



HELLENIC REPUBLIC
Ministry for Climate Crisis
and Civil Protection



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the European Union

Inputs and Recommendations for the Development of a Draft NDRM Plan for Greece

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Statement on COVID-19

The COVID-19 pandemic has led to substantial restrictions for travel, the organization of workshops, and face-to face meetings. There were certain limitations with regard to the collection of information and data due to the restrictions imposed as a result of the pandemic.

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List of Acronyms and Abbreviations

Note: There have been several changes in the official names of ministries. This report refers to line ministries with the most current name.

Acronym	English	Greek
AAL	Average Annual Loss	Μέσες ετήσιες απώλειες
ADMHE	Independent Power Transmission Operator	Ανεξάρτητος Διαχειριστής Μεταφοράς Ενέργειας (ΑΔΜΗΕ)
BBB	Building Back Better	Χτίζω-ξανά-καλύτερα (Βελτιωμένη Ανασυγκρότηση)
BCA	Benefit-Cost Analysis	Ανάλυση οφέλους-κόστους
BCR	Benefit-Cost Ratio	Σχέση οφέλους-κόστους
CBRN	Chemical, Biological, Radiological and Nuclear	Χημικός Βιολογικός Ραδιολογικός Πυρηνικός κίνδυνος
CCA	Climate Change Adaptation	Προσαρμογή στην Κλιματική Αλλαγή
CI	Critical Infrastructure	Κρίσιμες υποδομές
CP	Civil Protection	Πολιτική Προστασία
CSO	Civil Society Organization	Οργάνωση Κοινωνίας των Πολιτών
DEDDHE	Hellenic Electricity Distribution Network Operator S.A.	Διαχειριστής του Ελληνικού Δικτύου Διανομής Ηλεκτρικής Ενέργειας (ΔΕΔΔΗΕ)
DG ECHO	Directorate-General for Civil Protection and Humanitarian Aid Operations	Γενική Διεύθυνση Επιχειρήσεων Πολιτικής Προστασίας και Ανθρωπιστικής Βοήθειας
DRM	Disaster Risk Management	Διαχείριση κινδύνου καταστροφών /ής
DRR	Disaster Risk Reduction	Μείωση Κινδύνου Καταστροφών / ής
EAFRD	European Agricultural Fund for Rural Development	Ευρωπαϊκό Γεωργικό Ταμείο Αγροτικής Ανάπτυξης (ΕΓΤΑ)
EAGME	Hellenic Survey of Geology & Mineral Exploration (formerly IGME)	Ελληνική Αρχή Γεωλογικών & Μεταλλευτικών Ερευνών (ΕΑΓΜΕ)
EC	European Commission	Ευρωπαϊκή Επιτροπή
EEAE	Greek Atomic Energy Commission	Ελληνική Επιτροπή Ατομικής Ενέργειας
EIB	European Investment Bank	Ευρωπαϊκή Τράπεζα Επενδύσεων
EKEPY-EKAV	National Centre for Health Operations– Emergency Health Care Center (formerly Centre for Operations for the Co-ordination of Health Sector (KEPIHSOTY)	Εθνικό Κέντρο Επιχειρήσεων Υγείας (ΕΚΕΠΥ)
ELGA	Hellenic Agricultural Insurance Organization	Οργανισμός Ελληνικών Γεωργικών Ασφαλίσεων
EMFAF	European Maritime Fisheries and Aquaculture Fund	Ευρωπαϊκό Ταμείο Θαλάσσιας Αλιείας και Υδατοκαλλιέργειας
EMFF	European Maritime Fisheries Fund	Ευρωπαϊκό Ταμείο Θαλάσσιας Αλιείας
EODY	National Public Health Organization	Εθνικός Οργανισμός Δημόσιας Υγείας (ΕΟΔΥ)
ERDF	European Regional Development Fund	Ευρωπαϊκό Ταμείο Περιφερειακής Ανάπτυξης
ESI	Emergency Support Instrument	Όργανο υποστήριξης έκτακτης ανάγκης
ESIF	European Structural and Investment Funds	Ευρωπαϊκά Ταμεία Υποδομών και Επενδύσεων
ESKEDIK	National Coordination Center for Crisis Management	Εθνικό Συντονιστικό Κέντρο Επιχειρήσεων και Διαχείρισης Κρίσεων
ESPA	National Strategic Reference Framework	Εθνικό Στρατηγικό Πλαίσιο Αναφοράς (ΕΣΠΑ 2007-2013), Εταιρικό Σύμφωνο για το Πλαίσιο Ανάπτυξης (ΕΣΠΑ 2014-2020), Εταιρικό Σύμφωνο Περιφερειακής Ανάπτυξης (ΕΣΠΑ 2021-2027)
EU	European Union	Ευρωπαϊκή Ένωση

EUSF	European Union Solidarity Fund	Ταμείο Αλληλεγγύης της Ευρωπαϊκής Ένωσης (ΤΑΕΕ)
EWS	Early Warning Systems	Σύστημα Έγκαιρης Προειδοποίησης
GDAEFK	General Directorate of Natural Disasters Recovery	Γενική Διεύθυνση Αποκατάστασης Φυσικών Καταστροφών
GDP	Gross Domestic Product	Ακαθάριστο Εγχώριο Προϊόν (ΑΕΠ)
GG	Government Gazette	Φύλλα Εφημερίδας της Κυβέρνησης (ΦΕΚ)
GNSS	Global Navigation Satellite System	Παγκόσμιο Δορυφορικό Σύστημα Πλοήγησης
GSRT	General Secretariat for Research and Technology	Γενική Γραμματεία Έρευνας και Τεχνολογίας
HAIC	Hellenic Association of Insurance Companies	Ένωση Ασφαλιστικών Εταιρειών Ελλάδος
HNMS	Hellenic National Meteorological Service	Εθνική Μετεωρολογική Υπηρεσία (ΕΜΥ)
IPCC	Intergovernmental Panel on Climate Change	Διακυβερνητική Επιτροπή για την αλλαγή του κλίματος
JRC	Joint Research Centre	Κοινό Κέντρο Ερευνών
KEMEDIK	Center for Crisis Management Studies	Κέντρο Μελετών Διαχείρισης Κρίσεων
M&E	monitoring and evaluation	Παρακολούθηση και Αξιολόγηση
MCA	multicriteria analysis	Πολυκριτηριακή ανάλυση
MFF	multiannual financial framework	Πολυετές Δημοσιονομικό Πλαίσιο
MoCP	Ministry of Citizen Protection (former)	Υπουργείο Προστασίας του Πολίτη
MoCS	Ministry of Culture and Sports	Υπουργείο Πολιτισμού και Αθλητισμού
MoND	Ministry of National Defence	Υπουργείο Εθνικής Άμυνας
MoDI	Ministry of Development and Investment	Υπουργείο Ανάπτυξης και Επενδύσεων
MoEE	Ministry of Environment and Energy (formerly known as the Ministry of Environment, Physical Planning and Public Works)	Υπουργείο Περιβάλλοντος και Ενέργειας (πρώην Υπουργείο Περιβάλλοντος, Χωροταξίας και Δημοσίων Έργων)
MoERA	Ministry of Education and Religious Affairs	Υπουργείο Παιδείας και Θρησκευμάτων
MoF	Ministry of Finance	Υπουργείο Οικονομικών
MoH	Ministry of Health	Υπουργείο Υγείας
MoI	Ministry of Interior	Υπουργείο Εσωτερικών
MoIT	Ministry of Infrastructure and Transport	Υπουργείο Υποδομών και Μεταφορών
MoRDF	Ministry of Rural Development and Food	Υπουργείο Αγροτικής Ανάπτυξης & Τροφίμων
MfCCCP	Ministry for Climate Change and Civil Protection	Υπουργείο Κλιματικής Κρίσης και Πολιτικής προστασίας
Nat-CHAMM	National Crisis and Hazard Management Mechanism	Εθνικός Μηχανισμός Διαχείρισης Κρίσεων και Αντιμετώπισης Κινδύνων
NCSR	National Centre for Scientific Research	Εθνικό Κέντρο Έρευνας Φυσικών Επιστημών “Δημόκριτος”
NDP	National Development Program	Εθνικό Πρόγραμμα Ανάπτυξης
NGEU	NextGenerationEU	Επόμενη Γενιά ΕΕ
NGO	nongovernmental organization	Μη Κυβερνητική Οργάνωση
NOA	National Observatory Athens	Εθνικό Αστεροσκοπείο Αθηνών
NPP	nuclear power plant	Εργοστάσιο Πυρηνικής Ενέργειας
NRA	National Risk Assessment	Εθνική Εκτίμηση Κινδύνου
NRRP	National Recovery and Resilience Plan	Εθνικό Σχέδιο Ανάκαμψης και Ανθεκτικότητας (ΕΣΑΑ)
O&M	Operations and Maintenance	Λειτουργία και Συντήρηση
OASP	Earthquake Planning and Protection Organization	Οργανισμός Αντισεισμικού Σχεδιασμού και Προστασίας

OP	Operational program	Επιχειρησιακό Πρόγραμμα
PEKEPP	Regional Civil Protection Operational Centers	Περιφερειακά Κέντρα Επιχειρήσεων Πολιτικής Προστασίας
PEPYD	Regional Fire Administrations	Περιφερειακές Πυροσβεστικές Διευθύνσεις
PESOPP	Regional Operational Coordinating Bodies of Civil Protection	Περιφερειακά Συντονιστικά Όργανα Πολιτικής Προστασίας
PIP	Public Investment Program	Πρόγραμμα Δημοσίων Επενδύσεων (ΠΔΕ)
PML	probable maximum loss	Πιθανή μέγιστη απώλεια
PPP	public-private partnership	Συνεργασία Δημόσιου-Ιδιωτικού τομέα
RAS	Reimbursable Advisory Services	Επιστρεπτές Συμβουλευτικές Υπηρεσίες
RCM	Regional Climate Model	Περιφερειακό Μοντέλο Κλίματος
RCP	Representative Concentration Pathway	Αντιπροσωπευτικό Μονοπάτι Συγκέντρωσης
ROP	Regional Operational Program	Περιφερειακό Επιχειρησιακό Πρόγραμμα
RRF	Recovery and Resilience Facility	Ταμείο Ανάκαμψης και Ανθεκτικότητας
RTD	research and technological development	Έρευνα και τεχνολογική ανάπτυξη
SAPP	Coordinating Authority for Civil Protection	Συντονιστική Αρχή Πολιτικής Προστασίας
SAR	Synthetic-Aperture Radar	Ραντάρ Συνθετικού-Διαφράγματος
SAVA	South Aegean active Volcanic Arc	Ενεργό Ηφαιστειακό τόξο Νοτίου Αιγαίου
SME	Small and Medium Enterprises	Μικρές και μεσαίες επιχειρήσεις
SOPP	Coordinating Body for Civil Protection	Συντονιστικό Όργανο Πολιτικής Προστασίας
TEE	Technical Chamber of Greece	Τεχνικό Επιμελητήριο της Ελλάδος
TESOPP	Local Operational Coordinating Bodies of Civil Protection	Τοπικό Συντονιστικό Όργανο Πολιτικής Προστασίας
TOKEPP	Local Civil Protection Operational Centers	Τοπικά Κέντρα Επιχειρήσεων Πολιτικής Προστασίας
UCPM	Union Civil Protection Mechanism	Μηχανισμός Πολιτικής Προστασίας της Ένωσης
WUI	Wildland Urban Interface	Ζώνη Μίξης Δασών- Οικισμών

EXECUTIVE SUMMARY

Greece is exposed to a range of natural hazards. Beyond the wildfires in 2018 and 2021 and the floods and earthquakes in 2020, Greece has experienced 47 major disasters in the last 30 years, which have amounted to more than US\$10 billion in direct damages. Different types of flooding pose a significant recurrent risk in multiple regions in Greece; and earthquakes, while less frequent, present a substantial risk with potentially devastating impacts. Other frequently experienced natural hazards include landslides, wildfires, droughts, extreme heat, storms, and winter conditions. Greece also suffers from human, animal, and plant infectious diseases and faces risks from industrial, nuclear, and transportation accidents. Moreover, climate change is expected to result in more frequent and intense heat events, droughts, wildfires, and flash floods.

Given the risk profile of Greece, the current potential financial impact following from disasters could be substantial. A 2018 assessment of earthquake risk estimated that the probable maximum financial loss from a 1-in-a-200-year earthquake event (considered a more frequent earthquake) amounts to between €7 billion and €10 billion, or between 3.7% to 5.30% of Greece's gross domestic product (GDP).¹ Presented as annual modeled expected loss, the financial impact is suggested to be between €434 million and €950 million, well in excess of current natural catastrophe budget arrangements.

The proposed National Disaster Risk Management Plan (NDRMP) for Greece consolidates planned and proposed measures, as well as financing opportunities to manage these risks as part of an overarching goal to promote disaster risk prevention, preparedness, and resilience² and contribute to climate change adaptation and mitigation. The plan has three key objectives. First, the plan supports the implementation of the relevant European Union (EU) enabling conditions related to 2021–2027 financial resources available for disaster risk management (DRM) and climate change adaptation (CCA) and contributes to broader goals set out by the Paris Agreement, the Sendai Framework for Disaster Risk Reduction 2015–2030, and the Sustainable Development Goals. In line with this objective, the NDRMP follows a risk-based management approach which supports the prioritization of DRM investments with respect to the severity of the impacts that they may have to the economy, environmental, and societal assets of the country. Second, the NDRMP supports the implementation of Law 4662/2020, which is the latest key legal document regulating the current civil protection (CP)/DRM framework in Greece and the National Civil Protection Programme AEGIS³ as well as other initiatives, including strengthening of the National Crisis and Hazard Management Mechanism (Nat-CHAMM), all of which seek to upgrade the CP system in the country across different DRM areas. Third, the proposed NDRMP can also serve for raising

¹ Hellenic Association of Insurance Companies (HAIC). 2018. "Proposal of a Residential Earthquake Insurance System". The calculations of HAIC were performed with modeling by the RMS and AIR firms, using the 2011 building stock census based on the residential portfolio of Greece—excluding commercial and industrial risks, public infrastructure, state-owned buildings, loss of future income, etc., which means the loss in its totality could reach in the range of 8% to 10% of Greece's GDP.

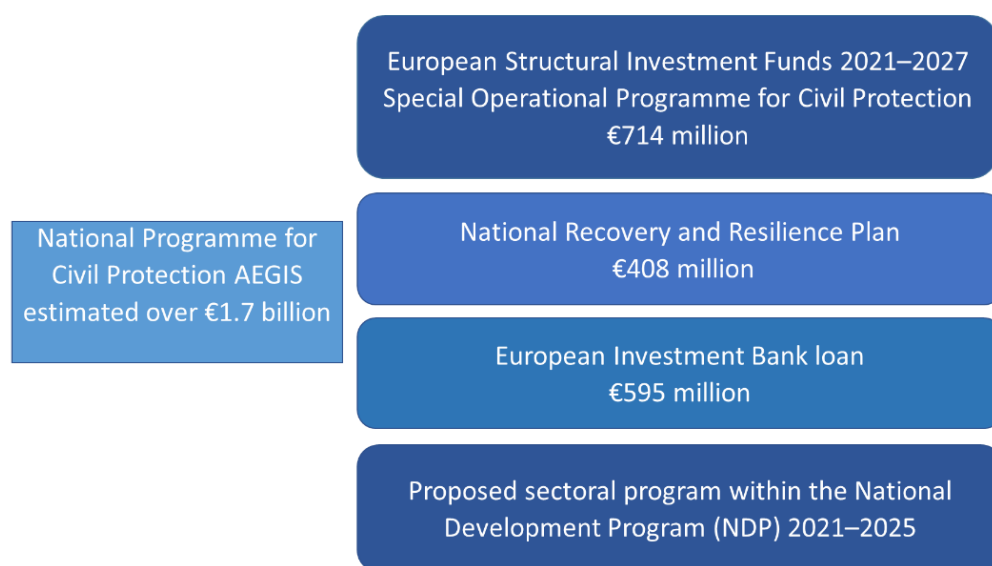
² See note on terminology in the Introduction and Annex 5. DRM measures cover all phases and whole spectrum of measures including prevention, preparedness, and response designed to improve understanding of risks, reduce and mitigate risks, better prepare for, respond and recovery from disasters, whether caused by natural hazards or man-made hazards. Disaster prevention, mitigation/reduction, and preparedness are considered ex-ante actions, while response and recovery are considered ex-post interventions.

³ Information related to AEGIS as of June 2021 as shared by General Secretariat for Civil Protection (GSCP).

awareness of the cross-sectoral nature of CP and DRM, building consensus between stakeholders, informing the wider public about measures and resources, and contributing to building a culture of disaster prevention.

To implement priority DRM measures, funding has been allocated from EU and national sources. The National Programme for Civil Protection, AEGIS, aims to upgrade CP infrastructure and equipment, as well as support the implementation of Law 4662/2020. The overall funding sources that will support the plan are set to exceed €1.7 billion, drawing on (i) a new operational program (OP) within the European Structural Investment Funds (ESIF) 2021–2027 focusing exclusively on CP (€714 million); (ii) the National Recovery and Resilience Plan (NRRP) that will be providing funding for infrastructure upgrading and prevention projects (€408 million); (iii) a European Investment Bank (EIB) loan (€595 million); and (iv) a proposed special development program for CP within the National Development Program (NDP) 2021–2025 which focuses on the management prevention of impacts of natural disasters on infrastructure⁴. The plans for the OP “Civil Protection” for the 2021–2027 EU programming period and the proposed special development program of NDP are in the process of approval.⁵

Figure 1. Planned resources for Greek National Programme for Civil Protection AEGIS



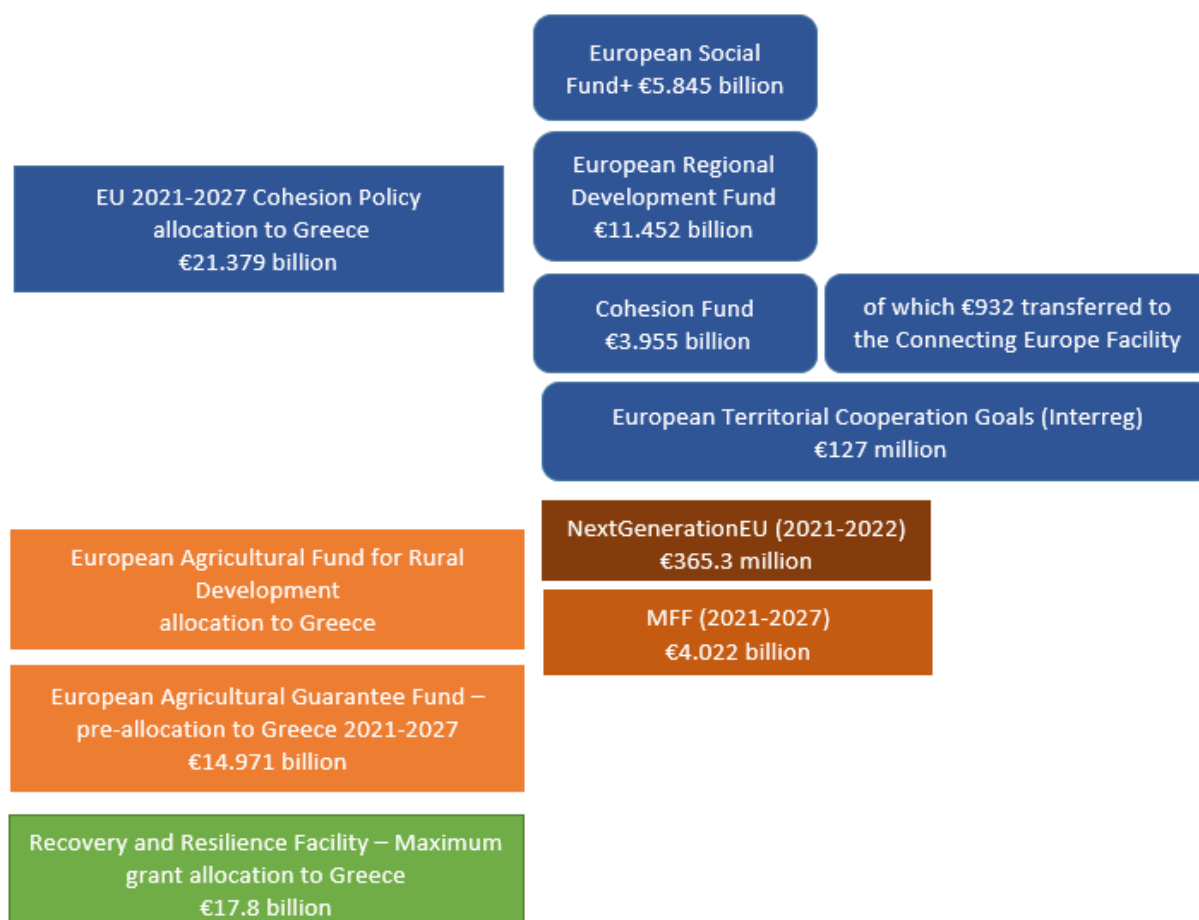
There are several opportunities to use EU funds for prevention, preparedness, and response. The new OP for CP will draw on the available ESIF funds. ESIF is aligned with the objectives and priorities of the European Cohesion Policy, which emphasizes financial resources to help restore Member States’ economies from the impact of the COVID-19 pandemic, mitigate and adapt to climate change, and

⁴ Confirmation on the expected amount is being sought from the GSCP.

⁵ The Ministry of Development and Investment (MoDI) issued the second circular containing the basic principles that will govern the structure and content of the programs of the programming period 2021–2027 to be financed by the European Regional Development Fund (ERDF), the Cohesion Fund, the European Social Fund Plus, the Fair Transition Fund, and the European Maritime and Fisheries Fund. See ESPA. 2021. Design of ESPA and Business Programs 2021–2027. ESPA 2014–2020. [Link](#). The GSCP has released a consultation document with the main programming guidelines for the new OP for Civil Protection; see Special Managing Authority of ESPA OP for Civil Protection. 2021. Concept Paper (ΕΣΠΑ 2021 – 2027 Επιχειρησιακό Πρόγραμμα Πολιτική Προστασία Concept Paper (Κείμενο διαβούλευσης). [Link](#).

transform to a green and energy-efficient economy. The 2021–2027 EU budget comprises of the traditional components of the multiannual financial framework (MFF) complemented by new financial resources, such as the Recovery and Resilience Facility (RRF) designed to secure EU economic recovery after the COVID-19 pandemic, and as noted above, Greece’s NRRP includes actions that are significant for CP and DRM efforts. Within the scope of the Cohesion Policy, Greece is expected to receive a total allocation of €21.47 billion (in current prices, see Figure 2) with some of these for climate change and disaster risk reduction. Additional financing is provided through several EIB loans to the Greek government and various entities, including municipalities, commercial entities (for risk reduction and COVID-19 recovery efforts), and the REACT-EU program under the NextGenerationEU (NGEU) instrument. Greece is also a contributor to the EU rescEU stockpiles and draws resources in time of crisis. From a climate perspective, InvestEU also has the potential to support sustainable infrastructure investments against climate and other natural disasters.

Figure 2. Pre-allocations for Greece under Multiannual Financial Framework 2021-2027 and NextGenerationEU



Source: European Commission. April 2021. The EU’s 2021-2027 long-term. Facts and Figures. EU Multiannual Financial Framework 2021-2027 and NextGenerationEU (in commitments) Pre-allocations per Member State.

Beyond national and EU financial resources, Greece is already working on establishing public-private partnership (PPP) contracts for the design, financing, construction, and technical management of the

13 new Regional Civil Protection Operational Centers (PEKEPP). The implementation of PEKEPP through PPP schemes will also be supported by the Greek NRRP, with an expected implementation duration until 2024. There may be further scope for cooperation in the exchange of expertise and experience through partnerships between the public sector, private sector, academia, and civil society organizations.

Priority measures for disaster prevention, preparedness, and response

The proposed NDRMP includes priority measures for disaster prevention, preparedness, and response for three time periods: 2025, 2030, and 2040. These include priority horizontal measures relevant to multiple hazards, as well as hazard-specific measures. These are accompanied by the expected outputs/results, estimated implementation time period, and authorities responsible for their implementation. The presented priority measures draw on (i) available information about CP/DRM programs and their priorities including AEGIS, the NRRP, the EIB loan, and so on; (ii) a list of the ongoing, planned, or considered priority projects/initiatives led by various institutions as collected during the consultation process; and (iii) additional measures based on a diagnostic analysis of gaps and needs of the CP/DRM framework in Greece in line with the disaster risk profile and available information about climate change projections.⁶ While the consultation process cannot be considered comprehensive, over 1,000 projects and initiatives submitted by authorities at different administrative levels were reviewed and integrated into the NDRMP. The overarching goals for horizontal and hazard-specific measures which contribute to disaster prevention, preparedness and response are listed in Table 1.

Table 1. NDRMP horizontal focus areas and overarching goals for priority measures contributing to disaster prevention, preparedness and response

CP/DRM multi-hazard focus areas		Overarching goals for priority measures
Disaster prevention, preparedness, and response	Risk governance	<ul style="list-style-type: none"> • The new CP framework is operationalized, and coordination mechanisms strengthen different CP/DRM phases/focus areas • Capabilities of CP professionals and stakeholders at different administrative levels are strengthened based on their needs across different CP/DRM phases/focus areas/hazards, including through infrastructure, equipment, ICT tools, human and financial resources, technical and operational skills • Disaster and climate resilience is integrated into sectoral legislation, strategies, and plans to enable scale-up of investments across different CP/DRM phases/focus areas
	Understanding risk	<ul style="list-style-type: none"> • Understanding of risk for individual/multi-hazard impacts is improved, including information on exposure and vulnerability as well as climate change • An information system is established with systematized risk information geared towards operational use of risk information by different stakeholders • Generation and use of risk information benefits from links from research and innovation, shared in appropriate ways among different stakeholders
	Risk reduction and prevention	<ul style="list-style-type: none"> • Regional and local authorities are able to integrate risk information and risk-informed approaches into spatial and development planning • Risk reduction (mitigation) and prevention investments are scaled up across different administrative levels and sectors with an immediate focus on priority hazards as well as

⁶ World Bank. 2021. World Bank Reimbursable Advisory Services - Greece Disaster Risk Management Plan (P173630). May 2021. Output 1 "Report on the diagnostics and proposed roadmap for reforms aimed at accelerating disaster preparedness, prevention and emergency response in Greece."

		<p>priority sectors, including emergency management, health, education, and transport, through dedicated funds and operational programs</p> <ul style="list-style-type: none"> • Public awareness for ex-ante prevention as well as financing for prevention is strengthened
	Early warning systems	<ul style="list-style-type: none"> • Capabilities and systems for monitoring and forecasting are improved, with an increasing ability to issue impact-based warnings • Communication and dissemination of early warnings are improved at different levels and for various users, including the establishment of feedback mechanisms from users of EWS and the implementation of Common Alerting Protocol
	Emergency preparedness, response, and recovery	<ul style="list-style-type: none"> • The Nat-CHAMM is fully operationalized with an efficient national Communication, Coordination, and Information (C4I) system, including updated emergency response plans and procedures at different levels and sufficient preparedness and intervention resources, including infrastructure, equipment and tools, human and financial resources; new technologies are utilized, and robust selection criteria followed • There is adequate stakeholder capacity and coordination for emergency preparedness response and recovery, focusing on the local level and readiness of critical elements • There is public awareness and community readiness for response and recovery, including using user-friendly platforms/dissemination methods and participatory approaches
	Financial protection	<ul style="list-style-type: none"> • An overarching disaster risk financing strategy is in place based on comprehensive financial analysis of financial risks and assessment of feasible instruments, including a national perils pool • Public awareness of risk insurance among the general population as well as private sector is improved through sharing of information and education

A multicriteria analysis (MCA) is proposed to prioritize the measures, which can inform future planning and decision-making processes, particularly in the medium- and long-term.⁷ While all measures presented as part of the NDRMP are considered priorities, with the MCA, these measures can be prioritized (rated) based on the importance of the risk(s) they address, sensitivity to climate change based on literature review⁸, effectiveness related to CP/DRM strategic goals, economic efficiency, viability of measures in the long-term, current capacity for implementation, and urgency of need. The total prioritization score of each measure is a weighted combination of the above criteria, each of which is scored between 1 and 3. This approach enables a combined quantitative and qualitative prioritization of potential measures within and across categories of risk. The MCA approach is flexible and can be adjusted based on specific stakeholder needs and information available.

It is proposed that the draft NDRMP is regularly monitored, and the planned/proposed measures reviewed and updated in consultation with relevant stakeholders. As the proposed priority investment measures are the responsibility of various institutions, these should also have monitoring and reporting responsibilities, including collecting, summarizing, analyzing, and submitting information to GSCP. The procedure and format for the submission of information by the institutions will be determined by the GSCP. Monitoring and reporting should include resources, outcomes, and impacts, identifying progress

⁷ Detailed description is provided in Chapter 3.

⁸ For this report, a two-part study was commissioned from the National Observatory Athens (NOA) to investigate climate change. One part provides an assessment of high-impact weather events in Greece during the period 2000 to 2020, while the other part is a literature review of more than 70 papers from the past two decades on future changes in severe and extreme weather due to climate change. Additionally, PESETA IV and other academic literature was considered as listed in the bibliography in **Annex 5**.

against a baseline. The information acquired in the process of developing the proposed NDRMP can support monitoring and evaluation activities. Finally, there is potential to link indicators/monitoring and reporting related to the draft NDRMP with other ongoing strategic initiatives in the CP/DRM field.

Recommendations for the NDRMP

To support the achievement of the NDRMP and set out horizontal and hazard-specific measures, the following overarching recommendations can be made:⁹

Greece is taking a proactive approach to managing disaster risks and there are opportunities to build on this momentum. In 2019, Greece completed a national risk assessment (NRA) focusing on nine types of hazards.¹⁰ In 2020, Law 4662/2020 was adopted marking the start of the operationalization of the Nat-CHAMM. Besides developing secondary legislation aligned with Law 4662/2020, completing emergency preparedness and response arrangements, and clarifying responsibilities, especially at the subnational level and across different actors, there is an opportunity to link emergency preparedness and response with multi-hazard risk prevention and reduction/mitigation as well as longer-term adaptation aiming to connect and address the entire DRM cycle. Secondary/technical regulation to support implementation of Law 4662/2020 could focus on clarifying specific areas, including risk assessments and use of risk information; continuity planning, especially at local and sectoral levels; risk prevention, reduction and mitigation in a systematic and integrated manner; emergency arrangements and building back better (BBB); (e) financial protection; and others. The setting up of robust monitoring and evaluation mechanisms to follow the progress and achievement of CP policy priorities across the whole DRM cycle is critical. Given that implementation of many CP/DRM measures will be carried out at different levels, there is a need to invest in coordination and capacity-building at both national and especially at the local levels. To understand specific needs, coordination mechanisms and adequate technical assistance and funding are needed.

Understanding of disaster risks in Greece varies significantly across the main hazards. There is opportunity to build on and further develop understanding of risks by regularly updating and expanding the national risk assessment with quantitative indicators of high accuracy and comparability, using robust loss data and considering climate change projections. Building on the world-class technical expertise of the Greek scientific community and on funding from both the EU and the state, mechanisms could be developed to undertake more complete, consistent, and detailed/granular assessments for specific localities, types of infrastructure, sectors, or groups of population in line with DRM objectives, all of which can better prioritize and target CP/DRM investments in prevention, preparedness and response. As risk information provides critical inputs for various DRM actions, this approach would enable stakeholders to take some key actions related to disaster risk prevention and reduction, such as developing risk-informed urban plans, prioritizing risk reduction/mitigation, creating scenarios for emergency preparedness and response planning, and developing emergency plans at urban scale informed by scientific evidence. The development of a possible regulation on sharing of risk data among institutional stakeholders and wider

⁹ These draw on World Bank. 2021. World Bank Reimbursable Advisory Services - Greece Disaster Risk Management Plan (P173630). May 2021. Output 1 “Report on the diagnostics and proposed roadmap for reforms aimed at accelerating disaster preparedness, prevention and emergency response in Greece”.

¹⁰ These hazards include earthquakes, floods, landscape fires, extreme weather events, tsunamis, landslides, volcanic hazards, cyber hazards, industrial accidents, and radiological/nuclear hazards.

public could be considered to ensure use of best research and strengthening awareness-raising. Beyond this, such efforts would contribute to strengthening of a culture of prevention.

There are several opportunities for scaling up risk prevention and reduction/mitigation in Greece. The recently updated legislation for spatial planning (Law 4759/2020) provides an opportunity for developing an inclusive and risk-informed urban and regional planning scheme. Specifically, a direct communication channel could be established for data sharing and exchange of plans between competent ministries and relevant institutions. Completion of design standards and quality assurance processes, as well as development of databases, inventories, and tools, could facilitate rapid portfolio-wide assessments of assets and prioritization of actions. Current efforts to make critical entities¹¹ at risk more resilient to natural and man-made disasters and climate change should be scaled up, with a focus on identifying needs and targeting investments to address the relative challenges. Critical assets include first responders' infrastructure, hospitals, schools, key transportation routes, and others; these could be prioritized given their role in emergency preparedness and response. There is also an opportunity to link prevention with preparedness and response and develop cross-sectoral linkages between climate change adaptation and infrastructure planning.

Greece has established a comprehensive framework for EWS that addresses institutional, technological, and human factors which provides a solid foundation upon which to further improve the effectiveness of these systems. Going forward, the upgrading of monitoring and forecasting systems remains essential for continued improvement in the effectiveness of early warning. Investments should focus on improved hardware and modeling tools, advances in technical capacities, and support for maintenance and research. Systems to address some particular hazards can be clearly identified. Improved flood forecasting through increased monitoring of rivers, piloting flood forecasting systems, and participating in regional flash flood guidance systems, could bring many benefits. Overall, the forecasting and warning services could move toward a system of impact-based forecasting. Research and collaboration are also needed to adopt multi-hazard approaches that consider cascading effects, climate change impacts, and emerging hazards. Building capacity at municipal level would support the effectiveness of early warning systems, especially last-mile warning to ensure that local populations, including vulnerable target groups can respond to avoid risk, having been trained to take adequate actions. The recently developed Integrated public warning system (112), combined with new CP legislation and arrangements, proved the significant benefits of the early warning services.

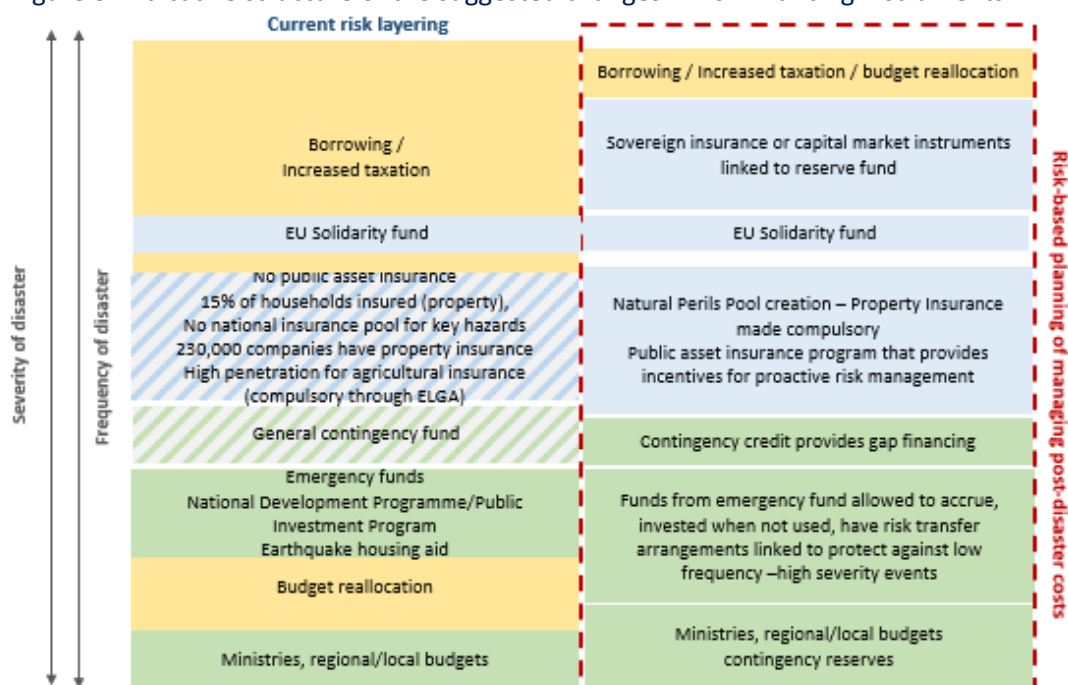
The establishment of Nat-CHAMM is an important step to strengthen emergency preparedness and response arrangements. It is critical that the expected performance/emergency service provision and coordination is enabled by capabilities across different stakeholders, especially at the local levels. The establishment of Nat-CHAMM requires detailed action plans and roadmaps, as well as attention to lessons learned from past efforts. The creation of a Joint Operations Center, and 112 system, is seen as a positive step by most stakeholders since it offers an opportunity for the national CP system to provide directly coordinated actions in the preparedness and response phases as well as in recovery. There is a need to link preparedness with long-term prevention focusing on all-year activities and all-capabilities, including equipment, human, technical (including training), financial, and so on. As noted above, emergency

¹¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:829:FIN>.

preparedness and response need to be closely linked to ex-ante actions - prevention and risk reduction, as well as early warning system, drawing on risk information, tools, and capacities as relevant.

Greece is exposed to large financial losses from disasters, which can affect fiscal planning and economic stability beyond the well-being of its population. To strengthen the country's financial resilience, as an immediate first step, financial analysis is necessary focusing on the most important hazard from financial perspective-earthquake.¹² Such analysis and other assessments would inform articulation of a comprehensive disaster risk financing and insurance strategy which would list appropriate instruments and options, such as risk-based budgeting, contingent credit arrangements, broader public asset insurance, and strengthening of the domestic insurance market, for example through a national catastrophe insurance pool, or other risk transfer mechanisms. An indicative structure of options to consider is included in Figure 3.

Figure 3. Indicative structure of the suggested changes in risk financing instruments



Source: World Bank. Note: Yellow = ex post sources of funding; green = pre-arranged budgetary sources of funds; blue = risk transfer instruments; diagonal stripes = partially available; gray = unavailable.

¹² Conflagration (large fires) should also be considered, however financially would be covered by any scheme which would adequately cover earthquake as earthquake probable maximum loss by far exceed those of any other peril in Greece.

INTRODUCTION

About this report

Between September 29, 2020 and October 31, 2021, the World Bank was engaged to provide technical assistance to the General Secretariat for Civil Protection (GSCP)¹³ funded through a grant from the European Commission (EC) Directorate-General for Civil Protection and Humanitarian Aid Operations (DG ECHO). The World Bank's assistance focused on two activities: (i) diagnostic analysis and development of a proposed roadmap for the implementation of a National Disaster Risk Management Plan (NDRMP); and (ii) support for the development of a NDRMP. The technical assistance takes into consideration the requirements of the relevant EU ex ante conditionalities under Decision No. 1313/2013/EC and the Civil Protection Law in the medium and long term.

In line with the Reimbursable Advisory Services (RAS) agreement, building on the diagnostic and proposed roadmap developed under Component 1, the World Bank provided support to the GSCP in its development of a proposed NDRMP that factors in goals for disaster prevention and preparedness, emergency response and risk reduction, investment priorities for risk awareness, financing mechanisms at national and subnational levels, and opportunities for public-private approaches to building resilience, including financial resilience to disaster shocks at sovereign, subnational and household levels. As part of the RAS agreement, the technical assistance includes a number of key tasks:

- a) Review the national risk profile (National Risk Assessment) of Greece in 2019, and relevant sectors/areas at a granular level to identify potential gaps and limitations that may adversely contribute to Greece's risk profile; and assess priorities areas for action in the short, medium and long term based on best international practices.
- b) Review current arrangements for managing disaster-related financial shocks at the household, municipal, and national levels; highlight potential gaps and opportunities to reduce these gaps; and build financial resilience across the public and private sectors based on best international practices.
- c) Review and determine domestic, international, and private sector sources of funding and other resources that may be available for direct investment in disaster prevention and preparedness and emergency response, based on experiences of similar EU Member States; and/or identify where funding can bring optimum co-benefits, such as considering seismic resilience alongside energy efficiency based on best international practices.
- d) Provide support to the GSCP in facilitating stakeholder consultations with relevant central and line ministries, subnational authorities, private sector, civil society, academia, and/or the general public, including vulnerable groups, to present the draft proposed NDRM Plan using the Hellenic National Platform for Disaster Risk Reduction to build consensus; areas to be discussed include

¹³ Until the 5th of September 2021, GSCP used to be supervised by the Ministry of Civil Protection (MoCP). As of the 6th of September, the Ministry for Climate Change and Civil Protection (MfCCCCP) was established with the Presidential Decree 70/2021. The new Ministry is supervising the GSCP, the Fire Service, all the administrative structures and functions of the Civil Protection (parts A - C of Law 4662/2020) and the monitoring of all European topics and policies in terms of adaptation to the Climate Change, a responsibility that belonged to the Ministry of Environment and Energy (MoEE).

key risks for mitigation; immediate urgent and medium-term priorities for actions based on risks vs. economic impact; and sustainable financing options for disaster and climate resilience.

- e) Provide support to the GSCP in drafting the NDRM Plan, taking into account the outcome of stakeholder consultations under activity (d) and results of the review under (a)-(c) above.

Methodology

This report draws on conclusions of the RAS Agreement Component 1 output, which informed the identification of proposed measures. This report considers natural hazards, infectious diseases, and man-made hazards (technological accidents) in line with the Greek National Risk Assessment (NRA) 2019, expanded by infectious diseases, sea-level rise, coastal erosion, and considerations of climate change. It is noted that not all hazards are covered at the same level of detail, given limited public information and/or information obtained during consultations. For this report, a two-part study was commissioned from the National Observatory Athens (NOA) to investigate climate change. One part provides an assessment of high-impact weather events in Greece during the period 2000 to 2020, while the other part is a literature review of more than 70 papers from the past two decades on future changes in severe and extreme weather due to climate change. Additionally, PESETA IV and other academic literature was considered as listed in the bibliography in **Annex 5**. The report drew on the information available about national initiatives, including the National Civil Protection Programme AEGIS (as of June 2021).

This report draws on information about planned investments and financial mechanisms provided by institutions at different administrative levels with responsibilities related to civil protection (CP) and DRM (disaster risk management). Stakeholder consultations with both central and local level authorities focused on the following: (i) implemented actions and measures, planned priority investments, and desired future investments related to disaster prevention, preparedness, and response measures; the extent to which they consider disaster and climate change risks; how were they prioritized; what funds have been allocated/identified; and whether they have allocations for operations and maintenance (O&M); and (ii) efforts to understand additional gaps/opportunities reflecting disaster and climate change risks and institutional capacity; identification of information available for existing costs and benefit analyses; etc.

Qualitative and quantitative data were received through the process of consultations.¹⁴ At the central level, five ministerial bodies provided information on ongoing and planned investments and recovery expenses. One research institute reported a high number of projects of a scientific and operational nature, which also involved central and local governments authorities. Consultations with local authorities benefited from a high response rate, with 84 municipalities (out of a total 332 municipalities in Greece) sharing more than 1,000 past, ongoing, and future measures, and investments, as well as insights into the CP/DRM framework. Answers from five regions and two regional units were received, along with additional information on measures planned, financed, and implemented by regional authorities. The geographic distribution and diversity of the survey respondents were significant, with responses from municipalities located in all 13 regions of Greece and with different profiles (metropolitan,

¹⁴ Note that consultations were conducted related to the development of the NDRMP as well as during the development of World Bank. 2021. More details on the consultations are provided in Annex 1.

large/medium/small mainland and island municipalities) as defined by the GG A' 133/19.07.2018 "Kleisthenis Program." For the complete list of the participating municipalities and regions, see **Annex 1**; a summary of observations is in **Annex 2**.

Data related to National Strategic Reference Framework (ESPA) 2014–2020 projects were analyzed in detail considering implementation status, implementing agencies, and types of hazards addressed. Data came from two lists, one with over 700 approved and ongoing projects supporting the implementation of Thematic Objectives 5 and 6 of Cohesion Policy 2014–2020, and one with over 3,000 subprojects, project tasks, and project-implementing authorities and beneficiaries across Thematic Objectives 4, 5, and 6 of Cohesion Policy 2014–2020; these were provided following two information requests to the National Coordination Authority for ESPA. Information about national initiatives, such as AEGIS, were based on available information as shared by GSCP.

Terminology

The report follows terminology outlined in the Law 4662/2020 which is aligned with international and EU terminology (see Box 1 and Annex 5). DRM measures cover all phases and the whole spectrum of measures including prevention, preparedness, and response designed to improve understanding of risks, reduce and mitigate risks, facilitate better warning, better prepare for, respond and recover from disasters, whether caused by natural hazards or man-made hazards. Disaster prevention, reduction/mitigation, and preparedness are considered ex-ante actions, while response and recovery are considered ex-post interventions. The scope is fully aligned with the Strategic Objective 2.4 'Promoting climate change adaptation and disaster risk prevention and resilience taking into consideration ecosystem-based approaches' of EC 2.4 of Cohesion Policy 2021-2027.

Box 1. Key terminology used

- **Prevention:** all actions and measures that aim at the absolute avoidance of the potential impact of hazards and at minimizing of the natural, technological disasters and other threats.
- **Preparedness:** the set of actions and measures taken in advance to ensure the effective response in cases of a disaster.
- **Response:** includes the actions during or immediately after the disaster for the protection of human life and health to address immediate living needs and to ensure the provision of assistance and support for mitigating the impacts of the disaster.
- **Resilience:** the ability of a system or a society, potentially exposed to potential hazards, to resist or to adapt, with a view to maintain an acceptable level of functioning and coherence.

Source: Definitions from the Law 4662/2020.

While the DRM framework relates to contributions of a broad range of stakeholders, including public authorities, private sector, academia, and communities, this report focuses primarily on measures planned by or capable of being undertaken by public authorities with specific responsibilities in DRM. These should be complemented by measures led by other stakeholders, which can be approached as part of dissemination and monitoring and evaluation (M&E) of the NDRMP.

Report structure

After this **introduction**, which provides information about the context and methodology used, followed by a description of proposed NDRMP objectives and monitoring and evaluation arrangements, **Chapter 1** provides an overview of CP structure in Greece and key opportunities relevant for the proposed NDRMP. **Chapter 2** provides a brief summary of the national risk profile and available climate change information. **Chapter 3** outlines the DRM goals for three time periods: 2025 (short term), 2030 (medium term), and 2040 (long term), along with priority measures for risk awareness, prevention/reduction, preparedness, and response and information on responsible institutions, time frames, and other relevant topics. This chapter further describes the multicriteria analysis (MCA) applied for the purpose of prioritizing the investments. **Chapter 4** provides information on the ex-ante and ex-post financing mechanisms and instruments available for the implementation of the proposed measures. Annexes are included in **Chapter 5**.

NATIONAL DISASTER RISK MANAGEMENT PLAN OBJECTIVES AND ARRANGEMENTS

Objectives of the NDRMP

The proposal for a NDRMP represents a framework of DRM measures for managing disaster risks. The main objectives of the proposed National DRM Plan of Greece are these:

- Support the implementation of Thematic Enabling Condition¹⁵ 2.4 “An effective disaster risk management framework,” related to the second policy objective of the new EU Cohesion Policy for 2021–2027,¹⁶ i.e., “A greener, low-carbon transitioning towards a net zero carbon economy and resilient Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate change mitigation and adaptation, risk prevention and management, and sustainable urban mobility” (Table 2); and contribute to broader goals set out by the Paris Agreement, the Sendai Framework for Disaster Risk Reduction 2015–2030, and the Sustainable Development Goals. In line with this objective, the NDRMP supports prioritization of DRM investments with respect to the risks the country faces and other criteria.
- In the period 2021–2023, support the implementation of Law 4662/2020 and render the operational structure of the National Crisis and Hazard Management Mechanism (Nat-CHAMM) fully functional. In line with this, the proposed NDRMP seeks to support the implementation of Law 4662/2020 and inform the implementation of operational programs (OPs), including the National Civil Protection Programme AEGIS¹⁷ as well as other initiatives, such as strengthening of the Nat-CHAMM; all of these efforts seek to upgrade the CP system in the country by providing a summary of planned and potential priorities for measures across key hazards.
- Through the process of development of the plan, inform responsible institutions, stakeholders, and the general public about the objectives, measures, tools, and resources for disaster risk management; raise awareness; and commit to ensure effective and efficient prevention, preparedness, response, and overall resilience to risks and relevant disasters.

Table 2. Enabling condition and fulfilment criteria

Policy objective	Specific objective	Name of enabling condition	Fulfilment criteria for the enabling condition
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¹⁵ To ensure the necessary prerequisites for the effective and efficient use of European Union support granted by the funds, a limited list of enabling conditions as well as a concise and exhaustive set of objective criteria for their assessment is established.

¹⁶ European Union. 2021. Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy.

¹⁷ Information related to AEGIS is as of June 2021, as shared by GSCP.

#2. “A greener, low-carbon transitioning towards a net zero carbon economy and resilient Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate change mitigation and adaptation, risk prevention and management, and sustainable urban mobility”	European Regional Development Funds (ERDF) and Cohesion Fund: <i>Promoting climate change adaptation, and disaster risk prevention and resilience, taking into account ecosystem-based approaches</i>	2.4 Effective disaster risk management framework	A national or regional disaster risk management plan, established on the basis of risk assessments, taking due account of the likely impacts of climate change and the existing climate adaptation strategies, is in place and includes: 1. A description of key risks, assessed in accordance with the provisions of Article 6 (1) of Decision No. 1313/2013/EU of the European Parliament and of the Council, reflecting the current and evolving risk profile with an indicative 25-to-35-year time span. The assessment shall build, for climate-related risks, on climate change projections and scenarios. 2. A description of disaster prevention, preparedness, and response measures to address the key risks identified. The measures shall be prioritized in proportion to the risks and their economic impact, capacity gaps, effectiveness, and efficiency, taking into account possible alternatives. 3. Information on financing resources and mechanisms available for covering the operation and maintenance costs related to prevention, preparedness, and response.
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Source: Annex IV of Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund and financial rules for those and for the Asylum, Migration and Integration Fund, the Internal Security Fund and the Instrument for Financial Support for Border Management and Visa Policy.

Beyond the proposed NDRMP, other documents relevant to the fulfillment of Enabling Condition 2.4. include the National Civil Protection Programme AEGIS, the Policy Plan for Civil Protection “Xenokrates” (national plan response to disaster risks) and provision for the individual Special Response Plans for each hazard; the NRA 2019 submitted to the European Commission; National Strategy for Climate Change Adaptation; the 13 Regional Plans for Adaptation to Climate Change; Management Plans for Water Scarcity and Drought Management Plans; Drought Risk Management Plans; Flood Risk Management Plans for River Basins and Water Districts; Strategy Plan for the Development of Forestry 2018–2038 (National Strategy for Forests); and Public Policy for the Prevention of Forest Fires. In addition, there are also several approved strategies of the Greek state with respect to environment management, environmental conditions, good environmental status, and implementing of EU environmental law (e.g., Environmental Impact Assessment Directive 2014/52/EU; Strategic Environmental Assessment Directive SEA 42/2001/E).

Monitoring and reporting arrangements

The implementation of the NDRMP is proposed to be regularly monitored and updated by GSCP in consultation with relevant ministries/public institutions responsible for the management of the type of risk concerned. According to Law 4662, the GSCP plans and monitors the application of the policy in the CP sector, including the six-year National Hazard Mitigation Policy and the three-year National Plan for CP; introduces it to the Interministerial Committee for CP Planning for approval; and monitors and controls its application at national level.

For the NDRMP, establishment of a monitoring and evaluation process is proposed; this would rely on systematic and continuous communication, collection, and analysis of information on the implementation of the activities and measures, and the achievement of expected results. An M&E process should be agreed among the involved institutions, outlining the responsibilities and coordination arrangements for collecting information as well as the evaluation methodology, including indicators and other parameters used. The process may also be used to assess the efficiency and effectiveness of the resources, drawing out specific recommendations for an updated NDRMP. The M&E process can also serve to continue regular communication with various institutions and inform the public about implementation progress.

At minimum, the M&E process should assess the degree to which respective programs are being implemented and expected results towards disaster prevention, preparedness, response and recovery. It may also be used to spot financial gaps or reprioritize certain activities:

- Extent to which/what kind of planned measures are being implemented by relevant implementing authorities
- Extent to which planned measures have achieved targets
- Extent to which planned measures have received financing and/or have experienced major constraints
- Quantitative data collected by overseeing/implementing agencies and/or beneficiaries related to specific measures/subprojects
- Qualitative feedback from overseeing/implementing agencies and/or beneficiaries about lessons learned and recommendations.

During the consultation process for the proposed NDRMP, a simple template (see **Annex 2**) was used as a tool to collect positive experiences from responders; a wealth of valuable information was collected in a short period of time. An elaborated version of this template could become a basis for a monitoring process led by GSCP in regular periods of time, in order to keep track of the progress of DRM projects across different administration levels (central, regional, and local). The collection of information could be expanded with information on other stakeholders as well. Data collection among key institutions could be conducted on a yearly basis, with interim evaluations conducted at minimum after 2025, after 3030, with a final evaluation after 2040.

It may be efficient to align certain indicators with any M&E arrangements set up for AEGIS, the proposed special program for natural disasters under the National Development Program 2021–2026, the Operational Program for Civil Protection 2021–2027, and the CP-/DRM-related investments and reforms under the National Recovery and Resilience Plan (NRRP). The AEGIS plan highlights the importance of “a coherent and effective system of administration, monitoring, control and evaluation of interventions, which will guarantee the correct implementation of the planning and the achievement of the expected results.” A more ambitious M&E process could also consider existing national, or EU funds related to processes and existing indicators (resources/outcome/impact, etc.). Notable evaluation efforts that could be considered by GSCP include the following:

- **In 2021, GSCP is implementing an ambitious reform and reorganization plan with many outputs (mapping, prevention, preparedness, training and awareness, protection of life, resources, and rescue).** Progress is monitored by three quantitative performance targets: (i) the increase in trained volunteers as a ratio of total active volunteers by 2.5% year on year, (ii) the conduct of four awareness and public sensitization campaigns per year, and (iii) a 10% reduction in the ratio of the number of disaster victims to the total number of inhabitants of an affected area.
- **Performance-based budgeting:** Since 2019, the MoCP has been participating with a pilot in performance-based budgeting,¹⁸ which generated information on the type of actions related to ordinary budget for CP and DRM. Progress for achieving the National Programme for Civil Protection is monitored by three quantitative performance targets: (i) the increase of trained volunteers as a ratio of total active volunteers by 2.5% year on year, (ii) the conduct of four awareness and public sensitization campaigns per year, and (iii) a 10% reduction in the ratio of the number of disaster victims to the total number of inhabitants of an affected area¹⁹.
- **EU-funded Cohesion Policy output and impact indicators.** There is a list of common output indicators, especially for the Cohesion Fund and European Regional Development Funds (ERDF), some of which are particularly relevant in that they monitor outputs related to the objectives of a NDRMP.²⁰ There is also a list of common impact indicators.²¹ Some of these draw data from GSCP, the Ministry of Environment and Energy (MoEE), decentralized water directorates, regions, etc. There are also special output indicators for each operational program (OP), focusing on beneficiaries, project impact, etc. Cohesion indicators are subject to revisions, in alignment with the current multiannual financial framework (MFF).²² A managing authority of the proposed Operational Programme for Civil Protection, funded by the European Structural and Investment Funds (ESIF), will be responsible for planning, implementing, monitoring, and evaluating this OP. During 2020, an Executive Unit for ESPA in the theme of Civil Protection was formed under the General Secretary for Civil Protection²³ with the responsibility for strategic and operational

¹⁸ Government of Greece. 2020. National Budget Introductory Report. Ministry of Finance and the General Accounting Office.

¹⁹ Ministry of Finance and General Accounting Office, 2020, "Pilot Planning for Performance-based budgeting for 2021", Athens, December 2020, pp. 200-204.

²⁰ Sample output indicators include the following: number of individuals exposed to risk of floods, where risk is reduced as a direct result of a co-funded project; number of individuals exposed to risk of forest fires, where risk is reduced as a result of a co-funded project; surface of land that has been restored, or polluted/deserted land that has been revitalized and is now available for the development of economic or communitarian activities (with the exception of the non-eligible activities); and land surface of restored or new areas with the aim to improve the conservation status for threatened species (actions can be implemented inside and outside of Natura 2000 areas, provided that they contribute to the improvement of the conservation state of the said species, their habitats, or ecosystems for the protection of biodiversity and the maintenance of ecosystem services). A further output indicator is number of residences that are classified in better energy consumption category.

²¹ Sample impact indicators include the following: land surface of areas for which the evaluation and management of flood risk is required and the implementation of the measures of Directive 2007/60/EC is required; land surface of areas for which the evaluation and management of flood risk is required under Directive 2007/60/EC; percentage of areas covered with flood protection; percentage of population that benefits from strengthening and expansion of infrastructures and services of civil protection in particularly sensitive regions; and land surface of areas threatened by floods of ΠΣΤΕ ΥΠΕΚΑ/implementation of Directive 2007/60/EC. For the Regional Operating Programmes: population that benefits from protection measures from natural disasters; number of flood incidents yearly; land surface consumed by fire yearly.

²² Further documentation on the integrated evaluation system for Cohesion Policy can be found in the documents published by the National Coordination Authority. [Link 1](#), [Link 2](#).

²³ Joint Ministerial Decision 124507 of November 25, 2020 (FEK 5228) and Art. 16 of Law 4314/2014.

planning for increasing the capacity in operational and management ability for participating services and bodies, in the area of civil protection, as well as serve the role of intermediary management body for any ESPA programs, subprograms and actions pertaining to CP. The Executive Unit was also tasked with planning the proposed Operational Program for Civil Protection for the programming period 2021-2027. When the ESPA 2021-2027 Operational Program for Civil Protection is approved a special managing authority will be tasked with planning, implementing, monitoring, and evaluating this OP.

- **Similarly, the M&E of the NDRMP could be also linked to other activities,** such as self-assessment of risk management capabilities and other strategic initiatives related to CP/DRM.

1. Chapter: Civil Protection and Disaster Risk Management Framework

This chapter provides a summary of the civil protection (CP)/disaster risk management (DRM) framework in Greece highlighting major pieces of legislation and the institutional arrangement. This is followed by recommendations for proposed priority measures related to different elements of the Greek CP/DRM system, namely risk governance, understanding risks, prevention/reducing risks, early warning systems, disaster preparedness and response, and financial protection.²⁴

1.1. Overview of the legal framework

Greece has an extensive legal framework related to CP/DRM that demonstrates the evolution of its system. Several laws directly or indirectly related to CP issues were adopted from 1959 onwards, especially following major disastrous events. A series of laws came into force for emergency response to earthquakes, a major hazard in Greece. The development of administrative and technical capacities to address the various aspects of the seismic risks was triggered by the 1978 Thessaloniki earthquake and the 1981 earthquake that affected Attica and the capital city of Athens.

Law 2344/1995 - Organization of Civil Protection and other provisions, established the General Secretariat for Civil Protection (GSCP) to protect the country from natural, technological, or other disasters. A Civil Protection Government Council (responsible for CP planning issues) and a Scientific Council for Civil Protection (aimed at facilitating access of the CP bodies to scientific knowledge) were introduced. At regional and (former) regional unit level, administrative units of CP were established as a civil defense structure managed by the Ministry of Defense, while ministries, decentralized public services, or other public enterprises were given the possibility of establishing their own CP units. The Secretary General of CP was designated as responsible for large-scale incidents and for the overall coordination of the state forces, while for local incidents the Secretary General of the Regional Administration and the respective prefects were designated, supported by local coordination bodies at the corresponding administrative level (Interministerial Coordinating Body regarding the GSCP, and the Regional Unit Coordinating Body at the local level).

Law 2641/1998 introduced people-based defense (PAM) i.e., participation of all Greek citizens able to offer their services and not already serving in the armed forces and national security. The PAM mission was to provide local defense, civil defense, and civil protection in times of political tension and war, and in times of peace to provide civil defense and CP. At the level of regional administrations and regional units, a PAM unit was established, encompassing the already existing civil defense structure managed by the Ministry of Defense and its CP units. PAM offices were also established in the municipalities and communities.

²⁴ This section draws on the results and recommendations of the Output 1 diagnostic analysis: World Bank. Reimbursable Advisory Services - Greece Disaster Risk Management Plan (P173630). May 2021. Output 1 "Report on the diagnostics and proposed roadmap for reforms aimed at accelerating disaster preparedness, prevention and emergency response in Greece."

Law 3013/2002 repealed the provisions of Law 2641/98 regarding the regulations for CP in peacetime and upgraded CP. The provisions of Law 2344/1995 were also repealed, except those concerning the establishment of the GSCP and the appointment of the Secretary General for CP. Upon recommendation of the GSCP, a CP unit with relevant responsibilities could be established at the central service of each ministry and organization of public. After the merging of municipalities and communities (Kapodistrias Plan, 1997), the involvement of local government in CP and the establishment of a CP office within local structures were institutionalized. The care for material and cultural goods, wealth-producing resources, and the infrastructure of the country was integrated into the aim of CP, with the purpose of minimizing the consequences of disasters; the scope of CP was also expanded to other hazards, such as the chemical, biological, radiological, and nuclear. All human resources and means of public organizations, private companies, and citizens were defined as CP forces.

To achieve the CP mission, the law provided that prevention plans and programs per type of risk are prepared, measures for preparedness are applied, and actions for prevention, preparedness, response, and rehabilitation are taken. Human resources are utilized, and public and private means are deployed at national, regional, and local level; in addition, suggestions are submitted to the competent ministries to reform respective legislation. Disasters are classified in terms of intensity (major, minor) and geographical extent (general, regional, local), and two types of CP mobilization status are defined: (i) CP preparedness status due to justified risk, which includes the escalation of preparedness of the human resources and means of civil protection; and (ii) CP emergency status. This status is defined as a disaster-related situation in which the GSCP needs to undertake special coordination of the staff and the means of the services and bodies acting at central, regional, and local level; and in which there is a need to mobilize forces and means beyond those available under normal conditions.

In accordance with the law, by decision 1299/2003 of the Minister of Interior, the preparation of CP plans and the competent central and regional bodies and organizations were designated. These plans are approved by the Secretary General of Civil Protection and implemented by the respective bodies. In addition, the role of CP Voluntary Organizations and Specialized Volunteers was institutionalized, and GSCP was mandated to maintain a register. All necessary arrangements were to be achieved through a ministerial decision (MD). After the 2004 Olympic Games, the one and only amendment to MD 1299/2003 was made by MD 3384/2006, which established the requirement for the development of a Management Plan for Human Losses. Furthermore, after the devastating forest fires of summer 2007, Article 18 in Law 3613/2007 set the framework for the organized evacuation of citizens of a municipality when threatened by an ongoing or impending disaster, by designating the local mayor as the competent decision-maker upon suggestion of the operational bodies responsible to limit the effects of the disaster. Arrangements for disasters affecting larger areas were provided as well. In addition, by PD 101/2012 the Fire Brigade administratively became part of the GSCP.

Law 4249/2014 sought to update the existing legislative framework by a number of changes: establishing a Coordinating Authority for Civil Protection (SAPP) at the GSCP, introducing risk assessment into the GSCP mission, and operationally subordinating the existing operational structures of the CP at regional level to the respective Regional Fire Administrations (PEPYD). The Central Coordinating Body for Civil Protection (KSOPP) and the Interministerial Committee for National Civil Protection Planning were

restructured and respectively competent to compile and approve a five-year National Policy for Disaster Risk Reduction, which aimed to increase the safety level of citizens and integrate disaster risk reduction into the sustainable development of the country. Based on this, a three-year National Civil Protection Plan and Annual National Civil Protection Plans had to be prepared (as already stipulated in Law 3013/2002). A National Early Warning System was to be established and operated at the GSCP, and an education and training system for the CP personnel and the volunteers was introduced with the establishment of the National School of Civil Protection within the framework of the Fire Academy. The CP volunteering system was also to be reorganized. GSCP's cooperation with the research and academic bodies of the country was emphasized, with the aim of better coordinating the planning and implementation of CP actions as well as monitoring and control of their implementation. The reorganization has not been completely finalized.

Law 4662/2020 is the latest key legal document regulating the current CP/DRM framework in Greece.

The law is structured in three parts: the first part regulates the CP system, the second part the volunteers and the volunteer organizations, and third part the Fire Service. The law aims through a number of provisions to overcome existing operational weaknesses, fragmentary competencies, overlaps, conflicts, and structural rigidities, mainly by improving coordination among stakeholders at central, regional, and local level from the prevention phase up to the recovery phase, while at the same time addressing the challenges of the climate crisis.

The law seeks to upgrade the country's DRM system, establishing a single structure for DRM—the National Crisis and Hazard Management Mechanism (Nat-CHAMM). Nat-CHAMM covers all phases of DRM and aims to contribute to the achievement of European and international CP mechanism objectives. The functioning of the Nat-CHAMM is guided by the six-year National Hazard Mitigation Policy (or National DRR Policy), which describes all necessary actions, procedures, and projects related to all phases of DRM. The policy covers prevention, preparedness, response, rehabilitation, and feedback from the planning at local and national levels related to reducing risk and enhancing resilience. The National Hazard Mitigation Policy is developed by the GSCP, following a suggestion made by the SOPP (Coordinating Body for Civil Protection), approved by the Interministerial Committee for National Civil Protection Planning, and subsequently presented to the Parliament. The National Hazard Mitigation Policy becomes a pillar of the country's overall development policy and a key axis for achieving sustainable development. This policy sets the framework for designing the three-year National Plan for Civil Protection in the form of an Operational Programme for Civil Protection. It is expected that the Operational Fund for Prevention and Treatment of Risks (ETPAK) will allow the GSCP to plan actions and secure resources for implementation of the new changes.

Nat-CHAMM is supervised by the Secretary General for CP and operates through several bodies. These include the National Coordination Center for Crisis Management (ESKEDIK), the Civil Protection Coordinating Bodies at central level (Coordinating Body for Civil Protection), regional level (Regional Operational Coordinating Bodies for Civil Protection, or PESOPP, established at the 13 regions), and local level (Local Operational Coordinating Bodies for Civil Protection, TESOPP), as well as the Regional 24/7 Operational Centers for Civil Protection (PEKEPP) (at each of the 13 regions) and the Emergency Management Frameworks (PDEA). The Coordinating Bodies' objectives is the application of measures to

assess and anticipate risks, vulnerabilities, and threats, so as to best deal with emergencies and reduce the negative consequences of impending disasters.

Per Law 4662/2020, risk analysis is seen as a prerequisite and component for both the preparation of the National Plan for Civil Protection (at national and regional level) and the elaboration and implementation of the General Plans for Emergency Response and Management of Consequences. The establishment of a National Hazard, Threat, and Disaster Loss Database will facilitate improved planning and proper allocation of resources. Levels of preparedness are specified in accordance with the gravity of a situation or incident, and the respective levels of response defined. Mobilization of forces succeeds upon activation of specific emergency management frameworks to be designed depending on the type of hazard to be met.

The cross-sectoral character of the CP is highlighted, as the specific operational program addresses interventions not only of the GSCP/relevant ministry, but also of the other ministries and government bodies, thus enhancing the cooperation and coordination across sectors and levels of the administration. The preventive projects or works of the municipalities, the regions, the GSCP, or any other body may be characterized by the Risk Assessment Committee as urgent and in need of immediate implementation; relevant works are cleaning works, small-scale flood protection works, works on fire zones, works on forest road networks, works for the preservation of public health, and works for the restoration of soil erosion of main road networks or for the support of slopes or the prevention of landslides. The integration of volunteer groups in the CP system along with provisions for upgrading their capacities through education and training is another aim of the law.

Furthermore, a National School for Crisis Management with the mandate to provide training Nat-CHAMM resources has been established under the auspices of the MoCP and the Ministry of Education and Religious Affairs (MoERA). The establishment of a CP Scientific Council, a register for CP experts, and the Crisis Management Studies Center (KEMEDIK)—an independent legal entity of private law—for applied and theoretical research and the elaboration of studies in the CP sector all aim to give to the CP system access to knowledge and scientific expertise.

A number of secondary laws are being prepared to support the full implementation of Law 4662/2020. For the first time in Greece, a Deputy Minister for CP was appointed following a suggestion of the Prime Minister (Presidential Decree 37/2020 (GG 65/A/15-3-2020)). Pursuant to Decision 1673 of the PM and Minister of Citizen Protection (GG 1070/27-3-2020), all responsibilities related to the GSCP, the Fire Brigade, and operational and administrative units that constitute Nat-CHAMM are assigned to the Deputy Minister for CP. Responsibilities include legislative initiatives, issuance of regulatory actions, coordination with other ministers for issuance of common legal actions, and representation of the ministry to the European Union and international organizations. However, the responsibilities for the Fire Brigade may also be exercised by the relevant ministry (Ministry for Climate Change and Civil Protection, MfCCCCP). Law 4782/2021 introduced changes to simplify the regulatory framework for public procurement, including procurement arrangements in the fields of defense and security and other provisions for development, infrastructure, and health, which are relevant for the Nat-CHAMM. The programmes of the Nat-CHAMM in terms of procurement, services and projects are defined and approved by decision of the Governmental

Council of Foreign Affairs and Defence (KYSEA), taken on a proposal from the Interministerial Committee for National Civil Protection Planning.

