) with the support from the Directorate for Civil Protection and Emergency Planning (*Direktoratet for samfunnssikkerhet og beredskap, DSB*⁷⁶).
- Finland: represented by the Ministry of the Interior⁷⁷.

⁶⁹ Operativa rutiner. Accessed on 9 October 2023 at: <https://www.nordred.org/sv/operativa-rutiner/>.

⁷⁰ Gränskommunala avtal. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/granskommunala-avtal/>.

⁷¹ Kontaktgrupp. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/kontaktgrupp/>.

⁷² <https://www.msb.se/>

⁷³ <https://politi.dk/virksomheden/rigspolitiet>

⁷⁴ <https://www.brs.dk/da/>

⁷⁵ <https://www.hovedredningssentralen.no/>

⁷⁶ <https://www.dsb.no/>

⁷⁷ <https://intermin.fi/etusivu>

- Iceland: represented by the Chief of Police (*Rigspolitichefen*⁷⁸).

Operational structure: The member states take turns leading the work on the national steering level. This rotation typically occurs every three years. One of the key responsibilities of the Nordred Group is to organise regular meetings and conferences. During these conferences the Group reviews and, if necessary, updates the framework agreement⁷⁹. These meetings provide a forum for the representatives to discuss strategies, share information and collectively assess preparedness across the Nordic countries.

Actors at the regional and local levels:

Municipal and county authorities are key participants in bilateral collaborations under the Nordred framework, specifically within local cross-border collaboration agreements, as detailed in Section 5.7.3. These agreements involve authorities from adjacent municipalities and counties across national borders, working together to enhance emergency response and rescue services in their respective border regions.

In addition, based on the Nordred Framework Agreement, three Border Rescue Councils (*Gränsräddningsråd*) have been established, involving Swedish and Norwegian actors. Examples of representatives within the Councils are medical staff and ambulance services, police, and rescue services, as well as the county administrative boards and the Norwegian counterparts (Statsforvalteren i Trøndelag, 2022). The border rescue councils are Mitt-Skandinavien⁸⁰, Dalarna-Värmland-Innlandet⁸¹, Västra Götaland-Värmland-Østfold⁸².

5.3.2. Concrete application & highlight of cross-border aspects

The practical application of Nordred is particularly relevant at the sub-national level through the bilateral cooperation agreements. In the case of an emergency or accident, it is the local rescue leader who makes the assessment and decision whether to request rescue assistance from cross-border municipalities. In such cases, they directly contact the cross-border organisation (MSB, 2015). In events of large crisis, such as forest fires, the Nordred agreement can be activated simultaneously as other disaster response and crisis management agreements, such as the Union Civil Protection Mechanism (UCPM).

According to Article 3 of the agreement, an authority in a contracting state which, in the event of an accident, is responsible for measures to prevent or limit damage to people or property or to the environment may request assistance directly from the competent authority in another contracting state. The authority from which the assistance is requested then decides whether this can be provided. The assisting state is entitled to compensation from the requesting state for the costs of its measures.

The agreement has been incorporated into the national legislation of the signatories. Accordingly, the government, a municipality, or a state authority responsible for rescue services, to the extent that follows from agreements that the respective country has entered with the others, may request assistance from or aid foreign authorities in rescue operations.

The **three Border Rescue Councils** (*Gränsräddningsråd*), established under the Nordred framework, constitute concrete and practical implementations of the Nordred agreement. They exemplify how cross-border rescue services and resource utilisation can be effectively executed in practice. The councils are responsible for coordinating cooperation, sharing

⁷⁸ <https://www.almannavarnir.is/>

⁷⁹ Nordred. Accessed on 27 September 2023 at: <https://www.nordred.org/sv/>

⁸⁰ <https://www.nordred.org/sv/gransraddningsrad/mittskandinavien/>

⁸¹ <https://www.nordred.org/sv/gransraddningsrad/varmland-dalarna-hedmark/>

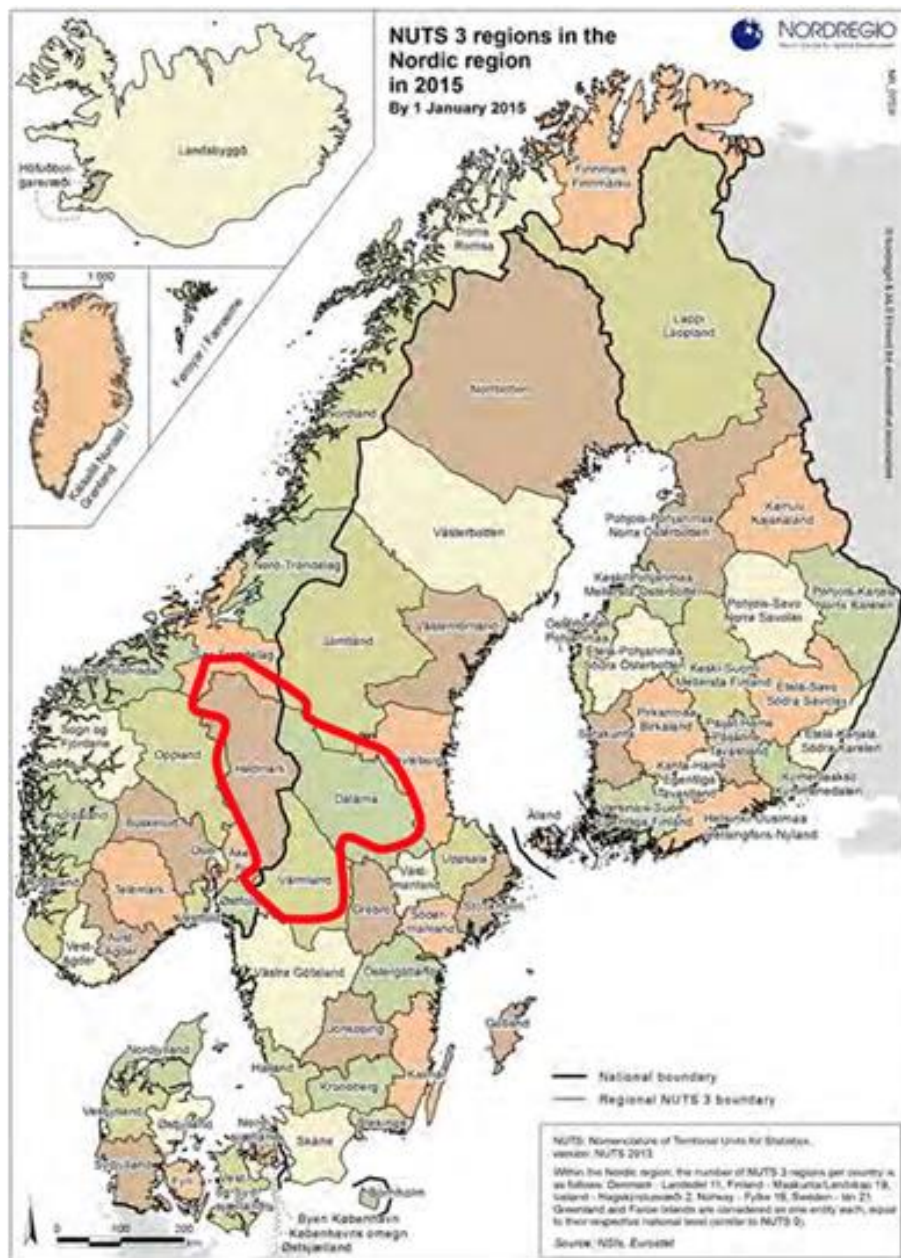
⁸² <https://www.nordred.org/sv/gransraddningsrad/vastra-gotaland-och-ostfold/>

information and knowledge, updating each other about events or changes, and initiating joint activities and exercises. They are also tasked with reviewing the agreements and updating when needed. The aim is to develop favourable conditions for efficient use of personnel, equipment, and other resources across borders⁸³.

Besides Nordred framework agreement, several other agreements constitute the basis for establishment of the cross-border rescue councils, such as the Nordic Health Preparedness Agreement (Nordhels) from 2002, the Haga declarations I and II from 2009 and 2013 respectively, as well as the work done in the Nordic Council of Ministers (Statsförvaltaren i Inlandet, n.d.; Gränsräddningsrådet i Mitt-Skandinavien, 2022).

A more detailed description of the Councils' objectives and activities is provided below.

Figure 22 Map of the border regions included in Border Rescue Council Dalarna-Innlandet -Värmland

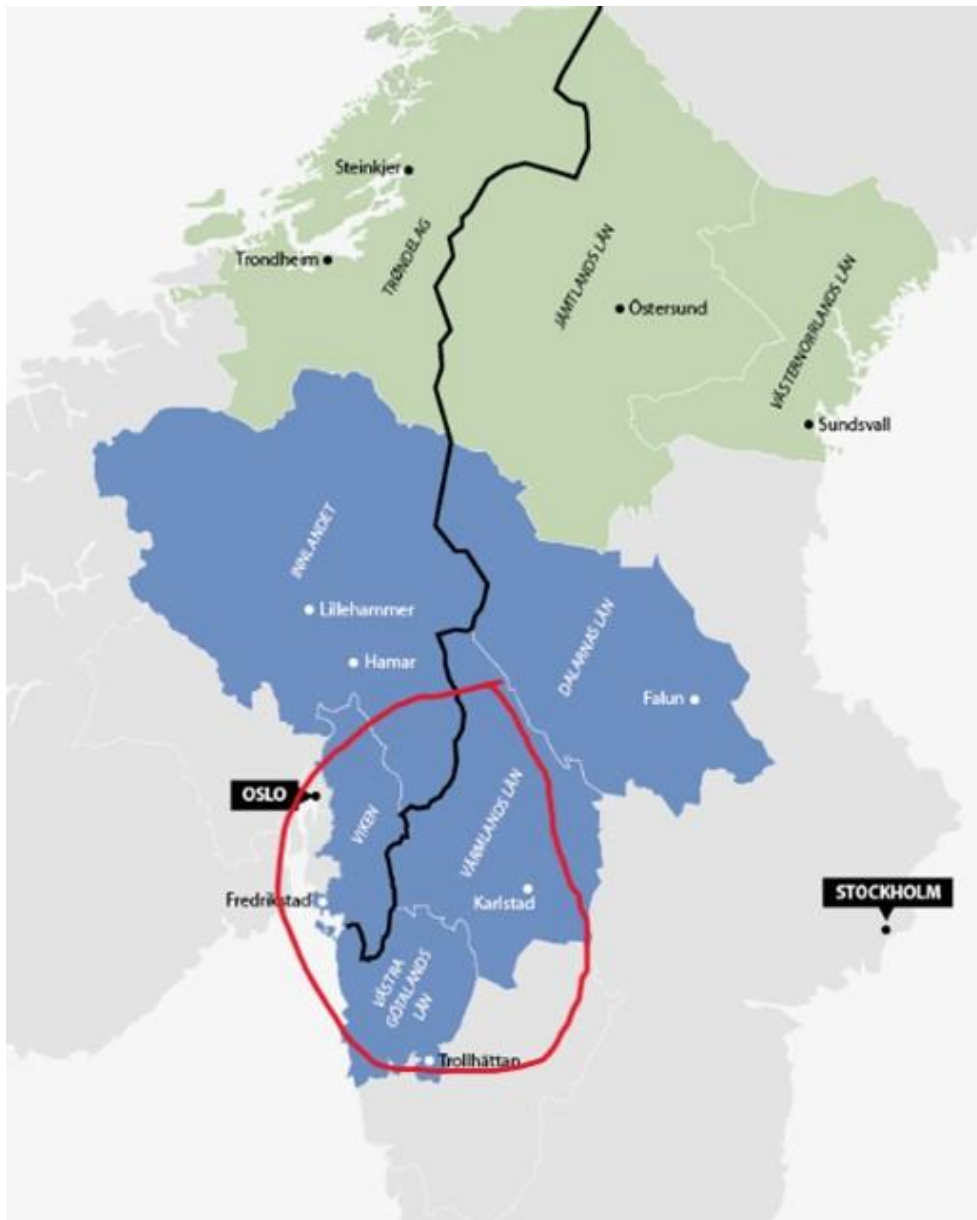


Source: Fylkesmannen i Hedmark, 2015, p.2).

⁸³ Gränsräddningsråd. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/gransraddningsrad/>.

The **Border Rescue Council Dalarna-Innlandet-Värmland** was established in 1992 and has four focus areas: (1) Regional risk and vulnerability analyses, (2) Develop courses for cooperation and joint exercises, (3) Develop the ability to communicate at and across the land border, and (4) Develop the ability to evacuate, alert and prioritise in a cross-border crisis. Some of the cross-border joint exercise has resulted in the development of common procedures, checklists, a glossary of terms and roles (Länsstyrelsen Dalarnas Län, 2015).

Figure 23 Map of the border regions included in Border Rescue Council Västra Götaland-Värmland-Østfold

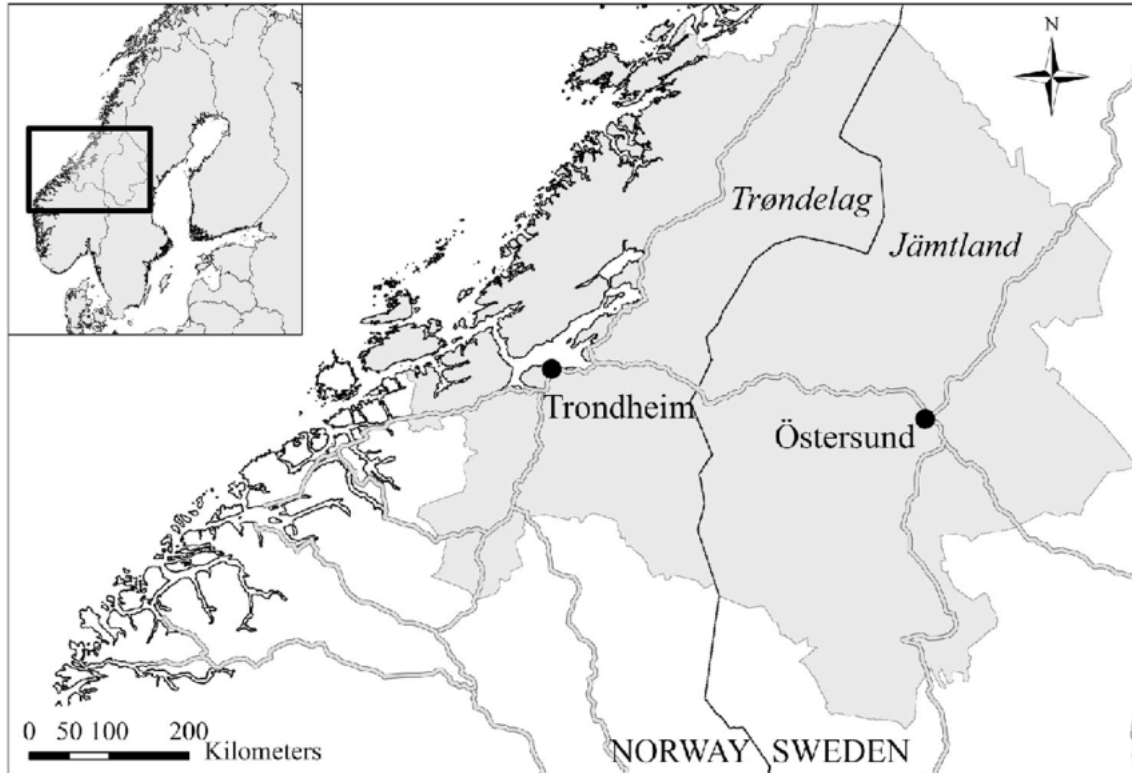


Source: EU fonder, 2022

The **Border Rescue Council Västra Götaland-Värmland-Østfold's** focus is on addressing common issues and finding solutions that arise from cross-border cooperation. It aims to optimise and seamlessly utilise each other's resources in the border region. The Council's objectives extend beyond just rescue services; it seeks to adopt a wider societal

and preparedness perspective, involving more types of actors in the cooperation⁸⁴. The council meets twice a year and acts as a forum for co-operation on rescue services and crisis management, emergency medical care, police activities, etc. The Council is also responsible for organising joint exercises every second year (Länsstyrelsen Värmland, 2012).

Figure 24 Map showing Jämtland County and Trøndelag County



Source: Shepherd & Ioannides, 2020, p. 6

The **Border Rescue Council Mitt-Skandinavien** was established in 1993, with the aim to strengthen and streamline rescue operations in the border region through better utilisation of personal, equipment, and other resources. The work was based on needs-based initiatives such as local cooperation, training, and exercises. The area covers Jämtland County in Sweden and Trøndelag County in Norway. The objective is to be a network between rescue services, civil protection, health preparedness and general community preparedness at municipal and regional level, to share information on areas of common interest, work towards co-utilisation of resources and exchange experiences after major events in the border region. This is done by organising Council meetings regularly, joint exercises at local and regional level, and evaluate major events on an ongoing basis to strengthen joint capabilities in the border region (Gränsräddningsrådet I Mitt-Skandinavien, 2022).

⁸⁴ Gränsräddningsrådet Västra Götaland och Østfold. Accessed on 11 October 2023 at: <https://www.nordred.org/sv/gransraddningsrad/vastra-gotaland-och-ostfold/>.

5.4. Impacts

5.4.1. Cross-border impacts & results

The Nordred cooperation framework enables rescue leaders to directly request support from counterparts in other Nordic countries, bypassing the need for involvement of central authorities or governments. There are several notable examples of when this agreement has been put into practice with beneficial results.

One example of the Nordred's successful application occurred during the summer of 2018, when large wildfires soared in Sweden. Sweden does not have access to own aircrafts for firefighting nor sufficient helicopters to deal with such extensive forest fires as during that summer. However, through the Nordred-agreement (and the EU Civil Protection Mechanism and Emergency Response Coordination Centre (ERCC), Sweden received support and got access to both helicopters and airplanes, both from ERCC and Norway through Nordred. Through Nordred, firefighters and equipment such as vehicles and hoses were requested (DSB, 2019; MSB, 2019c). This example illustrates how the Nordred agreement facilitates rapid and efficient cross-border emergency assistance, significantly enhancing the capacity of individual Nordic countries to respond to large-scale crises.

At the regional level, several accidents have occurred where the implementation of cross-border rescue service agreements (i.e. creating "borderless rescue services") have been of great advantage. A notable example occurred in 2010 following a train accident in the Norwegian community of Eidskog, close to the Swedish border. As the accident occurred close to the border, rescue teams from both sides were alerted and mobilised quickly, and it was possible to take care of the injured people quickly and efficiently. Favourable conditions such as weather and the accessible location of the accident aided in the management of the incident. However, a key factor contributing to the swift response was the availability and rapid mobilisation of numerous resources from both countries⁸⁵. Furthermore, the borderless rescue service has been beneficial in events of accidents, fires, and search operations (Länsstyrelsen Jämtlands län, 2015).

Figure 25 Train accidents in Eidskog 2010 with rescue teams on site



Source: Holmberg, 2010

⁸⁵ Gränsräddningsrådet Värmland, Dalarna, Hedmark. Accessed on 12 October 2023 at: <https://www.nordred.org/sv/gransraddningsrad/varmland-dalarna-hedmark/>.

5.4.2. Benefits

As many areas covered by Nordred have limited resources and large distances, building capacity through cooperation is a vital solution. This was also emphasised in the interviews with representatives experienced in the functioning of the Border Rescue Councils. The direct benefits include **enhanced preparedness to handle emergencies and crisis through the joint and efficient use of personnel, equipment, and other resources, as well as exchange of information, knowledge, and experience**. By doing this, it is possible to address problems in the border regions and find common solutions.

In a Nordic context, the countries may share several similarities, but there are still differences present that can complicate rescue assistance. As such, important lessons can be drawn from **joint exercises** and **clear communication channels**. Under the Nordred agreement, the countries are obliged to have regular meetings and update each other on legal aspects and regulations, and conduct joint exercises (MSB, 2014). Joint exercises conducted under Nordred, and some of them by the Border Rescue Councils, have been highlighted as highly beneficial for enhancing coordination and management in both aiding other countries and efficiently receiving help as a host nation (Länsstyrelsen Dalarnas Län, 2010). This helps to identify and address gaps in coordination, communication, and operational understanding. Thus, Nordred offers important lessons and insights regarding DRM (Disaster Risk Management) and **developing HNS (Host Nation Support) capabilities** in the Nordic countries (MSB, 2014).

5.5. Challenges

A challenge that Nordred has encountered, despite its success, is a **varying degree of engagement** at the national/authority steering level, creating fluctuations over time, as expressed by an interviewee with previous experience of the steering group.

Additionally, the **financing** of the Nordred operation on the national steering levels is also highlighted as a challenge for the common work, with no allocated budget other than from the appointed Nordred group authority.

Although the relevance of Nordred is still significant at the local or regional levels, some of the local/regional cross-border agreements that are based on Nordred have also varied over time in engagement and work efforts. Evaluating why, how, and what the cross-border rescue service agreement can at times be needed to get the most relevance and impact from the co-operation (Gränsräddningsrådet i Mitt-Skandinavien, 2022). Although, there are still obstacles for carrying out joint rescue operations (e.g., legal, or organisational obstacles) that need to be addressed (MSB, 2019b; Statens Offentliga Utredningar, 2012).

5.6. Conclusions and lessons learnt

The Nordred framework agreement enables rescue operations in a cross-border context, thus focusing on cooperation on operational issues and increasing the capability to respond to events. It also covers the capability of cooperation on planning, preventive and preparedness measures.

When it was developed, Nordred was regarded as a forerunner in cross-border rescue service co-operation, enabling a faster and more streamlined process in case of emergencies and accidents. More than thirty years later, its prominence at the national steering level has somewhat diminished, as noted by an interviewee. Nonetheless, its value as an enabling framework for guiding and facilitating the effective and efficient strengthening of local and regional co-operation in cross-border risk management remains highly pertinent

and active. At the local level, Nordred has indeed been institutionalised through various bilateral cooperation agreements between municipalities and counties, as well as through the establishment of Border Rescue Councils.

To maintain its continued relevance, it is necessary to regularly review and update the Nordred agreement to ensure that there is a common understanding of the agreement's scope and potential limitations. Particularly, a key focus area should be enhanced communication across national borders (Direktoratet for samfunnsikkerhet og beredskap, DSB, 2019).

According to an interview with the representatives from the Border Rescue Councils, understanding each other's differences and culture is important for creating borderless rescue service. Nordred offers a framework that not only facilitates this understanding but also opportunities for practically building and testing concrete solutions that can bridge these differences. The regular meetings and joint exercises facilitated by the Nordred framework are recognised as significant benefits of this cooperation, emphasising improved coordination and management skills, both in aiding other countries and in effectively receiving help as a host nation.

5.7. Links to other possible activities

5.7.1. HAGA I & II

On 27 April 2009, the Nordic countries agreed on a declaration on civil protection and preparedness, known as the Haga Declaration. In June 2013, the countries stated that co-operation should be further deepened, formulating the Haga II Declaration. Haga II is accompanied by a strategic development plan which concretizes the declaration and provides a more long-term direction for the continued work.

5.7.2. Nordhels

Nordhels is the Nordic Health Preparedness Agreement, a framework agreement for co-operation on health and medical preparedness. Nordhels is a complement to the Nordred agreement. Nordhels was signed in 2002 and involves Denmark, Finland, Norway, Iceland, Sweden and the three autonomous regions of Åland, Greenland and the Faroe Islands. The purpose of Nordhels was to create the conditions for co-operation among the countries to prepare and develop health care preparedness in the event of crises and disasters.

5.7.3. Agreements signed between border municipalities based on the Nordred Framework Agreement

Countries	Cross-border municipal/county agreements	Purpose
Denmark - Sweden	Copenhagen & Malmö	Agreement between Københavns Brandvæsen and Rådningstjänsten Syd.
Norway – Finland	Sör-Varanger & Enare	Provide assistance in case of an accident or imminent danger of an accident.
	Tana & Utsjoki	Provide assistance in the field of fire and rescue services (not yet signed).
	Karasjok & Utsjoki	Provide assistance in the field of fire and rescue services (not yet signed).

Countries	Cross-border municipal/county agreements	Purpose
Sweden – Finland	Östra Norrbotten & Torneå	Provide assistance in firefighting and rescue operations, in oil spill clean-up operations at sea or on land, and in emergency medical transport. Joint sky-lift to be used under the agreement on assistance in firefighting and rescue work.
	Östra Norrbotten & Ylitornio	Provide assistance in firefighting in the event of a fire or in other activities when specifically requested by the fire chief of the contracting municipality.
	Östra Norrbotten & Pello	Provide assistance in civil protection and rescue operations.
	Pajala & Muonio	Provide assistance in the event of a fire or, if necessary, in other activities at the specific request of the fire chief.
	Pajala & Kolari	Provide assistance in the event of a fire or, if necessary, in other activities at the specific request of the fire chief.
	Kiruna & Enontekis	At the specific request of the respective municipality's fire and rescue chief, assistance shall be provided in the event of a fire or, if necessary, other activities within the municipality.
	Norrbotten County & Lappland County	Each party shall provide information as soon as possible in the event of a suspected or actual nuclear accident in Sweden, Finland, or the Barents region. The alarm centres in Luleå and Rovaniemi mediate the contacts between the parties. The working language between the alarm centres is mainly English.
Sweden – Norway	Tanum, Strömstad, Dals Ed, Åmål, Bengtsfors & Årjäng, Halden, Aremark, Marker, Römskog	The parties undertake to cooperate in cases such as: forest fires and other major fires, "dangerous goods" accidents on roads and railways, road and rail traffic accidents involving personal injury, and other accidents on which cooperation is natural and which are covered by the framework agreement.
	Strömstad & Halden	In the event of an alarm in the Svinesund area (in Sweden), the Halden fire brigade is alerted at the same time as the Strömstad fire brigade.
	Eda, Arvika, Torsby & Kongsvinger	Mutual assistance in rescue operations aimed at saving human life and health that take place in the geographical area covered by the municipalities. (Revision in progress)
	Torsby & Kongsvinger, Grue, Åsnes, Våler, Trysil	Mutual co-operation to prevent and limit damage to property and the environment (separate agreements between Torsby and each Norwegian municipality, i.e. five separate agreements).
	Torsby & Österdal	Mutual assistance in rescue operations aimed at saving human life and health that take place in the geographical area covered by the municipalities. (Revision in progress)
	Älvdalen, Malung & Österdal	Mutual assistance during rescue operations.
	Härjedalen & Röros	Assist each other in emergency situations that may arise in the area.
	Strömstad, Krokmo & Lierne, Reyrvik	Assistance shall be provided in the event of an accident or imminent threat of an accident where people, property or the environment may be damaged, and where it is

Countries	Cross-border municipal/county agreements	Purpose
		significantly faster to request assistance from another country.
	Åre, Östersund & Meråker, Innröndelag	Assist each other in rescue operations in a specially agreed area along the Swedish-Norwegian border.
	Åre, Östersund & Verdal, Innröndelag	Assist each other in rescue operations in a specially agreed area along the Swedish-Norwegian border.
	Jämtland & Sör- and Nor-Tröndelag	Agreement on measures to increase the availability of ambulance resources (including ambulance helicopters) in the border area between Sweden and Norway. The agreement means, among other things, that rescue leaders and doctors at the scene of an accident have the right to order an ambulance from the neighbouring country.
	Södra Lappland, Storuman, Vilhelmina, Sorsele & Rana, Helgeland, Mo i Rana, Mosjön	Cooperating civil protection services.
	Kiruna & Narvik	Assist with rescue service operations along Nordkalottvägen.
	Strömsund, Krokmo & Lierne, Røyrvik	Agreement between the parties on assistance in case of accidents and imminent danger of accidents.
	Torsby, Malung, Älvdalen & Mitt-Hedmark	Agreement on fire and rescue services.

