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Brief communication: Strengthening coherence between climate change adaptation and disaster risk reduction through policies, methods and practices in Europe

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Authors' response to the Editor(s)

Dear Dr. Fuchs,

Thank you for your comments and suggestions. We have revised the manuscript, while paying attention to the comments of the two reviewers. Further down in this document you may find the manuscript with the revisions/modifications in track-change mode. We have

- thoroughly revised the manuscript while preserving the format (short communication),
- moved the references to regulatory and legislative documents to the supplementary material, and included instead references to peer-reviewed literature sources,
- moved parts of the text from manuscript to supplementary material and included the definitions of the main terms used.

Hereby we would like to thank the both reviewers and you for your help and insightful comments. Looking forward to hearing from you,

My best regards, Jaroslav Mysiak on behalf of all authors.

Editor's comments to the Authors (28 Aug 2018)

Editor Decision: Reconsider after major revisions (further review by editor and referees) (28 Aug 2018) by Sven Fuchs

Dear colleagues,

meanwhile we received two comments of referees as well as your public answers to their comments. As you may have recognized, there is a strong agreement among the referees that your short communication would gain if you include some of the issues on CCA and DRR in Europe which is beyond the statements made in the EEA report. In contrast, you argued that during the review process of the report considerable consultation with stakeholders from science and policy took place, which lead to the final statements made in the final (EEA) report. As you have stated in your response to referee #2, you have already revised the manuscript considering the suggestions made by the referees, also including the issues raised by referee #1 (stakeholder engagement...). So I kindly invite you to upload the revised version so that we can have a second round. Considering the comment of referee #2 about the definitions: you could also think about an "online supplement" or "appendix" to your article, this will not increase the page numbers, nr the limit with respect to references. I would like to thank you for your patience during the open discussion phase, and I am looking forward to receiving your finalized manuscript.

Kind regards,

Sven Fuchs (Editor NHESS)

Brief communication: Strengthening coherence between climate change adaptation and disaster risk reduction ~~through policies, methods and practices in Europe~~

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Abstract. Reducing ~~natural hazard-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. Sound climate risk management will lessen the impacts of disaster risks and contribute to boosting resilience. Climate change adaptation and disaster risk reduction have to some extent been mainstreamed into international and national policies but it is important to ensure that the resulting efforts are consistent and mutually supportive. The ~~EEA~~ report »Climate change adaptation and disaster risk reduction in Europe: enhancing coherence of the knowledge base, policies and practices« of the European Environment Agency identifies-identified several ways how ~~the coherence and resilience between CCA and DRR~~ can be built promoted through knowledge sharing, collaboration and investments.

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1 Introduction

~~Reducing natural hazard risks and adapting to climate change are ever more important policy goals. The already high economic, social and environmental tolls of extreme weather and climate-related events (hereafter, climate extremes) are expected to increase sizeably as a result of human induced climate change (EEA, 2016).~~

30 ~~Total~~The reported economic ~~losses-impacts~~ from extreme weather and climate-related events (hereafter, climate extremes) ~~climate extremes~~ in the European Environment Agency's (EEA) member countries over ~~the 1980–2016~~ period come to

more than EUR 43649 billion¹ (EEA, 2017b). These ~~should be understood as~~ are minimal conservative estimates of the actual economic impacts, since many intangible and non-monetary impacts are difficult to 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. ~~In addition, e~~ 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 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 ~~Along with climate change, growing~~ 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 ~~by increasing exposure and vulnerability.~~

Sound climate risk management (Mechler and Schinko, 2016) will can lessen the impacts of disaster risks and contribute to boosting resilience, ~~while harnessing the best available knowledge.~~ Climate change adaptation (CCA) and disaster risk reduction (DRR) (see supplementary material for the definition of main terms) have been, to some extent, ~~already been~~ mainstreamed into ~~international,~~ European and national policies, but it is important to make ensure that the resulting efforts ~~are~~ internally consistent and mutually supportive (EEA, 2017a). Policy coherence is an objective of EU regulation agenda ~~underlies the evaluation of fitness for purpose of European policies² – and is a cornerstone of the external actions~~ European Consensus on Development and Humanitarian Aid. But there is a notable remarkable vagueness ~~paucity~~ about how policy coherence between CCA and DRR can be actively promoted. According to a recent report of the European Environment Agency (EEA), e Evidence of good practices does exist (EFDRR, 2013) , ~~but public policies, methods and practices often lack coherence, and the~~ opportunities to build-up resilience by better integrating CCA and DRR are yet to be ~~not~~ fully exploited ~~to build up resilience by a better integration of CCA and DRR.~~

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 desk ~~review~~ and, consultations with the European Environment Information and Observation Network (EIONET) countries, ~~and an~~ international expert workshop held in April 2016. ~~Successively, it was comprehensively reviewed by a number of European~~

~~experts and EEA member country representatives. The Report is a result of joint efforts of the EEA, the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC/CCA), and the European Topic Centre on Inland, Coastal and Marine waters (ETC/ICM), and various services of the European Commission, such as the Joint Research Centre, DG Climate Action and DG Humanitarian Aid and Civil Protection.~~ 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 EU.⁷

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. Closer coherence between CCA and DRR is built into and endorsed by the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR; UN, 2015a) and the Paris Agreement on Climate Change (UNFCCC, 2015). Both are related and contribute to the 2030 Agenda for Sustainable Development (UN, 2015b). 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.