Most recently, following serious wildfires in the summer of 2021, institutional and legal framework for CP is being adjusted. Until the 5th of September 2021, GSCP used to be supervised by the Ministry of Civil Protection (MoCP). As of the 6th of September, the MfCCCP was established with the Presidential Decree 70/2021. The new Ministry is supervising the GSCP, the Fire Service, all the administrative structures and functions of the Civil Protection (parts A - C of Law 4662/2020) and the monitoring of all European topics and policies in terms of adaptation to the Climate Change, a responsibility that belonged to the MoEE. Several decisions are being prepared to make necessary adjustments in the CP framework.

1.2. Strategic opportunities going forward

The following is a summary of priority actions/measures that consider cross-cutting areas of CP/DRM, namely risk governance, understanding risks, risk prevention and reducing/mitigating risks, early warning systems (EWS), disaster preparedness and response, and financial protection. Disaster prevention, as a broader term, includes actions related to governance, understanding risk, risk reduction/risk mitigation, EWS, and to an extent also preparedness and financial protection. This summary informed the identification of priority horizontal and hazard-specific measures in Chapter 3.

The following measures are aligned with the government's priority of operationalizing Law 4662/2020. Several of the proposed actions, due to interdependencies and/or their nature, inevitably affect more than one area, and therefore their appropriate planning and successful implementation are critical for the successful modernization of the CP/DRM framework as a whole. For example, there are several interrelated/common measures: situation assessment and analysis; information and data collection and database formation and population; strategy formation; establishment of stakeholders' cooperation and consultation processes; setting up of coordination mechanisms; and planning, development, and implementation of an evaluation/feedback system to support implementation assessment and continuous improvement. In addition, the sustainability of priority measures and the continuous improvement of the CP system in Greece need to be supported by a functioning monitoring and evaluation system that would regularly and continuously identify gaps and opportunities, as well as propose and enact the necessary adjustments (to technological, organizational, procedural, and human resources issues) at the appropriate administrative level and DRM phase. Several sub-actions are to be developed and executed in the short term. They will be followed by other sub-actions that enhance the former and that will be planned, developed, and executed in the medium to long term.

Risk governance

A robust governance system needs policy and strategic guidance, supported by plans with agreed targets and implemented with appropriate financing, as well as institutions capable of fulfilling their mandates. As a cross-sectoral effort, DRM also requires the involvement of multiple actors and setting up of strong coordination mechanisms at all administration levels during all DRM phases; these must be able to perform under conditions of urgency and/or uncertainty. Robust risk governance requires all actors to

be aware of their key mandates and have the tools and capacities to perform their roles; it also requires that arrangements and systems be in place for overall coordination, sharing of information, and tracking and evaluation of progress to ensure the integration of changes and lessons learned.

Key findings

The institutional framework for CP in Greece is being modernized through Law 4662/2020. The framework is in a transition phase, as the COVID-19 pandemic response has affected the full application of the recently adopted Law 4662/2020, and in the meanwhile, prior legislation has remained in force. Operationalization of the new law requires issuing several secondary legislative arrangements. The regulation for the newly established National Joint Operations Center has already been passed. While some sectors are covered by more complete legislation, like hazards to which Greece has historically been more exposed (e.g., earthquakes) or that are the focus of EU directives (framework for flood risk management plans), others lack a more comprehensive approach that would cover all phases of the DRM cycle.

The CP system in Greece focused more on response and less on ex-ante risk prevention, and efforts need to be made to shift to a more balanced approach, including through Law 4662/2020 and the Nat-CHAMM, which covers all phases of DRM. Related to response, several emergency response plans issued by GSCP have yet to be aligned with Law 4662/2020²⁵, and the operationalization of the law via these plans is being undertaken by GSCP. The depth/scope of response planning differs for specific hazards (earthquake hazard, for example is well-developed). Concerning emergency plans at regional and local levels, GSCP could benefit from a mechanism to ensure that the planning has been undertaken in an adequate manner. Related to the existing governance framework related to DRM, institutional coordination and links between prevention and risk reduction/mitigation and preparedness and response could be supported going forward. The DRM Plan can facilitate this process, as it highlights the range of stakeholders involved in different aspects of the DRM cycle, including sector-led activities on risk prevention, mitigation/reduction, such as flood protection infrastructure, etc.

Concerning the institutional framework, vertical and horizontal coordination has traditionally posed a challenge in the CP system. The Inter-ministerial Committee, which is the highest policy body in the CP sector, elevates CP to a cross-sectoral government policy and enhances the links and cooperation of the CP sector with the other government policy sectors. The level (strength and depth) of cooperation between the numerous CP/DRM stakeholders and GSCP varies greatly. The establishment of Nat-CHAMM requires detailed action plans and roadmaps that take note of lessons learned from past efforts, as well as a system for evaluating coordination between competent agencies to better identify weaknesses and understand bottlenecks.

Beyond coordination, while human and technical capacities pose challenges at various levels and issues, there is no formal capacity building plan. For example, a gap is that local authorities do not always have adequate structures and mechanisms for assessing risks and developing emergency response as well as

²⁵ Note: law gives the possibility for fast-track procedures (within 90 days) to permit implementing important projects exclusively for prevention purposes (cleaning, opening of roads and fire zones, small flood protection works, etc.).

prevention/risk reduction plans. Greater awareness and actions to encourage a culture of resilience are needed. In the health sector, there are adequate coordination mechanisms among the entities responsible for DRM, since most actors are directly supervised by the Ministry of Health (MoH); however, greater coordination at regional and local levels is needed. European and international coordination on CP/DRM is well-established.

Concerning financing, CP is addressed through various funding instruments and funding streams. While reporting on CP expenses in the national budget has improved since 2019, the adoption of NDRMP and the introduction of the climate crisis portfolio would require a wider scope of reporting for actions related to DRM than is currently available. Allocations from development programs often lack clear criteria and uniform funding levels for awarding funding across the country on DRM related objectives. As a focus area of intervention for Greek development and structural funds, flood protection works seem to receive most of the DRM funding. The same seems to apply to this programming period 2021-2027 under the thirteen Regional OPs. Regarding the Operational Program for Transportation Infrastructure, Environment and Sustainable Development (OP YMEPERAA), the final evaluation report of 2018 noted that the axis of intervention on climate change mitigation and adaptation could have been developed to a greater degree.

Roadmap of key recommendations and areas for further engagement

Improvements in risk governance could be achieved through appropriate planning and subsequent implementation of certain sub-actions/activities; these are listed below, grouped under five main priority actions, and presented in the order of highest impact of action.

i. Engage stakeholders to operationalize the new law, fill gaps, clarify competences, and strengthen coordination mechanisms at all administrative levels and DRM phases.

Short term

- Conduct legislative, capacity, and needs assessments and consultations with national and subnational stakeholders, private sector, and professional and scientific organizations, to address existing gaps and promote reforms for specific legislative or DRM aspects, including regulating different aspects of Nat-CHAMM, undertaking prevention and risk reduction, defining the role of the local/ regional levels, creating a Joint Operations Center, completing the legal framework about subsidiarity as well as roles at local/regional levels, building back better (BBB), etc.
- Clarify transition arrangements and develop an action plan and roadmaps for operationalizing Nat-CHAMM.
- Strengthen prevention, DRR and response coordination between central and subnational levels starting with key hazards—floods, earthquakes, forest fires, etc.
- Clarify the role of the national DRR platform.

Medium term

- Establish regular consultation channels and processes for on legal, strategic/policy, operational, and technical issues related to the whole DRM cycle.
- Introduce revisions/reforms based on specific legislative or technical priorities and keep track of feedback on these changes to evaluate their effectiveness.

- Evaluate and develop lessons learned from actual emergencies.
- Introduce a performance monitoring and evaluation system for all participants in the DRM/CP system.

ii. **Develop a cross-sectoral National DRM Plan.**

Short term

- Conduct diagnostics and consultations to understand key gaps and challenges across different hazards/sectors and across all phases of DRM.
- Develop a communications/outreach strategy for both institutional stakeholders and more broadly (i.e., the wider public, etc.).
- Consult widely with engagement and commitment on specific targets and develop a joint plan.
- Align targets and planned activities with sectoral investments so that resilience-related policies²⁶ and measures across the agendas of different Ministries can be integrated in a NDRMP.
- Allocate funds and set up monitoring arrangements to track progress against agreed targets.

Medium term

- Regularly report to the highest level on the achievement of the plan and monitor progress across sectors.
- Continue to mobilize funds for achievement of plan.
- Continue outreach and communication on the importance of the plan's objectives and results.

iii. **Strengthen the capacity and skills diversity of CP professionals and stakeholders at different administrative levels.**

Short term

- Consult professionals at local level to understand specific needs and develop an action plan to support capacity building for different stakeholders across all phases of DRM.
- Organize training and materials related to specific topics identified, focusing on different technical but also managerial aspects.
- Assess the diversity and profile of CP resources to prepare a forward-looking human resources strategy.
- Improve outreach to civil society organizations (CSOs) and the private sector by developing specific action plan/approach in consultation with respective actors.

Medium term

- Implement capacity-building activities at different levels and evaluate results.
- Continue to develop training programs based on demand from civil protection professionals and DRM stakeholders.
- Regularly consult and evaluate initiatives.
- Encourage women's representation in leadership roles in the CP system by organizing leadership trainings; promote other educational opportunities for women working in emergency preparedness

²⁶ https://greece20.gov.gr/wp-content/uploads/2021/07/NRRP_Greece_2_0_English.pdf.

and response and adopt policies and quotas that promote gender inclusion and accommodate specific needs of women, etc.

- Monitor implementation of actions and adapt.

iv. **Support mainstreaming of DRM into sectoral strategies, plans, and investments, and their execution.**

Short term

- Integrate CCA in the DRM agenda, by enhancing coordination, promoting evidence- and data-based approaches, assessing feasibility for integrated solutions, and developing educational programs.
- Support the prioritization of DRM investments across other sectors by providing risk information and recommendations to sectoral strategies; these will help to mainstream DRM and will also be part of monitoring/implementation reporting to measure progress.
- Better understand expenditure to DRM/CP to identify specific measures and projects.

Medium term

- Regularly screen/assess sectoral legislation, strategies, and investments related to DRM.
- Mobilize funding for integrated measures combining DRM and CCA.
- Monitor implementation of actions and adapt.

v. **Support scientific involvement across all phases of DRM and practical application of evidence-based approaches.**

Short term

- Coordinate with leading academic/technical/scientific institutions to better utilize capacities across the DRM cycle and understand critical investment needs going forward.
- At different levels, promote and make further use of scientific tools, products, and expertise, with legal enhancement of the roles of end-users and service providers.
- Invest in DRM-related research with increased funding allocations.
- Identify opportunities to pursue innovative research for specific hazards/areas/DRM themes in bilateral/regional/global coordination mechanisms.

Medium term

- Co-create and adjust needed scientific services to be integrated in the operational practice.
- Continue to mobilize funds for DRM-related research.
- Integrate projects for specific hazards/areas/DRM themes in bilateral/regional/global coordination mechanisms.

Understanding risk

Understanding the scale of disaster risk in a comprehensive manner is a critical step for improved prevention and preparedness, efficient and cost-effective risk reduction, improved response, and reconstruction planning while providing a basis for financial protection. Risk assessment comprises the

analyses of hazard, exposure, and vulnerability aspects and materializes into the development of risk scenarios that inform decision-making.

Key findings

The level of understanding of (hazard and) risk differs across the main hazards that Greece is facing.

While flood hazard mapping has already been conducted as a result of the EU Floods Directive, there are no comprehensive provisions for mapping other hazards (listed in the most recent NRA). For example, even for earthquake risk, there is no comprehensive seismic risk assessment. In addition, the understanding of climate change projections could be strengthened, both at national and subnational levels. The responsibilities of various authorities for developing multi-hazard risk analysis are not well defined; assessments are currently coordinated by different institutions for different hazards (e.g., earthquakes, forest fires extreme weather, flood, and landslide hazards), and the flow of information is weak.

There are data gaps related to many hazards. As there is no provision for the establishment of a risk data repository, the data and results of many risk and hazard studies—funded either by the state or the EU—are not available to the government or local authorities, and in many cases the authorities are not aware of their existence. The new law provides (for the first time) the legal basis for the establishment of a National Hazard, Threat, and Disaster Loss Database, but a number of legal, technical, technological, and human resource issues have to be properly addressed for the law’s provisions to be successfully operationalized. The associated legal framework should contain guidelines on how to create a system with risk information flows and actions for the relevant authorities.

Roadmap of key recommendations and areas for further engagement

Improvements in understanding risk could be achieved through appropriate planning and subsequent implementation of certain sub-actions/activities; these are listed below, grouped under the four main priority actions and presented in the order of highest impact of action.

i. Improve understanding of risks that have information gaps and multi-hazard impacts.

Short term

- Establish a risk assessment methodology with common impact outcomes for all hazards and a framework for understanding risk scenarios, in consultation with a wide range of stakeholders.
- Coordinate existing and planned data compilation. Collaboration of the government with academia and research institutes will ensure the robust quality of the risk assessment framework.
- For the different authorities mentioned in the legislation, clarify responsibilities regarding multi-hazard risk analysis.
- Assign additional competencies to the Risk Assessment Committee in identifying and understanding risk scenarios and participating in the selection of risk assessment projects to be financed.

Medium term

- Develop hazard and multi-hazard maps at national or sub-national level for all the hazards that are in scope, with the aim to inform risk assessments, design code updates, targeted prevention/risk reduction efforts etc.
- Conduct risk assessments for different asset portfolios.
- Prepare risk-informed urban plans; prioritize DRM projects based on risk assessments, including risk reduction; develop scenarios for prevention planning, emergency preparedness and response planning; develop emergency plans at urban scale informed by scientific evidence; implement risk assessments for financial preparedness.

ii. **Establish a risk information system geared toward operationalization.**

Short term

- Engage the Risk Assessment Committee, established by the Law 4662/2020, with the National Hazard, Threat, and Disaster Loss Database, so it can stay informed about existing studies.
- Consult with risk information users and providers to define the scope of required databases and determine appropriate institutional arrangements to make risk data systems sustainable in the long term.
- Make the existing hazard and risk maps available on the GIS-enabled data platform aligned with the broader digital agenda (even if not publicly available, specific access criteria may be applied).

Medium term

- Establish institutional arrangements for geospatial risk data systems.
- Establish database/system processes and provide capacity training and guidelines for stakeholders seeking to use or provide information.

iii. **Expand and systematize risk information on exposure and vulnerability.**

Short term

- Develop a differentiated, step-by-step, prioritized, and coordinated approach for risk data collection; develop reporting mechanisms for critical infrastructure and public assets.
- Conduct preliminary data collection, including on the built environment, including critical infrastructure and other public assets, residential sector, cultural heritage; on the natural environment (e.g., Natura 2000 protected areas, habitats, ecosystem services), and the population (including different groups) at risk, in line with agreed methodology and expected use of risk data.

Medium term

- Complete the rapid visual screening of all public buildings and upload the inventory of public properties on the data platform, including data attributes related to buildings' first-degree seismic vulnerability assessment.
- Conduct more granular data collection for specific aspects of risk (conditions of buildings, etc.) based on specific needs and objectives of risk information use to inform prevention, preparedness and response planning.

- Establish a data set of all education and health buildings that includes construction year (based on which the seismic design would be assessed), materials used, and the structural system (height, building occupancy and function, post-construction modifications/improvements, etc.) to allow categorization of buildings by structural typologies, facilitate the assessment of building fragility and vulnerability, and thereby determine the most vulnerable buildings, which would be prioritized for risk prevention and reduction—to be retrofitted or demolished/rebuilt.

iv. **Share information among stakeholders.**

Short term

- Understand the risk information needs of different institutional and other stakeholders.
- Improve the interface and sharing of information by making risk maps available on GIS-enabled public platforms.
- Establish communication channels among relevant stakeholders for regular exchange of information/data to foster risk awareness.

Medium term

- Continuously seek feedback on risk information provided and how to improve information delivery.
- Facilitate exchange about completed/ongoing/planned projects among researchers, practitioners, and the wider public.

Reducing and preventing risks

Building on risk understanding, DRR seeks to reduce (mitigate) existing risk (for example, through maintenance or reinforcement of existing infrastructure) and to prevent the creation of new risk (for example, through spatial planning/new construction) via anticipatory measures and investments.²⁷ DRR concerns all assets, though critical public infrastructures are of particular importance. DRR includes both structural measures (engineered measures, such as flood protection infrastructure or retrofitting/rehabilitation of buildings, but also “green” infrastructure/nature or ecosystem-based solutions) and nonstructural measures (non-engineered measures, such as building codes or risk-informed zoning). Risk reduction/mitigation is part of broader risk prevention efforts.

Key findings

National planning and construction legislation have been significantly reformed to strengthen the resilience of the built and natural environment. There are also recent efforts to manage the risk of dilapidated buildings led by MoEE, the Technical Chamber of Greece (TEE), with the contribution of 111 municipalities. Nevertheless, there is no comprehensive strategy aiming at DRR and CCA and intended to guarantee/provide a common direction to the different regulations and guidelines dealing with prevention and mitigation measures and spatial planning. For example, whereas building codes for earthquakes follow the European standards, there are no formal design standards for other hazards; in

²⁷ UNDRR definition: “DRR is aimed at preventing new and reducing existing disaster risks and managing residual risks, all of which contribute to strengthening of resilience and therefore to the achievement of sustainable development.”

addition, there is no legislation or funding program that explicitly supports the integration of energy efficiency upgrades with seismic retrofitting.

As a result, existing attempts to address important DRR and CCA issues lack the necessary strategic support and adequate funding. Examples include the efforts of the Earthquake Planning and Protection Organization (OASP) and municipalities related to rapid visual screening, or a 2017 agreement among governmental bodies, scientific institutes, regional and municipal authorities, and TEE to further evaluate existing data and plan actions about the evolving risk of coastal erosion. An additional issue is that a number of responsibilities for DRR actions and measures are given to the regional and local authorities, which are understaffed and in need of technical assistance, access to accurate risk data, and appropriate tools (e.g., databases, GIS platforms) in order to develop the relevant plans and projects.

For critical infrastructures, there is no systematic process for collecting information (about structural conditions and vulnerability) to include in databases, and no specific national DRR program that would use prioritized/systematic approaches for specific types of assets (education, health, CP organizations buildings, etc.). This hinders the ability of asset owners/administrators to conduct portfolio-wide assessments of assets and prioritization of actions. This finding (weakness) is also fundamental to the disaster preparedness and financial protection strategy and measures.

Roadmap of key recommendations and areas for further engagement

Improvements in reducing risk could be achieved through appropriate planning and subsequent implementation of certain sub-actions/activities; these are listed below, grouped under the four main priority actions, and presented in the order of highest impact of action.

i. Support regional and local authorities to integrate risk information and risk-informed approaches into spatial and development planning.

Short term

- Analyze the needs of stakeholders at regional and local levels to provide tailored information to facilitate integration of risk information into spatial/development planning processes and plans.
- Support the development of support tools and enhance technical capacity of stakeholders to utilize data.
- Align spatial planning to facilitate the use of risk information and approaches.
- Gather/monitor good practice and share examples of risk-informed planning.

Medium term

- Provide technical assistance to stakeholders on how to gather and manage information necessary for spatial and development planning.
- Regularly consult and provide tailored/ improved information and share good practices.

ii. Complete the legislative framework to enable mainstreaming of risk reduction.

Short term

- Review legislation and support efforts related to the strengthening of building codes and quality assurance processes for different hazards/types of assets; clarify responsibilities, processes, and timelines.

Medium term

- Raise awareness and enact changes in legislation.

- iii. **Facilitate scale-up of multi-hazard and hazard-specific prevention and reduction investments across different administrative levels and sectors with immediate focus on priority sectors—emergency management, health, education, and transport.**

Short term

- Support the development of consolidated databases with risk information to guide investment planning.
- Support the systematic integration of risk information into decision-making processes at different levels and explore prioritization approaches to efficiently guide risk prevention and reduction investments, focusing on specific hazards (such as earthquake, floods, forest fires) or types of assets (e.g., first responders' infrastructure, schools, hospitals, and so on).
- Promote the development of (national) programs that target multi-hazard strengthening of specific types of infrastructure assets.
- Increase eligibility of financing for prevention and DRR through state and EU instruments, in coordination with relevant authorities (OPs).
- Coordinate with sectoral stakeholders to align cross-sectoral plans that include DRR measures and investments.
- Learning from past examples, engage stakeholders at sectoral/local administration levels to identify specific opportunities for mainstreaming DRR into their investments; provide awareness raising related to use of different sources of funding for prevention and DRR especially at the subnational level, and for hazards that may not yet have benefited from major investments in prevention and DRR.

Medium term

- Support stakeholders to continue gathering and managing exposure/risk information necessary for different types of risk assessments.
 - Support local and regional stakeholders to develop DRR plans and implement projects by sharing technical expertise and monitoring their progress.
 - Based on results of prioritized assessments, establish investment programs for specific hazards, types of assets, or sectors at risk.
 - Continue advocacy for investing in prevention and DRR, sharing good practice, including public awareness for ex-ante prevention, and strengthened culture of prevention.
- iv. **Integrate risk prevention, risk reduction/mitigation and climate change agenda in DRM planning and CP operational programs.**

Short term

- Promote knowledge and evidence-based approaches for sustainable and energy-efficient interventions that consider multiple hazards as well as climate change, conducting studies and providing information/capacity building, particularly at the local level.
- Support the use of green and nature/ecosystems-based solutions, sustainable forestry practice and others to prevent and reduce natural or climate –related disasters.

Medium term

- Share good practice examples and lessons learnt on integration of DRM into specific sectors and/or hazards.

Early warning systems

Early warning systems (EWS) provide critical services for prevention, emergency preparedness and response. The availability of and people's access to *multi-hazard* EWS is one of seven targets in the Sendai Framework for Disaster Risk Reduction. The assessments of EWS focus on four critical components that ensure the whole system is working and providing early and meaningful warnings to the relevant actors and people: (i) disaster risk knowledge; (ii) detection, monitoring, analysis, and forecasting of the hazards and possible consequences; (iii) warning, dissemination, and communication; and (iv) preparedness and response capabilities. In addition, several cross-cutting issues play an important role in establishing effectiveness: (i) effective governance and institutional arrangements; (ii) a multi-hazard approach to early warning; (iii) involvement of local communities, and (iv) consideration of gender and diversity concerns. The present section primarily addresses monitoring and forecasting and the dissemination of warnings. Disaster risk knowledge and response capabilities are primarily addressed in other sections of this chapter.

Key findings

The CP authority (GSCP) has established an Integrated Public Alert and Warning System, which makes use of multiple communication channels to disseminate warnings to at-risk stakeholders, based on the recipients' locations. The current monitoring and forecasting systems are in need of improved hardware (IT and telecommunications; monitoring equipment such as state-of-the-art weather radar systems) and modeling tools. In addition, investments in technical capacities, including maintenance budget, are needed to ensure the operability of the systems.

Greece is prone to a range of hazards, and the country could benefit from improved systems for monitoring and forecasting these hazards. Greece's topography and climate make it susceptible to flooding, which can have very short lead times (flash flooding). Flood forecasting is at an early stage of development, with few integrated forecasting systems that can incorporate high-resolution weather prediction/nowcasting and the installation and operation of flood forecasting models. In addition, real-time monitoring of rivers is not at the appropriate level needed. Along with flooding, other hazards resulting from extreme weather could see improvements by continued investments in the technology needed for more accurate weather forecasting. Greater partnerships with Europe-wide or regional partners could be an avenue for improvements. Wildfires are a recurrent threat, and EWS can extend the

capabilities of the daily national fire risk map, issued by the GSCP. Such extended capability can be based on ground monitoring systems (network of cameras in forest areas) and satellite data, as well as on systems that can assess the spread, growth and behavior of the wildfire. Early warning can be of great importance during active fires to guide the population what they have to do (or not). In the case of earthquake EWS, significant potential exists to provide warnings that would trigger automatic systems response to protect critical infrastructure assets.

Previous disasters have identified the challenge of sending actionable and early warnings to end-users.

While the establishment of Nat-CHAMM and an Integrated Public Alert and Warning System seek to overcome these challenges, a range of limitations—inadequate human resources in the last-mile, bottlenecks in communication pathways, difficulties in tailoring warnings to different groups, and limited numbers of trials, exercises, and a “lessons learned” system—could still prove problematic.

Roadmap of key recommendations and areas for further engagement

Improvements in early warning systems could be achieved through appropriate planning and subsequent implementation of certain sub-actions/activities; these are listed below, grouped under the two main priority actions and presented in the order of highest impact of action.

- i. **Enhance monitoring and forecasting systems and early warning systems via investments in state-of-the-art technologies, human, and technical capacity building.** Greater benefits could be achieved by aligning disaster prevention measures with improvements in preparedness and response.

Short term

- Conduct assessments for the expansion of monitoring and improvement of forecasting systems coupled with investments in human capacity, focusing on data needs and roles. Improve forecasting arrangements through improved data sharing, data maintenance, and data storage capacity.
- Undertake initiatives on how to leverage the capacities of government and research institutions to develop and implement innovative forecasting and warning approaches, considering legal arrangements and long-term research funding streams.
- Undertake feasibility studies to develop pilot systems for impact-based warnings. Such pilot systems should incorporate advanced risk information and include the potential recipients in co-production approaches.

Medium term

- Expand monitoring network and implement impact-based forecasting.
- Conduct technical assessment to improve geographical and temporal resolution of predictions and warnings.
- Implement the integration of EWS, considering the role of users at the center of multi-hazard early warning systems.
- Implement strengthened coordination between government and research institutions to support applied research and system development.

- ii. **Strengthen communication and dissemination of early warning systems.**

Short term

- Test and trial the new institutional arrangements and warning systems to identify bottlenecks in communication and to resolve institutional confusion.
- Build capacity at local levels to be able to respond to warnings.
- Conduct enhanced public awareness campaigns to build confidence in warning systems. Establish forums to provide feedback from users of EWS.
- Implement the Common Alerting Protocol²⁸ format to standardize all EWS in use, to allow interoperability, compatibility and sharing warnings with news media and other communication media. The adoption of common protocols should go hand in hand with continued engagement with regional and global systems, including the Copernicus Emergency Management System.
- Train/exercise the populations at risk (potentially affected) to act according to the warnings received; evaluate/assess results.

Medium term

- Implement and adjust communication and outreach through modern information and communication technology and through new dissemination means.
- Develop and implement frameworks to monitor the effectiveness of warnings, considering factors such as response time and coverage, including compliance with international standards.
- Implement mechanisms to receive feedback from users and to operate quality assurance processes for continual improvement.

Disaster preparedness and response

A disaster response system ensures the public safety of populations and protection of assets. Disaster response is traditionally divided into several critical phases, such as immediate response, recovery, and reconstruction, with specific objectives/priorities identified and responsibilities assigned in these phases. As in the case of the overall DRM governance system, disaster preparedness and response rely on strong institutional arrangements and coordination across different stakeholders, strong technical and operational capacities, and resources, especially for emergency services (such as firefighting, emergency medical services), and others—all part of an encompassing system that integrates the central and local levels, volunteers, the private sector, and others. The functionality of critical services in a disaster depends also on the safety and resilience of buildings hosting essential response functions, such as fire and police stations, hospitals and health services facilities, and buildings of institutions responsible for disaster risk management, defense, and national security, among others. Emergency transport routes and emergency shelters should also be fully operational in the immediate aftermath of a disaster. Well-aligned with other ex-ante preventative actions, preparedness activities of the responsible institutions and communities (planning, training, exercising, and lessons learned) are critical for effective disaster response.

²⁸ <http://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2-os.html>.

Key findings

Steps have been taken in emergency planning; several general plans based on the single-hazard model have been issued, and a few model plans have been developed for the local level. In addition, some fundamental steps have been taken in the area of exercises. Emergency arrangements are in place for key actions during the response phase, including shelter, provision of aid, evacuation, and so forth. Different stakeholders have also conducted a range of disaster-related awareness-raising activities, which could be further leveraged/improved by the implementation of the new law.

Some of the overarching challenges related to emergency management, preparedness, response, and recovery include the following: (i) secondary legislation under Law 4662/2020 provisions has not yet been promulgated; or if it has, it lacks clarity and specificity, thus preventing effective implementation; (ii) operational strengthening of structures (national, regional, local) for DRM and Nat-CHAMM is needed; it is also necessary to strengthen institutional capacities, upgrade staff skills, develop contemporary planning capabilities, mobilize voluntary organizations, adopt a “common language” among responders and other stakeholders, provide more training and exercises, develop a “lessons learned” system, conduct information campaigns, and implement measures to prevent and address natural hazards and disaster resilience; (iii) there is a need to address climate change effects and related risks (such as floods, drought, forest fires, heat waves, medicanes²⁹) in disaster response planning; (iv) more resources (expert, financial, technical, and so on) for competent authorities for DRM are needed; (v) coordinated financing of prevention, DRR and emergency planning activities could help provide a better overview; (vi) monitoring and evaluation of prevention and preparedness actions that have been undertaken could be strengthened to better track progress; (vii) a standardized and predefined recovery and reconstruction policy integrating a BBB framework could be helpful to guide post-disaster reconstruction; (viii) greater use of business continuity planning in critical services, and BBB aspects could also bring benefits; as well as (ix) there is a need to scale up public awareness.

Law 4662/2020 is a major step toward reforming the CP legislative and operational framework and seeks to address some of the key challenges identified in the pre-2020 CP system (and mentioned just above). Related to multi-risk governance and management of cascading/conjoint disaster effects, priority could be given to continuously developing institutional communication with an interdisciplinary and multi-sectoral character towards developing common capabilities—e.g., interconnectivity of equipment, broadcasting frequencies, a C4I (Command, Control, Communication, Coordination, and Information) system—based on international cooperation; this could be a priority task. Expert exchanges, lessons learned, joint exercises, and sharing of good practices, as well as the continuous and active participation in European and international DRM initiatives, could facilitate the task to foster discussion, agreements, planning, testing, and finally better coordinated action in the field. This would allow the forces of the Nat-CHAMM to make natural hazard risk and multi-risk governance and emergency management more efficient at local and national levels.

²⁹ Mediterranean hurricanes.

Roadmap of Key recommendations and areas for further engagement

Improvements in disaster preparedness and response could be achieved through appropriate planning and subsequent implementation of certain sub-actions/activities; these are listed below, grouped under the three main priority actions and presented in the order of highest impact of action.

i. In coordination with key CP stakeholders, operationalize Nat-CHAMM with an efficient national Command, Control, Communication, Coordination, and Information (C4I) system.

Short term

- Complete secondary legislation/technical regulations, etc. and address current gaps related to emergency response, such as contingency planning, horizontal coordination among local authorities, BBB, etc.
- Update plans related to emergency response for specific hazards and at different levels, engaging and providing technical support for the development of emergency response plans by other stakeholders and sharing good practice.
- Develop monitoring/evaluation process to oversee quality of plans.
- Apply good practice, such as lessons learned from the Union Civil Protection Mechanism UCPM on specific aspects of the mechanism.
- Establish an efficient national C4I system by establishing functional/user specifications using expertise and building upon best practices from other European CP organizations; implement and test the national C4I system with the participation of all stakeholders involved.

Medium term

- Regularly review and continue to improve functioning of Nat-CHAMM.
- Implement prioritized investments; assess needs on a regular basis to continue identifying and planning/implementing investments.
- Maintain and improve operational capabilities at a national and regional level. Enhance local capabilities. Invest in monitoring, evaluation, and improvements.
- Conduct regular tabletop exercises using the C4I system in view of its improvement. Establish a “lessons learned” process after each use of the system in real-life incidents.

ii. Improve stakeholder capacity and coordination for emergency preparedness response, and recovery, focusing on the local level and readiness of critical elements.

Short term

- Conduct an assessment of resources and capacities in view of developing prioritized investment plans related to technical and human resources and facilities, with a specific focus on local-level needs and capacities to fulfil their responsibilities. In doing so, consider current risk profiles, restructuring, emerging threats, and climate change, and consult with stakeholders at national, regional, and local levels, as well as with volunteers and the private sector, to understand opportunities to improve effectiveness of the emergency response.

- Focusing on the local level, develop an action plan for building capability of key CP stakeholders and/or addressing specific coordination gaps.
- With a special focus on local-level needs and capacities, review readiness of critical elements for disaster response and recovery, such as sheltering and other proposed actions, with an action plan on how to address these. In doing so, assess feasibility of using tools to support decision-making for emergency response and identify options for piloting/rollout.
- Develop concepts, standards, and guidance for processes related to response and recovery, such as damage assessments and use of BBB principles,” with an action plan for piloting and rollout.
- Establish curricula for common training and scenarios for exercises based on multi-hazard risk assessments and making best use of concepts, standards, and guidance for processes related to response, recovery, and BBB, with an action plan for piloting and rollout.

Medium term

- Share results of assessments with stakeholders to facilitate their decisions and investments and implement capacity-building/coordination activities according to the plan.
- Regularly consult and review additional needs and make adjustments to programs.
- Implement actions to increase response readiness, such as developing specific guidance for critical infrastructure and private critical services continuity, BBB, etc.; monitor progress/evaluate results.
- Based on lessons learned from pilot engagements, roll out specific initiatives, sharing good practice and increasing awareness and culture of risk prevention and preparedness.
- Implement corresponding training curricula in all academies, colleges, and schools of stakeholders involved in DRM operations.
- Make participation in higher-level common training programs a prerequisite for promotion to higher managerial and operational posts.

iii. **Scale up public awareness activities and share risk information for greater community preparedness.**

Short term

- Develop a communications/ awareness-raising strategy/action plan considering the risk profile and current gaps in capacities/activities of specific stakeholders/ needs to raise awareness of the wider public and/or in relation to specific hazards; pilot/rollout specific activities.
- Develop a user-friendly interface for sharing information available on GIS-enabled public platform (e.g., convert GIS maps of evacuation routes/ safe emergency shelters into a user-friendly map format for the wider public); pilot and roll out.
- Explain the results of risk assessments to different audiences in different formats in an accessible manner, with pilot initiatives that can be rolled out based on success.
- Support activities to promote culture of risk preparedness and a whole-of-society approach.

Medium term

- Regularly update the communication/awareness-raising strategy, evaluating progress and adding new activities.
- Evaluate pilot initiatives and based on lessons learned roll these out at a larger scale.
- Establish multi-level collaboration among stakeholders—e.g., municipalities with local citizen initiatives and nongovernmental organizations (NGOs)—to develop local networks to disseminate information and ensure everyone is appropriately informed, especially marginalized and vulnerable citizen groups.

Financial protection

Disasters can trigger major financial shocks for public resources and at-risk populations, especially the most vulnerable. Investing in risk prevention and reduction before disasters occur brings multiple benefits, including saving lives and reducing injuries; ensuring the continuity of critical public services (such as energy, water, communication, education, administration); reducing the loss of homes; and reducing the financial impact—direct and indirect, including environmental, cultural and social impacts. Having financial arrangements in place for financing ex ante risk reduction, prevention, and disaster preparedness is critical. In post-disaster contexts, the financial cost of response, recovery, and reconstruction is a significant burden on government finances, both at the national and subnational levels.

Global best practices show that disaster risk financing and insurance arrangements are a joint responsibility of the national and the local authorities, the private sector, and households. It is less cost-effective for governments to rely on a single source of funding than to adopt a disaster risk layering approach (combination of a range of financial instruments—e.g., budget reserves, contingency financing, insurance, etc.). This approach enables governments to allocate affordable sources of funds in anticipation of more frequent events, and to access more expensive sources of funds for rarer but more severe disaster events.

Key findings

Earthquakes, forest fires, and floods are the main natural disasters affecting the local, regional and national economy in a variety of ways including direct damages, loss of production and disruption of services. Climate change projections for increasing weather volatility, a growing insurance gap, and a strain on public spending seem to predict worsening of the financial consequences of disasters.

Greece has national arrangements in place for post-disaster financing. The national budget includes emergency funds dedicated for disasters or unexpected expenses. A number of state organizations have specific roles related to post-disaster financing. For example, the General Directorate of Natural Disasters Recovery (GDAEFK) is responsible for providing free state aid for repair and/or reconstruction to tenants and owners of disaster-damaged buildings, and the Ministry of Interior (Moi) provides support to municipalities for local infrastructure damages and affected citizens. Other relevant organizations are the Hellenic Agricultural Insurance Organization (ELGA) for agriculture and the Ministry of Finance (MoF). In addition, Greece can apply for EU Solidarity Fund (EUSF) for those events that fall into the scope of this mechanism.

Agriculture is the only sector in Greece in which a public DRM scheme is combined with the private insurance sector to cover an important element of the economy and people's livelihoods. All natural and legal persons who own or operate agricultural enterprises in Greece are mandatorily insured by ELGA, a longstanding state organization that (i) insures agricultural production as well as the capital expenditure of agricultural investments; (ii) conducts research related to natural hazards that affect agriculture; and (iii) organizes and implements active protection programs for crops.

At the same time, public infrastructure in Greece is not insured, and currently there is no such legal requirement. As mentioned before (in the section "Reducing risks") the absence of systematic information collection and databases means that data are fragmented, and thus exposure is very difficult to quantify.

Some 230,000 companies have property insurance; however, regarding homeowners, the private insurance companies offer standard named perils ("fire and allied perils") policies with very low penetration (less than 15%), leaving a financial burden on the Greek economy. Earthquake insurance is not standardly offered³⁰ and must be selected accounting for about 70%-80% of the 15%. Greece does not currently have a sovereign contingent credit solution for disasters to cover contingent liabilities.

Roadmap of key recommendations and areas for further engagement

Improvements in financial protection could be achieved through appropriate planning and subsequent implementation of certain sub-actions/activities; these are listed below, grouped under the main priority action and presented in the order of highest impact of action.

i. Develop an overarching disaster risk financing strategy.

Short-term

- Conduct a comprehensive financial analysis to inform development of a sustainable disaster risk financing strategy.
- Consult and strengthen coordination of key stakeholders on post-disaster financing, including the private sector, to understand priorities, challenges, and potential solutions.
- Assess opportunities for revising existing/developing new instruments (agriculture, public assets) for different administrative levels/sectors.
- Strengthen awareness of risk insurance, both among the general public and the private sector.

Medium-term

- Conduct activities set out by the strategy: adjust existing arrangements, pursue new instruments, link to programs for BBB, roll out public awareness campaigns on financial resilience, and potentially pursue legislation to foster expanded insurance coverage.
- Continue dialogue with stakeholders.

³⁰ Earthquake insurance is not offered as standard in order to reduce the cost. Moreover, in an insurance policy the premiums are segmented and if selected the premium for earthquake insurance is clearly visible.

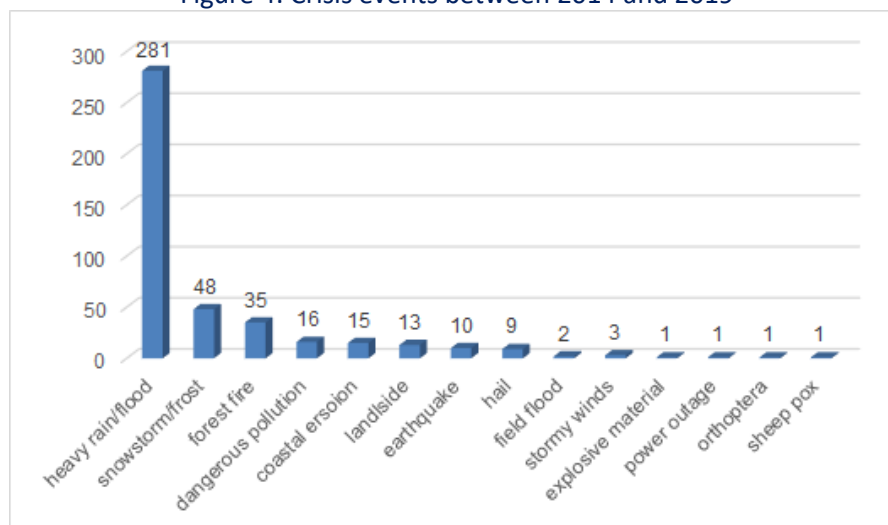
2. Chapter: Greece Risk Profile and Climate Change Considerations

This chapter provides a summary of the risks assessed in the National Risk Assessment (2019), with additional/complementary information on specific hazards (including pandemic risk) and risk elements based on available information, including a summary of the available information on climate change aspects. This is followed by a list of key takeaways for the NDRMP.

2.1. Disaster risk profile

Greece is exposed to a range of significant hazards and threats. According to the INFORM Risk Index (a global, open-source risk assessment estimate for humanitarian crises and disasters composed by various relevant stakeholders), Greece ranks 118th globally out of 192 countries (192nd with the lowest risk index).³¹ Over the past 10 years, Greece was impacted by approximately 20 major disasters associated with natural hazards, including the 2020 Samos earthquake, the 2020 Ianos medicanne and the ensuing flooding of the city of Karditsa (2011 population of 56,747), and the 2018 Northeastern Attica (Mati) wildland urban interface (WUI) forest fire. Figure 4 illustrates the statistics for the total number of emergency state declarations, including all events between 2014 and 2019 that required emergency intervention and actions and funding for rehabilitation, concerning mostly floods.³²

Figure 4. Crisis events between 2014 and 2019



Source: GSCP (2020) – Statistical Review of Emergency Declarations in the period 2014-2019. [Link](#).

The National Risk Assessment was developed in 2019 by the Center for Security Studies in cooperation with GSCP. The NRA built upon projects that included Greco-Risks, a project funded under the Hellenic General Secretariat for Research and Technology (GSRT) to develop a multi-hazard platform.³³ NRA is

³¹ European Commission. 2021. Home. DRMKC - INFORM. Disaster Risk Management Knowledge Center. [Link](#). The score is composed of the following dimensions: hazard and exposure (score of 3.6 out of 10), vulnerability (3.0 out of 10), and lack of coping capacity (2.4 out of 10).

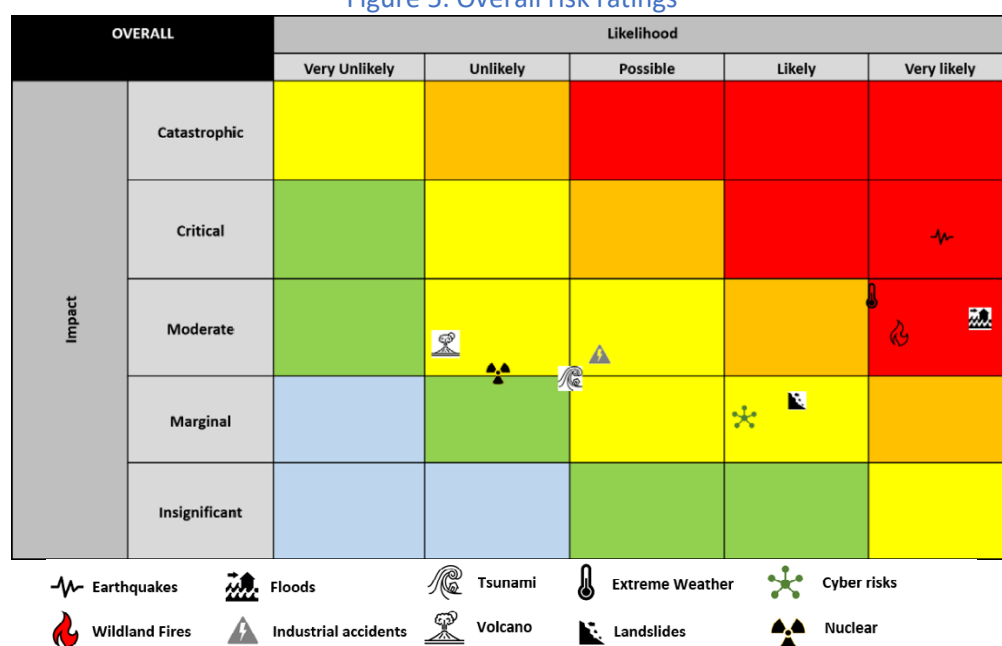
³² Legislation – Greece. 2002. N. 3013/2002, ΦΕΚ 102 Α.

³³ Kouskouna, V., Kaviris, G., Pomonis, A., Kallidromitou, D., Kassela, A., Bonazountas, M., ... & Misailidis, I. 2014. GRECO-RISKS. Hellenic Natural-Hazards Risk Mitigation System (A Real Time Operational Platform). Abstract, 2nd ECEES, Istanbul, Turkey.

based on the guidelines on national disaster risk assessment developed by the United Nations Office for Disaster Risk Reduction and on the EU risk assessment guidelines. The hazards considered in the NRA are earthquakes, floods, forest and WUI fires, extreme weather events, tsunamis (potential risk), landslides, volcanos (potential risk), cyber risks (emerging risk), industrial accidents, and radiological/nuclear accidents.

The NRA study was the first comprehensive work at national level that aimed to support the relevant obligation of the country to the EC.³⁴ Although it included a comprehensive collection of past data, available hazard and risk outcomes, and experts' estimate on impact, the NRA did not use a standardized approach to data available at similar levels or did not link risk outcomes with recommendations for policies. The main scope was to collect information available at national level and within studies with scenarios and to develop risk matrices per hazard based on the findings and experts' judgement for the following impact dimensions: life and health, social and political, economic, environmental, and cultural. The NRA does seek to address multi-hazard risks and the potential for cascading risks, acknowledging the linkages between hazards, and considering several relevant scenarios in case studies.

Figure 5. Overall risk ratings



Source: Government of Greece 2019, NRA.

³⁴ According to Article 6 of Dec. 1313/2013/EU amended by Dec. EU 2019/420, “each member state shall develop risk assessments at national or appropriate subnational level and make available to the Commission a summary of the relevant elements every three years.” Reporting Guidelines have been issued by EC to support this effort (SEC (2010) 1626; 2019/C 428/07). See European Union. 2019. Decision (EU) 2019/420 of the European Parliament and of the Council of 13 March 2019 amending Decision No 1313/2013/EU on a Union Civil Protection Mechanism [PE/90/2018/REV/1, OJ L 77I, 20.3.2019, p. 1–15]. [Link](#).

Figure 6. NRA approach to considering interactions between hazards

	Earthquake	Flood	Forest fires	Extreme Weather Events	Tsunami	Landslides	Volcano	Cyber	Chem/Industrial	Radiological/Nuclear	Biological/Health
Earthquake											
Flood											
Forest Fires											
Extreme Weather Events											
Tsunami											
Landslides											
Volcano											
Cyber											
Chem/Industrial											
Radiological/Nuclear											
Biological/Health											

Source: Government of Greece 2019, NRA.

Note: Red represents “triggering” and orange represents “influenced by.”

While the NRA represents an important step toward a unitary risk assessment at the national level, it also reveals certain limitations in Greek data infrastructure. The risk assessment for specific hazards was limited by data accessibility and by the inconsistency of the methodologies used in the studies reported. Not all hazards and risks are probabilistically estimated in the NRA and the analysis of all is not at the same level. Different procedures (qualitative, literature reviews, scenario risk assessments) were followed for the reporting of risk for each of the hazards considered. The data are at insufficient resolution for determining investment priorities related to prevention and reducing the risk of specific hazards. The need to better understand the impacts of cascading effects was not sufficiently included in the risk assessment. It should be mentioned that the layer of public buildings and critical infrastructure is missing in all hazards, given that detailed exposure datasets and risk assessments of these assets are not available. There are other limitations as well: data resolution is insufficient for making asset-level decisions on investment in prevention and risk reduction; risk data are not complete enough for developing scenarios needed for planning, prevention, preparedness, and cost-benefit analysis of DRM measures; and the risk assessment methodology is not consistent enough to perform multi-risk analysis. An important outcome was the creation of a first common empirical risk assessment methodology applied to all types of hazards to perform assessments with risk matrix approach. Greece needs a more in-depth, reliable, and relevant risk assessment, one that includes sensitivity analyses for upper- and lower-bound results. Such a risk

assessment may employ the methodology established at the national level and input data on the elements at risk but should have a higher resolution and more detailed technical significance of exposure data.

Earthquake

Greece is one of the most seismically active countries worldwide due to its location between the collision of the Eurasian and African plates.³⁵ The entire Greek territory is considered as earthquake-prone, considering that seismic faults are distributed throughout the country.³⁶ According to recent studies,³⁷ almost 50% of active faults in Greece pose a moderate to high seismic risk to urban areas. The most destructive seismic event in Greece in the last 100 years was the magnitude 7.2 earthquake that occurred on August 12, 1953, in Kefalonia. It caused major material damage in Kefalonia, Zakynthos, and Ithaca, resulting in the death of 476 people and injuring another 2,412. Among the 33,000 buildings on the islands, 27,659 buildings collapsed.³⁸ Approximately 15 earthquakes of M5.0 or higher occur every year, with one seismic event of M6.3 or higher per year.³⁹ Greece's two biggest cities (Athens and Thessaloniki) were struck by nearby earthquakes on September 7, 1999 (Mw 5.9) and June 20, 1978 (Mw 6.4), destroying around 5,350 and 9,500 buildings and killing 48 and 143 people, respectively. Presently around 46% of Greece's population resides in these two metropolitan areas. Compulsory earthquake design criteria were for the first time introduced in 1959 and updated in 1984. Earthquake design codes based on modern principles were then introduced in 1992 and updated in 2004. The level of adherence to the seismic codes increased gradually and is considered nearly complete from at least the early nineties.

Floods

Due to heavy rainfall attributes, high-intensity riverine and flash floods are frequent in Greece and trigger declarations of emergency state (e.g., there were 281 such cases during 2014–2019).⁴⁰ Floods occurring at the boundaries of built-up areas have significantly increased during the last decades in Greece due to urbanization.⁴¹ Forest fire desertification also drives the risk of floods in certain areas. For the period 1880–2010, 545 flood events were registered with a total of 686 casualties, with higher recurrence rates in November in urban environments.⁴² One of the deadliest events occurred recently in November 2017 in Western Attica (close to Athens) with 24 fatalities. In November 1961 and November 1977, Western Attica suffered from other catastrophic flood events, with more than 40 fatalities in the earlier event and more than 30 fatalities in the latter and considerable damage to properties.⁴³ Some of the floods are created by heavy torrential rain, especially in Attica. A catastrophic flood happened in Evros River (this river is forming the land borders between Greece and Turkey) in 2015. In addition to human interventions, flood events have also been attributed to the intensification of natural phenomena due to

³⁵ Papazachos, B. & Papazachou, C. 2003. The earthquakes of Greece. Ziti publications, Thessaloniki, Greece. p. 286 (in Greek).

³⁶ Makropoulos, K.C. 2010. Earthquakes and preventive measures, Bulletin of the Geological Society of Greece, vol. 43.

³⁷ Kassaras, I. et al. 2020. The new seismotectonic Atlas of Greece (v1.0) and its implementation, Geosciences, 10, 447.

³⁸ Papazachos, B., Papazachou, C., 1997. The Earthquakes of Greece. P. Ziti and Co, Thessaloniki, Greece. page 304.

³⁹ Papazachos K.; In. Gr. 2019. Earthquake: In Richter dance all over Greece - What scientists say. [Link](#).

⁴⁰ Lekkas, E. 2000. Natural and Technological disasters. 2nd Edition, Access Pre-Press, Athens.

⁴¹ Stathis, D. 2004. Extreme rainfall-events and flood-genesis in Greece. In: 7PGC/HGS: 1-8, Oct 2004.

⁴² Diakakis, M., Mavroulis, S., Deligiannakis, G. 2012. Floods in Greece, a statistical and spatial approach, Natural Hazards, vol. 62.

⁴³ Green Agenda. 2018. November, The Month with the Most Flood Victims in Attica (Photo). [Link](#).

climate change.⁴⁴ Literature on the occurrence of floods under future climate conditions in Greece can be broadly divided into two categories: scientific work focusing on future extreme precipitation events and analysis of specific river basins or water catchments. Overall, studies indicate a clear trend for heavy and extreme precipitation events to become more frequent and intense in the future, along with higher flooding risk.⁴⁵

Forest and wildland urban interface (WUI) fire

Over the past forty years (1980-2019), a significant increase in the number of forest fires has been observed in Greece. Although very complex, some of the main causes for this increase identified in the scientific literature are related to drought cycles possibly linked to climate change,⁴⁶ changes in forest and wildfire management policies, and land use planning practice. The statistics reveal an increasing number of fires after 1989, but the 20-year moving average of the burned area remains below 58,000 ha across the 40-year period. Figure 7 shows the geographical distribution of significant fires (burnt area greater than 50 ha) over the last two decades. The greatest concentration is observed in the areas of Attica, Ilia, Evia and Laconia. Figure 8 shows the annual burned land statistics in Greece for the period from 1980 till 2019. It is evident that changes in wildfire management policy and operational practices since 1999 have kept the burned area low during mild fire seasons; but the burned area soars during fire seasons with extreme temperatures and low humidity conditions (e.g., in 2000, 2007, 2021). Nevertheless, the worst loss of life since 1980 related to forest fires occurred in a mild fire season (2018), when the wildland-urban interface (WUI) Mati fire on July 23, 2018, caused the loss of 102 lives whilst it burnt less than 1500 ha of mixed land-use area within a few hours. Increased activity and degree of urbanization, increased tourism activities and building construction in coastal areas, rural clustered or scattered habitation-settlements, near densely forested land has led to a significant number of human casualties and to considerable losses of property and infrastructure during recent years. During the period 1977–2018, 307 fatalities were reported in 79 forest fire events in Greece⁴⁷, while in the same period loss of life from earthquakes including two that struck near the country's two largest metropolises was 278 in 21 events and loss of life from floods in 1960-2010 period was 179 (Diakakis, 2016). The dramatic WUI fire of Mati in 2018 set the ground for significant changes in the Greek CP mechanism (Law 4662/2020, AEGIS plan). Climate change impacts, including elongation of the dry season, increase of drought periods, frequent heat waves, and extreme winds, are expected to extend the high-fire-danger period, according to estimates throughout 2071–2100.⁴⁸

⁴⁴ Vassilios, D. 2020. The phenomenon of sudden urban floods (Urban Flash Floods). The case of the flood in Mandra, Attica on 15.11.2017: Result of climate change or human intervention? [Link](#); Government of Greece. 2016. National Strategy for Climate Change Adaptation. Ministry of Environment and Energy.

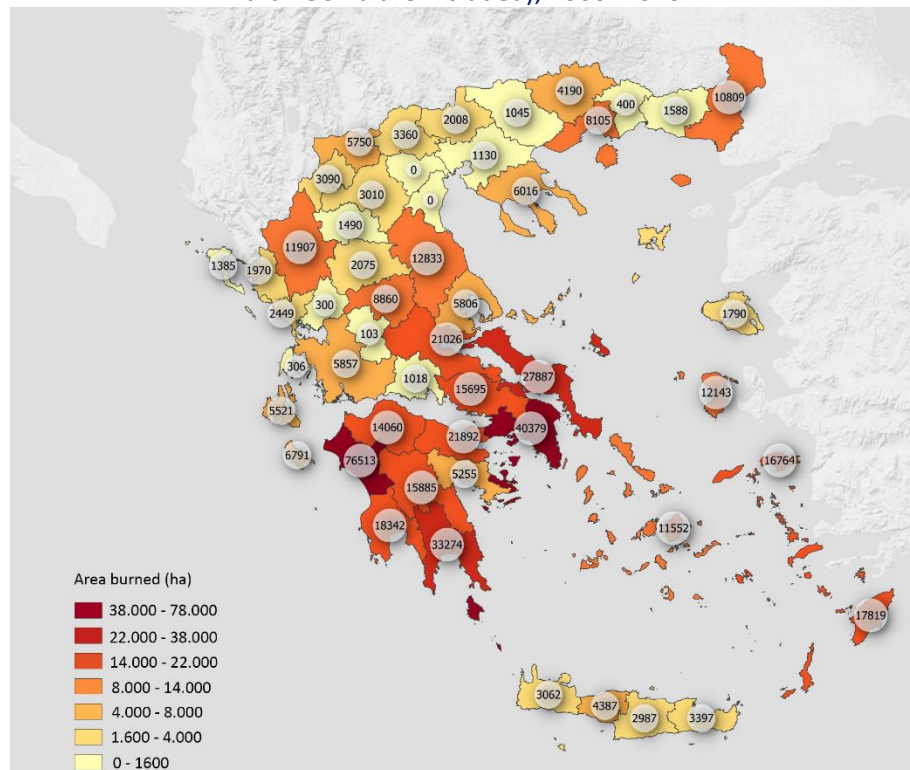
⁴⁵ Kotroni, V.; Giannaros, T., Papavasileiou, G.; Lagouvardos, K., Dafis, S. 2021. *Future Changes in Severe and Extreme Weather Due to Climate Change: A Literature Review focusing on Greece*. METEO, National Observatory of Athens.

⁴⁶ Dimitrakopoulos, A., Vlahou, M., Anagnostopoulou, C. and Mitsopoulos, I. 2011. Impact of drought on wildland fires in Greece; Implications of climatic change? *Climate Change* 109:331–347.

⁴⁷ KEMEA & GSCP. 2019. National Risk Assessment for Greece (NRA-GR).

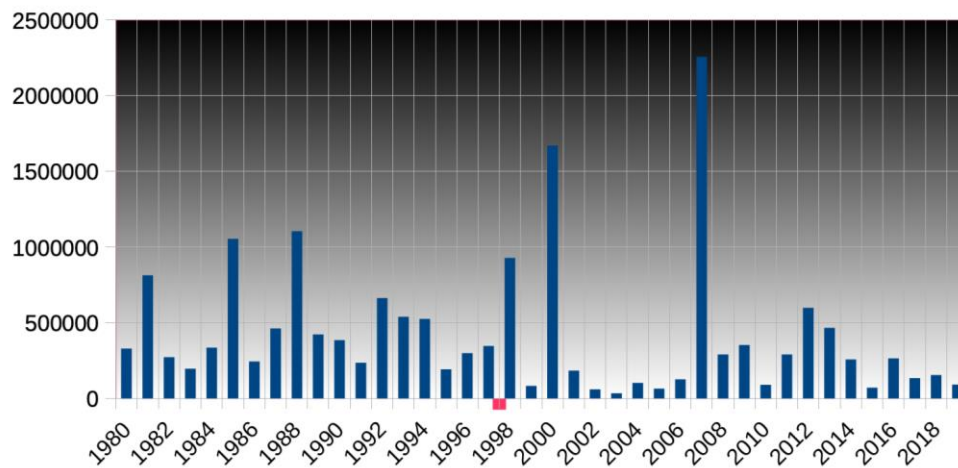
⁴⁸ Government of Greece. 2016. National Strategy for Climate change Adaptation. Ministry of Environment and Energy.

Figure 7. Geographical distribution of the area burned by large wildfires (only fires that burned more than 50 ha are included), 2000–2020



Source: Kotroni et al. 2021.

Figure 8. Burned areas in the years 1980-2019



Source: Data from E.F.F.I.S. ([Link](#))

Drought and heat waves

Drought is an issue affecting all EU countries in different ways, but Greece has been especially severely.⁴⁹ Estimates of the economic impacts of drought at the EU level suggest losses over the past 30 years of €100 billion. Increasing droughts and extreme climate phenomena (heat spells/heat waves) will impact Greece significantly by 2100.⁵⁰ Extended droughts were recorded in Greece in the years 1981, 1985, 1988, 1992, 1994, 2000, and 2007. For most of the eastern Mediterranean, the Balkan Peninsula, and especially for Greece,⁵¹ high temperatures were observed during the summer of 2007, with three major heat waves detected, one in each summer month; maximum and minimum temperature values broke records set in the late 1940s. Heat waves can cause serious direct effects on agriculture and the environment, but also indirectly affect the economy and people's well-being. Greece's most extreme heat wave occurred in July 1987 and caused the loss of around 1,300 lives (the majority of which in the Athens metropolitan area). It is possible that the July 25 – August 6, 2021, extreme heat wave will exceed in severity the 1987 event, although in this latter event, the heat-related deaths reported in the media did not exceed 5 persons.

Extreme weather events – windstorms – winter storms

Greece also faces risks associated with extreme/high-impact weather events, such as severe windstorms, strong winds, medicanes, tornadoes, hail, winter storms, snow/frost, and lightning, with adverse consequences for socioeconomic activity. Such events can affect power/communication, transportation networks, electricity, water, or other service delivery. In the period 2002–2017, 13 significant cold invasions resulted in severe snowfall, especially in the region of Attica. The 2002 and 2008 snowstorms were the most severe of these in terms of ensuing consequences in the Attica region. The frequency of events, as far as impact intensity is concerned, varies from year to year, while the percentage of events having very high impact intensity ranged from 18% to 70% in a given year. The 2021 “Medea” snowstorm had particularly severe effects on power supply to several Northern Athens suburban municipalities with hundreds of thousands of households and businesses losing power supply for several days and up to one week, while the two winter storms that affected Crete in February 2019 were also severe causing loss of life and losses in excess of 180 million EUR. The September 2019 “Ianos” medicanes was the strongest such type of event to have affected Greece, causing losses in excess of €500 million. Concerning the spatial distribution of high-impact weather events, amongst the 74 regional units of Greece, the areas of Attica, Thessaloniki, Evia, and Halkidiki were most frequently affected. In addition, the frequency of tornadoes in Evia and Halkidiki, windstorms in Attica, lightning, and hail events in Halkidiki, and snow/frost events in Thessaloniki was high.

⁴⁹ European Commission. 2007. Drought Management Plan Report. November 2007. [Link](#).

⁵⁰ IPCC. 2013. Climate change 2013: The physical science Basis. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change. In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V, Midgley PM (eds) Intergovernmental panel on climate change. Cambridge University Press, Cambridge.

⁵¹ Founda, D., Giannakopoulos, C. 2009. The exceptionally hot summer of 2007 in Athens, Greece, Global and Planetary Change 67, 3-4.

Sea-level rise and coastal erosion

With a total shoreline of roughly 16,300 km, Greece is particularly affected by the anticipated sea-level rise—a major impact of climate change estimates—included in relevant studies in Greece at national⁵² and local level.⁵³ The Greek economy is heavily dependent on its coastal zone. In addition to anthropogenic factors (climate change and greenhouse gas impact) that lead to sea-level rise in Greece, several other parameters affect sea level: (i) tides; (ii) tectonics, such as uplift of the Northern Peloponnese, Crete, and Rhodes; (iii) sediment supply from inland at the deltaic plains; and (iv) coastal morphology and susceptibility to erosion. According to a coastal vulnerability study,⁵⁴ 58% of the Greek coastline is exposed to very high risk, 32% to high risk, and 10% to moderate risk of sea-level rise. According to projections, assuming mean sea-level rise of 0.5 m by 2100, 15% of the current total area of coastal wetlands in Greece is expected to be flooded. Projections for 0.5 m and 1 m rise by 2100 lead to economic loss of €356 million and €649 million, respectively.⁵⁵ Meanwhile, different coastal zones suffer from erosion due to different natural factors (geomorphology, tectonics, and so on) and anthropogenic factors (aquifer over pumping, coastal development, illegal sand extraction, and so on); climate change–related variability (sea-level rise, storm surge) also plays a role. In the period 2014–2019, 15 areas of the regions of Peloponnese, Crete and South Aegean were declared in state of emergency due to coastal erosion.⁵⁶

Landslides

Landslides pose a risk to people and infrastructure in Greece. Generally, landslides occur as a cascading event following an earthquake or an extreme weather event (heavy rainfall). In the last decade in Greece, landslide activity has been increasingly high because of intense urbanization and development (transportation routes, dams and reservoirs, industrial and urban activities) in landslide-prone areas, continued deforestation, and extreme meteorological events, resulting in a significant increase in total economic losses.⁵⁷ Landslide occurrence is high in certain areas of the Greek territory, such as Western Greece, along the Pindos Mountain range, and in Evia, Magnesia, Pieria (Katerini), Crete, Samos, and Ikaria.⁵⁸ The case of Palaio Mikro Chorion, which was destroyed due to debris falls and flows in 1963 and caused the deaths of 13 people, is one of the most characteristic landslide phenomena in Greece.⁵⁹ Extensive rainfalls of 2015 triggered numerous events (rockfalls and debris falls) across Greece (e.g., in the broader area of Plaka Kleitorias, Epikoureios Apollonas and Analipsi in Peloponnese, Petousi in Ioannina, Klepa in Aitolokarnania, Samos Island, and Dipotama in Evrytania).

⁵² Bank of Greece. 2011. The environmental, economic and social impacts of climate change in Greece.

⁵³ Region of Attica. 2020. Preparation of the regional plan for climate change adaptation of Attica region.

⁵⁴ Alexandrakis et al. 2011. National Strategy for Climate change Adaptation. Ministry of Environment and Energy. 2016.

⁵⁵ Bank of Greece. 2011. The environmental, economic and social impacts of climate change in Greece.

⁵⁶ Government of Greece. 2020. Statistical review of emergency state declarations 2014–2019. GSCP. [Link](#).

⁵⁷ Koukis, G., Sabatakakis, N., Nikolau, N., Loupasakis, C. 2005. Landslide Hazard Zonation in Greece. In: Sassa, K., Fukuoka, H., Wang, F., Wang, G. (eds.). Landslides. Springer, Berlin, Heidelberg. [Link](#).

⁵⁸ Sakkas, G., Misailidis, I., Sakellariou, N., Kouskouna, V., Kaviris, G. 2016. Modeling landslide susceptibility in Greece: a weighted linear combination approach using analytic hierarchical process, validated with spatial and statistical analysis. *Natural Hazards* 84(3): 1873–1904.

⁵⁹ Rozos D, Apostolidis E (2004) Engineering geological investigation of slope failures in Paleo Mikro Horio Evrytania Pr., aiming at its safe residential development. Proceedings of the 10th International Congress, Thessaloniki.

Tsunami

Greece is vulnerable to tsunamis due to the length of its coastline, its islands, and its geographical proximity to the Hellenic arc active subduction zone. Tsunamis can be a result of an earthquake, a landslide, or a volcanic eruption.⁶⁰ The Hellenic subduction zone in the Mediterranean Sea is known for triggering major tsunamigenic earthquakes.⁶¹ In the 20th century (in 1956), a tsunami with reported maximum inundation depth of 1.2 m was documented at Volos harbor.⁶² In Thessaloniki, two tsunamis were reported;⁶³ the first one occurred on July 5, 1902, triggered by an earthquake of M_w 6.6; the second was on February 23, 1959, generated by unknown causes. A tsunami in 1956 in Amorgos inundated inland up to a height of 25 m (run-up) in the southern shore of Amorgos Island. Most of the tsunamis recorded are generated by earthquakes, except for the tsunami of February 7, 1963, generated by a submarine landslide.⁶⁴ Generally, all port infrastructure is at risk from a tsunami event, even impacts of moderate intensity (inundation depth), due to its heightened exposure compared to other structures. The tsunami generated by the offshore Samos Island earthquake (M_w 7.0, October 30, 2020) was the largest in the Aegean Sea since 1956, with waves reaching heights of ~3.35 m.⁶⁵ An inventory of past tsunami impact indicates that the main impact attributes are people killed and injured, as well as damage to buildings, vessels, cultivated land, and other property.⁶⁶

Volcanic eruption

Volcanic activity in Greece is not frequent yet can be devastating. The Hellenic volcanic arc in southern Greece, i.e., South Aegean active Volcanic Arc (SAVA), includes the volcanoes of Sousaki, Methana, Poros, Milos, Santorini, Kos, Nisyros, and Yali from west to east. The most significant volcanic field of SAVA is the Santorini volcanic complex, which is one of the most famous explosive volcanoes of the Mediterranean area. At least 12 eruptions of major intensity have taken place during the last 360,000 years. The most recent volcanic unrest occurred during 2011–2012 and was accompanied by intense seismic activity.⁶⁷ Greece also has a submarine volcano located 8 km northeast of Santorini, whose eruption in 1649–1650 caused several casualties in Santorini, most of them due to wind-transported poison gas.⁶⁸ There are other SAVA volcanoes that are active and explosive, such as the Nisyros volcano,⁶⁹ which is in the southeastern part of the South Aegean volcanic arc. It is considered active with a large hydrothermal system with

⁶⁰ Legislation – Greece. 2016. JMD 172058/2016.

⁶¹ Lorito, S., Tiberti, M.M., Basili, R., Piatanesi, A., Valensise, G. 2007. Earthquake-generated tsunamis in the Mediterranean Sea: Scenarios of potential threats to southern Italy. *J Geophys Res* 113, B01301.

⁶² National Geophysical Data Center / World Data Service: NCEI/WDS Global Historical Tsunami. [Link](#).

⁶³ Legislation – Greece. 20016. GG 102/2006.

⁶⁴ Papazachos, B., Papazachou, C. 2003. Earthquakes of Greece. Ziti publ., Thessaloniki.

⁶⁵ Triantafyllou, I., Gogou, M., Mavroulis, S., Lekkas, E., Papadopoulos, G.A., Thravalos, M. 2021. The Tsunami Caused by the 30 October 2020 Samos (Aegean Sea) M_w 7.0 Earthquake: Hydrodynamic Features, Source Properties and Impact Assessment from Post-Event Field Survey and Video Records. *J Mar Sci Eng* 9, 68. [Link](#).

⁶⁶ Papadopoulos, G.A. 2016. Tsunamis in the European-Mediterranean Region: From Historical Record to Risk Mitigation. Elsevier: Amsterdam, The Netherlands,

⁶⁷ Tzanis, A., Chailas, S., Sakkas, V., Lagios, E. 2020. Tectonic deformation in the Santorini volcanic complex (Greece) as inferred by joint analysis of gravity, magnetotelluric and DGPS observations. *Geophys J Int* 220:461–489.

⁶⁸ Barberi, F., Carapezza, M.L. 2018. Explosive volcanoes in the Mediterranean area: Hazards from future eruptions at Vesuvius (Italy) and Santorini (Greece). *Annals of geophysics* 62, 1, V001, doi: 10.4401/ag-7761.

