

Brief communication: Strengthening coherence between climate change adaptation and disaster risk reduction

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15 **Abstract.** Reducing disaster risks and adapting to climate change are ever more important policy goals in Europe and worldwide. The commitment to the 2030 Agenda for Sustainable Development and complementary multilateral frameworks, including the Sendai Framework for Disaster Risk Reduction 2015-2030 and the Paris Agreement on Climate Change, has galvanised pursuits for policy coherence. The report »Climate change adaptation and disaster risk reduction in Europe: enhancing coherence of the knowledge base, policies and practices« of the European Environment Agency identified several
20 ways how coherence and resilience can be built through knowledge sharing, collaboration and investments.

1 Introduction

The reported economic impacts from extreme weather and climate-related events (hereafter, climate extremes) in the European Environment Agency's (EEA) member countries over 1980–2017 come to more than EUR 449 billion¹. These are conservative estimates of the actual economic impacts, since many intangible and non-monetary impacts are difficult to
25 quantify (OECD, 2018). Climate variability and change have noticeable effects on human health, the spread of climate-sensitive diseases, environmental quality and social well-being, and these impacts are either not or only partially accounted for. Climate extremes can affect and shape ecosystems and thus have an impact on the services they provide (e.g. water retention, food production, cooling, energy production, recreation and carbon sequestration). In some cases the loss of such services can increase the probability of further hazards. For example, forest fires exacerbated by drought can lead to slope
30 destabilisation and increase the risk of landslides during extreme rainfall events.

The already high tolls of extreme weather and climate-related events (hereafter, climate extremes) are expected to further increase as a result of human-induced climate change. Under future climate change, nearly all climate extremes are projected to increase in severity, duration and/or extent, and some also in frequency (EEA, 2016). Heat waves are projected to become more intense and to persist longer in all regions in Europe (Russo et al., 2014). However, projected changes in frequency and intensity of extreme precipitation show regional differences with the largest increases in central and eastern Europe in winter months (Jacob et al., 2014). Similarly, changes in river floods show strong regional differences with the greatest increases for the British Isles, north-west and south-east France, northern Italy, parts of Spain, the Balkans and the Carpathians (Alfieri et al., 2015; Russo et al., 2014). Changes in population and wealth, driven by developments in hazard-prone areas (Winsemius et al., 2015), and the deteriorated status of natural ecosystems drive the impacts upwards.

Sound climate risk management (Mechler and Schinko, 2016) can lessen the impacts of disaster risks and contribute to boosting resilience. Climate change adaptation (CCA) and disaster risk reduction (DRR) (see supplementary material for the definition of main terms) have been, to some extent, mainstreamed into European and national policies, but it is important to make the resulting efforts internally consistent and mutually supportive. Policy coherence is an objective of EU regulation agenda² and external actions. But there is a notable paucity about how policy coherence between CCA and DRR can be actively promoted. Evidence of good practices does exist (EFDRR, 2013) but the opportunities to build-up resilience by better integrating CCA and DRR are yet to be fully exploited. The EEA report »Climate change adaptation and disaster risk reduction in Europe: enhancing coherence of the knowledge base, policies and practices« (EEA, 2017) tries to fill the above gap. The Report builds upon an extensive expert review and consultations with the European Environment Information and Observation Network (EIONET) countries. The release of the Report was aligned in a timely way with complementary reports of the Disaster Risk Management Knowledge Centre and the UN Office for Disaster Risk reduction (Poljanšek et al., 2017; UNISDR, 2017). It sets out to inform an ongoing review of the EU Climate Adaptation Strategy⁹ and the implementation of the Sendai Framework for DRR 2015-2030 in the EU⁷.

2. Defining good examples of policies, methods and practices

Policies driving cohesion between CCA and DRR in Europe

Building state and societal resilience to climate variability and change is a shared, progressively more coordinated, and goal-oriented concern of EU internal and external actions. The EU and Member States' commitment to the 2030 Agenda for Sustainable Development³ and complementary multilateral frameworks, including the Sendai Framework for Disaster Risk Reduction 2015-2030⁴ (SFDRR) and the Paris Agreement on Climate Change⁵, has sponsored greater policy coherence and resilience building. The SFDRR advocates multi-hazard, inclusive, science-based and risk-informed decision-making, and lays down priorities for action and policy targets. Progress in achieving these targets is monitored and assessed by means of 38 indicators, some of which are also used to report on the Sustainable Development Goals. The Sendai Framework Monitor was launched in March 2018 to facilitate the reporting. The Paris Agreement specifies, among other things, a global

adaptation goal focussed on the ability to adapt to the adverse impacts of climate change and on climate resilience, both among the essential prerequisites of sustainable development.

