



Progetto SMARTRIVER-1042

ADRIATIC-IONIAN SMARTRIVER STRATEGY FOR RESILIENCE AND RISK REDUCTION

(O.T3.2 - D.T3.2.1)





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1. Introduction

The SMARTRIVER project, funded by the INTERREG ADRION Programme, aims to increase the adaptation capacity of 6 river communities in the Adriatic-Ionian Macro-region by addressing the impacts of climate change. The project pursues the flooding risk reduction in local/regional development strategies through the application of the **River Contract (RC)** as an innovative tool for an integrated risk management approach in river spaces. RCs are also considered tools for sustainable development and towards the objectives of the UN 2030 Agenda.

Through their engagement and proactive participation, Project Partners have established the **Adriatic-Ionian SMARTRIVER network** and a joint Adriatic-Ionian Macro-Regional Strategy, to enhance the capacity to transnationally address environmental vulnerability, to manage and prevent flooding risks (and drought), natural risks and to increase the commitment to sustainable development in accordance with European policies and strategies on project topics.

This document, after an excursus on the climate and on the specific contexts of each partner country, presents the "**ADRIATIC-IONIAN SMARTRIVER STRATEGY FOR RESILIENCE AND RISK REDUCTION**" as the output of a joint elaboration shared between all project partners with reference to the risk of flood integrated with risk of drought.

2. Climate change and related risks in Europe and in the Mediterranean area

Within the **CLIMATE CHANGE 2022 Report - Impacts, Adaptation and Vulnerability (IPCC WG2 - AR6)** the IPCC identifies four key risk categories for Europe stating that the level of each risk increases as the level of global warming increases. **If the level of adaptation to climate change remains low**, these risks become more severe with a 2°C warming compared to a 1.5°C temperature rising.

The four risk categories are:

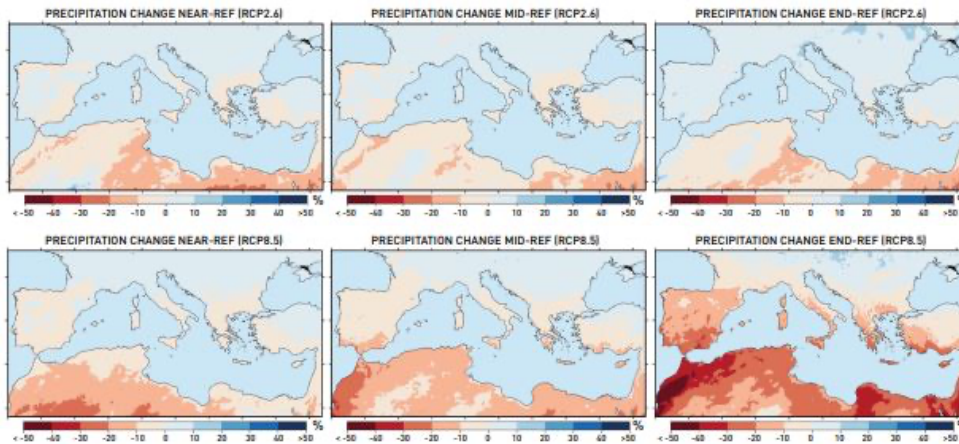




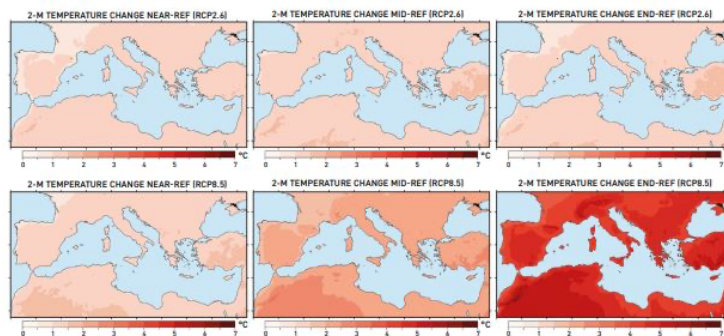
1. **Risks of heat waves on populations and ecosystems.** The number of deaths and people at risk of heat stress is expected to be double or triple for a 3 °C rising in temperature, compared with 1.5 °C. Warming will reduce natural habitats for current terrestrial and marine ecosystems by irreversibly changing their composition, with severe and negative effects above the 2 °C global warming level. The adaptation measures to the thermal stress of the population and the containment of the risks from heat waves require multiple interventions on buildings and urban areas. These measures need to be anticipated in southern Europe, where the risk is higher than in northern areas.
2. **Risks for agricultural production.** Due to a combination of heat and drought, relevant losses in agricultural production are expected in the 21st century for most parts of European countries, which will not be compensated by expected gains for Northern European Countries.
3. **Risks of a scarcity/reduction of water resources.** In southern Europe the risk is already high for a global warming level of 1.5 °C and becomes very high for a rise of 3 °C. In these regions, the demand for water resources already exceeds availability nowadays. This gap is widening due to climate change and socio-economic developments. In the event of a 3 °C rising in temperature, the risk of scarcity/reduction of water resources also becomes high in central-western Europe. Even with an average level of warming, adaptation strategies that reduce water needs must be combined with transformations such as source diversification and land use changes. In the event of a high level of warming, a large portfolio of interventions is required but may also be not sufficient to avoid a lack of water resources in southern Europe.
4. **Risks produced by increased frequency and intensity of floods.** Due to the changes in rainfall and rising sea levels, risks for people and infrastructure from coastal, river and pluvial flooding will increase in many regions of Europe.