⁶⁹ Vougioukalakis, G., Fytikas, M. 2005. Volcanic hazards in the Aegean area, relative risk evaluation, monitoring and present state of the active volcanic centers. *Dev. Volcanol.* 7:161-183. [Link](#).

thermal springs and fumaroles. In 1996 and 1997, volcanic activity started with earthquakes of magnitudes up to 5.5, damaging many houses in the major town of Mandraki. Daily, hundreds of tourists visit the impressive hydrothermal explosion craters on the caldera floor, attracted by its fuming fumaroles and mud pools.⁷⁰

Human infectious diseases – pandemic

Greece has suffered historically from pandemic diseases. In the past 50 years, the limited outbreak of different infectious diseases—measles in 1982–1983, pertussis in 1987, rubella in 1993, meningitis in 1975–1990—was often associated with gaps of vaccination coverage in childhood.⁷¹ HIV virus in the 1980s and later is mostly epidemic within communities of drug injectors; a small decrease has been documented during the past years. According to the epidemiological surveillance of the National Public Health Organization (EODY) for the period 2005–2009,⁷² the brucellosis notification rate in Greece is one of the highest in Europe. For the period 2004–2018, there is a considerable number of foodborne/waterborne outbreaks, the majority of which relate to the bacteria *Salmonella*, especially during the summer period. The surveillance of hepatitis A between 2004 and 2019⁷³ showed an outbreak in 2007, with most of the cases within the Roma population, while in 2016 the largest share was among refugees/migrants who were staying at accommodation facilities.⁷⁴ Although Greece is non-endemic for most of the mosquito-borne viruses, West Nile Virus (WNV) has established an endemic circulation in the country since 2010 when WNV to a human outbreak emerged in Northern Greece. Greece due to its aging population has also been severely affected by the COVID-19 pandemic.

Animal and plant infectious diseases

Although animal and plant diseases are well monitored and limited in Greece, various diseases have been present in its territory. Often special measures are taken when severe animal diseases are recognized in neighboring countries. In 2016, an alert was issued due to *peste des petits ruminants* (PPR) among animals in Turkey.⁷⁵ In 2018, the same disease was identified among sheep and goats of Bulgaria, and special measures were taken for animal movement and border control in northern Greece. Sheep and goat pox outbreaks are more frequent, especially in the border islands.⁷⁶ Similarly, lumpy skin disease affected northern Greece and the border regions in the years 2016–2017, when outbreaks were reported

⁷⁰ Dietrich, V.J., Lagios, E. (eds.). 2018. Nisyros Volcano: The Kos—Yali—Nisyros Volcanic Field. Springer, Berlin, Germany. DOI 10.1007/978-3-319-55460-0.

⁷¹ Theodoridou, M. 2020. “Paediatric infectious diseases in Greece: Insights from a tertiary reference unit and perspectives for the future.” *Experimental and Therapeutic Medicine* 20, 6. [Link](#).

⁷² National Public Health Organization. Annual epidemiological data. EODY.

⁷³ National Public Health Organization. Annual epidemiological data. EODY.

⁷⁴ National Public Health Organization. Annual epidemiological data. EODY.

⁷⁵ Government of Greece. 2016. Πανώλη των Μικρών Μηρυκαστικών (Peste des Petits Ruminants, PPR). Ministry of Rural Development and Food. Directorate General of Sustainable Animal Production and Veterinary Services. [Link](#).

⁷⁶ Government of Greece. 2017. Sheep Pox in Greece. Ministry of Rural Development and Food. Directorate General of Sustainable Animal Production and Veterinary Services. Department of Infectious and Parasitic Diseases, Animal Health Directorate. Sheep Pox in Greece (PAFF Committee, Brussels, 17.01.2017). January 17, 2017. European Commission. Food, farming, fisheries – Food Safety. [Link](#).

in the Balkans.⁷⁷ Although Greece is free of dog rabies, the disease may still be present in wildlife species (bats and foxes), for which an epidemiological monitoring program has been in force since 2020.⁷⁸ As far as plant diseases are concerned, there is a variety of diseases that may affect plants, crops, and forest trees to a more or less serious extent; to protect them, guidance is issued by the competent regional centers. Greece has taken special measures for the protection of olive trees from *Xylella fastidiosa*, a plant bacterium that has been infecting olive trees in Europe since 2013, and traces of the diseases have not been yet found. A study estimated a loss of €2 billion should the disease spread in Greece to the same extent as in Italy or Spain.⁷⁹

Industrial accidents

In Greece there are 215 active facilities⁸⁰ under the SEVESO III Directive (Directive 2012/18/EU aiming at the prevention of major accidents involving dangerous substances),⁸¹ 135 of which are low-tier and 80 high-tier. These are oil refineries, liquid and gaseous fuel storage and marketing facilities, pesticide standardization and marketing facilities, fertilizer production facilities, etc.⁸² In the past 35 years, nine large-scale accidents have taken place in Greece,⁸³ for different reasons. In 1992, a large explosion followed an industrial fire at the facilities of a petroleum refinery,⁸⁴ killing 15 people and injuring 24. This was the deadliest industrial accident in Greece's history, and it was attributed to improper maintenance of the facility. In 1998, during extreme wind conditions at the Port of Thessaloniki, a fuel leak occurred while fuel was being loaded and unloaded; the resulting explosion killed four people. In 2006, an accident occurred at a chemical factory in Lavrio (a port town in the southern tip of the Attica peninsula), with consequent dispersion of chemicals in the atmosphere. Due to the panic that followed and incomplete operational planning, the local population was informed only 10 hours later to stay indoors or to evacuate the area of direct proximity.⁸⁵ In 2020, a large fire broke out at a plastics factory in the northern suburbs of Athens, creating dense smoke that was suppressed after several days.⁸⁶

CBRN incidents and threats/ cross-border events

Chemical, biological, radiological, and nuclear (CBRN) incidents and threats include the malicious attempt to cause epidemics and the addition of infectious, polluting chemical, or biological agents to the water system and the air, as well as incidents related to nuclear energy. There has been no publicly

⁷⁷ Dilaveris, D. 2018. Lumpy skin disease (LSD) Update of Epidemiological Situation in SE Europe and EC initiatives – Standing Committee on Plants, Animals, Food and Feed Section Animal Health and Welfare 18–19 April 2018. European Commission Directorate-General for Health and Food Safety G3 – Official controls and eradication of diseases in animals. [Link](#).

⁷⁸ Government of Greece. 2020. Rabies (Λύσσα). Ministry of Rural Development and Food. October 8, 2020. [Link](#).

⁷⁹ European Parliament. 2020. Question for written answer E-002561/2020 to the Commission Rule 138 Manolis Kefalogiannis. Parliamentary questions. May 13, 2020. [Link](#).

⁸⁰ Data from Ministry of Environment and Energy.

⁸¹ European Union. 2012. Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC Text with EEA relevance. [Link](#).

⁸² Mouzakis. 2007. Emergency Management. Athens. National School for Local Administration.

⁸³ Data from Ministry of Environment and Energy.

⁸⁴ Astinomiko. 2019. 1992: Tragedy in "Petrola" (1992: Τραγωδία στην "Πετρόλα"). September 1, 2019. [Link](#).

⁸⁵ Vradelis, S. and Nesfige, L. 2006. "Naked" in the flames at critical hours. («Γυμνοί» στις φλόγες τις κρίσιμες ώρες). Tanea. [Link](#).

⁸⁶ Kokkinidis, T. 2020. Athens Covered with Thick Black Smoke as Fire Rages at Plastics Factory. Greek Reporter. August 15, [Link](#).

confirmed CBRN incident in Greece.⁸⁷ Greece has no nuclear power plant (NPP) or active reactor, though its neighbors have NPPs.⁸⁸ Bulgaria operates two reactors at the Kozloduy NPP.⁸⁹ Turkey is considering constructing and operating three NPPs with 12 reactor units in total: Akkuyu NPP is being constructed in southern Turkey and will be operational by 2023; Sinop NPP will be constructed and operated along the Black Sea; the site selection process for the third nuclear plant is ongoing.⁹⁰ So far, no specific studies are publicly available quantifying the potential impact to Greece of a nuclear incident. In Greece, there is one nuclear research reactor (in extended shutdown since 2014), operated by the Institute of Nuclear and Radiological Sciences and Technology, Energy and Safety of the National Centre for Scientific Research (NCSR) “Demokritos” in Athens. There is also one subcritical assembly, operated by the Atomic and Nuclear Physics Laboratory of the Aristotle University of Thessaloniki. An interim storage facility and a waste treatment facility are also operated by NCSR “Demokritos.” Radioactive waste originating from medicine, research, and industry is classified as low-level waste.⁹¹

Accidents due to transportation of dangerous goods

The main factors in Greece that can lead to an incident or accident that releases hazardous substances release in the road or rail network are collision between vehicles, collision with a fixed object, vehicle overturning, or incidents due to failure or negligence. Most of the explosions during road transportation are not directly related to the explosive character of the substance but occur in combination with other factors.⁹² In 2010, 306,000 tons of dangerous goods were transported via railway in Greece; in 2019 the figure was 85,000 tons. Data for dangerous freight transported via road network are confidential.⁹³ However, in the database for the period 2007–2016, zero accidents are documented. Per Egnatia Motorway,⁹⁴ historical data for the period 1949–1999 show that only 4 of 33 incidents of large-scale fire in road tunnels involved a vehicle carrying dangerous goods. In 1999, the deadliest road accident due to transportation of dangerous goods took place as a tanker truck carrying propane, stopped for paper control on the shoulder of the National Road Athens-Thessaloniki, and exploded after being rammed by a small truck. Four people died, 14 were injured, and rubble from the two trucks was found as far away as 1 km.

Poverty and well-being

Results of a regional study evaluating annual asset losses and annual well-being losses due to floods and earthquakes across different socioeconomic groups are available for Greece and illustrate the

⁸⁷ Government of Greece. 2019. CBRN events (ΧΒΡΠ συμβάντα). GSCP. [Link](#).

⁸⁸ EEAE (Greek Atomic Energy Commission). 2015. Radiological and nuclear incidents/accidents (Ραδιολογικά και πυρηνικά συμβάντα). [Link](#).

⁸⁹ IAEA. 2020. Bulgaria (updated 2020). Country Nuclear Power Profiles. [Link](#).

⁹⁰ IAEA. 2020. Turkey (updated 2020). Country Nuclear Power Profiles. [Link](#).

⁹¹ OECD, NEA. 2016. Nuclear Legislation in OECD and NEA Countries, Regulatory and Institutional Framework for Nuclear Activities in Greece.

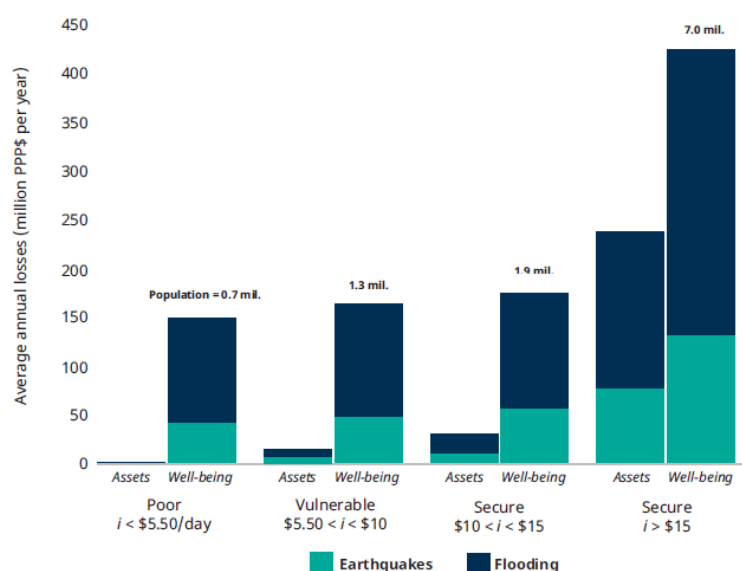
⁹² Government of Greece. 2020. GSCP General Plan for Emergency Response due to Accidents during the Road and Rail Transport of Dangerous Goods in accordance with ADR / RID Regulations (30/6/2020). June 30, 2020.

⁹³ European Commission. 2021. European Statistical Recovery Dashboard. Eurostat. [Link](#).

⁹⁴ Saramourtsis, A., Tsantsanoglou, A. “Transportation of dangerous goods in highways. Risk analysis in road tunnels,” Egnatia Motorway S.A.

disproportionate consequences of disasters for the poorest households.⁹⁵ Figure 9 illustrates the modeled consequences of disasters for the poorest households, looking at overall totals, while Figure 10 is concerned with per capita levels. While a household in the poorest income category would suffer only US\$4 in modeled asset losses each year, they experience far more—US\$226—in well-being losses each year. At the same time, the wealthiest income groups suffer 83% of the overall asset losses, while experiencing only 46% of the overall well-being losses. According to the study, the level of resilience of households in poor, vulnerable, secure, and middle-class socioeconomic groups in Greece is 2%, 9%, 18%, and 56%, respectively. This gap between the socioeconomic groups can be partly explained by the difference in pre-disaster income levels and access to financial resources, which affect households' ability to recover in an early and efficient manner. It is worth noting that generally, the urban poor are likely to be underrepresented within country-level averages. Members of this group face higher costs of living in search of economic opportunity and may receive little support from their home communities while still being expected to send remittances home.

Figure 9. Average total annual losses for various socioeconomic groups in Greece



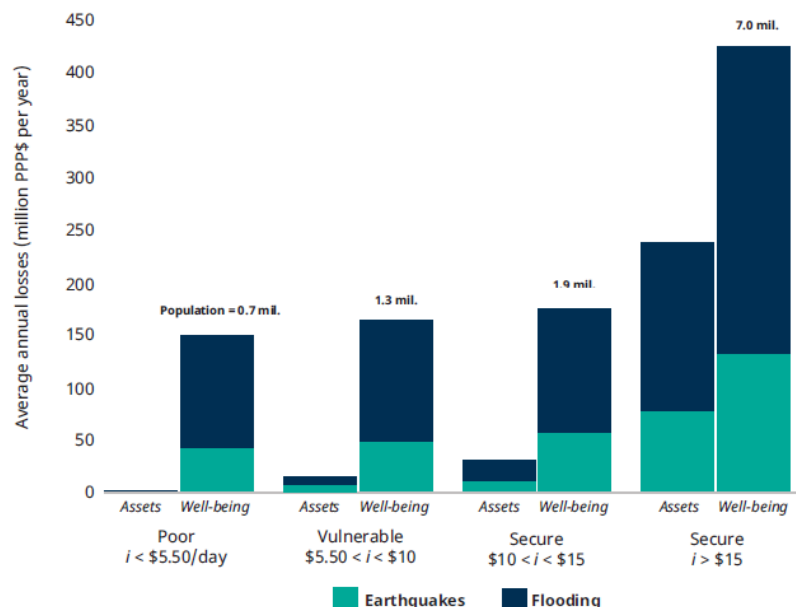
Source: World Bank 2020.

Note: Daily income (i) in terms of PPP (purchasing power parity).

⁹⁵ World Bank. 2020. Overlooked: Examining the impact of disasters and climate shocks on poverty in the Europe and Central Asia Region. Washington, DC: World Bank.

Asset losses are those that consist of the cost to repair or replace damaged assets including homes, vehicles, roads, bridges, factories, and more. Well-being losses are the equivalent loss of consumption for a given population and incorporate socioeconomic resilience, including households' ability to maintain consumption during recovery, their ability to save or borrow to rebuild their asset stock, and the decreasing returns on consumption. Decreasing returns on consumption refers to the fact that people who live on US\$2 per day (0.5% of Greece's population according to latest estimates) are much more affected by a US\$1 loss than are wealthier individuals. Socioeconomic resilience measures the ability of a given economy's ability to absorb the impact of well-being losses because of asset losses (and is calculated as the ratio of expected asset losses to well-being losses).

Figure 10. Average per capita annual losses for various socioeconomic groups in Greece



Source: World Bank 2020.

Note: Daily income (i) in terms of PPP (purchasing power parity).

Built environment

Regional-level catastrophe risk analysis was conducted by the World Bank for Member States in the EU to assess physical damage losses.⁹⁶ The study drew on data sets available for earthquake and flood risk and information about residential, commercial, industrial, health care, and school buildings. Losses for Greece are found as both return periods and average annual loss to the total building stock value separately for earthquakes and floods. The loss analysis used two probabilistic disaster risk models: namely, the JBA Risk Management (JBA) model for fluvial and surface water flood, and the Global Earthquake Model Foundation (GEM) model for seismic risk. The project also considered hypothetical investments for risk reduction using the Triple Dividend of Resilience approach⁹⁷, for which a relevant case study in Attica for wildfire alerting and preparedness was undertaken. The risk analysis for earthquakes found that Greece has an absolute average annual loss of €1.1 billion. Residential buildings are estimated to account for 50% (on average) of the average annual loss for both earthquake and flood hazards.

⁹⁶ World Bank. 2021a. *Economics of Prevention and Preparedness: Investment in Disaster Risk Management in Europe Makes Economic Sense*. International Bank for Reconstruction and Development/World Bank. Washington, DC.

⁹⁷ Tanner, T.M., Surminski, S., Wilkinson, E., Reid, R., Rentschler, J.E., and Rajput, S. 2015. *The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management*. Global Facility for Disaster Reduction and Recovery (GFDRR) at the World Bank and Overseas Development Institute (ODI), London. [Link](#).

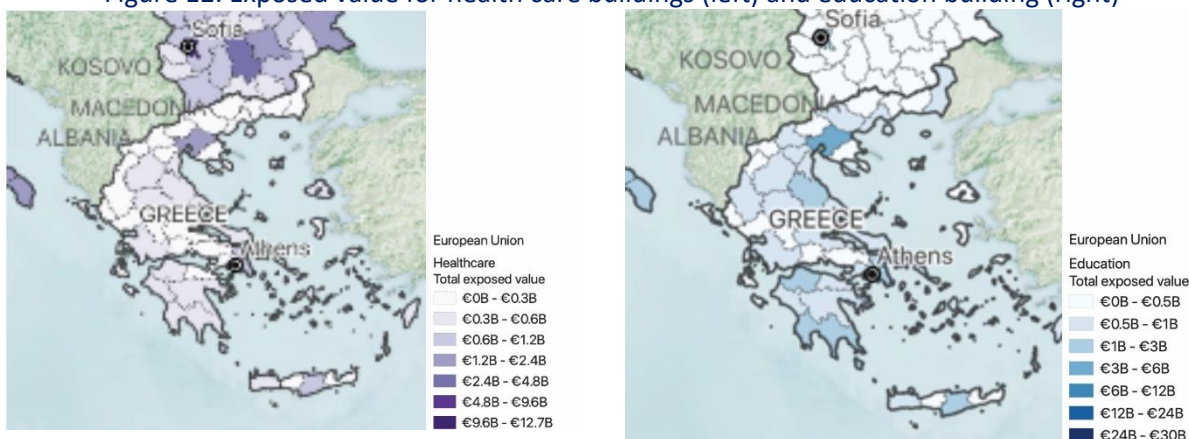
Figure 11. Population estimates for each NUTS 3 boundary per Eurostat



Source: World Bank. 2021a.

Note: NUTS 3 refers to Nomenclature of territorial units for statistics where NUTS 1 refers to major socio-economic regions, NUTS 2 to basic regions for the application of regional policies, and NUTS 3 to small regions for specific diagnoses.

Figure 12. Exposed value for health care buildings (left) and education building (right)



Source: World Bank. 2021a.

Figure 13. Earthquake average annual loss results for public and private buildings combined



Source: World Bank 2021a, drawing on GEM data for 2021.

Figure 14. Average annual losses for residential properties from current (2020) river flooding at the highest administrative division level for EU Member States (€)



Source: World Bank 2021a.

Note: Darker hues represent greater expected losses.

Ex ante assessment of high-impact weather events and large-scale forest fires in Greece

An assessment of high-impact weather events and large-scale forest fires that affected Greece over the last 21 years (2000–2020) was conducted by the METEO Unit at the National Observatory Athens.⁹⁸

These high-impact weather events include floods, lightning activity, hail, snow/frost, windstorms, and tornados. During the period 2000–2020, there was an increasing trend in the number of weather-related events with socioeconomic impacts. Flash floods were the most hazardous weather-related phenomenon; this finding is in line with the literature review and relevant studies for the Mediterranean region, which provide evidence of significant flood risk in the area. Flash floods also constitute the most serious weather-related threat to human lives, and despite recent advances and technologies for risk mitigation, flash flood events with adverse effects have increased during the past two decades. Also increasing over this time frame, but to a lesser extent, were both windstorm and tornado events. Attica—the most densely populated and important industrial and commercial region of Greece—is particularly vulnerable to high-impact weather events because the region has faced extensive deforestation and urbanization over the years. The study finds that the most highly vulnerable areas (regional units) are located near the coastal zone, and as such, they tend to be more densely populated and thus more vulnerable to weather-related phenomena.

2.2. Climate change projections

Greece's major climate change impacts are expected in the form of extreme weather events, such as heat waves, forest fires, and floods, as well as prolonged droughts and rising sea levels. Impacts on agricultural production will be more severe, while the impact on tourism and cultural heritage will also significantly affect household incomes and the economy. In 2011, the Bank of Greece estimated the cumulative cost from climate change on the Greek economy under an inaction scenario to be €701 billion by 2100.⁹⁹ The NRA includes a section on estimated climate change impacts, which relies on publications and cites literature for expected future hazards and climate change impacts, with near-term impacts

⁹⁸ Kotroni, V.; Papagiannaki, K.; Lagouvardos, K.; Giannaros, T. 2021. *High impact weather events in Greece: Analysis of the period 2000-2020*. METEO, National Observatory of Athens.

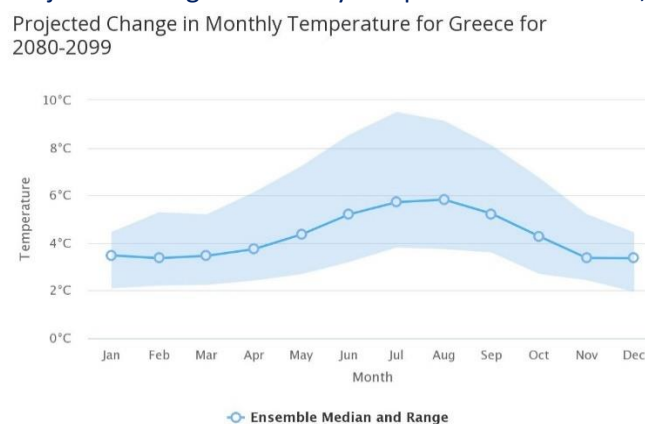
⁹⁹ Bank of Greece. 2011. *The Environmental, Economic, and Social Impacts of Climate Change in Greece*. [Link](#).

highlighted. Intergovernmental Panel on Climate Change (IPCC) scenarios are cited for future fire impacts in Greece for the end of the 21st century. According to the recently published Sixth Assessment Report of the IPCC, the Mediterranean region will have an increase in hydrological, agricultural, and ecological droughts and a projected increase in aridity and fire weather conditions at global warming of 2°C and above. The projected combination of climatic impact-driver changes (warming, temperature extremes, increase in droughts and aridity, precipitation decrease, increase in days with fire weather conditions¹⁰⁰, increase in mean and extreme sea levels, snow cover decrease, and wind speed alterations) are expected to increase by mid-century and at global warming of at least 2°C and above.¹⁰¹

According to the NRA, fire risk is expected to increase for all studied climate scenarios, especially in inland locations. Representative Concentration Pathway (RCP) scenarios are not included in the NRA but might be implicitly referenced in the research studies cited in the report. Overall, there are few projections for climate change hazards included in the NRA, although specific hazards such as fires and flooding do use deterministic scenarios to evaluate risk of certain return period hazards events.

The NRA reports on climate model projections that have found an expected increase in rainfall intensity in warmer climates, which in turn is directly associated with flash floods and urban floods. The NRA also cites research that highlights the relationship between increased landslide activity and increased humidity, with a potential increase in extreme rainfall events leading to more frequent landslide events. The NRA notes climate change impacts on wildfires, which are expected to increase in number and intensity in many parts of Greece. Due to the expected increase in temperatures, decrease in summer rain, and decrease in relative humidity, the number of fire events is expected to increase as well as the extent of the burnt areas. Fire hazard and drought are directly correlated, and the expected hotter and drier climate leads to an increase in the likelihood of wildfires.

Figure 15. Projected change in monthly temperature for Greece, 2080–2099



Source: World Bank. [Link](#).¹⁰²

Note: Mean annual temperature will rise 2.15°C (1.11°C to 3.56°C) in 2040–2059 (RCP 8.5, Ensemble).

¹⁰⁰ The types of weather that create favorable conditions for the start and spread of wildfires are collectively referred to as fire weather.

¹⁰¹ IPCC. 2021. Sixth Assessment Report, Regional Fact Sheet, Europe. [Link](#).

¹⁰² World Bank. Climate Knowledge Portal. [Link](#).

The PESETA IV Report developed by the Joint Research Centre (JRC) expects that southern European countries will face decreasing water availability.¹⁰³ In Greece, the number of people facing water stress will grow by 3.5 million to nearly 9 million—about 80% of the total population—in a 3°C warming scenario. For all southern European countries, including Greece, mitigation alone is not enough to avoid the adverse impacts of climate change, and adaptation strategies will be needed. Moreover, two studies were commissioned from NOA to investigate climate change for the purposes of DRM Plan recommendations informed by climate change impacts: an assessment of high-impact weather events in Greece during the period of 2000 to 2020, and a literature review of more than 70 papers written over the past two decades on future changes in severe and extreme weather due to climate change. A summary of these is provided below.¹⁰⁴

Floods

Available literature shows a clear trend for more frequent and more intense heavy and extreme precipitation events in the future, along with higher flooding risk.¹⁰⁵ The literature review also identified a future increase in the intensification of heavy and extreme precipitation events in the city of Athens; the percentage of precipitation amount due to extreme precipitation for the 2051–2100 period is projected to be almost double the reference period value. Studies focusing on specific river basins or water catchments have been carried out over the past few years, providing varied conclusions. There is expectation of higher springtime flooding risk in the Giofyros basin in Crete in the 2021–2050 timeframe. Focusing on northern Greece and the deltaic area of the Nestos River, studies¹⁰⁶ reported a decrease of extreme flood levels toward the end of the 21st century compared with the first half of it. Other studies found an increase in extreme flood events during the next 100 years in the Tsiknias River on the island of Lesbos; such events were projected to be distributed throughout the year and not just limited to the winter months. The PESETA IV report on coastal flooding¹⁰⁷ states that extreme sea levels in Europe could rise by as much as 1 m or more by the end of this century, with damages from coastal flooding in Greece amounting to 3.2% of future gross domestic product (GDP) by 2100.¹⁰⁸

Droughts

Existing literature provides robust evidence that droughts in Greece will occur more frequently and will have longer durations in the future. For climate in all subregions of Greece during the 2070–2100 period, significant decreases in future precipitation are expected, implying deterioration of drought conditions,

¹⁰³ European Commission. 2020. *Projection of Economic Impacts of Climate Change in Sectors of the EU based on bottom up Analysis (PESETA IV)*. Joint Research Center. [Link](#).

¹⁰⁴ NOA, Meteo Unit (2021). “High impact weather events in Greece, Analysis of the period 2000–2020,” Technical Report for World Bank RAS; and NOA, Meteo Unit (2021). “Future changes in severe and extreme weather due to climate change, A Literature review focusing on Greece,” Technical Report for World Bank RAS.

¹⁰⁵ Kotroni, V.; Giannaros, T.; Papavasileiou, G.; Lagouvardos, K.; Dafis, S. 2021.

¹⁰⁶ Skoulikaris C., Makris C., Katirtzidou M., Baltikas V., Krestenitis Y. 2021. Assessing the vulnerability of a deltaic environment due to climate change impact on surface and coastal waters: The case of Nestos River (Greece). *Environmental Modeling & Assessment*. [Link](#).

¹⁰⁷ Vousdoukas M., Mentaschi L., Mongelli I., Ciscar J-C, Hinkel J., Ward P., Gosling S., and Feyen L. 2020. *Adapting to rising coastal flood risk in the EU under climate change*, EUR 29969 EN, Publications Office of the European Union, JRC118512.

¹⁰⁸ Calculation assumes a high emissions pathway, RCP8.5.

as well as increases in the duration of maximum dry spells¹⁰⁹ in 22 locations in Greece. For the 2021–2050 period, the length of the longest dry spell is expected to increase in most of the country (e.g., at least 20 additional dry days are projected for the northern part of Greece¹¹⁰), while winters in Greece are projected to be drier by the end of the 21st century, with decreases estimated at up to 30% for the southern part of the country.¹¹¹ In studies¹¹² using the Standardized Precipitation Index (SPI), there are projections for future increases in the number of years with dry conditions in Greece.¹¹³ Regarding river basins and/or water catchments in Greece, several studies over the past two decades highlight that precipitation is projected to be significantly reduced and that there is a trend for much drier future conditions. The PESETA IV report¹¹⁴ on global warming and drought impacts states that droughts induce a complex web of impacts that span many sectors of the economy, as exemplified by extensive crop failure, reduced power supply, and shipping interruptions in the EU during 2018 and 2019. Greece is among the countries that see the largest economic losses from global warming. Because of the growth in the size of the economy, the projected losses in absolute terms are larger when future socioeconomic change is accounted for, compared to when it is assumed that current socioeconomic conditions continue in the future.

Heat waves

Current scientific knowledge indicates a significant warming of the country, with large increases in both the duration and intensity of heat waves.¹¹⁵ Research shows that the cities of Thessaloniki, Patras, Lamia, and Larissa should expect to experience up to 20 more hot days, and almost an additional month of nighttime temperatures exceeding 20°C. Irrespective of the IPCC emission scenario considered, the city of Athens is projected to experience a temperature increase of 5–7°C by the end of the century, which implies a very large number of future heat wave days. Analyzing regional climate models (RCMs), it is computed that significant warming trends are expected for hot extremes (warmer absolute maximum temperatures by 2–5°C) for both the near future (mid-century) and far future (end of century), underlining that the extremely hot summer of 2007 in Greece is likely to be the new normal towards the middle/end of the 21st century.

¹⁰⁹ Tolika K., Anagnostopoulou C., Maheras P., Vafiadis M. 2008. Simulation of future changes in extreme rainfall and temperature conditions over the Greek area: A comparison of two statistical downscaling approaches. *Global and Planetary Change* 63, 132–151.

¹¹⁰ Giannakopoulos C., Kostopoulou E., Varotsos K.V., Tziotziou K., Plitharas A. 2011. An integrated assessment of climate change impacts for Greece in the near future. *Regional Environmental Change* 11, 829–843.

¹¹¹ Tolika K., Zanis P., Anagnostopoulou C. (2012) Regional climate change scenarios for Greece: Future temperature and precipitation projections from ensembles of RCMs. *Global NEST Journal* 14, 407421.

¹¹² Daliakopoulos IN, Panagea IS, Tsanis IK, Grillakis MG, Koutroulis AG, Hessel R, Mayor AG, Ritsema CJ. 2017. Yield response of Mediterranean rangelands under a changing climate. *Land Degradation & Development* 28, 1962–1972.

¹¹³ Kotroni V, Cartalis C., Michaelides S, Stoyanova J, Tymvios F, Bezes A, Christoudias T, Dafis S, Giannakopoulos C, Giannaros TM, Georgiev C, Karagiannidis A, Karali A, Koletsis I, Lagouvardos K, Lemesios I, Mavroukou T, Papagiannaki K, Polydoros A, Proestos Y. 2020. DISARM early warning system for wildfires in the eastern Mediterranean. *Sustainability* 12, 6670; Koutroulis AG, Papadimitriou LV, Grillakis MG, Tsanis IK, Wyser K, Betts RA (2018) Freshwater vulnerability under high end climate change. A pan-European assessment. *Science of the Total Environment* 613–614, 271–286.

¹¹⁴ Cammalleri C., Naumann G., Mentaschi L., Formetta G., Forzieri G., Gosling S., Bisselink B., De Roo A., and Feyen L. (2020). “Global warming and drought impacts in the EU,” JRC PESETA IV project – Task 7.

¹¹⁵ Kotroni, V.; Giannaros, T., Papavasileiou, G.; Lagouvardos, K., Dafis, S. 2021.

According to the PESETA IV report,¹¹⁶ climate projections until 2100 indicate pronounced intensification of heat waves, especially in southern Europe. At the same time, cold waves are projected to become less and less frequent. In Greece, several studies¹¹⁷ confirm significant expected warming of the country, with increase in duration and intensity of heat waves. Studies have more particularly focused on large cities in which a significant increase in the number of hot days, with an increase in maximum temperatures, is also projected until the end of the century. The direct consequences of heat waves for human health are also reported; heat waves increase mortality by affecting cardiac, cerebral, and respiratory conditions.

Wildfires

Super heat waves, long dry periods, and mega-fires are linked to the impact of climate change in southern Europe. A recent study¹¹⁸ suggests that even if the Paris Agreement goal of less than 1.5°C of temperature increase is met, the burnt areas of the Mediterranean region will be 40 percent larger than today. Moreover, if the worst climate scenario (3°C temperature increase) materializes, these figures will be double. This result is linked to the fact that climate defines the fire regime in a given geographic area by determining the typology and form of the vegetation in that area, as well as its susceptibility to fire. At the same time, weather defines the way the vegetation (fuel) will be burned.

Although wildfires are very common in Greece, the number of studies focusing on future projections for wildfire hazards is limited. Considering that wildfires are strongly influenced by climate and weather, most of the existing work focuses on projections of future fire weather conditions, whereas only two studies in the literature review attempted to provide projections of future wildfire behavior. Overall, there is strong agreement that a warmer climate will set the stage for more and extreme wildfires.¹¹⁹ Researchers have concluded that critical fire risk days are projected to increase by as many as 50 days by the end of the 21st century, with local hot spots found in the eastern Peloponnese, Attica, central Macedonia, Thessaly, and Crete. Heat-induced fire weather is projected to increase by 14% in the Mediterranean by the end of the century, implying an increase in the number of wildfires in Greece by approximately 29% under the worst-case emissions scenario.

The PESETA IV report on wildfires in Europe¹²⁰ found a marked increase in predicted days with high-to-extreme fire danger in parts of Greece. The five Mediterranean countries—Portugal, Spain, Italy, Greece, and France—contribute 85% of the total burnt area in Europe per year. The PESETA IV report on forest

¹¹⁶ Naumann G., Russo S., Formetta G., Ibarreta D., Forzieri G., Girardello M., and Feyen L. (2020). “Global warming and human impacts of heat and cold extremes in the EU,” JRC PESETA IV project – Task 11.

¹¹⁷ NOA, Meteo Unit (2021b).

¹¹⁸ Marco Turco, Juan José Rosa Cánovas, Joaquín Bedia, Sonia Jerez, Juan Pedro Montávez, Maria Carmen Llasat y Antonello Provenzale. 2018. *Exacerbated fires in Mediterranean Europe due to anthropogenic warming projected with non-stationary climate-fire models*. Nature Communications, 2 October 2018. <https://www.nature.com/articles/s41467-018-06358-z>.

¹¹⁹ Kotroni, V.; Giannaros, T., Papavasileiou, G.; Lagouvardos, K., Dafis, S. 2021.

¹²⁰ Costa, H., de Rigo, D., Libert, G., Houston Durrant, T., San-Miguel-Ayanz, J., European wildfire danger and vulnerability in a changing climate: towards integrating risk dimensions, EUR 30116 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN: 978-92-76-16898-0, doi:10.2760/46951, JRC119980.

vulnerability¹²¹ discusses the impact of climate-driven disturbances in forests and the loss of forest services, such as carbon sequestration and supply of wood materials. The analysis undertaken in the report investigates in a systematic and spatially explicit manner the susceptibility of European forests when exposed to fires, windstorms, and insect outbreaks. An issue to be further investigated is that the report found that vulnerability to fires in Greece shows prominent decreasing trends in contrast with the general tendency in the rest of Europe, possibly driven by a reduction in available fuel (vegetation productivity).

Storms

The available literature suggests an overall attenuation of storms up to the year 2100, albeit with nonsignificant changes in the magnitude of extreme events.¹²² Research suggests an overall reduction of wintertime storm surges all over the Mediterranean, including Greece.¹²³ Under future climate conditions, the attenuation of storms does not seem to be related to the magnitude of extreme events, but rather to the duration, coverage, and local peak frequencies. Spatial analysis finds that storm surges in northern Greece are projected to remain stably larger than in the southern part of the country, thus exposing lowland coastal areas to higher flooding risk. There are expected increases in storm surge levels, including over the Aegean and Ionian Seas, while for the deltaic region of the Nestos River in northern Greece¹²⁴ there is an expected decrease of storm surge levels.¹²⁵

Mediterranean cyclones¹²⁶

Research suggests a general reduction of cyclone occurrence and an increase in their intensity up to the year 2100.¹²⁷ Most of the studies devoted to Mediterranean cyclones and the expected climate changes focus on either the western or eastern part of the Mediterranean, while there is not a single study focusing explicitly on Greece. Several studies simulating cyclones using global climate models (GCMs) and RCMs to assess future trends have produced contrasting results. The reduction in cyclone activity found by research studies has ranged from 10% to 35% in the Mediterranean.¹²⁸ Other studies have found that cyclones that occur in early autumn in the region will increase in intensity, albeit with high uncertainty

¹²¹ Forzieri G., Girardello M., Ceccherini G., Mauri A., Spinoni J., Beck P., Feyen L., and Cescatti A. *Vulnerability of European forests to natural disturbances*, EUR 29992 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-13884-6, doi:10.2760/736558, JRC118512.

¹²² Only a few studies have been carried out over the course of the past five years, and they focus on either storm surges or significant wave heights, rather than on the impacts of the storms themselves. Kotroni, V.; Giannaros, T., Papavasileiou, G.; Lagouvardos, K., Dafis, S. 2021.

¹²³ Androulidakis YS, Kombiadou KD, Makris CV, Baltikas VN, Krestenitis YN. 2015. Storm surges in the Mediterranean Sea: variability and trends under future climatic conditions. *Dynamics of Atmospheres and Oceans* 71, 56–82.

¹²⁴ Vousdoukas M.I., Voukouvalas E., Annunziato A., Giardino A., Feyen L. 2016. Projections of extreme storm surge levels along Europe. *Climate Dynamics* 47, 3171–3190.

¹²⁵ Skoulikaris C., Makris C., Katirtzidou M., Baltikas V., Krestenitis Y. 2021.

¹²⁶ Mediterranean cycles are associated with a broad range of environmental phenomena, some of which have disastrous consequences, such as heavy rainfall and floods, intense thunderstorms, windstorms, storm surges, and landslides.

¹²⁷ Kotroni, V., Giannaros, T., Papavasileiou, G., Lagouvardos, K., Dafis, S. 2021. “Future changes in severe and extreme weather due to climate change”.

¹²⁸ Gaertner MA, Jacob D, Gil V, Dominguez M, Padorno E, Sanchez E, Castro M (2007) Tropical cyclones over the Mediterranean Sea in climate change simulations. *Geophysical Research Letters* 34, L14711; Lionello P, Giorgi F (2007) Winter precipitation and cyclones in the Mediterranean region: future climate scenarios in a regional climate simulation. *Advances in Geosciences* 12, 153–158.

among the examined RCMs.¹²⁹ Mediterranean tropical-like cyclones (medicanes) are projected to decrease in frequency and to show a moderate increase in intensity.¹³⁰

Strong/extreme winds

Research points to a future decrease of winds over the Ionian Sea and an increase over the Aegean Sea.¹³¹ Changes in strong and extreme winds due to climate change in Greece are among the least-documented subjects in the reviewed literature of the past two decades. Recent studies focusing on the projected changes of near-surface winds and their extremes using RCM data under various scenarios provide evidence of robust decreases in mean wind speed over the Ionian Sea and robust increases in mean wind speed over the Aegean Sea. Although windstorms are among the most damaging natural hazards in Europe, the PESETA IV report¹³² shows that no direct correlation between climate change and windstorm risks has been proved. For Greece, windstorms account for only 22% of the intense and impactful phenomena for the years 2000–2020.

Sea-level rise and coastal erosion

Research suggests that the projected sea-level rise could result in significant coastline retreats along the country, in particular in the Aegean Sea.¹³³ Projected increase in sea level by the end of the century could result in a coastline retreat of up to 9 m.¹³⁴ Studies have been carried out focusing on the impact of various sea-level rise scenarios on the erosion of coastal areas and/or coastline retreat. Cretan beaches and those in the Aegean archipelago are found to have significant coastline retreat due to sea-level rise, which also has led to erosion of 31–88% of all studied beaches in the Aegean archipelago.¹³⁵

2.3. Climate change adaptation measures

The following is an overview of adaptation measures that can be considered in identification/prioritization of DRM measures and investments based on current climate change knowledge.

¹²⁹ Gaertner M.A., Jacob D., Gil V., Dominguez M., Padorno E., Sanchez E., Castro M. 2007.; Hochman A., Alpert P., Harpaz T., Saaroni H., Messori G. 2019. A new dynamical systems perspective on atmospheric predictability: Eastern Mediterranean weather regimes as a case study. *Science Advances* 5, eaau0936; Zappa G, Hawcroft MK, Shaffrey L, Black E, Brayshaw DJ (2015) Extratropical cyclones and the projected decline of winter Mediterranean precipitation in the CMIP5 models. *Climate Dynamics* 45, 1727-1738; Zappa G., Hawcroft MK, Shaffrey L, Black E, Brayshaw DJ (2015); Lionello P, Giorgi F (2007); Gaertner MA, Jacob D, Gil V, Dominguez M, Padorno E, Sanchez E, Castro M (2007).

¹³⁰ Tous M, Zappa G, Romero R, Shaffrey L, Vidale PL. 2016. Projected changes in Medicanes in the HadGEM3 N512 high-resolution global climate model. *Climate Dynamics* 47, 1913-1924; Cavicchia L, von Storch H, Gualdi S. 2014. Mediterranean tropical-like cyclones in present and future climate. *Journal of Climate* 27, 7493–7501.

¹³¹ Kotroni, V.; Giannaros, T., Papavasileiou, G.; Lagouvardos, K., Dafis, S. 2021.

¹³² Spinoni J, Formetta G., Mentaschi L., Forzieri G., Feyen L. (2020). "Global warming and windstorm impacts in the EU," JRC PESETA IV project – Task 13.

¹³³ Kotroni, V., Giannaros, T., Papavasileiou, G., Lagouvardos, K., Dafis, S. 2021.

¹³⁴ Valaouris A, Poulos S, Petrakis S, Alexandrakakis G, Vassilakis E, Ghionis G. 2014. Processes affecting recent and future morphological evolution of the Xylokastro beach zone (Gulf of Korinth, Greece). *Global NEST Journal* 16, 773–786.

¹³⁵ Monioudi IN, Velegrakis AF, Chatzipavlis AE, Rigos A, Karambas T, Voutsdoukas MI, Hasiotis T, Koukourouvli N, Peduzzi P, Manoutsoglou E, Poulos SE, Collins MB. 2017. Assessment of island beach erosion due to sea level rise: the case of the Aegean archipelago (eastern Mediterranean). *Natural Hazards and Earth System Sciences* 17, 449–466.

River floods

River floods are the costliest natural disaster in Europe.¹³⁶ The PESETA IV study analyzed costs and benefits across the EU and showed that strengthening existing dike systems by increasing their height can be economical, although with variations in some areas.¹³⁷ In Greece, dike heightening for flood protection may be economical in administrative regions with high concentration of people and economic activity. The results of the benefit-cost ratio (BCR) for Greece are in Table 3.

Table 3. Summary of economic analysis for the adaptation measure of strengthening dyke systems under considered warming scenarios for Greece

1.5°C			2.0°C			3.0°C		
BCR	EAD reduction	Costs (€, millions/year)	BCR	EAD reduction	Costs (€, millions/year)	BCR	EAD reduction	Costs (€, millions/year)
1.1	1%	<1	1.3	7%	1	1.3	19%	2

Source: PESETA IV.

Note: EAD = expected annual damage. BCR is for the period 2020–2100. EAD reduction is as compared with the “no adaptation” scenario for the year 2100. Costs are undiscounted total costs (annual average over the period 2020–2100 in million euros).

Other adaptation measures for river floods include creating retention areas—areas within or beside the river network that can be flooded in a controlled manner. For a 2.0°C warming scenario and socioeconomic projections up to 2100, the BCR for retention areas in Greece is approximately 2.5. Flood proofing through structural and nonstructural modifications of buildings can help prevent or reduce flood damage. Under the same criteria, the BCR for flood damage reduction measures is approximately 2.6. Relocating of people and assets appears to be the least cost-effective measure among all adaptation measures considered in PESETA IV; in Greece, the BCR for relocation is under 1. However, the results for relocation are prone to uncertainty compared to other adaptation measures considered, given that real market values of acquired land and relocation cost variables were available only at the European scale. While not included in the BCR analysis under PESETA IV, other possible adaptation measures include flood EWS, improvement of urban drainage systems, river re-naturalization, and emergency preparedness. The use of nature-based solutions or/and ecosystem-based risk reduction measures to reduce flood risk may also be considered to contribute to climate adaptation measures with positive BCR (World Bank 2021a).

Coastal measures

Adaptation measures to reduce future flood risk in coastal areas include natural structures (dunes) and artificial structures (dikes), beach nourishment, forecasting and warning systems, flood proofing of infrastructures, restricting new construction in future high-risk areas, and ultimately retreat from extensive flood protection infrastructure, such as increasing CO₂ storage, restoration of biodiversity, and offering recreational opportunities. The PESETA IV report’s BCR for raising dikes shows high spatial variability between coastal segments throughout Europe. For Greece, the percentage of the country’s coastline with and without adaptation measures under moderate and high emissions scenarios (RCP4.5

¹³⁶ Dottori, F., Mentaschi, L., Bianchi, A., Alfieri L., Feyen L. 2020. Adapting to rising river flood risk in the EU under climate change, JRC PESETA IV project – Task 5.

¹³⁷ The PESETA IV report produced an economic analysis for all adaptation measures under a 1.5°C, 2.0°C, and a 3.0°C temperature increase in the 2020–2100 period.

and RCP 8.5, respectively) is shown in Table 4 along with BCR from coastline adaptation. The little economic motivation for increased protection relates to several factors, such as natural barriers with steep morphology that sufficiently protect against the projected rise in sea-level extremes. Greece has a high BCR relative to other European countries under both moderate mitigation and high emissions scenarios, indicating that where adaptation is possible, it will provide large economic benefits over time against coastal flooding. The annual average cost of adaptation in million euros per year shows that the cost of dike reinforcement for Greece will be above €20 million/year.

Table 4. Summary of economic analysis for the adaptation measure related to coastal flooding for Greece

% no adaptation		% adaptation		Country BCR with adaptation	
moderate mitigation (RCP4.5)	high emissions (RCP8.5)	moderate mitigation (RCP4.5)	high emissions (RCP8.5)	moderate mitigation (RCP4.5)	high emissions (RCP8.5)
93	92	7	8	11.9	11.6

Source: PESETA IV.

Wildfires

A theoretical analysis of warning systems and public preparedness programs in Greece found a BCR of nearly 40:1 for investing in awareness raising along with fuel management near homes, due to the reduced impact on casualties.¹³⁸ Classification, characterization and mapping of forest fuels is a prerequisite for fuel management planning and for assessing wildfire potential and behavior. Fuel treatment (mechanical removal, grazing or even prescribed burning) is a major tool for preventing forest fire and for facilitating the work of firefighters. Forest vegetation is the only element of the fire triangle that fire managers can modify. Fuel management programs, fuel and fire breaks and forest management measures can mitigate the risk and make effective and efficient the control of the wildfires. Other adaptation measures that may offer benefits are linked to the improved land planning and land development, the building material and design, the forest fire risk awareness and sensitization campaigns and ultimately the informed wildfire evacuation plans. General adaptation options listed in the PESETA IV report on wildfires can lead to decreasing fire risk and to actions that lower the values of wildfire risk components. A study by an Experts Committee appointed in 2018 by the Greek government to analyze the underlying causes of forest fires and to make relative recommendations¹³⁹ suggested specific actions, focusing mainly to forest fire risk prevention. The proposals of the Committee that could be added to the suggestions of the NRA for Greece are the following:

- Classification and characterization (modelling) and mapping of forest fuel types to organize a consistent and documented wildfire risk assessment and propagation studies that will support the mitigation of forest fire risk.
- Utilize forest management and improve forest accessibility (paths and forest roads) aiming to slow-down fire propagation, lower fireline intensity and create favourable conditions for firefighting.

¹³⁸ World Bank Group 2021a.

¹³⁹ Report of the Independent Committee of Experts for the Investigation of the Causes of Fires in the context of the Prime Minister Decision Y60 / 2018 - Government Gazette 3937 / B / 10-9-2018, Athens, January 2021.

- Reduce the exposure to fire risk by controlling forest fuel proximity to human settlements and infrastructures and improve structures' resilience by using proper building codes in the mixed zone of forests with settlements as well as by clearing wildland vegetation around buildings and human infrastructures.
- Enhance wildfire risk perception and strengthen societal resilience by increasing awareness and preparedness for educated and responsible behavior. Education on self-protection, fire safety and short- and long-term health impacts due to smoke and emissions from fires are emphasized along with preparedness campaigns.
- Reduce wildfire risk and ecosystems' vulnerability by reducing fire propagation potential through fuel treatments, control of the flammability of forest fuels and reduction of the fuel load. This can be done by removal of biomass, focused thinning and pruning of trees, and in specific cases by using, locally, native and ecologically adapted tree species that are less flammable (e.g. in the perimeter of villages and settlements).
- Reduce fire danger by reducing the probability of ignitions. Awareness and education campaigns to address negligence, training and information campaigns to respond timely can support the reduction of wildfire ignitions, while the use of fire-safe tools and materials may contribute to reduce the number of fires (e.g., maintenance of the electricity network).
- Improve ecosystem's resilience by adequate environmental and forest management through regional planning and proper landscape vegetation patterns (forestry, agriculture, agroforestry) and adapting forest to climate change and the relative changes in wildfire frequency and severity. Scattered enrichment of conifers with broadleaved species might be considered to strengthen forest resilience and to reduce further the risk of forest fire spreading.
- Perform local fire threat analysis as component of a holistic wildfire-prevention plan. Such plan needs to quantify the probability of fire ignition, assess the expected fire intensity, identify and localize the assets at risk, map (temporal/spatial) the distribution of fire danger and risk and plan the required fire prevention, preparedness and response measures. Local knowledge and experience, wildfire science and advanced fire management technology are key elements to implement such analysis and planning.
- Revise the static map of the zones characterized as prone to forest fire (according to P.D. 575/1980), taking into account risk aspects on top of the forest and bioclimatic information e.g., land use and the expected climate changes.
- Improve the ground monitoring network and air patrolling for early fire detection. Technology can significantly assist in this task, e.g., using drone technology, crowdsourcing etc.
- Ensure the application of the legal framework, such as correct implementation of forest and environmental policies. There is need of brave decisions to solve issues created due to inadequate application (or lack) of past policies, since these challenges will undermine the fire safety for very long.

- Start considering the use of controlled or prescribed burning to reduce surface fuels. This action is not allowed currently under Greek legislation.¹⁴⁰

Forest ecosystems

The NRA includes the impact of fires on agricultural production, particularly on grains, arboriculture, greenhouses, and perennial crops; however, the report does not provide specific adaptation measures for forest ecosystems. The NRA notes as a specific case in this domain (primary production) the economic impacts from the fires in Chios island include the loss of production for approximately a decade, which is the time needed for replanted trees to reach a productive status. It is crucial for DRM planning to consider integrating the management of the Greek forests with the fire prevention objectives. All types of forest ecosystems are threatened by the wildfires. Currently the challenges are localized in the ecosystems of Southern Greece and in the lower altitudes. However, as a consequence of the climate change wildfires will start occurring in northern regions of the country as well as in higher altitudes. Vegetation and fuel treatments combined with multi-purpose forest management, aligned with the climate change impact to the forest ecosystems, is the main and proper way to improve the protection of the environment, strengthen the resilience of the forest and reduce flammability and probability of ignition.

Heat extremes

Mitigation and adaptation measures related to the impact of increasing heat waves, other than overall tackling of global warming, are inevitably linked with nature-based solutions. Especially in large cities, where the urban heat island effect is significant, greening of the cities and measures for reducing the energy requirements of buildings should be prioritized. Promoting reforestation inside large cities—by strategically selecting tree locations that offer shade to buildings and thus allow the development of reduced temperatures on their surfaces—is one of the proposed greening measures; as well as expansion of vegetation around/on top of buildings. Improving building insulation is expected to reduce energy consumption by 80–90%, with benefits for urban temperatures.

Windstorms

Even though wind hazard and risk are not expected to be highly affected by climate change, PESETA IV suggests that a range of measures can be taken to increase society's resilience to extreme wind. These include improved preparedness, increased forecast accuracy and warning time, improved societal and government readiness, and improved emergency communications and response. Furthermore, structural measures can also be promoted, e.g., incorporation of wind-resistant design measures in building codes or strengthening of buildings and infrastructures against wind loads.

¹⁴⁰ The Greek PM mentioned following the forest fires of the summer 2021 that prescribed burning will be one of the instruments that will be considered in the near future for forest fuel management purposes and for reducing the wildfire risk.

Water scarcity

Climate projections reveal decreasing water availability in Greece and other southern European countries.¹⁴¹ According to projected changes for scenarios of global warming, the number of water scarcity days is expected to increase to 10 for the most extreme case. In Greece, the number of people facing water scarcity grows by 3.5 million to nearly 9 million—about 80% of the present population—with 3°C warming. Economic activity exposed to severe water scarcity is estimated on the order of €50 billion should no effective adaptation measures be taken. Adaption measures include regulation and management of river basin water resources and improved irrigation practice (e.g., by changing irrigation methods to support the use of surface water, or reuse of treated wastewater, with pricing incentives or more drastic measures, promoting a shift towards crops with lower water needs, etc.). Water saving approaches include pricing incentives for users, different pricing for industrial and public water, and promotion of water-conserving technologies. Transition to renewable energy production, independent of water supply, is also expected to reduce water demand and consumption.

Drought

There is a wide range of measures to increase resilience to droughts, which differ among the sectors potentially affected. Specific measures in drought-sensitive sectors include insurance and other market tools, reduction of water leakages from the distribution networks, improved water use efficiency in various sectors, use of regenerated water, water conservation, desalinization of sea water with renewable energies, improved water harvesting techniques, conjunctive use of surface and groundwater, replacement of cooling system types and fuel switches, design of lighter river navigation vessels, use of drought-resistant crops, changed cropping patterns and timing, capacity building of relevant stakeholders, and early warning and alert systems, among others.¹⁴² It is generally accepted that the returns from investing in ex ante risk management actions are higher than those of investing in ex post crisis management. The actual costs and benefits of adaptation measures can vary substantially depending on the local geographical, climate, and socioeconomic conditions.

Energy supply

PESETA IV¹⁴³ assessed the impacts of climate change on electricity production by renewable energy sources and thermal power plants. In Greece, a projected reduction in water availability negatively affects hydropower and lignite plants, which are projected to reduce their production due to reductions in river runoff, particularly in summer. Water temperatures also limit the availability of thermal plants on the hottest summer days because of environmental regulations. The consequence of reduced production is that other (more expensive) thermal plants increase their production in order to meet the electricity demand. These plants also have to face the reduced water availability for cooling, but they compensate by using their existing excess capacity. According to a 2°C scenario (with mitigation efforts consistent with

¹⁴¹ Bisselink B., Bernhard J., Gelati E., Adamovic M., Guenther S., Mentaschi L., Feyen L., and de Roo, A. 2020. “Climate change and Europe’s water resources,” JRC PESETA IV project – Task 10.

¹⁴² Vogt, J.V., Naumann, G., Masante, D., Spinoni, J., Cammalleri, C., Erian, W., Pischke, F., Pulwarty, R., Barbosa, P. 2018. Drought Risk Assessment. A conceptual Framework. EUR 29464 EN, Publications Office of the European Union, Luxembourg, 2018. ISBN 978-92-79-97470-0, doi:10.2760/919458.

¹⁴³ Després J., Adamovic M. 2020. Seasonal impacts of climate change on electricity production, JRC PESETA IV project Task 4.

2°C warming at global level) in a dynamic context in 2050, where electricity demand and supply evolve over the century, it seems that lignite production won't be affected,¹⁴⁴ while without adaptation measures, capacities may be reduced by 50% on the most affected days. It is commonly observed across Europe that wind and solar plants are not projected to experience large impacts of climate change, and the energy transition towards them may be beneficial for additional reasons.

Economic impacts from climate change

The PESETA IV report¹⁴⁵ evaluates regional impacts from climate change damages on capital stocks, economic production, and the welfare of households. The analysis is performed within five EU regions, aggregating Greece with Bulgaria, Croatia, Cyprus, Italy, Malta, Portugal, Slovenia, and Spain in the *Southern Europe* region. The study finds that welfare losses from coastal floods in the Southern Europe region amount to approximately 50% of all losses in Europe. Over 90% of the drought-related damage in Europe is estimated to occur in the Southern Europe region in the 1.5°C warming scenario, and the share remains very high (75%) in the 2°C scenario and more than 50% in the 3°C warming scenario. Also reported are the changes in electricity production leading to welfare losses in Southern Europe. Overall, more than 80% of the mortality-related welfare losses are estimated to occur in the southern EU region.

2.4. Key observations

Greece is exposed to a range of significant hazards and threats. Hazards considered in Greece's NRA¹⁴⁶ are earthquakes, floods, forest and wildland fires, extreme weather events, tsunamis (potential risk), landslides, volcanos (potential risk), cyber risks (emerging risk), industrial accidents, and radiological/nuclear accidents. Among these, earthquakes, floods, and forest fires are the main disasters affecting Greece in terms of loss of life, financial impact, and impact on business continuity. In addition, climate change projections of increasing weather volatility predict a worsening of disaster impacts. The following can be highlighted considering the impact of hazards with high probability of occurrence according to the NRA and to the literature on future projections.

- **In line with the Greek NRA, floods are the hazard most likely to occur.** Floods due to heavy rainfall are the phenomenon that most often triggers declaration of emergency state in Greece. Flash floods in particular have been by far the most hazardous weather-related phenomenon, in line with relevant studies for the Mediterranean region, which provide evidence of significant flood risk in the area.¹⁴⁷ Flash floods also constitute the most serious weather-related threat to human lives, especially those due to autumn and winter rainstorms. It is noted that flood hazard and risk mapping is well advanced

¹⁴⁴ It should be noted, however, that according to the announced program of the Greek de-lignification program, all lignite units will be shut down by 2023.

¹⁴⁵ Szewczyk, W., Feyen, L., Matei, A., Ciscar, J.C., Mulholland, E., Soria, A. 2020. Economic analysis of selected climate impacts, EUR 30199 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18459-1, doi:10.2760/845605, JRC120452.

¹⁴⁶ KEMEA & GSCP. 2019. National Risk Assessment for Greece (NRA-GR).

¹⁴⁷ Petrucci, O., Pasqua, A. A., and Polemio, M. 2013. Impact of Damaging Geo-Hydrological Events and Population Development in Calabria, Southern Italy, *Water* 5:1780-1796; Llasat, M. C., Llasat-Botija, M., Barnolas, M., López, L. and Altava-Ortiz, V. 2009. An analysis of the evolution of hydrometeorological extremes in newspapers: the case of Catalonia, 1982–2006, *Nat. Hazards Earth Syst. Sci.* 9:1201–1212.

because of the EU Floods Directive. Despite recent advances in technologies for risk mitigation, flash flood events with adverse effects increased significantly during the last two decades.

- **The entire Greek territory is considered earthquake-prone considering that seismic faults are distributed throughout the country.** However, while seismic hazard and risk assessment in Greece is well advanced compared to other hazards, there are limitations in the exposure data needed to assess seismic vulnerabilities and risks.
- **Forest fires are very likely to occur in the country.** Most of the forest and wildland fires in Greece occur in altitudes less than 1,000 m, where Mediterranean vegetation prevails and where most of the human activity takes place. In recent decades, a significant increase of forest fires has been observed. In fact, since 1980 the number of fire events has doubled, and the extent of the burnt area has tripled.
- **Extreme weather events with moderate impact to life and health are also very likely to occur, and landslides with moderate impact are next most likely.** Major climate change effects in Greece are expected to be in the form of extreme weather events (such as heat waves and droughts) as well as rising sea levels. Landslides occur as a cascading event following an earthquake or an extreme weather event (heavy rainfall). In Greece, landslide activity has been increasingly high over the last decade because of urbanization and development (roads, dams and reservoirs, industrial and urban activities) in landslide-prone areas, continued deforestation, and extreme meteorological events, resulting in a significant increase in total economic losses.

The level of understanding of risk differs across the main hazards. For example, flood and earthquake risk maps are well advanced, while the understanding of climate change projections is more limited, both at national and subnational levels. While flood hazard and risk mapping have already been conducted in Greece (as a result of the EU Floods Directive), there are little provisions for comprehensively mapping other hazards and consequent risks, e.g., forest fire hazard may need updating to further improve the wildfire risk assessment capabilities and fire risk communication accordingly. Regarding climate change, further studies should be developed to be used for DRM.

While the NRA represents an important step toward a unitary risk assessment at the national level, it also reveals significant limitations in Greece's data infrastructure, which is needed for efficient DRM. Greece needs a more in-depth, reliable, and relevant risk assessment (at least for the major hazards), one that includes sensitivity analyses for upper- and lower-bound results. Such a risk assessment may employ the methodology established at the national level and input data on the elements at risk but should have a higher resolution and more detailed technical significance of exposure data. This risk information can be used to make asset-level decisions on investment in prevention and risk reduction and develop scenarios needed for planning, prevention, preparedness, or cost-benefit analysis of DRM measures.

A uniform analysis of climate change risk projections over time is needed at the national and subnational level to better prepare for mitigation and adaptation to climate change. A systematic evaluation of climate change using the latest regional models and projection data is required to improve understanding of and prioritize climate risk management. A gap that needs to be filled is the recording of

the financial cost of each hazard event¹⁴⁸; this information is needed to conduct risk analysis with quantitative indicators of high accuracy and comparability. The most common indicators of financial cost are insured and uninsured losses. However, the collection of data about uninsured losses such as governmental compensations is particularly difficult, mainly due to the bureaucratic processes and multiple institutions often involved and the fact that such data have not been digitized comprehensively. Access to insured data is also very difficult for reasons of confidentiality. Overcoming the problem of financial data availability will allow better assessment of risks and losses in comprehensive quantitative terms, which will allow better and more targeted risk management, based on past data and projected estimates.

An effective DRM plan requires a better understanding of the risks facing Greece, including multi-hazard impacts, and filling various information gaps. The establishment of a homogenous methodology for risk assessment with common impact outcomes for all hazards and a framework for understanding risk scenarios could enable the following urgent actions, among others: (i) risk-informed urban plans; (ii) prioritization of prevention and risk reduction; and (iii) development of response and emergency plans at urban scale informed by scientific risk evidence.

There are opportunities to collaborate with academia and research institutes to ensure the robust quality of such a risk assessment framework. If an effort to unify risk assessment is made under a national policy for safety and security, all hazards and threats (natural, technological, anthropogenic) and coupled risks should be identified and ranked, with the same qualitative methodology of assessment and levels and components of risk. Going forward, the newly established Risk Assessment Committee could have a role not only in designating preventive risk reduction projects, but also in identifying and understanding risk scenarios to be implemented in a future NRA or local studies, and in selecting potentially relevant financing. Moreover, multi-hazard probabilistic scenarios could help in comparing risks associated with different hazards and could inform different types of decisions, such as investment planning for prevention, risk reduction, or decisions on improving disaster response readiness or financial preparedness. This type of risk assessment could be particularly useful to inform risk financing strategies or specific instruments.

In addition, to increase the resilience of the build environment, risk assessments at the regional and local levels should be undertaken and harmonized with the national understanding of risk; this effort can be technically supported by the central authorities or specialized experts. Guidance and training should be provided through national channels or peer-to-peer networks (for example, local governments and regional governments can discuss risk assessment at annual meetings with mayors and governors, respectively). It is also recommended that various reports and ongoing project results at all levels of government be coordinated and synthesized in a common space, providing access and information to all competent and interested authorities. A comprehensive document could be annually generated that summarized findings of abovementioned projects, short- and long-term impacts of climate change, proposed corresponding strategies and prioritization of future investments to reduce risk based on

¹⁴⁸ There is also scope for quantitatively estimating the potential environmental and cultural impacts of specific hazards, in addition to economic dimensions.

scientific evidence. A key element would be to define the objectives and intended use of risk assessments, and what impacts should be addressed, such as physical damage, socio-economic impacts, environmental and cultural impacts, business disruption, and/or impacts on well-being.

In addition, for better DRM, a risk information system geared towards operationalization needs to be established. A risk data inventory, along with consultations with data providers and data users, could help to clarify the risk data (hazard, exposure, vulnerability, and loss) that has already been produced. Supported by modern information and communication technology, an information system/database/inventory of risk information with attributes relevant for different types of risk assessments (floods, earthquakes, forest fires, extreme weather, landslides, and so on) could offer many benefits and enhance the understanding and sharing of risk information. Such a database would be aligned with the EU's INSPIRE Directive.¹⁴⁹

Key data sets could be available to all national and subnational agencies with responsibilities for DRM, climate change, and urban and development planning, to enable the conduct of different types of risk assessments. Key underlying data sets that can be used to produce maps may include land use and vegetation, built-up layer, soil and geology, topography, river networks, transport, public buildings, critical infrastructure, residential building typologies, demographic information/population forecasts, GDP production, replacement costs, climate change projections, and so on. Furthermore, risk information on exposure and vulnerability needs to be expanded and systematized. Key exposure data may include transport systems, education facilities, hospital and medical facilities, emergency response buildings, demographics (age, gender, income levels, and so on), and residential, commercial, and industrial buildings (replacement costs and structural characteristics necessary for vulnerability assessment), as well as data on fragile terrestrial and maritime ecosystems and protected areas.

An inventory of public properties and cultural heritage assets could be created that would include data attributes related to their first-degree vulnerability assessment, obtained from the rapid visual screening. Rapid visual screening could narrow down the sample of buildings requiring more in-depth technical expertise, thus saving time and valuable resources. This would allow buildings to be categorized by structural typologies and determine the most vulnerable buildings, which would be prioritized for risk reduction—to be retrofitted or demolished/rebuilt.

It could also assist prioritization of structural interventions by the regional administrations or other building owners, towards a DRR national strategy. Such data sets would enable more granular risk assessment that could also consider indirect/second-order impacts, which for the business sector, for example, are often more substantial than direct impacts. Related to critical infrastructure and more generally to sensitive information, sensitive data needs to be handled carefully according to specific regulations (for industrial zones, critical facilities, and so on), but access could potentially be tiered to ensure access for public service use and/or research to produce robust analyses. Considering health-related risks, epidemiological and other critical information should be collected in a single repository

¹⁴⁹European Commission. 2007. Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

(EODY and its reference centers). This approach would improve the consistency and comparability of available data.

The cooperation of the government with public owners of critical infrastructure, academia, and research institutes could enhance the initiative to aggregate risk information on the built environment, including critical infrastructure and other public assets, the residential sector, cultural heritage, and the population at risk. In addition, risk information should be gathered about natural environment and protected terrestrial and maritime ecosystems under EU Natura 2000 network. To facilitate the expansion of risk data on publicly and privately owned assets, the government could employ a differentiated, step-by-step process for risk data collection as well as reporting mechanisms for critical infrastructure and public assets. For example, a risk data repository could be created, providing easy access to hazard and climate change scenario data as well as mapping of vulnerable groups and critical infrastructure. This would require public investment for development or acquisition of data, given that much of the elaborated information so far is the outcome of EU and state-funded projects. All the information or data that would be uploaded to this repository might not be publicly available, but specific access criteria could be applied. Researchers and institutions could also benefit from the exposure and other data and use them to conduct risk analyses for hazards that have not yet been assessed. Moreover, institutions and organizations that have already produced and disclosed their data could be incentivized to find, organize, and upload their data to the platform.

Related to sharing of information with the public, the interface and sharing of information could be improved to raise awareness. An option is to make risk maps available on INSPIRE or other GIS-enabled public platforms, and to provide information to the public as part of awareness-raising programs to explain the results of such assessments. Researchers, practitioners, and the wider public could also benefit from an online sharing mechanism or a platform to facilitate exchange about completed/ongoing/planned projects, research and studies, and results. Such a mechanism would ensure the sharing of lessons learned, building on peer research and information of policies.

3. Chapter: Priority Measures for Disaster Prevention, Preparedness, and Response

This chapter summarizes the proposed disaster prevention, preparedness, and response measures,¹⁵⁰ along with overarching goals, based on available information about national CP-related initiatives, information collected in stakeholder consultations, and additional recommendations that can be considered. A proposed prioritization approach is described considering criteria such as levels of risk, economic impact, capacity gaps, effectiveness and efficiency, and possible alternatives.

3.1. Focus areas and overarching goals for priority measures

The proposed NDRMP is structured across six multi-hazard focus areas for CP/DRM to promote risk prevention, preparedness and response. These six areas are: risk governance; understanding risk; risk reduction; early warning systems; emergency preparedness, response, and recovery; and financial protection. These cover all phases of CP/DRM contributing to risk prevention, preparedness and response to different extent. The focus areas are interrelated, for example risk information (understanding risk) feeds across all other focus areas. Risk prevention in the broader sense is closely connected with several aspects including risk information, improved risk governance, risk reduction/mitigation, and elements of preparedness (including early warning systems), as well as financial resilience. Assessing the functionality of EWS typically considers four key elements: (i) risk knowledge, (ii) monitoring and forecasting, (iii) dissemination and communication, and (iv) preparedness, with (i) covered under the understanding risk focus area; (ii) and (iii) covered under the EWS focus area; and (iv) covered under emergency preparedness, response, and recovery. In practice, also many DRM measures will be combined to enhance overall impact in terms of prevention of and preparedness for disasters. For example, EWS for forest fires can be effectively linked with preventative measures like clearing.