Coherence on sustainable development, disaster risk reduction and climate adaptation is backed by interrelated and consistent European action plans^{6,7}, aiming to reinforce resilience to shocks and stresses, while boosting innovation, growth and job creation. The EU Strategy on Adaptation to Climate Change⁸ has fostered development of national adaptation strategies and national adaptation plans and boosted knowledge sharing and mainstreaming of climate adaptation in other policy areas. These policy domains include environment and critical infrastructure protection, agriculture, food and nutrition security, integrated coastal management, Cohesion Policy and EU Structural and Investment Funds. While the EU Climate Adaptation Strategy only addressed impacts that may occur within EU borders, the 2017-2018 Review⁹ recommended more emphasis on (i) risks from climate impacts that (may) materialise elsewhere, and the (ii) relations between adaptation within and beyond EU. The EU's Civil Protection Mechanism¹⁰ emphasizes multi-hazard risk assessments and (short to long-term) prevention as bases for effective disaster preparedness and response. In 2017 the European Commission (EC) proposed a reform of the Mechanism¹¹ which accentuates coherence between climate change adaptation, disaster prevention and disaster response.

A systemic approach on policy coherence and resilience is also informing the EU external action. The 2016 Global Strategy for the EU's foreign and security policy¹² included 'state and societal resilience' among its five priorities. The Strategy recognised that climate change exacerbates potential conflicts, and laid down shared vision and common principles that foster coherence of EU external actions. The 2017 'Joint Communication on Resilience' by the Representative for Foreign Affairs and Security Policy and the EC further specifies how a strategic approach to resilience can support EU's development and humanitarian commitments, while better protecting it from external threats¹³. The Communication identified four 'building blocks' for incorporating resilience in EU's external actions: (i) improving risk analysis at country and regional level; (ii) a more dynamic monitoring of external pressures; (iii) integrating resilience in programming and financing external action; and (iv) developing international policy and practice on resilience.

Common methods and concerns

Assessment of climate-related hazards and risks is an area that has long stimulated the building of common grounds between CCA and DRR. Climate-related hazards are outcomes of multiple stochastic processes. On a temporal scale, the probability distributions span years, decades and centuries. In some cases, even lower probabilities are still relevant for today's decision making. These stochastic processes are often not stationary but respond to environmental changes, including climate change. This is why CCA and DRR communities have sought and succeeded in reconciling key terms and definitions (Jurgilevich et al., 2017). The levels of vulnerability are changing as our societies are transformed in terms of demography, wealth, cohesion and use of technology (Ward et al., 2017). Notwithstanding the importance of the quality-assured, systematically collected and thorough records on impacts of natural hazards, the loss data systems in Europe are fragmented and inconsistent. Empirical and evidence-based risk analysis and assessment are a vital part of CCA and DRR efforts.

Characteristics identified in good practice examples

The desk review and consultations have revealed a lack of explicit criteria that define ‘good’ practice examples in terms of policy coherence. Cases were identified which were characterised by a higher level of coherence, as well as examples that hold greater potential for transferable lessons learned. However, throughout our extensive search we did not find many cases in which (i) improved coherence was a planned outcome, with clearly demonstrated added value for both policy areas; (ii) where uncertainty was given due regard from long-term perspective; and (iii) where the existing practices were thoroughly embedded within the risk management and climate adaptation planning cycles.

Good examples of governance exhibit a robust legislative mandate, well-defined organisational and institutional tiers, and clearly assigned roles and responsibilities. In terms of risk and adaptation financing, good practices include proper budgetary endowments and sound use of financial or economic instruments/incentives. From a policy perspective, the proposed measures should not only be efficient and effective, but also compatible with and complementary to measures implemented for other similar purposes. On a more practical level, good practice examples imply use of combined knowledge and data on short and long-term hazards, exposure, vulnerability and performance of past climate risk reduction efforts, including the underlying assumptions and uncertainties.

Six good examples were eventually chosen for the report and include (1) development of a long-term planning vision in the Netherlands; (2) insurance and risk financing based on public–private partnerships in Spain, France and the United Kingdom; (3) local risk governance in Switzerland; (4) national risk assessments serving both CCA and DRR purposes; (5) city networking for improved urban resilience; and (6) financing nature-based solutions for CCA and DRR (Table 1).