The mentioned Report also states: “**The Mediterranean region has warmed and will continue to warm more than the global average, particularly in summertime**”. Such sentence applies to both, the terrestrial and marine environments, as well as for average temperatures and for heat waves. **The region will become drier as a combined effect of decreasing precipitation and increasing evapotranspiration. At the same time extreme rainfall will increase in some areas.**

Sea level will rise following the increasing of the global situation. Such increasing will be irreversible and progressive on multi-secular scales. The scale of all these changes increases as the level of global warming increases, i.e., the higher the average temperature of the planet increases, the greater the impacts on the Mediterranean region will be.

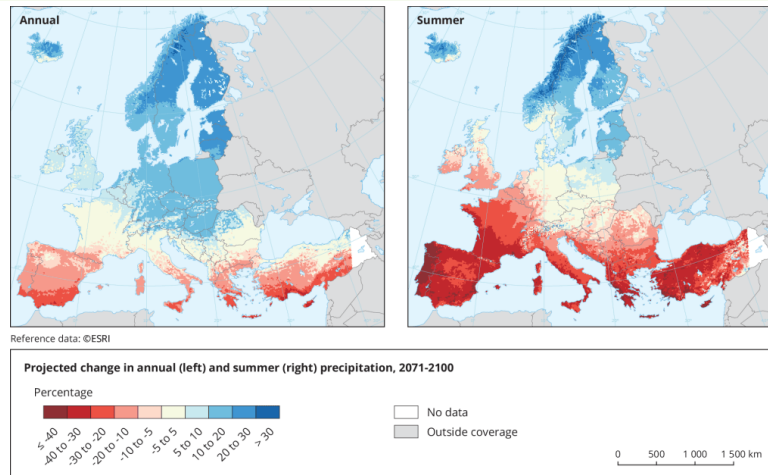


Change of annual, winter and summer precipitation in the Mediterranean Basin in two different scenarios (MedECC, 2020 - basato su dati Euro-cordex)



Projected changes in annual temperature in the Mediterranean Basin between the baseline period (1980-1999) and three future subperiods (Near: 2020-2039, Middle: 2040-2059, End: 2080-2099). (MedECC, 2020 - basato su dati Euro-cordex)

The risks associated with the climate change are particularly high for people and ecosystems in the Mediterranean basin due to a combination of various factors, including: a large and growing urban population exposed to heat waves; a large and growing number of people living in settlements affected by rising sea levels; **growing water shortages and flash floods**; growing demand for water from agriculture irrigation; loss of marine ecosystems, ecosystems in wetlands, rivers and also uplands, many of which are already endangered by unsustainable practices (e.g. overfishing, land use change, etc.). In support of what has been said and as a confirm of the seriousness of the period, this image - extracted from an assessment by the European Environment Agency (EEA) - presents the state of water stress in Europe with the aim of focusing on the management of water availability which is at risk due to the impacts of climate change. EEA estimates that around 30% of the European population experiences water stress in an average year and expects the situation to worsen as climate change increases the frequency, magnitude and impact of droughts.



Yearly (left) and summer (right) change forecasts of rainfall (2071-2100)

The EEA report **“Water Resources in Europe - Tackling Water Stress: An Updated Assessment”** presents the latest knowledge on water availability in Europe supporting **the shift from crisis management to risk management**, including focused measures addressing water consumption. Water stress, which is a situation where there is not enough water to meet the needs of people and the environment, is already a reality in many parts of Europe. Drought and water scarcity are no longer rare or extreme events in Europe for about 20% of the European territory and, as mentioned before, about 30% of Europeans are affected by water stress during an average year. Climate change is expected to make the situation worse, as droughts are increasing in frequency, magnitude and impact. Trends are particularly worrying for southern and south-western Europe where the flow of rivers during the summertime could decrease significantly. For that reason, Europe needs to strengthen the resilience of its ecosystems and use water more efficiently to minimize the impact of water stress on people and on the environment. According to the EEA assessment, EU-wide policies and regulations are in place to address both of these aspects, but their implementation needs to be accelerated and their effectiveness improved. In many areas, including Italy, agriculture, public water supply and tourism represent the main pressures on water availability, with significant seasonal peaks in summer.

We have deliberately focused on the " DROUGHT ", on the seriousness and on the possible repetition of this phenomenon with increasing frequency because, as recently confirmed by the extreme hydrological event that occurred on 15/16 September 2022 in the Marche region, many disastrous floods are generated in the Mediterranean area as **"FLASH FLOODS"** which occur right downstream or during dry periods, such as in August 2022 in Northern Italy, Trentino, Campania, Stromboli and then again in Liguria and Tuscany. EEA has calculated the economic impact of environmental disasters that occurred in the years between 1980 and