The EU Action Plan on SFDRR (EC, 2016a) acknowledged that a coherent realisation of the objectives laid down in the Framework could not only boost resilience, but also spur innovation and growth in the context of sustainable development. The EU's Civil Protection Mechanism (EC, 2013b) emphasizes multi-hazard (including climate) risk assessments and (short to long term) prevention as bases for effective disaster preparedness and response. In 2017 the Commission proposed a reform of the Mechanism (rescEU, EC 2017b) which accentuates coherence between climate change adaptation, disaster prevention and disaster response. The proposal empowers the Commission to compel, monitor and report on the implementation of prevention and preparedness plans (EC, 2017b).

The EU Strategy on Adaptation to Climate Change (EC, 2013a) 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. Building upon the achievements of the Europe 2020 strategy, the EC developed a long-term vision beyond 2020 and invited the EU member states to develop national frameworks for the achievement of the SDGs (EC, 2016b).

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, ~~which include sensitivity or susceptibility to harm and lack of capacity to cope and adapt,~~ 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

~~Innovative examples of integration in CCA and DRR policy and practice exist, but are not always explicit, e.g. in the flood risk prevention sector, where often climate projections are already considered in designing strategies and plans. In most areas, however, they are not, and the full potential of a better integration of CCA and DRR has yet to be exploited. This better integration will need closer and more effective vertical and horizontal, cross border and transnational coordination and cooperation.~~

The desk review and consultations have revealed a lack of ~~explicit unambiguous~~ criteria ~~that defining~~ 'good' practice examples ~~for in terms of fostering the coherence between CCA and DRR actions~~ 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, Notwithstanding throughout~~ our extensive ~~network~~ search, we did not find many cases in which ~~(i) enhanced-improved~~ coherence was a planned outcome, with ~~clearly demonstrated~~ added value for both policy areas; ~~(ii)~~ where uncertainty was given due regard from ~~the~~ long-term perspective; and ~~(iii)~~ where the ~~reviewed-existing~~ practices were ~~thoroughly well~~ embedded within ~~the the~~ risk management and climate adaptation planning cycles.

Good examples of governance exhibited 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 <u>co</u>-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, <u>in a close collaboration with and building upon the local knowledge of the local affected communities.</u> • 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

	<p>Cities Resilient campaign and Rockefeller 100 Resilient Cities, and others,</p> <ul style="list-style-type: none"> • Collaboration in absence of hierarchical authority, building upon information and communication, project funding, capacity building, good practice benchmarking and certification.
<p>Financing nature-based solutions (NBS) (e.g. European Investment Bank)</p>	<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

5 ~~Even though CCA and DRR pursue complementary~~ ~~Notwithstanding the interconnected goals and multiple synergies,~~ ~~CCA and DRR they~~ are two ~~distinct different~~ areas of policy and practice, ~~each,~~ ~~Each~~ characterised by ~~its~~ own institutional ~~organisation~~ and legal ~~frameworks~~ ~~frameworks,~~ which differ across countries as a result of multiple factors. The coherence between them can be promoted through ~~sharing~~ knowledge ~~sharing,~~ ~~and a~~ closer collaboration ~~between across~~ existing science and policy platforms and networks, ~~and better use of financial resources.~~ ~~Below we summarize the key recommendations in more detail:~~

10 **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) ~~goes is more than beyond~~ reducing the consequences of foreseeable events and builds resilience into systems to recover and adapt when adverse events occur. Climate change ~~actions both~~ 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 ~~contributes does~~ ~~to~~ the same ~~end~~ by improving the capacity to cope with ~~climate extremes~~ ~~the tail ends of climate variability.~~ For DRR, taking into account long-term climate change will enhance preventive responses to risks, ~~while for CCA and the emerging climate services, considering DRR requires a stronger focus on extremes and a better connection between shorter and longer term projections.~~

Improved climate risk assessment (EEA, 2018) ~~methods and mutually beneficial approaches~~ 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).

~~A thorough understanding of risks, including their cascade and spillover effects, is also important for a better understanding of implicit and explicit government liabilities, and designing comprehensive risk financing strategies. At a strategic level, CCA and DRR objectives should be pulled together and reconciled under the umbrella of long-term national sustainable development strategies. But connecting CCA and DRR at this high strategic level is useless if it is not complemented by concrete actions at the national and local level with adequate resources allocated.~~

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. ~~Well-managed knowledge portals provide a platform for sharing information and thus can increase the understanding of vulnerabilities and risks, as well as mitigation and adaptation measures.~~

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. ~~The Copernicus Climate Change Service (C3S) is one out of six services of the Copernicus service component, designed to deliver knowledge to support adaptation and mitigation policies.~~ But the uptake of climate services for policy and decision making is ~~still~~ 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'⁷¹, 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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[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](#)

⁵ [Adoption of the Paris Agreement. Decision 1/CP.21 UN Framework Convention on Climate Change, 2015](#)

⁶ [Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Next steps for a sustainable European future European action for sustainability, COM\(2016\) 739 final](#)

⁷ [Commission staff working document - Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030, A disaster risk-informed approach for all EU policies. Brussels, 16.6.2016 SWD\(2016\) 205 final](#)

⁸ [Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions An EU Strategy on Adaptation to climate COM\(2013\) 216 final change](#)

⁹ [Evaluation of the EU Strategy on Adapting to Climate Change – public consultation meeting report, Brussels 23/01/2018 bit.ly/2MzvZsb](#)

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