Within each focus area, specific overarching goals are proposed (Table 5) which are relevant for multi-hazard/cross-cutting as well as hazard-specific priority measures. Within the overarching goals, there is scope to also prioritize based on most critical/emerging hazards and climate change trends as noted in Chapter 2, and further information is provided in the hazard-specific tables.

Table 5. NDRMP horizontal focus areas and overarching goals for priority measures contributing to disaster prevention, preparedness, and response

Disaster prevention, preparedness and response	CP/DRM multi-hazard focus areas	Overarching goals for priority measures
	Risk governance	<ul style="list-style-type: none"> • The new CP framework is operationalized, and coordination mechanisms strengthen different CP/DRM phases/focus areas • Capabilities of CP professionals and stakeholders at different administrative levels are strengthened based on their needs across different CP/DRM phases/focus areas/hazards, including through infrastructure, equipment, ICT tools, human and financial resources, technical and operational skills

¹⁵⁰ For terminology, see European Commission. 2021. Disaster preparedness. Directorate-General for Civil Protection and Humanitarian Aid Operations. [Link](#); DG ECHO. 2006. *Disaster Preparedness and Prevention (DPP): State of Play and Strategic Orientations for EC Policy*. [Link](#)

		<ul style="list-style-type: none"> Disaster and climate resilience is integrated into sectoral legislation, strategies, and plans to enable scale-up of investments across different CP/DRM phases/focus areas
	Understanding risk	<ul style="list-style-type: none"> Understanding of risk for individual/multi-hazard impacts is improved especially those of specific importance and emerging hazards, including information on exposure and vulnerability as well as climate change An information system is established with systematized risk information geared towards operational use of risk information by different stakeholders Generation and use of risk information benefits from links from research and innovation, shared in appropriate ways among different stakeholders
	Risk reduction and prevention	<ul style="list-style-type: none"> Regional and local authorities are able to integrate risk information and risk-informed approaches into spatial and development planning Risk prevention and reduction (mitigation) investments are scaled up across different administrative levels and sectors with immediate focus on priority hazards as well as sectors, including emergency management, health, education, and transport, through dedicated funds and operational programs Public awareness for ex-ante prevention as well as financing for prevention is strengthened
	Early warning systems	<ul style="list-style-type: none"> Capabilities and systems for monitoring and forecasting systems are improved for priority as well as emerging hazards, with an increasing ability to issue impact-based warnings Communication and dissemination of early warnings are improved at different levels and for various users, including the establishment of feedback mechanisms from users of EWS and the implementation of Common Alerting Protocol
	Emergency preparedness, response, and recovery	<ul style="list-style-type: none"> The Nat-CHAMM is fully operationalized with an efficient national Communication, Coordination, and Information (C4I) system, including updated emergency response plans and procedures at different levels and sufficient preparedness and intervention resources, including infrastructure, equipment and tools, human and financial resources; new technologies are utilized, and robust selection criteria followed There is adequate stakeholder capacity and coordination for emergency preparedness response and recovery, focusing on the local level and readiness of critical elements, across key and emerging hazards There is public awareness and community readiness for response and recovery, including using user-friendly platforms/dissemination methods and participatory approaches
	Financial protection	<ul style="list-style-type: none"> An overarching disaster risk financing strategy is in place based on comprehensive financial analysis of financial risks and assessment of feasible instruments, including a national perils pool Public awareness of risk insurance among general public as well as private sector is improved through sharing of information and education

The overarching goals are well aligned with the various strategic initiatives and planned programs/investments related to CP/DRM. These are (i) the AEGIS plan, (ii) the ESIF-financed OP for CP 2021–2027, (iii) the NRRP, and (iv) the European Investment Bank (EIB) loan for COVID-19 disaster prevention and climate adaptation; (v) and the proposed special sectoral development program for natural disasters under the National Development Program 2021–2025.

- **The AEGIS plan's** four axes of intervention include (i) upgrading of infrastructure, facilities, and provision of training programs; (ii) [early] warning systems and prevention means; (iii) equipment and support and coordination resources; and (iv) operational equipment and means of response.

- **The ESIF-financed OP for CP 2021–2027 proposes seven subcategories:** infrastructure; human resources training; smart monitoring and managements systems; airborne equipment; forest firefighting, prevention, and response equipment; COVID-19 measures; and other “soft” (nonmaterial) measures.
- **The NRRP includes several investments in DRM/CP under Axis 1.4 Green Transition Pillar,** such as development of aerial means for crisis management, development of an innovative monitoring and management system, establishment of a strategic National Disaster Risk Management, forest firefighting, risk prevention, reforestation, response equipment, and implementation of Regional Civil Protection Centers (PEKEPP) through public-private partnership (PPP) schemes.¹⁵¹
- **The EIB framework loan** also supports the upgrading of the operational and administrative capabilities of the CP mechanism in Greece. It will finance new equipment for use by the Hellenic Fire Service, including helicopters and aircraft to fight wildfires and medical evacuation emergencies; and cover the expenses for the creation of 13 regional CP teams, new communications networks, and IT systems to use across the country.
- **A proposed special sectoral development program under the National Development Program 2021–2025** focuses on prevention, preparedness, and response/recovery for natural disasters.¹⁵² While the proposal has not been approved and remains under consideration, expected works include the upgrading of infrastructures of CP services, maintenance and upgrading of office equipment and machinery equipment, training of staff of volunteer groups, procurement of personal protective equipment and movable medical equipment, designation of spaces for CP at entrance points (airports, ports), and lease of aircrafts.

3.2. Horizontal and hazard-specific priority measures

The proposed NDRMP includes a list of priority prevention, preparedness, and response measures that have been identified covering three time periods: 2025, 2030, and 2040. These include horizontal measures, which pursue risk management for multiple hazards, as well as hazard-specific measures. The presented priority measures draw on (i) available information about national programs related to CP, such as AEGIS, priorities listed in the NRRP, and so on; (ii) list of ongoing, planned, or considered projects/initiatives led by various institutions as provided during the consultation process by the local, regional, and municipal authorities (see **Annex 1 and Annex 2**); and (iii) additional measures based on a diagnostic analysis of gaps and needs of the CP/DRM framework in Greece.¹⁵³

¹⁵¹ Information according to pp. 44–45 of European Commission. 2021. Commission Staff Working Document Analysis of the recovery and resilience plan of Greece Annex to the Proposal for a Council Implementing Decision on the approval of the assessment of the recovery and resilience plan for Greece (SWD (2021) 155 final), Brussels, July 17, 2021 {COM(2021) 328 final}.

¹⁵² Government of Greece. 2021. “Draft Proposal for A special sectoral development program within the National Development Program 2021-2025.” Ministry of Citizen Protection and GSCP. Athens, January 2021, pp. 100–101.

¹⁵³ World Bank. 2021. World Bank Reimbursable Advisory Services - Greece Disaster Risk Management Plan (P173630). May 2021. Output 1 “Report on the diagnostics and proposed roadmap for reforms aimed at accelerating disaster preparedness, prevention and emergency response in Greece.”

Listed measures include a description, applicable time period, and responsible institutions. Some measures are already planned for implementation with specific financing/under a specific program, while others are at the planning stage. The additional priority measures proposed are those that can be considered by authorities in the coming years, as they are complementary to the already planned measures. Planned measures are listed at the top of the hazard-specific matrices and additional measures are listed below these.

Horizontal measures are considered a high priority as they are expected to contribute to preventing and reducing risks from multiple hazards. They have been identified through diagnostic analysis and informed through the consultation process. The multicriteria analysis is not applied to these multi-hazard measures. The list is included in Table 6.

Priority hazard-specific measures are provided for most significant hazards. These include earthquake (Table 7), floods (Table 8), forest/wildland urban interface (WUI) fires (Table 9), heat wave and droughts (Table 10), climate extreme events (Table 11), landslides (Table 12), human infectious diseases (Table 13), technological hazards (Table 14), and CBRN hazards (Table 15). The first group of measures reflects the common priority measures shared by stakeholders at the national, regional and local administration level, while additional measures are recommended measures based on international approaches, future projections and relevant research. For all measures listed, the MCA is applied with results available in **Annex 3**.

Based on the information shared during the consultation process which included municipalities, regional authorities, and central-level institutions, several overarching observations can be made as listed in the sections below, with more details in Annex 2. While the consultation process yielded substantial response, it does not provide a comprehensive summary of all measures that the different stakeholders undertake or plan. The gaps observed were included for consideration among additional measures in the horizontal table of measures and the hazard-specific measures to ensure a comprehensive approach balancing different types of measures across all priority hazards.

Measures submitted by municipalities

Based on the responses received during consultations it was noted that most measures collected include actions for most-common hazards. These include WUI fires and floods, although a large number of measures is related to “multiple hazards.” While the majority of measures focus on prevention, however they are segmented and only few can be considered aligned to the strategic approach of the CP-OP to secure coordinated risk prevention in the long term. . Municipalities suggest prevention measures and actions to address key risks at the local scale. However, it is observed that municipalities tend to invest in short term prevention measures that are related to disasters they have encountered in the past. Although municipalities are expected to conduct long-term strategies (Operational Plans / Strategic plans) it seems that there is a lack of long-term DRM investments that will prevent the municipality in encountering a potential challenge based on future projections. This trend shows that local authorities may be missing long-term strategic plans with projections of future risks based on thorough assessments of their assets’ vulnerability. For example, infrastructure measures, such as flood prevention construction

works, seem to be planned or implemented mainly in areas that have been damaged by a past disaster and not necessarily in areas prone to future disasters based on studies or relevant predictions. This trend may also be linked to the fact that out of the 1,000 measures collected, only 79 measures are studies. Notably, there were no measures shared nature-based solutions for flood protection although such measures can be supported by the new operational program “Civil Protection 2021-2027”. Only two municipalities included the development of their Action Plan for Energy and Climate, and only one municipality listed efforts to establish an environmental observatory for monitoring and assessing environmental indicators.

The majority of prevention measures collected focused on first- and second-degree pre-seismic assessments of public buildings, as well as interventions for energy efficiency upgrade. This is likely due to the funding recently made available through “Antonis Tritsis” AT011 “Actions for infrastructure in need of earthquake protection (pre-seismic inspection)” provided by the Mol. For example, 49 municipalities listed measures for pre-seismic assessments, which highlights the importance of providing funds for prevention to local and regional authorities that can support prioritization of the DRM investments and long-term scale-up of prevention and risk reduction efforts at the local level.

There were several measures for community preparedness and supporting of CP volunteer groups, and a limited number of participatory measures such as mobile applications, evacuation route maps, and training sessions for citizens in case of an emergency. Very few municipalities seem to be planning or implementing actions for supporting CP volunteer groups. The municipalities that excel in community preparedness are the same ones that also prioritize the support of volunteers in their DRM planning. The majority of citizen awareness actions that were mentioned by the municipalities focused on earthquakes. This highlights the opportunity to link public engagement with other measures.

In the measures collected, urban planning was not commonly linked to DRM/CP. Only four municipalities mentioned the development or update of their urban master plans or urban development plans. While the majority of disasters depend largely on the urban fabric expansion and its impact on the natural environment, as well as on the appropriateness of the existing land uses, authorities tend to plan for civil protection independently from urban planning. The urgency of the upcoming risks due to climate change calls for immediate actions that reconsider the current urban and development planning practices and pursue a more sustainable and resilient approach.

Measures submitted by regional authorities¹⁵⁴

Based on the responses received during consultations it was noted that while the planned and ongoing measures collected cover all phases of disaster, the majority focus on prevention (protection works) and reconstruction (rehabilitation works following recent destructive events). The majority of the measures are expected to tackle multiple hazards. There were several gaps noted related to focus of the investments, related to hazards (some hazards are less in focus) or actions (types of DRM measures). The

¹⁵⁴ Note that projects submitted by the region of Attica under the Regional Operational Program (ROP) were received after the data analysis was completed. .

gaps were then considered and additional measures proposed in the hazard-specific tables, as well as more generally in the horizontal table of proposed measures.

- **Flood-related projects mostly include flood protection measures, studies, and works for water flow management of streams and rivers or cleaning of banks.** Urban flood protection works (e.g., culvert cleaning and construction of rainwater drains) are also included. Reconstruction investments refer to rehabilitation of infrastructures from flood events.
- **Projects related to multiple hazards** in several cases refer to flood protection works that are expected to upgrade infrastructures and the surrounding area, in parallel to works for other events (e.g., extreme weather, landslides). Investments that mainly refer to civil protection response (such as supply of equipment) are expected to tackle multiple hazards needs, as well as the development of IT systems for monitoring and assessment of climate change impact and general weather-related hazards (e.g., by the region of Epirus).
- **Related to earthquakes, the Ionian Islands region has several measures related to the** development of a technological system with integrated seismicity and seismic vulnerability data, the provision of seismicity monitoring tools, and conducting of risk awareness workshops and preparedness exercises. The region of Crete has integrated into funding the configuration and upgrade of assembly points in Chania in case of an earthquake.
- **There were not many investments related to forest fires,** other than those focusing on developing IT systems and supply of equipment for fire detection, monitoring of fire-prone areas, and fire risk assessment, as well as decision-making systems with real-time data processing.
- Most of the **extreme weather-related** investments lie within the reconstruction phase and refer to urgent maintenance and rehabilitation of road and other infrastructures after snowfalls and other extreme weather phenomena. One interesting investment is the provision of a system for weather data elaboration and monitoring at regional unit level, the implementation of which needs to be in accordance or combination with national alerts. **Climate change** adaptation measures are not particularly mentioned, other than a research program that the region of Crete participates in.
- Notable are several projects related to **coastal erosion** in Crete, the program against **infectious diseases of animals** by the region of Epirus, and a funding request to develop special plans for response to large-scale **technological accidents** for SEVESO installations in Crete.
- **Related to climate change adaptation,** the region of Attica pursues an approach to ensure complementarity and synergy among plans and available funding instruments for prioritizing the implementation of the actions listed in their recently developed climate adaptation plans. In doing so, they secure the coordinated implementation of their strategic plans while also setting an example for the rest of the regions to follow.

Measures submitted by ministries and institutions

Five institutions shared their planned projects and investments, most of them related to prevention/preparedness. A large number of projects (48) correspond to research projects related to

DRM; these are mostly EU-funded projects but include some ESPA projects and other projects funded by regional or municipal authorities. These related mostly to monitoring and risk studies covering a range of natural hazards. GDAEFK shared a long list of expenses within the 2020 budget for compensation of victims of fires, earthquakes, floods, and extreme weather events. The Ministry of Culture and Sports (MoCS) shared intended or ongoing investments, most of them referring to protection measures (prevention) for floods, climate change impact, multiple hazards affecting a series of cultural sites, and earthquake for vulnerable structures. The number of projects related to reconstruction and rehabilitation following destructive seismic, extreme weather, and flood events is also significant.

Table 6. Summary table of proposed priority horizontal (multi-hazard) measures

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
Risk governance <ul style="list-style-type: none"> Operationalize the CP law, and strengthen coordination mechanisms Strengthen the capacity of CP stakeholders Mainstream DRM into sectoral strategies, plans, and investments, and their execution 	<ul style="list-style-type: none"> Complete legislative framework and technical guidance to clarify roles/responsibilities and address existing gaps relevant for different phases of the DRM cycle, especially related to linking prevention and preparedness Complete establishment of the Nat-CHAMM and the Joint Operations Center, with adequate resources in place for different types of hazards and DRM phases Strengthen DRR and response coordination between central and subnational levels as well as with CSOs and private sector starting with key hazards—floods, earthquakes, forest fires, etc. by engaging these groups in emergency preparedness activities Introduce performance monitoring and evaluation system for all participants in the DRM/CP system, including the NDRMP 	Prevention, preparedness, response	<ul style="list-style-type: none"> The new CP framework is operationalized, and coordination mechanisms strengthened different CP/DRM phases/focus areas with clear roles/linkages among different stakeholders Regular progress reports across CP/DRM framework are produced and shared 	2021–2025	Lead: GSCP in coordination with relevant stakeholders
	<ul style="list-style-type: none"> Conduct regular legislative, capacity, and needs assessments in consultations with national and subnational stakeholders, private sector, and professional and scientific organizations; target community representatives to address existing gaps; and promote reforms for specific legislative or DRM aspects 			2025–2030–2040	
	<ul style="list-style-type: none"> Assess the needs of professionals involved in CP/DRM at different administrative levels and provide targeted capacity building 	Prevention, preparedness, response	<ul style="list-style-type: none"> Capabilities of CP professionals and stakeholders are strengthened based on their needs across different CP/DRM phases/focus areas 	2021–2025	Lead: GSCP
	<ul style="list-style-type: none"> Update capacity-building activities related to specific topics identified in consultation at different levels, evaluate and adjust programmes 			2030–2040	
	<ul style="list-style-type: none"> Align targets and planned activities with sectoral investments so that prevention and resilience principles can be integrated across different sectoral/development agendas Coordinate with academic/technical/scientific institutions to effectively utilize capacities across DRM cycle and understand critical investment needs 	Prevention, preparedness, response	<ul style="list-style-type: none"> Disaster and climate resilience is integrated into sectoral legislation, strategies, and plans to enable scale-up of investments in different CP/DRM phases/focus areas 	2021–2025 2030–2040	Lead: GSCP in coordination with relevant stakeholders
Understanding risk <ul style="list-style-type: none"> Improve understanding of 	<ul style="list-style-type: none"> Establish a risk assessment methodology with common impact outcomes for all hazards and a framework for understanding risk scenarios (including considering climate 	Prevention	<ul style="list-style-type: none"> Systematic understanding of risk for individual/multi-hazard impacts is improved 	2021–2025	Lead: GSCP in coordination with

<p>risks with information gaps and multi-hazard impacts</p> <ul style="list-style-type: none"> • Share information among stakeholders • Establish a risk information system geared towards operationalization • Expand and systematize risk information on exposure and vulnerability 	<p>change); which are used for regular updates of the national risk assessment</p> <ul style="list-style-type: none"> • Coordinate existing and planned data compilation with academia and research institutes to ensure the robust quality of the risk assessment framework • Conduct risk assessments for priority asset portfolios/ at different scales 		for different levels, including information on exposure and vulnerability and climate change		central/regional and local levels and research institutes/academia
	<ul style="list-style-type: none"> • Complete the rapid visual screening of all public buildings specific to hazard vulnerability and upload the inventory of public properties on the data platform, including data attributes related to buildings' first-degree seismic vulnerability assessment • Continue to expand and systematize risk information • Regularly update risk assessments and maps applying agreed methodology; conduct risk assessments for other types of asset portfolios/scales 			2025–2030–2040	
	<ul style="list-style-type: none"> • Establish a state-of-the-art disaster risk information system covering key hazard which has the capacity to share risk information among different stakeholders and takes climate change, specific information needs, and potential uses of information into account; such a system should enable the development of scenarios to support planning, prevention, preparedness, and cost-benefit analysis of DRM measures/investments. The system should adopt common data formats which allow it to interlink with early warning systems by providing risk knowledge • Train stakeholders to use the system • Make the existing hazard and risk maps available on the GIS-enabled data platform (even if not publicly available, specific access criteria may be applied) 	Prevention/ preparedness	<ul style="list-style-type: none"> • An information system is established with systematized risk information geared towards operational use of risk information by different stakeholders • Risk information of different granularity, such as hazard maps, is shared in appropriate ways among different stakeholders • Risk data are collected at national and local/regional level in a more easy and consistent way 	2021–2025	<p>Lead: GSCP in coordination with central/regional and local levels and research institutes/academia</p>
	<ul style="list-style-type: none"> • Continuously evaluate risk information system capability and options for functionality improvements based on feedback and user needs, and ability of institutions to maintain data • Facilitate exchange on completed, ongoing, and planned projects among researchers, practitioners, and the wider public 	Prevention	<ul style="list-style-type: none"> • Risk scenarios are used for planning and preparedness purposes 	2025–2030–2040	
<p>Risk reduction and prevention</p> <ul style="list-style-type: none"> • Support authorities to integrate risk 	<ul style="list-style-type: none"> • Assess resources and capacities to develop a prioritized investment plan related to technical and human resources and facilities; consider current risk profiles, emerging threats, climate change, stakeholders' needs at different levels to 	Prevention, preparedness	<ul style="list-style-type: none"> • Risk prevention and reduction (mitigation) investments are scaled up across different administrative levels and 	2021–2025 2030–2040	<p>Lead: GSCP in coordination with central/regional and local levels, infrastructure</p>

<p>information and risk-informed approaches into spatial and development planning</p> <ul style="list-style-type: none"> Facilitate scale-up of risk reduction and prevention investments across different administrative levels and sectors 	<p>improve efficiency of risk prevention and risk reduction measures</p> <ul style="list-style-type: none"> Explain the results of risk assessments to different audiences in different formats in an accessible manner, with pilot initiatives Carry out a risk assessment for fire stations, police, and emergency service buildings, hospitals, schools, critical public service buildings, specific sectors (e.g., tourism) and vulnerable areas to inform the prioritized approach to increasing their resilience, accompanied by DRR investment plans Promote the development of (national) programs that target multi-hazard strengthening of specific types of infrastructure assets, considering climate change Support efforts related to the strengthening of building codes and quality assurance processes related to different hazards/types of assets; clarify responsibilities, processes, and timelines Support administrators of cultural heritage sites/monuments to assess (multi) hazards and prepare risk prevention and management plans with different measures (e.g., improved maintenance and restoration actions) 		sectors with immediate focus on priority sectors		operators and MoCS
	<ul style="list-style-type: none"> Support the development of support tools and enhance technical capacity of stakeholders at different levels to pursue investments in risk prevention and risk reduction, including the use risk information in spatial/development planning processes and plans, conducting cost-benefit analysis, planning and implementation of projects, etc. By sharing technical expertise and monitoring progress, support local and regional stakeholders to develop DRR plans and implement risk prevention and risk reduction projects/initiatives that consider priority hazards, multiple hazards, climate change, use of nature-based solutions, and climate change adaptation 	Prevention, preparedness	<ul style="list-style-type: none"> Regional and local authorities are able to integrate risk information and risk-informed approaches into spatial and development planning 	<p>2021–2025</p> <p>2030–2040</p>	<p>Lead: GSCP in coordination with central/regional and local levels</p>
<p>Early warning systems</p> <ul style="list-style-type: none"> Continuously improve monitoring and forecasting 	<ul style="list-style-type: none"> Expand and upgrade monitoring and improve forecasting systems and arrangements, through investments in hardware, software, maintenance, data management tools, and capacity building Develop a flagship program to harmonize and support research into climate impacts (e.g., CLIMPACT) and early warning services with scientific and research institutes 	Preparedness, response	<ul style="list-style-type: none"> Monitoring and forecasting systems and capabilities are improved across different levels, including for impact-based forecasting 	2021–2025	<p>Lead: GSCP in coordination with, Hellenic National Meteorological Service (HNMS), NOA, and other</p>

<p>systems and early warning systems</p> <ul style="list-style-type: none"> Strengthen communication and dissemination of early warning systems 	<ul style="list-style-type: none"> Finance cooperation with universities and support research into innovative technologies including machine learning and exploitation of remotely sensed data (e.g., satellite data) Develop pilot systems for impact-based warnings with advanced risk information; adopt co-production approaches with potential recipients 				research institutes/academia
	<ul style="list-style-type: none"> Continue improving geographical and temporal resolution of forecasts and warnings through continued advances in monitoring and forecasting capabilities Continue to integrate EWS capabilities, taking a multi-hazard approach, and placing end-users at the center of multi-hazard early warning systems Continue coordination between government and research institutions to support applied research and system development 			2030–2040	
	<ul style="list-style-type: none"> Invest in new hardware and software to improve operational centers and the 112 system (e.g., remote fault detection systems, virtual servers, redesigned network infrastructure, business intelligence systems) Invest in municipal operational centers, including software for information management and hardware Procure dissemination systems for municipalities, including sirens, radio communication, and electronic boards Conduct public awareness campaigns and training exercises, targeted at vulnerable user groups to build trust in warning systems and to better prepare users on how to respond when faced with a disaster Establish forums to provide feedback from users of EWS Implement the Common Alerting Protocol format for all warning systems, to create the ability to integrate warnings into multiple media channels Build local capacity to respond to warnings (within municipalities and emergency responders) Undertake testing of early warning systems, including the public and emergency services Provide opportunity to integrate any evacuation planning at local level into alerting system as necessary 	Preparedness, response	<ul style="list-style-type: none"> Communication and dissemination of early warning systems and capabilities are improved across different levels 	2021–2025	Lead: GSCP in coordination with central/regional and local levels
	<ul style="list-style-type: none"> Continue to implement and adjust communication and outreach through modern information and communication technology 			2030–2040	Lead: GSCP in coordination with central/regional and local levels

	<ul style="list-style-type: none"> Continue to implement frameworks to monitor the effectiveness of warnings, considering factors such as response time and coverage and including compliance with international standards Continue to implement mechanisms to receive feedback from users and to operate quality assurance processes for continual improvement. 				
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Operationalize Nat-CHAMM with an efficient national C4I system Improve stakeholder capacity and coordination for emergency preparedness, response, and recovery Scale up public awareness activities and sharing of risk information for greater community preparedness 	<ul style="list-style-type: none"> Operationalize Nat-CHAMM, in coordination with key CP stakeholders, and improve readiness of critical elements of emergency response preparedness and stakeholder coordination Update emergency response plans at different levels, ensure preparedness and intervention resources, and develop monitoring/evaluation process to oversee quality of plans Establish an efficient national C4I system with functional/user specifications using expertise and building upon best practices from other European CP organizations; implement and test the national C4I system with the participation of stakeholders involved 	Preparedness, response	<ul style="list-style-type: none"> The Nat-CHAMM is fully operationalized with an efficient national C4I system 	2021–2025	Lead: GSCP in coordination with central/regional and local levels
	<ul style="list-style-type: none"> Assess readiness of critical elements for disaster response and recovery, such as sheltering Assess resources and capacities to develop a prioritized investment plan related to technical and human resources and facilities; consider current risk profiles, emerging threats, climate change, stakeholders' needs at different levels to improve effectiveness of the emergency response Provide capability building of key CP stakeholders and/or address specific coordination gaps, including curricula for common training and scenarios for exercises based on multi-hazard risk assessments, etc. Develop concepts, standards, and guidance or pilots for processes related to response, recovery, and use of BBB principles 	Preparedness, response	<ul style="list-style-type: none"> There is sufficient stakeholder capacity and coordination for emergency preparedness response, and recovery, with a focus on the local level and readiness of critical elements 	2021–2025	Lead: GSCP in coordination with central/regional and local levels, for example with MoDI on reconstruction and BBB
	<ul style="list-style-type: none"> Evaluate existing/implement new actions to increase response readiness, roll out specific initiatives, sharing good practice and increasing awareness Make higher-level common training program a prerequisite for promotion to higher managerial and operational posts Conduct hazard specific trainings for emergency management, particularly increasing climate hazards. 			2030–2040	

	<ul style="list-style-type: none"> • Develop a communications/awareness raising strategy/action plan considering risk profile and current gaps in capacities/activities related to specific hazards/stakeholders; pilot/roll out specific activities • Develop a user-friendly interface for sharing information available on GIS-enabled public platform; pilot and roll out • Explain the results of risk assessments to different audiences in different formats in an accessible manner, with pilot initiatives 	Preparedness, response	<ul style="list-style-type: none"> • There is public awareness and community readiness for response and recovery, including use of user-friendly platforms/dissemination methods and participatory approaches • Active and well-trained volunteers are capable of safely contributing to all phases of DRM at the local/regional level 	2021–2025	Lead: GSCP in coordination with central/regional and local levels
	<ul style="list-style-type: none"> • Regularly update communication/ awareness raising strategy, evaluating progress, and adding new activities • Evaluate pilot initiatives and based on lessons learned roll these out at larger scale • Invest in developing/ coordinating more training schemes for volunteers and design an awareness campaign to engage more citizens in joining the established or new local CP volunteering local groups • Provide dedicated training on specific hazards such as forest fires, earthquake etc. as each hazard requires a specialized approach • Increase the support of CP volunteering groups (e.g., regular trainings, equipment, facilities) 			2030–2040	
Financial protection <ul style="list-style-type: none"> • Improve understanding of financial risks • Improve understanding of available financial instruments • Strengthen financial protection at different levels through different instruments 	<ul style="list-style-type: none"> • Set up a forum with stakeholders focusing on financial protection • Conduct financial analysis to inform development of a sustainable disaster risk financing strategy, particularly focusing on major risks (earthquake, flood, forest fire) • Assess opportunities for revising existing /developing new instruments for different administrative levels/sectors, including a national peril pool for multiple hazards • Consult and strengthen coordination of key stakeholders on post-disaster financing, including the private sector, to understand priorities, challenges, and potential solutions 	Preparedness, response	<ul style="list-style-type: none"> • An overarching disaster risk financing strategy is in place based on comprehensive financial analysis of financial risks and assessment of feasible instruments; specific instruments are developed • Public awareness of risk insurance among general population as well as private sector is improved through sharing of information and education 	2021–2025	Lead: GSCP/MoF, Bank of Greece, HAIC, central/regional and local levels
	<ul style="list-style-type: none"> • Conduct activities set out by the strategy: adjust existing arrangements, pursue new instruments, link to programs for building back better, roll out public awareness campaigns on financial resilience, and potentially pursue legislation to foster expanded insurance coverage 			2030–2040	
	<ul style="list-style-type: none"> • Strengthen awareness of risk insurance, both among general population and private sector 			2025–2030–2040	

Earthquakes

Planned and ongoing investments/initiatives related to earthquakes collected through the consultation process cover all phases of disaster, with the majority of them related to preparedness and prevention. OASP and NOA, as well as other research/academic institutes, play an important role, as they participate in research projects and/or conduct programs or studies related to seismic risk assessment, earthquake engineering, and social seismic resilience to support the relevant departments of the central/regional/local authorities directly or indirectly involved in CP. OASP also plans public awareness actions on issues related to seismic risk, such as organization of seminars and workshops on issues related to seismic risk as well as operational earthquake drills for various population groups. Most seismic preparedness and prevention measures submitted by municipalities focus on first- and second-degree pre-seismic vulnerability assessments of schools and municipal buildings. This trend is linked to the recently available funding instrument “Antonis Tritsis” for actions for infrastructure in need of earthquake protection (pre-seismic inspection) provided by the MoI. It is highly recommended that this measure be applied not only to municipalities but to regions as well, so all critical infrastructure, public buildings, and health care facilities are included. Population risk awareness is also linked to this funding instrument, and several municipalities have used the opportunity to fund a citizens’ awareness campaign/program running in parallel with the pre-seismic assessments. A good example of linking preparedness, prevention, and risk awareness activities comes from the Ionian Islands region, which in collaboration with research institutes and academia supports the development of an operational seismic risk management system with various risk data, deployment of an innovative seismic hazard monitoring system, and performance of risk awareness workshops and preparedness exercises. Related to risk reduction, an important measure is the recording by municipalities and regions of all dilapidated buildings. Incentives for reuse and restoration of dilapidated and abandoned buildings should be put in place to prevent future fatalities in case of a disaster. The MoCS plans the restoration of specific monuments affected by recent earthquakes. It is recommended that financing mechanisms be developed for structural strengthening and rehabilitation of monuments and reconstruction or other interventions for the “near collapse” earthquake-stricken monuments. Urban planning has not yet effectively considered seismic risks. Only a few municipalities have mentioned the development of seismic risk-informed urban plans that can be used for efficient and prioritized investments in risk reduction. Similarly, a very limited number of municipalities have included measures for community preparedness and support of CP volunteer groups, such as training and support with supplies, equipment, and facilities.

Additional measures proposed to be potentially considered include the establishment of a common seismic risk assessment framework, the availability of the existing seismic hazard and risk maps on the GIS-enabled data platform, the sustainability of seismic risk data systems in the long term, investments in structural strengthening and improvement of the seismic resistance of residential buildings in densely populated areas, interventions for improved energy efficiency together with seismic retrofitting of buildings (to avoid missed opportunity from energy efficiency/climate change investments from NRRP and other EU funds), and the development of EWS systems to respond to seismic events and protect critical infrastructure. Related to financial protection, horizontal measures proposed are fully relevant.

Table 7. Summary table of priority measures for earthquakes

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
Risk governance/ understanding risk <ul style="list-style-type: none"> • Improve understanding of risks • Determine the directions of the country's seismic policy 	<ul style="list-style-type: none"> • Conduct programs or studies in the fields of seismic technology, seismotectonics, and social seismic defense • Assign specialized studies or research programs on addressing the consequences of earthquakes that have affected areas of Greece • Utilize the results above in determining the directions of the country's seismic policy 	Prevention	<ul style="list-style-type: none"> • Applied research in the fields of seismic technology, seismotectonics, and social seismic defense is enhanced • The results of the above are utilized in determining the directions of the country's seismic policy 	2030	OASP
Understanding risk <ul style="list-style-type: none"> • Improve understanding of risk for individual/multi-hazard impacts, including information on local site effects, exposure and vulnerability • Share risk information in appropriate ways among different stakeholders 	<ul style="list-style-type: none"> • Collect available data on local site effects or conduct microzonation and soil studies at the scale of a city where these are not available, as they provide important inputs to urban and spatial plans • Expand and systematize risk information on exposure and vulnerability for a national earthquake risk assessment using additional detailed and reliable data as well as additional asset categories, and considering secondary hazard effects and risks • Develop a differentiated, step-by-step, prioritized, and coordinated approach for seismic risk data collection as well as reporting mechanisms for critical infrastructure and public assets • Conduct preliminary data collection (on the built environment, including critical infrastructure and other public assets, residential sector, cultural heritage, and the population at seismic risk), in line 	Prevention, preparedness	<ul style="list-style-type: none"> • Seismic risk assessments are conducted in appropriately selected and vulnerable regions and municipalities based on collected information in a prioritized manner • Information, training, and unhindered and continuous access are provided to the relevant region/municipality departments directly or indirectly involved in CP to support further action such as (i) the analysis and design of civil protection measures, and (ii) implementation of intervention studies to reduce seismic risk 	2030	MfCCCP, GSCP, NOA in collaboration with research teams from universities; regions, municipalities
			<ul style="list-style-type: none"> • Applied research in the fields of seismic technology, seismotectonics, and social seismic defense is enhanced 	2030	

	<p>with agreed methodology and expected use of seismic risk data</p> <ul style="list-style-type: none"> • Provide risk information, training, and access to the relevant region/municipality departments directly or indirectly involved in CP • Conduct programs or studies in the fields of seismic technology, seismotectonics, and social seismic defense • Assign specialized studies or research programs on addressing the consequences of earthquakes that have affected areas of Greece • Utilize the results above in determining the directions of the country's seismic policy 		<ul style="list-style-type: none"> • The results of the above are utilized in determining the directions of the country's seismic policy 		
<p>Understanding risk</p> <ul style="list-style-type: none"> • Establish an operational seismic risk management system 	<ul style="list-style-type: none"> • Develop an operational seismic risk management system with various risk data for regions, which includes different data such as topographic data, satellite images, cadastral data and additional GIS data, geological maps, neotectonic maps, seismicity maps, maps of accompanying geodynamic phenomena, soil response measurements and soil classification, seismic hazard assessment, traditional and historic building response measurements, vulnerability assessment at urban scale, lifelines, and infrastructure vulnerability assessment 	Prevention, preparedness	<ul style="list-style-type: none"> • A web GIS system is developed with organized information generated in this system, which can be hosted by NOA on the servers of NOA/BYOND unit 	2025	Regions with support from NOA
<p>Understanding risk</p> <ul style="list-style-type: none"> • Improve understanding of geodynamic hazards in monuments and archaeological sites 	<ul style="list-style-type: none"> • Document and identify geodynamic hazards and solutions in monuments and archaeological sites (e.g., Acropolis of Athens) • Provide training of archaeological site staff (popularization of science) 	Prevention, preparedness	<ul style="list-style-type: none"> • Bibliographic record of studies, plans, and measures is produced • Hazard mapping is completed • Prevention/mitigation guidelines are prepared 	2025	NOA, MoCS

<ul style="list-style-type: none"> • Share information among stakeholders 			<ul style="list-style-type: none"> • A system for monitoring monuments is set up • Archaeological site staff are trained 		
Risk reduction and prevention <ul style="list-style-type: none"> • Support authorities to integrate risk information and risk-informed approaches into spatial and development planning 	<ul style="list-style-type: none"> • Prepare seismic risk-informed urban plans, prioritization of seismic risk reduction, and scenarios for emergency preparedness and response planning; develop emergency plans at urban scale informed by scientific evidence 	Prevention, preparedness, response	<ul style="list-style-type: none"> • Seismic risk-informed urban plans are produced 	2030	MfCCCP, GSCP, MoEE, Technical Chamber of Greece, NOA, research teams from universities; regions, municipalities
Risk reduction and prevention <ul style="list-style-type: none"> • Facilitate scale-up of risk reduction and prevention investments across different administrative levels and sectors • Conduct vulnerability assessment of public assets and develop protection measures 	<ul style="list-style-type: none"> • Conduct rapid visual screening (first-degree pre-seismic vulnerability assessment) of all public buildings and second-degree pre-seismic vulnerability assessment of those that are found to require further investigation (most vulnerable ones) 	Prevention, risk awareness	<ul style="list-style-type: none"> • First- or second-degree pre-seismic vulnerability assessment of critical infrastructure, schools, public buildings, and health care facilities is conducted, which includes seismic capacity assessment and protection measures to be taken in each case • Prevention measures and actions for informing inhabitants of the risks induced by earthquake are developed 	2025	Municipalities, regions
Risk reduction and prevention <ul style="list-style-type: none"> • Implement actions for dilapidated buildings 	<ul style="list-style-type: none"> • Record all the dilapidated buildings • Take immediate action for the “near collapse” dilapidated buildings • Set up incentives for reuse and restoration of dilapidated and abandoned buildings where feasible 	Prevention, response (recovery)	<ul style="list-style-type: none"> • List of all the dilapidated buildings is completed • Incentives for reuse and restoration of dilapidated and abandoned buildings are put in place where feasible • Subsidy scheme for listed building owners is developed 	2030	Regions, municipalities

Risk reduction <ul style="list-style-type: none"> • Implement actions for infrastructure requiring seismic protection 	<ul style="list-style-type: none"> • Repair most precarious buildings and infrastructure; conduct structural study and subsequently strengthen and improve the seismic resistance of infrastructure identified as needing further investigation after the rapid visual screening (first-degree) and the second-degree pre-seismic assessment to upgrade seismic capacity • Improve buildings' safety and functionality and increase citizens' security at the same time 	Prevention, response	<ul style="list-style-type: none"> • The seismic capacity, safety, and functionality of the most precarious buildings and infrastructure are strengthened and upgraded • The security of citizens is increased 	2030	Regions, municipalities
Risk reduction <ul style="list-style-type: none"> • Strengthen the seismic protection of monuments 	<ul style="list-style-type: none"> • Restore specific monuments affected by recent earthquakes • Take immediate actions for the "near collapse" earthquake-stricken monuments • Develop financing mechanisms for recovery, rehabilitation, and reconstruction of cultural heritage buildings and infrastructure 	Prevention (reconstruction)	<ul style="list-style-type: none"> • Investments in structural strengthening and rehabilitation of monuments and in reconstruction or other interventions for the "near collapse" earthquake-stricken monument 	2030	MoCS
Early warning systems <ul style="list-style-type: none"> • Continuously improve monitoring systems 	<ul style="list-style-type: none"> • Invest in new accelerometers to monitor seismic activity in regions and municipalities • Support the maintenance of existing monitoring stations at the regional level • Upgrade infrastructure for recording and monitoring earthquakes, strong ground movements, and deformation • Invest in portable seismic monitoring equipment 	Preparedness	<ul style="list-style-type: none"> • The capacity of regions and municipalities to monitor seismic activity is increased 	2025	Geodynamic Institute-NOA in collaboration with research teams from universities; regions, municipalities
Early warning systems <ul style="list-style-type: none"> • Continuously improve monitoring, forecasting, and early warning systems 	<ul style="list-style-type: none"> • Install seismological sensors for earthquake early warning in major industrial infrastructure and sensitive industrial plants (see also Table 14 on technological hazards) • Use early earthquake warning systems in major industrial installations and apply 	Preparedness	<ul style="list-style-type: none"> • Integrated EWS is applied in industrial infrastructure; methodologies/technical solutions designed to protect critical industrial installations from seismic hazard are applied 	2025	Geodynamic Institute-NOA

	methodologies/technical solutions designed to protect critical industrial installations from natural hazards, malicious human interference, or cyberattacks				
	<ul style="list-style-type: none"> Develop an electronic platform for the continuous monitoring of critical national infrastructure, which combines instrumental with remote monitoring and development of fuzzy cognitive network methods together with machine learning algorithms 	Preparedness	<ul style="list-style-type: none"> A multiparametric monitoring platform with micro-sensors is developed for “Enceladus” Hellenic supersite 	2030	Geodynamic Institute-NOA
Early warning systems <ul style="list-style-type: none"> Improve special operational equipment Continuously improve monitoring and forecasting systems and early warning systems Strengthen communication and dissemination of early warning systems 	<ul style="list-style-type: none"> Supply and install special operational equipment, including laptops, projectors, satellite phones, multifunction machines, tablets, PCs, monitors, keyboards, pumps, generators, etc. 	Preparedness, response	<ul style="list-style-type: none"> Upgraded and state-of-the-art electronic and special equipment are supplied and installed 	2025	Regions
	<ul style="list-style-type: none"> Develop an innovative seismic risk monitoring and management system Design and develop a low-cost network of large-scale seismometers-accelerometers Create algorithms for processing large-scale seismological data in real time Develop software for decision-making on seismic hazard and a model system for dissemination of seismic hazard information to institutions and citizens 	Preparedness	<ul style="list-style-type: none"> Seismic risk monitoring and management system is in place Operational software for decision-making on seismic hazard is developed Operational system for dissemination of hazard information to institutions and citizens is developed 	2030	Regions
Early warning systems/emergency preparedness, response, and recovery <ul style="list-style-type: none"> Upgrade accelerometers network and the permanent seismic response 	<ul style="list-style-type: none"> Supply, install, and maintain the permanent response measurement system of structures that belongs to OASP Supply, install, and maintain the 120 accelerometers of OASP’s National Network of Accelerometers 	Prevention, preparedness	<ul style="list-style-type: none"> The National Network of Accelerometers and permanent response measurement system are upgraded and up to date, resulting in more reliable and accurate monitoring of seismic events 	2025	OASP

measurement system					
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Develop more efficient guidelines for seismic assessment of infrastructure, enabling better preparedness for an earthquake 	<ul style="list-style-type: none"> Develop guidelines for seismic assessment of existing water, energy, transportation, and telecommunications infrastructure, as well as educational facilities, hospitals, and other health facilities, to ensure that they remain safe, effective, and operational during and after disasters 	Preparedness, response	<ul style="list-style-type: none"> More efficient regulations are in place in the field, enabling better preparedness for an earthquake, safer building assets, and clearer responsibility distribution between parties in the whole process of seismic risk reduction 	2030	MfCCCP, GSCP, Ministry of Infrastructure and Transport (MoIT), Technical Chamber of Greece, NOA, research teams from universities; regions, municipalities
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Build an operational system for drafting operational plans, and pilot implementation of preparedness exercises 	<ul style="list-style-type: none"> Build an operational system for compilation of operational plans Implement pilot combined preparedness exercises 	Preparedness, response	<ul style="list-style-type: none"> Operational centers are established Operational plans are submitted for approval by GSCP Pilot of combined preparedness exercises is implemented 	2025	Regions, GSCP
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Scale up public awareness activities and sharing of risk information for greater community preparedness Organize public awareness activities 	<ul style="list-style-type: none"> Create and print training materials on emergency response for different population groups 	Preparedness	<ul style="list-style-type: none"> Educational materials of OASP, which refer to seismic protection and accompanying phenomena, are designed created, and printed 	2025	OASP
	<ul style="list-style-type: none"> Organize seminars and workshops on issues related to seismic risk as well as operational earthquake drills for various population groups 	Preparedness	<ul style="list-style-type: none"> Public awareness on issues related to seismic risk is promoted 	2030	OASP

on issues related to seismic risk					
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> • Improve stakeholder capacity and coordination for emergency preparedness response, and recovery 	<ul style="list-style-type: none"> • Create educational and information material in digital format • Conduct stakeholder training workshops and tabletop exercises • Conduct workshops for training and information of instructors and for training and information of stakeholders in the tourism industry • Present the results in scientific conferences 	Preparedness	<ul style="list-style-type: none"> • Educational risk information actions for stakeholders are conducted 	2025	Regions, OASP
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> • Scale up public awareness activities and sharing of risk information for greater community preparedness 	<ul style="list-style-type: none"> • Conduct seismic risk information and awareness activities to broaden the population's consciousness and develop their earthquake behavior—i.e., knowledge of what to do before, during, and after an earthquake to effectively protect life and property 	Preparedness	<ul style="list-style-type: none"> • Public awareness of earthquake impacts, and protection measures is increased for all categories of citizens: students, parents and guardians, elderly people, workers in various workplaces, disabled people, staff of the educational and social structures, municipality visitors/tourists 	2025	MfCCCP, Municipalities
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> • Enhance effective response to earthquake 	<ul style="list-style-type: none"> • Develop a methodology for consistent rapid structural assessment after an earthquake event for all basic types of structures (large panel buildings, reinforced concrete, steel, masonry, and prefabricated reinforced concrete structures, bridges, tunnels, dams, tailings dams, lifelines) • Mobilize OASP and GDAEFK immediate response units and transition to affected areas after strong earthquakes • Install portable networks of seismographs and accelerometers 	Preparedness, response	<ul style="list-style-type: none"> • Rapid assessment of the structural condition and serviceability, damage, and losses of residential buildings and industrial and infrastructure facilities is conducted shortly after the disaster • Local actors are supported • Survey and mapping of the phenomena accompanying earthquakes is conducted • Coordinating bodies benefit from participation of OASP and 	2025	OASP, GDAEFK

	<ul style="list-style-type: none"> Implement informative and educational actions for various groups of the population 		GDAEFK immediate response units <ul style="list-style-type: none"> The post-seismic check of critical infrastructure suitability is carried out efficiently 		MfCCCP, Technical Chamber of Greece, GDAEFK, OASP
	<ul style="list-style-type: none"> Coordinate with the Technical Chamber of Greece to continue the development of a training process and the establishment of an organization of volunteer engineers trained to perform rapid assessment of seismic-induced damage potential Carry out coordination, training, and disclosure of these teams, providing information on administrative structure, regulations, communication system, responsibilities, and documentation (equipment, platform, input, and output) 		<ul style="list-style-type: none"> Post-earthquake capacities for effective response and recovery at all levels are improved Valuable time shortly after the disaster is saved 		
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Configure and organize refuge areas for use after an earthquake 	<ul style="list-style-type: none"> Construct necessary infrastructure so that designated areas defined as places of refuge meet the general criteria set by the directives of the GSCP and the OASP and can function as places for temporary gathering of the public after an earthquake 	Preparedness	<ul style="list-style-type: none"> Infrastructure is constructed and regularly assessed for adequacy 	2030	Regions, municipalities
Additional proposed priority measures for consideration					
Understanding risk <ul style="list-style-type: none"> Improve understanding of seismic risk Share information among stakeholders 	<ul style="list-style-type: none"> Establish a common seismic risk assessment methodology and a framework for understanding seismic risk scenarios Coordinate existing and planned data compilation; arrange collaboration of the government with academia and research institutes to ensure the robust quality of the seismic risk assessment framework 	Preparedness	<ul style="list-style-type: none"> A common seismic risk assessment framework is established 	2025	MfCCCP, GSCP, MoIT, Technical Chamber of Greece, NOA, research teams from universities; regions, municipalities

Understanding risk/emergency preparedness, response, and recovery <ul style="list-style-type: none"> Establish a seismic risk information system geared towards operationalization Improve stakeholder capacity and coordination for emergency preparedness, response, and recovery 	<ul style="list-style-type: none"> Consult with seismic risk information users and providers to define the scope of required databases Establish institutional arrangements for geospatial seismic risk data systems Make the existing seismic hazard and risk maps available on the GIS-enabled data platform (even if not publicly available, specific access criteria may be applied) Establish database/system processes; provide capacity training and guidelines for stakeholders to use and provide information 	Prevention, preparedness	<ul style="list-style-type: none"> Existing seismic hazard and risk maps are available on the GIS-enabled data platform Capacity training and guidelines are granted for stakeholders to use and provide information 	2025	MfCCCP, GSCP, MoIT, Technical Chamber of Greece, NOA in collaboration with research teams from universities; regions, municipalities
	<ul style="list-style-type: none"> Continuously evaluate seismic risk information system capability and options for functionality improvements based on feedback and user needs Regularly update seismic risk assessments and maps applying agreed methodology Continuously invest in the seismic risk data system and institutions that maintain them 		<ul style="list-style-type: none"> Seismic risk data systems are set to be sustainable in the long-term 	2040	
Risk reduction and prevention <ul style="list-style-type: none"> Plan earthquake-resilient cities Support authorities to integrate risk information and risk-informed approaches into spatial and development planning Facilitate scale-up of risk reduction investments across 	<ul style="list-style-type: none"> Develop seismic resilience master plan for the largest urban and industrial centers in the country Promote the mainstreaming of seismic risk assessments into land use policy development and implementation, including urban planning, land degradation assessments, and informal and nonpermanent housing; especially for informal housing that warrant special attention as to the seismic resistance, as many may not be built according to codes of practice at the time of construction, prioritize by seismic hazard zone 	Prevention	<ul style="list-style-type: none"> Settlements are more resilient to earthquakes Support is provided for the local authorities and engineers in the application of risk reduction measures 	2040	MfCCCP, MoIT, Technical Chamber of Greece, regions, municipalities, and related administrative bodies

different administrative levels and sectors	<ul style="list-style-type: none"> Promote the use of guidelines informed by anticipated demographic and environmental changes 				
Risk reduction and prevention <ul style="list-style-type: none"> Promote energy efficiency and seismic retrofitting of buildings 	<ul style="list-style-type: none"> Modify the current funding scheme and the associated legislation of the ongoing energy efficiency program to encourage reliable seismic assessment and seismic retrofit together with the interventions for improved energy efficiency 	Prevention	<ul style="list-style-type: none"> Interventions for improved energy efficiency together with seismic retrofitting of buildings are promoted 	2030	MfCCCP, MoIT, MoEE, MoF, Mol
Risk reduction <ul style="list-style-type: none"> Improve the seismic capacity of existing assets Develop incentives for seismic retrofit 	<ul style="list-style-type: none"> Develop incentives for seismic retrofitting of infrastructure— for example, certain financial stimulus or tax exemptions for seismic retrofit up to a certain minimum safety level, or certain restrictions for commercial use of vulnerable properties 	Prevention	<ul style="list-style-type: none"> Investment in structural strengthening and in improvement of seismic resistance of residential buildings in densely populated areas is promoted 	2030	Mol, MoF, regions, municipalities, and related administrative bodies
Early warning systems <ul style="list-style-type: none"> Improve ability to respond to seismic events and protect critical infrastructure Improve capabilities for earthquake early warning systems 	<ul style="list-style-type: none"> Develop systems to automate or accelerate response to seismic events such as shutting down critical infrastructure or closing access to vulnerable structures Support research into improved techniques for earthquake early warning, including the use of state-of-the-art techniques (e.g., machine learning) 	Preparedness, response, recovery	<ul style="list-style-type: none"> Ability to respond to seismic events and protect critical infrastructure is improved Capabilities for earthquake early warning systems are improved 	2030	GSCP in collaboration with NOA and research teams from universities
Financial Protection (See horizontal measures in Table 6)	<ul style="list-style-type: none"> Strengthen financial protection and resilience post event Provide financial assistance to the population in need after an earthquake event Develop awareness on risk and risk mitigation methods (e.g., insurance) Build an insurance scheme for both the public and private sector to provide financial support and coverage for damage caused by earthquake events 	Prevention, Preparedness	<ul style="list-style-type: none"> An expert panel is formed to assess risks and post-loss financing options A Natural Perils Pool is formed including new / updated legislation to provide for mandatory EQ insurance The public is educated on earthquake risk and financial resilience Incentives are introduced insure by tax exempting property insurance cost 	2025	Lead: GSCP/Ministry of Finance, Bank of Greece, Hellenic Association of Insurance Companies, central/regional and local levels

Floods

In the past, major investments in DRM actions and infrastructure across Greek regions were financed through several funding instruments. Some of these investments include also planned or ongoing investments related to floods as confirmed during the consultation process. Many of these relate to preparedness and prevention, followed by response. The MoEE, GSCP, as well as research and academic institutes have been instrumental given their participation in research projects and studies that relate to flood risk assessment, flood risk awareness and public risk awareness in order to support relevant authorities as well as broader public. Most preparedness and prevention measures focus on raising public awareness based on flood risk by educating both the public and other stakeholders through training and exercises. The main focus in risk governance is to update flood policies by improving current knowledge through applied research, pilots and an investment in technology via the ESPA operational program.

In terms of understanding risk, certain measures are ongoing using modern tools to develop a more robust flood risk plan at national and local levels. Taking into consideration both historical flood data and real time key performance indicators, it is possible to produce flood hazard maps on local and national levels based on the flood risk of a specific river basin. GIS technologies can be of great use in above mentioned measures by setting up a geo-portal to access data, monitor flood risk and produce flood hazard maps in real time. Furthermore, in terms of response measures and risk understanding, it is essential to map the flood event after appearing in order to assess damages and foresee/document possible cascading effects following the flood event. Overall, the proposed measures focus on public awareness, enhanced cooperation between research, practice, and implementation through improved coordination as well as the ability to support further actions and implementations to reduce flood risk.

Related to risk reduction, it is recommended that the main focus of investments is on flood protection works and drainage maintenance works in areas with a high flood risk. Risk reduction efforts should also consider sustainable green and nature-based solutions.

Concerning efficient and effective preparedness and prevention measures, there is a need to focus on EWS. It is strongly recommended to make greater use of the early warning alert system available (112) in order to prevent fatalities and contribute to a more robust flood management plan. Initiative under Horizon Europe, AEGIS, NRRP and others consider state-of-the-art tools which can be integrated into existing operational systems, allowing to integrate real-time observations into forecasting and now-casting models. Upgrading current monitoring equipment and/or installing new monitoring stations can create a stronger and reliable monitoring network operating with redundancies, in order to minimize the response time and provide real time monitoring at both local and national scales. Related to early warning, existing/planned investments focus on emergency preparedness, response, and recovery on a regional and municipal level to provide an optimal disaster contingency plan in terms of both operational and public viewpoint while some measures propose improving financing mechanisms for recovery, rehabilitation, and reconstruction and introducing insurance plans set by law.

Additional measures proposed for consideration include investing into research and state-of-the-art technologies in EWS, such as machine learning and Internet of Things, the availability of the existing flood hazard and risk maps on a GIS-enabled data platform and enhanced cooperation with regional partners on use of flood forecasting and meteorological forecasting systems. Related to financial protection, building an insurance scheme (with relevant stakeholders) for both public and private sector to provide financial support and coverage for any damages caused by flood events is of great importance.

Table 8. Summary table of priority measures for floods

Focus area and overarching goals	Priority measures (description)	Categories: prevention, preparedness, response	Expected output (results)	Time period (status)	Responsible institution
Risk governance <ul style="list-style-type: none"> • Improve understanding of flood risks • Produce risk governance plan and manuals per river basin 	<ul style="list-style-type: none"> • Produce risk maps and Master Plan at river basin and regional levels • Conduct applied research in the field of flood risk mitigation and tangible measures to be assumed • Update current flood risk policy based on above research by considering the WFD 2000/20 	Prevention, preparedness	<ul style="list-style-type: none"> • Risk maps per river basin and regions are developed • Applied research concerning flood risk is enhanced and updated • Results are utilized to determine country's flood risk policy • Plans and manuals are prepared 	2022+	Regions (primarily), regional unit(secondarily), GSCP (coordinator), regional stakeholders and Water Services Entities
Understanding risk <ul style="list-style-type: none"> • Record and analyze historical data to further understand flood risk • Identify floodplain points at river basin level • Understand risk and its cascading effects/events following a flood event to mitigate damages 	<ul style="list-style-type: none"> • Process historical and real-time data to calculate the risk of upcoming cascading events after a flood event (e.g., landslide) • Produce flood hazard maps based on extensive flood risk analysis at both national and local scale • Collect and maintain all flood data and key performance indicators in a geodatabase 	Prevention, preparedness	<ul style="list-style-type: none"> • Planning and prevention are improved via knowledge acquired from historical and damaging flood events in Greece and other countries • Flood risk at a local scale is understood • Trainings are available for involved stakeholders including updated guidelines 	2022+	GSCP, MoEE, research institutes, regions, and municipalities

<ul style="list-style-type: none"> • Produce vulnerability flood risk maps • Share information among stakeholders • Produce generic manual • Set up research partnerships between administration and academic centers • Identify settlements at high risk of flooding due to previous forest fires, incl. all forest fires of at least the last 15 years 	<ul style="list-style-type: none"> • Document and evaluate flood hazard in urban environments (through a Master Plan) • Produce manuals and training course • Provide trainings and exercises among involved stakeholders • Operationalize mechanisms for consultation and cooperation • Assess historic data of previous forest fires to point out high flood risk to inform appropriate actions (e.g., 2021 event in Evoia) 		<ul style="list-style-type: none"> • Access to flood hazard maps and data from a geoportal is enabled • More detailed flood risk assessment is completed and available to the public • Further actions and implementations to reduce flood risk can be supported 		
			<ul style="list-style-type: none"> • Cooperation between research, practice, and implementation is enhanced through coordination • Knowledge of policy design and application through partnerships are improved 	AEGIS 2022+	GSCP, MoEE, regions, regional stakeholders, research institutions (advisory)
<p>Understanding risk</p> <ul style="list-style-type: none"> • Map flood extent and conduct damage assessment • Educate stakeholders 	<ul style="list-style-type: none"> • Produce flood extent and flood depth, velocity maps after the flood event to optimize damage assessment • Foresee and document possible cascading effects after flood event (e.g., landslides impacts, 2021 Evoia case) 	Prevention, Response	<ul style="list-style-type: none"> • Damage assessment after the flood is optimal • Upcoming cascading effects can be handled based on flood extent maps • Awareness training is conducted 	2022+	GSCP, MoEE, regions, regional unit, regional stakeholders
<p>Risk reduction and prevention</p> <ul style="list-style-type: none"> • Implement flood protection works based on updated flood hazards maps and risk analysis • Maintain drainage systems in urban environments 	<ul style="list-style-type: none"> • Upgrade flood protection works while considering flood risk analysis taking into account climate change and hazard maps on a local scale¹⁵⁵ • Review and reapply maintenance works for the river basin systems (e.g., information system) 	Prevention, preparedness	<ul style="list-style-type: none"> • Fatalities are prevented by updating flood and maintenance work 	2022+	GSCP, MoEE, regions, regional unit, regional stakeholders

¹⁵⁵ A lot of work has been done by the General Secretariat for water of the Ministry of Environment under the Flood directive in terms of flood risk analysis and maps

<p>Early warning systems</p> <ul style="list-style-type: none"> • Implement flood protection works based on updated flood hazards maps and risk analysis • Maintain drainage systems in urban environments • Implement early warning for flood events through SMS and Cell Broadcasting approaches through 112 • Improve communication and coordination between involved authorities (police, fire department, etc.) 	<ul style="list-style-type: none"> • Utilize SMS/Cell Broadcasting/112 system for early warning on a larger scale and to targeted groups based on a data and on a location-driven approach (see also horizontal measures in Table 6) • Through continuous trainings and exercises, improve communication between different entities 	<p>Prevention, preparedness, response</p>	<p>Early alerts to the public leads to better flood management plan</p> <ul style="list-style-type: none"> • Enhanced communication provides a better disaster contingency plan 	<p>2022+</p>	<p>GSCP, MoEE, regions, regional unit, regional stakeholders</p>
<p>Early warning systems</p> <ul style="list-style-type: none"> • Enhance capabilities to monitor meteorological and hydrological conditions through investments in monitoring equipment and associated hardware and software for telemetry and data management. • Investment in real-time flood forecasting systems based on coupled meteorological and hydrological systems. 	<ul style="list-style-type: none"> • Install meteorological stations for effective monitoring networks • Replace (upgrade) and install new weather radar systems • Install state-of-the-art monitoring stations including cameras and river gauging sensors • Develop flood early warning systems, integrating information from weather and river monitoring and forecasting • Procure improved ICT technology (hardware, software, middleware) to manage early warning data in real time 	<p>Prevention, preparedness, response</p>	<ul style="list-style-type: none"> • Ability to monitor weather in real time and with greater spatial representation is enhanced • Real-time observations can be assimilated into forecasting and nowcasting models 	<p>2022+</p> <p>AEGIS NRRP ESPA 2022–2027 EIB EBRD</p>	<p>Hellenic National Meteorological Service (HNMS), GSCP, research institutions, MoEE, regions, municipalities, contractors (multi-annual obligations for servicing)</p>
	<ul style="list-style-type: none"> • Conduct research into innovative solutions for flood and extreme weather monitoring, including the use of satellite data 		<ul style="list-style-type: none"> • State-of-the-art tools can be integrated into operational systems after 	<p>2022+ Horizon Europe</p>	<p>GSRT, research entities, ministries,</p>

			comprehensive testing and quality control		international cooperation
Early warning systems <ul style="list-style-type: none"> Invest in local capabilities to monitor and forecast extreme events, in partnership with national entities. 	<ul style="list-style-type: none"> Supply and install equipment to support pilot system for observation and forecasting of intense weather phenomena at county level Install telemetry stations to monitor river/stream discharges Install advanced technologies (e.g., Doppler systems) for monitoring of discharges/velocities in drainage systems 	Prevention, preparedness	<ul style="list-style-type: none"> Monitoring capabilities are improved for a more advanced early warning system Real-time monitoring minimizes response time 	2023+ Public Tenders	MoEE, regions, municipalities, contractors (multi-annual obligations for servicing)
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Improve public awareness and sharing of risk information for greater public awareness Provide activities to public to raise awareness of flood risk 	<ul style="list-style-type: none"> Improve the public's preparedness for and reaction to floods Organize seminars and workshops targeted to the public as well as authorities Educate the public on emergency response techniques 	Prevention, preparedness	<ul style="list-style-type: none"> Increased public awareness of flood risk as well as accompanying phenomena (landslides) results in fewer fatalities Risk information actions for stakeholders are conducted 	2023+	Regions (primarily), municipalities (secondarily), GSCP (coordination), MoEE (follow)
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Configure and organize designated areas for the public after a flood event 	<ul style="list-style-type: none"> Provide people in affected areas with accommodation as a refuge 	Preparedness, response	<ul style="list-style-type: none"> Affected population can be evacuated to safe refuge 	2023+	Regions (primarily), municipalities (secondarily), GSCP (coordination), MoEE (follow)
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Improve effective response to a flood event Clear debris after a flooding event 	<ul style="list-style-type: none"> Mobilize local authorities as a first rapid response in cooperation with GSCP Invest in cleaning road networks to improve network status for optimal search and rescue missions Cooperate with local authorities to provide escape routes to the public 	Preparedness, response	<ul style="list-style-type: none"> Safety is improved following a flood event Road networks are restored more quickly to improve mobility of search and rescue missions Affected area is rapidly mapped to assess damage 	AEGIS 2022+	Regions (primarily), municipalities (secondarily), GSCP (coordination), MoEE (follow), research entities (advisory/ studies)

<ul style="list-style-type: none"> • Provide emergency evacuation routes 			to infrastructure as well as structural condition		
Financial protection <ul style="list-style-type: none"> • Strengthen financial protection for recovery • Carry out rehabilitation and reconstruction • Invest in maintenance and cost recovery 	<ul style="list-style-type: none"> • Improve financing mechanisms for recovery, rehabilitation, and reconstruction • Provide financial safety for the affected areas and population • Offer insurance plans (to be introduced by law) 	Prevention, preparedness	<ul style="list-style-type: none"> • There is investment in rehabilitation measures for affected people and areas • There is investment in prevention and preparedness measures for targeted areas based on their flood risk profiles • Budget is allocated to river/drainage basins 	2022+	regions, municipalities, GSCP/MfCCCCP, MoF, MoEE
Additional proposed priority measures for consideration (beyond what was collected in consultations)					
Early Warning Systems <ul style="list-style-type: none"> • Increase capabilities for flood forecasting (including flash flooding) through cooperation. 	<ul style="list-style-type: none"> • Enhance cooperation with regional partners on the operational use of flood forecasting and meteorological forecasting systems (e.g., ECMWF). • Develop improved Standard Operating Systems for flood forecasting/early warning systems to optimize communication and operation. 	Prevention, preparedness	<ul style="list-style-type: none"> • There is greater exploitation of regional/European facilities for improved ability to forecast floods and extreme weather events • Regions assume responsibilities for maintenance 	2025+	GSCP, HNMS, MoEE, regions, contractors, RTD institutions
Early warning systems <ul style="list-style-type: none"> • Apply innovation to improve monitoring, forecasting and response capabilities. 	<ul style="list-style-type: none"> • Automate response to flood events by shutting down critical infrastructure or forwarding assets to affected areas • Invest in research and latest technologies in early warning (e.g., machine learning, artificial intelligence, unmanned aerial vehicles, Internet of Things) 	Prevention preparedness, response	<ul style="list-style-type: none"> • Ability to respond to flood events and protect critical infrastructures is improved • Capabilities for flood early warning are enhanced • Data-driven early warning via ICT is in place 	2025+	GSCP, HNMS, MoEE, regions, contractors, RTD institutions
Emergency preparedness, response, and recovery	<ul style="list-style-type: none"> • Make use of a web GIS platform to collect, analyze, and monitor flood data and key performance indicators (e.g., part of the National Risk Base) 	Prevention preparedness, response	<ul style="list-style-type: none"> • Real-time flood illustrations are produced • Real-time flood hazard maps are produced 	2025+	GSCP, HNMS, MoEE, regions, contractors, RTD institutions

			<ul style="list-style-type: none"> • Spatial analysis of flood damages is carried out 		
Financial protection (see horizontal measures in Table 6)	<ul style="list-style-type: none"> • Strengthen financial protection and resilience post event • Provide financial assistance to the population in need after an EQ event • Develop awareness on risk and risk mitigation methods (e.g., insurance) • Build an insurance scheme for both public and private sector to provide financial support and coverage for damage caused by floods events 	Prevention, preparedness	<ul style="list-style-type: none"> • An expert panel is formed assess risks and post-loss financing options • A Natural Perils Pool is formed including new / updated legislation to provide for mandatory EQ insurance • The public is educated on earthquake risk and financial resilience • Incentives are introduced insure by tax exempting property insurance cost 	2025	Lead: GSCP/MoF, Bank of Greece, HAIC, central/regional and local levels

Forest fires or wildland urban interface fires

Wildfire management projects and investments are planned and implemented by several services and authorities. They refer to hazard-specific projects as well as CP projects dealing with multiple hazards. The responsibility for the major CP projects is currently with the GSCP; GSCP has undertaken several initiatives and leads in design and conduct of the National Civil Protection Programme AEGIS. Most of these projects are directly related to the management of wildfires.

A number of projects and investments have originated with local and regional authorities, mostly planned in the context of ESPA, the “Antonis Tritsis” program, the Agricultural Development Program, and the PIP. However, there is a lack of formal central monitoring and planning for these projects, which are funded by diverse programs; this makes it hard to address in a coordinated manner the challenges of managing wildfires as they are identified in the various geographic regions, and often leads to suboptimal results at the national, regional, or interregional level. In addition, it results in lost opportunities for cooperation and synergy among authorities. Most of these projects focus on the procurement of equipment, not on application of programs (e.g., fuel treatments) or training. Several other challenges need to be addressed in order to maximize the return on investment: there is a need to avoid delays in the tendering process, improve the technology skill level of the personnel (since currently it takes significant time to make a system operational), and consider and address the maintenance cost of the systems since the planning phase.

There are several ongoing (and planned) European R&D projects with sound Greek participation that concern policies, strategies, and technological solutions for addressing challenges in managing forest fires. These projects seek to involve GSCP, the Fire Service, and local and regional authorities in consortia (group of organizations joined together to work on a particular R&D project) to allow them to co-design and co-create the relevant solutions. In several cases, they deliver sound results, which might be used operationally in case a proper exploitation context is developed. The PCP (Pre-Commercial Procurement) financial instrument of Horizon 2020 and Horizon Europe, which allows public institutions to endorse and operationally test R&D solutions, is of particular interest. GSCP needs to take initiative in this regard when the Center for Crisis Management Studies (KEMEDIK) is activated, if not before. There are ongoing opportunities of Horizon Europe that shouldn't be lost for Greek CP.

Based on the available information on the ongoing and planned investments in wildfire management, there is an opportunity to focus more on central planning and monitoring of the various programs, relevant projects, and respective investments. Greece follows the relevant EU policies, and the public administration adapts the regional and local plans to the available lines of funding. Thus, the local and regional authorities respond to the availability of funds, adapting these projects to the priorities that are supported financially, and not to their particular needs or to the requirements of wildfire management. Concerning financial protection, horizontal measures proposed are fully relevant.

“Antonis Tritsis,” provided by the MoI, focuses on local development and CP through the implementation of projects and investments proposed by local and regional authorities and their associations and affiliate organizations. The program aims to strengthen local government responsibility by continuously integrating new needs and requirements and modernizing the civil protection capabilities at local level. A relevant (annual/national) program for managing high vegetation in the wildland urban interface areas should be adopted by GSCP in cooperation with the MoI and the MoEE. Such a program needs to be funded and implemented in an early manner, since the clearing of vegetation makes sense before the fire season; such timeliness isn't currently the case for the few relevant activities. The centralized national civil protection plan (AEGIS) focuses on procurements and infrastructure. While well-structured and organized, the AEGIS CP program could improve in terms of wildfire management with a better balance between suppression and prevention. Forest and fuel management needs to be further addressed, as well as cooperation between fire and forest services, a prerequisite for efficient forest fire management.