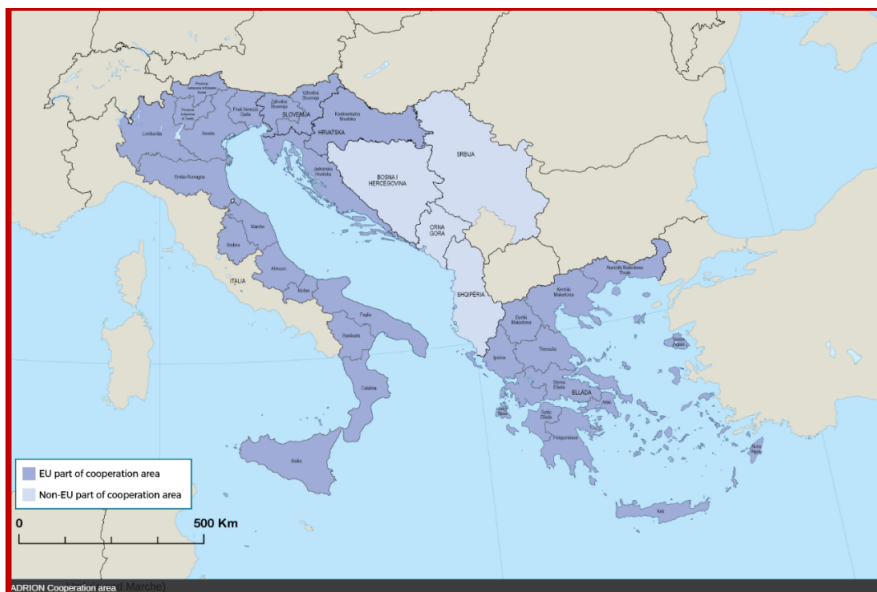
2020 in 32 European countries. Floods, heat waves, storms cost 450-520 billion euros making also between 85 and 140 thousand victims.

3. Climate situation and risks in the ADRION SMARTRIVER Region

ADRION Programme covers eight partner countries, four EU Member States (Croatia, Greece, Italy and Slovenia), three EU candidate countries (Albania, Montenegro, Serbia) and one EU potential candidate country (Bosnia and Herzegovina). The geographical area of each partner Country covers its national territory with the exception of Italy, where the ADRION Programme area covers 12 Regions and 2 provinces. The Mediterranean area, as already mentioned, according to the scientists of the [Intergovernmental Panel on Climate Change \(IPCC\)](#) is the basin that is warming up faster than other EU regions. For this reason it is considered as a climate change hotspot, as well as a biodiversity hotspot: a change that is considered by many scientists to be largely irreversible.

Furthermore, according to several independent experts in the [First Mediterranean Assessment Report](#), the Mediterranean region is now 1.5°C warmer than in the pre-industrial era. With a rate of +0.33°C every 10 years, this area is now warming more intensely and faster than the rest of the globe. **A particularly amplified warming regards the eastern part and the cities.** In Athens and Istanbul impressive anomalies have already been recorded: respectively +6.8°C and +5.9°C.

This climatic situation becomes even more delicate and more burdensome for the territories facing the Adriatic Sea, as a closed sea, as well as for the territories facing the Ionian Sea, which is open on one side only.





The GAP Analysis (WP.T1 - A.T1.4) carried out during the participatory processes (River Contract) of SMARTRIVER project partners (LEAD PARTNER Municipality of Senigallia, PP2 The Marche Region - Soil and Coast Defense Department, Italy) PP3 AGRRA Zadar County Rural Development Agency, Croatia, PP4 City of Osijek, Croatia, PP5 Maribor Development Agency (MRA), Slovenia, PP6 The Municipality of Maribor, Slovenia, PP7 Municipality of Patras, Greece, PP8 SERDA Sarajevo Economic Region Development Agency, Bosnia and Herzegovina, PP9 Municipality of Ilijas, Bosnia and Herzegovina, PP10 Change - Regional Development Agency, Albania, PP11 Selenice Municipality, Albania **on the identified river basins (Misa Nevola, Glafkos and Charadros, Drava, Vjosa, Bosna)** have highlighted a general situation of exposure to the risk of very high floods with also phenomena of drought.

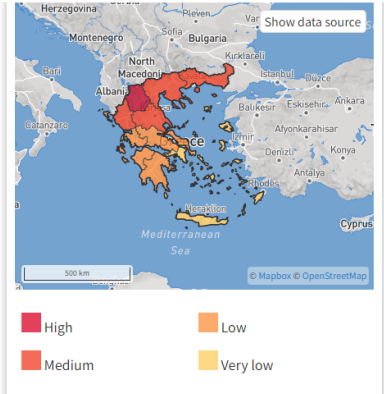
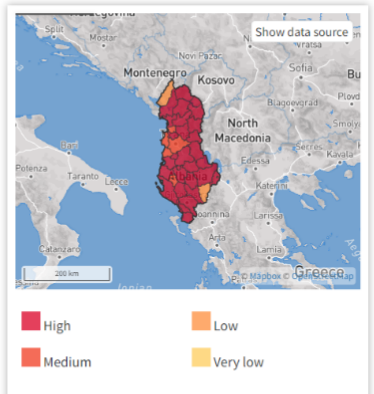
The GAP analysis (D.T1.4.2) carried out by the project partners (one for each river basin), available in the project website (<https://smartriver.adrioninterreg.eu>), have confirmed that most of the criticalities depending from floods and droughts underlined by each river basin involved in the project, are mostly connected to climate change issues. This phenomenology are causing intense and short-lived rain events in the each partner region, such as flash floods and increasingly long and frequent heat waves with related drought events.

