Report on the final climate scenario for each district area

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Summary

Executive Summary

The risk assessment of the San Benedetto del Tronto area revealed overall high risks of river and urban flooding and water shortage. Coastal flooding, accentuation of landslides and storms have been estimated as moderate risks while heat waves, diffusion of pest and alien species and accentuation of fire constitute low risk category. The latter risk assessment was performed based on climate projections and elements about exposure and vulnerability from the risk analysis, past events and information from the local media, references to planning tools and results of the stakeholders' consultation (preliminary questionnaire targeted to local managers and extended questionnaire presented during first participation event). The development of the final scenario was a participatory process where each development step was shared and communicated with stakeholders either through focus groups or bilateral meetings. The main result constitutes of 17 adaptation measures in total, to be implemented in different sectors (water, agriculture & forestry, environment & biodiversity, buildings, education, civil protection & emergency, land use planning and tourism. Most measures tackle issues in water sector, buildings and land use planning.

The vulnerability and risk assessment for the Abruzzo Region was the starting point for the definition of scenario zero. In both of defined areas (hilly and coastal) results mostly indicate moderate risks with exception of high risk of landslide and drought in hilly area, and high risk of flooding in coastal area. If the current circumstances continue i.e. if the "business as usual" scenario continue, all sectors could face adverse consequences of climate change. Given this, adaptation measures are a necessity, and this is encompassed in the final (optimal) scenario developed through the focus group approach. The focus groups were managed by the Joint Action coordinator in order to select climate measures at a wider territorial level, necessary for climate adaptation plans. To build a portfolio of actions, firstly a desktop review was undertaken of the existing literature and information on climate change adaptation actions available at the European, national and the local level, taking into consideration the results of Risk and Vulnerability assessment. Then the criteria used to select the actions give priority to: "win to win" actions that are able to mitigate the impacts of climate change on the territory, with an effectiveness both in terms of mitigation and adaptation; "no-regret" actions and "low-regret" actions.

The climate hazards relevant for both target areas are extreme heat, heavy precipitation, drought and water scarcity, mass movement. Additionally, for target area 1 there are also wildfires and for target area 2 coastal erosion. The main result is 26 measures for target area 1, the hilly one, and 23 measures for target area 2, the coastal one), with environment, biodiversity, agriculture and forestry having the highest number of measures.

The development of the scenario zero for the Target Area of the Pescara Municipality was based on the analysis of the output of the risk and vulnerability assessment where three impact chains were identified. All the analysis gives an average picture of the whole Target Area, since a downscale of the results at municipality or sub-municipality level was impossible to carried out to lack of some data for all the municipalities of the target area. Therefore, the 2030 climate situation was carried out at 'target area level' with no details at sub-municipality level, not only because the impact chains do not have this

resolution, but also because the climate projection tools have a regional scale resolution. The analysis of temperature data of the last 90-100 years for the two main Municipalities of the Target area, where long data record area available, show very similar trends in terms of changes tendency in all the timeframe (1930-1980, 1950-2015, 1980-2015) considered. This observation in one side confirm that the Target area can be considered homogenous from the point of view of the climate change observed in the past, on the other side gives consistency on the identification of an average 2030 climate state for all the Target area. For the climate projections were used the Copernicus Climate Service that gives climate projections for the Abruzzo region as the highest spatial resolution, but gives data for the year 2030, whereas the National Adaptation Plan (PNACC) has identified homogenous areas, one of which (the macroregion 2) is representative of the Target area, but the projections are the average of expected situations of the period 2020-2050. However, considering that the observed temperature trends of the last decades in the Abruzzo Region were 0.014±0.010°C/year, 0.042±0.007°C/year and 0.060±0.015°C/year, considering the period 1930-1980, 1950-2015 and 1980-2015, respectively, those values are well within the statistical error of the trends observed in the Target Area, so the projection of the Copernicus Climate Service, even if with regional resolution, can be considered representative of the Target Area, taking into account all the assumptions and uncertainties. Regarding the PNACC projections, due to the broad period considered for the mean results, a broader level of confidence was assumed even if 2020 is inside the time frame of the PACC analysis.