Table 9. Summary table of priority measures for forest and wildland urban interface fires

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
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Risk governance	<ul style="list-style-type: none"> • Revise current policies and investments aiming to improve the balance between wildfire prevention and suppression • Develop an integrated wildfire risk management plan at the country level to exploit the investments of the Aegis national CP program • Define clearly the legal and institutional basis for the cooperation and synergy between the fire (suppression) and the forest (prevention) service, based on the complementarity needed to manage wildfires in an integrated manner • Establish a central mechanism (GSCP) for monitoring actual/proposed management plans and investments at all levels (local/municipality, regional, national) and define respective priority and performance indicators 	Prevention, preparedness, response	<ul style="list-style-type: none"> • More efficient wildfire control, improved safety and security for the population, and reduction of damages from large fires • Improved coordination of fire management efforts • Multidisciplinary and cross-services management of wildfires • Efficient monitoring of wildfire management activity, geographic distribution of priorities, and return on investments 	2021–2022	GSCP/MfCCCCP in cooperation with all involved actors (public services, agencies, ministries, etc.) ¹⁵⁶
Understanding risk	<ul style="list-style-type: none"> • Identify high-risk WUI areas and prioritization of fuel treatments to reduce risk from eventual fires 	Prevention, preparedness	<ul style="list-style-type: none"> • Reduced fire risk in the WUI areas • Strengthened fire response performance in the WUI areas 	2021–2023	GSCP/MfCCCCP, Forest Service/MoEE, MoI ¹⁵⁷
	<ul style="list-style-type: none"> • In the AEGIS national CP plan, prioritize the vertical organization and improved coordination of civil protection according to the Nat-CHAMM concept 	Preparedness, response	<ul style="list-style-type: none"> • Improved coordination and informed crisis management 	2021–2027	GSCP/MfCCCCP in cooperation with MoI, MoCP, MoND
	<ul style="list-style-type: none"> • Conduct actions for raising awareness (included in AEGIS Axis 1) 	Prevention	<ul style="list-style-type: none"> • Reduced risk and fire impacts and improved self-protection 	2021–2027	GSCP/MfCCCCP in cooperation with local authorities (Municipalities, Regions),

¹⁵⁶ The actors' list should include (among others) Fire Corp. (Π.Σ.), Forest Service/Ministry of Environment and Energy, Ministry of Transport and Networks, Emergency Services (EKAB)/Ministry of Health, Association of Municipalities (ΚΕΔΕ) & Association of Regions (ΕΝΠΕ), Ministry of Climate Crisis and Civil Protection, Ministry of Agricultural Development, Ministry of Defence, Ministry of Finance, Representatives of the R&D community. Furthermore, L.4662/2020 includes a number of supportive structures (Part B' Art. 37- 43) that should be represented.

¹⁵⁷ GSCP / MfCCCCP to define civil protection (spatial and temporal) priorities, Forest Service to define the interventions needed/applicable and map the areas and the Municipalities/MoI to implement the relative projects.

					Active citizen associations, Volunteers' organizations. Schools and church can be also considered
	<ul style="list-style-type: none"> • Provide professional training in civil protection and crisis management technology (focus on wildfire emergencies needed) 	Entire DRM cycle	<ul style="list-style-type: none"> • Increased level of professionalism and improved performance of the personnel involved in wildfire management 	2021–2027	GSCP/MfCCCCP, Fire Service (National Academy of Crisis Management and Risk Management, L.4662/20 art.39), Forest Service, MoI (Civil Protection personnel of Municipalities ¹⁵⁸), (more organizations to be considered)
Risk reduction and preparedness	<ul style="list-style-type: none"> • Monitoring in systematic way (DB, KPIs) the implementation of “Iolaos” plan of GSCP concerning prevention and preparedness measures to be taken by the local authorities for addressing wildfire challenges 	Prevention, preparedness, response, recovery	<ul style="list-style-type: none"> • Improved and better-organized prevention, preparedness and response involvement of local and regional authorities and organizations in wildfire management activity 	Annual	GSCP/MfCCCCP, Municipalities & Regions, MoI, Association of Municipalities (ΚΕΔΕ) & Association of Regions (ΕΝΠΕ), other local public and private actors
	<ul style="list-style-type: none"> • Extend the program “DRYADES” implemented in June-July 2021 for the treatment of forest fuels in WUI areas 	Prevention, preparedness	<ul style="list-style-type: none"> • Strengthened resilience of WUI areas • Improved firefighting conditions in the WUI areas 	2021–2022	GSCP/MfCCCCP, Forest Service/MoEE, MoI ¹⁵⁹ (municipalities, regions), public networks and infrastructure administrators [e.g., DEDDHE (Hellenic Electricity Distribution Network Operator S.A.)
	<ul style="list-style-type: none"> • Develop and use the new operational structure of Greek CP, comprising the 	Prevention, preparedness,	<ul style="list-style-type: none"> • Improved common operational picture and documented 	2021–2023	GSCP/MfCCCCP

¹⁵⁸ Currently the level of the civil protection personnel of the Municipalities and local authorities is very low. There is no training available.

¹⁵⁹ GSCP / MfCCCCP to prioritize regions and ensure funding civil protection priorities, Forest Service to approve the plan and oversee the interventions/works and the Municipalities/MoI to implement the relative projects

	National Coordination Center for Crisis Management (ESKEDIK) and the respective 13 regional (PEKEPP) and 64 local (TOKEPP) operation centers	response, recovery	situational awareness and coordination		
Risk reduction and prevention	<ul style="list-style-type: none"> Implement AEGIS plan (Axes 3 and 4), which includes numerous procurements of aerial means (both purchased and rented), ground vehicles (patrol cars, heavy fire trucks, initial attack means, etc.), air surveillance operations center, fleet management systems, mobile CCs, and search and rescue equipment; address development of infrastructures for wildfire-related DRM 	Preparedness, Response and recovery	<ul style="list-style-type: none"> Maximized response capabilities of the Nat-CHAMM mechanism 	2021–2027	GSCP/MfCCCP
Risk reduction and prevention	<ul style="list-style-type: none"> Include in AEGIS a detailed program on wildfire prevention comprising basic priorities e.g., National Forest Fuel Map¹⁶⁰, National Forest Fuel Management Program¹⁶¹, Monitoring of the status of actual wildfire prevention projects etc. based on a integrated approach and national strategy 	Prevention, Preparedness	<ul style="list-style-type: none"> Improve fire prevention planning and strengthen resilience 	2021–2023	GSCP/MfCCCP, Forestry School/AUTH, Forest Service/MoEE, Fire Service
Risk reduction and prevention	<ul style="list-style-type: none"> Establish a specialized firefighting unit for forest operations (EMODE) 	Response	<ul style="list-style-type: none"> Improved firefighting capabilities and performance using forest equipment and tools by properly trained and experienced personnel 	2021–2023	GSCP/MfCCCP, Fire Service ¹⁶²
Early warning systems	<ul style="list-style-type: none"> Strengthen the National Disasters Management System (AEGIS), supported by information systems and IT solutions for the prevention of and response to natural risks 	Entire DRM cycle	<ul style="list-style-type: none"> Documented and informed wildfire management 	2021–2027	GSCP/MfCCCP

¹⁶⁰ Forestry School to implement the Fuel Classification/Map project through the Forest Service/MoEE and GSCP/MfCCCP, Fire Service and MoI as users/stakeholders

¹⁶¹ Planned and organized by the Forest Service/MoEE, funded by AEGIS Program.

¹⁶² Contribution of Forest Service/MoEE should be considered since EMODE will operate within the area managed by the Forest Service.

	<ul style="list-style-type: none"> Strengthen cooperation for developing R&D activity with research and technology organizations and academia (AEGIS, Axis 1) ¹⁶³ 	Entire DRM cycle	<ul style="list-style-type: none"> Scientific knowledge used and well-documented fire management approaches tested in operational conditions Innovative solutions with national added value developed Improved technology skills of the operational personnel 	2021–2027	GSCP/MfCCCP, Fire Service, forest services, Public authorities, Academia, Research & Technology Organizations, Research Institutes (and others)
	<ul style="list-style-type: none"> Develop smart monitoring and surveillance systems aiming to provide climate information and early warning for wildfires (AEGIS, Axis 2) 	Prevention, -preparedness, response	<ul style="list-style-type: none"> Improved planning of wildfire management and informed response decisions 	2021–2027	GSCP, MfCCCP, in cooperation with Mol (WUI and Urban forests/parks) and Fire Service/MoEE (public forests)
	<ul style="list-style-type: none"> Implement digital alert system for the population (AEGIS, Axis 2) 	Prevention, preparedness, response	<ul style="list-style-type: none"> Increased citizens' safety from wildfires and in trust between the state and the population Enhanced culture of forest fires prevention 	2022–2023	GSCP/MfCCCP (cooperation with Municipalities /Mol)
	<ul style="list-style-type: none"> Implement autonomous forest fire detection systems at the regional level, making use of technologies such as remote sensing and meteorological stations Use tools to monitor prevalent conditions and to model fuel and forest fire risk Develop systems for detection of forest fires with abilities to exploit crowdsourced data Develop/procure decision support tools for managing wildfires Develop official (GSCP) smartphone apps to disseminate warnings at municipal and regional level 	Prevention, preparedness, response	<ul style="list-style-type: none"> Involvement of the regions in wildfire prevention and management issues and support for coordination at different levels with the GSCP and the central government 	Funded by Ministry of Economy and Development (Public Investment Program)	GSCP/MfCCCP (planning and interoperability requirements), Municipalities and Regions (project implementation), Fire Service (use of project products/services/output)

¹⁶³ In general, the MfCCCP has to use the instrument of Pre-Commercial Procurement (Συμβάσεις Καινοτομίας) to introduce consistently R&D on new technology and innovation in focused areas of civil protection (e.g. use of drones, accelerographs, cameras).

Financial protection	<ul style="list-style-type: none"> • Use operational fund for risk prevention and response (AEGIS) 	Entire DRM cycle	<ul style="list-style-type: none"> • Improved ability to address increased needs in extreme fire seasons 	2020–2023	GSCP, MfCCCP, Fire Service, Forest Service/MoEE, Municipalities and Regions (Mol)
Additional proposed priority measures for consideration					
Understanding risk	<ul style="list-style-type: none"> • Conduct awareness campaigns to improve the perception of wildfire risk in the wildland urban interface among homeowners 	Prevention	<ul style="list-style-type: none"> • Improved understanding of prevailing conditions and risk 	2021–2027	MfCCCP/GSCP, Mol (municipalities, regions, etc.), volunteer organizations, etc., Fire Service, Forest service/MoEE.
	<ul style="list-style-type: none"> • Develop local wildfire protection plans (municipality level) 	Prevention, preparedness	<ul style="list-style-type: none"> • Increased resilience of local communities and villages 	2021–2023	Municipalities and Regions (Mol), MfCCCP/GSCP
	<ul style="list-style-type: none"> • Develop wildfire management plans for large forests and forested areas (for integration into the respective forest management plans) 	Prevention, preparedness	<ul style="list-style-type: none"> • Improved forest resilience, which will improve the performance of fire suppression and maximize the efficiency of firefighting 	2021–2023	Forest service/MoEE, Regions/Mol, MfCCCP/GSCP
Risk reduction and prevention	<ul style="list-style-type: none"> • Set up consistent monitoring of local authorities for application of the legislation for cleaning areas surrounding structures and empty lots 	Prevention, preparedness	<ul style="list-style-type: none"> • Reduced risk in wildland urban interface areas • Improved performance of firefighting in the WUI 	2021–2027	MfCCCP/GSCP, Municipalities/Mol, Forest Service/MoEE
Risk reduction and prevention	<ul style="list-style-type: none"> • Fund extensive forest and fuel management programs (funded and implemented properly and in an early manner) 	Prevention, preparedness	<ul style="list-style-type: none"> • Reduced risk of very large fires • Improved firefighting performance 	2021–2027	MfCCCP/GSCP, Forest Service/MoEE, Municipalities and Regions/Mol,
	<ul style="list-style-type: none"> • Develop economic activity linked with the forest production and services (forest economy) 	Prevention	<ul style="list-style-type: none"> • Reduced fire risk and strengthened local interest in protecting forests 	2021–2027	MoDI, Ministry of Rural Development and Food (MoRDF), MoEE
	<ul style="list-style-type: none"> • Improve land planning by integrating assessment and treatment of potential wildfire risk in the development of new areas 	Prevention	<ul style="list-style-type: none"> • Fire risk in built-up areas mixed with forest vegetation (WUI) reduced • Needs for population safety and firefighting in the WUI anticipated 	2021–2027	MoEE/Land Planning, MfCCCP, Mol

Risk reduction and prevention	<ul style="list-style-type: none"> Develop a formal registry of ongoing and planned wildfire management projects and investments at the local, regional, and national scale 	Entire DRM cycle	<ul style="list-style-type: none"> Geographic and operational developments for wildfire management by all involved stakeholders monitored in a continuous and consistent manner 	2021–2027	GSCP/MfCCCCP, Fire Service, Mol, (municipalities, regions), MoEE
	<ul style="list-style-type: none"> Develop a system of indicators to monitor and evaluate the performance of investments in wildfire management system (cost-benefit analysis) 	Entire DRM cycle	<ul style="list-style-type: none"> Return on investment of wildfire management investments evaluated 	2021–2027	GSCP/MfCCCCP
Early warning systems	<ul style="list-style-type: none"> Develop a national forest fuel map based on a relevant classification system to allow documented wildfire management; update the fuel map annually (burned areas) and revise every five years. 	Entire DRM cycle	<ul style="list-style-type: none"> Fire and propagation modeling with simulation tools facilitated Development of documented firefighting plans facilitated Informed fire prevention planning and fuel management programs supported 	2021–2023	GSCP/ MfCCCCP, MoEE, Forest research institute/research organization “DEMETRA”, Aristotle University of Thessaloniki (Remote Sensing and Forest Management Lab)
Early warning systems	<ul style="list-style-type: none"> Use the National Meteorological Service (specialized fire weather meteorologists) to allow GSCP (i) to develop seasonal risk assessment (monthly up to fire season) and (ii) to issue daily wildfire danger news during the fire season 	Entire DRM cycle	<ul style="list-style-type: none"> Increased citizen awareness of high-fire-risk areas Informed decision-making for the preparedness stage and the response operations facilitated 	2021–2023	National Meteorological Service/MoND, GSCP/MfCCCCP, Fire Service, forest services / MoEE
Early warning systems	<ul style="list-style-type: none"> Issue fire danger maps from GSCP and share with relevant public services and organizations; evolve to interactive maps providing preparedness risk reduction guidelines at the local and regional level 	Prevention, preparedness	<ul style="list-style-type: none"> Sharing of fire risk information among stakeholders in a consistent way supported (this can be the basis for refining the preparedness plans) 	2021–2023	GSCP/ MfCCCCP, Municipalities and Regions/Mol, Ministry of Digital Governance,
Early warning systems	<ul style="list-style-type: none"> Officially provide blended early warning of wildfire risk online—i.e., information combining remote sensing observations of the vegetation status, actual operational capabilities, and assets at risk 	Entire DRM cycle	<ul style="list-style-type: none"> Improved preparedness at the local level; facilitation of informed decisions on fire response 	2021–2023	GSCP/ MfCCCCP, Fire Service, remote sensing research and technology organizations, MoEE, Ministry of Digital Governance

Early warning systems	<ul style="list-style-type: none"> • Improve the 112 service to include standardized information (do/don't what and when) as well as guidelines for protecting domestic animals, wildlife, biodiversity, cultural heritage and property left behind 	Prevention, preparedness, response	<ul style="list-style-type: none"> • Risk of extensive damages in large fires reduced • Population trained to cooperate with GSCP • Trust fostered among citizens and the GSCP 	2021–2023	GSCP/MfCCCP, Municipalities and Regions/MoI, MoEE, MoRDF, Ministry of Digital Governance
Early warning systems	<ul style="list-style-type: none"> • Develop a standardized (common specs) online forest fire detection network, comprising point sensors, cameras, and meteorological stations • Equip aerial means (manned/unmanned) with thermal tracking capabilities • Revisit the concept and role of ground-based fire detection stations and upgrade the existing network accordingly 	Preparedness, response	<ul style="list-style-type: none"> • Improved ability to accurately and rapidly detect forest fires, resulting in more effective response • Reduced loss of life (human, domestic animals and wildlife I) and reduced property damage 	2021–2027	GSCP/MfCCCP, Forest Service/MoEE, MoD (aerial firefighting and patrolling), MfCCCP, Municipalities and Regions/MoI
Early warning systems	<ul style="list-style-type: none"> • Operationalize the research results dealing with advanced techniques for forest fire risk monitoring and modeling of forest fire spread and propagation ¹⁶⁴ 	Entire DRM cycle	<ul style="list-style-type: none"> • Enhanced ability and confidence in ability to monitor and forecast spread of forest fires • Development of tools that, with sufficient testing, could be operationalized by state authorities 	2021–2027	GSCP/MfCCCP, research institutes and organizations (R&D providers) and academia
Early warning systems	<ul style="list-style-type: none"> • Organize the specialized drone units (all hazards) for surveillance of high-risk areas at the peak-risk hours during the fire season 	Entire DRM cycle	<ul style="list-style-type: none"> • Improvement in common operational picture by sharing situational awareness information to the pertinent services 	2021–2023	GSCP, Fire Service, Hellenic Police, (MoND) ¹⁶⁵
Emergency preparedness, response, and recovery	<ul style="list-style-type: none"> • Organize annual tabletop and field exercises (escalated scenarios) at local, regional, and national level with the participation of all involved operational actors 	Emergency preparedness, response, recovery	<ul style="list-style-type: none"> • Improved preparedness, cooperation, and synergy between involved actors, which will lead to enhanced coordination 	2021–2027	All stakeholders involved in wildfire management

¹⁶⁴ In general, the MfCCCP has to use the Pre-Commercial Procurement procedure (Συμβάσεις Καινοτομίας) to introduce consistently R&D and innovation in wildfire management.

¹⁶⁵ Municipalities and Regions have started to use drones in context of their involvement on wildfire management tasks.

	<ul style="list-style-type: none"> • Create a professional wildfire analyst role and consider having at least two people with such profile for every country region (in the Regional Operational Centers) • Strengthen environmental restoration and socio-economic reliance post event 	Response	<ul style="list-style-type: none"> • Wildfire situation analysis at the preparedness and response phase supported • Ability to make informed decisions on firefighting and evacuation plans 	2021–2023	GSCP, Fire Service
Financial protection (see horizontal measures in Table 6)	<ul style="list-style-type: none"> • Provide financial assistance to the population in need after large or high-impact wildfire events • Develop awareness on risk and risk mitigation methods (e.g., insurance) • Build an insurance scheme for both public and private sector to provide financial support and coverage for damage caused by fire events 	Prevention, preparedness	<ul style="list-style-type: none"> • An expert panel is formed assess risks and post-loss financing options • A Natural Perils Pool is formed including new / updated legislation to provide for mandatory EQ insurance • The public is educated on earthquake risk and financial resilience <p>Incentives are introduced insure by tax exempting property insurance cost</p>	2022+	Lead: GSCP/MoF, Bank of Greece, HAIC, central/regional and local levels, MOEE

Heat waves and droughts

According to the current protocols of the Hellenic National Meteorological Service (HNMS) the official definition of what constitutes a **heat wave in Greece** is “the maximum temperature must be at least 37degC, the minimum must be above 26degC and the duration of the event to be at least 3 days”.

Consultations with ministries, regional authorities, and local municipalities highlighted several measures linked with heat waves and climate adaptation. Out of 84 municipalities, 13 submitted measures for energy efficiency and climate adaptive upgrades of school buildings for 2020–2027. Some municipalities had already completed such measures in the time period 2014–2020. Of the 84 engaged municipalities, 14 submitted measures for energy efficiency and climate adaptive upgrades of municipal buildings for the period 2020–2023. Some municipalities had already completed such measures in the time period 2014–2020. Six of the 84 engaged municipalities submitted measures for urban regeneration; however, there are likely more that were not listed in the scope of the consultations.

Several efforts that were noted in the consultation process may be considered by other regional and municipal levels. For example:

- The region of Crete is one of the participants of the EU-funded Life Adapt2Clima program to plan and adapt to climate change in the agricultural sector. This type of involvement can be replicated by other regions in Greece given appropriate program growth and regional support.
- The municipality of Thessaloniki has implemented a pilot forecasting system for urban heat island effects with the goal of developing urban adaptation strategies. Such piloted efforts should be showcased to other urban areas, with investments and support provided at the municipal level to undertake forecasting measures.
- Early warning tools like EXTREMA developed by NOA have been used by the Municipality of Athens and should be considered as an informational and preparedness tool by other municipalities.
- Monitoring systems for meteorological conditions and air quality in Nevrokopi have been used to detect pollutants that are a public health hazard due to heat waves.

There are additional opportunities related to measures for heat wave risk reduction. For example, with prior planning, immediate response and coordination for cooling centers and emergency needs could prevent mortality and morbidity during heat waves. Other opportunities include raising awareness among citizens about prevention and preparedness; providing incentives for the private sector to influence behavioral change and decrease overheating; and ensuring climate change–related hazards are considered in disaster preparedness, response, and recovery planning.

Table 10. Summary table of priority measures for heatwaves and droughts

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
Understanding risk <ul style="list-style-type: none"> • Increase knowledge of agricultural impacts to heat waves and climate change (e.g., support participation in EU-funded program Life Adapt2Clima) 	<ul style="list-style-type: none"> • Estimate climate change for agricultural areas through an assessment of the vulnerability of rural areas; develop, implement, and demonstrate a decision support tool; develop climate change adaptation strategies; conduct awareness raising for stakeholders and target groups 	Prevention	<ul style="list-style-type: none"> • Improved knowledge available to inform climate change adaptation measures for agricultural sector • Enhanced preparedness with simulation and assessment tool for the impacts of climate change on crop production; effectiveness of selected adaptation options in decreasing vulnerability to climate change 	2025	Regions
Understanding risk <ul style="list-style-type: none"> • Set up research partnerships between 	<ul style="list-style-type: none"> • Operationalization of mechanisms for consultation and cooperation (AEGIS) 	Prevention, preparedness, response	<ul style="list-style-type: none"> • Improved links between research, practice, and implementation through coordination 	2030	MoEE, MfCCCP, academia and research institutions/

administration and academic centers			<ul style="list-style-type: none"> Improved knowledge of policy design and application through partnerships 		regions
Understanding risk <ul style="list-style-type: none"> Undertake vulnerability and disaster risk mapping due to extreme weather conditions (YANTAS project) 	<ul style="list-style-type: none"> Develop a meteorological, economic, demographic, environmental, and social database for extreme heat and drought weather events and map vulnerability and risk indicators at the local scale; Process data to calculate the vulnerability to weather hazards and the level of risk from weather events in different geographical zones 	Prevention	<ul style="list-style-type: none"> Improved planning/prevention based on knowledge of historical and damaging weather events in Greece Enhanced understanding of local vulnerability to climate extreme events 	2025	MoDI
Risk reduction and prevention <ul style="list-style-type: none"> Undertake energy efficient and climate adaptive upgrade of elementary and secondary schools and public/municipal buildings 	<ul style="list-style-type: none"> Invest in thermal insulation of building shells; replace frames in openings; upgrade cooling and heating system; replace lighting with new LEDs; use photovoltaic installation, green roofs, green walls, etc.; implement interventions for greening schoolyards/public spaces, etc. 	Prevention	<ul style="list-style-type: none"> Reduced heating and cooling demands on electricity grid, which also reduces carbon emissions Cooler environments in schools with better energy efficiency Increased climate adaptation of buildings Raised awareness about climate change in the educational community 	2030	Municipalities
Risk reduction and prevention <ul style="list-style-type: none"> Implement green, blue, and white solutions for long-term reduction of urban heat island effects 	<ul style="list-style-type: none"> Invest in measures for improving urban microclimate and citizens' life quality, such as urban regeneration projects/ interventions aligned with the principles of sustainability, prevention, and resilience and integrating innovative solutions such as nature-based solutions, permeable surfaces 	Prevention	<ul style="list-style-type: none"> Increased percentage of green areas per capita Improved microclimate within densely built neighborhoods through urban planning and project-based measures 	2027/2030	Municipalities
Risk reduction and prevention <ul style="list-style-type: none"> Develop long-term strategy for climate action at the local level 	<ul style="list-style-type: none"> Develop provisioned strategic plans for climate adaptation and energy at the local level that will include: (1) multi-hazard maps with the inclusion of heat wave risk, especially for vulnerable 	Prevention	<ul style="list-style-type: none"> Development of Sustainable Energy and Climate Action Plan Informed long-term decision making/data-driven investments 	2025	Municipalities

	populations; (2) impacts to various economic sectors like agriculture, tourism, cultural heritage, and construction, as well as environmental impacts to regional biodiversity; Support local leadership in participating with Covenant of Mayors		<ul style="list-style-type: none"> Improved knowledge exchange through participation in a European network among cities utilizing innovative solutions to respond to climate change challenges 		
Early warning systems <ul style="list-style-type: none"> Implement pilot forecasting system for urban heat island effect for the development of urban adaptation strategies (e.g., EU-funded program LifeAsti / EXTREMA citizen alert application) 	<ul style="list-style-type: none"> Develop a system of high-resolution numerical models that leads to the short-term forecast and future projection of the urban heat island phenomenon at the city scale; Install early warning systems at municipal levels to notify populations susceptible to heat waves, particularly high-risk individuals like elderly, young children, and outdoor workers (e.g., agriculture/construction) and medical service providers 	Prevention, preparedness	<ul style="list-style-type: none"> Improved forecasting tools, such as bioclimatic indicators and heating and cooling degree days, to assess the energy needs of buildings and to assess the risks to population groups Creation of data-driven guidelines for incremental urban regeneration interventions that mitigate the urban heat island effect at neighborhood scale Raised awareness of/preparedness for heat waves among local communities Improved real-time access to heat wave warning information, actions to be taken by public/health officials, and resources offered depending on location/region 	2025	Municipalities with support from NOA
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Promote risk awareness and conduct training among human resources and volunteers; educate citizens 	<ul style="list-style-type: none"> Conduct pre-event awareness campaigns for receipt and description of emergency alerting; educate citizens on public health actions and community-based support systems (if these exist, i.e., cooling center locations/access) (AEGIS) 	Prevention	<ul style="list-style-type: none"> Increased public awareness of the alerting mechanisms, content of alerts, actions to be taken, and resources available prior to the event and during an emergency event 	2025	Municipalities

Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Construct water tanks and pipeline system extension to avoid water scarcity 	<ul style="list-style-type: none"> Invest in installation and maintenance of water tanks and pipeline infrastructure within municipality 	Preparedness	<ul style="list-style-type: none"> Creation of reliable water tanks and networks of pipeline systems to reduce water scarcity, particularly in rural or isolated communities 	2030	Municipalities
Additional proposed priority measures for consideration					
Risk reduction and prevention <ul style="list-style-type: none"> Educate citizens/ provide incentives for private sector to influence behavioral change Make funds available for prevention and climate change adaptation 	<ul style="list-style-type: none"> Develop awareness material campaigns and guidelines for behavioral change towards a sustainable way of living Provide attractive incentives for private entities to invest in developing environmental, social, and corporate governance schemes; and promote financing of climate change adaptation Provide an energy efficiency temporary operation plan during heat waves for public sector (public buildings, health facilities and schools) 	Prevention, preparedness	<ul style="list-style-type: none"> Improved public awareness, and continuous funds provided for, linking of disaster prevention and climate change adaptation Incentives set up for reducing households' energy usage during heat waves Coordinated preparedness integrating actions for local community preparedness Reduced energy usage of public buildings during heat waves 	2025	MoEE/MfCCCP/ MoERA
Early warning systems <ul style="list-style-type: none"> Employ state-of-the-art techniques to support monitoring and forecasting of extreme heat events and droughts Improve capabilities in impact-based forecasting to enhance response capabilities in sectors such as agriculture 	<ul style="list-style-type: none"> Implement heat wave warnings based on local/regional heat indexes that relate to biophysical indicators. Strengthen cooperation with regional partners (e.g., ECMWF) to support improved monitoring and forecasting of drought conditions 	Prevention, preparedness, response	<ul style="list-style-type: none"> Improved ability to monitor, forecast, and respond to slow-onset hazards. 	2030	HNMS with support for relevant ministries
Early warning systems <ul style="list-style-type: none"> Employ state-of-the-art techniques to support monitoring and 	<ul style="list-style-type: none"> Improve networks of temperature sensors and remote sensing for high-resolution monitoring of urban temperatures; Assimilate temperature 	Prevention, preparedness	<ul style="list-style-type: none"> Improved ability to monitor and forecast urban heat islands and identify high-risk zones/regions 	2030	Municipalities with support from NOA

forecasting of extreme heat events and droughts at the local level	information into micro-scale urban models to forecast extreme temperatures				
Emergency preparedness and response <ul style="list-style-type: none"> Develop community preparedness and response measures at local level 	<ul style="list-style-type: none"> Develop local strategy and maps for community preparedness and response. Develop maps for important public amenities (e.g., publicly accessible air-conditioned and shaded shelters, drinking water fountains, etc.) during days of extreme heat; Invest in communication channels with citizens/NGOs working with vulnerable populations; Create and disseminate information/awareness material for instructions about self-protection during heat waves Invest and share in accessible early warning tool 	Prevention, preparedness	<ul style="list-style-type: none"> Improved communication at local/community level for preparedness and response Increased risk awareness and enhanced preparedness actions by stakeholders, community members, and heat wave-vulnerable populations; improved communication channels with citizens/NGOs working with vulnerable groups 	2025	Municipalities
Emergency preparedness and response <ul style="list-style-type: none"> Develop comprehensive program addressing climate change effects in disaster response and recovery planning 	<ul style="list-style-type: none"> Coordinate planning and response efforts for climate change-related heat extremes; Increase awareness campaigns for sectors such as agriculture on how to respond to extreme heat and drought. 	Response (recovery)	<ul style="list-style-type: none"> Improved coordination between planning and response bodies, ranging from local, to municipal, to regional actors 	2030	Municipalities, regions, MoEE, MfCCCP, MoH
Emergency preparedness and response <ul style="list-style-type: none"> Deploy cooling centers and increase capacity for hospitals 	<ul style="list-style-type: none"> Plan and stage cooling centers in areas with highly vulnerable populations; Prepare for capacity surge at hospitals and clinics; extend hours at public venues that have air-conditioning 	Prevention, preparedness	<ul style="list-style-type: none"> Reduced mortality and morbidity of high-risk populations: elderly, young children, other populations with heat-related co-morbidities; planning for expected increase of medical demand during and following heat wave 	2025	MoH (coordination among regional health authorities [Υγειονομική Περιφέρεια-ΥΠΕ])

Extreme weather events

There were various investments for extreme weather events, including winter storm, snowstorm, windstorm, tornadoes, frost, hail, and heavy rainfall, collected through the consultation process. These include eight prevention measures, mainly for maintenance of stormwater management systems and retaining walls; 25 recovery measures, for reconstruction of the road network after intense rainfall/snowfall; 13 response measures, mainly for cleaning roads from snow; and three preparedness measures, mainly for the procurement of machinery and supplies (e.g., salt) in the response phase. Gaps from consultations include the lack of strategic planning at the local/municipal level for prevalent extreme weather events, as well as a lack of collected data through risk assessments for impacts and management of climate extreme events. Hazard-specific exercises for local/municipal emergency response coordinated at the municipal and regional levels will enhance operations during and following extreme weather events. In the area of early warning systems, there are overlaps with the interventions in Table 7 that deal with flood hazards, which can be grouped with extreme weather events as “hydro-meteorological hazards”. It is recommended that investments take multi-hazard approach, for example investments also consider tornadoes, heavy snowfall, severe hail fall, etc.

Table 11. Summary table of priority measures for extreme weather events (winter-storm/snowstorm, windstorm, tornadoes, frost, hail, rainfall)

Focus area and overarching goals	Hazard	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
Understanding risk <ul style="list-style-type: none"> Research application for Earth observation 	Thunderstorm, frost	<ul style="list-style-type: none"> Operationalize research activities in partnership with other European organizations for earth observations and monitoring of climate extreme events (e-shape EuroGEO) 	Prevention, preparedness	<ul style="list-style-type: none"> Improved risk knowledge and management of extreme events monitored through observation networks, pilots, and platforms 	2040	NOA
Understanding Risk <ul style="list-style-type: none"> Setting up research partnerships between administration and academic centers 	Winter storm/snowstorm, windstorm, tornado, frost, hail, rainfall	<ul style="list-style-type: none"> Operationalize mechanisms for consultation and cooperation 	Prevention, preparedness, response	<ul style="list-style-type: none"> Improved links between research, practice, and implementation through coordination Improved knowledge of policy design and 	2030 (AEGIS plan, Axis 1)	MoEE/MfCCCP/ academia and research institutions

				application through partnerships		
Risk reduction and prevention <ul style="list-style-type: none"> Stormwater management and installation of retaining walls and other prevention works 	Heavy rainfall, windstorm, frost	<ul style="list-style-type: none"> Invest in stormwater management and retaining walls; manage extreme rainfalls, windstorms, and frost 	Prevention, preparedness	<ul style="list-style-type: none"> Enhanced coordination and action for extreme weather events prone to overloading stormwater system Improved safety and reduction of water-borne illnesses 	2025	Municipalities
Early warning systems <ul style="list-style-type: none"> Improve capabilities for monitoring of extreme weather conditions. 	Heavy rainfall, storm, windstorm	<ul style="list-style-type: none"> Install additional meteorological stations to create denser monitoring network Replace (upgrade) and install new weather radar systems Procure improved software and associated hardware to manage early warning data in real-time 	Preparedness, response	<ul style="list-style-type: none"> Enhanced ability to monitor weather in real time and with greater spatial representation Ability to assimilate real-time observations into forecasting and nowcasting models 	AEGIS, NRRP, ESPA 2021–2027, EIB	HNMS
Early warning systems <ul style="list-style-type: none"> Boost capacities to produce forecasts of extreme weather, adopting state-of-the-art technology. 	Heavy rainfall, storm, windstorm	<ul style="list-style-type: none"> Supply and install equipment to support pilot system for observation and forecasting of intense weather phenomena at country level; establish extreme weather surveillance system/integrated monitoring systems Procure new technologies to monitor new events, including unmanned aerial vehicles with cameras, Internet of Things sensors, exploitation of remotely sensed data 	Preparedness, response	<ul style="list-style-type: none"> Establishment of municipal monitoring and forecasting systems, providing capabilities to monitor, and forecast extreme events 	AEGIS, NRRP, ESPA 2021–2027, EIB	Regions, municipalities, HNMS, GSCP

		<ul style="list-style-type: none"> • Ensure regional or municipal systems are aligned with and can communicate with national systems 				
Prevention and recovery <ul style="list-style-type: none"> • Maintenance, support, and restoration of ancient bridges, buildings, and museums 	Thunderstorm/ frost/ windstorm/ winter storm/ snowstorm	<ul style="list-style-type: none"> • Invest in programmatic support for ongoing maintenance and restoration of structural integrity of cultural heritage buildings and infrastructure 	Prevention, recovery	<ul style="list-style-type: none"> • Enhanced management and intervention prior to and following extreme weather events 	2025	MoCS
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> • Execution of rehabilitation works (AEGIS plan) • Reconstruction of road networks and public buildings 	Heavy rainfall/ snowstorm	<ul style="list-style-type: none"> • Support regions and municipalities in snow removal with investment in mechanical equipment and machinery (AEGIS) • Develop coordination mechanism and fund emergency road cleanup following extreme weather events • Invest in reconstruction of road networks as well as public buildings and infrastructure following extreme weather events (e.g., public schools, institutional buildings, etc.) 	Preparedness, response, recovery	<ul style="list-style-type: none"> • Improved recovery and functionality of public infrastructure and buildings • Increased response for repair of damage, ensuring immediate relief, decongestion, and resumption of activities (AEGIS plan) 	2025	Municipalities
Additional proposed priority measures for consideration						
Risk reduction and prevention <ul style="list-style-type: none"> • Long-term strategy for climate extreme events • Extreme climate event risk assessment and data collection 	Winter storm/ snowstorm, windstorm, tornado, frost, hail, rainfall	<ul style="list-style-type: none"> • Develop multi-hazard maps with inclusion of climate extreme events, especially for vulnerable areas and sectors, like agriculture • Identify and assign roles and responsibilities of the institutions involved in climate extreme event management 	Prevention	<ul style="list-style-type: none"> • Informed long-term/ data-driven decision-making and coordination that is publicly available • Enhanced strategic water management 	2030– 2040	Municipalities

<ul style="list-style-type: none"> Community awareness of climate extreme events 		<ul style="list-style-type: none"> Invest in a program to facilitate data-driven decision making, effective long-term planning, and implementation of investments Provide regular training on severe storm and extreme winter risk conditions 		<ul style="list-style-type: none"> plan for water scarcity Improved awareness and capacity to address and manage extreme climate events at the local level 		
Risk reduction and prevention <ul style="list-style-type: none"> Strengthen Power Supply Network resilience and preparedness for extreme weather events 	Multiple extreme hazards	<ul style="list-style-type: none"> Replace overhead cables providing electrical power or telecommunications, with underground cables in densely inhabited areas that are prone to extreme hazards (e.g., higher snowfall hazard, windstorms) 	Prevention	<ul style="list-style-type: none"> Safeguarded power supply network for critical infrastructure and inhabited areas Ensure continuity of services during an emergency Reduced disaster recovery costs and timeframe 	2030– 2040	DEDDHE, ADMHE, MoEE, MfCCCP/ Municipalities, regions
Early warning systems <ul style="list-style-type: none"> Improved dissemination capabilities 	Multiple extreme hazards	<ul style="list-style-type: none"> Develop and install common alerting protocol-enabled dissemination systems at hot spots (known or identified through analysis) Continue to expand public awareness campaigns in response to extreme weather events 	Preparedness, response	<ul style="list-style-type: none"> Greater ability to disseminate warnings 	2030	GSCP, municipalities
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Hazard-specific exercises for emergency responders 	Winter storm/ snowstorm, windstorm, tornado, frost, hail, rainfall	<ul style="list-style-type: none"> Invest In hazard-specific exercises for first/emergency responders in relation to extreme weather phenomena 	Response	<ul style="list-style-type: none"> Improved coordination for emergency response attuned to local context and specific to extreme hazard event 	2030	Municipalities, regions, GSCP

Landslides

Based on consultations, the regions of Crete, Epirus, and Western Greece have earmarked funding for several measures as part of the strategy to reduce and respond to landslide hazards; measures include road cleaning, rehabilitation of roads, and urgent safety response measures. Several municipalities have measures for reconstruction of roads after landslide hazards; however, fewer have measures for the creation and implementation of retaining walls for landslide prevention, including the repair and maintenance of these walls as a preventative measure. Based on the consultations, landslide hazard proposed measures could benefit from pursuing additional measures related to comprehensive mapping of landslide hazard areas throughout Greece, including a long-term strategy at the regional/local levels for managing landslide risks. SAR (synthetic-aperture radar) interferometry and Global Navigation Satellite System (GNSS) techniques with the support of NOA or other academic/research institutes can be used to study ground movements and identify landslide-prone areas, and thus produce and continuously update landslide hazard and risk maps. In addition, early warning for landslide hazards is not established for all local/regional community assets and monitoring for early detection of slope instability is considered necessary for effective preparedness and response, primarily at local level. Finally, there is a short-term need for evacuation planning at the local/regional level, and awareness building of such resources is important to include as a priority measure.

Table 12. Summary table of priority measures for landslides

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
Understanding risk <ul style="list-style-type: none"> Identify landslide hazard using SAR interferometry and GNSS 	<ul style="list-style-type: none"> Integrate Synthetic-aperture radar (SAR) interferometry and Global Navigation Satellite System (GNSS) for studying ground movements and identifying landslide hazard 	Prevention, preparedness	<ul style="list-style-type: none"> Landslide hazard and risk map is produced and continuously updated 	2025	Geodynamic Institute–NOA, academia/research institutions, EAGME, regions
Understanding risk <ul style="list-style-type: none"> Record and analyze potential landslide areas based on geological, geomorphological, hydrogeological, and tectonic criteria 	<ul style="list-style-type: none"> Record wider potential landslide areas based on geological and tectonic criteria Analyze the geological, geomorphological, tectonic, and hydrogeological elements of the identified landslide-prone areas Evaluate the geological formations (e.g., consistency, disintegration, assessment of mechanical behavior, etc.), tectonics, data 	Prevention, preparedness	<ul style="list-style-type: none"> Potential landslide areas are identified based on geological and tectonic criteria Detailed technical-geological mapping of the landslide-prone areas is carried out by the 	2030	Municipalities, EAGME

	on the seismicity of the area, and hydrogeological data		municipality in order to remove potential landslide hazards with appropriate preventive measures		
Understanding risk <ul style="list-style-type: none"> Improve understanding of landslide hazards in monuments and archaeological sites Share information among stakeholders 	<ul style="list-style-type: none"> Document and identify landslide hazards and solutions in monuments and archaeological sites (e.g., Acropolis of Athens) Provide training of archaeological site staff (popularization of science) 	Prevention, preparedness	<ul style="list-style-type: none"> Bibliographic record of studies, plans, and measures is produced Landslide hazard mapping is completed Prevention/ mitigation guidelines are prepared Monitoring of ground displacements under monuments is in infancy Archaeological site staff is trained (popularization of science) 	2025	NOA, MoCS
Risk reduction and prevention <ul style="list-style-type: none"> Take prevention measures for potential landslide events in areas prone to landslide, such as installation of retaining structures 	<ul style="list-style-type: none"> Conduct construction works for prevention of potential landslides in areas prone to landslide Take prevention measures for landslide events along the road network Invest in retaining structures to reduce the potential of landslide hazards 	Prevention	<ul style="list-style-type: none"> Improved protection, less damage, and less cascading impact from slope instability and landslide effects in landslide-vulnerable locations 	2025–2030	MoIT, municipalities, regions
Risk reduction and prevention <ul style="list-style-type: none"> Implement electronic platform for continuous infrastructure monitoring 	<ul style="list-style-type: none"> Invest in continuous monitoring of national infrastructure for impacts of landslides (stand-alone or as cascading hazard) 	Prevention	<ul style="list-style-type: none"> There are improved prevention, preparedness, and response measures 	2025	NOA, municipalities, regions, MoIT, critical infrastructure operators
Early warning systems <ul style="list-style-type: none"> Implement remote sensing, monitoring, early warning systems 	<ul style="list-style-type: none"> Enhance the use of remote sensing and ground-based sensors to detect landslides Develop an electronic platform for the continuous monitoring of critical national 	Preparedness	<ul style="list-style-type: none"> Early detection of slope instability allows decisions about evacuation and/or protective actions 	2030	NOA, academia and research institutions,

	infrastructure vis-à-vis the risk of co-seismic landslide, coastal deformation (e.g., in the region Gulf of Corinth, in the limits of the “Enceladus” Hellenic supersite)				municipalities, regions
	<ul style="list-style-type: none"> Develop landslide early warning systems to protect cultural heritage sites 	Prevention, preparedness			MoCS with support from NOA
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Clean road networks following landslide and repair retaining walls Undertake emergency reconstruction works Identify and disseminate information on emergency evacuation routes 	<ul style="list-style-type: none"> Invest in road cleaning networks following landslides, including provision of machinery for such works (as included in the AEGIS plan) Invest in emergency construction of retention walls and barriers to limit further landslides 	Response, recovery	<ul style="list-style-type: none"> There is improved safety following landslide events, including opening of emergency routes and preventative construction works to limit further landslide/rockfall Road network restoration is faster, allowing mobility of community members via road networks 	2025	Municipalities, regions (ministries/critical infrastructure operators)
Additional proposed priority measures for consideration					
Understanding risk <ul style="list-style-type: none"> Improve mapping and zonation of landslide hazard, and design standards to reduce landslide risk 	<ul style="list-style-type: none"> Develop and make accessible homogenized landslide risk information, particularly in areas of Western Greece that do not have the same detailed knowledge of landslide susceptibility 	Prevention, preparedness	<ul style="list-style-type: none"> There is improved uniformity of landslide risk analysis, mapping, and information throughout Greece to support management of landslides in existing or newly risk-prone areas 	2030	Regions, EAGME
Understanding risk/ Risk reduction and prevention <ul style="list-style-type: none"> Develop a long-term strategy for landslide management 	<ul style="list-style-type: none"> Develop a long-term landslide management strategy Take appropriate landslide protection measures Develop multi-hazard maps with the inclusion of landslide risk including co-seismic landslides 	Prevention, preparedness	<ul style="list-style-type: none"> Record keeping, active communication, and database accessibility among stakeholders and target groups is enhanced and will increase effective 	2030–2040	Municipalities/ regions, EAGME, research teams from universities

	<ul style="list-style-type: none"> • Create accessible database for landslide incidents 		landslide hazard management <ul style="list-style-type: none"> • Identification of priority areas for assessment and protection. 		
Early warning systems <ul style="list-style-type: none"> • Develop monitoring and forecasting systems for landslide hazards 	<ul style="list-style-type: none"> • Invest in systematic and streamlined collection of landslide information/registry of landslides; risk analysis requires data-sharing mechanism among institutions/across ministries • Invest in monitoring of terrains (satellite or airborne systems or ground-based systems) to assess movements and susceptibility of critical slopes • Develop slope stability models used for landslide risk monitoring/forecasting • Monitor infrastructure and heavily populated areas susceptible to landslide risk 	Prevention, preparedness	<ul style="list-style-type: none"> • There is improved landslide risk assessment, data collection, and development of accessible databases among institutions responsible for landslide hazard risks; institutions can formally establish knowledge-sharing and data management 	2025	Municipalities/ regions with support from NOA and other institutes
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> • Landslide evacuation planning 	<ul style="list-style-type: none"> • Develop landslide evacuation plans for particularly susceptible areas; include impacts of multi-hazard effects and cascading consequences 	Preparedness, response	<ul style="list-style-type: none"> • Emergency preparedness and response are improved, with well-defined evacuation routes 	2025	Municipalities/ regions
Risk reduction and prevention/ emergency preparedness, response, and recovery <ul style="list-style-type: none"> • Improve risk awareness and capacity building 	<ul style="list-style-type: none"> • Invest in risk and action awareness campaigns for the local community, including informing citizens about landslide-susceptible areas, actions to prepare for landslides, and landslide evacuation routes 	Preparedness	<ul style="list-style-type: none"> • Awareness of population, local authorities, and interested institutions is improved 	2025	Municipalities/ regions

Human infectious diseases

Infectious diseases management is planned and implemented by several entities and services. However, the overall responsibility for strategic planning and co-ordination during potential infectious disease outbreak is held with the MoH and the National Public Health Organization. The MoH has supervised and undertaken various initiatives for the design and implementation of strategies for infectious disease control and prevention. The first systematic effort to design a strategic plan for infectious diseases was in 2008, when the MoH published the National Action Plan for Infectious Diseases 2008-2012 and the National Action Plan for Antimicrobial Resistance and Infections 2008-2012. Both national action plans were part of a series of action plans for various public health topics and challenges, which collectively comprised the National Action Plan for Public Health 2008-2012. In 2014, the MoH published the National Strategy for Health and Actions in the health sector relating to ESPA. Although this report was not an actual action plan for infectious diseases control and prevention, it presented various measures for the improvement of preparedness and response of emergency care and crisis management in health care and emphasized the importance of the evaluation and assessment of preparedness measures on a regular basis. It also highlighted the existence of multiple levels of preparedness both on local, regional, and national level.

These measures were strengthened with the National Strategic Plan for Public Health 2019-2022, which included a section discussing the emergency situations due to infectious diseases and stressed the critical role of the rigorous implementation of the International Health Regulations as well as the potential changes needed in terms of institutional capacity, legislation, and funding. The National Strategic Plan for Public Health 2019-2022 also proposed reforms for the National Network of Laboratories for detecting infectious disease and for epidemiological surveillance. The ongoing effort of strengthening the response mechanisms for health emergencies was further stressed by the onset of the COVID-19 pandemic. This is reflected in the current National Action Plan for Public Health, which was published in early 2021 and has focused on the period until 2025. More details and a summary of priority measures and goals are presented in Table 13.

Apart from the strategic plans, there are several operational plans for preparedness against health threats and emergencies. Among these is the Perseas Plan, which focuses on modelling the procedures of emergency response within a hospital setting. Furthermore, the Philoktitis plan outlines a set of instructions and guidance for the management of chemical, biological, radiological, and nuclear threats. The Sostratos plan, among others, focuses on the continuity of the provision of hospital services. Lastly, the Artemis plan provides operational guidance against a potential influenza pandemic. According to the National Action Plan 2021-2025, the latter is proposed to be updated in light of the policy responses implemented to control the COVID-19 pandemic.

An important gap relates to the lack of planning in the local, municipal, and regional level. This issue mainly relates to the overlapping responsibilities among various entities, such as the MoH, the regional health authorities, and the administrative regions. It can be also attributed

to the highly centralized governance of the Greek health system, with regional health authorities having relatively limited role and impact on decision-making and planning. Second, public health and prevention of infectious diseases is a neglected and underfunded policy area, compared to curative services. The services for public health and epidemiological surveillance are also understaffed, whereas education in these disciplines is only provided in a limited number of educational institutions. Therefore, rethinking public policy priorities in health sector is particularly important in terms of funding and resource allocation, with a particular focus on infectious disease control and public health in general. Third, the current COVID-19 pandemic demonstrated that tackling infectious disease outbreaks requires approaches that go beyond the standard epidemiological measures and extend to various elements of social and behavioral sciences. Therefore, effective policy responses can be drawn by multidisciplinary groups of policy makers and experts, whose approaches consider the clinical, social, and behavioral implications of disease outbreaks.

Table 13. Summary table of priority measures for human infectious diseases

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period / status	Responsible institutions
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Create an evidence-based decision-making process 	<ul style="list-style-type: none"> Establish a committee for tackling emergency situations from infectious diseases Establish a committee for COVID-19 pandemic 	Response	<ul style="list-style-type: none"> Reports and consultations from public health experts regarding the response to infectious disease outbreaks 	2021-2025	MoH
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Create well-structured operational planning 	<ul style="list-style-type: none"> Update the Artemis Plan Reorganize the Directorate for Operational Preparedness for Public Health Emergencies Collaborate with both national and international entities responsible for crisis management 	Prevention, preparedness	<ul style="list-style-type: none"> Extended operational guidance from the updated Artemis Plan Better coordination among entities responsible for infectious disease outbreaks 	2021-2025	MoH
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Develop awareness for the potential effects of large-scale disease outbreaks 	<ul style="list-style-type: none"> Support to tackle the potential psychosocial implications of an extensive disease outbreak (such as COVID-19) 	Response	<ul style="list-style-type: none"> Mitigating the negative impact of pandemics on mental health 	2021-2025	MoH
Emergency preparedness, response, and recovery	<ul style="list-style-type: none"> Establish surveillance mechanisms for testing and tracking cases in the general population 	Prevention, preparedness	<ul style="list-style-type: none"> Identify potential cases through testing 	2021-2025	MoH

<ul style="list-style-type: none"> Contain the extensive outbreak of potential pandemic 	<ul style="list-style-type: none"> Introduce registries of infected patients/cases in the population Capitalize on the success of the setup of quick immunization 		<ul style="list-style-type: none"> Real-time data on the number of infections Increase in vaccination uptake 		
Early warning systems <ul style="list-style-type: none"> Improve data management systems Set up mechanisms for data analysis Link with currently existing international networks 	<ul style="list-style-type: none"> Invest in development of collection and treatment systems for epidemiological and other data Expand e-health initiatives, supply of diagnostic equipment, and consumables for remote areas Build capacity for data analytics in all the phases of policy formulation against health threats (design, application, key performance indicator measurement, evaluation) 	Preparedness, response	<ul style="list-style-type: none"> Improve the ability to monitor public health and outbreak of infections Build capacity 	2025	European Investment Bank funding
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Improve the effectiveness of rapid response mechanisms 	<ul style="list-style-type: none"> Create designated spaces for storage of procurement and supplies for epidemiological response in airports and ports. Ensure the community health of regions with increased population mobility Cover potential health needs of migrants/refugees 	Preparedness, response	<ul style="list-style-type: none"> Ensure adequate supplies in case of emergency Mitigate the potential outbreak due to increasing population mobility 	2025	MoH
Additional proposed priority measures for consideration					
Understanding risk <ul style="list-style-type: none"> Create and develop awareness of emerging threats for health 	<ul style="list-style-type: none"> Elaborate with stakeholders and develop a national awareness strategy for infectious diseases and pandemics Enhance awareness of measures for personal protection against infectious diseases (personal hygiene, social distancing, etc.) Introduce a single point of information in the system, which will be responsible for tracking the situation of infectious diseases and potential emerging threats globally Solidify a single point of communication in the system, which will be responsible for 	Prevention, preparedness	<ul style="list-style-type: none"> Develop a national roadmap and strategic plan for emerging health threats that will guide national services as well as the general public in epidemics Familiarize the general public with relevant knowledge and protective measures Provide real-time information on emerging threats 	2025	MoH and GSCP

	disseminating valid information on health threats and behaviors		<ul style="list-style-type: none"> • Reduce “fake news” and misinformation • Build effective cross-country collaboration and coordination in messaging 		
Understanding risk <ul style="list-style-type: none"> • Enhance and solidify training for emerging health threats 	<ul style="list-style-type: none"> • Introduce specific courses in the curricula of health sciences • Introduce “train the trainer” activities for training of volunteers among the general public 	Prevention, preparedness	<ul style="list-style-type: none"> • Promote the culture of awareness in all health professionals • Solidify a base of knowledge around emerging threats and infectious diseases in the society • Train highly skilled and well-educated health professionals who can apply innovative and effective epidemiological surveillance 	2030	MoH
Risk reduction and prevention <ul style="list-style-type: none"> • Modernize institutional and technical framework 	<ul style="list-style-type: none"> • Establish a protocol for effective and early response to infectious disease outbreaks • Improve epidemiological surveillance systems for both human and animal infectious diseases • Ensure effective monitoring and adherence to guidelines and recommendations for disease surveillance 	Prevention, preparedness	<ul style="list-style-type: none"> • Improve institutional and technical capacity for managing infectious diseases 	2025	MoH, National Public Health Organization
	<ul style="list-style-type: none"> • Introduce digital systems for contact tracing and for monitoring hospital and intensive care capacity • Strengthen the role of primary care 	Response	<ul style="list-style-type: none"> • Reduce deaths and control health costs • Optimize use of hospital beds and health resources when health system is overwhelmed 	2040	MoH, National Centre for Health Operations–Emergency Health Care Center (EKEPY-EKAV)
Risk reduction and prevention <ul style="list-style-type: none"> • Introduce behavioral and social science tools 	<ul style="list-style-type: none"> • Use insights from behavioral and social sciences to monitor and change human behavior during disease outbreaks 	Prevention, Response	<ul style="list-style-type: none"> • Highlight and demonstrate the interdisciplinary nature and elements of public health 	2025	MoH, Prime Minister’s Office

	<ul style="list-style-type: none"> Establish an interdisciplinary task force of experts in policy making behavioral and social science, economics, and bioethics Invest in development of collection and treatment systems for epidemiological and other data Expand e-health initiatives, supply of diagnostic equipment, and consumables for remote areas Build capacity for data analytics in all the phases of policy formulation against health threats (design, application, key performance indicator measurement, evaluation) 		<ul style="list-style-type: none"> Optimize the effectiveness of various measures and policies during a pandemic Recommend additional measures that adopt an interdisciplinary and holistic perspective 		
Emergency preparedness, response, and recovery <ul style="list-style-type: none"> Strengthen the capacity of the system Establish a National Public Health Service, extending to regional level 	<ul style="list-style-type: none"> Clarify and simplify overlapping legislation Set up a national protocol of action with specified roles for agencies Minimize overlapping responsibilities between agencies and ministries on the response to population-level health emergencies Set up a specified authority for the response in human infectious diseases incidents Set up an operational national public health service that will be organized under a single center (national level) with the coordination of regional authorities, under a joint organization 	Preparedness	<ul style="list-style-type: none"> Reduce confusion Improve speed of decisions and speed of action Promote the efficient use of currently existing public health workforce 	2025	MoH
Financial protection <ul style="list-style-type: none"> Improve availability and affordability of financing instruments, making government a proactive manager following health disasters Emphasize government's role in emergency relief, 	<ul style="list-style-type: none"> Expand insurance markets and uptake devoted to major disasters and hazards Improve data collection, risk modeling, and structuring of financial mechanisms to create more efficient and targeted contingency plans Prioritize shock-responsive fiscal policy and planning, through the establishment of a fiscal risk management unit 	Response	<ul style="list-style-type: none"> Ensure accessible, affordable, transparent, and effective financing following pandemics and health hazards Protect households and enterprises affected by health hazards and pandemics 	2025	MoH, MoF, GSCP

recovery, and reconstruction <ul style="list-style-type: none"> • Link macroeconomic and fiscal policy with disaster risk management 					
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Technological accidents

The consultation process with central bodies and regional/local authorities provided a limited number of measures related to technological hazards. Ongoing or planned investments to be funded by NRRP or ESPA do not clearly include projects for prevention of or protection from technological hazards, or the state's and society's response to them; however, there are EU research projects on these topics, the outcomes of which could eventually be operationalized. Planned measures focus primarily on early warning by upgrading monitoring systems and installing radioactivity detection equipment. There are research projects with NOA participation to enhance resilience of industrial facilities by installing a system for holistic protection of industrial entities, monitoring systems, and active detectors. Regions are required to develop Response Plans for Large Technological Accidents, for which technical support is often required, along with close cooperation with all involved parties, from emergency responders to industrial stakeholders. Although water pollution does not lie within the responsibility of central CP authorities, at local level, measures for passive response to seawater pollution have been included in DRM-related funding (e.g., by the Municipality of Corfu).

A number of other measures could potentially be considered, noting that these haven't been clearly identified by authorities. GSCP and other ministries that monitor industries may take the initiative for strengthening DRM at institutional and operational level. Relevant actions may include support for preparedness and response planning, coordination of communication and data exchange (which is particularly important due to interdependencies), and financial and legal actions to facilitate the adoption of technological innovations. The need for training in and public awareness of technological accidents, and the state's and public's response in case one occurs, should be highlighted, given existing gaps in hands-on experience and relevant expertise.

Table 14. Summary table of priority measures for technological accidents

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
Risk reduction and prevention <ul style="list-style-type: none">Improving resilience of sensitive industrial plants and infrastructures exposed to cyber or physical threats	<ul style="list-style-type: none">Apply methodologies/technical solutions designed to protect critical industrial installations from natural hazards, malicious human interference, or cyberattacks	Prevention, preparedness	<ul style="list-style-type: none">Technology (e.g., integrated platform and systems) for protection from natural, man-made, and cyber threats is used in a holistic manner	Planned 2019–2021	NOA (research project)

Early warning systems <ul style="list-style-type: none"> Strengthening of national infrastructure for radioactive waste management and radiological emergency response 	<ul style="list-style-type: none"> Install new stations and design new telemetric networks for monitoring environmental radioactivity, including acquisition and installation of new equipment (stations, detectors, air samplers) Integrate new detectors / stations and upgrade / replacement of existing ones to operate into as single system in order to support emergency decision making 	Preparedness	<ul style="list-style-type: none"> Monitoring of radioactivity for early warning and early response is upgraded 	Planned 2021–2025	Greek Atomic Energy Commission
Early warning systems and emergency preparedness <ul style="list-style-type: none"> Development and maintenance of monitoring and early warning systems for industrial infrastructures and public awareness 	<ul style="list-style-type: none"> Monitor dam stability Conduct public education to address the industrial risk Install seismological sensors for earthquake early warning at sensitive industrial installations 	Prevention, preparedness	<ul style="list-style-type: none"> Capacity of industries for early detection of technological emergencies triggered by natural events is strengthened Public awareness is focused on industrial hazard monitoring and warning 	Planned 2019–2021	NOA (research project)
Emergency preparedness and response <ul style="list-style-type: none"> Enhancement of institutional capacity and preparedness 	<ul style="list-style-type: none"> Develop Special (or external) Response Plans for Large Technological Accidents for the external area of upper-tier SEVESO facilities at regional or municipality level 	Preparedness, response	<ul style="list-style-type: none"> Institutional capacity of local authorities to cope with technological emergencies by following pre-established plans and training is strengthened 	Planned 2019–2023	Regional/local authorities
Risk reduction and prevention <ul style="list-style-type: none"> Supply of material for water anti-pollution technology 	<ul style="list-style-type: none"> Supply material for water anti-pollution technology (e.g., anti-pollution protection 400 m sea barrier) 	Prevention, Response	<ul style="list-style-type: none"> Preparedness for early and effective response in case of sea pollution is strengthened with technological material 	Identified as a need (2022–2023)	Municipality
Additional proposed priority measures for consideration					
Risk governance <ul style="list-style-type: none"> Improving effectiveness of disaster risk 	<ul style="list-style-type: none"> Strengthen communication among interdependent industries, and between them and emergency 	Response	<ul style="list-style-type: none"> Early and accurate exchange of relevant information is established with involved stakeholders for effective 	2025	Industry, MoEE, MoDI, MfCCCP

management (from prevention to recovery)	response authorities, by creation of appropriate links and channels • Establish cross-border communication channels for reliable information on technological accidents		response and guarantee of uninterrupted critical service provision (from alternative industries/providers, if necessary)		
	• Maintain an updated comprehensive damage loss database, including near misses and lessons learned, with closer collaboration among involved authorities and industries	Prevention, preparedness, response	• Regular and systematic major accident analysis and response are secured • Commonly informed decision-making process and improved DRM planning at national and local level is established	2030	MoEE, GSCP
	• Provide technical assistance to regional/local authorities for the development of Special (or external) Response Plans for Large Technological Accidents for the external area of upper-tier SEVESO facilities	Preparedness, response	• Risk- and needs-informed response plans are developed	2025	GSCP, regional authorities
	• Implement cutting-edge technology • Capitalize research and innovation programs	Prevention, preparedness, response	• Improved and coherent risk reduction actions to foster research and innovation are developed	2030–2040	MoDI, industry
Early warning systems • Investing in targeted early warning system for technological hazards	• Develop and maintain early detection and warning and population alert system by implementation of low-cost systems and modern technology	Preparedness	• Early alert of authorities and population in case of severe industrial incidents or accidents is improved • Rapid mobilization and improved coordination of emergency responders and other involved stakeholders is achieved	2030	Local authorities, MoEE

Emergency preparedness and response <ul style="list-style-type: none"> Investing in public awareness and operational preparedness 	<ul style="list-style-type: none"> Conduct public awareness through campaigns about existing hazards (at local or national level) and necessary actions in case of emergency Develop and regularly conduct practical training scenarios at local level for technological accidents, including industries, authorities, and the public Correlate industrial risk assessment with DRM planning 	Preparedness	<ul style="list-style-type: none"> Capacity of authorities and emergency response organizations to cope with industrial accidents is strengthened, including for accidents with which there is limited experience Public awareness of response actions is increased 	2025	Local/regional authorities, GSCP
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Chemical, biological, radiological, and nuclear events

Consultations with both central and local bodies did not yield a significant number of planned measures related to CBRN emergencies. The country does not host a nuclear facility, and only the radiological waste facility of NCSR “Demokritos” needs funding for physical protection and eventual decommissioning. The ongoing projects mentioned mainly refer to installation of monitoring equipment that will allow early warning to the authorities for radioactivity, chemical substances, and other atmospheric quality measurements. The proposed priorities include integrating monitoring results in a digitized platform, for reliable and early information of involved stakeholders and the public. Public awareness is considered of the utmost importance, considering the rarity of such events as well as the misinformation often associated with them. Moreover, although training of special teams for responding to CBRN events has been planned by the Hellenic Police, the need for common training and drills with all involved stakeholders is also recognized. Last but not most important, cross-border collaboration and communication are proposed for enhancement, due to the nuclear facilities in the territories of neighboring states, the globalization of terrorist threats, and the impact of CBRN incidents.

Table 15. Summary table of priority measures for CBRN events

Focus area and overarching goals	Priority measure description	Category: prevention, preparedness, response	Expected outputs/results	Time period/status	Responsible institutions
Risk reduction and prevention <ul style="list-style-type: none"> Increasing protection for domestic risky installations 	<ul style="list-style-type: none"> Upgrade the physical protection measures and the nuclear safety of the radiological waste management at Demokritos. Secure funds for the eventual transfer of the waste to special recycling 	Prevention	<ul style="list-style-type: none"> Passive nuclear hazard is reduced for Athens 	Identified as a need	Greek Atomic Energy Commission (EEAE)

	facilities abroad (the highest radiological intensity sources with the remaining buried).				
Early warning systems, emergency preparedness and response <ul style="list-style-type: none"> Strengthening national infrastructure for radioactive waste management and radiological emergency response 	<ul style="list-style-type: none"> Install new stations and design a new telemetric network for monitoring environmental radioactivity, including acquisition and installation of new equipment (stations, detectors, air samplers) Commission new detectors/stations and upgrade/replace existing ones to form part of a single system in order to support emergency decision-making 	Preparedness	<ul style="list-style-type: none"> Monitoring of radioactivity is upgraded for early warning and early response 	2021–2025	EEAE
Emergency preparedness and response <ul style="list-style-type: none"> Strengthening response capacities through training 	<ul style="list-style-type: none"> Develop the National Training Center for Response to CBRN Threats 	Preparedness, response	<ul style="list-style-type: none"> National Training Center for Response to CBRN Threats is established 	2019–2022	Joint Coordination Center for Operations & Crisis Management/ Hellenic Police
Early warning systems <ul style="list-style-type: none"> Investing in monitoring of the atmosphere for dangerous substances 	<ul style="list-style-type: none"> Measure electromagnetic radiation and other particles Install atmospheric air quality monitoring stations (CO, NO, NO₂, O₃, SO₂, microparticles, temperature, humidity, vapor pressure) with intelligent application for monitoring environmental data and ability to predict the quality of the atmosphere 	Preparedness	<ul style="list-style-type: none"> Monitoring of electromagnetic radiation and chemical particles is upgraded for early warning and early response 	Identified as a need and partially submitted for funding	Local authorities
Additional proposed priority measures for consideration					
Risk governance <ul style="list-style-type: none"> Clarifying competencies Increasing interinstitutional coordination and dialogue 	<ul style="list-style-type: none"> Co-create response plans for CBRN events, allowing for clear understanding of roles of all stakeholders Enhance communication and data exchange channels among different stakeholders 	Preparedness, response	<ul style="list-style-type: none"> Understanding of competences is clarified, and cooperation is improved 	2025	GSCP and all involved stakeholders

Prevention, emergency preparedness, and response <ul style="list-style-type: none"> Increasing public awareness and information 	<ul style="list-style-type: none"> Create platform for common interinstitutional access with CBRN measurements and best practices exchange Create official platform for communication with the public, improving societal confidence in case of CBRN emergencies 	Prevention, preparedness, response	<ul style="list-style-type: none"> Official information is exchanged for informed and prepared experts and decision-makers Official public information is updated to avoid misinformation Dedicated guidelines are provided to the public 	2030	GSCP, MoEE, EAEE, State General Lab
Emergency preparedness and response <ul style="list-style-type: none"> Strengthening institutional collaboration and response to CBRN events 	<ul style="list-style-type: none"> Perform dedicated exercises for CBRN events, and/or include CBRN events in multi-hazard drills 	Preparedness, response	<ul style="list-style-type: none"> Experts and decision makers are trained 	2030	GSCP, Hellenic Police, and all involved stakeholders
Early warning, preparedness <ul style="list-style-type: none"> Strengthening cross-border collaboration 	<ul style="list-style-type: none"> Establish regular cross-border exchange of good practices and emerging risks with Bulgaria and Turkey Establish official alert/warning system for CBRN emergencies 	Preparedness, response	<ul style="list-style-type: none"> There is better integration of cross-border alert system and data exchange 	2030	GSCP, MoEE
Understanding risk <ul style="list-style-type: none"> Performing risk assessment 	<ul style="list-style-type: none"> Perform risk analysis for CBRN events following an established methodology with collaboration of involved stakeholders 	Prevention, preparedness	<ul style="list-style-type: none"> Potential risks (probability vs. impact) of CBRN incidents (accidental or malicious) are regularly recognized to prioritize actions 	2025	GSCP, Hellenic Police

3.3. Multi-criteria analysis and prioritization

MCA is a methodological approach and common tool used to evaluate and select between options or measures analyzing several criteria. It is a structured framework allowing users to combine expert evaluations. Criteria are typically assigned values to provide quantitative scores and enable comparison of alternatives. Criteria are weighted, highlighting their relative importance.