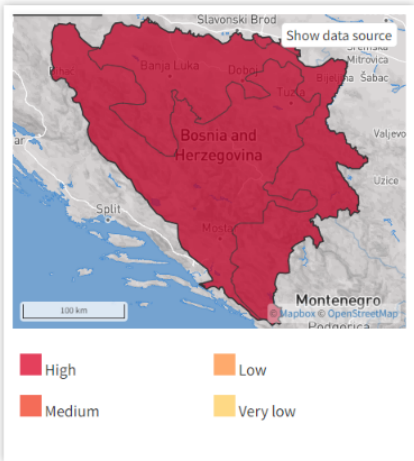
These analyses, which are based on past climatic evidences, give an image of the land use which, in many cases, presents levels of excessive anthropization near the rivers, with urban development also in the floodplain areas close to the banks. The last exceptional weather event that occurred in the Misa Nevola basin suggests identifying, for resilience and reduction strategies, "Risk" scenarios at higher levels than those of the existing regulations in the different countries. The repetitiveness and frequency of climatic crises with long dry periods in Mediterranean countries and in particular in hydrographic basins located near the sea (Adriatic and Ionian) can infact trigger exceptional weather events such as the last one in the Marche region ("v-shaped storm", a powerful thunderstorm system - self-regenerating storm) which draws its energy from warm and humid currents and from the presence of the sea.

As a proof of the above, below the images of the countries joining SMARTRIVER project taken from the website <https://thinkhazard.org/en/> supported by the World Bank of Investments (World Bank) "Global Facility for Disaster Reduction and Recovery" (GFDRR) which helps low and middle income countries to better understand and reduce their vulnerability to natural hazards and climate change. In these images the expected levels of hazard are estimated with different color gradations, and general recommendations are suggested.



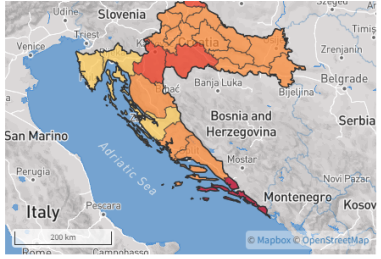


<p>GREECE</p>  <p>Legend: ■ High ■ Low ■ Medium ■ Very low</p>	<p>Urban flood Hazard level: High ?</p> <p>In the area you have selected (Greece) urban flood hazard is classified as high based on modeled flood information currently available to this tool. This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. Project planning decisions, project design, and construction methods must take into account the level of urban flood hazard. The following is a list of recommendations that could be followed in different phases of the project to help reduce the risk to your project. Please note that these recommendations are generic and not project-specific.</p> <p>Climate change impacts: Model projections are inconsistent in their estimates of changes in rainfall. The present hazard level may increase in the future due to the effects of climate change. It would be prudent to design projects in this area to be robust to river flood hazard in the long-term.</p> <p>Recommendations</p> <ul style="list-style-type: none"> ■ EXISTING INFORMATION: Obtain pre-existing flood hazard information. The high-level information available in this tool may indicate the presence of flood hazard in your project area. However, because flood hazard can change dramatically over short distances, the exact geographical location of your project should be checked against pre-existing flood hazard information. More information
<p>ALBANIA</p>  <p>Legend: ■ High ■ Low ■ Medium ■ Very low</p>	<p>Urban flood Hazard level: High ?</p> <p>In the area you have selected (Albania) urban flood hazard is classified as high based on modeled flood information currently available to this tool. This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. Project planning decisions, project design, and construction methods must take into account the level of urban flood hazard. The following is a list of recommendations that could be followed in different phases of the project to help reduce the risk to your project. Please note that these recommendations are generic and not project-specific.</p> <p>Climate change impacts: Model projections are inconsistent in their estimates of changes in rainfall. The present hazard level may increase in the future due to the effects of climate change. It would be prudent to design projects in this area to be robust to river flood hazard in the long-term.</p> <p>Recommendations</p> <ul style="list-style-type: none"> ■ EXISTING INFORMATION: Obtain pre-existing flood hazard information. The high-level information available in this tool may indicate the presence of flood hazard in your project area. However, because flood hazard can change dramatically over short distances, the exact geographical location of your project should be checked against pre-existing flood hazard information. More information

<p>BOSNIA-HERZEGOVINA</p>  <p>Legend: ■ High ■ Low ■ Medium ■ Very low</p>	<p>Urban flood Hazard level: High ?</p> <p>In the area you have selected (Bosnia and Herzegovina) urban flood hazard is classified as high based on modeled flood information currently available to this tool. This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. Project planning decisions, project design, and construction methods must take into account the level of urban flood hazard. The following is a list of recommendations that could be followed in different phases of the project to help reduce the risk to your project. Please note that these recommendations are generic and not project-specific.</p> <p>Climate change impacts: Model projections are inconsistent in their estimates of changes in rainfall. The present hazard level may increase in the future due to the effects of climate change. It would be prudent to design projects in this area to be robust to river flood hazard in the long-term.</p> <p>Recommendations</p> <ul style="list-style-type: none"> ■ EXISTING INFORMATION: Obtain pre-existing flood hazard information. The high-level information available in this tool may indicate the presence of flood hazard in your project area. However, because flood hazard can change dramatically over short distances, the exact geographical location of your project should be checked against pre-existing flood hazard information. More information
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CROAZIA



■ High	■ Low
■ Medium	■ Very low

Urban flood Hazard level: **High** ?