Good practice examples	and their features
Multi-level and long-term governance (e.g. Delta programme in Netherlands)	<ul style="list-style-type: none"> • Multi-actor partnership for co-designing climate-proof water management across otherwise separate policy domains, • Multi-layer safety policies and measures in which an optimal mix is proposed between prevention, sustainable spatial planning and crisis management, • Adaptive Delta Management employing short-term interventions within long-term planning perspectives, while taking into account uncertain impacts of climate change through a range of scenarios.
Public-private partnerships (PPPs) for hazard risk transfer (e.g. insurance and reinsurance schemes in Spain, France, UK)	<ul style="list-style-type: none"> • Examples of longstanding insurance-related PPPs include the Spanish Consorcio de Compensación de Seguros (CCS), the French Catastrophes Naturelles (CatNat) and the Flood Reinsurance Scheme (Flood Re) in the UK, • Vehicles of joint bearing of responsibilities and efficient risk sharing enabling insurability and financial backing also for low-probability/high-impact risks, • Incentivising risk prevention, helping to improve risk understanding and

	knowledge, and stimulating active engagement and investment.
Multi-level risk governance (e.g. Switzerland)	<ul style="list-style-type: none"> • Decentralised system with cantons and municipalities investing operational responsibility for DRR and civil protection, and federal authorities engaged in strategic planning, financial and technical support, and overall control, • Formal arrangements secure cooperation between these actors, horizontally and vertically, and between federal organisations, the private sector and academic organisations.
National risk assessments (NRAs)	<ul style="list-style-type: none"> • NRAs are instrumental for identifying, assessing and prioritising security threats, including those arising from climate variability and change, in a close collaboration with and building upon the local knowledge of the local affected communities, • Experiences of some countries, such as France, the Netherlands and the United Kingdom, show that climate vulnerability and risk assessments need to build on strong institutional frameworks, clearly assigned responsibilities and authority, and close stakeholder engagement.
City networks	<ul style="list-style-type: none"> • Covenant of Mayors for Climate and Energy, C40 Cities, UNISDR Making Cities Resilient campaign and Rockefeller 100 Resilient Cities, and others, • Collaboration in absence of hierarchical authority, building upon information and communication, project funding, capacity building, good practice benchmarking and certification.
Financing nature-based solutions (NBS) (e.g. European Investment Bank)	<ul style="list-style-type: none"> • Ecosystems may mitigate natural hazard risks, by mediation of flows and nuisances; or through maintenance of physical, chemical, biological conditions in the face of pressures, • European Investment Bank's Natural Capital Finance Facility (NCFE) is a new finance instrument which aims specifically at financing projects which apply nature-based solutions to adaptation measures, • NCFE sets out to generate a revenue stream or achieve cost savings in order to pay back the investment; the instrument typically includes an equity-type component to reduce risk, and a technical assistance component.

Table 1: Selected examples of good practice that fosters coherence between DRR and CCA

3. Opportunities to enhance coherence between climate change adaptation and disaster risk reduction in policy and practice

Even though CCA and DRR pursue complementary goals, they are two distinct areas of policy and practice, each characterised by own institutional organisation and legal frameworks, which differ across countries as a result of multiple factors. The coherence between them can be promoted through knowledge sharing, and a closer collaboration across existing science and policy platforms and networks.

Resilience to climate variability and change provides common ground for CCA and DRR upon which more coherent actions can be built. Building the culture and practice of resilience (NRC, 2012) is more than reducing the consequences of foreseeable events and builds resilience into systems to recover and adapt when adverse events occur. Climate change mitigation and adaptation contribute to closing the ‘resilience gap’ by helping to avoid unmanageable changes and managing them when they become unavoidable (Bierbaum et al., 2007). DRR does the same by improving the capacity to cope with climate extremes. For DRR, taking into account long-term climate change will enhance preventive responses to risks.

Improved climate risk assessment (EEA, 2018) present opportunities for enhancing coherence between the two policy areas. National risk assessments and national adaptation strategies have been completed by most of the EEA member countries, sometimes in a coordinated manner. Hazard mapping and risk assessment are areas where integration of CCA and DRR is more advanced and recognised as a priority. High performance computing has enabled new generation of climate models that are better capable of simulating climate extremes. Progress in climate risk assessment, modelling of cascade and spillover effects (Pérez-Blanco et al., 2016), and their propagation through networks has resulted in improved methodologies for estimating damage and losses. These advancements should be harnessed for a better understanding of implicit and explicit government liabilities, and designing comprehensive risk financing strategies (OECD, 2015).