For the proposed NDRMP, a simplified MCA was used to prioritize the NDRMP measures, given limited data on costs of implementation, the high-level nature of the measures, and the fact that all measures included are considered as priorities. The MCA is flexible and can be adjusted to policy-makers needs at different levels seeking to prioritize among measures. The MCA was carried out independently for the measures for each hazard. A standardized score on a three-point scale (range of 1 to 3) was applied for each of the criteria. Only the first criterion, “disaster risk significance,” is not evaluated by applying the three-point scale, but rather reflects the Greece NRA 2019 results and additional considerations indicated in Chapter 2. The weights of individual criteria affect the ranking and selection of investment priorities in the NDRMP, and the final ranking of NDRMP measures is based on a weighted sum total. The following steps were taken as part of the proposed NDRMP:

- Determining the number, type, and definition of criteria
- Determining the relative weight of criteria significance
- Evaluating measures by assigning scores within a given range
- Evaluating measures against criteria based on the weighting method
- Prioritizing measures (total score)

Evaluation criteria

Six criteria are used to rank proposed NDRMP priority measures. These criteria are aligned with the conditionality requirement for EU funding, which notes that “the measures shall be prioritized in proportion to the risks and their economic impact, capacity gaps, effectiveness and efficiency, taking into account possible alternatives.”¹⁶⁶ Consideration of possible alternatives is reflected in the MCA, which enables comparison between proposed investment priorities that would achieve the same impacts (“effectiveness”), and comparison of these to the status quo option of doing nothing. These criteria are also aligned with matrixes used by other institutions such as the Organisation for Economic Co-operation and Development (OECD).¹⁶⁷

- **Significance of risk** is a quantitative criterion with value derived from the NRA 2019 and adjusted in proportion to the scale up to 3. The NRA itself considered several aspects as listed in Table 16. *The weight of the criterion is 20%.*

¹⁶⁶ European Union. 2018. Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, and the European Maritime and Fisheries Fund and financial rules for those and for the Asylum and Migration Fund, the Internal Security Fund and the Border Management and Visa Instrument COM/2018/375 final - 2018/0196 (COD). [Link](#).

¹⁶⁷ OECD. 2021. Evaluation Criteria. OECD DAC Network on Development Evaluation (EvalNet). [Link](#).

Table 16. NRA risk rating for each hazard

Hazards	Likelihood	Life/ health	Social/ political	Economic	Environmental/ cultural	NRA Overall Risk Index	Significance of risk (for NDRMP)
Earthquakes	4.5	4.5	3.2	4.1	2.7	3.5	2.25
Floods	4.8	2.7	3.5	2.7	2.3	2.6	1.80
Landscape fires	4.2	2.4	2.7	2.2	2.3	2.4	1.70
Extreme Weather	4.0	2.7	2.8	3.0	2.6	2.8	1.90
Tsunamis	2.0	2.7	1.6	2.4	1.1	2.0	1.50
Landslides	3.5	2.1	2.5	1.5	1.3	1.8	1.40
Volcanoes	1.1	2.6	2.0	2.3	1.7	2.2	1.60
Cyber risks	3.2	2.0	1.0	1.0	2.5	1.6	1.30
Industrial accidents	2.2	2.0	1.5	3.5	1.5	2.1	1.55
Radiological/nuclear	1.5	1.0	1.8	4.5	1.0	2.1	1.55

Source: Government of Greece 2019. NRA, p. 200, with added column on “significance of risk” and health row.

Notes: Original scores ranged between 1 and 5, The original rate was proportionally adjusted to the scale 1 to 3. Health was not considered in the NRA, and for the purpose of this report, the significance was assigned as 1.5.

- **Climate sensitivity** refers to the extent to which the hazard is sensitive to projects’ impacts of climate change, based on available research and information. (i) a low-sensitivity; (ii) a medium-sensitivity; and (iii) a high-sensitivity. *The weight of the criterion is 10%.*
- **Effectiveness** refers to the extent to which a measure contributes to achievement of overarching CP policy objectives as pursued by AEGIS, the proposed sectoral program for natural disasters under the National Development Program, the OP CP, the NRRP, and the EIB loan—and the extent to which the objectives can be achieved. Estimation of the assessed measures in view of the criterion is performed as follows: (i) a low-level measure contributes to the achievement of policy objectives as pursued by one of the programs or funding sources just listed; (ii) a medium-level measure contributes to the achievement of policy objectives of more than one of the programs or funding sources, but does not contribute to all goals; and (iii) a high-level measure contributes to the achievement of policy objectives of all the programs or funding sources. *The weight of the criterion is 20%.* An alternative approach is prioritizing measures which contribution to broader EU objectives, such as Cohesion policy Specific objective 2.4.
- **Efficiency** refers to the economic viability of investment measures—i.e., the extent to which costs and investments contribute to achieving the expected socioeconomic benefits, noting that general benefit-cost ratios (such as those collected by the PESETA IV report and noted in Chapter 2) were considered rather than specific calculations, given limited data. The evaluation is in the following range: (i) low efficiency, where costs/funding outweigh the benefits of measures; (ii) medium efficiency, where costs/funding are commensurate with the benefit of a measure; and (iii) high efficiency, where benefits are greater than costs/funding incurred for the implementation of the measure. *The weight of the criterion is 20%.*
- **Sustainability** reflects the extent to which investment measures make a sustainable contribution to disaster resilience and climate change. The evaluation highlights measures that are sustainable in the long term. Accordingly, the evaluation range is (i) low degree of sustainability, where measures contribute to solving the problems of disaster risk reduction in the short term but are

not sustainable; (ii) medium degree of sustainability, where measures have an effect and are sustainable in the medium term; and (iii) high degree of sustainability, where measures are fully sustainable over time and in the long run. *The weight of the criterion is 10%.*

- **Capacity** shows the current availability of the resources (administrative, financial, human, technical) needed to implement the measures for achieving objectives and carrying out the activities of the AEGIS, the proposed sectoral program for natural disasters under the National Development Program, the OP CP, the NRRP, and the EIB loan. The evaluation takes into account the degree to which necessary resources have been secured and accordingly evaluates measures as follows: (i) low level with insufficient capacity, i.e., lack of sufficient resources to implement the measures; (ii) medium level with generally available capacity but needing some improvements in the use of resources; and (iii) fully sufficient capacity, i.e., resources are available and guarantee the implementation of measures. *The weight of the criterion is 10%.* An alternative approach is prioritizing measures with low capacity to support the strengthening of capacity in this area, and also to distinguish further between levels of administration or among institutions, as capacities differ.
- **Urgency** the need to identify which measures need to be implemented without delay and in the short term, given the risk disasters pose for society and the economy and the potential benefits of investing in CP/DRM. Evaluation of measures is subject to the following conditions: (i) low urgency, where the measure can be implemented in the long run, i.e., more than five years in the future; (ii) medium urgency, where the measure is to be completed within five years; and (iii) high urgency, where measures need to be implemented as soon as possible. *The weight of the criterion is 10%.*

A sample matrix of the proposed MCA is presented in Table 17, with scoring results from the MCA for all hazards considered in the proposed NDRMP are further detailed and listed in Annex 3.

Table 17. Sample multi-criteria analysis matrix

Evaluation criteria	Significance of risk	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Final score
Weight	20%	10%	20%	20%	10%	10%	10%	100%
Proposed interventions								
Measure 1	2	1	2	3	3	1	2	1.9
Measure 2	3	2	1	3	3	3	3	2.2
Measure 3	1	3	3	1	1	2	1	1.6
Measure 4	2	2	2	2	2	1	3	1.7

Note: The highest possible final score is 3.0, and the lowest possible is 1.0.

Further prioritization approaches/alternatives

The benefits of DRM investments can produce triple dividends. These are (i) avoiding losses and saving lives during a disaster; (ii) unlocking economic potential as a result of stimulated innovations and bolstered economic activities, which are due to the reduction in background risks related to disasters; and (iii) generating social, environmental, and economic co-benefits of DRM investments even in the absence of

a disaster.¹⁶⁸ While there are approaches to quantify all these potential benefits, some benefits can be challenging to assess and/or are often overlooked, particularly broader social and environmental benefits. Consideration of the triple dividends results in a more holistic approach and provides an opportunity for consensus-based prioritization. The recently published *Economics for Disaster Prevention and Preparedness in Europe*¹⁶⁹ provides guidance and case studies on how to apply the Triple Dividend approach.

Benefit-cost analysis (BCA) is a well-established process used to identify, measure, and analyze the benefits of a project, program, or decision versus the costs associated with it. The metrics produced—namely the benefit-cost ratio, net present value, and internal rate of return—indicate if and when the assessed potential investment is economically efficient, delivering more benefits than total costs (capital, maintenance, and operations) over the duration/life cycle of the investment. BCA metrics of competing potential investments can also be compared to support prioritization of options. The EU previously provided guidance on BCA to support Member States to implement the 2014–2020 Cohesion Policy.¹⁷⁰ For BCA, sufficient information is needed at the level of investment.

Following prioritization of measures, selection of specific investments and projects can be supported by BCA. While the proposed MCA approach includes the criterion “efficiency,” it considers economic efficiency in a general sense based on experience with similar measures and a general recognition of the involved costs and benefits. As specific investments and projects are identified and their costs and benefits more quantitatively determined, BCA can be applied to help prioritize investments that are potentially competing for the same funds. To support decision-making in DRM, probabilistic BCA integrates the quantified frequencies and magnitudes of the hazards being addressed, often in an annualized form.

A robust stakeholder engagement process can lead to an increased level of transparency, engagement, and ownership of the final priority measures. A participatory process can help build consensus on prioritization metrics and criteria such as those used in the MCA and can promote agreement on and broad ownership of the final prioritization. While societal preferences can to a certain degree be considered in more quantitative decision-making methodologies, suitable participatory processes are encouraged. For example, through the use of social discount rates, BCA can consider society’s average valuation of future versus present benefits and costs of potential investment (a high discount rate indicates a lower valuation of the future and a preference for the present, which particularly in the context of climate change also has implications for intergenerational equity). However, adequate consideration of the preferences of multiple stakeholders is generally not possible through singular quantitative metrics. Stakeholder consultations and public perception surveys are useful tools to build consensus, which can facilitate dialogue between different and sometimes competing stakeholders and elicit perspectives from

¹⁶⁸ Tanner, T.M., Surminski, S., Wilkinson, E., Reid, R., Rentschler, J.E., and Rajput, S. 2015. The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management. Global Facility for Disaster Reduction and Recovery (GFDRR) at the World Bank and Overseas Development Institute (ODI), London. [Link](#).

¹⁶⁹ World Bank. 2021a. Economics for Disaster Prevention and Preparedness: Investment in Disaster Risk Management in Europe Makes Economic Sense. [Link](#).

¹⁷⁰ European Commission. 2014. Guide to Cost-Benefit Analysis of Investment Projects: Economic appraisal tool for Cohesion Policy 2014–2020. DG REGIO. [Link](#).

the general public. Stakeholder consultations should follow the legal requirements set in the given sector, but it is recommended that public sector authorities be proactive and use public consultation tools that go beyond the minimum required by the relevant legal acts.

Socio-political feasibility can be a critical but sensitive success factor for measures. The aforementioned use of robust participatory processes is critical to manage the dynamic socio-political realities of DRM. As highlighted for example in the EU Water Framework Directive,¹⁷¹ “it is necessary to provide proper information of planned measures and to report on progress with their implementation with a view to the involvement of the general public before final decisions on the necessary measures are adopted.” While planning and decision-making should be based as much as possible on quantified evidence, public and stakeholder engagement should be facilitated to help ensure public ownership and consistency of political support.

¹⁷¹ European Commission. 2000. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. [Link](#).

4. Chapter: Financial Resources and Mechanisms for CP and DRM

This chapter contains a summary of budgetary and financing resources and mechanisms related to prevention, preparedness, and response measures, considering past financing trends and planned investments. The desk review examined potential budgetary and financing resources and mechanisms for DRM investments, including investment priorities at the national, EU, and international level, based on information as of July 2021. It should be noted that the presented financial figures for future periods are indicative and subject to change. The review focuses on the 2021–2027 multiannual financial framework.

4.1. Past and current financing arrangements (2014-2021)

Between 2014 and 2020, major investments in CP and DRM across Greek regions have been financed through several funding instruments (Table 18), amounting to approximately €3.2 billion.¹⁷² The main sources of investment spending were: (a) EU co-funded programs funded by the European Structural and Investment Funds (ESIF), mainly through the national (sectoral) and regional Operational program (OPs), which include the Sectoral OP “Transport Infrastructure, Environment and Sustainable Development,” the Rural Development Program, the OP “Fisheries and Maritime,” and the OP “Competitiveness, Entrepreneurship and Innovation”¹⁷³; and (b) state budget-funded programs, including the National Development Program (FILODIMOS 1 and 2, and “Antonis Tritsis”) and the Green Fund grant allocations. It is noted that some ESIF-funded projects from the cycle 2014-2020 have a duration (completion date) through to 2023.¹⁷⁴ A number of projects contributing to DRM were funded through the LIFE Programme and HORIZON, and smaller grants for CP have also been made to Greece through DG ECHO, either specifically for Greece or to multiple countries including Greece. Minor investments have also come from the EU along with international research and technology development grants to beneficiaries in research, academia, and public bodies. Greece benefited from the European Union Solidarity Fund (EUSF) and the RescEU facility.

Table 18. Budget overview of investment programs (2014-2020) addressing DRM/CP objectives according to approved projects and budget for published calls for projects until 2021

	Source of funding	Policy field	Theme/measure	Budget allocations	Hazard focus
EU co-funded	ERDF	Cohesion Policy	5. Climate change adaptation and risk prevention And selection of projects from Objective 6	283,200,250 ^a Or approved project budget 274,103,649 ^b	See Annex 4 for main investment categories and budgets

¹⁷² This is an estimation based on available information of investment programs that include CP/DRM elements. There may be also other activities/measures that were not included in this calculation. Green transition programs, carbon reduction and energy upgrading projects were not included in the figure.

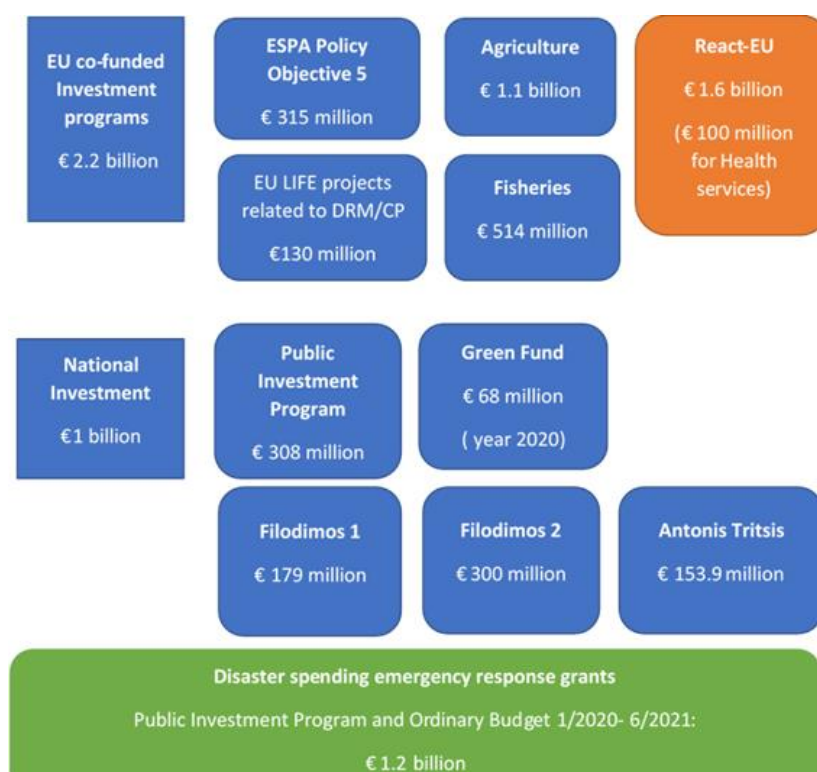
¹⁷³ There are priorities in the past Fisheries program 2014-2020 which are relevant to DRM. The 2014-2020 OP under Priority 6 supported Integrated Maritime Policy and the Common Information Sharing Environment.

¹⁷⁴ From the listed 222 ongoing projects addressing Objectives 5 and 6 of ESPA 2014-2020, most are programmed to end in the year 2023. From these, 26 projects are programmed to end in 2021, 40 projects in 2022, 155 projects in 2023 and 1 project in 2025. The projects are mainly related to Climate Change, Natural Disasters and Risks and Natural Habitats. The total investment budget for these 222 projects is €819,411,790 with €94,865,181 payments so far.

	CF	Cohesion Policy	5. Climate change adaptation and risk prevention	108,277,649 ^c	See Annex 4 as above
	EAFRD	Agricultural Policy	Forests and CCA	1,178,278,187 ^d	
	EMFF	Fisheries	Priority 6 Environment and Resource Efficiency	136,128,894 ^e	
	EU LIFE	EU LIFE projects		130,670,068 ^f	
Nationally funded	National Investment Budget	Public Investment Program (PIP)	Disaster reconstruction and recovery projects	308,688,988 ^g	See Annex 4 for details
		Green Fund	Various calls for projects	68,000,000 ^h	Environmental risk, pollution
		Filodimos 1	Various calls for projects	179,000,000 ⁱ	Floods
		Filodimos 2	Various calls for projects	300,000,000	Floods
		Antonis Tritsis	Various calls for projects	153,916,150	Earthquake, flood protection
Total (estimate)				2,764,031,292	

Note: This list is not exhaustive, and the total amount is hence an estimate based on calls for projects information considering allocations to approved projects and calls for projects budget for Cohesion (mainly Objective 5) and national investment program calls and grants for the period up to July 2021. a) Figure According to EC Cohesion Data, Update on May 21, 2021; b) Figure according to data processed for projects approved with project content relevant to DRM/CP, August 2021; c) Figure according to EC Cohesion Data, Update on May 21, 2021; d) Figure for program budget dedicated to Theme 5; e) Figure for program allocations supporting priorities 6 of ESIF “Environmental Protection and Resource Efficiency”. Fisheries and Sea OP Program 2015, [Link](#); f) Figure for all projects with interventions in Greece; g) Figure for legally contracted amounts for CP/DRM projects during 2016-2020; h) Annual figure from 2020 implementation report; i) Figure is for Flood protection projects only.

Figure 16. Estimates of allocated funding supporting DRM and CP objectives in the period 2014-2021



Note: Total figure of EU co-funded is drawn from EU Cohesion data portal, for investments supporting Thematic Objective 5 of Cohesion Policy funded from ERDF and CF. Emergency disaster response grants of approximately € 1.2 billion have been allocated from the ordinary budget and public investment program during January 2020- June 2021, as a response to disaster events.

Budgetary lines in the state budget have provided funding for the operation of GSCP, Fire Services, police, and armed forces as well as general grants to local and regional government. A special grant for CP is awarded yearly to municipalities to support (exclusively) fire prevention efforts. For 2021, ordinary funding (covering operational costs, programs, and salaries) for GSCP from the national budget for the policy program of CP and DRM amounts to €3.8 million, and to Fire Service to €492.5 million.¹⁷⁵

The investment focus of the nationally-funded public investment program during 2016–2020 was on road works and flood works. The bulk of investment projects approved in the PIP 2016–2020 focus on flood works (232 projects with €90 million in legally contracted amounts) and various types of road works, including rural, provincial, municipal, and forest roads. Urgent reconstruction projects and general local infrastructures are other categories of sizable investment, with €45.6 million and €11.4 million in legal contracts, respectively. Projects focusing on reconstruction are fewer; three projects on fire prevention receive a higher-than-average rate of payments, totaling €11.6 million, and seven projects for prevention and reconstruction have received €469,000 in payments. The studies and technical assistance category comprised 53 projects with €3.4 million in legal contracts; for many projects implementation is still ongoing, with €1.7 million in payments. Many of these projects are ongoing. Concerning the focus on specific hazards, most of the past funding from the nationally funded segment of the Public Investment Program (PIP) has been assigned to road works and flood protection, followed by urgent reconstruction measures. A relatively small funding focus was given to fire prevention, with three projects. Detailed financing trends with regard to the PIP/NDP are in **Annex 4**.

Post-disaster reconstruction is financed through various sources, including especially the funds for earthquake and fire victims, the PIP, and national grants. During the period January 2020 and June 2021, a sum of € 1.2 billion has been allocated to disaster response, relief and prevention actions (see also Table 42 in Annex 4).¹⁷⁶ Greece has demonstrated its commitment to the UCPM, volunteering own assets within the Civil Protection Pool, and acting as host country to both rescEU stockpiles, namely the forest fire stockpile and the medical equipment stockpile. Greece has been one of the top recipients of EUSF funds (Table 19).

Table 19. Funding received through EU Solidarity Fund in Greece

Period	Disaster event	EUSF funds approved (€)
2006–2019	March 2006 – floods (Evros); August 2007 – forest fires; January 2014 – earthquakes (Kefalonia); February 2015 – floods (Evros and Central Greece); November 2015 – earthquake (Lefkada); June 2017 – earthquake (Lesbos); July 2017 – earthquake (Kos); February 2019 – severe weather (Crete)	122.8 million

¹⁷⁵ Ministry of Finance and General Accounting Office, Budget Report, 2020, p. 195-200.

¹⁷⁶ Ministry of Finance, press statement, "Measures for relief and support to fire victims", August 9th, 2021. [Link](#).

2020 onwards	August 2020 – floods (Sterea Ellada region); September 2020 – Cyclone Ianos; October 2020 – earthquake (Samos, Ikaria, Chios)	24.6 million
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Source: European Commission. EU Solidarity Fund Interventions since 2002. Beneficiary State. Last update 18 November 2019 (by country) [Link](#); European Commission. 2021 various articles: [Link](#), [Link](#).

4.2. Planned national finances for 2021-2027 and beyond

In the upcoming 2021–2027 period, funds of €3+ billion and more will be available to investments in DRM/CP. This includes committed funds linked to achieve priority CP policy objectives, as well as funds that will be available for climate change and disaster risk prevention through ESIF and other mechanisms described in sections described below such as the regional programs and the OP for Environment and Climate Change. Significant funds are being committed to CP policy and DRM to support the main CP policy goal in the period 2021–2023 which is implementation of Law 4662/2020 and to render the operational structure of Nat-CHAMM fully functional. To this end, the Greek government has presented the integrated plan AEGIS (Table 20) which aims at upgrading the means and infrastructures of CP, as well as implementing the operational provisions of Law 4662/2020. The overall funding sources that will support the AEGIS plan are set to exceed €1.7 billion and will come from (i) the new ESIF-funded OP in the new programming period 2021–2027 focusing exclusively on CP (€714 million); (ii) the NRRP, which will be providing funding for infrastructure upgrading and DRR projects (€461.2 million); (iii) an EIB Loan Agreement (€595 million); and (iv) a proposed special development program within the PIP/NDP 2021–2025, which focuses on management and prevention of impacts of natural disasters on infrastructures.¹⁷⁷ The plans for the ESIF Civil Protection OP for the 2021–2027 programming period and the Sectoral Development Program for Civil Protection under the NDP are in the process of approval.¹⁷⁸ The consultations for the new Operational Program for Civil Protection were held in May, 2021.¹⁷⁹ In May 2021, the draft proposal of the OP was submitted to the EC for informal consultation. The completion of the approval procedures at European level is expected to take place by the end of 2021.

¹⁷⁷ The figure is drawn from the following report: Ministry of Citizen Protection and GSCP, “Draft Proposal for A special sectoral development program within the National Development Program 2021–2025,” Athens, January 2021.

¹⁷⁸ The Ministry of Development and Investment issued the second circular containing the basic principles that will govern the structure and content of the programs of the programming period 2021–2027 to be financed by the ERDF, the Cohesion Fund, the European Social Fund Plus, the Fair Transition Fund, and the European Maritime and Fisheries Fund. ESPA. 2021. Design of NSRF and Business Programs 2021–2027. ESPA 2014–2020. [Link](#). The GSCP has released a consultation document with the main programming guidelines for the new OP for Civil Protection; see Special Managing Authority of ESPA OP for Civil Protection. 2021. Concept Paper (ΕΣΠΑ 2021–2027 Επιχειρησιακό Πρόγραμμα Πολιτική Προστασία Concept Paper). [Link](#).

¹⁷⁹ Consultation meetings were held with representatives from the scientific community, with which CP is dynamically connected, to ensure sharing of data and know-how. Participants comprised representatives from the Geodynamic Institute and OASP, NOA, Hellenic Survey of Geology & Mineral Exploration (EAGME), MoEE, and Ministry of Infrastructure and Transport. Also, a meeting was held with the managing authorities of the operational programs of the 13 regions of the country. Government of Greece. 2021. GSCP press statement May 14. 2021. [Link](#)

Table 20. Overview of program axes and sources of the National Program for Civil Protection AEGIS (June 2021)

Axis	Description	Budget (€)	EIB (€)	NRRP (€)	ESPA (ESIF) (€)
Axis 1	Upgrading of infrastructure, facilities; provision of educational programs	229,300,000	51,500,000	109,500,000	68,300,000
Axis 2	(Early) warning systems and prevention means	268,700,000	94,000,000	34,000,000	140,700,000
Axis 3	Equipment and means of support and coordination	215,000,000	107,500,000	77,000,000	30,500,000
Axis 4	Operational equipment and means of response	1,047,000,000	342,000,000	187,500,000	517,500,000
Total		1.76 billion	595 million	408 million ^a	757 million ^b

Source: GSCP, Aegis Program Presentation, June 2021, p. 11.

Note: All figures are provisional and subject to change pending the final approval of the funding programs. ESPA = National Strategic Reference Framework. ESIF = European Structural and Investment Funds.

a. The total for the NRRP differs from what is otherwise reported. b. Note that the latest preliminary figure for ESIF allocations to the OP for CP is €713 million.

National Development Program 2021–2025

A proposed special sectoral development program for addressing and preventing disaster-related impacts to infrastructure is part of the NDP for 2021–2025. The proposal, which was tabled, suggested that funding of short-term reconstruction works by municipalities and regions should take place exclusively through the special sectoral program. The proposal merges the existing three funding lines for reconstruction works (MoIT, MoI, MoDI) into one line.¹⁸⁰ Internal negotiations on the form of the proposed special program were not concluded as of June 2021.¹⁸¹ The NDP came into force on July 1, 2021.

The proposed special sectoral development program for natural disasters comprises three priority axes.¹⁸² Priority Axis 1 is focused on continuing projects and works on natural disasters; Priority Axis 2 is focused on reconstruction and recovery from natural disasters; and Priority Axis 3 is focused on prevention projects. The proposed special program lists the following categories of new projects/works:¹⁸³

- Upgrading of building infrastructures of CP services
- Maintenance and upgrading of office equipment
- Maintenance and upgrading of machinery equipment

¹⁸⁰ Presentation by GSCP, March 24, 2021, Natural Disasters Response and Prevention, Slide 4.

¹⁸¹ Per communication with financial programming officers at the Ministry of Development and Investment, July 1, 2021.

¹⁸² Government of Greece. 2021. "Draft Proposal for A special sectoral development program within the National Development Program 2021-2025." Ministry of Citizen Protection and GSCP. Athens, January 2021, pp. 100–101.

¹⁸³ Government of Greece. 2021. "Draft Proposal for A special sectoral development program within the National Development Program 2021–2025." Ministry of Citizen Protection and GSCP. Athens, January 2021, p. 97.

- Training of staff of volunteer groups
- Procurement of personal protective equipment and moveable medical equipment
- Designation of spaces for CP at entrance points (airports, ports)
- Lease of aircrafts

4.3. EU funds relevant for investing in CP/DRM in the period 2021–2027

In the next financing period, 2021–2027, the EU aims to integrate DRM and climate change into policy planning and investments of the EU Member States. The EC has made the implementation of the EU Green Deal a priority, under which climate change adaptation, post-COVID-19 recovery, and DRM are envisaged.¹⁸⁴ The EU Green Deal has an overall objective to “transform the EU into a modern, resource-efficient and competitive economy, ensuring: no net emissions of greenhouse gases by 2050, economic growth decoupled from resource use, and no person and no place left behind.”¹⁸⁵ The EC plans one-third of the €1.8 trillion investments for the NextGenerationEU (NGEU) recovery plan, which is the recovery package to support EU Member States hit by the COVID-19 pandemic, while the EU’s seven-year budget will finance the European Green Deal. There are also opportunities to link some of these investments with disaster resilience, business continuity, resilient infrastructure/infrastructure upgrading, etc.

The EU budget (2021–2027) comprises the traditional components of the MFF complemented by new financial resources such as those designed to secure EU economic recovery after the COVID-19 pandemic. The EU’s MFF and financial facilities are complementary sources of investment available in the current 2021–2027 programming period through the national programs funded by the ERDF and the Cohesion Fund. The EU provided a stimulus package worth €2.018 trillion, which consists of the EU’s long-term budget for 2021 to 2027 of €1.211 trillion, topped up by €806.9 billion through the NGEU fund which will operate from 2021 to 2023 and be tied to the regular 2021–2027 budget. Greece expects to receive €30.5 billion from the NGEU pandemic recovery plan (of which, € 17.8 billion are grants and € 12.7 billion are loans), and a further € 40 billion in co-funded grants in 2021 to 2027 MMF.¹⁸⁶

Greece is expected to benefit from several EU policy domains, and associated financial resources, with relevance for DRM/CP policy. These include the EU Cohesion Policy and the structural funds (ERDF, European Social Fund, Cohesion Fund), the Common Agricultural Policy and the European Agricultural Fund for Rural Development (EAFRD), and the Integrated Maritime Policy (IMP)¹⁸⁷ and the Common Fisheries Policy through the European Maritime Fisheries and Aquaculture Fund (EMFAF)¹⁸⁸ Greece has

¹⁸⁴ European Commission. 2019. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal COM/2019/640 final. [Link](#).

¹⁸⁵ Ibid.

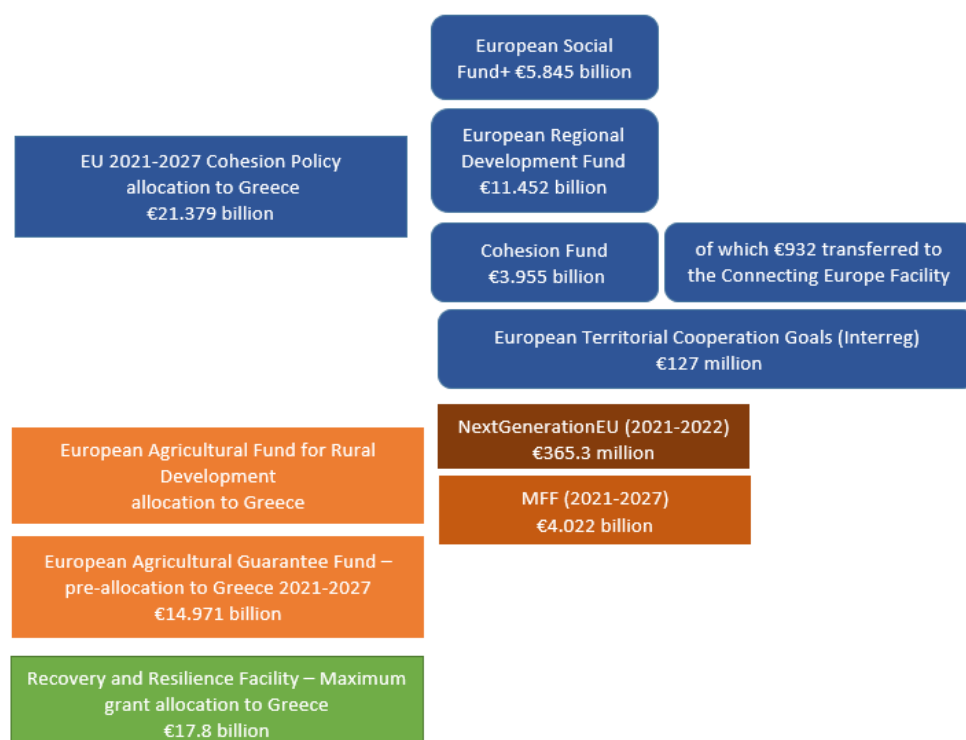
¹⁸⁶ EU Commission press statement, August 9, 2021. [Link](#).

¹⁸⁷ The EU’s Integrated Maritime Policy (IMP) is a policy framework aiming to foster the sustainable development of all sea-based activities and coastal regions by improving the coordination of policies affecting the oceans, seas, islands, coastal and outermost regions and maritime sectors, and by developing cross-cutting tools. [Link](#).

¹⁸⁸ The European Maritime Fisheries and Aquaculture Fund (EMFAF) runs from 2021 to 2027 and supports the EU common fisheries policy (CFP), the EU maritime policy and the EU agenda for international ocean governance. It provides support for developing innovative projects ensuring that aquatic and maritime resources are used sustainably. [Link](#).

also established a Just Transition Fund to assist development efforts for lignite- and fossil fuel–dependent regions. Greece’s NRRP includes some actions that are significant for CP and DRM efforts with further information provided below. Additional financing is provided through several EIB loans to the Greek state and various beneficiaries, including municipalities and commercial entities (for risk reduction and COVID-19 recovery efforts), as well as the REACT-EU program (under the NGEU instrument that addresses crisis response and recovery after the COVID-19 pandemic). Greece is a contributor to the rescEU stockpile and also draws resources in time of crisis. From a climate perspective, InvestEU also has the potential to support sustainable infrastructure investments against climate-related events and other natural disasters.

Figure 17. Pre-allocations for Greece under Multiannual Financial Framework 2021-2027 and NextGenerationEU



Source: European Commission. April 2021. The EU’s 2021-2027 long-term. Facts and Figures. EU Multiannual Financial Framework 2021-2027 and NextGenerationEU (in commitments) Pre-allocations per Member State, [Link](#).

ESIF Funding 2021–2027

Within the scope of the Cohesion Policy, under Greece’s ESPA 2014–2020, climate change adaptation and risk prevention have been allocated a total of €1.57 billion in funding ongoing until 2023 across funds. From this amount, €283 million is funded by the ERDF; €108 million is under the Cohesion Fund; and €1.18 billion is under the EAFRD.¹⁸⁹

¹⁸⁹ European Commission. 2020. Climate Change Adaptation & Risk Prevention. European Structural and Investment Funds. Data. [Link](#).

Interventions from the ESIF that are relevant for DRM/CP in the programming period 2021–2027 are mostly those that support Policy Objective 2: Greener Europe. The Partnership Agreement lists the provisional total allocations for Policy Objective 2 at €5.66 billion. This provisional figure for total allocations is broken down as follows across the funds: the Cohesion Fund will finance interventions at national scale, of strategic importance, or with a transregional character with an allocated budget of €2.23 billion, while ERDF will finance all other interventions, mainly on a regional scale, with an allocated budget of €3.13 billion at national level. Lastly, the EMFAF will allocate almost €300 million in support of the same policy objective.¹⁹⁰ The enabling conditions are listed in **Annex 4**.

The Regional Operational Programs will provide finance interventions in the fields of wastewater treatment, sanitation, access to drinking water, sustainable development and the promotion of sustainable development, climate change adaptation measures, water management, small-scale flood protection projects, local energy storage projects, and energy saving projects in public buildings except for buildings of the central public administration, and it will contribute to the implementation of projects under the Greco Islands initiative, complementing the Just Transition Fund and other funds (e.g., European Maritime Fisheries and Aquaculture Fund, EMFAF).

The Sectoral Operational Programs will mainly finance actions of national or strategic importance, including risk management, biodiversity and NATURA sites, solid waste management infrastructure projects,¹⁹¹ energy saving projects in residential buildings, supply of civil protection equipment, targeted strategic flood protection projects, awareness-raising and human resources training actions, and horizontal projects. In addition, pilot interventions will be financed in selected urban areas aiming at holistic management of drinking water. For interventions promoting sustainable multimodal urban mobility, the Transport Sector Program will focus on financing actions related to fixed railways and the renewal of the urban bus fleet with electric vehicles.

There are synergies identified with the EMFF, the EAFRD, and the Just Transition Fund:

- The EMFAF will contribute to the specific objectives of Policy Objective 2 and to the promotion of the sustainable blue economy, including
 - Preservation of marine and coastal biodiversity with the aim of protecting and restoring aquatic ecosystems, mitigating environmental impacts on marine and coastal ecosystems, and promoting the Green Economy
 - Reduction of the fisheries footprint and adaptation to climate change through sustainable fishing, aquaculture, processing, and marketing activities
 - Facilitation of the supply of quality and safe fisheries products, and actions to ensure safe, protected, clean, and sustainably managed seas.

¹⁹⁰ The source of those preliminary allocations figures is the approved document of the Partnership Agreement for Greece. Table 8, p. 56. 2021,EL16FFPA001, available online [here](#).

¹⁹¹ Only small-scale local infrastructure and mainly procurements of local character will be eligible for implementation by the Regional Operational Programs, assuming they are in line with an integrated plan for the region, serve the purposes of integrated and efficient management, and make a well-documented contribution to the achievement of recycling objectives.

- The EAFRD reduces the use of natural resources and furthers their sustainable management; it also promotes energy efficiency in agriculture, the use of renewable energy sources for agriculture, the conservation of biodiversity in rural areas, and adaptation to climate change.
- The Just Transition Fund supports actions relating to the fair energy transition of affected areas, and to the protection and restoration of ecosystems and the environment.

Operational programs

Operational Program for Civil Protection

A new sectoral OP under the National Strategic Reference Framework 2021–2027 is being prepared by the GSCP to focus on CP with a foreseen total co-funded budget of €714 million.¹⁹² The main strategy of the OP is to finance the creation of a modern and effective CP mechanism that focuses on prevention, preparedness, response, and intervention in order to protect the life, health, and property of citizens—as well as cultural heritage, infrastructure, the natural environment, resources, vital services, and tangible and intangible assets—from natural and technological disasters and other related threats that could cause emergencies. The program priorities comprise the following:

- Development of applications and diagnostic systems to address natural and man-made hazards using information and communication technologies
- Exploitation of research, technological development, and innovation; and adoption/promotion of innovative solutions for risk prevention and risk management
- Upgrading of equipment for the prevention and management of risks associated with fires
- Upgrading of equipment for the prevention and management of risks associated with extreme weather events
- Upgrading of equipment for the prevention and management of risks associated with man-made activity, biological and health hazards, and non-climate-related natural disasters
- Upgrading of sanitary equipment of CP structures and services for the protection of human life and public health
- Upgrading of the skills of CP human resources
- Communication with/awareness raising of the population in the face of risks

The Sectoral OP for CP is structured along seven subcategories of program interventions: infrastructure; human resources training; intelligent monitoring and management systems; airborne equipment; forest firefighting, prevention, and response equipment; COVID-19 measures; and other “soft” nonmaterial measures. The proposal suggests that the seven interventions will be transformed into five intervention axes:

- **Axis 1.** Intelligent systems for the prevention of natural disasters (in the context of Policy Objective 1)
- **Axis 2.** Natural disaster response equipment (under Policy Objective 2)

¹⁹² This co-funded total is listed in the Partnership Agreement that was approved in July 2021. [Link](#). The operational program’s approval is expected to take place in September 2021.

- **Axis 3.** Handling of the impact of man-made hazards/public health protection (under Policy Objective 2)
- **Axis 4.** Upgrading of human resources skills (within the framework of Policy Objective 2)
- **Axis 5.** Technical assistance

The total public spending was revised to a provisional allocation of €714 million.¹⁹³ Eligible geographical areas of the OP are defined as the 13 regions of the country. Based on categorization by GDP and the official regional data for the years 2012–2014, they are divided into (i) less developed regions, including Eastern Macedonia and Thrace, Central Macedonia, Western Macedonia, Thessaly, Epirus, Western Greece, Ionian Islands, Sterea Ellada, Peloponnese, North Aegean, and Crete; and (ii) regions in transition, including Attica and South Aegean.

Flagship actions foreseen under the program are as follows:

- Intelligent risk prevention and response systems
- Prediction and early warning systems for impending disasters from natural hazards (floods, fires, earthquakes, tsunamis, landslides, hailstorms, volcanic eruptions, etc.)
- Modernization of an increase in the fleet of air assets for firefighting
- Upgrading of the communication system of the services involved in the National Mechanism for Crisis Management and Risk Management
- Supply of four rescue and transport vessels for the transportation of patients from islands and coastal areas
- Upgrading of material and technological equipment of the Fire Brigade, police, and coast guard, for response to natural disasters and man-made risks
- Education/awareness raising among, and communication with, schoolchildren and the general public on dealing with natural disasters, specific hazards, and special categories of the population in the provision of first aid
- Field hospitals in the regions and regional units of the country to manage the consequences of floods, fires, earthquakes, and other natural disasters

Operational Program for Environment, Energy and Climate Change

A sectoral OP under ESPA 2021–2027 will focus on environment, energy, and climate change. The program is designed and envisioned to lead to “a greener, more resilient and low-carbon Europe, by promoting the transition to clean energy, green and blue investments, the circular economy, mitigation and adaptation to climate change, risk prevention and management, and sustainable urban mobility.” It will thus contribute to the achievement of Policy Objective 2 of the ESPA 2021–2027 and the European Cohesion Policy. The program aims to implement the country’s development strategy in the following thematic areas of the Cohesion Policy:

- **Environment:** Environmental protection; environmental protection of the natural environment; management of liquid and solid waste and promotion of a circular economy; protection of the

¹⁹³ Note that a preliminary figure of €713,757,939,00 is listed in the Partnership Agreement. [Link](#).

water environment and rational management of water resources; protection against climate change and protection of the environment from climate change; protection against air pollution and the adverse effects of noise pollution

- **Climate Change Adaptation and Energy:** Flood protection, prevention, and mitigation; management of water resources; protection of the environment and the environmentally sound management of water resources; mitigation of climate change and its impacts; energy efficiency; implementation of the National Energy and Climate Plan; promotion of energy production from renewable energy sources.

The estimated program budget for Environment, Energy and Climate Change OP for the period 2021–2027 is €3.6 billion.¹⁹⁴ Table 21 includes the program’s proposed priority axes, funding sources, and links to objectives.

Table 21. Proposed priority axes under OP for Environment, Energy and Climate Change (as of April 2021)

Priority axis	Funding source	Links to specific objectives
Priority Axis 1: Energy efficiency; promotion of renewable energy sources and infrastructures	Multi-fund, ERDF/Cohesion Fund	Linked to Specific Objectives 1, 2, 3
Priority axis 2: Adaptation to climate change	Multiannual financial framework, ERDF/Cohesion Fund	Linked to Specific Objective 4
Priority axis 3: Urban regeneration	ERDF	Linked to Specific Objective 7
Priority axis 4: Integrated waste management; transition to integrated waste management	Cohesion Fund	Linked to Specific Objective 6
Priority axis 5: Urban wastewater and water management	Cohesion Fund	Linked to the Specific Objective 5
Priority axis 6: Protection of biodiversity	ERDF	Linked to Specific Objective 7
Priority axis 7: Technical assistance	ERDF and Cohesion Fund	

Source: Adapted from data contained in Draft 1 of the OP for Environment, Energy and Climate Change 2021–2027, April 2021, p. 133.

Common Agriculture Policy Investments

EU’s Common Agricultural Policy has several common objectives, including (i) promotion of an intelligent, sustainable, and diversified agricultural sector providing food security; (ii) strengthening of environmental care and climate action and contribution to the objectives of the EU related to environment and climate; and (iii) strengthening of the socioeconomic structure of rural areas. Three of the nine Common Agricultural Policy-specific objectives target climate change, efficient use of natural resources, and protection of biodiversity, habitats, and landscapes. Investments in support of the second of these objectives are aimed at reducing disaster risks in agriculture through climate adaptation activities. At least 40% of the total European Agricultural Guarantee Fund investment spending and 30% of the EAFRD are to be allocated to environmental and climate change objectives. Under the EAFRD, Greece has been

¹⁹⁴ Partnership Agreement, July 2021, Table 9A, pp. 61–62.

allocated a total of €4.72 billion.¹⁹⁵ The new Strategic Plan for Rural Development for the period 2023-2027 of the Common Agricultural Policy in Greece, is under consultation process.¹⁹⁶

Other EU funds and instruments

Recovery and Resilience Facility (RRF)

With Regulation (EU) 2021/241, the EU has set up the European Recovery and Resilience Facility (RRF) as part of the NGEU initiative, with the aim to address the needs of recovery and resilience following the COVID-19 pandemic and the bloc's climate, economic, and social objectives. The RRF is designed to promote the economic, social, and territorial cohesion of the Union by improving resilience, preparedness, sustainability, crisis response preparedness, adaptive capacity, and growth potential of EU Member States, mitigating the impact of crises and the social and economic impact of the COVID-19 crisis, in particular on women. This is done by contributing to the implementation of the European Pillar of Social Rights, supporting the green transition, contributing to the achievement of the EU's climate objectives for 2030 as set out in Article 2(11) of Regulation (EU) No. 2018/1999, and complying with the EU's climate neutrality target for 2050 and the digital transition.

Greece submitted a National Recovery and Resilience plan (NRRP), which was approved by the EC in July 2021. The EU and national resources committed to Greece's NRRP amount to €31.16 billion.¹⁹⁷ It is expected that a total of €59.81 billion will be leveraged through the fund's actions, including private investments. The scope of the NRRP refers to policy areas of European relevance and is structured around six pillars:

- a) Green transition
- b) Digital transformation
- c) Smart, sustainable, and inclusive growth, with economic cohesion, employment, productivity and competitiveness, research, development and innovation, and a well-functioning internal market with strong small and medium enterprises (SMEs)
- d) Social and territorial cohesion
- e) Health, economic, social, and institutional resilience, with a view to, inter alia, increasing preparedness for crisis preparedness and crisis response capacity
- f) Policies for the next generation, children, and young people, such as policies on education and skills.

Table 22. Pillars, components, and costs of Greece's NRRP

Pillar	Costs (€, millions)
Total for Pillar 1: Green transition	6,194
1.1 Power up	1,200
1.2 Renovate	2,711

¹⁹⁵ European Commission. 2020. European Agricultural Fund for Rural Development. European Structural and Investment Funds. Data. [Link](#).

¹⁹⁶ See consultations page for the new Common Agricultural Policy. [Link](#). Currently, only information regarding the plan's principles are publicly available.

¹⁹⁷ The estimated total cost of the national recovery and resilience plan of Greece is €31,164,331,515.

1.3 Recharge and refuel	520
1.4 Sustainable use of resources, climate resilience, and environmental protection	1,763
Total for Pillar 2: Digital transformation	2,178
2.1 Connect	522
2.2 Modernize	1,281
2.3 Digitalization of businesses	375
Total for Pillar 3: Employment, skills, and social cohesion	5,184
3.1 Increasing job creation and participation in the labor market	776
3.2 Education, vocational education, training, and skills	2,311
3.3 Improve resilience, accessibility, and sustainability of health care	1,486
3.4 Increase access to effective and inclusive social policies	611
Total for Pillar 4: Private investment and transformation of the economy	4,880
4.1 Make taxes more growth friendly, and improving tax administration and tax collection	187
4.2 Modernize the public administration, including through speeding up the implementation of public investments, improving the public procurement framework, implementing capacity-building measures and fighting corruption	189
4.3 Improve the efficiency of the justice system	251
4.4 Strengthen the financial sector and capital markets	21
4.5 Promote research and innovation	444
4.6 Modernize and improve resilience of key economic sectors	3,743
4.7 Improve competitiveness and promote private investment and trade	5
Technical assistance	40
Total for all pillars	18,436
RRF Loan Facility	12,728 (loans)

Source: Commission Staff Working Document, “Analysis of the recovery and resilience plan of Greece Accompanying the document Proposal for a Council Implementing Decision” on the approval of the assessment of the NRRP, SWD/2021/155 final.

Several measures of the NRRP are of relevance for DRM/CP with component 1.4 comprising the most significant investments. This is focused on “Sustainable Resource Use, Resilience to Climate Change and Biodiversity Conservation,” with a budget of €1.76 billion. On clean energy, component 1.1 includes both reforms and investments aiming to increase the renewable energy sources in Greece’s energy mix. On building and renovating, sizable investments are planned under Component 1.2 to improve the energy efficiency of Greece’s aging housing stock, complemented by actions targeting energy-poor households as well as reforms and investments for urban plan development and interventions. Component 1.2 thus sets a framework to support green investments and enhance climate resilience of cities. On sustainable mobility, Component 1.3 includes both reforms and investments aiming to improve urban public transport and enhance the infrastructure for electric vehicles. Component 1.4 includes measures to promote and support biodiversity, such as a new system for permanent monitoring of species and habitat types, and reforestation of 16,500 ha of degraded forest ecosystems, mainly through native species. Finally, on sustainable agriculture, Component 4.6 includes a measure aiming at increasing the added value of agricultural products, promoting innovation, and protecting the environment. The key objectives of the measure include increasing competitiveness, with a greater emphasis on research, technology, and digitization; increase in skill levels in the rural/agricultural sector; improvement of the environmental profile of agricultural holdings; and mitigation of the effects of climate change.

The group of measures focusing on civil protection (Group 7), which are part of Component 1.4, include a number of CP Projects:¹⁹⁸ Aerial means for crisis management (ID: 16911), development of an innovative monitoring and management system (ID: 16910), establishment of a strategic National Disaster Risk Management Plan (ID: 16909), forest firefighting, prevention, and response equipment (ID: 16912), and implementation of Regional Civil Protection Centers (PEKEPP) through PPP schemes (ID: 16283). Several planned investments and reforms relevant to DRM and CP under Component 1.4 are described in Table 23. Additional measures that can potentially contribute to DRM and the management of environmental and technological risks are included in Table 24.

Table 23. DRM/CP-related projects and reforms in the Greek NRRP: Green Transition pillar

Investments
“Aerial means for crisis management” (measure ID: 16911) comprises the delivery of purchased aerial means and modernization of existing aircrafts used for civil protection, such as helicopters for medical use, transportation, and deployment of emergency infrastructure as well as drones for air surveillance and aircraft for firefighting. In particular, all special-purpose aircraft shall be “best in class” assets. The implementation duration is through December 31, 2025.
“Flood mitigation projects” (measure ID: 16882) comprise interventions reducing risks of flooding, providing water for irrigation purposes in areas facing drought during the summer, and enhancing surface water management efficiency in several areas in Greece. The measure requires that all works comply with the following principles: (i) all technically feasible and ecologically relevant mitigation measures will be implemented to reduce adverse impacts on water and relevant habitats and species; (ii) a newly built dam must not result in the deterioration of relevant and connected water bodies or compromise the achievement of their good status. In particular, for each sub-investment, full compliance with the requirements of the Water Framework Directive (Directive 2000/60/EC) are to be ensured before, during, and after the commencement of the construction works. Further, the measure is subject to an Environmental Impact Assessment (EIA) pursuant to Directive 2011/92/EU, as well as relevant assessments in the context of Directive 2000/60/EC and Directive 92/43/EEC, including the implementation of required mitigation measures. The implementation duration is through December 31, 2025.
“Forest firefighting, prevention, and response equipment” (measure ID: 16912) comprises the delivery of the purchased forest firefighting, prevention, and response equipment; the development of prevention projects for regions and local authorities; and support to the General Secretariat for Civil Protection volunteering organizations. The implementation duration is through December 31, 2025.
“Biodiversity protection as a driver for sustainable growth” (measure ID: 16851) consists of the following projects: (i) the establishment of a national network of paths and hiking trails, (ii) the enhancement of environmental protection through the implementation of a national system for permanent monitoring of species and habitat types, (iii) establishment of a national system for the surveillance of protected areas, (iv) the introduction of multimedia applications and bioclimatic and energy upgrade of the building facilities of the protected areas management units, (v) the modernization of the information centers of the protected areas management units, (vi) the creation of an integrated digital platform to offer information on protected areas, such as for eco-tourism, and (vii) the promotion of local products under an umbrella “Nature Greece” brand. The implementation duration is through December 31, 2025.
“Infrastructure – Establishment of a strategic National Disaster Risk Management” (measure ID: 16909) comprises the upgrade and supply of digital equipment (such as air surveillance control and telecommunication equipment) for the General Secretariat for Civil Protection buildings, and the development of mobile administration and on-site management centers. The implementation duration is through December 31, 2025.
“Monitoring and management system” (measure ID: 16910) consists of the supply of digital infrastructure for the General Secretariat for Civil Protection, such as a GPS monitoring system, early warning system, fire detection

¹⁹⁸ Information according to pp. 44–45 of Annex to the Proposal for a Council Implementing Decision on the approval of the assessment of the recovery and resilience plan for Greece (SWD (2021) 155 final), Brussels, July 17, 2021.

extinguishing systems, and emergency communication stations. The implementation duration is through December 31, 2025.
“Implementation of Regional Civil Protection Centers (PEKEPP) through PPP schemes” (measure ID: 16283) involves construction of 13 Regional Centers for Civil Protection through public-private partnerships. The objective of the investment is to ensure early and effective management of risks and crises at regional level. The newly constructed buildings are to comply with a Primary Energy Demand (PED) that is at least 20% lower than the NZEB requirement (nearly zero-energy building, national directives). The implementation duration is through December 31, 2024.
Reforms
“Waste management law for the implementation of sustainable landfilling and recycling” (measure ID: 16772) comprises a revision of the existing waste management legislation with a view to enabling the transition towards a circular economy. In particular, the reform introduces incentives for municipalities to achieve higher recycling rates and enforce separate collection of bio-waste by the end of 2022 and of metal, paper, glass, and plastic. It also extends the “producer’s responsibility” scheme, upgrades the operation of recycling sorting facilities, and simplifies the legislation around green points. The reform supports the achievement of targets of increasing reuse and recycling rates of municipal solid waste to 60% and reducing the landfill rate to 10% by 2030. The national waste regulatory authority put in place in the context of this reform will be responsible for ensuring the soundness of the pricing policy, supervising waste management implementation across the country, and supervising the proper functioning of the regional and local waste management utilities. The implementation of the reform is to be completed by June 30, 2023.
“Establishment of new water and wastewater regulatory authority” (measure ID: 16979) establishes a single body, the National Water Regulatory Authority responsible for implementing the policy for a rational management of water resources designed by the MoEE. The new authority is expected to strengthen the institutional framework and supervise the sector, including the nationalization of water tariff policy in line with the “polluter pays” principle and ensuring the sustainability of water services in Greece. The implementation of the reform is to be completed by December 31, 2023.

Table 24. Greek NRRP measures that can contribute to managing disaster, environmental, and technological risks

<p>Group 1: “Power Up”:</p> <ul style="list-style-type: none"> • Support for installation of storage systems to enhance renewable energy sources penetration (ID: 16926) • Revitalization actions of the most affected territories (Just Transition territories) (ID: 16871) • Hellenic Electricity Distribution Network Operator (DEDDHE) network upgrades aiming at enhancing resilience and protecting the environment (ID: 16901) • DEDDHE overhead network upgrading in forest areas (ID: 16900) • Installed capacity increase in Hellenic Electricity Distribution Network Operator (DEDDHE) HV/MV substations for new RES connection (ID: 16899)
<p>Group 2: “Energy renovation of enterprises and public buildings”:</p> <ul style="list-style-type: none"> • Energy and entrepreneurship (ID: 16874) • Energy upgrade of public sector buildings and energy infrastructure of public entities (ID: 16876) • Energy poverty action plan (ID: 16920)
<p>Group 3: “Interventions in residential areas and in the building stock”:</p> <ul style="list-style-type: none"> • Interventions in residential areas and in the building stock (ID: 16873) • Infrastructure development and building restoration in former royal estate in Tatoi (ID: 16875) • Olympic Athletic Center of Athens (ID: 16932)
<p>Group 5: “National Reforestation Plan and Biodiversity Protection”:</p> <ul style="list-style-type: none"> • National Reforestation Plan and Parnitha flagship investment (ID: 16849) • Biodiversity protection as a driver for sustainable growth (ID: 16851)
<p>Group 6: Wastewater & water infrastructure, water savings:</p> <ul style="list-style-type: none"> • Urban wastewater and sludge management infrastructures (ID: 16846)

<ul style="list-style-type: none"> • Drinking water supply and savings infrastructures (ID: 16850) • Flood protection project (ID: 16882) • Water supply projects (ID: 16898)
<p>Group 13: Improve resilience, accessibility, and sustainability of health care</p> <ul style="list-style-type: none"> • Organizational reforms in the health system (KETEKNY, ODIPY) (ID:16756) • Reform in the fields of mental health and addiction (ID: 16820) • Reform of the primary health care system (ID: 16755) • Implementation of National Public Health Prevention Program “Spiros Doxiadis” (ID: 16783)
<p>Group 14: Improve resilience, accessibility, and sustainability of health care</p> <ul style="list-style-type: none"> • Digital transformation of health (ID: 16752) • NHS hospital renovation and infrastructure upgrade (ID: 16795) • Establishment of a radiotherapy center at the Sotiria Thoracic Diseases Hospital of Athens (ID: 16757) • Project for the construction of a building dedicated to cellular and gene therapies and hematology clinic laboratories within the General Hospital of Thessaloniki Papanikolaou (ID: 16793) • Establishment of Home Health Care & Hospital at Home systems (ID: 16753)
<p>Group 25: Culture</p> <ul style="list-style-type: none"> • Labor reform in the cultural sector (ID:16715) • Culture as a driver of growth (ID: 16293) • Museum of underwater antiquities (ID: 16486) • Utilizing “arts on prescription,” promoting social cohesion, and tapping the silver economy (ID: 16735) • Upgrade of infrastructure, renewal of equipment, and upgrade of quality of services provided by HOCRED (Hellenic Organization of Cultural Resources Development) (ID: 16536) • Highways for nature and culture (ID: 16970) • Protection of cultural monuments and archaeological sites from climate change (2nd Group) (ID: 16433) • Upgrading higher arts education (ID: 16725) • Cultural routes at emblematic archaeological sites and monuments (ID: 16485) • Restoration – conservation – enhancement of the Acropolis monuments (ID: 16435) • Skill building for creative and cultural professionals (ID: 16723)
<p>Group 28: Agriculture</p> <ul style="list-style-type: none"> • Economic transformation of the agricultural sector (ID: 16626) • Digital transformation of the agri-food sector (ID: 16653) • Proposals for actions in the aquaculture sector (ID: 16584) • Investments in the national irrigation network through PPP schemes (ID: 16285)

NextGenerationEU – REACT-EU

Under the NGEU funds, the EC created the Recovery Assistance for Cohesion and the Territories of Europe Initiative (REACT-EU), which aims to provide financial support to EU Member States with crisis response and recovery measures following COVID-19.¹⁹⁹ Under REACT-EU, Greece has been allocated €1.715 billion (current prices).

Just Transition Fund

As a part of the “no person and no place left behind,” the EC established the Just Transition Fund with the overarching objective of “enabling regions and people to address the social, economic and environmental impacts of the transition towards a climate-neutral economy.” The allocations to Greece from the JTF are

¹⁹⁹ European Union. 2021. NextGenerationEU: Commission carries out €800 million of first payments to foster crisis repair and resilience. EU regional and urban development. [Link](#).

€834 million (in current prices) of which €469 million is under NGEU and €365 million under MFF 2021-2027. Funded activities include the following:

- Productive investments in SMEs, including start-ups, leading to economic diversification and reconversion
- Investments in the creation of new firms, including through business incubators and consulting services
- Investments in research and innovation activities and fostering of the transfer of advanced technologies
- Investments in the deployment of technology and infrastructures for affordable clean energy, greenhouse gas emission reduction, energy efficiency, and renewable energy
- Investments in digitalization and digital connectivity
- Investments in regeneration and decontamination of sites, land restoration and repurposing projects.
- Investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair, and recycling
- Upskilling and reskilling of workers
- Job-search assistance to job seekers
Active inclusion of job seekers
- Technical assistance

The Just Transition mechanism also comprises a complementary public loan facility with the EIB, which contains an element of grant support. The facility covers investments in energy and transport infrastructure decarbonization, district heating, and energy efficiency measures, including renovation of buildings. These can also have relevance to DRM/CP if linked with multi-hazard risk reduction.

Horizon Europe

Horizon Europe is an EU funding program for research and innovation with an overall budget of €95.5 billion (€5.4 billion allocated from the NGEU for green and digital recovery from COVID-19) for 2021-2027. Roughly a third of the budget (35%) will contribute to climate objectives. Horizon is managed at EU level with no predetermined financial allocations to Member States. Research institutes, private companies, and other bodies must bid to participate in Horizon projects, usually in partnership with bodies from other Member States. In the previous programming period, Greece was successful in acquiring funds. New for 2021–2027 are the five key mission areas adopted: (i) cancer; (ii) adaptation to climate change, including societal transformation; (iii) healthy oceans, seas, and coastal and inland waterways; (iv) climate-neutral and smart cities; and (v) soil health and food. All five mission areas have some relevance to disaster and climate resilience; the second and fourth are particularly relevant. An additional role has recently been assigned to the EU’s research and innovation effort as part of the recovery from the COVID-19 pandemic. The Horizon Europe Mission Board for climate neutral and smart cities recently proposed its first mission, 100 Climate Neutral Cities by 2030. The aim is to support and promote 100 European cities in making a systemic transformation towards climate neutrality by 2030—that is, to achieve in 10 years what Europe plans to achieve in 30 years.

LIFE (Programme for Environment and Climate Action)

The LIFE program is dedicated to environmental protection as well as adaptation to and mitigation of climate change effects. Total budget proposed by the EC for 2021–2027 is €5.5 billion, divided between the following subprograms: nature and biodiversity; circular economy and quality of life; climate change mitigation and adaptation; and clean energy transition. The conservation of nature and biodiversity, including marine ecosystems, remains an important action area. A new type of project, called a strategic nature project, is being introduced to support programs of action for the mainstreaming of nature and biodiversity policy objectives into other EU policies, such as agriculture and rural development, and to ensure that relevant funds are leveraged to implement these objectives.

Union Civil Protection Mechanism (UCPM)

The total budget allocated for the UCPM amounts to €3.319 billion in current prices (€1.263 billion under the MFF and €2.065 under the EU RRF, NGEU). The UCPM was upgraded in 2019 and 2020 through the establishment of the rescEU stockpile, intended to reinforce and strengthen components of EU DRM. Greece is a host nation to the rescEU medical stockpile and rescEU firefighting.²⁰⁰ Within the rescEU forest fire fleet, Greece has provided two firefighting planes to be deployed upon the activation of rescEU. Under the umbrella of the UCPM, DG ECHO has made available grants for “Prevention and Preparedness Projects in Civil Protection,” which is a DRM funding opportunity that Greece has participated in.²⁰¹ Under the UCPM, DG ECHO has launched other funding opportunities related to DRM. Under the UCPM’s voluntary European Civil Protection Pool (ECPP), DG ECHO has launched the ECPP adaptation grants, to upgrade or repair response capacities to a state of readiness and availability that makes them deployable as part of the European Civil Protection Pool. Furthermore, under the UCPM Knowledge Network, DG ECHO has launched a call for proposals Network Partnership, which will fund meetings, networking events, studies, surveys, research, retreats, workshops, seminars, development and testing of new technologies and IT tools.²⁰² Similarly, DG ECHO has launched a call for proposals for UCPM full scale exercises as well as a call for proposals for Prevention and Preparedness Projects on Civil Protection and Marine Pollution.²⁰³

European Union Solidarity Fund (EUSF)

In 2002, the European Union established the European Union Solidarity Fund in response to severe flooding in Europe and as an expression of solidarity with Member States affected by disasters.²⁰⁴ Following the COVID-19 pandemic, the scope of the EUSF has expanded. As of March 2020, the EUSF can be mobilized “when serious repercussions on living conditions, human health, the natural environment or

²⁰⁰ European Commission. 2019. “rescEU - Factsheet.” Directorate-General for European Civil Protection and Humanitarian Aid Operations. [Link](#); European Commission. 2021. Forest Fires. DG ECHO. [Link](#); See European Commission. 2020. *Commission adds planes to rescEU fleet to prepare for summer forest fires*. DG ECHO. [Link](#).

²⁰¹ European Commission. 2020. List of Awarded Track I Projects. Directorate-General for Civil Protection and Humanitarian Aid Operations. [Link](#).

²⁰² European Commission. 2021. Union Civil Protection Mechanism (UCPM) Call for proposals Network Partnership (UCPM-2021-KN). Directorate-General for Civil Protection and Humanitarian Aid Operations. [Link](#).

²⁰³ European Commission. 2021. Calls for proposals. Directorate-General for Civil Protection and Humanitarian Aid Operations. [Link](#).

²⁰⁴ European Commission. 2021. EU Solidarity Fund. EU Regional and Urban Development. Regional Policy. Funding. [Link](#). See European Union. 2002. Council Regulation No. 1212/2002 of November 11, 2002 establishing the European Union Solidarity Fund (OJ L 311 14.11.2002, p. 3). [Link](#).

the economy occur in one or more regions of that eligible State as a consequence of: (a) a major or regional natural disaster having taken place on the territory of the same eligible State or of a neighboring eligible State; or (b) a major public health emergency having taken place on the territory of the same eligible State.”²⁰⁵ Additionally, the EUSF will be included in the Solidarity and Emergency Aid Reserve within the EU 2021–2027 programming period, pursuant to Article 9 of Council Regulation 2020/2093.²⁰⁶ The Solidarity and Emergency Aid Reserve covers finances that are beyond the scope of the EUSF, including those related to “man-made disasters, humanitarian crises in cases of large-scale public health, veterinary or phytosanitary threats, as well as in situations of particular pressure at the Union’s external borders resulting from migratory flows, where circumstances so require.”²⁰⁷

Emergency Support Instrument

Regulation (EU) 2016/369 on the provision of emergency support within the EU²⁰⁸ provides a set of rules for emergency humanitarian support for EU countries during man-made or natural disasters; the Emergency Support Instrument (ESI) comes into play when other instruments prove insufficient, complementing the actions of the affected EU country or countries. Following the COVID-19 outbreak in 2020, the Council adopted Regulation (EU) 2020/521 activating emergency support measures under Regulation (EU) 2016/369. The activation period is from February 1, 2020, to January 31, 2022. The regulation was triggered for the EC to procure assistance either jointly with Member States or on its own. As this is the second time the ESI has been activated, the current activation is focused on the context of COVID-19 response, although could apply any major disaster that affects human health and civilian life. For example, between 2016 to 2019, the European Commission allocated almost €650 million from partner organizations to support refugees and migrants in Greece.

The ESI has been used on top of the UCPM and the rescEU element. Through the ESI, the EU mobilized €2.7 billion to fund emergency health care support.²⁰⁹ Within the scope of DG ECHO activities, the ESI is separate from the UCPM and the rescEU element, though it can be considered complementary. The Mobility Package, a two-year emergency instrument under ESI and overseen by DG ECHO, allocated €150 million for support related to the transfer of COVID-19-related cargo (such as personal protective equipment), the cross-border transfer of medical personnel, and the cross-border emergency transfer of patients. Local authorities can also apply for the Mobility Package support.

²⁰⁵ European Union. 2020. Article 1. Regulation (EU) 2020/461 of the European Parliament and of the Council of 30 March 2020 amending Council Regulation (EC) No 2012/2002 of March 30, 2020 in order to provide financial assistance to Member States and to countries negotiating their accession to the Union that are seriously affected by a major public health emergency (OJ L 99/10 31.3.2020).

²⁰⁶ European Union. 2020. Article 9. Council Regulation (EU, Euratom) 2020/2093 of 17 December 2020 laying down the multiannual financial framework for the years 2021 to 2027 (OJ L 433I, 22.12.2020, p. 11–22).

²⁰⁷ European Union. 2020. Article 9. Council Regulation (EU, Euratom) 2020/2093 of 17 December 2020 laying down the multiannual financial framework for the years 2021 to 2027 (OJ L 433I, 22.12.2020, p. 11–22).

²⁰⁸ European Union. 2016. Council Regulation (EU) 2016/369 of 15 March 2016 on the provision of emergency support within the Union OJ L 70, 16.3.2016, p. 1–6. [Link](#).

²⁰⁹ European Commission. 2021. Emergency Support Instrument. [Link](#). ESI has been the main instrument used by the EC for procurement and delivery of COVID-19 vaccines and medicines, for delivery of personal protective equipment during the COVID-19 pandemic, and for establishment of the EU digital COVID certificate.

Other financial instruments and arrangements

European Investment Bank (EIB)

The EIB offers investment opportunities in infrastructure and environmental funds and in strategic development. In terms of investments in infrastructure and environmental funds, the EIB funds provide support in equity, namely “investments in equity and debt funds which are focused on projects dealing with climate action and/or infrastructure,” as well as “equity and hybrid debt co-investments with top ranked funds and investment partners.”²¹⁰ The EIB also offers support in strategic development through advisory services, which can be through awareness raising campaigns, design of investment programs, or capacity enhancement, as well as projects with a focus on innovation, environmental and social sustainability, climate impact, and circularity.²¹¹

Greece has made use of such EIB investment possibilities. The EIB lists 46 financing projects for Greece that address various themes, such as infrastructure works, energy upgrading, electricity and gas interconnectors, loans to commercial banks and investment in disaster risk prevention (floods), and research on climate change and prevention. Some of the main projects that are of relevance to DRM activities are listed in Table 25. These include the EIB loan for COVID-19 disaster prevention and climate adaptation, which supports the setting up of the Nat-CHAMM.²¹²

Table 25. Selection of EIB ongoing loans relevant to Greece’s DRM policy

Loan theme and status	Objective(s)	Financial intermediary	Proposed EIB funds/total cost (€, millions) ^a
COVID-19 Disaster Prevention and Climate Adaptation (signed)	The project aims to upgrade the effectiveness of the interventions of the civil protection mechanism for disaster prevention and impact minimization, public health, and environmental protection.	Hellenic Republic	595 / 794
Flood protection measures (signed September 26, 2019)	The project consists of flood protection measures in the highly populated urban regions of Attica, Central Macedonia (Thessaloniki), and Peloponnese in Greece.	Hellenic Republic	150 / 356
Marine Atmospheric and Climate Change Research (signed June 20, 2018)	The project concerns investments that will improve understanding of the sources and impact of climate change and is expected to identify ways to mitigate and adapt to it, including economically. It comprises acquisition of a research vessel and the establishment of an atmospheric observatory on the island of Antikythera.	Hellenic Republic	58 / 78
Greece Sustainable Urban Development (signed March 16, 2021)	The project is an intermediated framework loan operation in support of two programs launched by the MoI and the MoEE, aiming to support municipalities, regional authorities, and their agencies in order to invest in a wide range of	Hellenic Republic	500 / 2,300

²¹⁰ European Investment Bank. 2021. Investments in infrastructure and environmental funds. Equity. [Link](#). See also European Investment Bank. 2021. Co-investment Facilities. [Link](#).

²¹¹ European Investment Bank. 2021. Strategic Development. Advisory Services. [Link](#).