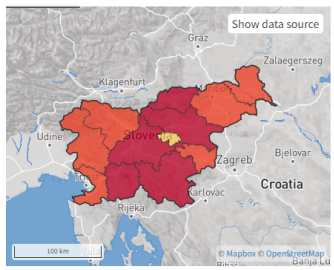
In the area you have selected (Croatia) urban flood hazard is classified as **high** based on modeled flood information currently available to this tool. This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. **Project planning decisions, project design, and construction methods must take into account the level of urban flood hazard.** The following is a list of recommendations that could be followed in different phases of the project to help reduce the risk to your project. Please note that these recommendations are generic and not project-specific.

Climate change impacts: Model projections are inconsistent in their estimates of changes in rainfall. The present hazard level may increase in the future due to the effects of climate change. It would be prudent to design projects in this area to be robust to river flood hazard in the long-term.

Recommendations

- **EXISTING INFORMATION:** Obtain pre-existing flood hazard information. The high-level information available in this tool may indicate the presence of flood hazard in your project area. However, because flood hazard can change dramatically over short distances, the exact geographical location of your project should be checked against pre-existing flood hazard information. [More information](#)

SLOVENIA



■ High	■ Low
■ Medium	■ Very low

Urban flood Hazard level: **High** ?

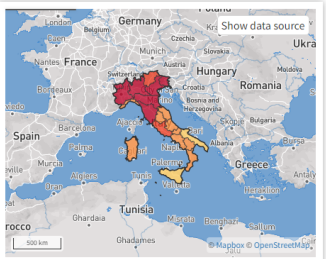
In the area you have selected (Slovenia) urban flood hazard is classified as **high** based on modeled flood information currently available to this tool. This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. **Project planning decisions, project design, and construction methods must take into account the level of urban flood hazard.** The following is a list of recommendations that could be followed in different phases of the project to help reduce the risk to your project. Please note that these recommendations are generic and not project-specific.

Climate change impacts: High confidence in more frequent and intense precipitation days in winter and an increase in the number of extreme rainfall events. The present hazard level is expected to increase in the future due to the effects of climate change. It would be prudent to design projects in this area to be robust to river flood hazard in the long-term.

Recommendations

- **EXISTING INFORMATION:** Obtain pre-existing flood hazard information. The high-level information available in this tool may indicate the presence of flood hazard in your project area. However, because flood hazard can change dramatically over short distances, the exact geographical location of your project should be checked against pre-existing flood hazard information. [More information](#)

ITALIA



■ High	■ Low
■ Medium	■ Very low

Urban flood Hazard level: **High** ?

In the area you have selected (Italy) urban flood hazard is classified as **high** based on modeled flood information currently available to this tool. This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. **Project planning decisions, project design, and construction methods must take into account the level of urban flood hazard.** The following is a list of recommendations that could be followed in different phases of the project to help reduce the risk to your project. Please note that these recommendations are generic and not project-specific.

Climate change impacts: Model projections are inconsistent in their estimates of changes in rainfall. The present hazard level may increase in the future due to the effects of climate change. It would be prudent to design projects in this area to be robust to river flood hazard in the long-term.

Recommendations

- **EXISTING INFORMATION:** Obtain pre-existing flood hazard information. The high-level information available in this tool may indicate the presence of flood hazard in your project area. However, because flood hazard can change dramatically over short distances, the exact geographical location of your project should be checked against pre-existing flood hazard information. [More information](#)



4. The river contract as a participatory tool for flooding risk reduction and sustainable development

The Sendai Framework for Disaster Risk Reduction (2015-2030) is an international document adopted by the member states of the United Nations on March 15, 2015 in Sendai, Japan. Member states have stressed the need to address disaster risk reduction and climate change adaptation in setting the Sustainable Development Goals (also known as Agenda 2030, signed in 2015 and to be achieved by 2030).

Insufficient attention to risk reduction and resilience has been highlighted in previous Millennium Development Goals (signed in 2000 and to be achieved in 2015). The Sendai Framework sets out four specific priorities for action: Understanding the risk of disasters; Strengthen disaster risk management; Investing in disaster risk reduction for resilience; Improving disaster preparedness for an effective response and building better in recovery, rehabilitation, and rebuilding. Emphasis in this document has been given to the need to significantly increase the availability and access to multi-hazard early warning systems, population information and disaster risk assessments for people by 2030.

Since 2016, River Contracts have been an instrument in Italy envisaged by the Environmental Code in Article 68bis "Rules on soil protection and fight against desertification, protection of water from pollution and resource management" - Section I Title II Chapter II: *"River contracts contribute to the definition and implementation of district planning tools at river basin and sub-basin level, such as voluntary strategic and negotiated planning tools that pursue protection, the correct management of water resources and the enhancement of river territories, together with the protection from hydraulic risk, contributing to the local development of these areas"*.