Source: Nordred, Gränskommunala avtal. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/granskommunala-avtal/>.

5.8. Bibliography

- Direktoratet for samfunnssikkerhet og beredskap. (2019). Skogbrannsesongen 2018: Erfaringer og læringspunkter. https://www.dsb.no/globalassets/dokumenter/rapporter/skogbrannsesongen_2018.pdf
- EU fonder. (2022). Sverige-Norge. <https://eufonder.se/interreg/interreg-sverige-norge.html>
- Fylkesmannen i Hedmark. (2015). Grenseredningsrådet Dalarna / Värmland / Hedmark. <https://www.nordred.org/siteassets/nordred/konferenser/konferens-2015/Presentationer/Neby-Gustavsson-Forsstrom.pdf>
- Gränsräddningsrådet i Mitt-Skandinavien (2022). Samarbetsavtal mellan Länsstyrelsen Jämtlands län och Statsforvalteren i Trøndelag. https://www.lansstyrelsen.se/download/18.596d2fac184a433f3e45a9/1669219068755/Gr%C3%A4nsr%C3%A4ddningsr%C3%A5det,%20samarbetsavtal_2022.pdf
- Holmberg, K. (2010, October 1). Tre allvarligt skadade i SJ-olycka i Norge. <https://www.dn.se/nyheter/varlden/tre-allvarligt-skadade-i-sj-olycka-i-norge/>
- Länsstyrelsen Dalarnas Län. (2010). Gränsövning Sälen 2010. <https://rib.msb.se/bib/Search/RenderDocument?url=media/26405.pdf>
- Länsstyrelsen Dalarnas Län. (2015). Dalarnas gränsöverskridande krissamverkan i fokus på nordisk konferens. Accessed on 11 October 2023 at: https://www.mynewsdesk.com/se/lansstyrelsen_i_dalarnas_lan/pressreleases/dalarnas-graensoeverskridande-krissamverkan-i-fokus-paa-nordisk-konferens-1219749
- Länsstyrelsen Jämtlands Län. (2015). Gränsräddningsrådet i Mitt-Skandinavien. <https://www.riskkollegiet.se/wp-content/uploads/2015/06/J-Gr%C3%A4nsr%C3%B6verskridande-samverkan-Staffan-Edler.pdf>
- Länsstyrelsen Värmland. (2012). Risk- och sårbarhetsanalys: Värmlands län 2012. https://catalog.lansstyrelsen.se/store/38/resource/2013_11
- Nordred. Accessed on 27 September 2023 at: <https://www.nordred.org/sv/>
- Nordred. Om Nordred. Accessed on 27 September 2023 at: <https://www.nordred.org/sv/om-nordred/>
- Nordred. Nordred-avtalet. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/nordred-avtalet/>
- Nordred. Gränskommunala avtal. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/granskommunala-avtal/>
- Nordred. Gränsräddningsråd. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/gransraddningsrad/>
- Nordred. Kontaktgrupp. Accessed on 2 October 2023 at: <https://www.nordred.org/sv/kontaktgrupp/>
- Nordred. Operativa rutiner. Accessed on 9 October 2023 at: <https://www.nordred.org/sv/operativa-rutiner/>
- Nordred. Gränsräddningsrådet Västra Götaland och Østfold. Accessed on 11 October 2023 at: <https://www.nordred.org/sv/gransraddningsrad/vastra-gotaland-och-ostfold/>

- Nordred. Gränsräddningsrådet Värmland, Dalarna, Hedmark. Accessed on 12 October 2023 at: <https://www.nordred.org/sv/gransraddningsrad/varmland-dalarna-hedmark/>
- Myndigheten för samhällsskydd och beredskap, MSB. (2014). Förbättrade möjligheter för stöd inom Norden: Samordnad utveckling av praktiska förutsättningar för stöd mellan de nordiska länderna vid kriser och allvarliga händelser i fredstid. <https://www.msb.se/siteassets/dokument/om-msb/vart-uppdrag/regeringsuppdrag/2014/140415-forbatttrade-mojligheter-for-stod-inom-norden.pdf>
- Myndigheten för samhällsskydd och beredskap. (2015). Vägledning i att ta emot internationellt stöd. <https://rib.msb.se/bib/Search/RenderDocument?url=media/27955.pdf>
- Myndigheten för samhällsskydd och beredskap. (2018). MSB:s arbete med skogsbränderna 2018 - Tillsammans kunde vi hantera en extrem skogsbrandssäsong. <https://www.msb.se/RibData/Filer/pdf/28735.pdf>
- Myndigheten för samhällsskydd och beredskap. (2019a). Uppdrag till MSB att redovisa behoven av förstärkt kapacitet avseende material, personalförsörjning och flygkapacitet. <https://rib.msb.se/Filer/pdf/28799.pdf>
- Myndigheten för samhällsskydd och beredskap. (2019b). Building Resilience in the Nordic Region: A Swedish perspective. <https://rib.msb.se/filer/pdf/28840.pdf>
- Myndigheten för samhällsskydd och beredskap. (2019c). Utvärdering av MSB:s arbete i samband med skogsbränderna 2018. <https://rib.msb.se/bib/Search/RenderDocument?url=media/28817.pdf>
- Shepherd, J., & Ioannides, D. (2020). Useful funds, disappointing framework: tourism stakeholder experiences of INTERREG, *Scandinavian Journal of Hospitality and Tourism*. <https://doi.org/10.1080/15022250.2020.1792339>
- Statens Offentliga Utredningar (2012). Sveriges möjligheter att ta emot internationellt stöd vid kriser och allvarliga händelser i fredstid. <https://www.regeringen.se/contentassets/1c28516db8f54529a4128cbbb58f80be/sveriges-mojligheter-att-ta-emot-internationellt-stod-vid-kriser-och-allvarliga-handelser-i-fredstid-sou-201229/>
- Statsforvaltaren I Innlandet (n.d.). Grenseredningsrådet. Accessed on 11 October 2023 at: <https://www.statsforvalteren.no/innlandet/samfunnssikkerhet-og-beredskap/krisehandtering-og-samordning/grenseredningsradet/>
- Statsforvalteren i Trøndelag. (2022). Grenseredningsavtale forlenget. Accessed on 12 October 2023 at: <https://www.statsforvalteren.no/trondelag/folk-og-samfunn/grenseredningsavtale-forlenget/>
- Swedish Civil Contingencies Agency. (2022). Nordic Civil Protection and Host Nation Support – Solidarity put into Practice. <https://rib.msb.se/filer/pdf/29970.pdf>

6. Nordic Public Health Preparedness Agreement (Nordhel)

6.1. Executive summary

This case study shows how cross-border cooperation can serve to design and implement an all-hazards approach that complements EU, national and bilateral agreements in preparedness and response of Disaster Risk Management. The study focuses on the 2002 Nordic public health preparedness agreement (Nordhel), which applies to co-operation between the public health and social service authorities in the Nordic countries Denmark, Finland, Iceland, Norway, and Sweden.

The main disaster and risk management components addressed by this case study are:

- Planning, prevention measures planning, response contingency planning, financial planning investments, pooling of response resources.
- Early warning, public warning, situational awareness, real-time data exchange.
- Response cooperation, structures/arrangements for joint response, training/exercises.
- Risk communication with population, civic engagement in resilience building, volunteering.
- Comprehensive approaches for cooperation over a longer period.

In terms of hazards, Nordhel takes an all-hazards approach, but it is particularly relevant to emergencies and disasters, such as natural disasters, accidents and acts of terror involving, for instance, radioactive emissions, biological substances, and chemical substances.

Nordhel is integrated in the legal system in the Nordic countries as part of the overall Nordic Cooperation and is complementary to the bilateral agreements between the Nordic countries and the Union Civil Protection Mechanism and other EU legal texts. It is also complementary to EU legal frameworks such as the Union Civil Protection Mechanism (UCPM) and the Early Warning and Response System (EWRS). The agreement is particularly relevant in emergencies where assistance is not covered by other European and Nordic multilateral and bilateral agreements.

Overall, Nordhel is an excellent basis for cooperation in public health preparedness between Nordic countries. It contributes to a stronger and more integrated Nordic region. There are several relevant initiatives in the Nordic Region which build upon Nordhel.

The agreement is an excellent example of a cooperation framework and is highly replicable in other European border territories.

6.2. Introduction

The Nordic public health preparedness agreement (Nordhel) was signed in 2002. It applies to co-operation between the public health and social service authorities in the Nordic countries Denmark, Finland, Iceland, Norway, and Sweden and ensures:

- Access to relevant and quality-assured information;
- Prepared procedures for offering and receiving assistance;
- Strengthened capacity for Host Nation Support; and

- Systematic learning from exercises and past events.

The agreement entails collaboration between the social services regarding crisis management and the social service's relation to healthcare.

Nordhel is integrated in the legal system in the Nordic countries as part of the overall Nordic Cooperation for a stronger and more integrated Nordic Region. The work is mainly conducted within a joint Working Group called *Svalbard Group* and includes joint exercises, procedures, information, and skills exchange.

6.3. Presentation

6.3.1. Countries and borders involved

The Nordic Public Health Preparedness agreement involves five countries - Denmark, Finland, Iceland, Norway, and Sweden.

Figure 26 Map of Scandinavia including Nordhel signatory countries



Source: Nordic Cooperation

The signatories of the agreement are the responsible authorities in the five countries:

- in Denmark: Ministry of the Interior and Health;
- in Finland: Ministry of Social Affairs and Health;
- in Iceland: Ministry of Health and Social Security;
- in Norway: Ministry of Health;
- in Sweden: the Government (Ministry of Health and Social Affairs).

6.3.2. Objective

The objective of the agreement is to provide the basis of cooperation for the purpose of 'increasing the capacity and preparedness of the Nordic countries to deal with emergencies

and disasters, such as natural disasters and events (accidents and acts of terror) involving, for instance, radioactive emissions, biological substances, and chemical substances.

From a territorial perspective, in most cases, Nordhel is applicable to border territories when, for example, an ambulance service from the country on the other side of the border is closer to the incident.

6.3.3. Relevance

The agreement is particularly relevant in emergencies where assistance is not covered by other Nordic multilateral and bilateral agreements, e.g. the agreement between Denmark, Finland, Iceland, Norway, and Sweden of 1989 concerning cooperation across territorial boundaries to prevent or limit damage to people, property, or the environment in the event of accidents (the “Nordic Rescue Services Agreement”).

Moreover, as pointed out in the Declaration from the Nordic ministers on health preparedness and resilience⁸⁶, the Nordic cooperation efforts are only in addition to the “vital role of the European Union and its efforts towards enhancing health preparedness and crisis response including research and development, industrial scale up, and securing an open strategic autonomy for all medical countermeasures”. The declaration welcomes the Health Emergency Preparedness and Response Authority (HERA)⁸⁷ together with the Union Civil Protection Mechanism (UCPM) and the European Warning and Response System (EWRS). Hence, Nordhel does not overlap other legal frameworks but is complementary to them.

6.3.4. Scope

The cooperation includes preparation of contingency measures; and assistance on occasions when one of the contracting states suffers an emergency or disaster.

The signatories undertake to:

- aid one another upon request, as far as possible under the provisions of the Agreement;
- inform one another, as promptly as possible, of measures they plan to implement, or are implementing, that will have or are expected to have a significant impact on the other Nordic countries;
- promote cooperation and as far as possible remove obstacles in national legislation, regulations, and other rules of law;
- provide opportunities for the exchange of experience, cooperation, and competence building;
- promote the development of cooperation in this area;
- inform one another of relevant changes in the countries’ preparedness regulations, including amendments of legislation.

6.3.5. Governance

The Ministers for Health and Social Affairs in signatory States meet at regular intervals to discuss problems in the areas covered by the Agreement. The practical implementation of this agreement requires the responsible authorities to maintain direct contact with one

⁸⁶ <http://norden.diva-portal.org/smash/get/diva2:1648529/FULLTEXT01.pdf>

⁸⁷ https://health.ec.europa.eu/health-emergency-preparedness-and-response-hera_en

another. Moreover, they yearly evaluate the development and implementation of the agreement.

Svalbard Group

The Group is a co-operative body for the authorities that are party to the Nordic Public Health Preparedness Agreement. The Svalbard Group's mandate comes from the Nordic Council of Ministers for Health and Social Affairs and is based on the Nordic Public Health Preparedness Agreement.

The activities of the Svalbard Group are in the fields of emergency planning, crisis and risk management, risk reduction, risk assessment, risk analysis, risk evaluation, prevention, emergency response, reconstruction, and evaluation.

Its purpose is to improve co-operation and to share information, skills, and knowledge across the Nordic Region in the field of public health and social services in relation to emergency preparedness, and crisis and disaster management with the objective of being able to better manage crises and disasters. Such co-operation includes all phases and aspects of a crisis or disaster event.

Accordingly, the possible activities of the Group include emergency planning, as well as assistance should one of the countries be affected by a crisis or disaster. The Group may also share experiences and knowledge about radiation, the storage of rare vaccines, immunoglobulins, and antidotes.

The Svalbard Group's activities are defined in a strategic framework and in a yearly action plan.

6.3.6. Strategy

Every year, the Group adopts an action plan for the following one based on the strategic framework. The strategy includes vision statements and strategic objectives that need to be achieved. It consists of three types of actions that are linked to the objectives:

- Actions related to increasing joint understanding and knowledge;
- Actions that need to be completed once;
- Actions that are continuous yearly operations.

The strategy also includes general guidelines for implementation and monitoring. The timespan for the strategy is 10 years with a mid-term review after five years. The current strategy was established in 2018 and the midterm review is due in 2023. The strategy aims to be clear and concise with concrete objectives that the Svalbard Group can contribute to. The strategy includes a clear action and implementation plan following the responsibilities set in the mandate but will also leave flexibility for implementation.

6.4. Relevant Initiatives within the Nordhel framework

6.4.1. Nordic Mass Burn Casualty Incident Response Plan

Nordic Mass Burn Casualty Incident Response Plan describes the outline and practical details of a joint Nordic mass burn casualty incident (MBCI) and its response mechanism. This plan is the result of a conjoined effort by the national burn centres in Bergen, Norway; Linköping and Uppsala, Sweden; Helsinki, Finland; Copenhagen, Denmark, and the health authorities in the Nordic countries.

The Nordic Mass Burn Casualty Agreement was finalized in 2018 as a result of a cooperative work of all the Nordic countries under the leadership of Norway. It was introduced to the Nordic Council of Ministers in Reykjavik in March 2019.

The response mechanism is based on existing national response mechanisms and ones being developed in the participating countries, and the on-going work to establish a European MBCI response mechanism. The main outline is based on the suggested medical standards from the European Burns Association (EBA) in this regard.

The plan is focused on an MBCI situation where the affected country is overwhelmed, but where the situation is still manageable within the Nordic regional capacity. These countries have a long history of mutual help and development in burn care, and a regional MBCI plan is a natural extension of this. These countries have experiences with the same challenges of scattered settlements and long distances and seem well prepared for joint responses in these circumstances. The outline of this plan is made to be in line with national response mechanisms in these countries and with the European mechanism under way, thus being a natural step in this response ladder.

6.4.2. Nordic Mechanism for Sharing Situation Awareness in Health and Social care

The project “Nordic mechanism for sharing situation awareness in health and social care” (2021- 2023) has built on the experiences and practices formed to respond to the COVID-19 pandemic crisis. The Nordic countries’ national responses have highlighted needs to strengthen Nordic co-operation to be better prepared for future crises. The aim of the project is to develop a common framework and a minimum dataset for gathering situation awareness data for health and social services in the Nordics.

The identified data and its dissemination are tested out in an exercise and on a platform that serves as a proof-of-concept for a more integrated and common service for sharing information among the Nordic countries’ and autonomous areas’ social and health officials. In the following years the project is expected to evolve into a situation awareness platform to address various threat scenarios, align with EU-HERA and other international stakeholders and develop Nordic information sharing during everyday co-operation as well as extraordinary events.

6.5. Impacts

There has not been a recent evaluation of Nordhel and its precise impact is difficult to judge. However, in the opinion of a representative from the Nordic Cooperation, the fact that there was a ministerial declaration⁸⁸ in 2022 related to even more advanced cooperation on prevention and preparedness in health is a proof of Nordhel’s effectiveness. Nordic Prime Ministers have also emphasized the importance of strengthening cooperation in health through the Svalbard Group, hence the Nordhel Agreement.

Nordhel has also been acknowledged (in reports, interviews, and political declarations) as an excellent basis for cooperation in public health preparedness between Nordic countries triggering mutual support and assistance in numerous occasions.

Overall, it has contributed to a stronger and more integrated Nordic region. However, the COVID-19 pandemic crisis presented Nordic societies with new challenges, which can be addressed by “working even more closely together on contingency planning and crisis

⁸⁸ <https://www.norden.org/en/declaration/declaration-ministers-nordic-co-operation>

management”. In the opinion of an interviewed representative from Nordic Cooperation, Nordhel is a central instrument for this.

One of Nordhel’s strengths is that it is a basis for other relevant initiatives in the Nordic Region. The two initiatives presented earlier - Nordic Mass Burn Casualty Incident Response Plan and Nordic Mechanism for Sharing Situation Awareness in Health and Social care – are a case in point. Moreover, a report on The Future Nordic Co-operation on Health⁸⁹ spelled out concrete cooperation in health preparedness such as joint research and development, training, purchasing, and contingency stocks. Concrete examples of cooperation include joint air medical training programmes and common resources for airborne medical evacuation.

Figure 27 The air ambulance system evacuates about a thousand patients yearly between Greenland, Iceland, the Faroe Islands and across the Atlantic to other hospitals.



Source: Mark König, Unsplash

6.6. Challenges and way ahead

A report on The Future Nordic Co-operation on Health from 2014⁹⁰ underlined “the importance of broadening the health preparedness from the perspective of holistic safety”. The report pointed out that cooperation needed to adapt to new threats such as various cyber-threats and boost preparedness including using digital tools.

As regards challenges encountered by the Nordhel, its effectiveness has been hampered in some cases due to conflicts with national legislation. As of 2014, the Svalbard Group

⁸⁹ <https://norden.diva-portal.org/smash/get/diva2:723237/FULLTEXT01.pdf>

⁹⁰ Idem.

had certain difficulties in carrying out its tasks, mainly because there are many authorities/institutions involved at national level, with different perspectives and goals. In response to that, in 2023 the Svalbard Group has launched a baseline study to explore ways to deal with conflicting rules in the case of certain incidents (e.g. when an ambulance must cross the border). Through a mapping of regulations that create obstacles to cross-border cooperation, the project will show how the Nordic countries can develop joint mechanisms and capacities that can ensure seamless healthcare assistance in a crisis in the Nordics, Europe and possibly globally⁹¹. The study will also scan for new cooperation potential without duplicating existing structures. The project is set to end in 2025.

Limited budget is another challenge and while countries finance the participation of their representatives in meetings, financial resources for additional projects are negotiated on a case by case basis.

Concerning the way ahead, in a joint statement on deepening cooperation in the field of security of supply and preparedness which followed the COVID-19 pandemic crisis, the Nordic Prime Ministers⁹² “emphasized the need for stronger international, European, regional, as well as bilateral cooperation to complement our national and local perspectives”.

Nordhel represent from this point of view an inspiring approach to prepare for scenarios that require immediate crisis responses and emergency resources, be it in the form of major fires, floodings, incidents involving chemical, biological, radiological, and nuclear risks, or other accidents and hazards, recognizing also the risks imposed by climate change.

The possible directions for further improving the approach include:

- The ways and means of securing information exchange, shared situational awareness and dialogue as early as possible, on all possible scenarios and throughout the entire crisis/circumstances.
- Mapping the potential forms of cooperation to best utilize the capacities to prepare for, respond to and manage medical urgencies, thus contributing also to a stronger European preparedness.
- Cooperation within supplies and logistics contingency planning and crisis management.
- Pooling of resources and structures, when feasible and bringing operational synergies.
- Further developing joint exercises and training programmes.

6.7. Links to other relevant activities

Below, we are presenting other activities which are of relevance to health cooperation. These activities have been selected as potentially highly replicable in other parts of Europe.

6.7.1. Northern Health Across Borders: ambulance and pre-hospital services in Northern Scandinavia

The northernmost healthcare authorities of Finland, Sweden and Norway participate in an agreement called Northern Health Across Borders that was initiated in 2008. The areas in

⁹¹ <https://projektdb.norden.org/details/70240556-e066-4af6-b947-78f60baad0fa>

⁹² https://um.fi/current-affairs/-/asset_publisher/gc654PySnjTX/content/nordic-prime-ministers-joint-statement-on-deepening-cooperation-in-the-field-of-security-of-supply-and-preparedness

the North are scarcely populated and hospitals are widely dispersed, which means that patients have, by and large, worse facilities than those who live further south.

The Sámi people live in the far north of Finland, Russia, Norway, and Sweden, but they may live nearer a hospital in an adjoining country than that in which they live. Cooperation across borders can help in this situation.

The cross-border cooperation between the Nordic health care authorities helps to ensure the proper health and medical care for those that live in rural areas and the agreement puts emphasis on the healthcare of the Sámi people and “other national minorities.” If a national emergency unit is unavailable, an ambulance from a partner country can be sent instead. However, the cooperation has been under strain due to a severe imbalance in the number of missions. For example, Norway carries out more missions because they have a more concentrated infrastructure in northern areas of Scandinavia than Finland, for example⁹³. The ambulance staff on the ground often considers it their moral duty to help others in need irrespective of national borders, and Northern Health Across Borders is both a way to cope with the realities of the far north and a rational solution to ensure the health of Nordic citizens. A joint secretariat is based on Luleå in Sweden.

6.7.2. Nordic Emergency Communications

The emergency communication services of Sweden, Finland and Norway are interconnected which helps the health, law, security, and emergency services to communicate with each other in the case of a cross-border emergency. In 2019, the Nordic Council suggested that the communication systems of Denmark and Iceland should be integrated as soon as possible to advance the realization of a “borderless” Nordic region.⁹⁴

6.7.3. EU Healthy Gateways Joint Action Preparedness and Action at Points of Entry (ports, airports, ground crossings)⁹⁵

The Healthy Gateways joint action arose from joining together two consortiums (SHIPSAN and AIRSAN) established from the implementation of previously funded projects under the Health Programme of the European Union. The consortium comprises of 38 authorities including Ministries of Health and Transport, national public health institutes and universities from 29 European countries and Taiwan Center for Disease Control.

The joint action aims at facilitating EU Member States (EU MS) on the implementation of requirements of Article 4, on preparedness and response planning of Decision No 1082/2013/EU⁹⁶, by preparing the competent authorities and the transport sector for immediate and adequate response to serious cross-border threats to health.

The general objective of the Joint Action is to support cooperation and coordination between EU MS to improve their capacities at points of entry (PoE) – including ports, airports, and ground crossings – in preventing and combating cross-border health threats affecting or inherently coming from the transport sector, and therefore contributing to a high level of public health protection in the EU.

⁹³ For more on this, see Tom Schwarzenberg's “Negotiating invisible lines: Cross-border emergency care in the rural north of Scandinavia” from 2019

⁹⁴ <https://nordics.info/show/artikel/the-many-faces-of-nordic-civil-security-cooperation>

⁹⁵ <https://www.healthygateways.eu/Novel-coronavirus>

⁹⁶ Decision No 1082/2013/EU of the European Parliament and of the Council of 22 October 2013 on serious cross-border threats to health.

The Joint Action developed the Cross-border health threats: State of the Art report for ground crossings⁹⁷ to characterize external EU/EEA ground crossings in terms of the risk of public health threats from infectious diseases, vector spread and chemical events, as well as operational possibilities to mitigate risks. It identifies “best practices” implemented at European ground crossings.

European level training of the trainers’ (TOT) course for Preparedness and response to public health events at ground crossings⁹⁸.

The purpose of this web-based training was to increase competence and capacity for managing public health events in ground transport including risk assessment, decision-making and crisis communication. Training specifically addressed: preparedness planning and communication at ground crossings; event detection, verification, risk assessment, decision making; experiences and lessons learned for management of a public health event; management of a public health event due to chemical agents.

EU HEALTHY GATEWAYS Webinar Series.

Several webinars related to public health preparedness and response at ground crossings were conducted addressing Border health measures to reduce the potential for the introduction or exportation and spread of public health diseases of international concern as well as Crossing Borders. Past webinars are available for play-back viewing and can be accessed by applying at the following link: <https://www.healthygateways.eu/Contact-Us>.

EU HEALTHY GATEWAYS web-based training resources catalogue⁹⁹.