Predictions made by Croatian Meteorological and Hydrological Service predict the increase in intensity and frequency of heatwaves which will last longer periods. Most of the simulation for the droughts predict the increase in their intensity and frequency, although the amount of precipitation throughout the year should not fall. For the Dubrovnik-Neretva target region, all identified risks (drought, heat waves, shoreline flooding) were estimated as moderate risks. The final scenario analysed 4 sectors (agriculture, healthcare, water supply, tourism) in connection with 2 hazards (drought, heat waves) which resulted in 13 adaptation measures. Most measures were envisaged for water supply and agriculture sector with regards to expected drought.

The climate scenarios for IRENA are being developed by the external expert Ecorys Hrvatska Ltd from Zagreb. The main results of the climate scenarios analysis include the definition of the observed current and future projected climate changes for the scenarios. These include projections that show overall temperature rise in Croatia (expected increase of average maximum air temperature, increase of number of hot days, increase of number of tropical nights and prolongation of warm period duration), medium to high chance of overall increase of precipitation in winter and reduction of precipitation in summer. Other results also include the definition of the overall risk level for the pilot areas by sector and of the measures that will be confirmed by and used during the SECAP implementation by the pilot area stakeholders. The final scenario constitutes of 22 adaptation measures for 6 sectors including agriculture, health, water supply and drainage, tourism, coastal management and spatial planning. Most measures tackle issues in tourism, water supply and drainage and health sector.

Vulnerability and risk estimation for the target area (Kastav, Opatija, Čavle, Matulji and Viškovo) was performed for water supply, health and tourism sector. Overall, results indicate moderate risks for all sectors. Should the current circumstances continue i.e. should "business as usual" scenario continue, all sectors could face adverse consequences of climate change which can be either direct damage to the environment, properties, infrastructure and livelihoods (e.g. lack of water) and/or decrease in incomes followed by decrease in employment. Given this, adaptation measures are a necessity, and this is encompassed in the final (optimal) scenario developed through the focus group approach. The focus group was a diverse group of attendees: local and County level experts, City/Municipality representatives, different associations, utilities etc. providing their expertise and advice on possible actions to alleviate expected consequences of climate change. These activities were evaluated using six criteria – how significant, urgent, cost-effective and feasible the action is and whether it provides benefits to other sectors (synergistic effect) and regardless of climate change (multiple usefulness). The main result constitutes 22 measures, with water management having the highest number of adaptation actions considered as necessary.

Vulnerability and risk estimation for island of Brač was performed for agriculture, health, tourism and water supply, on municipality level. Overall, results mostly indicate moderate risks except for tourism (specific municipalities only). Due to lack of specific data and information, risks to fisheries and coastal management were assumed the same as the ones estimated on national level which is high risk. Should the current circumstances continue i.e. should "business as usual" scenario continue, all sectors could face adverse consequences of climate change which can be either direct damage to the environment, properties, infrastructure and livelihoods (e.g. lack of water) and/or decrease in incomes followed by decrease in employment. Given this, adaptation measures are a necessity, and this is encompassed in the final (optimal) scenario developed through the focus group approach. The focus group was a highly diverse group of attendees, from local to County level experts, different associations, utilities etc. providing their expertise and advice on possible actions to alleviate expected consequences of climate change. These activities were evaluated using six criteria – how significant, urgent, cost-effective and feasible the action is and whether it provides benefits to other sectors and regardless of climate change. The main result constitutes 27 measures, with water management, health, tourism and forestry having the highest number of measures.