The "Partnership Agreement between Italy and the European Commission 2022" signed in July 2022 reports *"Considering that the objectives of the European Green Deal can only be achieved without leaving anyone behind and in a fair and inclusive way, the most vulnerable and exposed people and communities to the social and economic effects of the transition will be supported. In addition, environmental protection initiatives based on participatory tools (e.g., River Contracts or other voluntary tools) will be valorized as they are able to make stakeholders, main actors and local communities responsible for the correct management of natural resources. With regards to investment policies, priority will be given to those types of intervention that maximize the fight against climate change."*

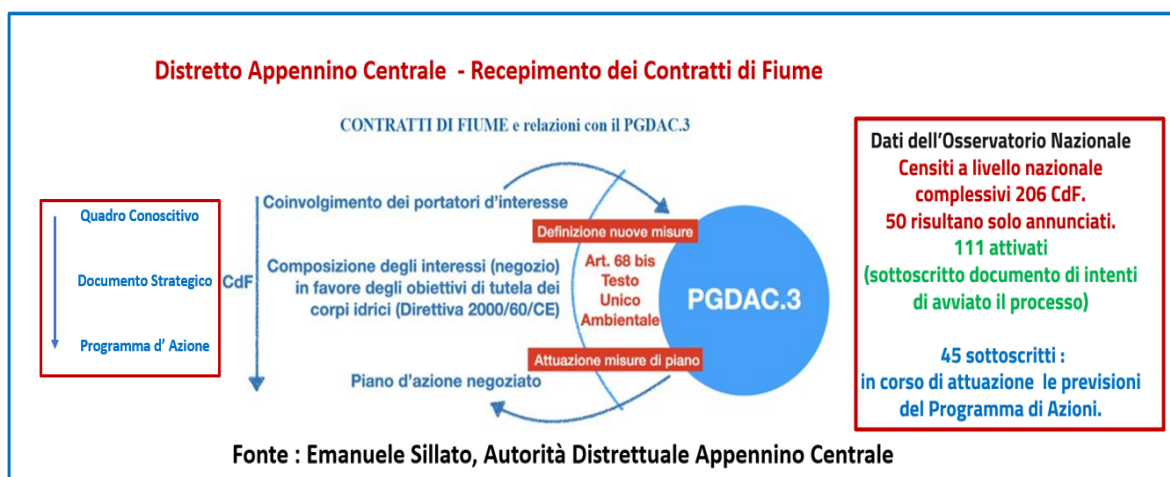
Specific attention must be paid to the protection and enhancement of biodiversity strengthening what was planned and implemented in the 2014-2020 programming period. Droughts, floods and forest fires deal with the water flowing in our rivers and therefore the management of river spaces and water will be increasingly determined from an economic



and ecological point of view. This participatory tool - the River Contract - already widespread in Italy with various approved Action Programmes, now known and widespread also in the partners countries of SMARTRIVER project, will be strongly implemented and relaunched to build and carry on, through a public debate between the actors involved (stakeholders), participatory and shared structural and non-structural measures to be included in plans and programs for adaptation to the negative effects of climate change and for reduction of the risk of floods and droughts. The world of research, technologies, service management, institutions and finance will have to create a system to support managerial and operational innovation on water planning and management issues that can no longer be postponed.

5. Overview of the application of River Contracts in Italy and in the Marche Region

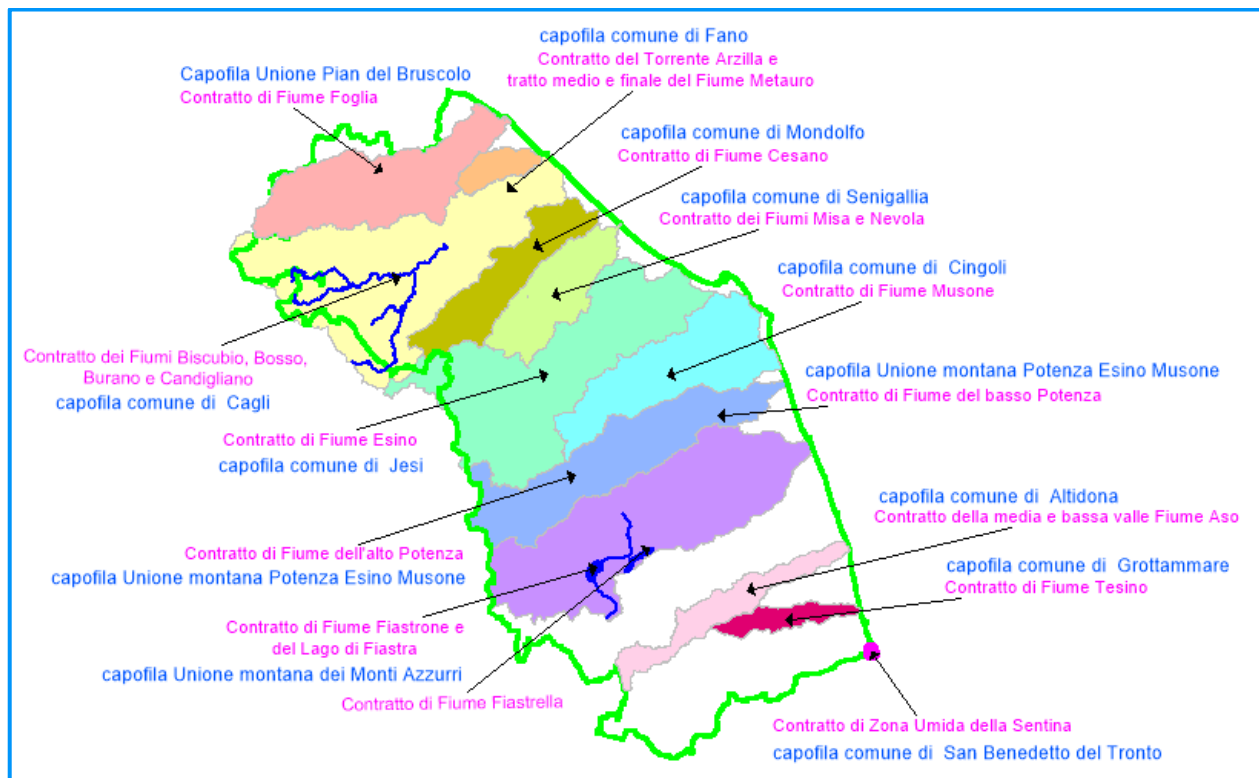
To date in Italy all the Basin District Authorities have foreseen the River Contracts in their Management Plans and about 95% of the Italian Regions and Autonomous Provinces have adopted regional laws, resolutions or other acts concerning the River Contracts as an instrument to be applied and implemented in the programming and planning of river spaces even if, up to now, River Contracts have not benefited from funding lines or dedicated national strategies. Only some Regions have allocated funds to support this tool. From the data of the National Observatory on River Contracts, which is based at the Ministry of Ecological Transition, it emerges that around 100 River Contracts processes have been financed by the Regions, for a total of around 5 million Euros in the period 2006-2021, through direct assignments or tenders. About 10 River Contracts were able to take advantage of direct European funding (LIFE Programme) or indirect funds, as cooperation programmes (Interreg) and through Regional Operational Programs (ROP). The following figure shows a diagram of the provisions in the Management Plan of the Central Apennines District Authority.