This searchable catalogue compiles training resources from international, European, and national courses specific to points of entry and addressing public health threats in the maritime, air and ground-crossings sector (including chemical threats).

Model Memorandums of Understanding (MoU) for public health preparedness and response¹⁰⁰.

Two MoUs were developed to foster collaboration between countries and at a local level, for public health preparedness and response at ground crossings. The model MoUs can be modified based on the local context and used by Joint Action countries:

- Model MoU on personal data exchange for public health contact tracing.
- Model MoU on coordination of response to public health events of mutual interest, for use at ground crossings between 2 countries.

Chemical preparedness at points of entry (including ground crossings)¹⁰¹.

Guidance for dealing with chemicals and chemical incidents at points of entry to assist in preparedness and response to chemical incidents at ports, airports, and ground crossings. As a reference document, it is aimed at public health professionals, health workers at points

⁹⁷ https://www.healthygateways.eu/Portals/0/plcdocs/EUHG_D5.1_State_of_the_Art_Report.pdf?ver=2021-03-19-122838-007

⁹⁸ <https://elearning.shipsan.eu/login/index.php>

⁹⁹ <https://www.healthygateways.eu/Web-based-training-resources-catalogue>

¹⁰⁰ https://www.healthygateways.eu/Portals/0/plcdocs/EUHG_M5.9_MoUs_Ground_Crossings.pdf

¹⁰¹ https://www.healthygateways.eu/Portals/0/plcdocs/D8_2_Guidance_document.pdf?ver=2022-06-09-135338-957

of entry and other relevant agencies who may be notified if a public health incident involving chemicals occurs.

A chemical preparedness assessment tool¹⁰²

This tool was developed to provide a framework for consistent planning of hazard-specific competencies. The tool can be used for auditing, training, and exercising purposes at the point of entry and is intended for use by public health planners, safety managers and officials working at the point of entry/state jurisdictional level.

6.8. Conclusions and lessons learnt

The Nordic public health preparedness agreement (Nordhel) has been active for more than 20 years. The agreement is complementary to the existing EU and other Nordic legal frameworks and has been used in cases where emergencies have not been covered by other legal instruments.

It has been widely recognised as a successful cooperation framework both on a practical and on a political level. The agreement entails collaboration between the civil protection and social services which is a very positive example. It strengthens other bilateral and European legal and cooperation frameworks.

The work is mainly conducted within a joint Working Group which includes joint exercises, procedures, information, and skills exchange. It represents an innovative and effective governance mechanism, which incorporates mechanisms for correcting deficiencies such as conflicts with other agreements and national rules. This governance example is worth exploring and replicating especially in cases of multiple borders.

Notably, the Svalbard Group is a good example of institutional cooperation in health preparedness in the Nordic region. Thanks to its inbuilt flexibility (regular reviews every five years) its strategy can adapt to evolving context and circumstances.

Another positive feature of Nordhel is that it is an enabling framework for cooperation, new ideas and joint efforts to implement an all-hazard approach, covering the whole threat spectrum and preparing for all kinds of emergencies and crises caused by man or nature. As a result, there are numerous examples of initiatives having spawn within the Nordhel agreement, such as the Nordic Mass Burn Casualty Incident Response Plan and the Nordic Mechanism for Sharing Situation Awareness in Health and Social care.

Overall, Nordhel has brought about a much stronger cross-border cooperation in the Nordic region, and it has the potential to develop even further, contributing also to a stronger European preparedness through the replication of its approach and processes in other areas.

¹⁰²https://www.healthygateways.eu/Portals/0/plcdocs/D8_1_REVISSED_Chemical_Assessment_Tool.pdf?ver=2022-08-18-091115-200

6.9. Bibliography

- Chemical preparedness assessment tool available here https://www.healthygateways.eu/Portals/0/plcdocs/D8_1_REVISED_Chemical_Assessment_Tool.pdf?ver=2022-08-18-091115-200
- Cross-border health threats: State of the Art report for ground crossings, available here https://www.healthygateways.eu/Portals/0/plcdocs/EUHG_D5.1_State_of_the_Art_Report.pdf?ver=2021-03-19-122838-007
- Guidance for dealing with chemicals and chemical incidents at points of entry, available here https://www.healthygateways.eu/Portals/0/plcdocs/D8_2_Guidance_document.pdf?ver=2022-06-09-135338-957
- Interview with representative from Joint action Healthy Gateways, carried out on 23/03/2023
- Interview with representative from Nordic Cooperation, Nordic Council of Ministers for Health and Social Affairs (MR-S), The Department of Knowledge and Welfare (KV)
- Model MoUs for preparedness and action at points of entry, available here: https://www.healthygateways.eu/Portals/0/plcdocs/EUHG_M5.9_MoUs_Ground_Crossings.pdf
- Nordic Mass Burn Casualty Incident Response Plan, available Nordic Mass Burn Casualty Incident Response Plan.pdf (helsedirektoratet.no)
- Nordic Public Health Preparedness Agreement, available at [Nordic-Public-Health-Preparedness-Agreement-in-English \(3\).pdf](#)
- Website of Nordics Info, Aarhus University, available at <https://nordics.info/show/artikel/the-many-faces-of-nordic-civil-security-cooperation>
- Website of NORDRED – Nordic Civil Cooperation, available at <https://www.nordred.org/>
- Website of the EU Healthy Gateways Joint Action Preparedness and Action at Points of Entry (ports, airports, ground crossings), available at <https://www.healthygateways.eu/>
- Website of the Nordic Co-operation, available at <https://www.norden.org/en/information/nordic-health-co-operation>
- Website of the Nordic Health Preparedness, available at <https://nordichealthpreparedness.org/organisation/>

7. Cross-border cooperation on seismic risk management between Italy, Austria, and Slovenia

7.1. Executive Summary

This case study shows **how cross-border cooperation can contribute to enhance resilience against seismic risk**. The focus is on the experience of the South-Eastern Alps region. Over the centuries, this cross-border area, shared by North-Eastern Italy (Veneto, Friuli Venezia Giulia, and Trentino - Alto Adige Regions), Austria (Tyrol, Carinthia) and Slovenia, was affected by severe and destructive earthquakes, the most recent and relevant ones being the 1976 earthquake in Friuli Venezia Giulia, Italy, and the 1998 one in Bovec, Slovenia. These events highlighted the need for a closer collaboration between the nearby governmental and scientific institutions to facilitate seismic risk management in the cross-border area.

The main disaster and risk management components addressed by this case study are:

- Risk assessment, vulnerability assessment, foresight, data-collection, mapping/GIS of risks
- Planning, prevention measures planning, response contingency planning, financial planning investments, pooling of response resources
- Early warning, public warning, situational awareness, real-time data exchange
- Response cooperation, structures/arrangements for joint response, training/exercises
- Innovation using new technologies, digital tools
- Cooperation/Partnerships with private sector, cross-border infrastructure, critical infrastructure management
- Comprehensive approaches for cooperation over a longer period.

In 2001, the first agreement on seismic data exchange was signed by four key research institutes operating in this cross-border area. Since then, the cooperation and collaboration between the three countries has evolved and led to the adoption of several potentially replicable examples of good practices that could serve as inspiration to other transboundary territories exposed to seismic risk.

In most cases, these achievements were the result of EU funded projects. The actors and institutions involved in those projects - namely the scientific community and civil protection authorities of the three bordering countries - were able to take advantage of these opportunities and external funding to build upon existing capacities and approaches, enabling a continuous improvement in cross-border seismic risk management in this region. A summary of the key initiatives addressed in this study is presented below.

The project Trans-National Seismological Networks in the South-Eastern Alps represents a milestone in the history of cooperation between Italy, Austria, and Slovenia and can be considered as the turning point for the management of seismic risks in this area. The project was carried out within the INTERREG III A Italy-Austria 2000-2006, with the aim of improving the seismic monitoring system in the cross-border area by integrating and connecting the networks belonging to the three countries. It also aimed to strengthen data sharing and establish procedures for real-time data exchange in the aftermath of an earthquake. The integrated networks and their connection with a software (Antelope) that enables real-time data acquisition, sharing and processing, proved successful specifically in the 2004 earthquake in Bovec-Kobarid, Slovenia. This project laid the foundation for two

decades of ongoing strong cooperation both among the scientific community and civil protection authorities of the three countries.

Building upon existing results achieved by previous activities, the Real-time accelerometric monitoring network of sites and buildings in Italy and Austria INTERREG IV A project (ARMONIA, 2019-2021) further strengthened the cross-border cooperation between the civil protection authorities of Italy and Austria on seismic risk management. The project implemented a seismic monitoring system and drafted common protocols/standard operating procedures (SOPs) for rapid post-disaster impact assessments. The Atlas developed in ARMONIA is an efficient tool that elaborates seismological data in near-real time and provides maps useful for civil protection purposes.

With regard to the Italian-Slovenian border, the enhancement of cross-border institutional and governance capacities were addressed in the Cross-border cooperation between Slovenia and Italy for a safer region INTERREG V A project (CROSSIT SAFER, 2019-2022), focused on seismic risks and other natural hazards, such as wildfires. The signing of the Agreement on the exchange of mutual assistance in case of emergencies by all parties involved in the project - namely the scientific partners and public administrations of the two countries - legally formalised the results achieved.

Other inspiring results are those recently accomplished by the Union Civil Protection Mechanism (UCPM) project Cross-border risk assessment for increased prevention and preparedness in Europe (BORIS, 2021-2022), which developed harmonised cross-border approaches for assessing the multiple risks posed by the seismic - and hydro-meteorological - hazard in the cross-border area of Italy, Austria, and Slovenia. Boris also developed a platform aimed at facilitating the visualisation of the results achieved in the project. The platform also allows for storage of data, models, and documents. A follow up of the project (BORIS 2) is scheduled to begin soon to develop an upgraded version of the platform aimed at supporting civil protection authorities in preparing for and responding to seismic emergencies.

The cross-border cooperation among Italy, Austria, and Slovenia in seismic risk management has become a successful reality that is constantly growing and improving. In 2014, the connection between the Italian, Austrian and Slovenian seismological networks was formalised through the signature of a Memorandum of Understanding named “Central and East European Earthquake Research Network” (CE3RN or CE3R Network), which currently involves other countries and has become another inspiring example of transnational cooperation. The development of networks for the timely exchange of reliable information has been key towards building efficient actions for cross-border assessment, prevention, and response of the seismic risk in the area. Also, the continuous collaboration between actors involved in DRM at the border area achieved through different projects fostered joint development of know-hows and resources to deal with associated risks and impacts at the cross-border level. Besides the exchange of seismological data, this initiative also enabled the consolidation of strong collaborative relationships among both the scientific communities and civil protection authorities.

7.2. Introduction

The South-Eastern Alps region is characterised by a relatively high seismic risk. Over the centuries, the cross-border area, shared by North-Eastern Italy (Friuli- Venezia Giulia, Trentino-Alto Adige), Austria (Tyrol, Carinthia) and Slovenia (Figure 28), was affected by severe and destructive earthquakes. One of the most relevant and recent seismic events that hit Italy was the 1976 earthquake in Friuli Venezia Giulia region. It was a 6.5 magnitude earthquake on the Richter scale that was felt by surrounding territories and countries. It is the fifth worst earthquake that hit Italy in 1900: 990 people were killed, up to about 3,000

were injured, and nearly 200,000 were left homeless¹⁰³. In 1998, an earthquake with a Richter scale magnitude of 5.6 hit Bovec (Slovenia) and caused damage to over 4,000 buildings, fortunately without fatalities¹⁰⁴. To date, this event is the largest instrumentally recorded earthquake in the country¹⁰⁵.

Figure 28 Cross-border area shared by Italy, Austria, and Slovenia



Source: authors.

After those major events, the need for a closer collaboration to facilitate seismic risk management in the cross-border area was recognised by the nearby governmental and scientific institutions. In 2001, the first agreement on seismological data exchange was signed by four key transboundary research institutes operating in this field. From this date, the cooperation and collaboration between the three countries evolved and led to the adoption of several examples of good practice that could serve as inspiration to other cross-border areas exposed to seismic risk. In most cases, these achievements were the result of several internationally financed projects focused on the prevention, preparedness, and response to seismic events in the cross-border area.

In the next sections, some of the most successful projects on seismic risk management will be explored, including INTERREG projects *Trans-National Seismological Networks in the South-Eastern Alps*, *Real-time accelerometric monitoring network of sites and buildings in Italy and Austria* (ARMONIA), *Cross-border cooperation between Slovenia and Italy for a safer region* (CROSSIT SAFER), and the UCPM project *Cross-border risk assessment for increased prevention and preparedness in Europe* (BORIS).

¹⁰³ <https://www.ogs.it/it/content/terremoto-friuli>

¹⁰⁴ https://www.ansa.it/nuova_europa/en/news/sections/news/2023/04/10/slovenia-remembers-the-1998-bovec-earthquake_ec3cc982-c944-4ccb-9316-6a4d9988a3a6.html

¹⁰⁵ https://www.researchgate.net/publication/233868637_The_1998_Bovec-Krn_Mountain_Slovenia_Earthquake_Sequence

7.3. Presentation

After the 1976 Friuli Venezia Giulia earthquake, the seismological stations of the National Institute of Oceanography and Experimental Geophysics (OGS) of Trieste was the only monitoring network installed in the South-Eastern Alps, along with other accelerometric stations of the Italian National Accelerometric Network. From 1976, the situation notably evolved and different seismological stations and networks were established in North-East Italy, Austria, and Slovenia mainly by those institutes that, a few decades later, took part in the project *Trans-National Seismological Networks in the South-Eastern Alps* – hereinafter “Trans-National Networks”. These are the seismic networks run by [OGS](#) (1977); the accelerometric network of the Italian Department of Earth Sciences of the University of Trieste ([DST](#)) (1993); the Slovenian seismic network of the Office of Seismology of the Environment Agency of the Republic of Slovenia ([ARSO](#)); and the seismic network of the Austrian Department of Geophysics of the Central Institute for Meteorology and Geodynamics ([ZAMG](#)). Those initiatives resulted in the implementation of different seismological networks in the cross-border area, developed and run independently by scientific institutes from the different neighbouring countries¹⁰⁶.

Nonetheless, the 1998 earthquake in Bovec, Slovenia, highlighted the need for the further integration and strengthening of those monitoring networks. The lack of a direct connection between the seismological centres and of a homogeneous system for data analysis and collection as well as the heterogeneity of the existing sensors and tools emerged as relevant gaps for efficient cross-border seismic risk management. In the event of an earthquake, the respective civil protection authorities were informed by their national networks and only afterwards the data from the other networks was integrated, in most cases only for scientific purposes¹⁰⁷.

To fill in those gaps, two international initiatives were implemented aimed to harmonise and integrate the existing networks and foster the cross-border cooperation of the institutions and the civil protection authorities of the three countries/regions. The workshop “Beyond Frontiers: Seismic Networks in the Southern Alps” and the conference “Integrating the Seismic Monitoring in Central Europe”, respectively held in Trieste and Udine in 2001, were organised by the OGS, DST, and the Civil Protection of the Region Friuli Venezia Giulia (PCFVG), with the collaboration of the Italian National Civil Protection, the National Institute of Geophysics and Volcanology (INGV) and the Department of National Technical Services. The main outcome of these two initiatives was an agreement between the parties on the exchange of seismic data in real-time. This agreement opened the doors to a new path of cooperation and ensured the success of the [Trans-National Networks](#) project. The latter was a European project funded by the INTERREG III A Italy-Austria 2000-2006, which started in 2003 and ended in 2006. The beneficiaries of the project were the PCFVG for Italy and the ZAMG for Austria, and the partners were the DST, OGS and ARSO. Since Slovenia was not part of the European Union yet, ARSO could not be directly financed, but it successfully participated in the project and benefited from it. The main goal of the project was the cross-border integration of the seismological networks present in the three states, with the aim of enabling a strict and consistent collaboration between civil protection authorities as well as providing data for scientific purposes¹⁰⁸. The achievements of the project (see next chapter) set the foundation for a series of developments which further intensified the just-born collaboration between the institutes.

Building upon results achieved in previous initiatives - including the Trans-National Network project -, the [ARMONIA](#) project focused on the cross-border area shared by Italy and Austria

¹⁰⁶ <https://www.yumpu.com/it/document/read/16411489/reti-sismologiche-senza-frontiere-nelle-alpi-sud-orientali-netzwerke>

¹⁰⁷ <https://www.yumpu.com/it/document/read/16411489/reti-sismologiche-senza-frontiere-nelle-alpi-sud-orientali-netzwerke>

¹⁰⁸ <https://www.protezionecivile.fvg.it/it/reti-transfrontaliere>

and strengthened the cooperation between civil protection authorities. Funded by the European Regional Development Fund (ERDF) and INTERREG VA Italy-Austria 2014-2020, the project involved scientific partners and the civil protections of Veneto and Friuli Venezia Giulia regions. These institutions jointly developed an innovative monitoring system (extended to strategic buildings, too) aimed at providing key information for rapid and targeted operation in the event of an earthquake. Analysis tools for the emergency management centres, such as real-time thematic maps, as well as common protocols for training of volunteers and citizens and joint exercises of civil protection were also developed.

At the Italian-Slovenian border, the strengthening of cross-border institutional and governance capacities in disaster risk management (DRM) among civil protection authorities was the objective of the [CROSSIT SAFER](#). This project was part of the INTERREG V-A Italia-Slovenia Cooperation Programme 2014-2020 and involved scientific partners and public administration representatives of the two countries. The focus was the enhancement of institutional collaboration by encouraging public bodies and civil protection authorities to plan common and coordinated actions in the various phases of the DRM cycle. The signature of the final agreement, in June 2022, legally regulated the cross-border mutual exchange of assistance in case of emergencies between the actors involved¹⁰⁹.

Another successful example of cooperation in the cross-border area is provided by the [BORIS](#) project. Funded by the Directorate-General for European Civil Protection and Humanitarian Aid Operations of the European Commission (DG ECHO), BORIS was carried out between 2021-2022 by a group of academia and research partners. The Decision No. 1313/2013/EU on a UCPM requires governments to carry out national risk assessments regularly. Like national risk assessments, cross-border risk assessments are an essential tool to foster prevention and preparedness in transboundary areas. However, several challenges appear when dealing with the transboundary dimension, since the different countries' national risk assessments are not harmonised or comparable in terms of methodologies and data used. For this reason, a process of harmonisation is crucial for developing effective prevention and planning strategies and reducing the impact of disasters in cross-border regions. To address this issue, BORIS focused on implementing a harmonised process that guides the South-Eastern Alps region to use common approaches, data, and models for assessing the level of seismic risk, flood risk as well as multi-risk in the region of interest. The platform developed by the project to collect and visualise its results (see next section) has been linked to the DRMKC - Disaster Risk Management Knowledge Centre - Risk Data Hub of the European Commission with the scope to disseminate and promote data access to a wider public.

Overall, all these projects are aligned with existing EU policy in DRM field since they address in different ways the following [European Union Disaster Resilience Goals](#): to anticipate – to improve risk assessment, anticipation, and disaster risk management planning (DRG 1); to prepare - to increase risk awareness and preparedness of the population (DRG 2); to respond – to enhance the Union Civil Protection Mechanism response capacity (DRG 4); to secure - to ensure a robust civil protection system (DRG 5).

7.4. Impacts

After recognising the existence of significant barriers that undermined effective cross-border risk management, both in terms of shared knowledge and ability to address one of the major risk facing the South-Eastern Alpine area, Italy, Austria, and Slovenia demonstrated an excellent capacity to address and overcome these challenges by joining efforts to increase the resilience of the cross-border area. The three Countries have been able to jointly take

¹⁰⁹ <https://2014-2020.ita-slo.eu/en/all-news/news/crossit-safer-agreement-signing>

advantage of different international funding sources offered by the EC to implement common measures and to ensure their continuity over time. They also had the foresight to improve their joint governance capacities in all DRMC phases by bringing together both the scientific community and public institutions.

Below, the key objectives and major impacts of each project are presented to highlight how they contributed to the establishment of an effective cross-border collaboration and cooperation. Table 5 further below summarises the list of countries, the actors involved, and the key results achieved in each project.

The development of a joint seismic monitoring network and the establishment of effective good relationship among transboundary research institutes [IT/AT/SI]

The Trans-National Networks project successfully connected and harmonised the formerly independent seismic monitoring networks controlled by OGS and DST (Trieste, IT), ZAMG (Vienna, AT), and ARSO (Ljubljana, SI). The key outcomes of the project include:

- the implementation of a real-time data collection centre at the Regional Operations Room (SOR) of the PCFVG in Palmanova, Italy, and the upgrade of the data collection centres of DST, OGS, and Vienna;
- the identification and implementation of efficient and secure data connection systems between the seismic stations and the data collection centres;
- the improvement of the geometry of the seismological networks to guarantee the best possible coverage of high-risk areas in the cross border territory;
- the planning of common procedures and operations in the event of strong earthquakes;
- the homogeneous calibration of the monitoring stations;
- the integration of the joint monitoring data within a software (Antelope) that enables real-time data acquisition, sharing and processing¹¹⁰.

The effectiveness of this project was fully demonstrated during the 2004 earthquake in Bovec-Kobarid. The Antelope system automatically geo-localised the earthquake registered by the three monitoring networks in a few minutes and promptly transmitted the information to the emergency management rooms of the cross-border territory. Also, the establishment of good relationships and the trust built between the neighbouring actors¹¹¹ through this project laid the ground for additional fruitful collaborations. As an example, among other initiatives, they collaborated within the INTERREG IV project SeismoSAT (2012-2015) to further improve the joint seismic network. SeismoSAT complemented the results achieved in the Trans-National Network project by connecting the seismic data centres in real time also via satellite (and not only via internet, which might be interrupted after a strong earthquake). In this way, SeismoSAT contributed to the implementation of a more robust and reliable joint seismic network and ensured data exchange stability during internet outage¹¹².

The connection between the seismological networks was formalised in 2014, when ARSO, the Department of Mathematics and Geoscience of the University of Trieste, OGS and ZAMG agreed to sign a Memorandum of Understanding and created the “Central and East European Earthquake Research Network” (CE3RN or CE3R Network). CE3RN’s goal of enhancing the collaboration between different seismological communities was immediately accomplished: the same year of its creation, the network started incorporating new

¹¹⁰ <https://www.protezionecivile.fvg.it/it/reti-transfrontaliere>

¹¹¹ OGS, AMG, and ARSO, with the addition of the Civil Protection of the Autonomous Province of Bolzano, Italy

¹¹² http://www.crs.ogs.it/seismosat/SeismoSAT-home_files/adgeo-36-57-2014.pdf

members and became an excellent example of trans-national collaboration based on high-quality research and infrastructures. To date, CE3RN also includes the University of Zagreb (Croatia); the National Institute for Earth Physics, Bucharest (Romania); the Hungarian Academy of Science, Geodetic and Geophysical Institute, Budapest (Hungary); the Institute of Physics of the Earth, Masaryk University, Brno (Czech Republic); the Polytechnic University, Institute of Geosciences, Energy, Water and Environment, Tirana, (Albania); the Carpathian Branch of Subbotin Institute Geophysics National Academy of Science of Ukraine; the Academy of Sciences, Institute of Geophysics, Sofia (Bulgaria)¹¹³.

Figure 29 Map of CE3RN Parties (some countries are only involved partially).



Source: CE3RN website

Figure 30 map of seismic stations of the CE3RN network available in the IRIS archive portal



Source: CE3RN website

¹¹³ <https://seisram.units.it/content/ce3rn>

As highlighted by the interviewed experts, cross-border cooperation has become a solid reality that is constantly growing and improving not only from a scientific point of view. Besides the improvement of the network infrastructure and data sharing, the above-mentioned initiatives contributed to the establishment of good human relationships between the actors involved, which facilitates cross-border disaster management and communication especially during emergencies. An example is the strong collaborative relationships between civil protections operating at the border of the three countries, which was in turn facilitated by the signing of memorandum of understandings¹¹⁴ on cross-border mutual assistance in DRM and projects focused on civil protection activities, including SeismoSAT, RIMACOMM (*Risk Management and Communications on Local and Regional level*) and HAREIA (*Historical And Recent Earthquakes in Italy and Austria*)¹¹⁵, but also the more recent ARMONIA and CROSSIT SAFER.

Figure 31 Meeting of civil protection authorities from Italy and Slovenia involved in CROSSIT SAFER



Source: INTERREG Italia-Slovenia <https://2014-2020.ita-slo.eu/crossit-safer>

The sharing of harmonised post-event information for civil protection purposes and the development of common standard operating procedures for the post-disaster phase [IT/AT]

In the aftermath of an earthquake in the cross-border territory of the North-Eastern Alp region, the seismic data collected through the CE3RN (and previously the Trans-National Network) were used to be analysed in different ways by the civil protection authorities. This discrepancy in the analysis was soon recognised as a major gap by the cross-border disaster risk management authorities. For this reason, the project ARMONIA focused on the harmonisation of post-event information to be used for civil protection purposes.

The main result of this project is an Atlas - ARMONIAtlas - that provides harmonised information adopting a common approach and terminology. Thanks to ARMONIA, data collected by the seismological network (CE3RN) and by an additional accelerometric network installed in “sentinel” buildings are immediately elaborated and shared in form of maps through the Atlas. This tool allows the different civil protection authorities to visualise and use consistent data and information to evaluate the ongoing scenario and support their response operations.