Web-based knowledge portals and multi-stakeholder coordination platforms can be designed to help communicate and share more a consistent and complementary knowledge for CCA and DRR. To make the multiple strategies responsive and sensitive to the needs of vulnerable communities, social strata and businesses, national and local multi-stakeholder platforms have been established in many countries across Europe, driving horizontal cooperation and partnerships across public and private spheres. In order to be effective, the multi-stakeholders engagement and partnerships are to be complemented by effective means of sharing and reusing information and knowledge, conducive to a common understanding of vulnerabilities, risks and solutions.

A well-functioning system of public and private, user-driven climate services that connect short- and long-term climatic changes can help catalyse an economic and societal transformation that reduces risks and improves societal resilience. Climate services support mitigation and adaptation to climate change and encourage a science-based and climate-informed policy development. Moreover, climate services may unlock Europe’s innovation potential, competitiveness and economic growth. Over the past decades, the climate services have grown in numbers, quality and sophistication. The EU has made large investments in frontline systems enabling modern meteorological services under the Copernicus Earth observation programme. But the uptake of climate services for policy and decision making is relatively modest (Brasseur and

Gallardo, 2016). Improved alignment of demand-led CCA and DRR climate service products requires decision-makers from both communities to have stronger linkages with each other, as well as with the providers of climate information and knowledge, and intermediate providers of climate services. The DRR community has a long history of making use of hydro-meteorological services, but there are opportunities to better integrate uncertainty associated with future climate variability and change (Street et al., n.d.).

Nature-based solutions (NBSs) are a prime example of means for simultaneously reducing natural hazard risks and boosting societal resilience that address both CCA and DRR. Ecosystems can provide means for mitigating natural hazard risks and boosting societal resilience, locally or regionally. Compared to engineered or built solutions, ecosystem-based approaches can be cost-effective and have co-benefits, thus becoming increasingly valuable in the face of more frequent and/or severe extreme events. They have an economic value in the context of natural disaster risk reduction, even if no price is actually paid for their provision and/or maintenance. Many ecosystem-based initiatives have been developed for DRR and CCA to respond to societal challenges through innovative actions inspired or supported by nature. However, a more systematic learning about impacts and effectiveness of ecosystem-based approaches is needed, by taking account of local perceptions and knowledge, and sustained political support, monitoring and funding.

Connecting available funding and financing options for CCA and DRR at the EU and other levels can identify new opportunities for projects and programmes enhancing resilience. To mainstream climate change concerns in its broader development strategy, the EU has agreed to spend 20% of its resources under the Multiannual Financial Framework 2014–2020 on climate change-related action. Under the European Structural and Investment Fund (ESIF), EUR 29 billion have been allocated to the thematic objective 'Climate change adaptation and risk management'⁷, but disaster resilience and climate risk management are also promoted under other priorities. Additional funds available for fostering climate adaptation and DRR include Horizon 2020, LIFE and the European Solidarity Fund. Policy instruments that incentivise a more efficient use of natural resources contribute to reducing the impacts of climate change. Economic incentives and/or disincentives drive individual and business behaviour toward achieving sustainable development objectives, including an efficient use of natural resources and disaster risk reduction. Pricing instruments such as land taxes, tax reliefs or subsidies are commonly applied to correct market failures and decouple environmental pressures from economic growth. Incentive and transparent pricing (e.g. of insurance policies or water) can contribute to reducing the economic effects of extreme events (such as droughts and floods).

Setting up an interaction and learning mechanism between emerging Monitoring, Reporting and Evaluation (MRE) schemes can improve coherence, quality and relevance for CCA and DRR. MRE can help learning across cities, regions and countries. CCA and DRR share a number of characteristics that can make MRE challenging, such as long timescales, uncertainty and common baselines. Improving the connectivity and coordination of national-level indicators between DRR, CCA and other policy frameworks such as the SDGs can improve the efficiency of data collection and build up a more complete picture of CCA and DRR progress and priorities. It can also support improved learning regarding the integration of CCA and DRR, and how this can lead to more efficient and effective implementation on the ground.

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- 15 [Note for the editor: Please note that the end notes have been moved to the supplementary material and are left here only for your convenience, they will be removed from the manuscript]

¹ EEA indicator 'Economic losses from climate-related extremes' (2018 update) based on NatCatService of Munich Re

² Better Regulation Guidelines - Commission staff working document SWD (2017) 350

³ Transforming our world: the 2030 Agenda for Sustainable Development. Resolution adopted by the UN General Assembly on 25 September 2015

⁴ Sendai Framework for Disaster Risk Reduction 2015-2030. A/CONF.224/CRP.1. 18 March 2015

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