In Marche Region, the process of River Contract began with the approval of DGR 1470/2014 concerning adhesion to the National Charter of River Contracts and continued in 2016 with the establishment of the Permanent Technical Table for the Coordination of River Contract, assigning to the regional administration, the role of coordinator of the mentioned working group, by following, accompanying and stimulating the path implemented by the River Contracts in the regional territory. From 2015 to 2021, 14 River Contracts were launched, including one for the River-Lake and one for the Wetland which already signed a Negotiated Agreement.

The current status of the River Contracts is illustrated in the following figure:



63% of the regional territory is involved in River Contracts: 134 Municipalities (out of a total of 227) participate to this process, 9 Municipalities with the role of Lead Partner, more than 67% of the resident regional population is involved in RCs processes, together with approximately 200 private and public stakeholders, 6 River Contracts have reached the Action Program phase, 2 the final phase of signing the negotiated Agreement. This is the dimension that, in a few years, the River Contracts in the Marche region have acquired in terms of social relevance and territorial governance, taking advantage from an innovative and participatory approach. The political and strategic relevance of RCs is also documented by the campaign of "Dialogue Tables and Meetings" involving the interested regional territories, under the coordination of Marche Region.



The primary purpose of these tables and meetings was to collect local requests, have direct feedback on the state of implementation of each River Contract, gather suggestions on the compliance with the methodology indicated by the indication of the National Table on River Contracts "Definitions and qualitative requirements of basis of the RCs", verify, together with the territories, the possibility of carrying on and implementing concrete measures and actions to support the processes and orient interventions and actions to be implemented, in line with the existing territorial and environmental planning tools.

The need of territories to have a strategic framework linked with the opportunity to collect, in a more uniform way, the different measures and actions of several Action Programs with respect to the regional programming, brought Marche Region, in collaboration with the permanent Regional Technical Table for the coordination of the River Contracts, to prepare standard format to facilitate the drafting of the Action Plans. The DDPF n.3 of 1 February 2021 approves and discloses the descriptive sheets of the structural and non-structural interventions and a contract process sheet, the latter, to facilitate and trace the internal governance of each RC process. (the format can be found at the following link: <https://www.regione.marche.it/Regione-Utile/Paesaggio-Territorio-Urbanistica-Genio-Civile/Contratti-di-fiumehanno>).

In 2018, the regional administration, deeply convinced of the RC tool, included a "Participatory Programming and Planning Workshop on River Contracts" in its Regional Training Plan, having the Esino River as a pilot basin. The course was dedicated not only to internal personnel of the region but also to external personnel belonging to other relevant actors in River Contracts to promote capacity building of main river stakeholders.

With the aim of disseminating and providing a greater impetus to the application of the River Contract, the Regional Law no. 29/2020, amending Regional Law no. 31/2012 "Regulations on the management of watercourses", art. 4 - Regional grants and art. 5 - Instruments for implementing the interventions, establishes that to promote regional development and guarantee the implementation of River Contracts, funds are granted according to criteria and methods indicated by the Regional Council. Regional programs related to European Structural Funds must be addressed to the implementation of interventions envisaged by the law.

Within this legal framework, the RCs have been formally included in the sectorial regulations since 2012. The social and environmental context has gradually changed in relation to climate change, drawing attention also on the "management of watercourses". Article 2 establishes that the integrated interventions envisaged by the General Management Plans, introduced with the Regional Law 31/2012, can also be identified on the basis of the Action Programs proposed by the territories applying River Contracts.



Through the River Contracts, important and strategic aspects such as surveillance, prevention, risk management also connected to hydrogeological instability, as well as the ordinary and extraordinary maintenance of river area, can be tackled in a virtuous way. The maintenance of such areas is often the expression of a territorial supervision carried out by the local communities themselves, which are responsible for the protection of the most valuable natural areas of the country, and at the same time, guarantors of an action of control and conservation of the territory.