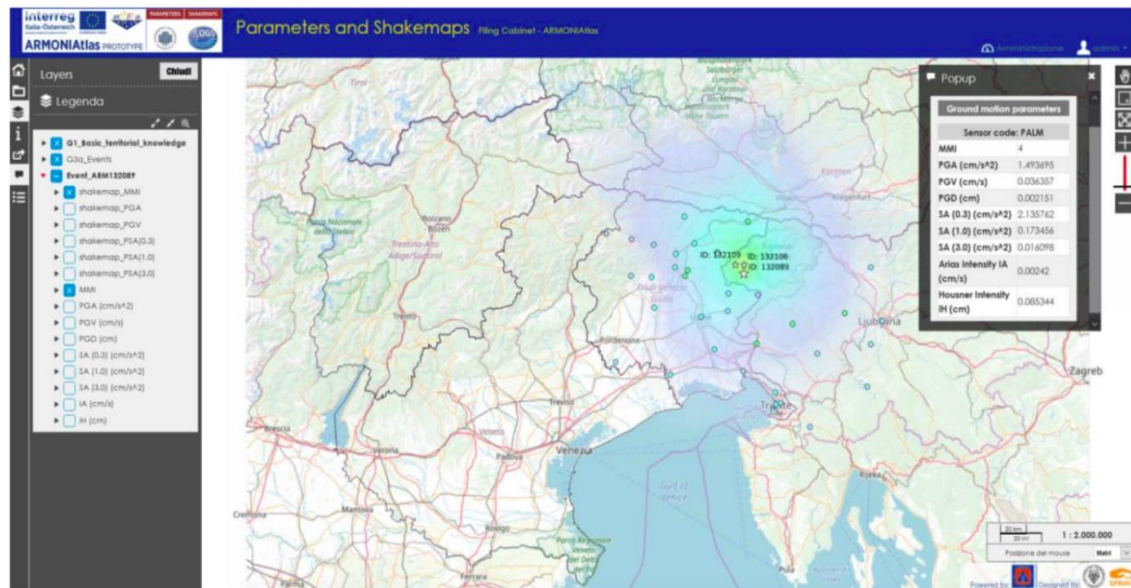
Figure 32 shows a “Shakemap” that can be jointly consulted in the Atlas right after a seismic event. The shakemap collects ground motion data calculated from different sensors distributed throughout the cross-border territory (apart from the ones installed on the floors of buildings)¹¹⁶.

¹¹⁴ The first MoU between the PCFVG and Carinthia and the PCFVG and Slovenia were signed in 2006

¹¹⁵ A description of these and other projects can be found on the website of the PCFVG at <https://www.protezionecivile.fvg.it/it/progetti-europei>

¹¹⁶ <https://drive.google.com/file/d/1oUnwrlBCcpHyNWmJ7HIMMmHJCiXr2RWS/view>

Figure 32 Example of Shakemap on the ARMONIAtlas with ground motion parameters calculated from recordings from different sensors distributed throughout the territory.



Source: ARMONIAtlas Guide.

The partners of ARMONIA also drafted some manuals with instructions on how to complete seismic resentment surveys targeted to civil protection volunteers, and rapid post-disaster impact assessment, as well as other documents that are made available on the website of the project¹¹⁷. At the same time, common protocols developed in the project allowed for common planning, training, and implementation of harmonised actions of civil protection volunteers and citizens to facilitate rescue operations. Training and table-top exercises were organised by the partners of the project to test the cross-border procedures developed in ARMONIA, ranging from seismic alarm to disaster response under the coordination of the respective emergency rooms¹¹⁸. Finally, ARMONIA's goal was to provide civil protection authorities with common information and to allow for a common understanding of seismic events and impacts. Despite the civil protection of Austria not being directly involved in the project it took part in some training exercises and is aware of its results and of the documentation drafted.

The improvement of the preparedness and response phases by joint training programmes and the signature of a cross-border cooperation protocol [IT/SI]

On the Italian-Slovenian side, the collaboration between civil protection and other DRM public authorities was addressed in the CROSSIT SAFER project. The project focused on a list of natural hazards and related risks at the border of Italy and Slovenia and included activities for the improvement of the management of seismic risk. One of the seismic risk-related activities included the simulation of evacuations in schools, which turned out to be a very successful exercise for the communities involved¹¹⁹. The impact of the project on the DRM system of this region is represented by the signature of the cross-border cooperation protocol, the harmonisation of procedures for civil protection interventions in case of natural hazards related risk and the organisation and implementation of joint training and education programmes for civil protection units in both countries. Specifically, thanks to what can be considered a historic agreement signed on June 5, 2022, by the fire brigades in the border area of the Republic of Slovenia and the National Fire Brigade of the Republic of Italy, the

¹¹⁷ Website available at <https://www.armoniaproject.eu/it/blog/30-gennaio-2023-online-la-documentazione-del-progetto>.

¹¹⁸ <https://www.armoniaproject.eu/it/blogs>

¹¹⁹ <https://futurium.ec.europa.eu/pl/border-focal-point-network/good-practices/crossit-safer-cross-border-cooperation-between-slovenia-and-italy-safer-region?language=pl>

units involved in emergency response will be able to cross the border and provide quick and efficient mutual exchange of assistance in case of emergencies¹²⁰.

Figure 33 Picture of a simulation implemented within the CROSSIT SAFER project in 2021



Source: <https://www.facebook.com/crossitsafer/photos>

The drafting of risk assessment guidelines for the cross-border area for seismic risk, flood risk and multiple risks [IT/SI/AT]

As with the ARMONIA project, the importance of sharing a common understanding when dealing with disaster risk management was also the core theme of the BORIS project. In December 2022, BORIS published the consolidated version of the guidelines on cross-border risk assessment¹²¹. Specifically, the document presents general guidelines for carrying out cross-border seismic, flood, and multi-risk assessment, as well as specific guidelines for hazard, exposure, vulnerability, and impact modelling. This shared methodology was applied in some selected municipalities of the two cross-border pilot sites, on the Italian-Slovenian and Slovenian-Austrian borders. It is important to highlight that the guidelines on risk assessment have been elaborated to be entirely transferable and adaptable to any other cross-border area exposed to the seismic risk. The transferability of the methodology to other regions was also tested to the other participating countries (Montenegro and Türkiye) and proved that it can be fully applied to other cross-border areas. Among the main beneficiaries of the guidelines are the scientific community and civil protection authorities. The sharing of common approaches by the scientific communities and research centres in this field represents a step towards the strengthening of common knowledge and trust, as happened in BORIS with the Austrian, Italian and Slovenian scientific partners.

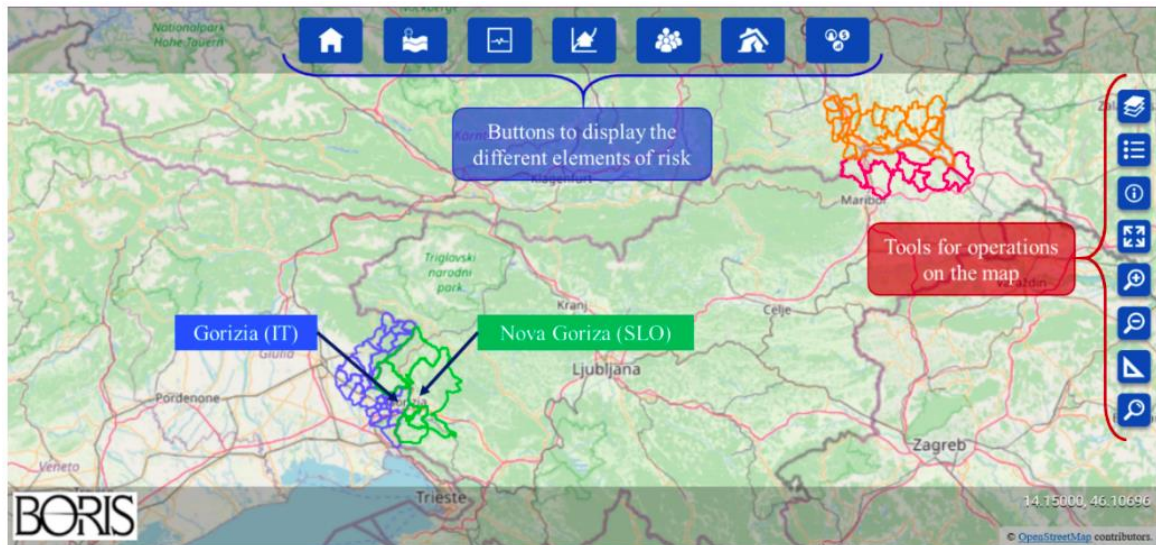
BORIS also developed a WebGIS platform¹²² that allows the user to visualise the data and analyses obtained in the project specific to the two pilot case studies. The figure below shows the platform interface, from which the different elements of risk in the two municipalities can be displayed through the buttons on the top bar.

¹²⁰ <https://2014-2020.ita-slo.eu/en/all-news/news/crossit-safer-agreement-signing>

¹²¹ <https://www.borisproject.eu/wp-content/uploads/2023/01/BORIS-Deliverable-D5.2-submitted.pdf>

¹²² <https://www.borisproject.eu/web-based-platform/>

Figure 34 Platform developed in the BORIS project showing seismic risk assessment of the two pilot cross-border areas



Source: https://www.sciencedirect.com/science/article/pii/S2452321623000240?ref=pdf_download&fr=RR-2&rr=817a15cbdd6d668f.

Overall, both the methodology and the platform were developed with the aim of contributing to the prevention phase of seismic risk management and, especially, to territorial planning. During the training sessions of the Italian, Austrian and Slovenian civil protections on the usage of the platform some suggestions for further improvement were highlighted: in particular, the units of the three countries expressed their interest in a version of the platform more focused on the preparedness and response phase to emergencies. To meet these demands, BORIS 2 is scheduled to begin soon with the aim of supporting emergency management. The platform will be adapted to a lower scale and will include, among other information, data on critical infrastructures and main road networks, that can be used to ensure immediate response in case of an earthquake. In addition, it will be possible to easily simulate risk scenarios including damages and impacts, which can be used for civil protection joint exercises. The results of the BORIS project have also been published on the DRMKC Risk Data Hub¹²³.

Table 6 Initiatives that enhanced the cross-border seismic risk management of Austria, Italy, and Slovenia

Initiative	Countries	Partners	Results achieved
Trans-National Seismological Networks in the South-Eastern Alps (INTERREG, 2003-2006)	Italy, Austria, Slovenia	ZAMG; DST; OGS; and ARSO	<ul style="list-style-type: none"> • implementation of a collection centre of real-time seismic data within the Regional Operations Room (SOR) of the PCFVG in Palmanova, Italy; • upgrade of the data collection centres of DST, OGS, and Vienna; • identification and implementation of efficient and secure data connection systems between stations and collection centres; • redefinition of the geometry of the seismological networks to guarantee the best possible coverage of potentially dangerous areas close to state borders;

¹²³ <https://drmkc.jrc.ec.europa.eu/risk-data-hub#/project/BORIS>

Initiative	Countries	Partners	Results achieved
			<ul style="list-style-type: none"> • planning of common actions and operations in the event of strong earthquakes; • homogeneous calibration of the seismic sensors; • integration of the joint monitoring data within a software (Antelope) that enables real-time data acquisition, sharing and processing.
SeimoSAT (INTERREG, 2012-2015)	Italy, Austria	OGS; ZAMG; ARSO; and the Civil Protection of the Autonomous Province of Bolzano (IT).	Connection of the seismic data centres via satellite.
Central and East European Earthquake Research Network - CE3RN (Founded in 2014)	Italy, Austria, Slovenia, and others.	OGS; ZAMG; ARSO; University of Trieste. Other partners: the University of Zagreb (HR); the National Institute for Earth Physics, Bucharest (RO); the Hungarian Academy of Science, Geodetic and Geophysical Institute, Budapest (HU); the Institute of Physics of the Earth, Masaryk University, Brno (CZ); the Polytechnic University, Institute of Geosciences, Energy, Water and Environment, Tirana, (AL); the Carpathian Branch of Subbotin Institute Geophysics National Academy of Science of Ukraine; the	<ul style="list-style-type: none"> • creation of the seismological network “CE3RN” by OGS, ZAMG, ARSO; • engagement of new members and enforcement of transnational collaboration

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Initiative	Countries	Partners	Results achieved
		Academy of Sciences, Institute of Geophysics, Sofia (BG)	
Real-time accelerometric monitoring network of sites and buildings in Italy and Austria – ARMONIA (INTERREG, 2019-2021)	Italy, Austria	OGS; University of Trieste; University of Udine; PCFVG; Civil Protection of the Veneto Region; ZAMG; and University of Innsbruck	<ul style="list-style-type: none"> • creation of the ARMONIAtlas to provide civil protections with harmonised information in case of earthquake; • drafting of manuals on how to complete seismic resentment surveys and developing rapid post-disaster impact assessments.
Cross-border cooperation between Slovenia and Italy for a safer region - CROSSIT SAFER (INTERREG, 2019-2022)	Italy, Slovenia	PCFVG; the Municipality Of Ajdovščina, Goriška (SI); the Association of Fire Brigades Slovenia; the Public Institution for Fire and Rescue Activities - Fire Brigade Nova Gorica, Gorš (SI); the Institute for Fire and Rescue Service Sežana, Obalno Kraška (SI); the Civil Protection of Veneto (IT); the University of Padua (IT); the Metropolitan City of Venice (IT); and the Municipality of Postojna, Primorsko-notranjska (SI)	<ul style="list-style-type: none"> • signature of a cross-border cooperation protocol; • harmonisation of procedures for civil protection operation; • planning and implementation of joint training and education programmes for civil protection units in both countries
Cross-border risk assessment for increased prevention and preparedness	Italy, Austria, Slovenia	The Italian Centre on Research on Risk Reduction (CI3R) ¹²⁴ ; the Disaster	<ul style="list-style-type: none"> • drafting of guidelines for cross-border risk assessment; • development of a WebGIS platform to visualize data and results achieved in the project

¹²⁴ Within the project three partner members of CI3R were involved: the Network of the University Laboratories of Seismic Engineering (ReLUIS), EUCENTRE, and International Centre for Environmental Monitoring (CIMA).

Initiative	Countries	Partners	Results achieved
in Europe – BORIS (UCPM, 2021-2022)		Competence Network Austria; the University of Ljubljana; the University of Montenegro; and the Ministry of Interior Disaster And Emergency Management Authority of Türkiye	

7.5. Challenges

Some of the experts (see Section 7.8), who directly contributed to the projects described in previous sections, outlined some challenges in the seismic risk management of the cross-border area under analysis. For instance, it was pointed out that carrying out bilateral projects (i.e. ARMONIA - Italy/Austria; CROSSIT SAFER - Italy/Slovenia) rather than initiatives that involve the three countries altogether is only partially beneficial towards the development of a common seismic risk management approach shared by the three countries along the entire border. Another common challenge is the limited and different availability of data for the border areas, to which project activities often must adapt.

In addition, the experts highlighted issues related to the sustainability of the tools implemented within the projects. Once projects are over, it is necessary to find the funds needed to maintain and upgrade the tools and infrastructure developed. Additionally, in most cases, specific training, and exercises on the use of tools elaborated by the project are no longer carried out.

Lastly, the absence of common regional guidelines and regulations for seismic risk management and assessment is considered by some experts as one of main issues hindering a shared approach among countries, making coordination in this field more complex.

7.6. Conclusions and lessons learnt

The cooperation in the seismic risk management field among Italy, Austria, and Slovenia is an excellent example of transboundary good practice. The wide range of activities and projects financed by different European and international sources, such as INTERREG and UCPM, have led to the consolidation of a strong collaboration both in the scientific community and among civil protection authorities of the bordering countries and regions. Parallely, the capabilities to take advantage of external funded opportunities by the actors and institutions involved in cross-border seismic risk management was key towards the continuous improvement of existing capacities and approaches.

The projects described significantly improved the transboundary resilience of the North-Eastern Alps by allowing the achievement of concrete results in better joint assessment and cross border management of seismic risk.

It is worth noting that this cross-border cooperation was started and first led by the scientific community and research centres of the three countries. Hence, what initially was an

informal exchange of knowledge for scientific purposes laid the ground for constant investments in seismic risk management through European funds and projects which involved both the scientific community and the civil protection authorities of the bordering countries.

In response to the challenges mentioned above, the interviewed experts also outlined a series of key recommendations for improving cross-border seismic management between Italy, Austria, and Slovenia. These suggestions include:

- Carrying out more projects involving the three countries altogether, to allow for better prevention, preparedness, and assessment of seismic risk at the border, especially with regards to civil protection activities.
- Increasing the availability of data to better perform assessments in real-time.
- Holding regular meetings between the scientific community to address recent problems and to share research results.
- Conducting exercises and training for civil protection on the use of the tools created within the project with regular frequency over the years.
- Implementing financing mechanisms for ensuring the maintenance and updating of tools, infrastructures and to cover the costs of personnel involved in these activities after the end of the projects.
- Extending the European legislation and guidelines on risk assessment towards the application of common approaches for seismic risk management, similarly to the existing Floods Directive (2007/60/EC).

All the activities carried out through this fruitful collaboration could be replicated in other countries, as highlighted, and recommended by the experts interviewed, who have had or currently hold an active role in seismic risk management in the cross-border area of the South-Eastern Alps region.

7.7. Bibliography

- ANSA.it. Slovenia remembers the 1998 Bovec earthquake. https://www.ansa.it/nuova_europa/en/news/sections/news/2023/04/10/slovenia-remembers-the-1998-bovec-earthquake_ec3cc982-c944-4ccb-9316-6a4d9988a3a6.html (accessed 2023-10-13).
- Bajc, J.; Aoudia, A.; Saraò, A.; Suhadolc, P. The 1998 Bovec-Krn Mountain (Slovenia) Earthquake Sequence. *Geophys. Res. Lett.* 2001, 28 (9), 1839–1842. <https://doi.org/10.1029/2000GL011973>.
- BORIS. <https://www.borisproject.eu/> (accessed 2023-10-13).
- BORIS. Web platform. <https://www.borisproject.eu/web-based-platform/> (accessed 2023-10-13).
- INTERREG Italia-Österreich - ARMONIA. 30 gennaio 2023, Online la documentazione del progetto | Armonia. <https://www.armoniaproject.eu/it/blog/30-gennaio-2023-online-la-documentazione-del-progetto> (accessed 2023-10-13).
- INTERREG Italia-Österreich - ARMONIA. Armonia. ARMONIA: un progetto per fare rete in tema di prevenzione sismologica. <https://www.armoniaproject.eu/it> (accessed 2023-10-13).
- INTERREG Italia-Österreich - ARMONIA. News and events | Armonia. <https://www.armoniaproject.eu/it/blogs> (accessed 2023-10-13).

- INTERREG Italia-Slovenija. Crossit Safer: Agreement signing. <https://2014-2020.ita-slo.eu/en/all-news/news/crossit-safer-agreement-signing> (accessed 2023-10-13).
- Komisja Europejska. CROSSIT-SAFER, Cross-border cooperation between Slovenia and Italy for a safer region | Futurium. Border Focal Point Network. <https://futurium.ec.europa.eu/pl/border-focal-point-network/good-practices/crossit-safer-cross-border-cooperation-between-slovenia-and-italy-safer-region?language=pl> (accessed 2023-10-13).
- OGS; Istituto Nazionale di Oceanografia e di Geofisica Sperimentale. Terremoto Friuli. <https://www.ogs.it/it/content/terremoto-friuli> (accessed 2023-10-13).
- Pesaresi, D.; Lenhardt, W.; Rauch, M.; Živčić, M.; Steiner, R.; Fabris, P.; Bertoni, M. The INTERREG IV Italia-Austria “SeismoSAT”Project: Connecting Seismic Data Centers via Satellite. *Adv. Geosci.* 2014, 36, 57–60. <https://doi.org/10.5194/adgeo-36-57-2014>.
- Polese, M.; Tocchi, G.; Dolsek, M.; Babič, A.; Faravelli, M.; Quaroni, D.; Borzi, B.; Prota, A. Seismic Risk Assessment in Transboundary Areas: The Case Study on the Border between Italy and Slovenia. *Procedia Structural Integrity* 2023, 44, 123–130. <https://doi.org/10.1016/j.prostr.2023.01.017>.
- Protezione Civile della Regione. Reti Sismologiche Senza Frontiere Nelle Alpi Sud. <https://www.yumpu.com/it/document/read/16411489/reti-sismologiche-senza-frontiere-nelle-alpi-sud-orientali-netzwerke-> (accessed 2023-10-13).
- Protezione Civile-Regione Autonoma Friuli Venezia Giulia. Reti Transfrontaliere | Protezione Civile - Friuli Venezia Giulia. Reti Transfrontaliere - Il Progetto INTERREG IIIA Italia-Austria Reti Sismologiche senza Frontiere nelle Alpi Sud-orientali. <https://www.protezionecivile.fvg.it/it/reti-transfrontaliere> (accessed 2023-10-13).
- Università degli Studi di Trieste - Dep. Mathematics and Geosciences. Central and Eastern European Earthquake Research Network CE3RN. CE3RN. <https://seisram.units.it/content/ce3rn> (accessed 2023-10-13).

8. Mont Cenis Dam: Disaster Risk Management between Italy and France

8.1. Executive summary

This case study shows **how cross-border cooperation can increase resilience to address the risks of dam failure or rupture**. The focus is on the development of a shared system for assessing the vulnerability and monitoring of dams, but also through the active involvement of the population exposed to the direct and cascade consequences of a dam failure or collapse.

The **main disaster and risk management components addressed by this case study** are:

- Planning, prevention measures planning, response contingency planning, pooling of response resources.
- Early warning, public warning, situational awareness, real-time data exchange.
- Response cooperation, structures/arrangements for joint response, training/exercises.
- Risk communication with population.
- Innovation using new technologies, digital tools.
- Comprehensive approaches for cooperation over a longer period.

The approach showcased is potentially replicable in other cross-border regions with dams located in the Alpine area, as well as in other parts of the European Union.

As an inspiring example, the case study illustrates the legal, technical, and technological governance framework established between France and Italy with the 2021 Quirinal Treaty, and RESBA – Résilience des Barrages¹²⁵, a project co-financed by the European Regional Development Fund under the INTERREG V France – Italy cross-border ALCOTRA programme.

Notably, RESBA implemented an integrated cross-border assessment system for vulnerability assessment and damage monitoring, involving the authorities responsible for civil protection, research laboratories, local communities, and dam operators. The project developed assessment methods and tools to guarantee a higher level of dam safety and compliance with technical regulations. In addition, new technologies and innovative communication tools were relied upon to facilitate exchanges between the competent cross-border authorities and stakeholders, helping to forge a collective culture of cooperation in disaster and risk management.

8.2. Introduction

The Mont Cenis dam, which is subject to French legislation due to its position, is used to produce hydroelectric energy by France and Italy, through the main electricity power

¹²⁵ http://www.torinometropoli.it/cms/risorse/protciv/dwd/alcotra-resba/description-technique/description_technique.pdf

generation companies (EDF and ENEL respectively), based on the 1947 Treaty of Peace between Italy and France, thus establishing a cross-border dam.

The 2021 Treaty between the French Republic and the Italian Republic for a Strengthened Bilateral Cooperation (the Quirinal Treaty) represents a significant advancement in cross-border cooperation between the two countries. By establishing a dedicated committee, both countries commit to collaborating on crucial issues such as the environment, health, economy, culture, tourism, and disaster and risk management.¹²⁶

By a decree of the Piedmont Regional Council on 26 March 2021, the Dam emergency plan was approved to address the risks related to the propagation of a flood wave caused by a hypothetical structural collapse and/or high-water discharge. The Inter-Institutional Working Group on the Moncenisio Cross-Border Dam Emergency Plan was established with the participation of the Italian civil protection department.

In addition, since 2017, some specific activities related to emergency planning of the Mont Cenis (Moncenisio) dam have been conducted within the cooperative framework of the INTERREG V-A Italy-France Project RESBA that ended on 31/12/2020. RESBA was part of the cross-border ALCOTRA programme, and involved the autonomous region of Valle d'Aosta, the Piedmont region, the French *Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture* (IRSTEA), *Politecnico di Torino*, *Città metropolitana di Torino*, *Direction Régionale de l'Environnement, de l'aménagement et du logement Rhône-Alpes* (DREAL), the *Préfecture de la Savoie*, and Enel s.p.a. The project aimed to secure artificial dams in the Alpine regions, thereby enhancing prevention, communication, and the safety of the respective territories in coordination with civil protection authorities. In the specific case of the Mont Cenis Dam, the project aimed to enhance overall cooperation with other dams in the Alps through close monitoring, enabling precise measurement of deformations that may occur and threaten the stability of the installation down to the millimetre.¹²⁷

8.3. Presentation

The Mont Cenis plateau, which was formerly Italian territory, was attached to French territory by the treaty of 10 February 1947. This paved the way for the construction of a large dam in collaboration between EDF (Électricité de France) and its Italian counterpart (ENEL).

The construction of the main dam took place between 1963 and 1964, with gradual impoundment between 1967 and 1970. The dam is 120 metres high and has a material volume of 14.7 hm³, creating a reservoir with a total capacity of 320 hm³.

What sets this joint infrastructure apart is that the dam is located entirely on French territory, but the reservoir overlooks Italian territory, including a densely populated valley with the towns of Suze and Turin. This situation raises major risks relating to water management and safety in this border region.¹²⁸

¹²⁶ The Quirinal treaty

<https://www.elysee.fr/admin/upload/default/0001/11/8143fbb609fe8fa002cd7a36deccc1a219766cda.pdf>

¹²⁷ <https://www.cls.fr/la-sante-des-barrages-transalpines-surveillee-par-satellite/>

¹²⁸ COTTIN Loïc. Aménagement hydroélectrique du Mont Cenis: le glissement du LAMET auscultation et surveillance renforcée, 2007.