²¹² <https://www.eib.org/en/projects/pipelines/all/20200182>.

	projects contributing to the sustainable development of urban areas. It comprises two sub-programs: (i) infrastructure projects; and (ii) local spatial plans, namely integrated plans and related interventions.		
Athens Resilient City and Integrated Development (signed June 20, 2018)	The project consists of a framework loan to co-finance selected multi-sector urban schemes aiming at enhancing the resilience of Athens and contributing to its integrated development (Integrated Territorial Investment – ITI – Plan).	Municipality of Athens	50 / 185
Greece Loan for Climate Action and other priorities (signed August 19, 2020)	The project consists of Multi-Beneficiary Intermediated Loans through eligible banks operating in Greece. The aim is to enhance access to loan finance to Greek SMEs and mid-caps, with a focus on climate action projects and projects in the Just Transition areas of Greece, as well as other priorities, such as youth employment and the empowerment of women in the workplace.	Commercial banks: Piraeus Bank SA, National Bank of Greece SA, Pancretan Cooperative Bank Ltd., Eurobank Ergasias SA, Alpha Bank AE	500 / not applicable
COVID-19 Response for SMES & Mid-caps, various commercial banks	This multi-beneficiary intermediated loan forms part of EIB's economic response to the COVID-19 pandemic crisis. It aims at covering the financing needs—primarily working capital and liquidity needs, but also possible investment-related needs—of SMEs and mid-caps in Greece that have been affected by the pandemic.	Eurobank Ergasias Holdings	150 / not applicable
Energy Efficiency in Public Venues (signed December 28, 2020)	This integrated investment program, launched by the MoEE and the Ministry of Economy and Development, aims to improve energy efficiency in public buildings and other venues (e.g., schools, hospitals, and sports facilities). This project falls under the Smart Finance for Smart Buildings (SFSB) initiative, a joint initiative of the EIB Group and the EC aiming at supporting energy efficiency investments in buildings. This includes, for example, the replacement of frames, insulation measures, replacement of obsolete heating and cooling equipment, and installation of renewable energy and building management systems, as well as interventions aiming to enhance the static integrity of the buildings when necessary.	Hellenic Republic	375 / 714
Greece Road Rehabilitation and Safety Project (signed November 25, 2020)	The proposed project is a framework loan to finance investment works on 7,000 small-scale, low-cost road safety improvements on regional roads in northern Greece.	Egnatia Odos AE	235 / 470

Note: a. Amounts in the last column are approximate

InvestEU program

The InvestEU program²¹³ is part of the EU 2021–2027 Cohesion Policy providing long-term funding and support to EU policies. One of the areas of support is “sustainable infrastructure,” including projects in sustainable energy, digital connectivity, transport, the circular economy, water, waste, other environmental infrastructure, and more. InvestEU is a centrally managed program composed of the InvestEU Fund, InvestEU Advisory Hub, and InvestEU portal.

Green bonds

Green bond–supported investments exist in the field of clean energy, transport, energy efficiency, water management, waste management and pollution control, nature conservation, agriculture, and forestry. Green bonds are important for combating climate change and reducing disaster risk; they represent innovations for mobilizing sustainable investments by institutional investors such as pension funds, insurance companies, mutual funds, and state funds.

Global climate and DRM funds

International financial organizations and multilateral development banks also play a role in supporting disaster risk management. Many of these organizations provide a wide range of different financial instruments, including grants, concessional loans, contingent credits, loan guarantees, and share capital, as well as mixed public and private sector financing. The UN Framework Convention on Climate Change (UNFCCC) established different funding facilities for climate change activities, including for climate change adaptation. The main funding resources for climate change adaptation and resilience are the Green Climate Fund, the Adaptation Fund, and the Special Climate Change Fund. These funds offer financial support through grants, concession debts, loan guarantees, equity, and mixed finances.

Public-private partnerships (PPPs)

The Sendai Framework for Disaster Risk Reduction 2015–2030 recommends PPPs to strengthen DRM through cooperation with the private sector and stakeholders. In January 2021, the state-owned company Building Infrastructures SA (KTYP) published first-stage tenders for the design, financing, construction, and technical operation of the 13 new PEKEPP, in the form of PPP contracts.²¹⁴ Each tender corresponds to a group of PEKEPP: there are seven in one group—Eastern Macedonia and Thrace, Central Macedonia, Western Macedonia, Thessaly, Epirus, North Aegean, and Ionian Islands; and six in the other—Central Greece, Attica, Peloponnese, Western Greece, Crete, and South Aegean. The private sector partner to be selected will design, build, and finance the construction of the assets. After construction (24 months), the private sector partner will operate and maintain the assets for 25 years. In exchange, the governmental entity will conduct annual availability payments, which may reach a maximum of €70.8 million for the first group and €60.7 million for the second group, plus value added tax (VAT). Implementation of PEKEPP through PPP schemes is also included in the Greek NRRP, which lasts until 2024 and has a total budget of €89 million: €21.3 million requested as a grant from RRF and €68

²¹³ InvestEU funds will be invested through financial partners. A main partner will be the EIB Group. In addition to the EIB Group, international financial institutions operating in Europe—such as the EBRD—will also have direct access to the EU guarantee.

²¹⁴ The selection is currently at the stage of submission of financial offers from the initially selected bidding consortia.

million (VAT excluded) via PPPs. The PEKEPP will be strategic points of reception and processing for all relevant information as well as decision-making and coordination centers for all stakeholders for the effective management of and response to each event. In addition, the PEKEPP will be central points where citizens can get information and interact with the institutions and functions of CP, and they will also permanently house CP's administrative functions.

Financing operations and maintenance

Sustainable maintenance and operations arrangements are critical to support successful implementation of the NDRMP and broader advancement of CP/DRM reforms and agenda in the country. The state, through the budget process, provides O&M funds, and these funds are included in the budgets of the responsible authorities. For example, related to aerial means, maintenance is carried out normally by air forces, and a yearly account of their total expenses is provided to the Fire Service. For vehicles, the Fire Service covers the maintenance for their vehicles in use. Municipalities and other entities (e.g., mountain protection team) cover the maintenance costs of their vehicles in use. Also, it is noted that the NDP 2021–2025's proposed special sectoral development program for natural disasters lists maintenance and upgrading of office equipment and maintenance and upgrading of machinery equipment as part of eligible categories.²¹⁵ Specific O&M arrangements are foreseen for the PPPs for PEKEPP as noted above.

4.4. Disaster risk financing and insurance

Understanding potential financial risk and gaps

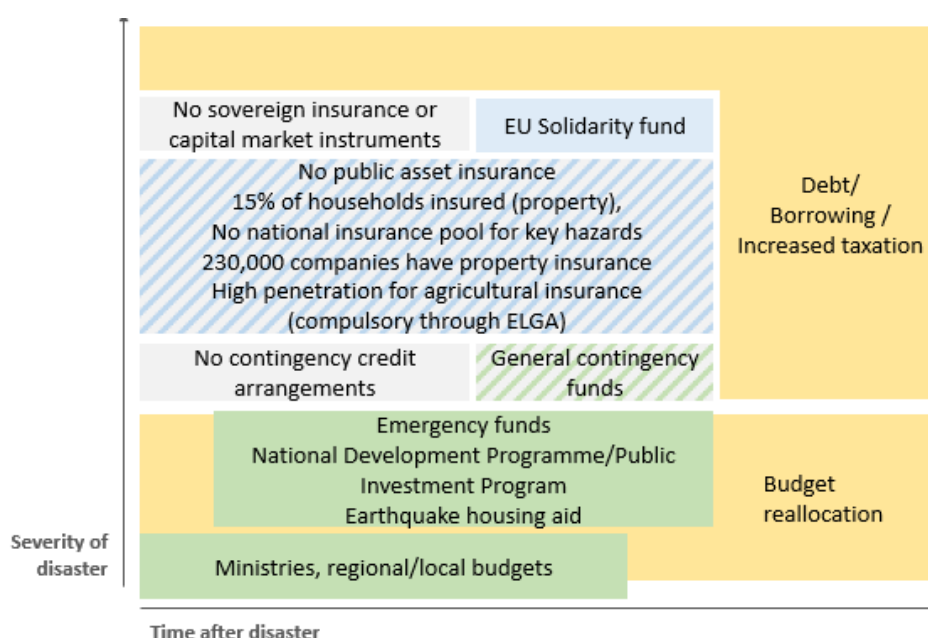
Natural disasters pose a serious strain on the state budget. From January 2020 until August 2021, more than €1.7 billion has been or is expected to be allocated for damage recovery and reconstruction related to floods, earthquakes, extreme weather and forest fires (with some €500 million of these related to the August 2021 fires, in different parts of the country). That amount is equivalent to more than 80% of the annual ENFIA (real estate property tax) paid by Greek taxpayers, only to compensate for damages incurred over 18 months. One of the biggest losses in recent years was the September 2020 Ianos Mediane with disaster costs estimated by the government at around €500 million in 2020-2021. Between 2002 and 2019, Greece has seen disasters amounting to €3.44 billion in government expenditure and has received €122.8 million from the EUSF for these disasters.²¹⁶ This amount does not include other disasters, some of which – while costly – did not qualify for EUSF funding, as the estimated government costs did not exceed the threshold of 2.5% of the regional GDP in the affected regions (e.g., the November 2017 Mandra Flash flood, the July 2018, Attica forest fires). Considering also the contribution of private initiatives, it is estimated that Greece has exceeded some €7–8 billion in natural disaster related damages and losses in the last 20 years.

²¹⁵ Ministry of Citizen Protection and GSCP, "Draft Proposal for A special sectoral development program within the National Development Program 2021–2025," Athens, January 2021, p. 97.

²¹⁶ https://ec.europa.eu/regional_policy/sources/thefunds/doc/interventions_since_2002.pdf.

While several post-disaster financial arrangements are in place (some of which depicted in Figure 18), the Greek government remains substantially exposed to large financial losses from disasters, which could negatively impact the fiscal planning and economic stability of the country and the well-being of its population. Earthquakes, forest fires, and floods are natural disasters affecting Greece frequently and severely in terms of loss of life, financial impact, and business continuity. Greece has dedicated state budget emergency funds and uses PIP/NDP for post-disaster works. GDAEFK is a public service that is activated after a natural disaster to carry-out building damage assessments based on which aid is provided to the tenants and owners of damaged or destroyed buildings (usually a mix of 30% in interest free loans and 70% as grants, though this varies per disaster); the Ministry of Labor and Social Affairs provides camp and tent material needed for the emergency sheltering of affected population, while ELGA insures all natural and legal persons who own or operate agriculture enterprises.²¹⁷ Greece does not currently have a pre-arranged sovereign contingent credit solution for disasters to cover contingent liabilities. Related to the private sector and households, only some 230,000 companies have property insurance and less than 15% of Greek households insure their primary residence for fire, allied perils, and earthquake.²¹⁸ Public infrastructure in Greece is not insured, and currently there is no such legal requirement—an arrangement that leaves any post-disaster costs subject to state budget.

Figure 18. Current post-disaster financial arrangements in Greece



Source: World Bank.

Note: Yellow = ex post sources of funding; green = pre-arranged budgetary sources of funds; blue = risk transfer instruments; diagonal stripes = partially available; gray = unavailable.

²¹⁷ ELGA's limit of indemnification is the maximum between (i) per beneficiary compensation of €250,000; and (ii) per plot compensation of 80% of the insured value of production of the damaged plot. In total ELGA has paid out more than €1.1 billion in the period 2011–2019.

²¹⁸ More detailed information is provided in the World Bank.2021. RAS Diagnostic Report.

Increasing weather volatility linked to climate change, a growing insurance gap between potential risk facing public and private infrastructure and activities and coverage, and strains on public spending create a potential significant financial gap that has not been quantified by the Greek state. To determine the right financing solution, careful quantitative analysis is used to quantify potential loss scenarios. In the context of data limitations (as noted in Chapter 2) and lack of comprehensive studies for Greece, the following sources are considered as part of the proposed NDRMP measures for financial protection:

- In 2018, the Hellenic Association of Insurance Companies (HAIC) assessed the earthquake risk in Greece as the most significant threat to life and property, estimating that the probable maximum loss (PML) from an earthquake with a return period of 1-in-200 years²¹⁹, amounts to between €7 and €10 billion.²²⁰ In other words, between 3.7% to 5.3% of Greece's GDP could be at risk from a single event. The calculation is based on the official 2011 building stock census²²¹ and focuses solely on the residential portfolio of Greece excluding (among other categories) commercial and industrial risks, public infrastructure, state-owned buildings (e.g., schools, ministerial buildings, etc.), and loss of future income; thus, it is possible to assume that the loss in its totality could easily exceed 10% of Greece's GDP. HAIC calculated the annual average loss (AAL) to between €434 million and €950 million²²², well in excess of current natural catastrophe budget considerations.
- In 2021, the World Bank and DG ECHO conducted a regional study²²³ covering EU Member States to assess the macro-fiscal impacts of earthquakes and floods, identify financial instruments in place to manage this risk, and identify any potential funding gaps. An earthquake and flood modelling exercise was performed based on an exposure database including residential, commercial, industrial, education and health care risks amounting to a total of €617 billion. The resulting funding gap case study analysis estimated that in the 1-in-100 year event results to over €1.4 billion in losses, with a potential funding gap of over €700 million. The amount could be even larger should reserve funds be limited and/or EUSF not available (see **Annex 4** for more details).

Proposed measures for financial protection

Engage with stakeholders and consider international good practice

The Government of Greece could form an expert task force to look holistically at disaster risk financing information, data and financial gaps, and potential solutions. This task force, comprising of different stakeholders and including GSCP, MoF, Bank of Greece, HAIC, and others, could help oversee the activities proposed below, mobilize additional expertise as needed, and support decision-making on priority areas

²¹⁹ A return period of 1 in 200 years is considered appropriate as it coincides with Solvency II's requirement for insurance companies and represents a serious event. In comparison HAIC's 1-in-100, 1-in 500, and 1-in-1,000- return period modeled losses were estimated to be between €6.5-6.8bln, €14.7-16.5bln and €18.4-24.1bln respectively.

²²⁰ HAIC, "Proposal of a Residential Earthquake Insurance System," 2018. The calculations of HAIC were performed with modeling by the RMS and AIR firms, using the 2011 building stock census.

²²¹ The final exposure database was adjusted to include changes from 2011 to 2017 as those were recorded by the Hellenic Statistical Authority. This represented an increase of 1.4% (vs the 2011 census).

²²² The AAL range is broad which is linked to the fact that vendor models use different assumptions that lead to different results. The lack of real events that would enable continuous calibration of the models adds to this uncertainty.

²²³ World Bank 2021b. The calculations used regional modeling results from JBA on floods and GEM on earthquakes.

for intervention. Of immediate urgency would be that the task force focuses on quantifying various perils PML's, especially for earthquake and floods, as well as improving the use of risk transfer mechanisms (insurance) and engaging the private sector in strengthening financial protection.

Undertake initial quantification of risk to inform a comprehensive risk financing strategy

To improve understanding of gaps and needs, Greece should assess in detail its financial exposure and available resources and incorporate the results into its future fiscal and budgetary strategies. The findings could inform the development of a more comprehensive disaster risk financing and insurance strategy to establish the overarching principles, objectives, and methods for financing the response and recovery costs associated with damage-causing events. The strategy would consider capacities of different actors, including domestic insurance market. A well-considered split between risk retention (that is, budgetary reserves) and risk transfer (that is, insurance), as well as consideration of numerous complementary risk financing sources, ensures that funding is diverse and not subject to a single point of failure. The strategy could also outline ways to deepen or adjust existing financial mechanisms, consider the feasibility of setting up a national peril pool, and so on. To ensure consistency, a disaster risk financing plan should be established and coordinated by one entity (e.g., GSCP/MoF) working with others.

In parallel, given that a serious earthquake loss could in most cases exceed a single loss from any other peril, efforts could focus on finding adequate financing for earthquake, which could de facto cover all perils (and not just an earthquake). As an immediate step, the earthquake PML distribution for Greece needs to be quantified, with various loss metrics (including the 1-in-200 year event), based on the planned 2021 building stock census; this includes information on (i) commercial and industrial risks (building on existing studies), and (ii) public infrastructure, including interministerial efforts and state-owned buildings (in coordination with ministries and different administrative levels). Best efforts should be made to assess corresponding PMLs for flood, fire, and snow/hail, drawing on available studies/data.

Assess risk financing solutions

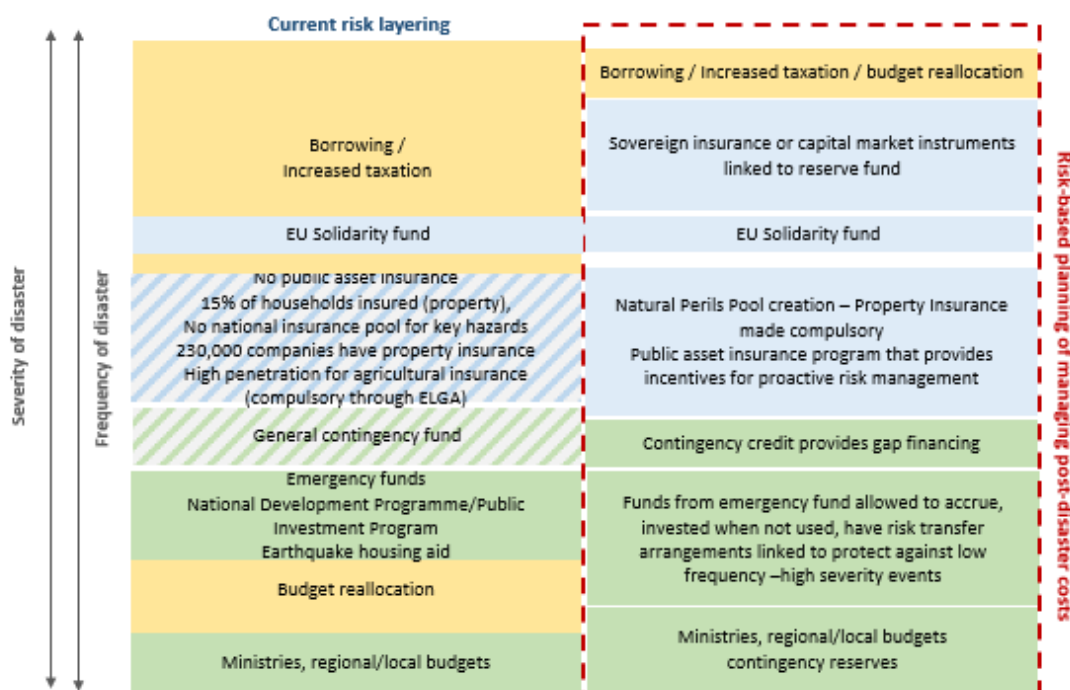
Following the PML quantification of earthquake (and other hazards), and in line with a comprehensive disaster risk financing and insurance strategy, the government should pursue suitable risk financing solutions in line with a risk-layering approach. A risk-layering approach combines different instruments cost-effectively to address different sizes and frequencies of disasters; it facilitates access to “cheaper” funds from a combination of reserve funds at different levels, contingent credit lines, and insurance or other types of risk transfer products. Beyond technical aspects, for some of these solutions (such as parametric insurance), the legislative framework may need to be adjusted or new legislation be introduced.²²⁴

Based on quantification of risks and identified priority areas, the government can pursue a number of activities that may be implemented in parallel (Figure 19). For example, the government could focus on (i) reducing its contingent liabilities through strengthening the domestic insurance market; (ii) closing the funding gap through domestic public finance; (iii) strengthening and making timelier the delivery of financing after disasters by adjusting existing arrangements for state financing, or (iv) indirect financing

²²⁴ World Bank. 2021. RAS Output 1 provides further information about the different types of instruments.

through incentivization. Risk layering is important for cost-effective management of disaster costs. For instance, insurance will not be able to cover all types of costs, but it will be able to help either reduce government contingent liabilities (household or agricultural insurance) or manage government liabilities more effectively (public asset insurance or sovereign insurance). Gradual strengthening of disaster data and improved analytics will help improve the risk layering balance of instruments over time.

Figure 19. Indicative structure of the suggested changes in risk financing instruments



Source: World Bank.

Note: Yellow = ex post sources of funding; green = pre-arranged budgetary sources of funds; blue = risk transfer instruments; diagonal stripes = partially available; gray = unavailable.

Given high public spending on post-disaster recovery and reconstruction, the HAIC have considered the establishment of a natural perils pool financial scheme as one of the instruments available for increasing financial protection. Based on the 2018 study mentioned above,²²⁵ HAIC has proposed that a risk transfer solution focusing on earthquake risk should be evaluated. Several key parameters of a national perils pool will need to be considered during the assessment of feasibility of such as pool:

- **Earthquake, fire, and flood insurance is established as compulsory for all residential properties.**²²⁶ The state may also determine income criteria based on which the cost of insurance is subsidized from the budget; or alternatively and as an exception to the basic rule, there is no insurance obligation for certain citizens, and the ex-post payment of compensation in the form of

²²⁵ HAIC, "Proposal of a Residential Earthquake Insurance System," 2018.

²²⁶ There are many countries in which property insurance is compulsory such as Romania, Turkey and others. In Greece compulsory insurance exists for motor third party liability as well as various occupational professional indemnity. More information and examples are provided in World Bank 2021. RAS Diagnostic Report.

a special scheme is maintained. The State would carry out an information campaign, and at the same time insurance companies would have to commit to participate with their own information campaigns. A special tax treatment of these premiums might be proposed as an incentive, as well as noncompliance sanctions based on a suitable real estate identification number such as the cadaster number.

- **Compulsory insurance applies to residential building risks.** Parts of residential buildings that are used for commercial purposes should also be compulsorily insured in accordance with the rules of operation of co-ownership (horizontal properties). The owner of the residence would have the obligation to insure, and the obligation would exist for an agreed area (square meters) of each residence. The insurance would be provided on a first loss basis²²⁷ given that the insured value corresponds to the total value of the reconstruction; the insured value would be calculated based on the cost of reconstruction of a normal house and should be set to an agreed amount per square meter²²⁸ with building contents as optional insurance.
- **Risk management and underwriting** are options to be considered, including provisions where insurance and policy management are undertaken by the insurance industry, which assumes the largest part of the risk, or where a pool (state owned or not) is established and undertakes part of the risk in cooperation with the insurance industry. With the co-financing by a pool (state owned or not), the utilization of financing mechanisms beyond reinsurance is maximized. Solutions that would otherwise not be available can be implemented, such as catastrophe bonds, insurance-linked securities, capital markets, and others.
- **Role/participation of the state** is clearly defined, especially related to system set-up and monitoring, provision of additional co-insurance coverage, and special guarantee insurance coverage, as well as **insurance premiums, conditions, and deductibles** in line with simple and fair pricing. **The relevant legislative framework and operation arrangements** of such a national catastrophe insurance pool are also clearly established.

Strengthen public awareness to improve financial responsibility of government as well as private and household asset owners/administrators

The government could help inform consumers about taking preventive measures and (based on specific disaster risk financing options pursued) about the benefits and obligations at household level. The state could take additional measures to decrease uninsured damages and introduce incentives or preventive measures that contribute to decreasing future damages.

- **Awareness raising.** This would focus on different aspects of DRM, including financial protection and own responsibility for protecting one's assets. OASP has various initiatives in this respect that could be leveraged, and it could work cooperatively with other stakeholders such as HAIC.
- **Earthquake certificate.** Much like the energy certificate, an earthquake certificate could be established, especially for public buildings with high life accumulation such as schools and

²²⁷ First loss means that even if the property is underinsured the law of averages will not apply.

²²⁸ The reconstruction cost should be assessed regularly by appropriate group/expert panel.

hospitals. In addition to cataloging the risks, the earthquake certificate could help incentivize the necessary discipline to protect assets.

- **Cataloging and financial protection of public infrastructure.** Metrics such as usage and potential life accumulation could be established. If potential life accumulation is more than a certain threshold, then these properties should be assessed, and protection measures could be implemented as mandatory.

Improve data and regularly update risk understanding

Financial risks and potential risk retention and risk transfer instruments should be assessed on a regular basis. There is a need to continuously improve risk information in coordination with relevant authorities, covering at a minimum the following: residential buildings and housing units (including second homes, holiday homes, etc.); commercial and industrial risks (by type of activity and potential hazardous aspects); public infrastructure risks, segmented into different types of infrastructure (buildings, roads, bridges, ports, airports, etc.); and state-owned buildings, segmented at least into type of building (schools, hospitals, other health facilities, public administrative building, etc.). For all of the above, minimum information should include a sum-insured estimate (reconstruction cost estimate); location postcode and geocoded information; year built; and construction type/materials (reinforced concrete, wood, stone, etc.) and state of maintenance. Improved information would allow regularly assessing the scale of macro-fiscal risks). Improved information would allow regularly assessing the scale of macro-fiscal risks.

4.5. Key observations

There are substantial resources planned and available for CP/DRM in the coming years, including through national and EU-funded initiatives. The investment priorities set out in the proposed NDRMP correspond to the priorities and measures envisaged in these programs. The AEGIS plan, the proposed special sectoral program for CP, EIB loan, and proposed ESIF-financed OP for CP all focus on operationalization of Law 4662/2020 and on ensuring functionality of the unified Nat-CHAMM system. The use of financial instruments (loans, guarantee schemes co-financed by the ESIF and the state) to support businesses and households during the COVID-19 pandemic demonstrates the instruments' applicability in disaster recovery. The use of financial instruments is expected to increase given their ability to attract significant private funding to finance disaster preparedness and recovery activities by means of a small portion of public funds (supported by EU budget). Greece also has experience with PPPs in the field of DRM. To scale up investments in CP/DRM, there are broader opportunities to explore cooperation with the public and private sector, academia, and CSOs, and to promote exchange of expertise and experience between them.

Disasters trigger major financial shocks for public resources and at-risk populations, including the most vulnerable. Investing in risk reduction before disasters occur brings multiple benefits, including saving lives and reducing injuries; ensuring the continuity of critical public services (such as energy, water, communication, education, administration); reducing the loss of homes; and reducing the financial impact—direct and indirect. Having financial arrangements in place for financing ex ante risk reduction, prevention, and disaster preparedness is critical. In addition, there are various financing schemes that

would enable the financial loss to be partly or even wholly exported from the country, thus injecting the economy with fresh capital at a time when it is most needed.

The objective of DRM measures is to improve the current financial protection to ensure the following:

- The framework maximizes the population's financial protection against disaster risk.
- The framework does not "coerce" the state to make large and unexpected disbursements while confronting the dissatisfaction of citizens.
- The framework does not subject citizens to unexpected economic sacrifices.
- The framework distributes the burden of damage recovery more equitably between homeowners and the state.
- The framework does not unnecessarily absorb the loss domestically (for example, is able to export losses to other countries or third parties).

There are several opportunities for improving financial management of risks in Greece. The following are priority actions for the development of an overarching disaster risk financing strategy: (i) conduct a comprehensive financial analysis to inform development of a sustainable disaster risk financing strategy; (ii) consult with and strengthen coordination of key stakeholders, including the private sector, on post-disaster financing to understand priorities, challenges, and potential solutions; (iii) assess opportunities for revising existing or developing new instruments (related to agriculture, public assets) for different administrative levels/sectors; and (iv) strengthen public awareness of risk transfer and promote a culture of resilience among people and businesses.

5. ANNEXES

5.1. Annex 1. List of stakeholders consulted

While the planned consultations were impacted by the restrictions linked to the COVID-19 outbreak, this report draws on online stakeholder consultations and feedback collected through online communication and questionnaires.

As part of diagnostic analysis conducted prior to the development of the NDRMP (see World Bank 2021), consultations were conducted with various stakeholders at both national and local levels. A total of 15 online consultations were held with stakeholders, including eight line ministries/public authorities with key responsibilities in DRM, four national research institutes, the Association of Municipalities (KEDE) one local municipality, one civil society organization, and one multinational corporation related to business contingency planning. Consultations were conducted with a structured agenda through virtual group discussions and in-depth interviews and with the support of questionnaires. To extend the sources of information, targeted questionnaires were also sent to all the relevant DRM departments of all regions and municipalities in Greece and the responses were taken into consideration. More information is included in Table 26.

Qualitative and quantitative data were received through the process of consultations.²²⁹ At the central level, five ministerial bodies provided information on ongoing and planned investments and recovery expenses. One research institute reported a high number of projects of a scientific and operational nature, which also involved central and local governments authorities. Consultations with local authorities benefited from a high response rate, with 84 municipalities (out of a total 332 municipalities in Greece) sharing more than 1,000 past, ongoing, and future measures, and investments, as well as insights into the CP/DRM framework. Answers from five regions and two regional units were received, along with additional information on measures planned, financed, and implemented by regional authorities. The geographic distribution and diversity of the survey respondents were significant, with responses from municipalities located in all 13 regions of Greece and with different profiles (metropolitan, large/medium/small mainland and island municipalities) as defined by the GG A' 133/19.07.2018 "Kleisthenis Program." For the complete list of the participating municipalities and regions, see Table 27. Additionally, findings regarding ongoing and planned measures from the consultations during the diagnostic analysis (see World Bank 2021) were also integrated into the NDRMP.

Table 26. Consultations conducted as part of diagnostic analysis in preparation of the NDRMP

Stakeholders Consulted		Consultation Activity
Ministry of Environment and Energy (Υπουργείο Περιβάλλοντος και Ενέργειας)	General Secretariat of Natural Environment and Water (Γενική Γραμματεία Φυσικού περιβάλλοντος και Υδάτων)	Questionnaire and Consultation meeting

²²⁹ Note that consultations were conducted related to the development of the NDRMP as well as during the development of World Bank. 2021. More details on the consultations are provided in Annex 1.

	General Secretariat of Spatial Planning and Urban Environment (Γενική Γραμματεία Χωροταξίας και Αστικού Περιβάλλοντος)	Questionnaire and Consultation meeting
Ministry of Infrastructure and Transportation (Υπουργείο Υποδομών)	General Secretariat of Infrastructure (Γενική Γραμματεία Υποδομών)	Questionnaire and Consultation meetings
Hellenic Ministry of Agricultural Development and Food (Υπουργείο Αγροτικής Ανάπτυξης και Τροφίμων)	General Secretariat for Agricultural Policy and Community Resources Management (Γενική Γραμματεία Αγροτικής Πολιτικής και Διαχείρισης Κοινοτικών Πόρων)	Questionnaire and Consultation meeting
	General Secretariat for Rural Development and Food (Γενική Γραμματεία Αγροτικής Ανάπτυξης και Τροφίμων)	Questionnaire and Consultation meeting
Ministry of Culture and Sports (Υπουργείο Πολιτισμού και Αθλητισμού)	General Directorate of Antiquities and Cultural Heritage /Directorate of Conservation of Ancient and Modern Monuments	Questionnaire and Consultation meetings
Ministry of Citizen Protection (Υπουργείο Προστασίας του Πολίτη)	General Secretariat for Civil Protection	Questionnaire and Consultation meeting
National Center for Emergency Assistance (EKAB) (Εθνικό Κέντρο Άμεσης Βοήθειας - EKAB)		Questionnaire and Consultation meeting
Hellenic Police Headquarters (Αρχηγείο Ελληνικής Αστυνομίας)		Questionnaire and Consultation meeting
Hellenic Coast Guard (Ελληνικό Λιμενικό Σώμα)		Questionnaire and Consultation meeting
Earthquake Planning and Protection Organization (Οργανισμός Αντισεισμικού Σχεδιασμού και Προστασίας - ΟΑΣΠ) & Permanent Scientific Committee for the Monitoring of the Greek Volcanic Arc (Μόνιμη Επιστημονική Επιτροπή Παρακολούθησης Ελληνικού Ηφαιστειακού Τόξου		Questionnaire and Consultation meeting
Hellenic National Meteorological Service (Εθνική Μετεωρολογική Υπηρεσία)		Questionnaire and Consultation meeting
Institute of Geodynamics (Γεωδυναμικό Ινστιτούτο) & Hellenic National Tsunami Warning Centre (Εθνικό Κέντρο Προειδοποίησης για τσουνάμι)		Questionnaire and Consultation meeting
Greek Atomic Energy Commission (Ελληνική Επιτροπή Ατομικής Ενέργειας – ΕΕΑΕ)		Questionnaire and Consultation meeting
Central Union of Municipalities in Greece (ΚΕΔΕ)		Questionnaire and Consultation meeting
Municipality of Thessaloniki (Δήμος Θεσσαλονίκης)		Questionnaire and Consultation meeting
All Municipalities of Greece (Δήμοι της Ελλάδας)		Questionnaire
All Regions of Greece (Περιφέρειες της Ελλάδας)		Questionnaire

Table 27. Consultations conducted as part of preparation of the NDRMP

Ministerial Bodies		Parent institute
1	Greek Atomic Energy Commission	Ministry of Development and Investment
2	Earthquake Planning and Protection Organization	Ministry of Infrastructure and Transport
3	Joint Coordination Center for Operations & Crisis Management	Hellenic Police
4	Ministry of Culture	Ministry of Culture

5	Directorate of Natural Disasters Recovery	Ministry of Infrastructure and Transport	
Research Institutes			
1	National Observatory of Athens		
Regions			
1	Crete		
2	Epirus		
3	Central Macedonia		
4	Western Macedonia		
5	Ionian Islands		
6	Attica ²³⁰		
Regional Units			
1	R.U. Ilias – Region of Western Greece		
2	R.U. Kozanis – Region of Western Macedonia		
Municipal Associations			
1	Association of South Attica (mun. Alimos, Kallithea, Palaio Faliro)		
Municipalities		Region	Profile
1	Municipality of Servia	Region of Western Macedonia	Medium Mainland Municipality
2	Municipality of Myki	Region of East Macedonia and Thrace	Medium Mainland Municipality
3	Municipality of Lake Plastira	Region of Thessaly	Small Mainland Municipality
4	Municipality of G.Karaiskakis	Region of Epirus	Small Mainland Municipality
5	Municipality of Lixouri (Kefallonia)	Region of Ionian Islands	Medium Island Municipality
6	Municipality of Dion -Olympus	Region of Central Macedonia	Medium Mainland Municipality
7	Municipality of Eretria	Region of Central Greece	Medium Mainland Municipality
8	Municipality of Ampelokipi - Menemeni	Region of Central Macedonia	Metropolitan Municipality
9	Municipality of Edessa	Region of Central Macedonia	Large Mainland Municipality
10	Municipality of Western Mani	Region of Peloponnese	Small Mainland Municipality
11	Municipality of Eastern Samos	Region of North Aegean	Medium /Large Island Municipality
12	Municipality of Paionia	Region of Central Macedonia	Large Mainland Municipality
13	Municipality of Elassona	Region of Thessaly	Large Mainland Municipality
14	Municipality of Moshato-Tavros	Region of Attica	Metropolitan Municipality
15	Municipality of Kalavrita	Region of Western Greece	Medium Mainland Municipality
16	Municipality of Ilioupoli	Region of Attica	Metropolitan Municipality
17	Municipality of Zagora - Mouresi	Region of Thessaly	Small Mainland Municipality
18	Municipality of N.Propontida	Region of Central Macedonia	Large Mainland Municipality
19	Municipality of Kalimnos	Region of Southern Aegean	Medium /Large Island Municipality
20	Municipality of Western Lesvos	Region of North Aegean	Medium /Large Island Municipality
21	Municipality of Grevena	Region of Western Macedonia	Large Mainland Municipality
22	Municipality of Makrakomi	Region of Central Greece	Medium Mainland Municipality
23	Municipality of Sitia	Region of Crete	Medium Mainland Municipality
24	Municipality of Skiathos	Region of Thessaly	Medium /Large Island Municipality

²³⁰ Note that projects submitted by Region of Attica under Regional Operational Programme haven't been included as were sent few days prior to the report's submission for peer review.

25	Municipality of Amflikia-Elatia	Region of Central Greece	Medium Mainland Municipality
26	Municipality of Anogia	Region of Crete	Small Mainland Municipality
27	Municipality of Symi	Region of Southern Aegean	Small Island Municipality
28	Municipality of N.Zihni	Region of Central Macedonia	Medium /Large Island Municipality
29	Municipality of Paggaio	Region of East Macedonia and Thrace	Large Mainland Municipality
30	Municipality of Sofades	Region of Thessaly	Medium Mainland Municipality
31	Municipality of Kozani	Region of Western Macedonia	Large Mainland Municipality
32	Municipality of Ioannina	Region of Epirus	Large Mainland Municipality
33	Municipality of Halkidona	Region of Central Macedonia	Large Mainland Municipality
34	Municipality of Voios	Region of Western Macedonia	Medium Mainland Municipality
35	Municipality of Karpenisi	Region of Central Greece	Medium Mainland Municipality
36	Municipality of Pylos - Nestor	Region of Peloponnese	Medium Mainland Municipality
37	Municipality of Galatsi	Region of Attica	Metropolitan Municipality
38	Municipality of Pella	Region of Central Macedonia	Large Mainland Municipality
39	Municipality of Eordea	Region of Western Macedonia	Large Mainland Municipality
40	Municipality of N.Filadelfia - Halkidona	Region of Attica	Metropolitan Municipality
41	Municipality of Lavreotiki	Region of Attica	Large Mainland Municipality
42	Municipality of Komotini	Region of East Macedonia and Thrace	Large Mainland Municipality
43	Municipality of Thermi	Region of Central Macedonia	Large Mainland Municipality
44	Municipality of Drama	Region of East Macedonia and Thrace	Large Mainland Municipality
45	Municipality of Sami	Region of Ionian Islands	Small Island Municipality
46	Municipality of Evrotas	Region of Peloponnese	Medium Mainland Municipality
47	Municipality of Delta	Region of Central Macedonia	Large Mainland Municipality
48	Municipality of Larissa	Region of Thessaly	Large Mainland Municipality
49	Municipality of Kymi	Region of Central Greece	Large Mainland Municipality
50	Municipality of Platanias	Region of Crete	Medium Mainland Municipality
51	Municipality of Veria	Region of Central Macedonia	Large Mainland Municipality
52	Municipality of Palaio Faliro	Region of Attica	Metropolitan Municipality
53	Municipality of Pydna - Kolindros	Region of Central Macedonia	Medium Mainland Municipality
54	Municipality of Amphiloia	Region of Western Greece	Medium Mainland Municipality
55	Municipality of Chania	Region of Crete	Large Mainland Municipality
56	Municipality of Elefsina	Region of Attica	Medium Mainland Municipality
57	Municipality of Vyronas	Region of Attica	Metropolitan Municipality
58	Municipality of Doxato	Region of East Macedonia and Thrace	Medium Mainland Municipality
59	Municipality of Penteli	Region of Attica	Metropolitan Municipality
60	Municipality of Mantoudi -Limni-Agia Anna	Region of Central Greece	Medium Mainland Municipality
61	Municipality of Kalamaria	Region of Central Macedonia	Metropolitan Municipality
62	Municipality of Pyli	Region of Thessaly	Medium Mainland Municipality
63	Municipality of Marousi	Region of Attica	Metropolitan Municipality
64	Municipality of Zografou	Region of Attica	Metropolitan Municipality
65	Municipality of Thassos	Region of East Macedonia and Thrace	Medium /Large Island Municipality

66	Municipality of Kavala	Region of East Macedonia and Thrace	Large Mainland Municipality
67	Municipality of Serres	Region of Central Macedonia	Large Mainland Municipality
68	Municipality of Patra	Region of Western Greece	Large Mainland Municipality
69	Municipality of Thessaloniki	Region of Central Macedonia	Metropolitan Municipality
70	Municipality of Domokos	Region of Central Greece	Medium Mainland Municipality
71	Municipality of Apokoronos	Region of Crete	Medium Mainland Municipality
72	Municipality of Central Corfu and Diapontial Islands	Region of Ionian Islands	Medium /Large Island Municipality
73	Municipality of Nestos	Region of East Macedonia and Thrace	Medium Mainland Municipality
74	Municipality of Pogoni	Region of Epirus	Small Mainland Municipality
75	Municipality of Ag.Anargyroi	Region of Attica	Metropolitan Municipality
76	Municipality of Malevizi	Region of Crete	Medium Mainland Municipality
77	Municipality of Athens	Region of Attica	Metropolitan Municipality
78	Municipality of Amari	Region of Crete	Small Mainland Municipality
79	Municipality of Dodoni	Region of Epirus	Small Mainland Municipality
80	Municipality of N.Smyrni	Region of Attica	Metropolitan Municipality
81	Municipality of Katerini	Region of Central Macedonia	Large Mainland Municipality
82	Municipality of Agrinio	Region of Western Greece	Large Mainland Municipality
83	Municipality of Tripoli	Region of Western Greece	Large Mainland Municipality
84	Municipality of Haidari	Region of Attica	Metropolitan Municipality

5.2. Annex 2. Additional information collected during consultations (provided separately)

A separate excel sheet is provided with detailed information collected during the consultation process. Below is a summary of the consultation findings.

Overview of the consultation process

To identify the current priority investments for DRM at the central, regional, and local level, a consultation process was conducted to collect relevant insights and data from all levels of administration using a template covering aspects such as: scope of measure, type of hazard, status, implementation period, responsible institution/ stakeholder, funding Instrument, budget, and priority level. The forms were disseminated to Ministries and Institutions as well as to all 332 Municipalities and 13 Regional Authorities. The duration of the engagement process was 30 days (June,17 –July,16 2021).

At the regional and local level, the response rate was satisfactory with 84 municipalities having submitted more than 1,000 measures and 6 regional authorities, 2 regional units and one association of municipalities have submitted more than 230 measures (see **Annex 1**). The sample of the respondents is adequate as it demonstrates a satisfying geographic distribution as well as a range of different sizes of municipalities (metropolitan, small/ medium/ large mainland and island municipalities).

It is important to note that while almost the 25% of the country's Municipalities, and almost 40% of the country's Regional Authorities/bodies and several Ministries/ National Institutions have responded to the WB-GSCP invitation for engagement and therefore the outcomes cannot be considered as fully comprehensive. The collected information demonstrates current trends for investments at the local scale as well as their capacities and perceptions for DRM planning. However, given the method of collecting data, the survey does not comprehensively reflect all the work conducted by those listed organizations; and it is possible that multiple measures that responding organizations are currently planning or already implementing them were not included in the submitted data.

Table 28. Type of participating municipalities

Type	Description	Participating municipalities
Metropolitan Municipality	All Municipalities within the Regional Units of Athens (North, South, West) Regional Unit of Piraeus Large Municipalities within the Regional Unit of Thessaloniki	16
Large Mainland Municipalities	Population over 25.000 citizens	26
Medium Mainland Municipalities	Population between 10.000 – 25.000 citizens	24
Small Mainland Municipalities	Population less than 10.000 citizens	8
Medium/ Large Island Municipalities	Population over 3.500 citizens	7
Small Island Municipalities	Population less than 3.500	3

Table 29. Number of participating municipalities by regions

Regions	Participating municipalities
Region of Attica	15
Region of Central Greece	7
Region of Central Macedonia	16
Region of Crete	7
Region of East Macedonia & Thrace	8
Region of Epirus	4
Region of Ionian Islands	3
Region of Northern Aegean	2
Region of Peloponnese	3
Region of Southern Aegean	2
Region of Thessaly	7
Region of Western Greece	5
Region of Western Macedonia	5

Consultations' results and highlights

Measures submitted by municipalities

From the information provided in the consultation process, most of the measures listed refer to WUI fires and floods as these two hazards occurred in the recent years more frequently in Greece and therefore most reconstruction projects have been about restoring damaged areas from such disasters. However, the large number of measures for “multiple hazards” indicates an emerging trend for a holistic approach in DRM planning. The majority of the measures shared by Municipalities are either completed or have already secured funding for their implementation from a wide range of available funding sources. A limited number of Municipalities have included “desired” measures in their forms, which may indicate the lack of future/ long-term planning at the local scale. Submitted responses indicate a different perception in the understanding of DRM measures. In several cases, Municipalities have overlooked completed, ongoing or planned measures that contribute to DRM. It seems that most respondents have focused on more familiar risks and shared in the template the relevant measures. This observation also indicates that Municipalities are more prepared for risks they have already experienced before in their area.

It is also evident that most local authorities are missing long-term strategic plans with projections of future risks based on thorough assessments of their assets' vulnerability. While the majority of measures submitted by Municipalities focus on prevention, only a few of those measures are related to strategic approach that would secure coordinated risk prevention in the long-term. More specifically, the majority of prevention measures are focused on first and second degree of pre-seismic assessments of public buildings as well as interventions for energy efficiency upgrade. This finding could be largely influenced by the recently available funding instrument “Antonis Tritsis” – AT 011 “Actions for infrastructure in need of earthquake protection (pre-seismic inspection), provided by the MoI. For example, 49 Municipalities have mentioned measures for pre-seismic assessments, which proves that the available funding instruments are likely to determine the prioritization of the DRM planning at the local scale. Therefore, funding instruments that promote a horizontal approach for DRM planning could help regional and local

authorities increase their understanding of all aspects of DRM planning as they are guided to invest in the implementation of cross-sectoral projects, capable to secure long term risk reduction.

Infrastructure measures, such as flood prevention construction works, seems to be planned or implemented mainly in areas that have been damaged by a past disaster and not necessarily in areas prone to future disasters based on studies or relevant predictions. Such observation highlights a major gap in implemented and planned measures, the lack of studies and impact assessments. Overall, only 79 measures out of the 1,000 in total are studies, whereas most of them are construction related measures. Moreover, 90 measures are for procurement, mainly for machinery and vehicles and 51 related to maintenance. Moreover, a review of the scope of those flood prevention measures demonstrates the lack of innovative solutions for preventing future risks. For example, nature-based solutions are not included in the measures, although such measures would provide multiple benefits for the area and not only against flood risk. At the same time, many measures are actions –repeated or planned annually- for example vegetation clearing works for fire prevention, however, it is questionable whether they are adequate, considering the size of the vulnerable areas in each Municipality, as well as if their timeframe for implementation is appropriate to ensure effective risk prevention.

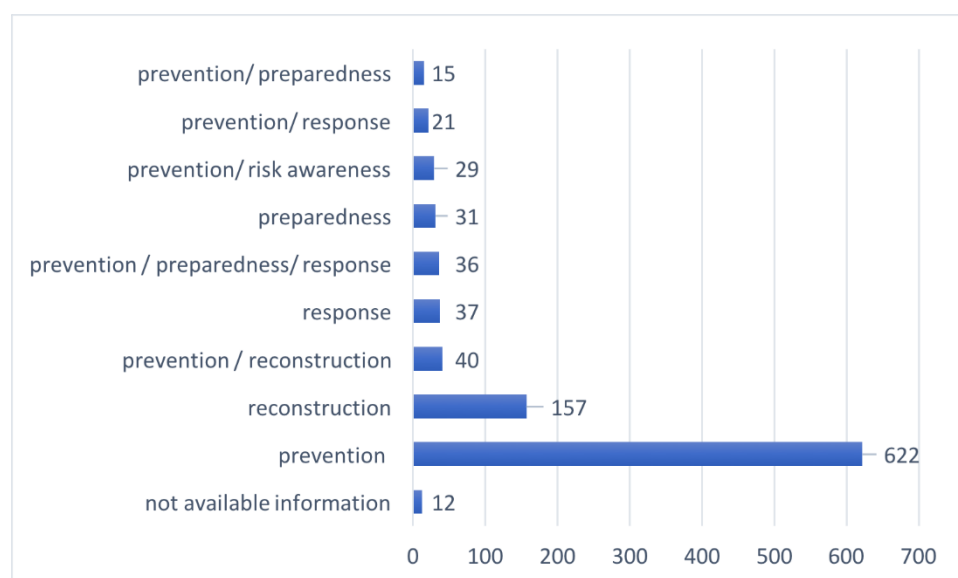
A limited number of Municipalities have included measures for community preparedness and supporting CP volunteer groups. Only 5 Municipalities have mentioned measures such as mobile applications, evacuation routes maps and training sessions for citizens in the case of an emergency. Only 6 Municipalities are planning or implementing actions for supporting CP volunteer groups. Such actions include trainings and support with supplies, equipment, and facilities. The Municipalities that excel in community preparedness are the same ones that also prioritize the support of volunteers in their DRM planning.

It was noted that some citizens' risk awareness activities are directly linked to the available funding instruments due to its specific eligibility guidelines. The majority of citizens' awareness actions that were mentioned by the Municipalities focused on earthquakes as the aforementioned recent funding instrument "Antonis Tritsis" which specifically focused on earthquake also encouraged Municipalities to apply for funding for engagement and awareness activities regarding earthquakes. In particular, out of the 49 Municipalities that have a planned or ongoing measure for pre-seismic assessment funded by this funding instrument, 13 Municipalities also leveraged the opportunity to fund a citizens' awareness campaign or program simultaneously with the assessments. This finding highlights the opportunity and the importance to pair soft actions for public engagement with every infrastructure project regardless its scale. Past and recent disaster events have proven that effective public awareness and preparedness is key to successful prevention and response actions for any type of hazard.

An important gap is identified in the development of long-term strategic plans. Only 2 Municipalities have included the development of their Action Plan for Energy and Climate (as signatories of the Covenant of Mayors) as a DRM measure and just 1 Municipality mentioned their attempt for establishing an Environmental Observatory for monitoring and assessing environmental indicators. Moreover, urban planning has not been a relevant topic to DRM. Only 4 Municipalities mentioned the development or

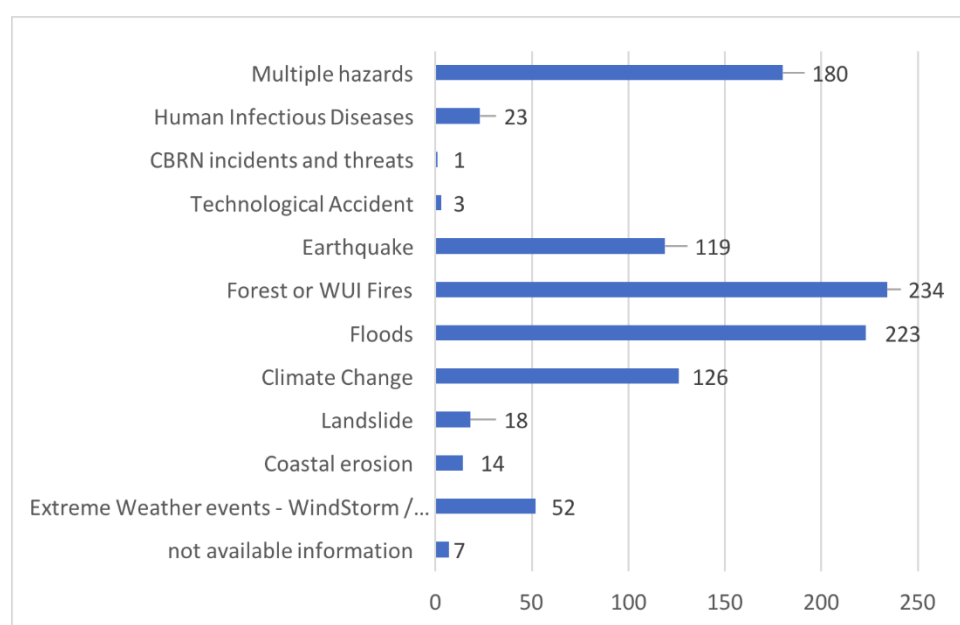
update of their urban masterplans or urban development plans. While the majority of disasters depend largely on the urban fabric expansion and its impact to the natural environment as well as the appropriateness of the existing land uses, authorities tend to plan for Civil protection actions independently from urban planning. The urgency of the upcoming risks due to climate change call for immediate actions that aim to reconsider the current urban and development planning practices and pursue a more sustainable and resilient approach.

Figure 20. Type of CP/DRM measures submitted by municipalities during consultations



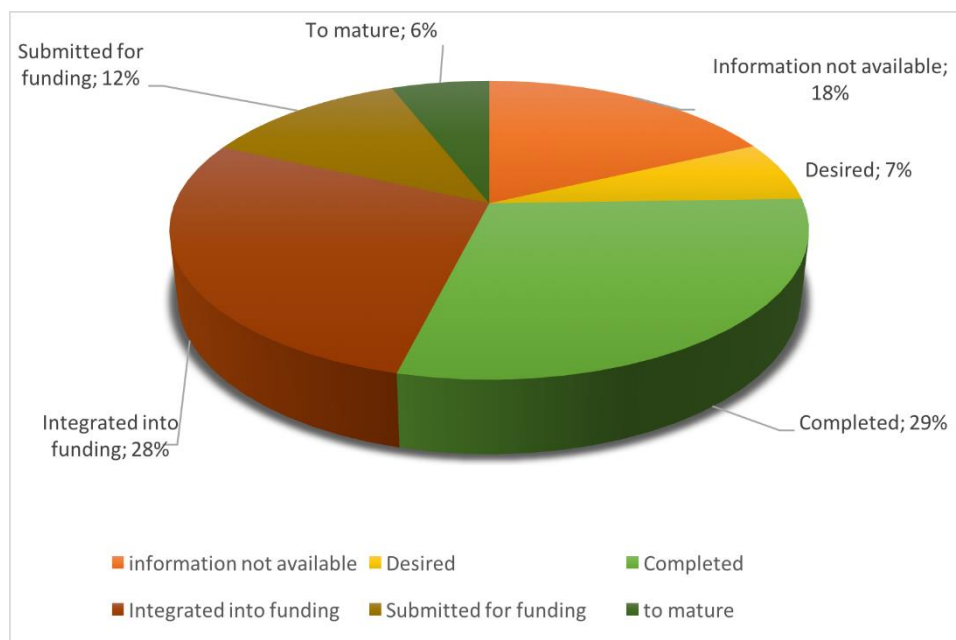
Note: This corresponds to 1,000 responses as of July 2021.

Figure 21. Categorization of Municipalities' measures according to the type of hazard



Note: This corresponds to 1,000 responses as of July 2021.

Figure 22. Status of submitted measures shared by municipalities



Note: This corresponds to 1,000 responses as of July 2021. "Status" refers to maturity of projects.

Measures submitted by regional authorities²³¹

While the planned and ongoing measures collected during the consultation process cover all phases of disaster, the majority focus on prevention (protection works) and reconstruction (rehabilitation works following recent destructive events). Investments cover a wide range of hazards with particular focus given to floods and extreme weather events, while a vast number of projects are expected to tackle the needs for multiple hazards.

Flood related projects mostly refer to flood protection measures, studies and works for waterflow management of streams and rivers or cleaning of the banks. Several of the works deal with rehabilitation of existing flood protection measures due to deterioration from past events or aging. Moreover, urban flood protection works are referenced, such culvert cleaning and construction of rainwater drainage. Investments for reconstruction refer to rehabilitation of infrastructures from flood events, mainly roads, also dams, culverts, or bridges.

Projects referenced to be related to multiple hazards in several cases refer to flood protection works that are expected to upgrade infrastructures and the surrounding area, in parallel to works for other events too (e.g., extreme weather, landslides). In other cases, measures refer to reconstruction/rehabilitation/strengthening works that are expected to be efficient for multiple hazards. Moreover, investments that mainly refer to civil protection response (such as supply of equipment) are

²³¹ Note that projects submitted by Region of Attica under ROP haven't been included as were sent few days prior to the report's submission for peer review.

expected to tackle multiple hazards needs, as well as the development of an IT system for monitoring and assessment of climate change impact and general weather-related hazards (e.g., by the Region of Epirus).

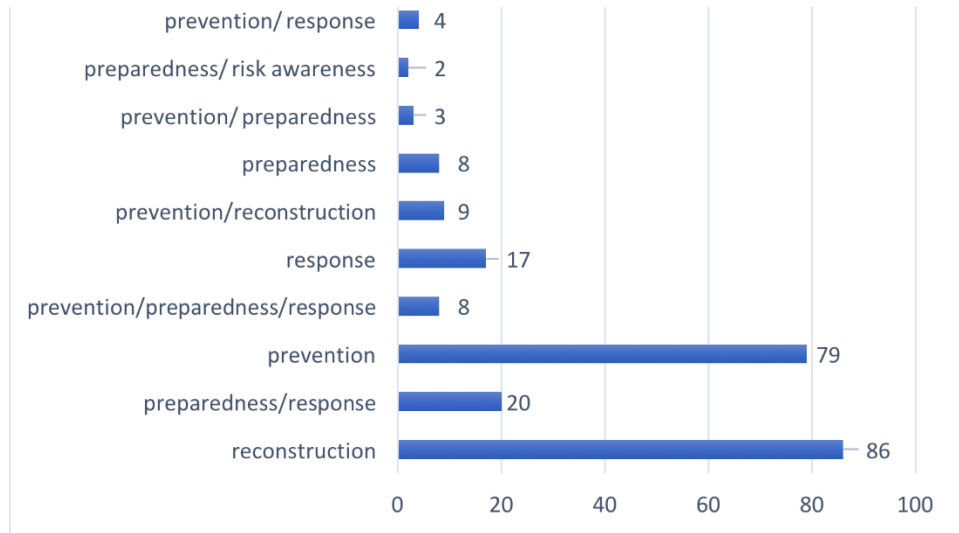
Related to earthquakes, the Region of Ionian Islands (highest seismicity zone) has enlisted a list of actions under a research project (in collaboration with academic and research Institutes) for the development of a technological system with integrated seismicity and seismic vulnerability data, the provision of seismicity monitoring tools, performance of risk awareness workshops and preparedness exercises. The Region of Crete has integrated into funding the configuration and upgrade of assembly points in Chania in case of an earthquake.

Related to other hazards:

- **There were not many investments shared by regions related to forest fires.** The submitted ones mostly focus to the development of IT systems and supply of equipment for fire detection, monitoring of fire affected areas and fire risk assessment, also together with decision-making system with real-time data processing.
- Notable is the relatively high number (11) of projects related to **coastal erosion** in Crete, and the program against **infectious diseases of animals** by the Region of Epirus, recognized to be included in DRM projects, as well as the request for funding of the development of Special Plans for Response to Large Scale **Technological Accidents** for SEVESO installations in Crete.
- Most of the **extreme weather-related** investments lie within the reconstruction phase and they refer to urgent maintenance and rehabilitation of road networks and other infrastructure types after snowfalls and other extreme weather phenomena. Interesting is the provision of a system for weather data elaboration and monitoring at regional unit level, the implementation of which needs to be in accordance and/or in combination with national alerts.
- **Climate change** adaptation measures are not particularly mentioned, other than a research program that the Region of Crete participates in.
- For **animal infectious diseases** 1 measure has been submitted from the Region of Epirus "Collection and management programme for dead animals (in accordance with the scope of the programme) and seized products and taking samples of brain tissue from dead bovine, ovine and caprine animals."

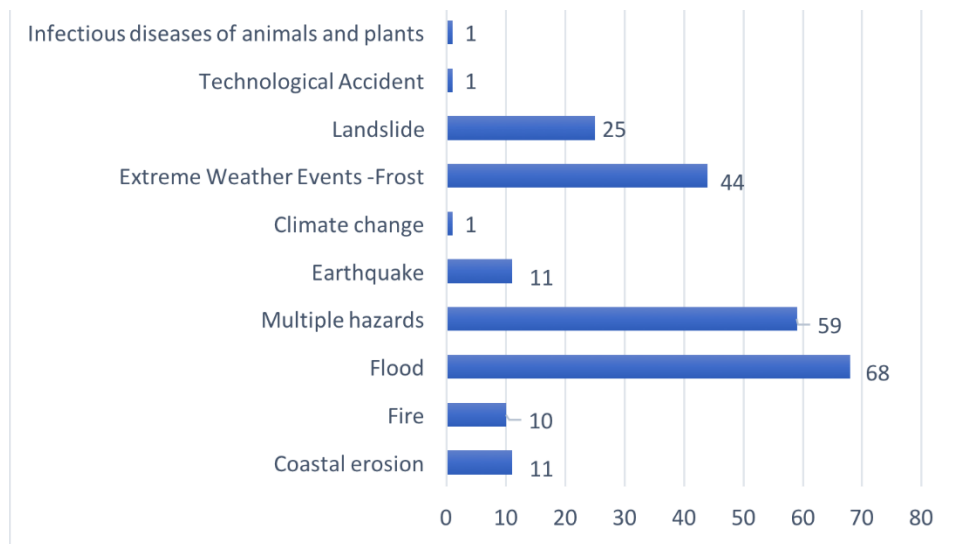
Related to status, the vast majority of the projects submitted by the regional authorities **have already secured funding for implementation** from a wide range of available funding sources. It should be though mentioned that the fact that mostly "integrated into funding" projects were submitted, this doesn't necessarily exclude the availability of completed or desired projects within the DRM domain.

Figure 23. Type of CP/DRM measures submitted by regional authorities during consultations



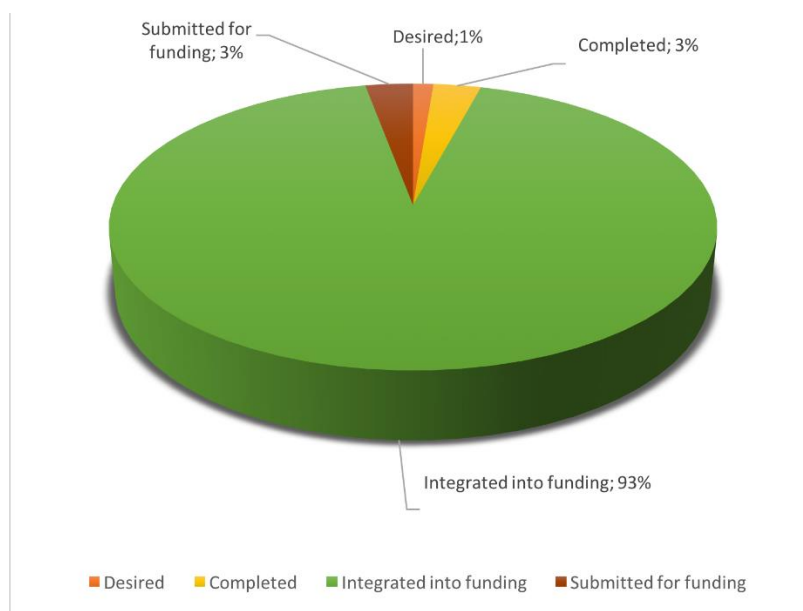
Notes: This corresponds to 236 responses as of July 2021.

Figure 24. Categorization of measures submitted by regional authorities by type of hazard



Note: This corresponds to 236 responses of July 2021.

Figure 25. Current Status of submitted measures by regional authorities



Note: This corresponds to 236 responses as of July 2021. "Status" refers to maturity of projects.

Measures submitted by Ministries and Institutions

Among the central bodies, 5 Institutions shared projects and investments planned or integrated for funding. The majority of them belongs to the prevention/preparedness phase. The majority of the submitted projects are integrated into funding, while 9 measures of EPPO are implemented only when required and/or approved (e.g., following the occurrence of strong seismic events). A large number of projects (48) correspond to research projects related with DRM. The majority of them are European funded projects, while some ESPA are enlisted as well as projects funded by Regional or municipal authorities. Almost the 100% of the projects belong to the prevention/preparedness phase, as they deal with monitoring and risk studies with different technological and scientific methods. Although some of the products are marked as operational, none of them are institutionalized as they are results of research programs. The projects cover a wide range of natural hazards.

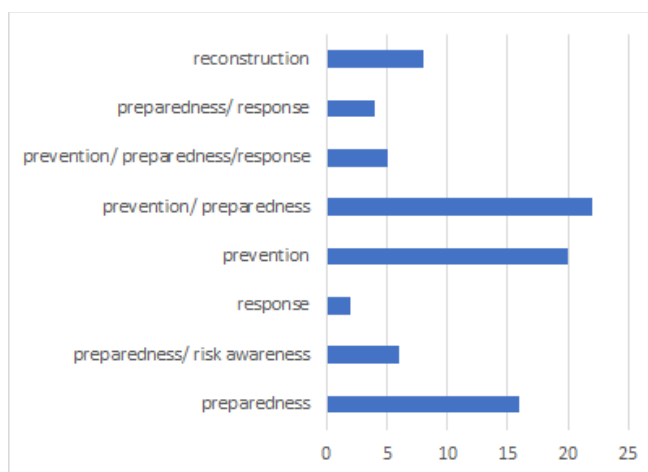
Additionally, GDAEFK shared a long list of expenses within the budget of 2020 for compensation of victims from fires, earthquakes, floods, and extreme weather events. Expenses date back to catastrophic events of 1993, due to pending lawsuits of citizens, inheritance issues and compensations granted in multiple stages. Budget refers to the following type of expenses:

- Free state aid for repair or reconstruction of damaged buildings from the aforementioned hazards
- Compensations for rehabilitation of the surrounding area of damaged buildings
- Compensations for rehabilitation of infrastructures after earthquake damage, flood, fire, and landslide in Greece
- General and operating expenditure to cover all nature needs, related to fire, flood and landslide in Greece

- Construction of buildings for permanent housing of affected population
- Expenditure for transportation of Directorate employees
- Integrated 24-hour monitoring system of Santorini volcano for Risk assessment and treatment of volcano risk
- Supply of 600 mobile houses for temporary housing of homeless population from natural hazards
- Delineation of affected areas and credit facilities for restoration of damages in buildings
- Rent subsidy to cover housing expenses
- Expenditure for demolition, cleaning, support of earthquake destructed buildings

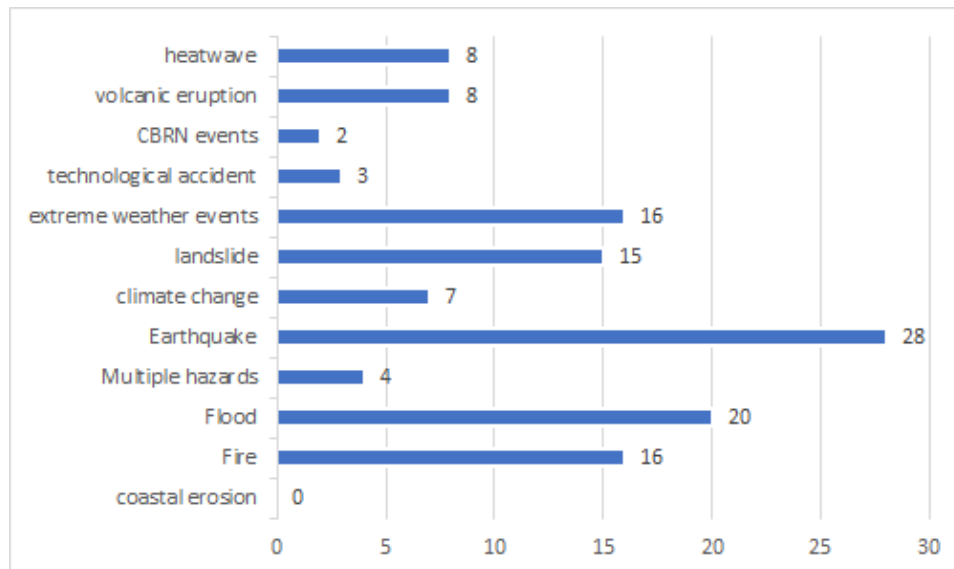
Ministry of Culture shared intended or ongoing investment (Submitted for funding and Integrated into funding projects) from two Directorates (Directorate of Studies and Projects of Museums and Civil Buildings and Directorate for the Preservation of Ancient and Modern Monuments). The majority of the projects refer to protection measures (prevention) for floods, climate change impact, for multiple hazards in a series of cultural sites and earthquake for vulnerable structures. Significant is also the number of projects related to reconstruction and rehabilitation, following destructive seismic, extreme weather and flood events.

Figure 26. Type of measures by ministries and institutions submitted during consultations



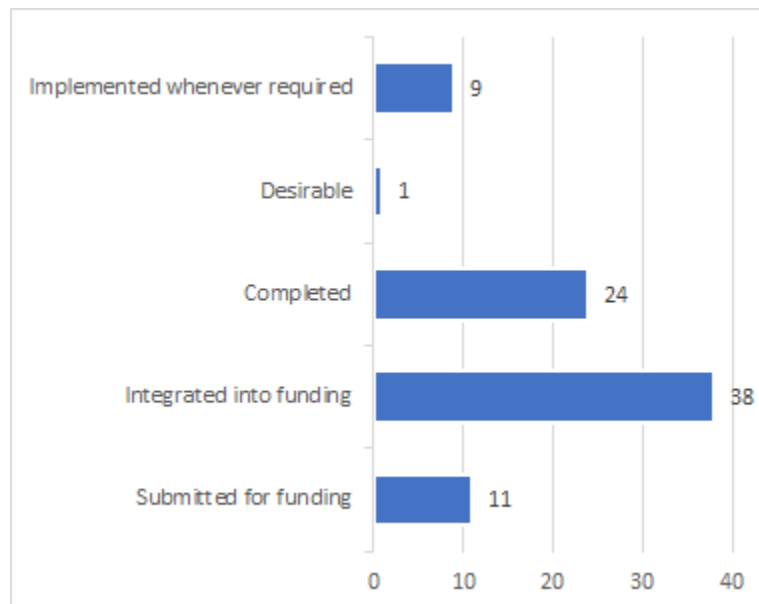
Note: This corresponds to 83 responses, without the inclusion of GDAEFK projects that correspond only to relief and recovery expenses.

Figure 27. Categorization of measures submitted by ministries and institutions per type of hazard



Note: This corresponds to 83 responses, without the inclusion of GDAEFK projects that correspond only to relief and recovery expenses. Projects with reference to multiple hazards have been counted multiple times.

Figure 28. Current Status of submitted measures submitted by ministries and institutions



Note: This corresponds to 83 responses. "Status" refers to funding status of the projects.

5.3. Annex 3. Proposed multicriteria analysis scores for prevention, preparedness and response measures

The following are the scores per measure for each hazard following the MCA. As the horizontal investment priorities are considered high priority, the MCA approach is here not applied to them. However, it should be noted that if desired, the MCA would be applicable to the horizontal investment priorities but would require stakeholder consultation for agreeing the criteria scores necessary for ranking.