If the strategy will be considered as a driver to act on a proactive basis, it could become a particularly useful document to draft and implement hydrogeological risk prevention policies. In this regard, experimental actions, that can be applied in a transversal way to all River Contracts, have been encouraged for the sustainable reduction of hydraulic risk, facilitating the active participation of environmental associations, public administrations, private sector and the whole civil society in the protection and enhancement of the river areas from a social, economic, historical and cultural point of view, focusing on the multidimensional approach which is the basis of win-win measures.

Through the formalization of such approach, the Region intends to confirm, also for the future, the importance that has been recognized to River Contracts, as a means to promote strategies and actions for sustainable environmental development, enhancing the promotion of local measures and projects aimed at developing basic knowledge on the RCs related topics, ensuring, as a final result, an efficient coordination through an integrated and systemic management approach of watercourses.

6. Development and declination of the SMARTRIVER strategy

Based on what has been explained in the previous chapters, due to the expected climate change, it is clear that a strategy for resilience and risk reduction must include numerous lines of action to be developed in parallel. Below the ones considered priority in relation to water and river spaces:

- A. FOSTERING transactional cooperation in the Adriatic-Ionian area by promoting Flood Risk Reduction Plans (FRRP) to increase the resilience of river communities and fully implement Directives 2000/60/EC and 2007/60/EC, following the *think globally, act locally* approach;
- B. PROMOTING Public-Private partnerships to create innovative and multidisciplinary risk management governance models through multisectoral agreements, especially RCs, facilitating integrated investments and periodic planning of maintenance (at cadence



- and deadlines) of riverbeds (for the main and tributary branches), systems for collecting and disposing of waste-water and cultivated land;
- C. IMPROVING the retention capacity of the territory and reducing the inflow of rainwater and solid transport in the riverbed through actions on the slopes, including through appropriate agricultural hydraulic arrangements, interruption of monoculture hill fronts and new plantings;
 - D. STIMULATING the active participation of local communities to facilitate the dissemination of environmental information relating to the themes of risk perception, river management, protection of aquatic ecosystems through the activation of innovative warning systems and information/training for schools and citizens through:
 - i) questionnaire surveys on knowledge and perception of risk;
 - ii) information and training meetings with residents in floodable areas;
 - iii) brochures and paper documentation to be delivered to resident citizens to educate them on the behaviors to be adopted;
 - iv) periodic simulated exercises;
 - E. IMPROVING of scientific knowledge, river basins-related topics, through detailed advanced technical methodologies (benefitting also of satellite tools), through local knowledge collected to support the development of adaptation and resilience plans;
 - F. Monitoring of Climate Change also in terms of inflows and outflows in the selected river basins, with the aim of applying and managing weather alerts;
 - G. IMPROVING the configuration of risk reduction plans including technical, economic and structural projects and interventions to be implemented with quantification of the residual risk or sustainable risk to be managed; technical and economic feasibility projects for the construction of multifunctional hillside reservoirs for the capture and storage of flood waters for subsequent multiple use of the reservoir waters;
 - H. CREATING *Climate Proof Communities* through the involvement of local stakeholders, especially from the agricultural world, by stimulating the introduction and development of agricultural practices based on the efficiency of consumption and the reduction of water needs.
 - I. ENHANCING the management of forests that help regulating water flow and water resources through ecosystem services related to hydrology.

On 13 October 2022, precisely on the anniversary of the International Day for the Reduction of Natural Disasters of the UN, attention was paid to the need to implement multi-risk early warning systems. While structural interventions have to be programmed without delay to mitigate and reduce the effects of climate change, the people-centred early warning systems are considered urgent and parallel to structural interventions to save human lives. Early warnings are increasingly needed due to the continuous emergence of frequent, extreme and



unpredictable climate-related events. Appropriate warnings are essential to ensure that not only incoming hazards are identified, but also that the message is understandable and actionable by focusing them on people: design systems with people in mind, to enable them to act in time and appropriately to reduce the potential damages and deaths.

Risk management, with reference to those risks related to water flows, represents a component of sustainable development in relation to the frequency with which droughts and floods have occurred in the last 10/20 years. The structural measures which will be realized, will produce effectiveness probably not before 5/10 years. In the meantime, it is necessary to act urgently in prevention by increasing everyone's collaborative and reactive capacity, thus investing in non-structural measures with reference to early warning and citizen education.

Resilience and reduction of climate impacts must also be promoted by creating a coordinated and smarter multilevel governance model for addressing climate risk in river contexts, involving local, regional and national stakeholders in a participatory-voluntary approach. Promoting this new approach to water/river management through the enhancement of multidimensional governance, the sharing of skills and information also at a transnational level and, above all, within the Adriatic-Ionian Macro-region will contribute to improving participatory approaches for the integrated management of rivers and river spaces, droughts and floods, in the context of the four pillars of the EUSAIR Strategy for mitigation and adaptation to the effects of climate change and disaster risk management.

7. Conclusion

For all the aforementioned reasons, this **ADRIATIC-IONIAN SMARTRIVER STRATEGY FOR RESILIENCE AND RISK REDUCTION** shared by all SMARTRIVER project partners, proposes a political agenda on climate change adaptation through initiatives that include direct knowledge of local communities, participatory and inclusive governance, actions based on social and gender equity and adequate funding. This strategy aims not only at developing a strong and stable interaction between the SMARTRIVER partners and the most relevant project stakeholders, but also for its **transferability, replicability and adoption at all INTERREG ADRION regions in the perspective of future actions which can be implemented with the future 2021-2027 programme.**

Edited by





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