<https://www.e-periodica.ch/cntmng?pid=wel-004%3A2007%3A99%3A%3A442>

Figure 35 Location of the Mont Cenis dam



Source: <https://www.google.com/maps/place/Barrage+Du+Mont-Cenis/@49.2518593,5.8922062,5.83z/data=!4m6!3m5!1s0x4789bbae3e4d5ce9:0xffff65f30c0520f40!8m2!3d45.2250533!4d6.9500582!16s%2Fg%2F11rx6llzdp?hl=fr&entry=tu>

Figure 36 Mont-Cenis dam



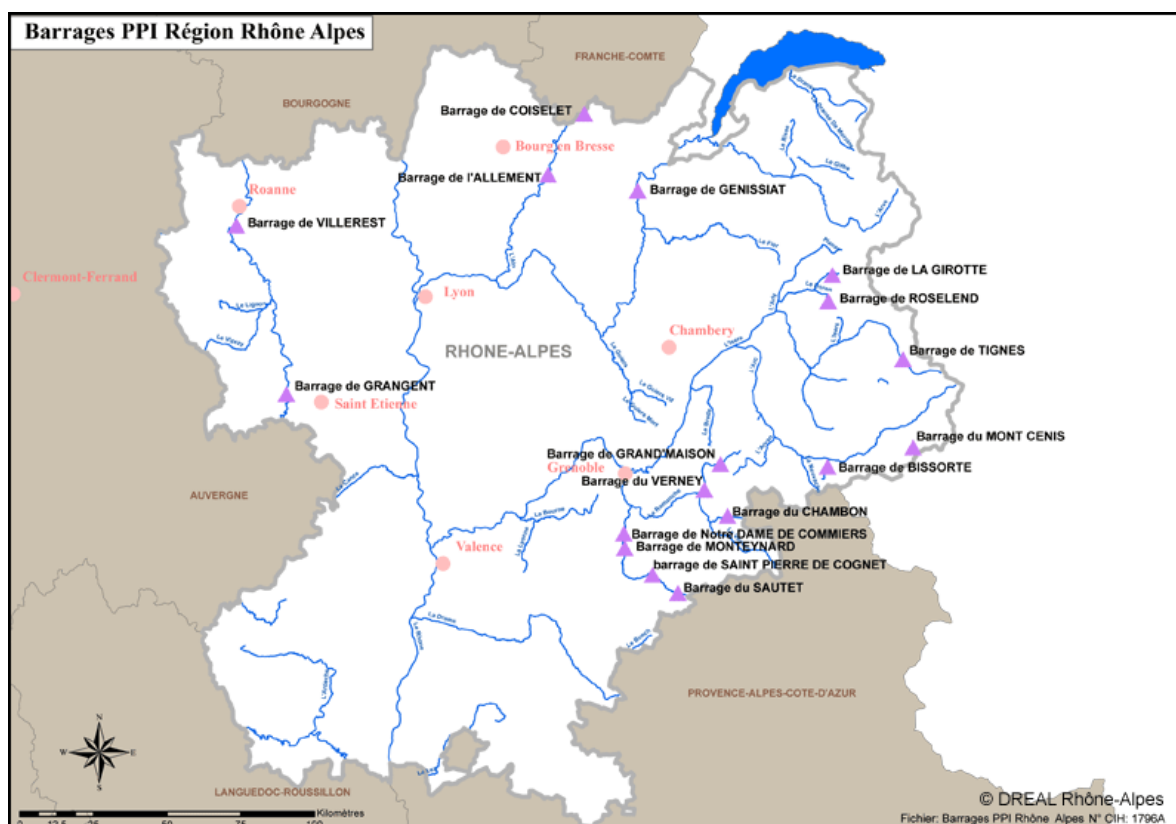
Source: Photo Chiara Guercio on Unsplash.

Cross-border mountain dams, whatever their size, present significant risks for people and property downstream, particularly in urban areas and heavily frequented tourist areas. These risks stem mainly from the possibility of dam failure or rupture, which could have major destructive consequences. The consequence of an accident, downstream, is a

particularly rapid and devastating flood. The wave generated can have repercussions several tens of kilometres downstream, which can be particularly serious if there are highly inhabited areas or sensitive installations, e.g. industries, communication routes, power stations, etc. Furthermore, a dam rupture can generate cascade effects including a risk of pollution of soil, water, or even air, if industrial establishments using dangerous and toxic products are affected.

Dams located in the Alps and in mid-mountain areas are exposed to specific threats that require adapted design approaches and organisational settings. Careful assessment of their vulnerability is required, particularly in the face of hydrogeological hazards such as landslides and flooding, as well as potential seismic hazards present in the regions where these dams are located. These hazards are considered at regional level, which should be harmonised and shared within the Franco-Italian cross-border area. Consequently, close monitoring of these infrastructures is essential to guarantee their safety and that of the people living nearby.¹²⁹

Figure 37 Dams in the French Region of Rhône Alpes



Source: https://www.irma-grenoble.com/05documentation/04dossiers_PJ.php?id_PJ=198&id_DT=9

8.3.1. Current regulatory framework

The Quirinal Treaty represents a significant advancement in cross-border cooperation between France and Italy. By recognising the Franco-Italian border as a shared point of interest, both countries commit to working together to address a diverse range of challenges. The establishment of a dedicated committee, involving local, regional, and national stakeholders, demonstrates their shared determination to address crucial issues

¹²⁹ Comité français des barrages et réservoirs, Modernisation de la surveillance du barrage frontalier du Mont-Cenis exploité et surveillé en collaboration franco-italienne, 2015.

https://www.barrages-cfbr.eu/IMG/pdf/12_-_fabre_-_modernisation_de_la_surveillance_au_barrage_frontalier_du_mont_cenis.pdf

such as the environment, health, energy, transportation, education, economy, culture, and tourism. This treaty thus lays the groundwork for a robust and integrated collaboration, establishing the foundations for sustainable and mutually beneficial transborder relations between the two nations¹³⁰.

In the case of the Mont Cenis dam, the Commission Technique de Surveillance (CTS), set up in 1947 by the French and Italian governments, is responsible for supervising this structure. In its early years, its main mission was to supervise the construction of the facility, and subsequently to oversee its operation by EDF. In 1977, to provide additional support to the CTS, a Committee of Experts was set up, meeting physically twice a year to contribute to the preparation of CTS decisions. In short, the CTS plays a crucial role as an essential forum for exchange between the French and Italian delegations concerning the operation and monitoring of the dam. this institution is technically responsible for the dam.

As regards the current regulatory framework for monitoring the dam, Italy, and France each have their own legislation. Since 2018, they have been working on a binational emergency plan.

From the Italian side, the dam emergency plan, drawn up by the Piedmont region with the support of the civil protection department, implements numerous measures to deal with the risks of dam bursting and to ensure the safety of the population and property at risk. Documents are produced every day to indicate the absence or presence of dangerous situations, thanks to different alert levels, identified by a colour code and operational phases.¹³¹

Green corresponds to a normal operational phase; yellow to an operational phase of attention; orange to an operational phase of attention; red to an operational phase of alarm. The communes of the Val Cenise, at an orange alert level, and the other communes at a red alert level, receive an alert message from the Piedmont region crisis unit and implement the operational measures set out in the civil protection plan.¹³²

The Piedmont region of Italy is currently working on a new plan that complies with the "Seveso directive" (European directive 82/501 / EEC, implemented in Italy by the presidential decree of 17 May 1988, n. 175 in its first version), which obliges EU member states to identify their sites at risk. The document will be shared with the prefecture and local authorities, with a view to a precise and effective distribution of warning and emergency response tasks. In the case of the Mont Cenis dam, the French procedure will have to be brought in line with the Italian one: in practical terms, for example, France has seven alert phases compared with three (yellow, orange, and red) in Italy. The fundamental aspect is precisely that of integration: it will be essential for the local plans of the communes to be harmonised with the national levels.¹³³

In France, three laws (law no. 2006-1772 of 30 December 2006, decree no. 2007-1735 and the circular of 8 July 2008) classify hydraulic structures such as dams into 4 categories (A, B, C and D). In the Alps, the DREAL (Direction régionale de l'environnement, de d'Aménagement et du logement) is responsible for monitoring dams at regional level, in collaboration with the prefect.

The category A Mont Cenis dam is subject to a special intervention plan (PPI) which sets out the measures to be taken to protect the population, property, and the environment. This

¹³⁰ The Quirinal treaty.

<https://www.elysee.fr/admin/upload/default/0001/11/8143fbb609fe8fa002cd7a36deccc1a219766cda.pdf>

¹³¹ Histoires de résilience, le barrage de Moncenisio, les administrateurs, les urgences, la population et le territoire (Website). <https://futura.news/histoires-de-resilience/>

¹³² Histoires de résilience, le barrage de Moncenisio, les administrateurs, les urgences, la population et le territoire (Website). <https://futura.news/histoires-de-resilience/>

¹³³ Histoires de résilience, le barrage de Moncenisio, les administrateurs, les urgences, la population et le territoire (Website). <https://futura.news/histoires-de-resilience/>

specific intervention plan sets out the obligations of the dam operator, who must ensure regular monitoring of the structure, by carrying out periodic visits to the facilities and regular checks on the safety of the structure. This monitoring enables the risk of failure to be detected. At the same time, the DREAL carries out annual and ten-yearly inspections.¹³⁴

8.3.2. RESBA Project

In a context of cross-border cooperation for the specific management of the Mont Cenis dam, the RESBA project was launched in 2017 as part of the INTERREG V-A Italy-France (ALCOTRA) 2014-2020 cross-border European territorial cooperation programme. Led by the autonomous region of the Aosta Valley, the project brings together several partners (cf. Figure 38) with the aim of increasing knowledge of the risks associated with the presence of dams in Alpine territories and improving prevention, communication, and management of dam safety downstream of dams using appropriate civil protection procedures, thereby increasing the resilience of the territory. The general aim is to increase knowledge, train technical staff and raise awareness of dams among local administrators and citizens about dam-related risk management and prevention.¹³⁵

Figure 38 Members of the RESBA project



Source : Torino metropoli

In line with the ESIF operational programmes, the project has set the following specific objectives:¹³⁶

¹³⁴ Département de la Savoie. Dossier départemental des risques majeurs de la Savoie.

¹³⁵ Projet résilience des barrages, description technique détaillée du dossier INTERREG, 2020. http://www.torinometropoli.it/cms/risorse/protciv/dwd/alcotra-resba/description-technique/description_technique.pdf

¹³⁶ Torino metropoli, projet ALCOTRA RESBA. <http://www.torinometropoli.it/cms/protezione-civile/special-projet-alcotra/projet-alcotra>

- Assess the vulnerability of cross-border barriers and develop innovative monitoring systems
- Involve all citizens through an information and communication strategy
- Organise training programmes for local administrators, technicians, professionals, citizens, and schools
- Carry out a bilateral civil protection operation on the Mont Cenis dam as a "pilot zone" to assess the reaction of the local authorities and the population in the event of the emergency plan being activated
- Promote a risk management culture by improving warning communication tools and technologies, and by conducting specific information campaigns on emergency plan.

Figure 39 Piedmont region operations room



Source: RESBA project

The actions planned to increase understanding of dam safety phenomena include the development of procedures and best practices for assessing the safety of existing dams and planning the construction of new dams. Alpine and mid-mountain dams are exposed to specific hazards that require specific design methodologies, a careful assessment of their vulnerability to the hydrogeological (landslides and flooding) and seismic hazards in the areas where they are located.

This objective has been achieved through several steps, including a study of accidents and incidents in the Franco-Italian Alps region, an analysis of the effects of natural phenomena

in the Franco-Italian Alps on dam vulnerability, an assessment of dam vulnerability and the exploration of innovative methods for monitoring dam condition.¹³⁷

A major training activity is aimed at the various target groups who will benefit from the results of the project, including local administrators and elected representatives, municipal technical services, associations and volunteers, and operators of dams at risk in the area.

Internal meetings of the project partners were organised to share the progress of the various activities and the results. During years 1 and 2 of the project, two seminars were organised in France and Italy to bring together local stakeholders in the mountains and valleys of the Alpine arc including State administrations, local authorities, nature and civil society associations, and professional representatives. At the end of the project, two conferences in France and Italy open to the dam industry were organised to present the final results.¹³⁸

In addition, the project aims to improve communication between the institutional and operational bodies involved in implementing the emergency plan by renovating the warning dissemination systems. For example, the RESBA project has put in place shared tools between French and Italian players to be effective in risk prevention. Among the actions implemented, the complete computerisation of the emergency plan and its sharing on a web platform has facilitated data accessibility. Cross-border training, awareness-raising and simulation exercises have also been undertaken to improve coordination.

Finally, with the aim of making the areas concerned more resilient, the RESBA project has helped to improve communication with the public by optimising institutional websites and running information campaigns on adopting the rules of self-protection in the event of an emergency.

The RESBA project's communication

The RESBA project's communication aims to achieve the following objectives:

- To raise awareness of the importance of environmental conservation and protection;
- Strengthen and extend the involvement and participation of target systems and groups;
- Facilitate and strengthen exchanges between project partners in order to achieve the expected results;
- To provide a "brand" for the project, i.e. an image that is familiar and therefore easily and immediately recognisable;
- To strengthen the international network of the Alcotra programme thanks to the experience of this project;
- To publicise the European Commission's funding and what it is doing for the development of territories and citizens.

Source: RESBA project

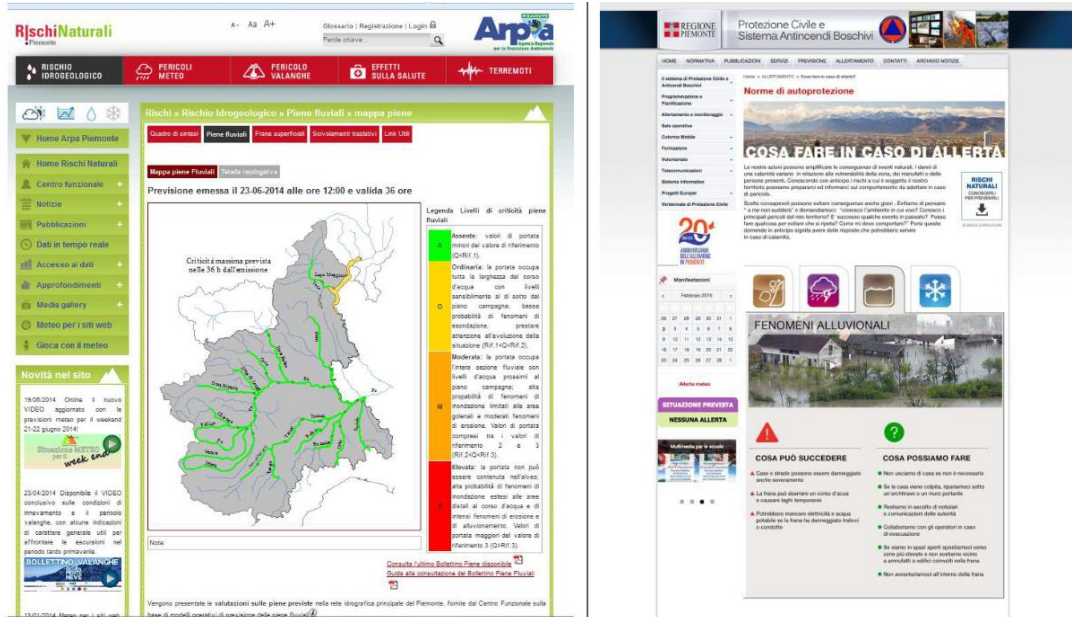
¹³⁷ Projet résilience des barrages, description technique détaillée du dossier INTERREG, 2020. http://www.torinometropoli.it/cms/risorse/protciv/dwd/alcotra-resba/description-technique/description_technique.pdf

¹³⁸ Projet résilience des barrages, description technique détaillée du dossier INTERREG, 2020. http://www.torinometropoli.it/cms/risorse/protciv/dwd/alcotra-resba/description-technique/description_technique.pdf

8.4. Impacts

In addition to strengthening cooperation between the Italian and French civil protection services and getting the public more involved in risk management, the RESBA project has produced concrete technical results, such as the creation of a bi-national database, the development of testing methods to check the watertightness of infrastructure, and the improvement of monitoring techniques using new technologies.

Figure 40 Bi-national websites



Source : RESBA project

This project could be replicated for similar dams in the Alpine region and beyond. These dams are subject to specific risks that require correct design, a careful assessment of vulnerability to hydrogeological (landslides and flooding) and the seismicity of the areas in which they are located and require constant monitoring.

As part of the INTERREG RESBA project, five other dams in the Aosta Valley are being monitored by satellite imagery. This technique enables continuous monitoring of the five dams, measuring to the nearest millimetre any deformations that might occur and threaten the solidity of the installation.¹³⁹

Figure 41 Dams in the Aosta Valley monitored by satellite imagery



La Grantesta - La Thuile

Nouva - Pila Gressan

Cime Bianche - Cervin

Weissmatten - Gressoney

Source: INTERREG ALCOTRA

¹³⁹ CLS. The state of Transalpine dams monitored via satellite, 2020. <https://www.cls.fr/en/the-state-of-transalpine-dams-monitored-via-satellite/>

Despite the different legal frameworks for dam management, this project provided an opportunity to bring the civil and political authorities closer together in the practical management of risk and the implementation of a bi-national emergency plan. In a common territory, with similar problems, cross-border territorial cooperation projects are an important way of bringing together the technical and scientific experience of the various partners.

8.5. Challenges

From a technical point of view, the RESBA project, in particular satellite monitoring techniques, can be used for dams located at altitude. This project cannot therefore be optimally implemented on dams located on the plains.

The interviews also revealed that the different regulatory frameworks in the civil protection systems could be a challenge in the coordination between the Italian and French teams in implementing the project. In France and Italy, civil protection is not a task assigned to a single administration. It is a system coordinated by several players operating at different levels.

In addition, the population living near or downstream of the dams often lacks adequate knowledge on this subject and would find themselves in great difficulty in the event of the implementation of an emergency plan linked to the failure of a dam. The development of adequate means of awareness raising, and of communication tools that are capable of targeting people who are at risk from dam failure is therefore crucial.

8.6. Conclusions and lessons learnt

Dams in cross-border mountain regions play a crucial economic and social role, supplying drinking water, facilitating irrigation, generating hydroelectric power, and producing artificial snow. These infrastructures require constant monitoring because of the risk of breakage, and it is strongly facilitated by active cross-border cooperation.

The RESBA project demonstrates that to create resilient communities against the risks linked to dam failure or rupture, it is important to strengthen the cooperation between competent cross border authorities, but is also key to provide citizens with information, gather their opinions and actively engage them in effective communication.

The RESBA project is a successful demonstration of cross-border cooperation in the prevention of dam failure risk. Moreover, INTERREG has proven its key role for catalysing cross-border Disaster Risk Prevention.

Despite areas for improvement in regulatory aspects and coordination among stakeholders, this project, with its innovative techniques, can be replicated in other similar dams in the Alpine area and elsewhere.

8.7. Bibliography

- CLS. The state of Transalpine dams monitored via satellite, 2020, <https://www.cls.fr/en/the-state-of-transalpine-dams-monitored-via-satellite/>
- Comité français des barrages et réservoirs, Modernisation de la surveillance du barrage frontalier du Mont-Cenis exploité et surveillé en collaboration franco-italienne, 2015. https://www.barrages-cfbr.eu/IMG/pdf/12_-_fabre_-_modernisation_de_la_surveillance_au_barrage_frontalier_du_mont_cenis.pdf
- COTTIN Loïc. «Aménagement hydroélectrique du Mont Cenis: le glissement du LAMET auscultation et surveillance renforcée», 2007
- [Histoires de résilience, le barrage de Moncenisio](#), les administrateurs, les urgences, la population et le territoire (Website), <https://futura.news/histoires-de-resilience/>
- « Les barrages : la connaissance et la sécurité », séminaire technique transfrontalier du projet alcotra resba, 2018. http://www.cittametropolitana.torino.it/cms/risorse/protciv/dwd/alcotra-resba/convegno/convegno-19-06/sautron-arenti_savoie.pdf
- Projet résilience des barrages, description technique détaillée du dossier INTERREG, 2020 http://www.torinometropoli.it/cms/risorse/protciv/dwd/alcotra-resba/description-technique/description_technique.pdf
- Summary report Italy, report pursuant to article 6 (1) (D) of decision 1313/2013/EU https://civil-protection-humanitarian-aid.ec.europa.eu/system/files/2022-09/Summary-Report-Italy-art-6_1-d-Decision-1313-2013_EN.pdf
- Torino metropoli, projet ALCOTRA RESBA, <http://www.torinometropoli.it/cms/protezione-civile/special-projet-alcotra/projet-alcotra>

9. Intersucho: Joint Drought Management between Czechia and Slovakia

9.1. Executive Summary

This case study shows how cross-border cooperation can contribute to enhance resilience against the risk of drought. It focuses on the collaboration between the Czech Republic, Slovakia, and other Central Europe countries for setting up an integrated system for drought monitoring to monitor and predict soil moisture and drought intensity, which can be further exploited for supporting decisions in risk management.

The main disaster and risk management components addressed by this case study are:

- Risk assessment, vulnerability assessment, foresight, data-collection, mapping/GIS of risks
- Early warning, public warning, situational awareness, real-time data exchange
- Civic engagement in resilience building, volunteering
- Nature based solutions, working with natural processes (floods, wildfire, droughts, climate-proof building) including building partnerships with stakeholders.

The study showcases the INTERSUCHO service, which analyses past and monitors current drought conditions, and explores future trends in the Czech Republic, Slovakia, and Central Europe¹⁴⁰. The service involves compiling high-resolution drought indicators and gathering original information about drought impacts through a network of voluntary impact reporters. These drought reporters assess the effects of drought within their geographic areas and fields of expertise.

The INTERSUCHO team involves meteorologists, atmospheric physicists, climatologists, historical climatology experts, agroclimatologists, dendrochronologists, eco-physiologists, historians, archivists, and socio-economists, collaborating with satellite data experts. The team also includes a programmer and GIS specialists. The team leverages previous drought monitoring and research initiatives in the US and collaborates with the European Drought Observatory (EDO), a component of the Copernicus Emergency Service.

Previously, the initiative received funding from diverse sources, including the Ministry of Education, Youth, and Physical Education, the National Agency for Agricultural Research of the Czech Republic, the European Commission, and the Grant Agency of the Czech Republic. In 2015, the collaboration expanded to include experts from the Academy of Sciences of the Slovak Republic and the Slovak Hydrometeorological Institute.

The primary research is conducted at the Institute of Global Change Research of the Academy of Sciences of the Czech Republic (CzechGlobe), Mendel University in Brno, and Masaryk University. Collaboration extends to include the Czech Hydro-Meteorology Institute (CHMU), Slovak Hydro-Meteorology Institute (SHMU), Slovak Academy of Science (SAV), and agrometeorologists at the Doksany observatory. The INTERSUCHO service involves drought research conducted at two national hydro-meteorological institutions, the Czech Hydrometeorological Institute (CHMU) and the Slovak Hydrometeorological Institute (SHMU). This collaboration was initially initiated through the DriDanube project¹⁴¹, which was co-funded by the European Regional Development Fund under the INTERREG Danube transnational programme.

¹⁴⁰ <https://www.intersucho.cz/sk/o-nas/o-projekte/?mapcountry=sk>

¹⁴¹ <https://www.interreg-danube.eu/approved-projects/dridanube>

The cross-border dimension of this project is the common sharing of data, tools, methodology, innovation, and approach of data collection from the local drought reporters.

The primary outcome of this service is a fully functional drought monitoring system equipped with early warning capabilities for local stakeholders across borders. This service integrates data from models and satellite sensors with reports on drought impacts from farmers and foresters. What distinguishes the INTERSUCHO team in the field of drought research is their distinctive approach of bringing together diverse disciplines and their strong commitment to collaborating with potential end-users. These users range from senior officials in the Ministry of Agriculture to individual agricultural and forestry enterprises, as well as the general public.

The methods and tools employed are **replicable** in other countries. Additionally, since some of the products are already offered at the European and global scale, and the approach of engaging local drought reporters from agriculture and forestry is user-friendly and easily implementable.

9.2. Introduction

The INTERSUCHO service was launched in response to the growing frequency and severity of droughts in Central Europe, which have been exacerbated by climate change. It focuses on monitoring and forecasting drought intensity, water deficits, soil saturation levels, vegetation health, and the impacts of drought on agricultural yields and forests in both Czechia and Slovakia. It also extends its coverage, at lower resolution, to other parts of Central Europe (see Figure 43). Data are collected from sensors, models, and local stakeholders, including farmers and forest owners. The extent of impact monitoring relies on the cooperation of local data contributors, and the main challenge is to attain comprehensive coverage.

In addition to advanced data processing and the analysis of drought conditions using satellite observations of soil humidity and vegetation conditions, the INTERSUCHO service employs multi-model rainfall forecasts and an innovative impact monitoring system that involves a network of local drought “reporters” people from the agriculture or forestry industry through a crowdsourcing approach. These local drought reporters are tasked with completing a brief online questionnaire. The data collected by the INTERSUCHO team in the Czech Republic and Slovakia is used to create drought impact maps, which are integrated with maps generated from models and satellite data [ECMWF¹⁴², Copernicus¹⁴³].

9.3. Presentation

9.3.1. Location

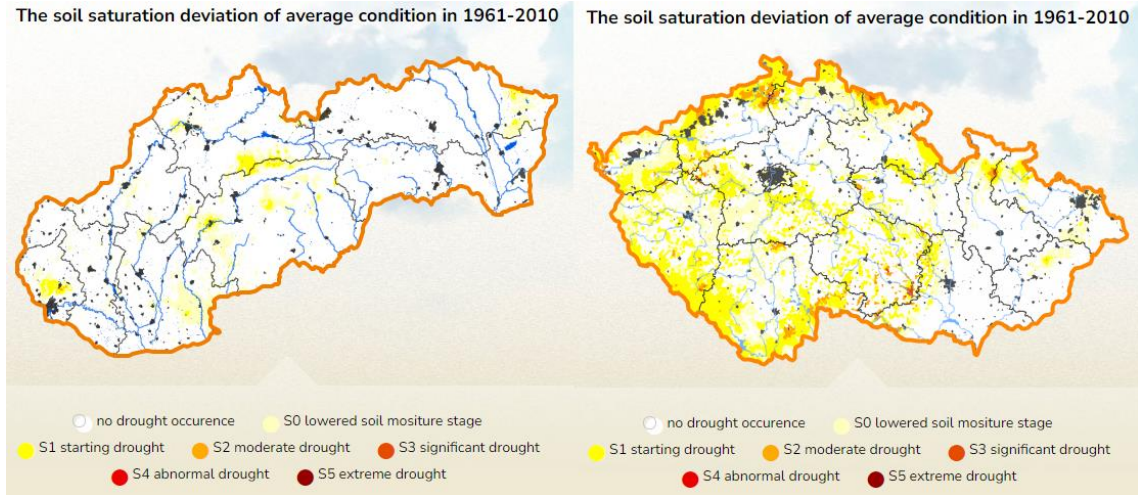
The service was mainly implemented in Czechia and Slovakia, but certain products were also implemented on a broader scale, covering Central Europe, and extending to a global level (Figures 42-43). The service results can be found on the website INTERSUCHO¹⁴⁴. This webpage presents drought maps (Figure 44) with the impact on different fields of the cross-border area. These data are updated daily.