A multi-criteria analysis (MCA) is proposed to prioritize the measures. Measures are rated based on the importance of the national risk(s) they address, effectiveness in reducing risk, economic efficiency, financial and social sustainability, current capacity for implementation, and urgency of need. The total prioritization score of each measure is a weighted combination of the above criteria, each of which is scored between 1 and 3, where 1 corresponds to the lowest priority and 3 corresponds to highest priority measure. This approach enables a combined quantitative and qualitative prioritization of potential measures within and across categories of risk. See Section 3.4 for definitions of MCA criteria.

Score index	low - 1	medium- 2	high -3
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Table 30. MCA analysis for earthquake measures

	Prevention, preparedness and response measures	Risk importance	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total score
No.	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1	Conduct programs or studies in the fields of seismic technology, seismotectonics, and social seismic defense	2.25	1	1	1	2	2	1	1.45
2	Assign specialized studies or research programs on addressing the consequences of earthquakes that have affected areas of Greece	2.25	1	1	2	2	2	2	1.75
3	Utilize the results above in determining the directions of the country's seismic policy	2.25	1	1	3	2	3	2	2.05
4	Collect available data on local site effects or conduct microzonation and soil studies at the scale of a city where these are not available, as they provide important inputs to urban and spatial plans	2.25	1	1	3	3	2	2	2.05
5	Expand and systematize risk information on exposure and vulnerability for a national earthquake risk assessment using additional detailed and reliable data as well as additional asset categories, and considering secondary hazard effects and risks	2.25	1	2	3	3	2	2	2.25
6	Develop a differentiated, step-by-step prioritized, and coordinated approach for seismic risk data collection as well as reporting mechanisms for critical infrastructure and public assets	2.25	1	2	3	3	3	3	2.45

7	Conduct preliminary data collection (on the built environment, including critical infrastructure and other public assets, residential sector, cultural heritage, and the population at seismic risk), in line with agreed methodology and expected use of seismic risk data	2.25	1	2	2	2	3	3	2.15
8	Provide risk information, training, and access to the region/municipality departments directly or indirectly involved in CP	2.25	1	3	2	2	3	3	2.35
9	Develop an operational seismic risk management system with various risk data for regions, which includes different data such as topographic data, satellite images, cadastral data and additional GIS data, geological maps, neotectonic maps, seismicity maps, maps of accompanying geodynamic phenomena, soil response measurements and soil classification, seismic hazard assessment, traditional and historic building response measurements, vulnerability assessment at urban scale, lifelines, and infrastructure vulnerability assessment	2.25	1	2	3	3	2	1	2.15
10	Document and identify geodynamic hazards and solutions in monuments and archaeological sites (e.g., Acropolis of Athens)	2.25	1	1	3	2	3	2	2.05
11	Provide training of archaeological site staff (popularization of science)	2.25	1	1	2	2	2	2	1.75
12	Prepare seismic risk-informed urban plans, prioritization of seismic risk reduction, and scenarios for emergency preparedness and response planning; develop emergency plans at urban scale informed by scientific evidence	2.25	1	2	3	3	3	2	2.35
13	Conduct rapid visual screening (first-degree pre-seismic vulnerability assessment) of all public buildings and second-degree pre-seismic vulnerability assessment of those that are found to require further investigation (most vulnerable ones)	2.25	1	2	3	2	2	2	2.15
14	Record all the dilapidated buildings	2.25	1	2	3	2	3	3	2.35
15	Take immediate action for the “near collapse” dilapidated buildings	2.25	1	3	3	3	1	2	2.35
16	Set up incentives for reuse and restoration of dilapidated and abandoned buildings where feasible	2.25	1	2	3	3	3	2	2.35
17	Repair most precarious buildings and infrastructure; conduct structural study and subsequently strengthen and improve the seismic resistance of infrastructure identified as needing further investigation after the rapid visual screening (first-degree) and the second-degree pre-seismic assessment to upgrade seismic capacity	2.25	1	3	2	3	2	3	2.35

18	Improve buildings' safety and functionality and increase citizens' security at the same time	2.25	1	2	3	3	2	3	2.35
19	Restore specific monuments affected by recent earthquakes	2.25	1	2	3	3	2	3	2.35
20	Take immediate actions for the "near collapse" earthquake-stricken monuments	2.25	1	2	3	3	2	3	2.35
21	Develop financing mechanisms for recovery, rehabilitation, and reconstruction of cultural heritage buildings and infrastructure	2.25	1	2	3	3	1	2	2.15
22	Invest in new accelerometers to monitor seismic activity in regions and municipalities	2.25	1	3	2	2	2	3	2.25
23	Support the maintenance of existing monitoring stations at the regional level	2.25	1	3	3	3	2	2	2.45
24	Upgrade infrastructure for recording and monitoring earthquakes, strong ground movements, and deformation	2.25	1	3	3	3	2	1	2.35
25	Invest in portable seismic monitoring equipment	2.25	1	3	3	2	2	2	2.35
26	Install seismological sensors for earthquake early warning in major industrial infrastructure and sensitive industrial plants (see also Table 14 in technological hazards)	2.25	1	3	3	2	1	2	2.25
27	Use early earthquake warning systems in major industrial installations and apply methodologies/technical solutions designed to protect critical industrial installations from natural hazards, malicious human interference, or cyberattacks	2.25	1	3	3	3	1	2	2.35
28	Develop an electronic platform for the continuous monitoring of critical national infrastructure, which combines instrumental with remote monitoring and development of fuzzy cognitive network methods together with machine learning algorithms	2.25	1	2	3	3	2	2	2.25
29	Supply and install special operational equipment including laptops, projectors, satellite phones, multifunction machines, tablets, PCs, monitors, keyboards, pumps, generators, etc.	2.25	1	3	2	2	2	3	2.25
30	Develop an innovative seismic risk monitoring and management system	2.25	1	3	3	3	2	2	2.45
31	Design and develop a low-cost network of large-scale seismometers-accelerometers	2.25	1	3	3	2	2	1	2.25
32	Create stochastic algorithms for processing large-scale seismological data in real-time	2.25	1	2	2	3	2	1	1.95
33	Develop software for decision-making on seismic hazard and a model system for dissemination of seismic hazard information to institutions and citizens	2.25	1	2	3	3	2	2	2.25
34	Supply, install, and maintain the permanent response measurement system of structures that belongs to OASP	2.25	1	2	2	3	3	3	2.25

35	Supply, install, and maintain the 120 accelerometers of OASP's National Network of Accelerometers	2.25	1	2	2	3	3	3	2.25
36	Develop guidelines for seismic assessment of existing water, energy, transportation, and telecommunications infrastructure, as well as educational facilities, hospitals, and other health facilities, to ensure that they remain safe, effective, and operational during and after disasters	2.25	1	1	3	3	3	2	2.15
37	Build an operational system for compilation of operational plans	2.25	1	1	2	3	3	2	1.95
38	Implement pilot combined preparedness exercises	2.25	1	2	3	2	3	3	2.35
39	Create and print training materials on emergency response for different population groups	2.25	1	3	3	2	3	3	2.55
40	Organize seminars and workshops on issues related to seismic risk as well as operational earthquake drills for various population groups	2.25	1	3	3	2	3	3	2.55
41	Create educational and information material in digital format	2.25	1	3	3	2	3	3	2.55
42	Conduct stakeholder training workshops and tabletop exercises	2.25	1	3	3	2	3	2	2.45
43	Conduct workshops for training and information of instructors and for training and information of stakeholders in the tourism industry	2.25	1	2	3	2	1	2	2.05
44	Present the results in scientific conferences	2.25	1	1	2	2	2	3	1.85
45	Conduct seismic risk information and awareness activities to broaden the population's consciousness and develop their earthquake behavior—i.e., knowledge of what to do before, during, and after an earthquake to effectively protect life and property	2.25	1	1	3	3	2	2	2.05
46	Develop a methodology for consistent rapid structural assessment after an earthquake event for all basic types of structures (large panel buildings, reinforced concrete, steel, masonry and prefabricated reinforced concrete structures, bridges, tunnels, dams, tailings dams, lifelines)	2.25	1	1	2	3	3	3	2.05
47	Mobilize OASP and GDAEFK immediate response units and transition to affected areas after strong earthquakes	2.25	1	1	2	3	3	3	2.05
48	Install portable networks of seismographs and accelerometers	2.25	1	3	3	2	2	2	2.35
49	Implement informative and educational actions for various groups of the population	2.25	1	2	3	2	1	3	2.15
50	Coordinate with the Technical Chamber of Greece to continue the development of a training process and the establishment of an organization of volunteer engineers trained to perform rapid assessment of seismic-induced damage potential	2.25	1	3	3	3	2	2	2.45

51	Carry out coordination, training, and disclosure of these teams, providing information on administrative structure, regulations, communication system, responsibilities, documentation (equipment, platform, input, and output)	2.25	1	3	3	3	2	2	2.45
52	Construct necessary infrastructure so that designated areas defined as places of refuge meet the general criteria set by the directives of the GSCP and the OASP and can function as places for temporary gathering of the public after an earthquake	2.25	1	3	2	3	1	2	2.15
53	Strengthen financial protection and resilience post event	2.25	1	2	3	3	2	2	2.25
54	Provide financial assistance to the population in need after an earthquake event	2.25	1	2	2	1	2	3	1.95
55	Develop awareness on risk and risk mitigation methods (e.g., insurance)	2.25	1	3	3	3	2	3	2.55
56	Build an insurance scheme for both the public and private sector to provide financial support and coverage for damage caused by earthquake events	2.25	1	2	2	3	1	2	1.95
Additional proposed priority measures for consideration									
1	Establish a common seismic risk assessment methodology and a framework for understanding seismic risk scenarios	2.25	1	1	3	3	3	2	2.15
2	Coordinate existing and planned data compilation; arrange collaboration of the government with academia and research institutes to ensure the robust quality of the seismic risk assessment framework	2.25	1	1	3	2	3	3	2.15
3	Consult with seismic risk information users and providers to define the scope of required databases	2.25	1	1	2	2	3	3	1.95
4	Establish institutional arrangements for geospatial seismic risk data systems	2.25	1	1	2	3	3	2	1.95
5	Make the existing seismic hazard and risk maps available on the GIS-enabled data platform (even not publicly available, specific access criteria may be applied)	2.25	1	2	3	3	2	2	2.25
6	Establish database/system processes; provide capacity training and guidelines for stakeholders to use and provide information	2.25	1	2	3	3	2	2	2.25
7	Continuously evaluate seismic risk information system capability and options for functionality improvements based on feedback and user needs	2.25	1	2	2	3	2	1	1.95
8	Regularly update seismic risk assessments and maps applying agreed methodology	2.25	1	1	2	3	2	1	1.75
9	Continuously invest in the seismic risk data system and institutions that maintain them	2.25	1	1	3	3	2	1	1.95
10	Develop seismic resilience master plan for the largest urban and industrial centers in the country	2.25	1	2	3	3	2	2	2.25

11	Promote the mainstreaming of seismic risk assessments into land use policy development and implementation, including urban planning, land degradation assessments, and informal and nonpermanent housing; especially for informal housing that warrant special attention as to the seismic resistance, as many may not be built according to codes of practice at the time of construction, prioritize by seismic hazard zone	2.25	1	2	3	3	3	3	2.45
12	Promote the use of guidelines informed by anticipated demographic and environmental changes	2.25	1	1	3	3	3	3	2.25
13	Modify the current funding scheme and the associated legislation of the ongoing energy efficiency program to encourage reliable seismic assessment and seismic retrofit together with the interventions for improved energy efficiency	2.25	1	2	2	3	1	2	1.95
14	Develop incentives for seismic retrofitting of infrastructure—for example, certain financial stimulus or tax exemptions for seismic retrofit up to a certain minimum safety level, or certain restrictions for commercial use of vulnerable properties	2.25	1	2	2	3	2	2	2.05
15	Develop systems to automate or accelerate response to seismic events such as shutting down critical infrastructure or closing access to vulnerable structures	2.25	1	1	2	2	1	2	1.65
16	Support research into improved techniques for earthquake early warning, including the use of state-of-the-art techniques (e.g., machine learning)	2.25	1	2	2	2	2	3	2.05

Table 31. MCA analysis for flood measures

	Prevention, preparedness and response measures	Risk importance	Climate Sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total score
No.	Weights	20%	10%	20%	20%	10%	10%	10%	90%
1	Produce risk maps and Master Plan at river basin and regional levels	1.8	2	3	3	2	2	3	2.46
2	Conduct applied research in the field of flood risk mitigation and tangible measures to be assumed	1.8	3	3	2	2	2	3	2.36
3	Update current flood risk policy based on above research by considering WFD 2000/20	1.8	2	3	3	2	2	2	2.36
4	Process historical and real-time data to calculate the risk of upcoming cascading events after a flood event (e.g. landslide)	1.8	2	2	3	2	2	2	2.16
5	Produce flood hazard maps based on extensive flood risk analysis at both national and local scale	1.8	1	2	2	2	2	3	1.96

6	Collect and maintain all flood data and key performance indicators in a geodatabase	1.8	1	2	2	1	1	2	1.66
7	Document and evaluate flood hazard in urban environments (through a Master Plan)	1.8	2	2	1	1	2	3	1.76
8	Produce manuals and training course	1.8	1	2	2	1	2	1	1.66
9	Provide trainings and exercises among involved stakeholders	1.8	2	3	3	2	2	3	2.46
10	Operationalize mechanisms for consultation and cooperation	1.8	1	2	2	2	2	2	1.86
11	Assess historic data of previous forest fires in order to point out high flood risk to inform appropriate actions (e.g., 2021 event in Evoia)	1.8	1	2	2	2	2	3	1.96
12	Produce flood extent and flood depth, velocity maps after the flood event to optimize damage assessment	1.8	2	3	3	2	2	3	2.46
13	Foresee and document possible cascading effects after flood event (e.g. landslides impacts, 2021 Evoia case)	1.8	3	2	1	2	2	3	1.96
14	Upgrade flood protection works while considering flood risk analysis taking into account climate change and hazard maps on a local scale	1.8	2	3	3	2	1	3	2.36
15	Review and reapply maintenance works for the river basin systems (e.g., information system)	1.8	2	1	1	3	3	2	1.76
16	Utilize SMS/Cell Broadcasting/112 system for early warning on a larger scale and to targeted groups based on a data and on a location-driven approach	1.8	1	2	1	2	1	2	1.56
17	Through continuous trainings and exercises, improve communication between different entities	1.8	1	2	2	2	2	2	1.86
18	Install meteorological stations for effective monitoring networks	1.8	2	3	3	2	2	3	2.46
19	Replace (upgrade) and install new weather radar systems	1.8	2	3	3	2	2	2	2.36
20	Install state-of-the-art monitoring stations including cameras and river gauging sensors	1.8	1	3	3	2	2	2	2.26
21	Develop flood early warning systems, integrating information from weather and river monitoring and forecasting	1.8	2	3	2	2	2	3	2.26
22	Procure improved ICT technology (hardware, software, middleware) to manage early warning data in real time	1.8	1	2	3	1	2	2	1.96
23	Conduct research into innovative solutions for flood and extreme weather monitoring, including the use of satellite data	1.8	2	3	2	2	2	2	2.16

24	Supply and install equipment to support pilot system for observation and forecasting of intense weather phenomena at county level	1.8	1	2	2	2	1	2	1.76
25	Install telemetry stations to monitor river/stream discharges	1.8	1	2	2	2	2	1	1.76
26	Install advanced technologies (e.g., Doppler systems) for monitoring of discharges/ velocities in drainage systems	1.8	1	2	2	2	1	2	1.76
27	Improve the public's preparedness for and reaction to floods	1.8	1	3	3	3	3	3	2.56
28	Organize seminars and workshops targeted to the public as well as authorities	1.8	2	3	3	2	3	2	2.46
29	Educate the public on emergency response techniques	1.8	1	3	2	2	2	3	2.16
30	Provide people in affected areas with accommodation as a refuge	1.8	1	3	2	2	1	3	2.06
31	Mobilize local authorities as a first rapid response in cooperation with GSCP	1.8	2	3	2	2	1	3	2.16
32	Invest in cleaning road networks to improve network status for optimal search and rescue missions	1.8	2	3	3	2	2	3	2.46
33	Cooperate with local authorities to provide escape routes to the public	1.8	2	2	2	1	1	2	1.76
34	Improve financing mechanisms for recovery, rehabilitation, and reconstruction	1.8	1	1	3	2	1	3	1.86
35	Provide financial safety for the affected areas and population	1.8	1	2	2	2	2	1	1.76
36	Offer insurance plans (to be introduced by law)	1.8	1	2	2	1	1	2	1.66
Additional proposed priority measures for consideration									
1	Enhance cooperation with regional partners on the operational use of flood forecasting and meteorological forecasting systems (e.g., ECMWF).	1.8	1	3	3	2	1	2	2.16
2	Develop improved Standard Operating Systems for flood forecasting/early warning systems to optimize communication and operation.	1.8	1	3	2	2	1	2	1.96
3	Automate response to flood events by shutting down critical infrastructure or forwarding assets to affected areas	1.8	1	3	3	2	1	2	2.16
4	Invest in research and latest technologies in early warning (e.g., machine learning, artificial intelligence, unmanned aerial vehicles, Internet of Things)	1.8	2	3	2	2	1	2	2.06
5	Make use of a web GIS platform to collect, analyze, and monitor flood data and key performance indicators (e.g. part of the National Risk Base)	1.8	1	3	3	2	2	2	2.26
6	Strengthen financial protection and resilience post event	1.8	1	3	2	2	2	3	2.16

7	Provide financial assistance to the population in need after an Flood event	1.8	1	2	2	2	2	2	1.86
8	Develop awareness on risk and risk mitigation methods (e.g. insurance)	1.8	1	2	2	2	1	2	1.76
9	Build an insurance scheme for both public and private sector to provide financial support and coverage for damage caused by floods events	1.8	1	3	2	2	1	2	1.96

Table 32. MCA analysis for forest or wildland urban interface fire measures

	Prevention, preparedness and response measures	National risk importance	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total Score
No,	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1	Revise current policies and investments aiming to improve the balance between wildfire prevention and suppression	1.7	3	3	3	3	2	3	2.30
2	Develop an integrated wildfire risk management plan at the country level to exploit the investments of the Aegis national CP program	1.7	3	3	3	3	3	3	2.40
3	Define clearly the legal and institutional basis for the cooperation and synergy between the fire (suppression) and the forest (prevention) service, based on the complementarity needed to manage wildfires in an integrated manner	1.7	3	3	3	3	3	3	2.40
4	Establish a central mechanism (GSCP) for monitoring actual/proposed management plans and investments at all levels (local/municipality, regional, national) and define respective priority and performance indicators	1.7	3	3	3	2	3	3	2.30
5	Identify high-risk WUI areas and prioritization of fuel treatments to reduce risk from eventual fires	1.7	3	3	3	3	3	3	2.40
6	In the AEGIS national CP plan, prioritize the vertical organization and improved coordination of civil protection according to the Nat-CHAMM concept	1.7	3	3	3	3	3	3	2.40
7	Conduct actions for raising awareness (AEGIS Axis 1)	1.7	3	3	3	3	3	3	2.40
8	Provide professional training in civil protection and crisis management technology (focus on wildfire emergencies needed)	1.7	3	3	2	2	3	2	2.00
9	Monitor in systematic way the implementation of Iolaos Plan	1.7	3	3	3	2	2	2	2.10

10	Extend the program “DRYADES” implemented in June-July 2021 for the treatment of forest fuels in WUI areas	1.7	3	3	3	3	3	3	2.40
11	Develop and use the new operational structure of Greek CP, comprising the National Coordination Center for Crisis Management (Ε.Σ.ΚΕ.ΔΙ.Κ.) and the respective 13 regional (ΠΕ.ΚΕ.Π.Π.) and 64 local (ΤΟ.ΚΕ.Π.Π.) operation centers	1.7	3	3	3	3	3	3	2.40
12	Implement AEGIS plan (Axes 3 and 4), which includes numerous procurements of aerial means (both purchased and rented), ground vehicles (patrol cars, heavy fire trucks, initial attack means, etc.), air surveillance operations center, fleet management systems, mobile CCs, and search and rescue equipment; address development of infrastructures for wildfire-related DRM	1.7	3	3	2	2	2	3	2.00
13	Include in AEGIS a detailed programme on wildfire prevention comprising basic priorities.	1.7	3	3	3	3	3	3	2.40
14	Establish a specialized firefighting unit for forest operations (EMODE)	1.7	3	3	3	3	3	3	2.40
15	Strengthen the National Disasters Management System, supported by information systems and IT solutions for the prevention of and response to natural risks	1.7	3	3	2	3	3	3	2.20
16	Strengthen cooperation for developing R&D activity with research and technology organizations and academia (AEGIS, Axis 1)	1.7	3	2	2	3	2	2	1.80
17	Develop smart monitoring and surveillance systems aiming to provide climate information and early warning for wildfires (AEGIS, Axis 2)	1.7	3	2	2	2	2	2	1.70
18	Implement digital alert system for the population (AEGIS, Axis 2)	1.7	3	3	3	2	2	2	2.10
19	Implement autonomous forest fire detection systems at the regional level, making use of technologies such as remote sensing and meteorological stations	1.7	3	2	1	2	3	3	1.70
20	Use tools to monitor prevalent conditions and to model fuel and forest fire risk	1.7	3	3	3	2	2	3	2.20
21	Develop systems for detection of forest fires with abilities to exploit crowdsourced data	1.7	3	2	2	2	3	2	1.80
22	Develop/procure decision support tools for managing wildfires	1.7	3	3	3	2	3	3	2.30
23	Develop official (GSCP) smartphone apps to disseminate warnings at municipal and regional level	1.7	2	2	2	2	2	2	1.60
24	Use operational fund for risk prevention and response (AEGIS)	1.7	3	3	3	2	3	3	2.30

Additional proposed priority measures for consideration									
25	Conduct awareness campaigns to improve the perception of wildfire risk in the wildland urban interface among homeowners	1.7	3	3	3	2	3	3	2.30
26	Develop local wildfire protection plans (municipality level)	1.7	3	3	3	2	3	3	2.30
27	Develop wildfire management plans for large forests and forested areas (for integration into the respective forest management plans)	1.7	3	3	3	2	2	3	2.20
28	Set up consistent monitoring of local authorities for application of the legislation for cleaning areas surrounding structures and empty lots	1.7	3	3	2	1	2	2	1.80
29	Fund extensive forest and fuel management programs (funded and implemented properly and in an early manner)	1.7	3	3	3	3	3	3	2.40
30	Develop economic activity linked with the forest production and services (forest economy)	1.7	3	3	3	3	3	3	2.40
31	Improve land planning by integrating assessment and treatment of potential wildfire risk in the development of new areas	1.7	3	3	3	3	2	2	2.20
32	Develop a formal registry of ongoing and planned wildfire management projects and investments at the local, regional, and national scale	1.7	2	3	3	3	3	3	2.30
33	Develop a system of indicators to monitor and evaluate the performance of investments in wildfire management system (cost-benefit analysis)	1.7	2	3	3	2	3	2	2.10
34	Develop a national forest fuel map based on a relevant classification system to allow documented wildfire management; update the fuel map annually (burned areas) and revise every five years.	1.7	3	3	3	3	3	3	2.40
35	Use the National Meteorological Service (specialized fire weather meteorologists) to allow GSCP (i) to develop seasonal risk assessment (monthly up to fire season) and (ii) to issue daily wildfire danger news during the fire season	1.7	3	3	2	2	2	2	1.90
36	Issue fire danger maps from GSCP and share with relevant public services and organizations; evolve to interactive maps providing preparedness risk reduction guidelines at the local and regional level	1.7	3	3	2	2	3	2	2.00
37	Officially provide blended early warning of wildfire risk online—i.e., information combining remote sensing observations of the vegetation status, actual operational capabilities, and assets at risk	1.7	3	3	2	2	2	2	1.90

38	Improve the 112 service to include standardized information (do what and when) as well as guidelines for protecting animals, wildfire, biodiversity, cultural heritage, and property left behind	1.7	3	3	3	2	3	2	2.20
39	Develop a standardized (common specs) online fire detection network, comprising point sensors, cameras, and meteorological stations	1.7	3	3	3	2	2	3	2.20
40	Equip aerial means (manned/unmanned) with thermal tracking capabilities	1.7	3	3	3	2	3	3	2.30
41	Revisit the concept and role of ground-based forest fire detection stations and upgrade the existing network accordingly	1.7	3	3	2	2	2	3	2.00
42	Operationalize the research results dealing with advanced techniques for forest fire risk monitoring and modeling of fire spread and propagation	1.7	3	3	2	2	3	2	2.00
43	Organize the specialized drone units (all hazards) for surveillance of high-risk areas at the peak-risk hours during the fire season	1.7	3	3	3	3	3	3	2.40
44	Organize annual tabletop and field exercises (escalated scenarios) at local, regional, and national level with the participation of all involved operational actors	1.7	3	3	3	3	3	3	2.40
45	Create a professional wildfire analyst role and consider having at least two people with such profile for every country region (in the Regional Operational Centers)	1.7	3	3	3	3	3	3	2.40
46	Strengthen environmental restoration and socio-economic resilience post event	1.7	3	3	2	3	2	2	2.00
47	Provide financial assistance to the population in need after large or high-impact wildfire events	1.7	3	3	2	1	2	3	1.90
48	Develop awareness on risk and risk mitigation methods (e.g. insurance)	1.7	3	2	3	2	2	2	1.90
49	Build an insurance scheme for both public and private sector to provide financial support and coverage for damage caused by fire events	1.7	3	2	2	2	2	2	1.70

Table 33. MCA analysis for heatwaves and droughts measures

	Prevention, preparedness and response measures	Risk importance	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total score
No.	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1	Estimate climate change for agricultural areas through an assessment of the vulnerability of rural areas; Develop,	1.9	3	2	2	3	2	2	2.18

	implement, and demonstrate a decision support tool; develop climate change adaptation strategies; conduct awareness raising for stakeholders and target groups								
2	Operationalization of mechanisms for consultation and cooperation (AEGIS report)	1.9	3	2	3	3	3	3	2.58
3	Develop a meteorological, economic, demographic, environmental, and social database for extreme heat and drought weather events and map vulnerability and risk indicators at the local scale; Process data to calculate the vulnerability to weather risks and the level of risk from weather events in geographical zones	1.9	3	2	3	3	2	3	2.48
4	Invest in thermal insulation into building shells; replace frames in openings; upgrade cooling and heating system; replace lighting with new LEDs; use photovoltaic installation, green roofs, green walls, etc.; implement interventions for greening schoolyards/public spaces, etc.	1.9	3	2	2	2	2	2	2.08
5	Invest in measures for improving urban microclimate and citizens' life quality, such as urban regeneration projects/ interventions aligned with the principles of sustainability, prevention, and resilience and integrating innovative solutions such as nature-based solutions, permeable surfaces	1.9	3	2	2	2	1	2	1.98
6	Develop provisioned strategic plans for climate adaptation and energy at the local level that will include: (1) multi-hazard maps with the inclusion of heat wave risk, especially for vulnerable populations (from Output 1 gaps) (2) impacts to various economic sectors like agriculture, tourism, cultural heritage, and construction, as well as environmental impacts to regional biodiversity; Support local leadership in participating with Covenant of Mayors	1.9	3	2	3	3	2	2	2.38
7	Develop a system of high-resolution numerical models that lead to the short-term forecast and future projection of the urban heat island phenomenon on the city scale; Install early warning systems at municipal levels to notify populations susceptible to heatwaves, particularly high-risk individuals like elderly, young children, and outdoor workers (e.g., agriculture/construction) and medical service providers.	1.9	3	2	3	2	1	3	2.28
8	Conduct pre-event awareness campaigns for receipt and description of emergency alerting; educate citizens on public health actions and community-based support systems (if	1.9	3	3	3	3	2	3	2.68

	these exist, i.e., cooling center locations/access) (AEGIS report)								
9	Invest in installation and maintenance of water tanks and pipeline infrastructure within municipality	1.9	3	1	2	2	1	3	1.88
Additional proposed priority measures for consideration									
10	Develop awareness material campaigns and guidelines for behavioral change towards a sustainable way of living	1.9	3	1	3	3	2	2	2.18
11	Provide attractive incentives for private entities to invest in developing environmental, social, and corporate governance schemes (ESG); and promote financing climate change adaptation	1.9	3	1	3	3	2	2	2.18
12	Provide an energy efficiency temporary operation plan during heatwaves for public sector (public buildings, health facilities, and schools)	1.9	3	3	3	3	1	3	2.58
13	Implement heat waves warnings based on local/regional heat indexes that relate to biophysical indicators.	1.9	3	2	2	2	2	2	2.08
14	Strengthen cooperation with regional partners (e.g. ECMWF) to support improved monitoring and forecasting of drought conditions.	1.9	3	2	3	3	2	3	2.48
15	Improve networks of temperature sensors and remote sensing for high-resolution monitoring of urban temperatures; Assimilate temperature information into micro-scale urban models to forecast extreme temperatures.	1.9	3	2	2	2	2	2	2.08
16	Develop local strategy and maps for community preparedness and response; Develop maps for important public amenities (e.g., publicly accessible air-conditioned and shaded shelters, drinking water fountains, etc.) during days of extreme heat; Invest in communication channels with citizens/NGOs working with vulnerable populations; Create and disseminate information/awareness material for instructions about self-protection during heat waves	1.9	3	2	3	3	1	3	2.38
17	Invest and share in accessible early warning tool at the local scale	1.9	3	2	3	3	1	3	2.38
18	Coordinate planning and response efforts for climate change related heat extremes; Increase awareness campaigns for sectors such as agriculture on how to respond to extreme heat and drought.	1.9	3	2	3	3	1	3	2.38
19	Plan and stage cooling centers in areas with highly vulnerable populations; Prepare for capacity surge at hospitals and	1.9	3	1	3	3	2	3	2.28

	clinics; extend hours at public venues that have air-conditioning								
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Table 34. MCA analysis for extreme weather events measures

	Prevention, preparedness and response measures	Risk importance	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total score
No.	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1	Thunderstorm/Frost: Operationalize research activities in partnership with other European organizations for earth observations and monitoring of climate extreme events. (e-shape EuroGEO)	1.9	3	2	3	2	3	1	2.28
2	All Extreme weather events: Operationalization of mechanisms for consultation and cooperation	1.9	3	3	3	3	3	3	2.78
3	Heavy rainfall, windstorms, frost: Invest in stormwater management and retaining walls manage extreme rainfalls, windstorms, and frost.	1.9	3	2	3	3	2	3	2.48
4	Heavy rainfall, storms, windstorms: Install additional meteorological stations to create denser monitoring network	1.9	3	3	3	2	3	3	2.68
5	Heavy rainfall, storms, windstorms: Replace (upgrade) and installation of new weather radar systems	1.9	3	3	3	2	3	3	2.68
6	Heavy rainfall, storms, windstorms: Procure improved software and associated hardware to manage early warning data in real-time	1.9	3	3	3	3	3	3	2.78
7	Heavy rainfall, storms, windstorms: Supply and install equipment to support pilot system for observation and forecasting of intense weather phenomena at county level; establish extreme weather surveillance system/integrated monitoring systems	1.9	3	3	3	3	3	3	2.78
8	Heavy rainfall, storms, windstorms: Procure new technologies to monitor new events, including unmanned aerial vehicles with cameras, Internet of Things sensors, exploitation of remotely sensed data	1.9	3	3	3	3	3	3	2.78
9	Heavy rainfall, storms, windstorms: Ensure regional or municipal systems are aligned with and can communicate with national systems	1.9	3	3	3	2	2	2	2.48
10	All Extreme weather events: Invest in programmatic support for ongoing maintenance and restoration of structural integrity of cultural heritage buildings and infrastructure	1.9	3	3	3	2	3	1	2.48

11	Heavy rainfall/snowstorms: Support regions and municipalities in snow removal with investment in mechanical equipment and machinery (AEGIS Plan)	1.9	3	3	3	3	3	3	2.78
12	Heavy rainfall/snowstorms: Develop coordination mechanism and fund emergency road cleanup following extreme weather events.	1.9	3	3	3	3	2	3	2.68
13	Heavy rainfall/snowstorms: Invest in reconstruction of road networks as well as public buildings and infrastructure following extreme weather events (e.g., public schools, institutional buildings, etc.)	1.9	3	3	3	2	2	3	2.58
Additional proposed priority measures for consideration									
14	All extreme hazards: Develop multi-hazard maps with inclusion of climate extreme events, especially for vulnerable areas and sectors, like agriculture	1.9	3	1	3	3	2	2	2.18
15	All extreme hazards: Identify and assign roles and responsibilities of the institutions involved in climate extreme event management	1.9	3	2	3	3	3	3	2.58
16	All extreme hazards: Invest in a program to facilitate data-driven decision making, effective long-term planning, and implementation of investments.	1.9	3	3	3	2	2	2	2.48
17	All extreme hazards: Provide regular training on severe storm and extreme winter risk conditions	1.9	3	3	3	3	2	2	2.58
18	All extreme hazards: Replace overhead cables providing electrical power or telecommunications, with underground cables in densely inhabited areas that are prone to extreme hazards (e.g., higher snowfall hazard, windstorms)	1.9	3	2	3	3	1	3	2.38
18	All extreme hazards: Invest In hazard-specific exercises for first/emergency responders in relation to extreme weather phenomena	1.9	3	3	3	3	3	3	2.78
19	All extreme hazards: Develop and install common alerting protocol-enabled dissemination systems at hotspots (known or identified through analysis).	1.9	3	2	3	2	3	2	2.38
20	All extreme hazards: Continue to expand public awareness campaigns in response to extreme weather events	1.9	3	2	3	3	3	1	2.38

Table 35. MCA analysis for landslide measures

	Prevention, preparedness and response measures	Risk importance	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total score
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N	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1	Integrate Synthetic-aperture radar (SAR) interferometry and Global Navigation Satellite System (GNSS) for studying ground movements and identifying landslide hazard	1.4	2	2	3	2	3	2	2.18
2	Record wider potential landslide areas based on geological and tectonic criteria	1.4	2	2	2	3	3	1	1.98
3	Analyze the geological, geomorphological, tectonic, and hydrogeological elements of the identified landslide prone areas	1.4	2	2	2	3	3	1	1.98
4	Evaluate the geological formations (e.g., consistency, disintegration, assessment of mechanical behavior, etc.), tectonics, data on the seismicity of the area, and hydrogeological data	1.4	2	2	2	3	2	1	1.88
5	Document and identify landslide hazards and solutions in monuments and archaeological sites (e.g., Acropolis of Athens)	1.4	2	1	2	3	2	2	1.78
6	Provide training of archaeological site staff (popularization of science)	1.4	2	1	2	2	2	2	1.68
7	Conduct construction works for prevention of potential landslides in areas prone to landslide	1.4	2	3	3	3	2	3	2.48
8	Take prevention measures for landslide events along the road network	1.4	2	3	3	3	2	3	2.48
9	Invest in retaining structures to reduce the potential of landslide hazards	1.4	2	3	3	3	2	3	2.48
10	Invest in continuous monitoring of national infrastructure for impacts of landslides (stand-alone or as cascading hazard)	1.4	2	3	3	3	2	3	2.48
11	Enhance the use of remote sensing and ground-based sensors to detect landslides	1.4	2	3	3	3	1	2	2.28
12	Develop an electronic platform for the continuous monitoring of critical national infrastructure vis-à-vis the risk for co-seismic landslide, coastal deformation (e.g., in the region Gulf of Corinth, in the limits of the Greek supersite)	1.4	2	3	3	3	2	1	2.28
13	Develop landslide early warning systems to protect cultural heritage sites	1.4	2	3	3	3	1	3	2.38
14	Invest in road cleaning networks following landslides, including provision of machinery for such works (as included in the AEGIS plan)	1.4	2	3	3	3	3	3	2.58
15	Invest in emergency construction of retention walls and barriers to limit further landslides	1.4	2	3	3	3	3	3	2.58

Additional proposed priority measures for consideration									
1	Develop and make accessible homogenized landslide risk information, particularly in areas of Western Greece that do not have the same detail or knowledge of landslide susceptibility	1.4	2	1	2	2	3	2	1.78
2	Develop a long-term landslide management strategy	1.4	2	2	3	3	3	2	2.28
3	Take appropriate landslide protection measures	1.4	2	3	3	3	2	3	2.48
4	Develop multi-hazard maps with the inclusion of landslide risk including co-seismic landslides	1.4	2	1	2	2	2	2	1.68
5	Create accessible database for landslide incidents	1.4	2	2	2	3	2	1	1.88
6	Invest in systematic and streamlined collection of landslide information/registry of landslides; risk analysis requires data-sharing mechanism among institutions/across ministries	1.4	2	3	3	3	2	1	2.28
7	Invest in monitoring of terrains (satellite or airborne systems or ground-based systems) to assess movements and susceptibility of critical slopes	1.4	2	3	3	3	2	3	2.48
8	Develop slope stability models used for landslide risk monitoring / forecasting	1.4	2	2	2	3	2	2	1.98
9	Monitor infrastructure and heavily populated areas susceptible to landslide risk	1.4	2	2	3	3	2	3	2.28
10	Develop landslide evacuation plans for particularly susceptible areas; include impacts of multi-hazard effects and cascading consequences	1.4	2	2	3	3	3	3	2.38
11	Invest in risk and action awareness campaigns for local community, including informing citizens on landslide susceptible areas, actions to prepare for landslides, and landslide evacuation routes	1.4	2	1	3	3	3	3	2.18

Table 36. MCA analysis for human infectious diseases measures

	Prevention, preparedness and response measures	Significance of risk	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total score
	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1.	Establish a committee for tackling emergency situations from infectious diseases	1.5	1.5	2	3	3	3	3	2.35
2.	Establish a committee for COVID-19 pandemic	1.5	1.5	2	3	2	3	3	2.25
3.	Update the Artemis Plan	1.5	1.5	3	3	3	3	3	2.55
4.	Reorganize the Directorate for Operational Preparedness for Public Health Emergencies	1.5	1.5	3	2	2	2	2	2.05

5.	Collaborate with both national and international entities responsible for crisis management	1.5	1.5	2	2	3	3	3	2.15
6.	Support to tackle the potential psychosocial implications of an extensive disease outbreak (such as COVID-19)	1.5	1.5	1	2	1	2	3	1.65
7.	Establish surveillance mechanisms for testing and tracking cases in the general population	1.5	1.5	2	2	2	2	2	1.85
8.	Introduce registries of infected patients/cases in the population	1.5	1.5	2	3	3	3	2	2.25
9.	Capitalize on the success of the setup of quick immunization	1.5	1.5	2	2	3	3	3	2.15
10.	Invest in development of collection and treatment systems for epidemiological and other data	1.5	1.5	3	2	3	2	2	2.15
11.	Expand e-health initiatives, supply of diagnostic equipment, and consumables for remote areas	1.5	1.5	2	2	3	3	2	2.05
12.	Build capacity for data analytics in all the phases of policy formulation against health threats (design, application, key performance indicator measurement, evaluation)	1.5	1.5	3	3	3	2	2	2.35
13.	Create designated spaces for storage of procurement and supplies for epidemiological response in airports and ports.	1.5	1.5	1	2	2	3	3	1.85
14.	Ensure the community health of regions with increased population mobility	1.5	1.5	2	2	3	3	3	2.15
15.	Cover potential health needs of migrants/refugees	1.5	1.5	3	2	3	2	3	2.25
Additional proposed priority measures for consideration									
16.	Elaborate with stakeholders and develop a national awareness strategy for infectious diseases and pandemics	1.5	1.5	2	3	2	3	2	2.15
17.	Enhance awareness of measures for personal protection against infectious diseases (personal hygiene, social distancing, etc.)	1.5	1.5	2	2	3	2	3	2.05
18.	Introduce a “single point of information” in the system, which will be responsible for tracking the situation of infectious diseases and potential emerging threats globally	1.5	1.5	2	3	2	3	3	2.25
19.	Solidify a single point of communication in the system, which will be responsible for disseminating valid information on health threats and behaviors	1.5	1.5	2	3	2	3	3	2.25
20.	Introduce specific courses in the curricula of health sciences	1.5	1.5	1	2	3	2	2	1.75
21.	Introduce “train the trainer” activities for training of volunteers among the general public	1.5	1.5	2	2	2	2	2	1.85
22.	Establish a protocol for effective and early response to infectious disease outbreaks	1.5	1.5	2	3	3	3	3	2.35
23.	Improve epidemiological surveillance systems for both human and animal infectious diseases	1.5	1.5	2	2	2	2	3	1.95

24.	Ensure effective monitoring and adherence to guidelines and recommendations for disease surveillance	1.5	1.5	1	2	3	3	3	1.95
25.	Introduce digital systems for contact tracing and for monitoring hospital and intensive care capacity	1.5	1.5	2	3	3	2	3	2.25
26.	Strengthen the role of primary care	1.5	1.5	2	2	3	1	2	1.85
27.	Use insights from behavioral and social sciences to monitor and change human behavior during disease outbreaks	1.5	1.5	2	2	3	3	2	2.05
28.	Establish an interdisciplinary task force of experts in policy making behavioral and social science, economics, and bioethics	1.5	1.5	2	3	3	3	2	2.25
29.	Invest in development of collection and treatment systems for epidemiological and other data	1.5	1.5	2	2	2	2	2	1.85
30.	Expand e-health initiatives, supply of diagnostic equipment, and consumables for remote areas	1.5	1.5	1	2	2	2	2	1.65
31.	Build capacity for data analytics in all the phases of policy formulation against health threats (design, application, key performance indicator measurement, evaluation)	1.5	1.5	2	3	3	2	3	2.25
32.	Clarify and simplify overlapping legislation	1.5	1.5	3	3	3	3	2	2.45
33.	Set up a national protocol of action with specified roles for agencies	1.5	1.5	3	3	3	3	2	2.45
34.	Minimise overlapping responsibilities between agencies and ministries on the response to population-level health emergencies	1.5	1.5	3	3	3	3	3	2.55
35.	Set up a specified authority for the response in human infectious diseases incidents	1.5	1.5	2	2	2	2	2	1.85
36.	Set up an operational national public health service that will be organized under a single center (national level) with the coordination of regional authorities, under a joint organization	1.5	1.5	2	2	3	2	2	1.95
37.	Expand insurance markets and uptake devoted to major disasters and hazards	1.5	1.5	2	2	3	2	2	1.95
38.	Improve data collection, risk modeling, and structuring of financial mechanisms to create more efficient and targeted contingency plans	1.5	1.5	2	2	3	3	2	2.05
39.	Prioritize shock-responsive fiscal policy and planning, through the establishment of a fiscal risk management unit	1.5	1.5	2	2	3	2	2	1.95

Table 37. MCA analysis for technological accidents measures

	Prevention, preparedness and response measures	Risk importance	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total score
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No.	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1	Apply methodologies / technical solutions designed to protect critical industrial installations from natural hazards, malicious human interference, or cyberattacks	1.55	2	1	2	2	1	2	1.61
2	Install new stations and design new telemetric networks for monitoring environmental radioactivity, including acquisition and installation of new equipment (stations and detectors, air samplers). Integrate new detectors / stations and upgrade / replacement of existing ones to operate into as single system in order to support emergency decision making.	1.55	2	3	2	2	2	2	2.11
3	Monitor dam stability	1.55	2	2	3	2	1	2	2.01
4	Conduct public education to address industrial risk.	1.55	2	2	3	3	1	3	2.21
5	Install seismological sensors for earthquake early warning at sensitive industrial installations	1.55	2	2	3	2	1	2	2.01
6	Develop Special (or external) Response Plans for Large Technological Accidents for the external area of upper-tier SEVESO facilities at regional or municipality level	1.55	2	1	3	2	2	3	2.01
7	Supply material for water anti-pollution technology (e.g., anti-pollution protection 400m sea barrier)	1.55	2	1	1	1	1	2	1.31
Additional proposed priority measures for consideration									
8	Strengthen communication among interdependent industries, and between them and emergency response authorities by creation of appropriate links and channels	1.55	2	2	3	3	2	2	2.21
9	Establish cross-border communication channels for reliable information on technological accidents	1.55	2	2	3	3	2	2	2.21
10	Maintain an updated comprehensive damage loss database, including near misses and lessons learned, with closer collaboration among involved authorities and industries.	1.55	2	3	3	3	2	3	2.51
11	Provide technical assistance to regional/local authorities for the development of Special (or external) Response Plans for Large Technological Accidents for the external area of upper-tier SEVESO facilities	1.55	2	1	2	2	1	2	1.61
12	Implement cut-edge technology	1.55	2	1	2	2	2	1	1.61
13	Capitalize research and innovation programs	1.55	2	1	2	2	2	1	1.61
14	Develop and maintain early detection and warning and population alert system by implementation of low-cost systems and modern technology	1.55	2	3	3	2	1	2	2.21
15	Conduct public awareness through campaigns about existing hazards (at local or national level) and necessary actions in case of emergency	1.55	2	3	3	3	3	3	2.61

16	Develop and conduct regular practical implementation of training scenarios at local level for technological accidents, including industries authorities, public	1.55	2	2	2	3	2	3	2.11
17	Correlate industrial risk assessment with DRM planning	1.55	2	1	2	3	1	1	1.61

Table 38. MCA analysis for CBRN events measures

	Prevention, preparedness and response measures	Risk importance	Climate sensitivity	Effectiveness	Efficiency	Sustainability	Capacity	Urgency	Total scores
No.	Weights	20%	10%	20%	20%	10%	10%	10%	100%
1	Upgrade of the physical protection measures and the nuclear safety of the radiological waste management at Demokritos.	1.55	1	1	2	2	2	2	1.61
2	Secure funds for the eventual transfer of the waste to special recycling facilities abroad (the highest radiological intensity sources with the remaining buried)	1.55	1	1	2	3	1	3	1.71
3	Install new stations and design a new telemetric network for monitoring environmental radioactivity, including acquisition and installation of new equipment (stations, detectors, air samplers)	1.55	1	2	3	2	2	2	2.01
4	Commission new detectors / stations and upgrade / replace existing ones to form part of a single system in order to support emergency decision-making.	1.55	1	2	3	2	2	2	2.01
5	Develop the National Training Center for Response to CBRN threats	1.55	1	1	3	3	2	2	1.91
6	Measure electromagnetic radiation and other particles.	1.55	1	2	3	2	2	2	2.01
7	Install atmospheric air quality monitoring stations (CO, NO, NO2, O3, SO2, microparticles, temperature, humidity, vapor pressure) with intelligent application for monitoring environmental data and ability to predict the quality of the atmosphere	1.55	1	2	3	2	2	2	2.01
Additional proposed priority measures for consideration									
8	Co-create response plans for CBRN events, allowing for clear understanding of roles of all stakeholders	1.55	1	2	3	3	2	3	2.21
9	Enhance communication and data exchange channels among different stakeholders	1.55	1	2	3	3	2	2	2.11
10	Create platform for common interinstitutional access with CBRN measurements and best practices exchange.	1.55	1	2	3	3	1	2	2.01
11	Create official platform for communication platform with the public, improving societal confidence in case of CBRN emergencies	1.55	1	2	3	3	1	2	2.01

12	Perform dedicated exercises for CBRN events, and/or include CBRN events in multi-hazard drills	1.55	1	2	2	3	2	2	1.91
13	Establish regular cross-border exchange of good practices and emerging risks with Bulgaria and Turkey.	1.55	2.0	3.0	3.0	1.0	3.0	1.0	2.11
14	Establish official alert/warning system for CBRN emergencies	1.55	1	2	3	2	1	3	2.01
15	Perform risk analysis for CBRN events following an established methodology with collaboration of involved stakeholders	1.55	1	1	2	3	2	1	1.61

5.4. Annex 4. Additional information for Chapter 4. Financial Resources and Mechanisms

Table 39 provides information on types of projects and amounts under PIP 2016-2020. Notable are 316 projects focusing on urgent reconstruction works amounting to almost €46 million, as well as 7 projects focusing on works for prevention and reconstruction (almost €500,000).

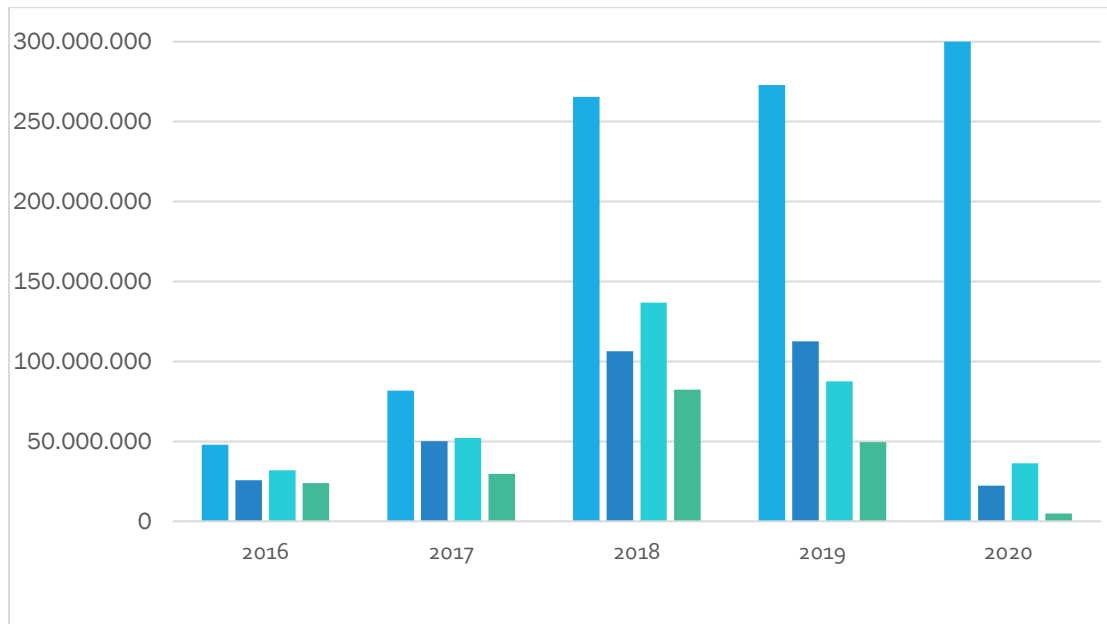
Table 39. Categories of projects, contracted amounts, and payments of the PIP (2016–2020)

Category of Subproject	Number of projects	Legally contracted amounts (€)	Total payments (€)	% Implementation
Flood works	232	90,408,775	55,333,152	61
Road works	132	62,430,339	35,418,456	57
Provincial roads	232	46,853,853	29,581,249	63
<i>Urgent Reconstruction works</i>	316	45,663,314	25,223,281	55
Fire prevention	3	11,698,329	11,697,592	100
Local infrastructures in general	47	11,490,315	7,383,104	64
Municipal roadworks	59	9,877,907	4,054,458	41
Reconstruction of fresh water supply- irrigation	35	7,461,102	2,577,531	35
Rural roads	81	6,773,808	5,813,752	86
Reconstruction of fresh water supply-irrigation	37	3,926,247	2,419,595	62
Infrastructures of regional units in general	5	3,738,107	2,926,178	78
Studies and technical assistance	53	3,435,662	1,700,140	49
Ports and harbors	3	2,867,023	0	0
Management Expenses of Regional Funds	7	871,848	871,848	100
<i>Works for prevention and reconstruction</i>	7	468,686	468,681	100
Travel expenses	4	315,022	83,853	27
Buildings	10	292,115	141,530	48
Forest roads	12	116,537	108,551	93
TOTAL	1,275	308,688,988	185,802,951	60%

Source: Table 8, p. 76 in “Draft Proposal for A special sectoral development program within the National Development Program 2021-2025”, Ministry of Citizen Protection and GSCP, Athens, January 2021.

Note: This table focuses on investment projects. 316 projects marked as "Urgent Reconstruction Works" focus strictly on reconstruction. There are also seven projects marked as "Works for prevention and reconstruction."

Figure 29. Evolution of budgets, allocations, legal contracts, and payments in the PIP, 2016–2020



Source: Presentation by GSCP, 24th March 2021, Natural Disasters Response and Prevention, Slide 5.

Note: legend – from left to right: budget, allocation, legal contracts, and payments.

Table 40 lists the Collective Decisions for works ΣΑΕΠ, through which funding for recovery from natural disasters has been provided by the PIP. Information is drawn from the Common Ministerial Decision KYA 18565 12/2/2019 (ΦΕΚ Β' 459) 'Assigned allocations for continuing projects of the Public Investment Program for the year 2019'.

Table 40. Collective decisions for works ΣΑΕΠ

Name of Agency	Collective decision (ΣΑ) for works on natural disasters
Ministry of Interior	ΣΑΕ Ε855
Region of Attica	ΣΑΕΠ ΕΠ885
Region of Eastern Macedonia-Thrace	ΣΑΕΠ ΕΠ831
Region of Central Macedonia	ΣΑΕΠ ΕΠ808
Region of Epirus	ΣΑΕΠ ΕΠ830
Region of Thessaly	ΣΑΕΠ ΕΠ817
Region of Sterea Ellada	ΣΑΕΠ ΕΠ866
Region of Peloponnese	ΣΑΕΠ ΕΠ826
Region of Western Greece	ΣΑΕΠ ΕΠ801
Region of Ionian Islands	ΣΑΕΠ ΕΠ822
Region of Northern Aegean	ΣΑΕΠ ΕΠ888
Region of Crete	ΣΑΕΠ ΕΠ802
GSCP	ΣΑΕ ΕΠ650 ΣΔΙΤ
Ministry of Culture and Sport	ΣΑΕ Ε814
Ministry of Infrastructure and Transport	ΣΑΕ Ε847 Δημοσίων Κτιρίων ΣΑΕ Ε870 Λιμανιών ΣΑΕ Ε871 Οδικών Υποδομών ΣΑΕ Ε872 Εγγειοβελτιωτικών ΣΑΕ Ε876 Υδρεύσεων-Αποχετεύσεων

Ministry of Infrastructure and Transport	ΣΑΕ Ε069 ΑΠΟΚΑΤΑΣΤΑΣΗ ΣΕΙΣΜΟΠΑΘΩΝ
Ministry of Infrastructure and Transport	ΣΑΕ Ε269 ΑΠΟΚΑΤΑΣΤΑΣΗ ΠΥΡΟΠΛΗΚΤΩΝ

Source: Presentation by GSCP, 24th March 2021, Natural Disasters Response and Prevention, Slide 4 and Draft Proposal for A special sectoral development program within the National Development Program 2021-2025”, Ministry of Citizen Protection and GSCP, Athens January 2021, p. 16.

According to provisional data (January 2021) a number of 175 works were inscribed in the PIP, with a budget of €968 million. This budget exceeds the total budget of the Reserve fund of the National Development Program (EUR 750 million) for 2021-2025 by €218 million.

Table 41. Summary of the enabling conditions for investments under ESIF 2021–2027 Objective 2

ERDF/CF Specific Objective(s)	Summary of Enabling Conditions
2.1 Promoting energy efficiency measures	A national long term renovation strategy to support renovation of the national stock of residential and non-residential buildings is adopted, in line with the Energy Performance of Buildings Directive.
2.1 Promoting energy efficiency measures 2.2 Promoting renewable energy through investment in generation capacity	National Energy and Climate Plan are adopted, comply with Regulation (EU) 2018/1999 on Governance of the Energy Union and provide an indicative outline of envisaged financing resources and mechanisms for measures promoting low-carbon energy.
2.2 Promoting renewable energy through investment in generation capacity	Measures are in place which ensure compliance with the 2020 national renewables binding target and with this baseline up to 2030, as well as increase in the share of renewables in the heating and cooling sector by 1 percentage point per year up to 2030.
2.4 Promoting climate change adaptation, risk prevention and disaster resilience	A national or regional disaster risk management plan, consistent with the existing climate adaptation strategies is in place and includes: current and long-term threats (25- 35 years), description of the disaster prevention, preparedness and response measures and information on budgetary and financing resources and mechanisms available.
2.5 Promoting water efficiency	A national investment plan is in place and includes assessments of the current state of implementation of the Urban Wastewater Treatment Directive and of the Drinking Water Directive, identification and planning of any public investments required and indication of potential sources of public financing, when needed to complement user charges.
2.6 Developing the transition to circular economy, through investment in the waste sector and resource efficiency	Waste management plan(s) are in place in accordance with revised Waste Framework Directive, including an analysis of the current waste management situation, an assessment of existing waste collection schemes, investment gap assessment justifying the need for additional or upgraded waste infrastructure and information on the location and capacity of future waste treatment installations.
2.7 Promoting green infrastructure in the urban environment and reducing pollution	A priority action framework pursuant to Article 8 of the Habitats Directive is in place and includes all elements agreed by the Commission and the Member States for 2021-2027, an identification of the priority measures and an estimate of financing needs.

Note: For full version, see Annex IV of proposed Common Provisions Regulations.

Immediate response and prevention measures funded by state (ordinary) budget and public investment budget during the period January 2020 and June 2021 are included in

Table 42. Disaster relief and compensation measures announced by the Ministry of Finance (January 2020-August 2021)

Theme	Funding Source	Recipient	Final beneficiaries	Period	Total figure	Payments
Compensations to victims of disasters	Ordinary Budget	Grants via ministries: MoI, MoIT, MoRDF	Victims of natural disasters	Jan. 2020-August 2021	€352.1 million in payments made	€209.6 during 2020 and €142.5 during 2021
New relief and reconstruction investment projects	Public Investment Program	Ministries and Regions	-	Jan. 2020-June 2021	€787.2 million	Jan 2020 -Jun 2021 €269.5 million; €156.7 during 2020 and €112.8 million during semester 1, 2021.
Housing Rent support subsidy grant	Account 128/75	-	-	n.d.	€3.2 million	-
Urgent support to GSCP						
Forest fire prevention measures	Ordinary reserve	GSCP		2021	€45.5 million forest fire prevention	-
Urgent support to GSCP post “Medea” storm event for cleaning and debris removal.	Ministry of Finance	GSCP		2021	€14.6 million	-
Urgent support to GSCP Interoperability of “112” centres and national coordination and crisis management centre		GSCP			€2.8 million	-
Fire zones, open water tanks, fire service vehicle maintenance	Ordinary Reserve	GSCP	Fire Service		€3	-
Rental of aerial firefighting means	Ordinary reserve	GSCP	-		€17	-
Overtime payments	Ordinary reserve	GSCP	Fire Service		€8	-
Total					€1.233	

Source: Data according to a press release by the Ministry of Finance, August 10, 2021. [Link](#).

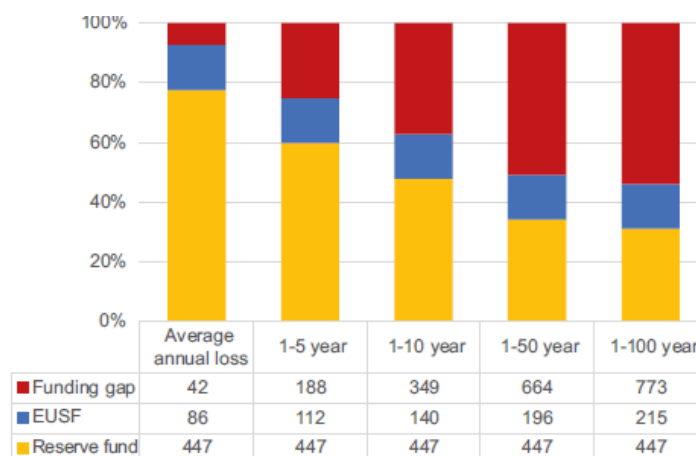
Example of Funding Gap analysis

The World Bank conducted a study that assessed the macro-fiscal impacts of earthquakes and floods in the European Union Member States and to conduct an analysis of the financial instruments in place to manage this risk and identify any associated funding gaps. A funding gap case study analysis was conducted for Greece which includes an overview of the disaster profile, disaster risk financing instruments, discussion on contingent liabilities and the analysis. Both the macro-fiscal gap and the funding gap analyses use two scenarios for different levels of liability: (i) low liability - the government is expected to help reconstruct only the low-income share of the uninsured households, reconstruct all

public assts (with one third of these assets insured) and cover the emergency response costs; and, (ii) high government liability - the government is expected to help reconstruct all uninsured households, public assets (with no public assistance insurance in place), and cover the emergency response costs.

Funding gap analyses seek to demonstrate the proportion of future losses from earthquakes and floods that can be covered by existing financial instruments held by EU Member States and what remains to be financed – the funding gap. An initial case study was conducted for Greece which saw high values of net government liabilities as percent of GDP. The study for disaster funding gap in Greece demonstrates how combining different risk financing instruments may impact the amount of finance available for disaster losses. Figure 30 shows the utilization of instruments by return period for low level government liabilities, with large funding gap in the 1-year to 50-year return period threats for earthquakes and hazards. This indicates that other financing mechanisms, such as household catastrophic insurance, along with increased and sustained reserve funds will be needed for higher level threats.

Figure 30. World Bank regional study – Gap analysis case study Greece (€, millions)



Note: The figure shows the breakdown of instruments that may be used for different magnitude of events by return period in case of a “low liability” scenario.

Information about HAIC study

The below shows the PML results (in millions) of HAIC’s Earthquake modelling study for the residential portfolio of Greece based on the 2011 building stock census and assuming a reconstruction cost of €1,000 per square meter. According to Model A, there is a 0.5% probability that on any given year Greece could experience an earthquake that could lead to a loss of at least €9,987 million. The results of Model B are markedly lower for earthquakes with return period equal or below 250 years.

Table 43. PML results from HAIC earthquake modelling study for residential portfolio

Return Period	Model A	Model B
5	750	363
10	1,273	923
20	2,085	1,856
50	4,286	3,721

100	6,818	5,276
200	9,987	6,639
250	11,097	7,661
500	14,690	11,755
1,000	18,480	18,890
AAL	950	434

Note: Annual Average Loss or AAL is the expected loss of the PML distribution.

5.5. Annex 5: Terminology and bibliography

Terminology

Institutions and countries use a range of terminologies related to disaster risk management (DRM). The terminology used by the United Nations Office for Disaster Risk Reduction (UNDRR) is applied globally. In addition, DG ECHO and the World Bank use several terms in line with the DRM areas they focus on as part of their work and institutional portfolios as noted below. In this report, disaster prevention, mitigation/reduction, and preparedness are considered ex-ante actions, while response and recovery are considered ex-post interventions.

Law 4662/2020 – selected terms (unofficial translation)

- **Hazard:** a potentially catastrophic event, phenomenon or human activity that can cause loss of life or injuries, damage to property, social and economic provision disruptions or environmental degradation
- **Vulnerability:** the conditions that are determined by natural, social, economic and environmental factors or processes that are increasing the susceptibility of a society to the impact of hazards
- **Susceptibility:** the factors that create the conditions for the development of a hazard into a disaster
- **Resilience:** the ability of a system or a society, potentially exposed to potential hazards, to resist or to adapt, with a view to maintain an acceptable level of functioning and coherence.
- **Disaster:** the serious disruption of the functioning of society, causing extensive human, material and environmental losses, which exceed the capability of the affected society to cope with them with its own means and resources
- **Early Warning:** the provision of early warning and adequate information, through the competent bodies, which enables the launching of specific actions for the avoidance or reduction of the impact of hazard and preparation for effective response.
- **Coordination:** the organization, prioritization and monitoring of the required actions and ensuring interoperability, the implementation of the rules on operational action and the cooperation between stakeholders for the achievement of a common goal
- **Prevention:** all actions and measures that aim at the absolute avoidance of the potential impact of hazards and at minimizing of the natural, technological disasters and other threats.
- **Preparedness:** the set of actions and measures taken in advance to ensure the effective response in cases of a disaster.
- **Response:** includes the actions during or immediately after the disaster for the protection of human life and health to address immediate living needs and to ensure the provision of assistance and support for mitigating the impacts of the disaster
- **Short-term Relief:** includes actions after a disaster that aim at the recovery or improvement of living conditions during the first hours and days after the occurrence of the disaster
- **Disaster Management Cycle:** the set of tactics and management decisions and operational activities at all stages and phases of the cycle of disaster, prevention, preparedness, response and rehabilitation.
- **Evacuation:** includes all the actions taken for the preventive evacuation of citizens who are in danger because of their permanence near an area threatened by a catastrophic phenomenon that is ongoing.
- **First Responders:** Those competent on a case-by-case basis and area, operationally, who are the first to cope with the catastrophic event.
- **Civil Protection Experts:** the expert scientist or the certified member staff on subjects regarding the management and response to disasters and the calculation of critical factors, such as the assessment of the risk of the general hazards, vulnerability, exposure to risk.
- **Emergency:** the sudden and unexpected threatening situation that requires to take immediate measures to minimize its adverse consequences

- **National Hazard Mitigation Policy:** a plan of actions that determines at national level the final and intermediate targets for reducing the risk from disasters, as well as the corresponding indicators of evaluation and the time schedules. Includes all necessary actions, procedures and programs related to all phases of the disaster's cycle and in particular prevention, preparedness, response, recovery, as well as the feedback of the local and national planning in order to mitigate risk and enhance resilience.
- **Risk:** the possible human, material or environmental losses over a specified period of time, which are the result of combination of hazards, vulnerability conditions and inadequacy of capability or appropriate measures to mitigate the potential negative consequences

DG ECHO²³²

- **Disaster preparedness** consists of a set of measures undertaken by governments, organizations, communities, or individuals to better respond and cope with the immediate aftermath of a disaster, whether it is man-made or caused by natural hazards. The objective is to reduce loss of life and livelihoods. Simple initiatives can go a long way, for instance, training for search and rescue, establishing early warning systems, developing contingency plans, or stockpiling equipment and supplies.

Disaster risk reduction (DRR) and preparedness plays an important role in building the **resilience of communities**.

- **Preparedness:** Organizational activities which ensure that the systems, procedures, and resources required to confront a natural disaster are available to provide early assistance to those affected, using existing mechanisms wherever possible (for example, training, awareness raising, establishment of disaster plans, evacuation plans, pre-positioning of stocks, early warning mechanisms, and strengthening of indigenous knowledge).
- **Mitigation:** Measures taken before disasters which intend to reduce or eliminate their impact on society and the environment. These measures reduce the physical vulnerability of existing infrastructures or of vulnerable sites which directly endanger the populations (for example, retrofitting of buildings and reinforce 'lifeline' infrastructure).
- **Prevention:** Activities conceived to ensure a permanent protection against a disaster. These include engineering, physical protection measures, legislative measures for the control of land use, and codes of construction. These activities reduce the physical vulnerability and/or exposure to risks through infrastructures (for example, dams, flood barriers, and building of refuges) and through improvement of existing infrastructures (for example, restoring original flood patterns of rivers to avoid excessive floods downstream) and sustainable development practices (for example, no deforestation in upstream areas and active reforestation).

UNDRR²³³

- **Resilience:** The ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, adapt to, transform, and recover from the effects of a hazard in an early and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.
- **DRM** is the application of DRR policies and strategies to prevent new disaster risks, reduce existing disaster risks, and manage residual risks, contributing to the strengthening of resilience and reduction of disaster losses.
- **DRM plans** set out the goals and specific objectives for reducing disaster risks together with related actions to accomplish these objectives. They should be guided by the Sendai Framework for Disaster Risk Reduction 2015–2030 and considered and coordinated within relevant development plans, resource allocations, and program activities. National-level plans need to be specific to each level of administrative responsibility and adapted to the different social and geographical circumstances that are present. The time frame and responsibilities for implementation and the sources of funding should be specified in the plan. Links to sustainable development and climate change adaptation plans should be made where possible.
- **DRR** is aimed at preventing new and reducing existing disaster risks and managing residual risks, all of which contribute to strengthening of resilience and therefore to the achievement of sustainable development. DRR is the policy objective of DRM, and its goals and objectives are defined in DRR strategies and plans.

²³² European Commission. 2021. Disaster preparedness. Directorate-General for Civil Protection and Humanitarian Aid Operations. [Link](#); European Commission. 2006. *Disaster Preparedness and Prevention (DPP): State of Play and Strategic Orientations for EC Policy*. Directorate-General for Civil Protection and Humanitarian Aid Operations. [Link](#).

²³³ United Nations Office for Disaster Risk Reduction. 2021. Terminology. [Link](#).

- **DRR strategies and policies** define goals and objectives across different timescales and with concrete targets, indicators, and time frames. In line with the Sendai Framework for Disaster Risk Reduction 2015–2030, these should be aimed at preventing the creation of disaster risk; the reduction of existing risk; and the strengthening of economic, social, health, and environmental resilience.
- **Preparedness:** The knowledge and capacities developed by governments, response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, or current disasters.
- **Prevention:** Activities and measures to avoid existing and new disaster risks. Prevention aims at reducing vulnerability and exposure in such contexts where, as a result, the risk of disaster is removed.
- **Mitigation:** The lessening or minimizing of the adverse impacts of a hazardous event. Mitigation measures include engineering techniques and hazard-resistant construction as well as improved environmental and social policies and public awareness.
- **Response:** Actions taken directly before, during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief. Effective, efficient, and early response relies on disaster risk-informed preparedness measures, including the development of the response capacities of individuals, communities, organizations, countries and the international community. The institutional elements of response often include the provision of emergency services and public assistance by public and private sectors and community sectors, as well as community and volunteer participation. “Emergency services” are a critical set of specialized agencies that have specific responsibilities in serving and protecting people and property in emergency and disaster situations. They include civil protection authorities and police and fire services, among many others. The division between the response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

World Bank²³⁴

- The World Bank conceptualizes DRM into different ‘pillars’ including (a) understanding of risk, (b) risk reduction (structural and non-structural), (c) early warning and emergency preparedness, (d) financial resilience, and (e) resilience, recovery, and reconstruction. These are broadly aligned with the Sendai DRR priority areas.

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²³⁴ World Bank, 2013. Building Resilience: Integrating Climate and Disaster Risk Into Development. Lessons from World Bank Group experience. The World Bank, Washington DC.

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