¹⁴² <https://www.ecmwf.int/en/forecasts/datasets>

¹⁴³ <https://land.copernicus.eu/global/products/swi>

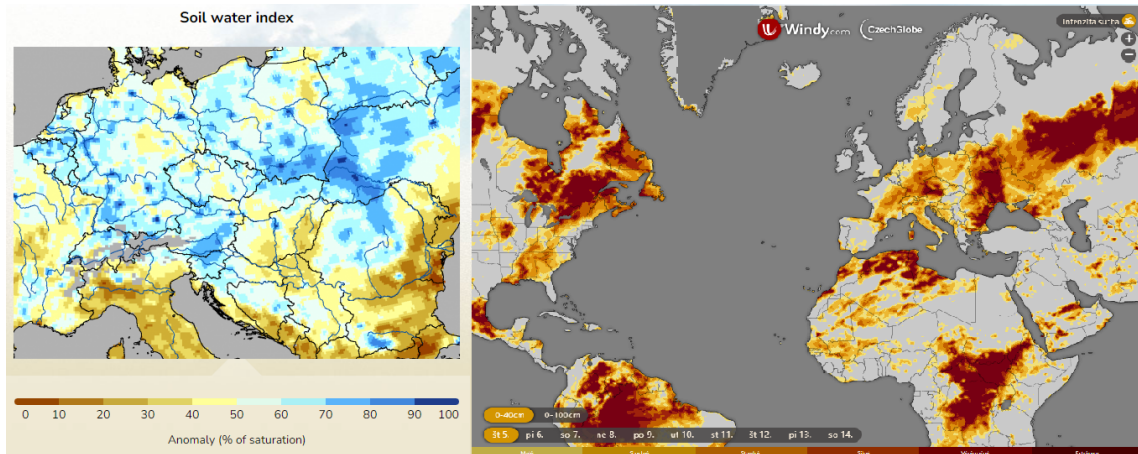
¹⁴⁴ <https://www.intersucho.sk/en/?mapcountry=sk&from=2023-09-07&to=2023-10-05¤t=2023-10-01;>
[https://www.intersucho.cz/en/?from=2023-09-07&to=2023-10-05¤t=2023-10-01](https://www.intersucho.sk/en/?maphttps://www.intersucho.cz/en/?from=2023-09-07&to=2023-10-05¤t=2023-10-01)

Figure 42 The soil saturation of average conditions in 1961-2010 for CZ and SK.



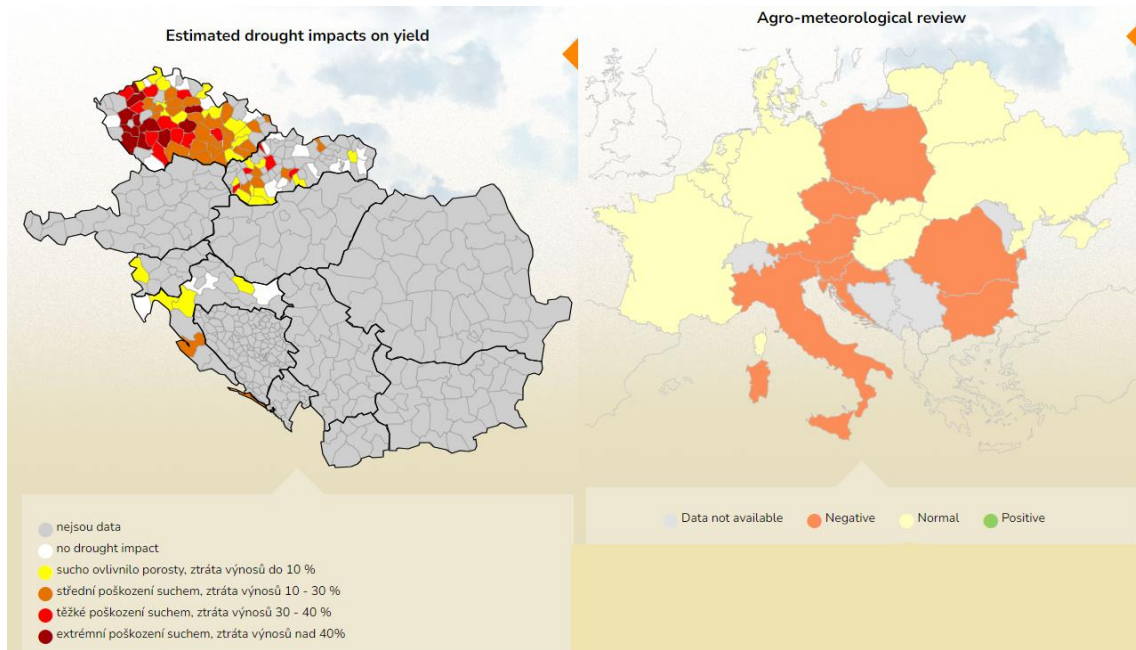
Source: intersucho.cz/sk

Figure 43 Soil water index for EU and worldwide from sensor



Source: intersucho.cz/sk

Figure 44 Drought impacts on yield and Agro-meteorological review for Central EU

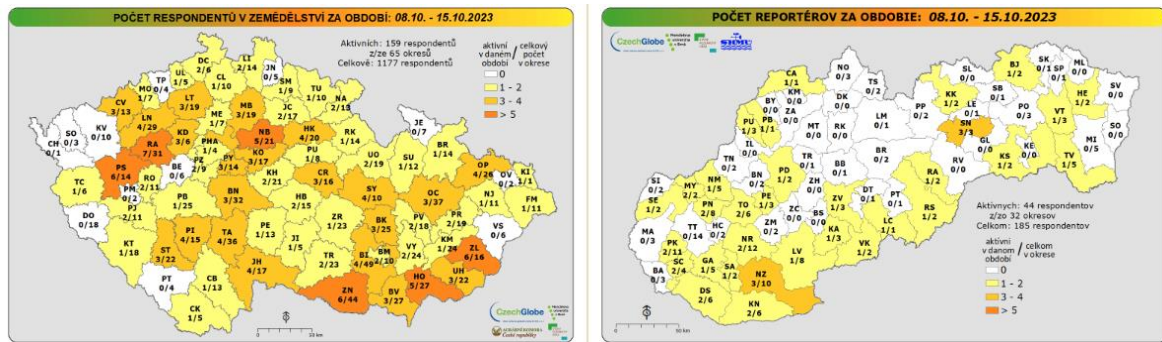


Source: intersucho.cz/sk

9.3.2. Stakeholders involved

The INTERSUCHO drought monitoring service was developed in collaboration with Czech Globe¹⁴⁵ and Mendeleev University in Brno¹⁴⁶. Input data for calculations are sourced from Czech¹⁴⁷ and Slovak Hydro-Meteorological institutions¹⁴⁸ through contractual cooperation. The field drought monitoring is overseen by “local drought reporters”, primarily individuals working in agriculture and forestry but also enthusiastic citizens eager to contribute. The whole Intersucho team is described at the [Intersucho.cz](https://www.intersucho.cz) and [Intersucho.sk](https://www.intersucho.sk) websites.

Figure 45 Number of the drought reporters for the given period / total number of drought reporters in Czechia (left) and Slovakia (right) source: [Intersucho.cz/sk](https://www.intersucho.cz/sk)



Dr. Miroslav Trnka from Czech Globe played a pivotal role in initiating this service. He has been conceptualising a functional, multi-level drought monitoring system since 2001. Collaborating with other research team members, this vision has been successfully realised. Dr. Trnka is responsible for the system’s architecture and methodologies, overseeing its development, and evaluating its outcomes. He leads or contributes to studies that analyse the causes and impacts of ongoing drought episodes. His research is heavily focused on studying historical droughts and projecting future scenarios for the 21st century, taking climate change effects into account.

9.3.3. Needs

The INTERSUCHO service originated from the agricultural and forestry sectors, which were facing progressively longer drought periods.¹⁴⁹ Droughts can have devastating impacts on both the environment and society, which makes monitoring essential.

Traditionally, scientists have concentrated on drought indicators to evaluate the drought evolution. The INTERREG DriDanube project¹⁵⁰ on the other hand sought to enhance this approach by integrating on-the-ground information about drought impacts. This comprehensive approach enabled a more thorough evaluation of the current drought condition.

The INTERSUCHO team from the Czech Globe identified a significant gap in drought management, specifically the absence of information concerning drought impacts throughout the region. Early awareness of these impacts is crucial for generating early estimates and warnings about their scale. Equipped with these estimates, proactive measures can be implemented to reduce damage costs effectively.

¹⁴⁵ <https://www.czechglobe.cz/cs/>

¹⁴⁶ <https://mendelu.cz/>

¹⁴⁷ <https://www.chmi.cz/>

¹⁴⁸ https://www.shmu.sk/sk/?page=1&id=meteo_num_mgram&nwp_mesto=32331

¹⁴⁹ <https://www.climatechangepost.com/slovakia/droughts/>

¹⁵⁰ <https://www.interreg-danube.eu/approved-projects/dridanube>

After the creation of the methodology by the Czech Globe, the idea came to share it on the national and cross-border level. Slovakia was the first choice for sharing, because the Czech and Slovak Hydro-meteorological authorities have a common history, and the Interreg-project (Dri-Danube) supported it with funding.

9.3.4. Description of the actions

The INTERSUCHO service provides data collected from local contributors and research from Czech Globe, and Czech and Slovak Hydro-Meteorological Institutions. Data consist of observed data and from projection and early warning.

Drought monitoring encompasses three key steps:

- Using the verified SoilClim water balance model¹⁵¹, which was developed through collaborative projects involving the three participating institutions. This model maximises input data from Czech and Slovak Hydro-Meteorological Institutions ground measurements interpolated at a 500 m grid resolution. The calculation also considers various factors such as vegetation cover (or land use), current developmental status, slope level, exposure, and fundamental soil properties.
- Comparing the current soil moisture state estimated by SoilClim model with the 50-year long-term average 1961-2010 of soil moisture for each day. These values are represented using a straightforward 7-degree colour scale (Figure 43).
- Enhancing drought monitoring through an independent analysis of drought's impact on vegetation. This is achieved by comparing current and historical satellite images of vegetation conditions (with a resolution of 250 m), obtained from the Aqua and Terra satellites - the MODIS system¹⁵². This analysis is conducted in collaboration with Mendeleev University in Brno, CzechGlobe, and the Geographical Institute of Masaryk University.

All data sources are unified into one grid system and stored and updated at the Agrometeorological Observatory CHMU in Doksany¹⁵³.

The SoilClim model draws inspiration from the work of Allen et al. (1998 and 2005), it incorporates a series of modifications and adaptations to suit the specific conditions of the Slovak Republic. The current version of the model allows for the estimation of current and reference evapotranspiration, as well as soil moisture content in two root profile layers, across 11 vegetation types. It also includes a dynamic growth and phenological model. The resulting value indicates the likelihood of the given soil moisture content recurring on that day and is used to assign the corresponding drought intensity level (S0=lowered soil moisture stage; S1=starting drought; S2=moderate drought; S3=significant drought; S4=abnormal drought; S5=extreme drought)¹⁵⁴.

Drought impact mapping operates on a weekly time scale. The process begins with the completion of a brief online questionnaire. Subsequently, the impact map is provided, typically within two days of receiving the completed questionnaires.

¹⁵¹ <https://www.sciencedirect.com/science/article/abs/pii/S0378377411000643>. Hlavinka P, Trnka M, Balek J, Semerádová D, Hayes M, Svoboda M, Eitzinger J, Možný M, Fischer M, Hunt E, Žalud Z. 2011. Development and evaluation of the SoilClim model for water balance and soil climate estimates. *Agriculture and Water Management* 98: 1249–1261. DOI: 10.1016/j.agwat.2011.03.011

¹⁵² <https://modis.gsfc.nasa.gov/about/>

¹⁵³ <https://www.chmi.cz/aktualni-situace/aktualni-stav-pocasi/ceska-republika/stanice/profesionalni-stanice/prehled-stanic/doksany?l=en>

¹⁵⁴ <https://www.intersucho.cz/cz/o-suchu/jak-sucho-monitorujeme/>

Figure 46 Online questionnaire [Intersucho questionnaire]

Som tu prvýkrát Už mám účet Zabudnuté heslo

Dotazník vyplňujte k dátumu poslednej nedeli (informácie o dátume)

8.10.2023

Meno * Priezvisko * E-mail * Názov firmy *

Oblasť hospodárenia * Katastrálne územie * (prečítajte si ako zvoliť kataster)

Oblasť hospodárenia: Vyberte okres Vyberte kataster pre pridanie POKRAČOVAŤ

Prečítajte si ako správne vyplňovať dotazníky.

1. Aká je pôdna vlhkosť vo vrstve od povrchu do 20 cm?

- 1. pôda na dotyk suchá, prašná, bez možnosti vytvoriť akýkoľvek tvar
- 2. pôda na dotyk suchšia, rozsypajúcej štruktúry; nezanecháva vlhkosť
- 3. pôda mierne vlhká, dá sa formovať, ale nízka súdržnosť; zanecháva vlhký pocit na prstoch
- 4. vlhká pôda dobre tvarovateľná s možnosťou otláčenia prsta
- 5. pôda plne nasýtená vodou, lepí sa na prstoch - blatistá
- nemožno hodnotiť

2. Ako hodnotíte posledné 3 mesiace z pohľadu vodnej bilancie?

-3 -2 -1 0 1 2 3

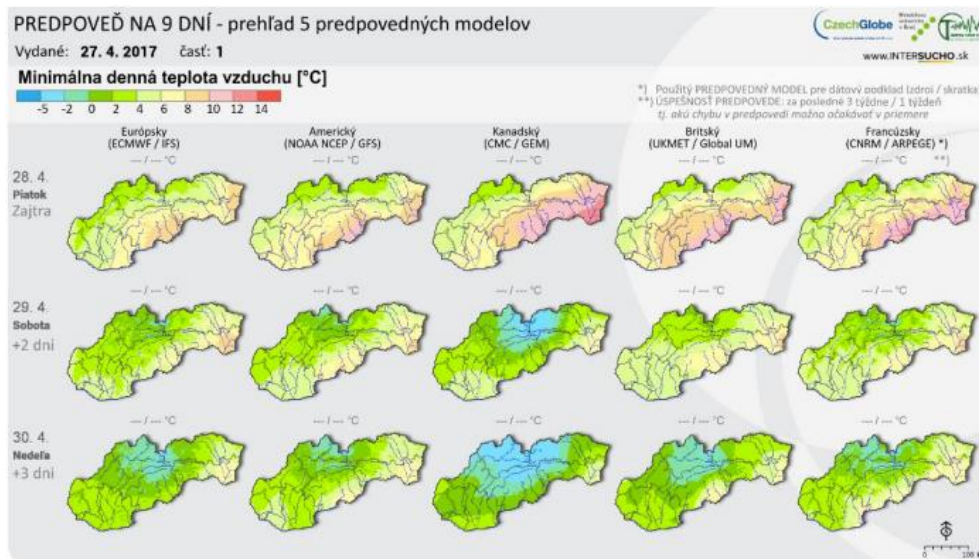
Source: intersucho.cz/sk

Information gathered from local drought reporters in the agriculture and forestry sectors plays a crucial role in communication with organizations like the [Czech and Slovak Chamber of Agriculture and Food](#), the [Czech and Slovak Ministry of Agriculture and Rural Development](#), as well as other government institutions and media outlets. These real-time reports submitted by local experts are vital for enabling prompt responses, not only from businesses but also from government authorities.

The INTERSUCHO service provides a 10-day forecast for relative soil humidity and drought intensity, which is accessible to the public free of charge. Additionally, drought reporters have access to "bonus" maps, offering forecasts for ten-day precipitation, maximum and minimum temperatures. Drought reporters are required to complete the questionnaire for the given week to access these maps. These bonus maps are updated daily and can be accessed through user accounts on the monitoring page. An example of one such bonus map is the minimum air temperature forecast from the first three of the ten days, as illustrated in Figure 47.

Furthermore, as part of the service, hourly forecasts for precipitation, wind velocity, and wind direction for the next ten days are prepared exclusively for drought reporters. Drought reporters have the flexibility to choose the location for these projections¹⁵⁵.

Figure 47 Nine-day forecast of the minimal daily air temperatures – overview of the 5 projections models.



Source: [Ministry of Agriculture and Rural Development of Slovakia](#)

Reporters have exclusive access to region maps, allowing them to view current drought intensity and soil saturation levels in their chosen location. Additionally, mapping of drought impact on yield is available to the public at no cost.

Membership as a drought reporter is open to anyone in the agricultural and forestry sectors, granting them free access to the "bonus" data on the website.

Drought impact forecasting encompasses three distinct data sources:

- Impact information sourced from the National Reporting Networks.
- A statistical model based on ground observation data and remote sensing data, provided by DUS.
- Historical data on drought impacts extracted from press sources covering the period from 1971 to 2016, along with regional yield data¹⁵⁶.

Public visitors of the Intersucho service have access to all data available on the Intersucho website¹⁵⁷ except "bonus maps", available only for local drought reporters.

9.3.5. Success factors

A significant contributor to the services' success is its sustained operation since 2012, with continuous growth each year. The INTERSUCHO team in the Czech Republic and Slovakia organizes an annual meeting for agriculture, forestry, and field drought reporters to address potential enhancements and challenges. Additionally, the project received recognition, being honoured with the Czech Minister of Agriculture's award for the second-best realized research and experimental development result, utilizing certified methodologies. "Use of forecasting soil moisture and drought intensity for better decision-making in plant

¹⁵⁵ <https://www.mpsr.sk/index.php?navID=1&navID2=1&slD=40&id=12611>

¹⁵⁶ <https://www.interreg-danube.eu/news-and-events/programme-news-and-events/2182>

¹⁵⁷ <https://www.intersucho.sk/en/?mapcountry=sk&from=2023-09-26&to=2023-10-24¤t=2023-10-22>

production”¹⁵⁸. This project was also nominated for “Kristalova lupa” awards. This Czech internet award honours the most popular and interesting projects and services of the Czech Internet for the year 2023.

This service receives funding from the Czech and Slovak Ministry of Agriculture, which covers its operational costs. However, to enhance innovation and data quality, the Intersucho teams sought additional funding. This service has received co-funding from the Interreg project Dri-Danube, supported by the European Regional Development Fund (ERDF) and Instrument for Pre-accession Assistance (IPA) funds. Additionally, data on drought, maximum and minimum temperatures from the European Drought Observatory (EDO) are also utilized¹⁵⁹.

9.3.6. Alignment with EU policy

The idea of inviting Slovakia to this service came from the EU initiative INTERREG project DriDanube. DriDanube project focused on drought mitigation in the whole Danube basin. The Intersucho service followed this idea and created its own methodologies¹⁶⁰. The DriDanube project was supported by the International Commission for the Protection of the Danube River (ICPDR)¹⁶¹. This project primarily contributes to the DRG (Drought Risk Reduction Group) in terms of ANTICIPATION. To a lesser extent, it also assists in PREPARATION for mitigating the detrimental effects of drought and ALERTING stakeholders of worsening conditions. This service uses its own approaches and methodologies which are not connected with the EU standards or policies.

The Czech and Slovak Hydrometeorology are the main national institutions responsible for the early warning system in case of drought, severe weather, or flooding. As the co-creators of Intersucho service they are also using the results from this service.

9.4. Impacts

9.4.1. What main results were achieved?

The key result of this is more than 10 years of continuous expansion of this service and the network of drought reporters. This system stands out for the integration of data from local drought reporters and the combination of both measured (satellite) and computed (model) data. Detailed information on observations, forecasts, and early warnings is available on the INTERSUCHO website. This comprehensive service is particularly beneficial for farmers and foresters, helping them prepare more effectively for drought periods and other weather-related challenges. Reporters can easily access forecasts for soil saturation, as well as information on minimum and maximum temperatures, wind speed and direction, and precipitation.

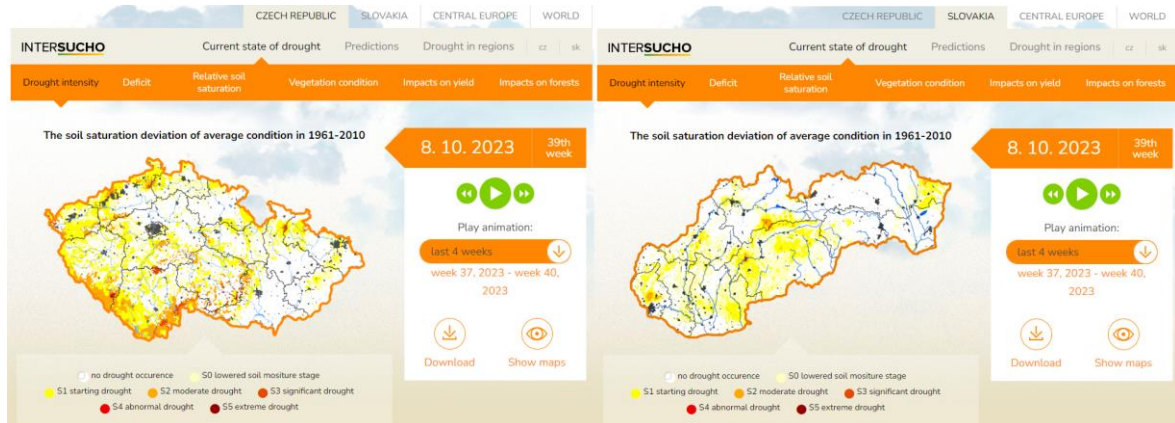
¹⁵⁸ <https://www.intersucho.cz/cz/o-suchu/vyuziti-predpovedi-sucha/>. Trnka M., Kersebaum KC, Eitzinger J., Hayes M., Hlavinka P., Svoboda M., Dubrovský M., Semerádová D., Wardlow B., Pokorný E., Možný M., Wilhite D., Žalud Z. 2013, Consequences of climate change for the soil climate in Central Europe and the central plains of the United States, Climatic Change, DOI, 10.1007/s10584-013-0786-4.

¹⁵⁹ <https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1000>

¹⁶⁰ <https://www.intersucho.cz/cz/o-suchu/vyuziti-predpovedi-sucha/>

¹⁶¹ <https://www.icpdr.org/publications/danube-watch-1-2018-strategic-relevance-dridanube-project-danube-region>

Figure 48 The Intersucho website landing page



9.4.2. Evidence of benefits and impact on DRM

The ongoing increase in the number of drought reporters since 2012 underscores the significance of the service to them. Reporters are primarily driven by the results, including drought forecasts and early warning, as they do not receive any financial incentives for their participation. Furthermore, their eagerness to engage in annual meetings with the service creators highlights their dedication to the services objectives.

Additionally, the service's results have been instrumental for policy purposes, particularly in assessing compensation and providing state aid to agricultural holdings affected by disasters. The transparent methodologies and the INTERSUCHO team's independence have fostered trust and enabled expedited aid allocation processes.

This service covers the whole territorial area of Czechia and Slovakia, notably agricultural areas. The neighbouring border regions of Czechian Morava, Slovakian Zahorie, and Stredne Povazie are famous for their agricultural products; this service helps them to be better prepared for drought and prepare for severe weather-connected risks. The evidence of benefits is the relatively huge number of local drought reporters from both countries, more than 300 – from Czechia and 16 drought reporters from Slovakia (multiple factors cause this disbalance of the number of reporters: the Slovak region is a significantly smaller than the Czech one; Czechia is a more agriculture-oriented country; the bigger interest of the Czech farmers to contribute).

9.4.3. Potential for replication of the practice/s.

The INTERSUCHO service holds promise for replication in other countries thanks to its data sources, which are already generated for the EU or global use. Additionally, its well-organized crowd-sourcing approach involving local drought reporters can be easily adapted for replication, potentially expanding the services impact, or identifying areas for improvement. However, one significant challenge lies in securing sustained funding to support service operations, including website management, mapping, and data collection from local drought reporters. The existence of a good scientific team and availability of necessary data are other decisive factors.

9.5. Challenges

One of the primary challenges for this service is expanding the network of local drought reporters. A significant gap exists in terms of data coverage related to the impact on crop yields and forests, as this coverage depends on the willingness of local contributors

(farmers and foresters) to participate, and some may not be aware of this service or may be reluctant to share information.

9.6. Conclusions and lessons learnt

Climate change has led to an increased frequency of water scarcity, droughts, and heatwaves in the Danube region, which can have substantial economic and societal impacts. However, drought has not always been a high-priority concern, and many people remain unaware of its consequences.

Drawing on the results of a previous INTERREG project (DriDanube), INTERSUCHO offers an innovative cross-border approach to manage drought-related risks by integrating scientifically validated models and satellite sensors with real-time impact data obtained through crowdsourcing. This combination provides measured data on drought impacts as well as future projections. The service engages local drought reporters from the agriculture and forestry sectors to create drought impact maps based on their real experiences with crop yields and forest conditions.

This service was also rewarded with Czech Minister of Agriculture's award and nominated for the "Křtalova lupa" award.

Another success factor is the constantly growing number of drought reporters.

The innovative methodology and well-designed crowd-sourcing system make this service an ideal candidate for replication in other countries. The main challenge for this project is linked to addressing the risk for data gaps due to the increasing number of drought reporters, and to ensuring the coverage of the whole area of Czechia and Slovakia.

9.7. Links to other possible activities

Link to other possible activities along other borders covered by the study:

<https://www.windy.com/?48.183,17.038,5>.

9.8. Bibliography

- Allen RG, Pereira LS, Raes D, Smith M. 1998. Crop evapotranspiration. Guidelines for computing crop water requirements. FAO Irrigation and Drainage Paper No. 56.
- Brown, J. F., B. D. Wardlow, T. Tadesse, M. J. Hayes, and B. C. Reed (2008), The Vegetation Drought Response Index (VegDRI): A new integrated approach for monitoring drought stress in vegetation, *GISci. Remote Sens.*, 45, 16–46, doi:10.2747/1548-1603.45.1.16.
- Hlavinka P, Trnka M, Balek J, Semerádová D, Hayes M, Svoboda M, Eitzinger J, Možný M, Fischer M, Hunt E, Žalud Z. 2011. Development and evaluation of the SoilClim model for water balance and soil climate estimates. *Agriculture and Water Management* 98: 1249–1261. DOI: 10.1016/j.agwat.2011.03.011.
- Tadesse, T., J.F. Brown, and M.J. Hayes. 2005. A new approach for predicting drought-related vegetation stress: Integrating satellite, climate, and biophysical data over the U.S. central plains. *ISPRS Journal of Photogrammetry and Remote Sensing*, 59(4):244-253.

- Trnka M., Kersebaum KC, Eitzinger J., Hayes M., Hlavinka P., Svoboda M., Dubrovský M., Semerádová D., Wardlow B., Pokorný E., Možný M., Wilhite D., Žalud Z. 2013, Consequences of climate change for the soil climate in Central Europe and the central plains of the United States, Climatic Change, DOI, 10.1007/s10584-013-0786-4.
- Web site: www.intersucho.cz / www.intersucho.sk
- Web site: <https://www.mpsr.sk/index.php?navID=1&navID2=1&slD=40&id=12611>
- Web site: <https://www.interreg-danube.eu/news-and-events/programme-news-and-events/2182>

10. Disaster Risk Management in the Baltic Sea Region

10.1. Executive Summary

This study shows how cross-border cooperation can increase resilience to address risks related to climate change and their consequences in a coastal and marine environment. It focuses on the experience achieved in the Baltic Sea Region.

The main disaster and risk management components addressed by this case study are:

- Risk assessment, vulnerability assessment, foresight, data-collection, mapping/GIS of risks
- Planning, prevention measures planning, response contingency planning, financial planning investments, pooling of response resources
- Early warning, public warning, situational awareness, real-time data exchange
- Response cooperation, structures/arrangements for joint response, training/exercises
- Risk communication with population, civic engagement in resilience building, volunteering
- Nature based solutions, working with natural processes (floods, wildfire, droughts, climate-proof building) including building partnerships with stakeholders
- Comprehensive approaches for cooperation over a longer period.

The study examines several instruments aiming at building individual and joint capacity and regional resilience to address risks linked to extreme weather, flooding and oil and hazardous noxious substance discharges in the basin area. Such initiatives are complementary to the Union Civil Protection Mechanism and include the Council of the Baltic Sea States (CBSS) and its Civil Protection Network, as well as the EU Strategy for the Baltic Sea Region, and the INTERREG Central Baltic Programme. As such, Disaster Risk Management (DRM) actions between countries look for “gaps to fill” and in many ways are as much about building networks between stakeholders as they are about direct DRM actions.

A particular example that is featured in the study is the Baltic Excellence Programme that seeks to create a network of civil security actors in the Baltic Sea Region and to equip them with the tools and information needed to manage cross-border collaboration and in an intercultural context.

The programme is connected to the Community Safety Action for Supporting Climate Adaptation and Development (CASCADE) project, funded by the European Union Civil Protection and Humanitarian Fund. The project delivered a cross-sectoral and cross-regional Climate Risk Preparedness Toolbox. It discussed future of climate change adaptation, disaster risk reduction and resilience improving the capacity to understand, assess, and treat current and future climate change related risks on the local level, focusing on the particular in Baltic Sea Region (BSR) conditions.

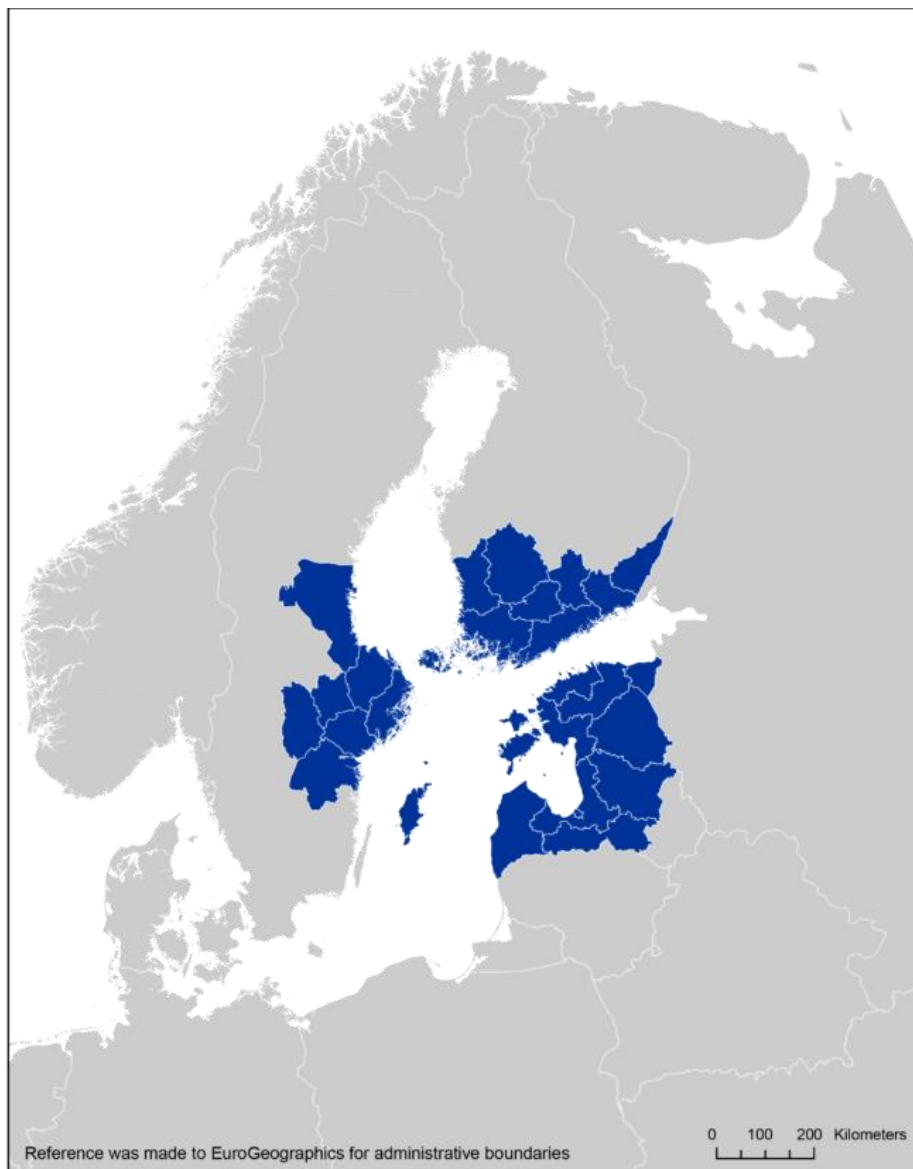
Likewise, the Volunteers and Local Authorities – Baltic Sea Region Network (VOALA) project is described as another inspiring example of supporting multi-sectoral cooperation for societal security in the Baltic Sea region and enhancing resilience to natural and man-made disasters by strengthening cross-sectoral cooperation between authorities and volunteer organisations in crisis management.

The strategic frameworks and approaches, as well as the project measures presented represent interesting potential for **replicability** by other regions from other basin areas exposed to similar risks.

10.2. Introduction

The purpose of the case study is to explore the existing cross-border DRM instruments implemented in the Central Baltic region with a particular focus on the maritime border between countries. Earlier review of national measures in Estonia, Latvia, Finland, and Sweden demonstrated a comparatively limited implementation of cross-border DRM tools. Thus, the case study will attempt to expand on the conducted research by increasing the geographic scope from country-to-country borders to efforts undertaken on the regional level. To that end, it is important to define the regional coverage which is where several nuances arise. The Central Baltic itself is defined within the 2021-2027 Interreg programming period, and comprises 27 regions located within Finland, Estonia, Latvia, and Sweden.

Figure 49 Map of the Central Baltic



Source: Interreg (2023). Central Baltic Programme 2021-2027 cooperation area. Available at: <https://centralbaltic.eu/programme/about-the-programme/programme-area/>

On a wider scale, the Central Baltic is part of the Baltic Sea Region (BSR) which has a marine coast shared by Germany, Denmark, Poland, Lithuania, Latvia, Estonia, Finland, and Sweden. For this case study, it was decided to examine DRM instruments, tools, etc. that are implemented in the Central Baltic and the wider BSR. This approach offers the best opportunity of representing cooperative DRM actions being taken by countries.

In the context of hazards, the Community Safety Action for Supporting Climate Adaptation and Development (CASCADE) project has produced an analysis which focused on identifying risks related to climate change and their consequences to BSR countries.¹⁶² The following presents an overview of the risks facing the maritime borders in the region.

10.3. Extreme weather

Extreme weather risks, particularly those connected to winds (windstorms, hurricanes, etc.) have increased due to climate change. Windstorms and related phenomena are most common in the autumn and winter seasons and the increasing temperatures and lessened effects of cold results in declining capacity of flora in the coastal regions to withstand windstorms. This is a result of warmer ground providing less support for root systems to withstand severe winds when compared to frozen ground.

The vulnerability to extreme weather depends on the coastal areas and coastal vegetation in the region. Coastal erosion has also been noted because of extreme weather events affecting regional coastlines in Germany, Poland, and the Baltic states (Lithuania, Latvia, and Estonia) in particular.

Increased risk of flooding and windstorms damage soft cliffs as well as negatively effects trees that have root systems extending across coasts. Damage to trees and other vegetation causes further erosion because the affected root systems are among the foundational elements of maintaining stable coastal cliffs.

10.4. Flooding

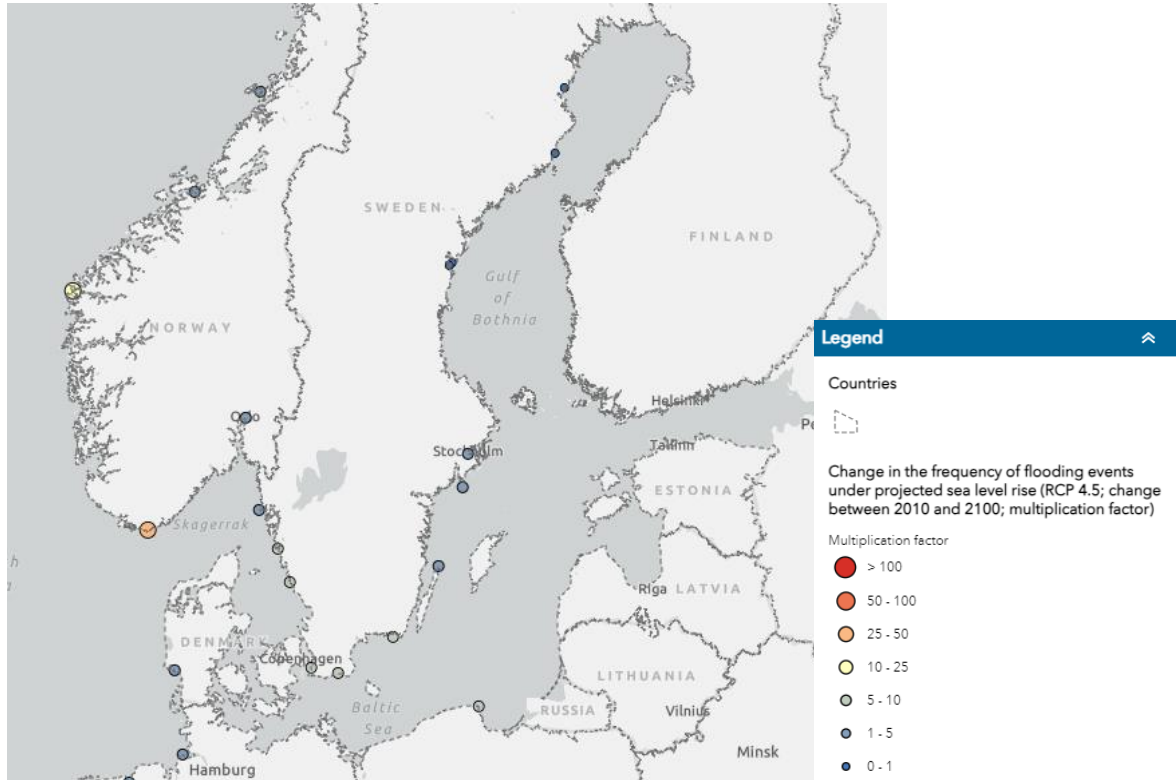
Flooding is seen as a risk among countries around the Baltic Sea, with fluvial flooding the most common type identified. By 2020 among the BSR countries, Denmark, Latvia, and Lithuania had identified coastal flooding as a specific risk discussed in their national risk assessments. However, this situation will likely be changing as flooding risks become more common in the region.

The Climate ADAPT Urban Adaptation Map Viewer¹⁶³ outlines the projected climate hazards that are and will continue to affect European cities. The mapping data for coastal flooding events in the future indicates Sweden to be particularly vulnerable to future flood risks.

¹⁶² CASCADE (2020). Overview of climate risk drivers, hazards, and consequences in the Baltic Sea Region. Available at: http://www.cascade-bsr.eu/sites/cascade-bsr/files/outputs/cascade_overview_of_climate_drivers_and_hazards_final_version.pdf

¹⁶³ Climate ADAPT (2023). Urban Adaptation Map Viewer. Available at: <https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-adaptation>

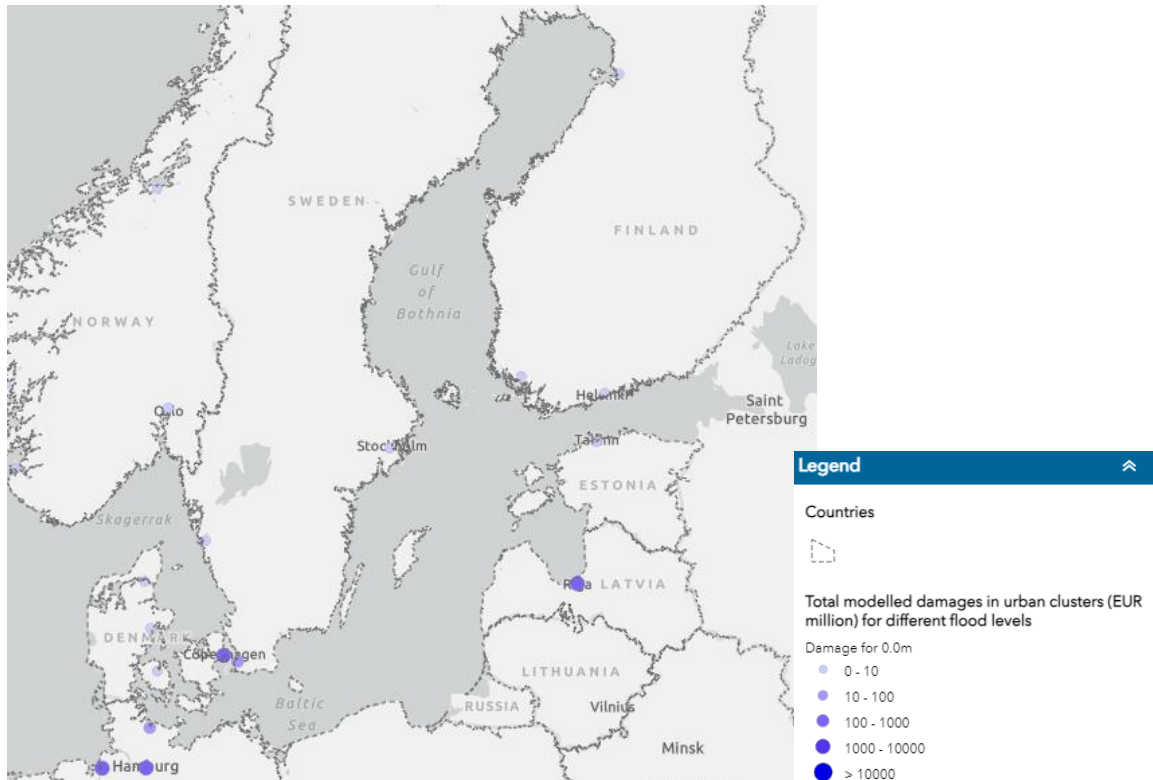
Figure 50 Change in the frequency of flooding events under projected sea level rise



Source: Climate ADAPT (2023). Urban Adaptation Map Viewer

However, the Latvian capital Riga, Danish capital Copenhagen and the city of Hamburg are facing the highest monetary risk in terms of flooding damages to urban areas.

Figure 51 Total modelled damages in urban clusters (EUR million) for different flood levels



Source: Climate ADAPT (2023). Urban Adaptation Map Viewer

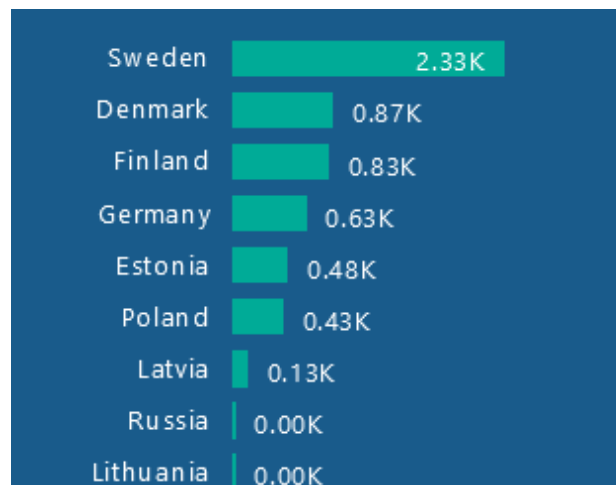
10.5. Oil and hazardous noxious substance discharges

In the past several decades oil and hazardous noxious substance (HNS) discharges have been declining, thanks to increased cooperation efforts in the region in terms of aerial surveillance identifying spillage and continued international cooperation under Helsinki Commission (HELCOM). Risks of oil and HNS are primarily connected to maritime traffic, both in terms of direct oil transport and spillage resulting from other shipping activities or refuelling at sea.

The environmental vulnerability to oil and HNS depends on several factors. In a 2013 report, the Northern Baltic had been identified as a high vulnerability area due to increased ice sheets and the considerably higher difficulties of removing oil from ice. However, the Northern Baltic region also experiences less shipping and is in lesser risk of spills as a result. The Southern Baltic has greater ship traffic, more ports and narrower shipping lanes around Denmark which pose further risk of spills.¹⁶⁴

During the period of 1998-2022 the greatest impacts of discharges has been observed on Sweden which has seen around as many discharges than the next three countries below it combined (Denmark, Finland, and Germany).

Figure 52 Number of observed discharges by country (1998-2022)

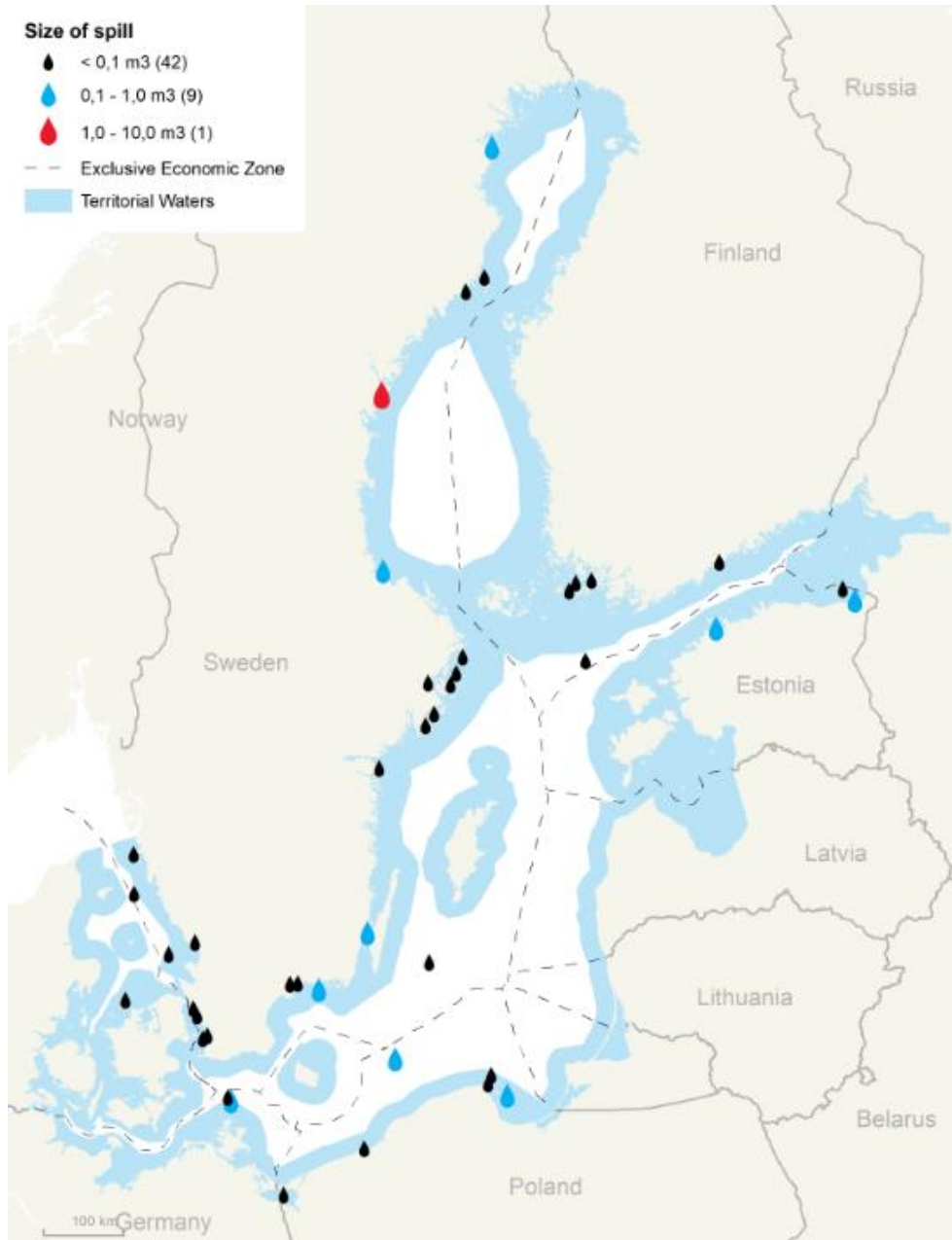


Source: HELCOM (2022). Interactive dashboard on observed discharges. Available at: <https://app.powerbi.com/view?r=eyJrIjoieYmRjYjczMGYtZjI2OS00OTZmLThkZDEtOWZmMGZmM2VjMDBkIiwidCI6IjM4MjA3MDJhLWUzMTktNGYzNy1hOTQ1LWVhYmYyYWMwMWMxMCIslmMiOj9>

The 2021 report by HELCOM further indicates that many of the observed oil and HNS discharges were concentrated around Sweden, Denmark, and Finland.

¹⁶⁴ HELCOM (2013). Risks of Oil and Chemical Pollution in the Baltic Sea. Available at: https://helcom.fi/post_type_publ/brisk-brisk-ru_summarypublication_spill_of_oil/

Figure 53 Discharges observed in the Baltic Sea during aerial surveillance in 2021



Source: HELCOM (2021). Annual report on discharges observed during aerial surveillance in the Baltic Sea 2021. https://helcom.fi/post_type_publ/helcom-annual-report-on-discharges-observed-during-aerial-surveillance-in-the-baltic-sea-2021/

10.6. Regional actions for disaster risk management in Central Baltic and the Baltic Sea Region

As the countries around the Baltic Sea are expected to face increased risk of natural disasters in the coming decade, regional authorities, particularly with support from international organisations, are taking steps towards DRM capacity building. Notably the Council of the Baltic Sea States (CBSS) and its Civil Protection Network are funding new initiatives that will strengthen regional resilience.

The EU Strategy for the Baltic Sea Region, involving eight EU Member States (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden), provides a strategic framework to mobilise all relevant EU funding and policies and coordinate the actions of the European Union, EU countries, regions, pan-Baltic organisations, financing institutions and non-governmental bodies to promote a more balanced development of the Baltic Sea Region, including in the domain of risk prevention and management.

The INTERREG Central Baltic Programme likewise includes DRM actions, particularly through funding opportunities for cooperative projects between the Central Baltic countries (Finland, Estonia, Latvia, and Sweden). The Programme is funded by the European Regional Development Fund (ERDF) and has a total budget of € 122 million during its 2021-2027 running period.

Importantly, despite the different sources for these DRM actions, there is a deliberate attempt to design instruments that would be complementary to those already active in the region (i.e., considering the UCPM). In some ways, this offers one explanation for the regional cross-border DRM mechanisms. The EU Civil Protection Mechanism has been noted as a particularly effective framework for DRM with stakeholder support for its introduction. As such, DRM actions between countries look for “gaps to fill” and in many ways are as much about building networks between stakeholders as they are about direct DRM actions.

The following sections present an overview of some of the DRM instruments that are active in the region.

10.6.1. EU Strategy for the Baltic Sea Region

The European Union Strategy for the Baltic Sea Region (EUSBSR)¹⁶⁵ is the first Macro-regional Strategy in Europe. The Strategy was approved by the European Council in 2009 following a communication and an action plan from the European Commission. The Strategy focuses on three objectives addressing the key challenges of the Strategy: saving the sea, connecting the region, and increasing prosperity.

One of its sub-objectives is dedicated to risk prevention and management to be pursued through better coordination and cooperation between the countries and regions involved. The Strategy has several priority areas (PA) of relevance for DRM:

- **PA Safe**, dedicated to reducing the risk of maritime accidents and marine pollution, including hazardous spills. Policy Area (PA) Safe actions focus on many aspects which can improve maritime safety and security including resurveying of shipping routes, improving safety of navigation by means of e-navigation and new technology, emergency preparedness and winter navigation.
- **PA Secure**, focused on protection from land-based emergencies, accidents, and cross-border crime. PA Secure promotes a comprehensive and coherent approach to reduce trans-boundary vulnerabilities and to build common capacities for societal security in the Baltic Sea region. PA Secure activities are related to four areas: better risk assessment and crisis management, building up resilience and prevention towards emergencies and threats at the local level, enhancing effective cooperation in protecting human beings against criminal threats and preventing serious crime through developing efficient framework for law enforcement cooperation.
- **PA Hazards**, aiming at reducing the use and impact of hazardous substances. PA Hazards' actions concentrate on reducing the use and preventing emissions of hazardous substances by developing and implementing primarily non-regulatory measures and Baltic Sea Region-wide policies, as well as mitigating and

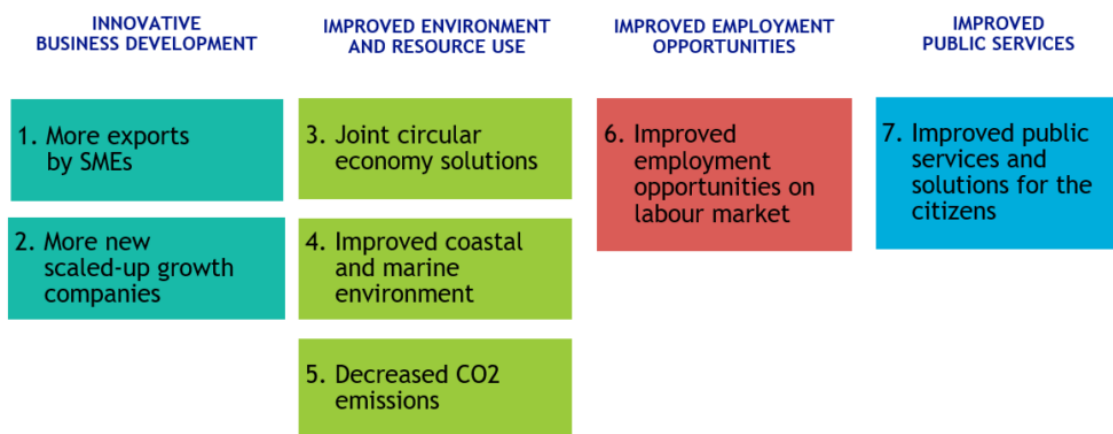
¹⁶⁵ <http://www.balticsea-region-strategy.eu>.

remediating historic contamination still causing negative effect on the Baltic ecosystem. It also supports to the implementation and compliance with EU regulations and international agreements related to hazardous substances, as well as support to the development of innovative and cost-effective management.

10.6.2. Central Baltic Programme objective “Improved coastal and marine environment”

The Central Baltic Programme has a total of seven objectives, each aimed at strengthening regional resilience and cohesion. Under each objective projects between regional partners are funded to achieve different results and increase cooperation between different actors.

Figure 54 Central Baltic Programme objectives



Source: Central Baltic Programme (2021). Central Baltic Programme 2021-2027. Available at: <https://centralbaltic.eu/programme/about-the-programme/>

Through the fourth objective “Improved coastal and marine environment” it is expected that “the load of nutrients and other harmful substances to the Baltic Sea is reduced from various sources.”¹⁶⁶ Different public and private organisations (public authorities, NGOs, private companies) can apply for project funding.

MUSTBE project

Through MUSTBE, partner organisations attempt to improve the conditions of the Baltic Sea by developing multi-benefit stormwater management systems. Operating in Finland, Estonia, Latvia and Sweden, the project will increase the efficiency of municipalities to monitor and treat stormwater by focusing on nature-based solutions and technological solutions in important areas of the community. The Central Baltic area has some high risk-areas for flooding and needs the help and cooperation from other partners to become more resilient against that risk. Cross-border co-operation will ensure the necessary technological innovation that is in focus within visioned stormwater solutions and ensure replication of the technological innovation in international level.

Expected impacts: Novel stormwater management systems are expected to reduce the amount of suspended solids in the Baltic Sea by 60%, total nitrogen by 30%, pathogens by 60%, oil products by 50%, metals by 40%.

Total budget: € 3,980 476.

Source: Central Baltic Programme (2023). MUSTBE. Available at: <https://centralbaltic.eu/project/mustbe/>

Specifically, the objective covers the maritime coastal areas defined in national water management plans and marine strategies of Finland, Estonia, Latvia, and Sweden. Mainly,

¹⁶⁶ Central Baltic Programme (2021). Programme Objectives. Available at: <https://centralbaltic.eu/programme/programme-objectives/>

projects are expected to target substances that originate on land and pose the risk of spilling out into the Baltic Sea. However, sea-based harmful substances are also applicable for targeted project action.

StoPWa project

The project aims at developing novel stormwater filtering solutions using construction and demolition waste (CDW). The filters will be developed under lab-conditions before piloting scaled-up stormwater filters in Lahti (Finland), Harju County (Estonia) and Smiltene (Latvia).

Expected impacts: It is expected that the project will offer a novel solutions for stormwater treatment and filtering while contributing towards waste reduction and creating new business opportunities in the region to manufacture filters.

Total budget: € 2,587,356.

Source: Central Baltic Programme (2023). StoPWa. Available at: <https://centralbaltic.eu/project/stopwa/>

Projects funded through the Central Baltic Programme can engage in the following activities that facilitate reducing Baltic Sea pollution¹⁶⁷:

- Awareness raising.
- Information collection, surveys.
- Analysis and surveys, plans, drawings, and designs.
- Designing, adapting methods.
- Planning and investing into digital solutions and processes.
- Joint pilot actions to reduce inflows of nutrients, toxins, and hazardous substances.
- Small scale investments to reduce inflows of nutrients, toxins, and hazardous substances.
- Experience exchange and learning as result of joint implementation.

As of October 2023, five projects have been launched with a total funding of € 13,441,840.

10.6.3. CBSS Civil Protection Network

The Civil Protection Network (CPN) was established in 2002 to bring together civil protection experts from CBSS Member States to find common solutions to challenges. CPN inherently is about cooperation and transnational approaches towards risk prevention and civil protection. CPN has the following strategic priorities¹⁶⁸:

- Combining national efforts in implementing the Sendai Framework for Disaster Risk Reduction with a particular focus on managing increasing risks from climate change.
- Enhancing resilience of the BSR to disasters by strengthening systemic multi-hazard approach and fostering existing, emerging, and future risk awareness, prevention, preparedness, and response.
- Increasing cross-sectorial cooperation and societal partnerships.

¹⁶⁷ Central Baltic Programme (2023). Improved coastal and marine environment. Available at: <https://centralbaltic.eu/programme/programme-objectives/4-improved-coastal-and-marine-environment/>

¹⁶⁸ CBSS (2023). Civil Protection Network. Available at: <https://cbss.org/cbss-bodies/civil-protection-network-2/>

- Building capacity of Member States in the civil security area.
- Supporting mutually beneficial interaction between research and practitioners.

Vilnius II Declaration

The “Vision for the Baltic Sea Region by 2030” (known as Vilnius II Declaration) is a political commitment by high-level representatives from the BSR towards continued work in strengthening regional cooperation networks.

In terms of maritime DRM, Vilnius II Declaration commits that “the Region experiences significant progress in regional cooperation in civil protection, especially the prevention, preparedness and response against emergencies, including oil pollution, forest fires and in maritime search and rescue.”

Source: CBSS (2021). Vilnius II Declaration A Vision for the Baltic Sea Region by 2030. Available at: <https://cbss.org/wp-content/uploads/2021/06/vilnius-ii-declaration.pdf>

The CPN manages several instruments that support DRM in the region and promote overall cross-border cooperation. The following presents an overview of these instruments and highlights their application to maritime DRM in the region.

10.6.4. Baltic Excellence Programme

The Baltic Excellence Programme (BEP) is part of CBSS. Established in 2012 (initially called Baltic Leadership Programme before adopting the current name in 2015).

BEP is hosted annually by the CBSS Civil Protection Network Chair and is organized as a conference over several days during which different topics related to DRM are discussed. While the organisation of each BEP event is left to the CPN Chair, thus, each event is different, several common elements are worth bringing up to highlight how similar actions could be replicated elsewhere.

- The training event is a two- or three-day visit to the host country.
- The training event is hosted by an organisation that is involved in DRM. In the case of BEP these are civil protection organisation whose members make up the CPN. The important consideration in this regard is that the host organisation is an intrinsic part of discussions about DRM actions in the region and a grasp on the current DRM challenges.
- Training combines theory with field visits, highlighting implementation of DRM instruments. Often, this is an opportunity for the hosting organisation/country to engage in knowledge transfer.

By 2023 a total of 11 BEP events had been organised, involving over 150 civil protection and law enforcement experts from CBSS Member States. The purpose of BEP is to bring together DRM experts to exchange knowledge and undergo training during the events, strengthening their capacity towards DRM actions.¹⁶⁹

Through BEP, transnational cooperation is fostered by creating a network of experts who share their experiences and challenges. According to interviews with a CBSS representative, BEP is aimed at strengthening the middle management positions at organisations working with DRM. These experts can receive training, exchange knowledge, and share contacts with their peers. As they advance in management positions, the BEP

¹⁶⁹ CBSS (2023). 11th Baltic Excellence Programme highlights children and youth participation in DRR, energy, early warning systems and dumped munitions. Available at: <https://cbss.org/2023/03/06/11th-baltic-excellence-programme/>

networking translates into increased capacity to work with their colleagues cross-borders and cross-sectors.

As each BEP event has a different focus (for example in 2022 BEP was explicitly about regional cooperation in disaster prevention¹⁷⁰), a broad range of DRM concerns can be approached and as an annual event BEP is positioned to continue strengthening DRM capacity in the BSR.

10.6.5. Community Safety Action for Supporting Climate Adaptation and Development (CASCADE)

CASCADE was a project funded by the CBSS that ran during the period of 2019-2021 and involved partners from Finland, Sweden, Denmark, Germany, Latvia, Estonia, and Poland with the Southwest Finland Emergency Services acting as the project lead and the remaining partner organization encompassing various emergency services as well as the Council of the Baltic Sea States (CBSS) Secretariat.

The project was launched as a response to climate change related risk, noting that climate change is causing either increased unpredictability of the various risks encountered in the region or increasing their severity. Furthermore, risk assessment and risk response measures were considered in need of updating to incorporate climate change as a factor in risk frequency and severity. Thus, CASCADE aimed to support risk management capacity within BSR, with a particular focus on local authorities and urban areas. Broadly, the project had the following goals:

- Adapt existing risk assessment methodologies in BSR to account for climate change and ensure these methodologies consider and are applicable at the local level. Through this, build stronger connections between local and national civil protection authorities and connections between risk management experts and climate change experts.
- Improve capacity to analyse and forecast climate change related risks on the local level and lead towards greater harmonisation in risk assessments between the countries. This is an important consideration in terms of maritime risks as analysis under CASCADE found that not all countries in the region considered maritime or coastal risks in their national risk assessments.
- Initiated a: “region-wide policy dialogue on the UN Sendai Framework for Disaster Risk Reduction to form cross-sectorial cooperation between different levels of governance and for greater policy coherence on climate risk assessments.”¹⁷¹

CASCADE was designed as a cross-sectoral approach aiming to increase DRM capacity in the region by building networks and providing tools for climate change and disaster risk management experts to meet on common terms and facilitate exchange of ideas and practices.

Climate Change Risk Assessment Tools Portfolio is a collection of methodologies of approaching risk assessment in the context of climate change on the local level. Among the presented methods, one discusses risks posed to coastal regions. These are mainly short-form cases highlighting how risk assessment is conducted on a local, regional levels as further inspiration to potential users.

¹⁷⁰ CBSS (2022). Baltic Excellence Programme 2022 – Disaster Prevention and Regional Cooperation in focus. Available at: <https://cbss.org/2022/03/07/baltic-excellence-programme-2022-disaster-prevention-and-regional-cooperation-in-focus/>

¹⁷¹ CASCADE (2021). Project final review – interviews with project partners. Available at: https://www.cascade-bsr.eu/sites/cascade-bsr/files/publications/cascade_project_final_review-_interviews_with_the_project_partners.pdf

The case “Regional Risk Assessment for climate change impacts on coastal aquifers” considers hazards to coastal aquifers (groundwater systems that cross land-ocean boundaries) and the impacts on coastal conditions (both for flora and humans who depend on fresh groundwater near the coast).

Hazards such as: “changes in the precipitation regime, river flow discharge, and groundwater depth and quality” can have negative consequences for the balance to freshwater along coastal regions.

The case outlines the implementation of a Regional Risk Assessment (RRA) that was developed for and used in the Esino coastal aquifer. The methodology is a six-step process:

- Defining the regional risk matrix.
- Assessment of hazard.
- Exposure assessment.
- Susceptibility assessment.
- Risk assessment.
- Damage assessment.

The implementation of the RRA would support conducting analysis of risks posed to coastal areas, particularly from the perspective of maintaining natural and human systems dependent on fresh groundwater along the maritime border.

Source: CASCADE (2021). Portfolio of reviewed risk assessment methods and tools. Available at: http://www.cascade-bsr.eu/sites/cascade-bsr/files/publications/cascade_portfolio_of_risk_assessmen_tools.pdf

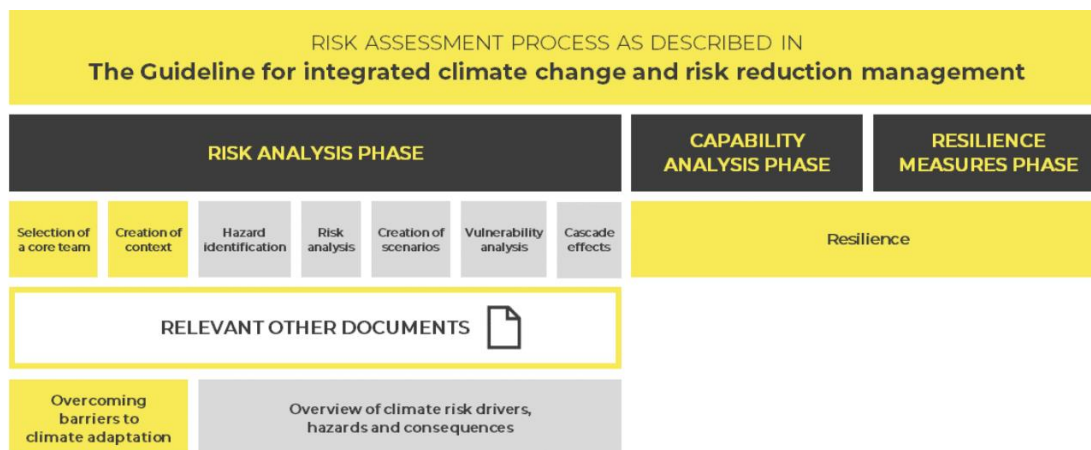
The document is not a definitive approach; rather, it highlights the variety of actions that can be taken.¹⁷²

Guidelines for integrated climate change and risk reduction management for local authorities are the detailed methodological approaches that highlight procedures and methods for DRM in the context of climate change.¹⁷³

¹⁷² CASCADE (2021). Portfolio of reviewed risk assessment methods and tools. Available at: http://www.cascade-bsr.eu/sites/cascade-bsr/files/publications/cascade_portfolio_of_risk_assessmen_tools.pdf

¹⁷³ CASCADE (2021). Guidelines for integrated climate change and risk reduction management for local authorities. Available at: http://www.cascade-bsr.eu/sites/cascade-bsr/files/publications/cascade_guidelines_0.pdf

Figure 55 CASCADE Guidelines for integrated climate change and risk reduction management for local authorities



Source: CASCADE (2021). Guidelines for integrated climate change and risk reduction management for local authorities

The guidelines are primarily based on the Sendai Framework for Disaster Risk Reduction 2015-2030 and the National Climate Change Impact, Vulnerability and Risk Assessments in Europe 2018. The focus of the guidelines is twofold – first it presents the potential impact of climate change on risks and hazards in the BSR including discussing the consequences on the region. Secondly, the guidelines present methods, tools, advice targeting local authorities and their specific needs. Included in the guidelines are considerations and examples of adaptation measures targeting different areas. This includes discussing reactive and anticipatory measures targeting coastal areas and supporting maritime risk reduction.

Figure 56 Samples of Adaptation Measures

Sector	Reactive Adaptation	Anticipatory Adaptation
Coastal zone	<ul style="list-style-type: none"> • Protection of economic infrastructure • Public awareness to enhance protection of coastal and marine ecosystems • Building sea walls and beach reinforcement • Protection and conservation of coral reefs, mangroves, sea grass and littoral vegetation 	<ul style="list-style-type: none"> • Integrated coastal zone management • Better coastal planning and zoning • Development of legislation for coastal protection • Research and monitoring of coasts and coastal ecosystems

Source: CASCADE (2021). Guidelines for integrated climate change and risk reduction management for local authorities

Capacity building tools in the form of training courses have been developed (based on a survey regarding training and education needs for DRM on the local level). The detailed training methodologies are presented for either trainers working with DRM and related experts or for higher education institutions.¹⁷⁴

¹⁷⁴ CASCADE (2021). Capacity Building Training Materials. Available at: <http://www.cascade-bsr.eu/toolbox/training-materials>

Figure 57 CASCADE Capacity Building Training Materials

THE TRAINING COURSE INCLUDES:

- An introduction to climate change and SENDAI framework and the Paris Agreement
- Policy coherence on Climate Change Adaptation and Disaster Risk Reduction
- How to identify barriers to climate adaptation and climate risk assessment
- How to understand disaster risk and how to carry out integrated climate change and risk reduction management

TRAINING MATERIALS FOR HIGHER EDUCATION

The training course for local authorities was adapted as educational material for higher education by Åbo Akademi University to continue education, among the universities in the Baltic University Programme.

The content is divided into lessons, glossary and exercises:

- Lesson 1: Climate Change
- Lesson 2: Sendai Framework for Disaster Risk Reduction
- Lesson 3: Disaster Risk Reduction and Climate Change Adaptation
- Glossary: List of terminology with explanations
- Exercise 1: Climate Adaptation Game

Source: CASCADE (2021). Capacity Building Training Materials. Available at: <http://www.cascade-bsr.eu/toolbox/training-materials>

The outputs of CASCADE were delivered by 2021. According to interviews, the project was an important stepping stone that demonstrated the strengths of involving cross-sectoral experts (climate change experts in this case) in DRM activities. Furthermore, building the capacity of local communities is a focus for CBSS. This has carried over into the VOALA project which approaches the aspect of community involvement in DRM from another perspective.

10.6.6. Volunteers and Local Authorities – Baltic Sea Region Network (VOALA)



Though not a direct follow-up from CASCADE, VOALA continues the efforts to support regional cross-border cooperation in DRM. Running for the period of 2022-2024 with funding from the Swedish Institute, the project aims to: “support multi-sectoral cooperation for societal security in the region and enhance resilience to natural and man-made disasters. It plans to do so by strengthening cross-sectoral cooperation between authorities and volunteer organisations in crisis management.”¹⁷⁵ Thus, whereas CASCADE promoted addressing climate change in DRM actions and strengthening local level DRM capacity, VOALA aims towards raising the role of volunteer organisation.

To achieve this, under VOALA a Baltic Sea Region Network of volunteers will be established. The network will promote activities that bring together different stakeholders, including national round tables, international workshops for volunteer leaders and national authorities, and conferences. Furthermore, through the project:

- Volunteer organisations active in BSR will be mapped to create a database of volunteer stakeholders who could be involved in DRM activities in the future.

¹⁷⁵ Swedish Institute (2022). VOALA; Volunteers and Local Authorities – Baltic Sea Region Network. Available at: <https://si.se/en/projects-granted-funding/voala-volunteers-and-local-authorities-baltic-sea-region-network/>

- An analysis of existing practices will be performed to compile best practices in volunteer organisation involvement as well as recommendation on how approaches could be applied across BSR.

By focusing on volunteer organisations, VOALA will continue strengthening local level capacity to manage disasters, especially supporting vulnerable communities. It should be noted that the cross-border aspect of VOALA is primarily in knowledge sharing between volunteer organisations through the Network of volunteers, organisation of international round tables which will enable practice transfer.

The strength of VOALA, according to CBSS, is the whole of society approach which is embedded in the NORDIC countries and is considered a significant strength in terms of resilience to disasters. Whole of society indicates that in the event of disaster every member of the community knows the role they must play in disaster management. This has, reportedly, created a strong culture for volunteer work and it is hoped that through VOALA, volunteering can be further strengthened across the whole region.

10.6.7. Baltic Marine Environment Protection Commission (HELCOM)

The Baltic Marine Environment Protection Commission, also known as the Helsinki Commission (HELCOM), is an intergovernmental organisation composed of Contracting Parties that include Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, Sweden, and the EU. Established in 1974, HELCOM organises annual meetings between the Contracting Parties and adopts recommendations for maritime protection and activities.¹⁷⁶

In 1977 HELCOM established the Expert Group on Oil Combatting, now called the HELCOM Response Working Group, that brings together pollution response authorities from BSR countries. This facilitates international cooperation against oil spills in the Baltic Sea.

Response to spills is further strengthened by the HELCOM Manual on Co-operation in Response to Marine Pollution which was adopted in 1983 and the latest revision in 2021 renamed it into the HELCOM Response Manual.¹⁷⁷ The Response Manual presents administrative and operational procedures as well as financial questions that guide the cross-border response, including communicating between countries (national contact points) and requesting assistance, to maritime risks of oil hazardous noxious substance (HNS) pollution. Further cooperation extends to response towards risks to coastlines, fauna and flora around the coast that would be impacted by oil and HNS spillage. The Response Manual outlines an organisational overview of authorities and responsibilities when countries contact one another and request assistance.

The effectiveness of the response is further strengthened through annual training exercises that are meant to test the preparedness of regional actors to conduct joint maritime operations against oil risks. The training itself is organised following the HELCOM Response Exercise Plan (HREP) (presented in Annex 11 of the HELCOM Response Manual). HREP is a cyclical methodology based on a needs analysis (conducted around every four years to update the response needs in the region) after which the identified needs, lead countries and potential exercises are discussed, exercise projects developed and implemented with lessons learned compiled to be used in the next cycle of needs analysis.

¹⁷⁶ HELCOM (2023). Organisation. Available at: <https://helcom.fi/about-us/organisation/>

¹⁷⁷ HELCOM (2023). Manuals and Guidelines. Available at: <https://helcom.fi/action-areas/response-to-spills/manuals-and-guidelines/>

Working more together across sectors, levels, and borders will be the best way for the BSR to improve resilience.”

Representative of CBSS.

Source: CASCADE (2021). Project final review – interviews with project partners

The quote helps explain the approach taken for the CASCADE project which predominantly focused on local level authorities and supporting their capacity for DRM in the context of climate change. To offer further arguments, a discussion with a Lithuanian Red Cross representative during this project indicated that the BSR has experienced lower chances and consequences of natural risks and hazards when compared to, for example, Southern European countries.

Cross-border cooperation within the region is also challenged by the capacity for local level stakeholders to engage in DRM actions. During interviews with CBSS representatives, it has been noted how capacity to meaningfully engage in DRM actions (data collection and data analysis, DRM tools, DRM training, etc.) can be concentrated in cities, large municipalities; thus, reducing the capacity of smaller local actors to conduct DRM. Because local actors are kept “outside the loop” of DRM, or otherwise do not receive the proper support required to engage in DRM (i.e., insufficient training in data collection, data interpretation and analysis, DRM tool usage, etc.), their capacity to work on cross-border DRM is significantly reduced.

While it is a complex issue of funding, resource availability, expert availability, one key point to note is that in terms of natural disasters the BSR is a comparatively safe geographic area, or at least that can be a common perception. This can, unfortunately, translate into reduced capacity to properly react to natural disasters, particularly when considering the effects of climate change on the region and how this translates into forecasted increase in risks (i.e., coastal flooding, windstorms).

Furthermore, cross-sectoral collaboration still needs strengthening in addition to projects facilitating bringing experts from different sectors together. According to conducted interviews, DRM should not be only connected to DRM experts, but involve stakeholders from across different sectors and civil society. Deepening the available knowledge base in terms of how, why risks emerge can only support DRM experts in their activities.

10.8. Conclusions and lessons learnt

The impacts of climate change on the region in the past several years have become increasingly visible. The reviewed documents and conducted interviews point towards effect of climate change becoming an increasingly major source of maritime risks in the coming years. In response, countries are starting to reevaluate their DRM strategies to account for the effects of climate change and that is where the role and importance of regional initiatives and platforms enabling country collaboration can be seen.

CBSS has approached DRM support with a focus on areas that are not being covered by other international bodies (i.e., EU Civil Protection Mechanism which is highly regarded among CBSS). According to the interviews, for CBSS it is important to ensure funded projects do not overlap with already existing EU mechanisms, programmes, agreements, etc. and are complementary to ensure greater benefit and impact for countries around the Baltic Sea. For CBSS this translated in actions supporting a bottom-up approach to DRM, targeting local communities, building capacity of different stakeholders across different sectors and civil society to support DRM measures. In the case of HELCOM, the EU is part of the Contracting Parties and thus has a voice in the implementation of DRM activities targeting oil pollution. This likewise means that HELCOM can coordinate its response measures to be in line with EU mechanisms.

The benefits of CBSS actions are in facilitating knowledge sharing, networking both nationally and internationally. Events bringing experts together to train and exchange knowledge are embedded in the design of projects that support DRM capacity building. This is very much intentional as CBSS experts indicate how important it is to ensure those involved in DRM activities exchange approaches taken and build contacts with their peers. Often countries face similar risks and sharing approaches taken can support greater cohesion in DRM approaches. Enabling close personal contacts between experts yield greater confidence in tackling risks, especially in terms of cooperating with colleagues they already know.

However, it is important to note that such networking actions must target the right people and ensure that societal value is created through their implementation. It is not enough to host an event in DRM training if the right people are not in attendance. BEP is a good example of an annual training event that specifically targets middle managers with the objective of supporting the coming generation of high-level civil protection managers in building their knowledge base for DRM as well as their professional contacts with experts in comparable positions.

Furthermore, capacity building actions for DRM must recognise the level of support needed for their target groups to engage in DRM activities. Experience in implementing projects, such as CASCADE and VOALA, point towards necessity to consider sustainability of results. From translation requirements, to training and education needs, ability to collect and analyse relevant data for disaster identification and prevention.

Projects designed to strengthen DRM capacity should not be viewed as “off-the-shelf” solutions; rather, careful consideration must be placed on the beneficiaries needs and capacity to engage in DRM. Only then can meaningful impacts be achieved.

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