Vulnerability and risk estimation for island of Korčula was performed for agriculture, forestry, health, tourism, water supply, fisheries and coastal management sector, on municipality level. Overall, results mostly indicate moderate risks except for forestry and tourism (specific municipalities only). Due to lack of specific data and information, risks to fisheries and coastal management were assumed the same as the ones estimated on national level which is high risk. Should the current circumstances continue i.e. should "business as usual" scenario continue, all sectors could face adverse consequences of climate change which can be either direct damage to the environment, properties, infrastructure and livelihoods (e.g. lack of water) and/or decrease in incomes followed by decrease in employment. Given this, adaptation measures are a necessity, and this is encompassed in the final (optimal) scenario developed through the focus group approach. The focus group was a highly diverse group of attendees, from local

to County level experts, different associations, utilities etc. providing their expertise and advice on possible actions to alleviate expected consequences of climate change. These activities were evaluated using six criteria – how significant, urgent, cost-effective the action is and whether it provides benefits to other sectors and regardless of climate change. The main result constitutes 22 measures, with tourism and forestry having the highest number of measures followed by health and water supply.

Based on the comparative analyses of final scenarios for both Croatian and Italian target areas, it can be concluded that there are no joint measures for the entire project area; however, there are important similarities. Most common measures are the non-structural ones, majority of which is focused on capacity building/education of various stakeholders. Improvements in water management and agriculture sector are also pointed out throughout the project area. Croatian target areas are mostly concerned with drought while the Italian side is more focused on extreme heat.

Introduction

Climate change require due attention of all stakeholders at all levels and profiles. In order to stimulate thinking about possible consequences, opportunities and risks, and courses of action, this project activity included the development of climate scenarios, namely scenario "0" and the final (optimal) scenario for each target area.

1 Climate scenarios

1.1 Scenario 0

Scenario "0" ("business as usual" scenario) assumes that in the near future there will not be any legislative, strategic, technological, economic, behavioural or priority changes keeping the usual circumstances unaltered and, accordingly, possible consequences of climate change. The latter was developed based on risk and vulnerability assessments (RVA) performed for each target area.

1.1.1 PP1 – IRENA - Istrian Regional Energy Agency

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of drought in Agricultural sector	**!!**	**+**	**+**	**
Risk of heat stroke in Health sector	**!! (Buje,Brtonigla) !!! Novigrad**	**+**	**+**	**
Risk of drought in water supply sector	**!!**	**+**	**+**	**
Risk of high temperatures and heavy precipitation in Tourism sector	**!!**	**+**	**+**	**
Risk of temperature level rise in Fisheries sector	**!!!**	**+**	**+**	**
Risk water circulation changes due to thermohaline reasons in Fisheries sector	**!!!**	**+**	**+**	**

Risk of sea level rise in Fisheries sector	**!!**	**+**	**+**	****
Risk of sea acidity level rise in Fisheries sector	**!!!**	**+**	**+**	****
Risk of sea floods (Coastline)	**!!!**	**+**	**+**	****

!: Low; !!: Moderate; !!!: High; +: Growth ; _: Decline ; =: no change; ? = not know; *: Low; ** Moderate; *** High

The Risk and Vulnerability assessment to climate change for the designated area was carried out for all sectors listed above, and the level of processing was determined by the availability of specific data (indicators) – due to the limitation and inaccessibility of specific data, Coastline and Fisheries sector were processed more qualitatively.

Due to the limitation and inaccessibility of specific data, the risk for Coastline and Fisheries sector is determined the same as national level risk (Note: certain specific analyses point to a low to medium vulnerability of observed coastline to sea flood risk.)

1.1.2 PP2 – Municipality of San Benedetto Del Tronto

In the following there are some tables and explanations concerning the Scenario 0 construction for the pilot area leaded by San Benedetto del Tronto municipality.

RISK (*)	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION	Ref. to Explanatory note
River flooding	**!!!**	**+**	**+**	*	**(1)**
Urban flooding	**!!!**	**+**	**+**	***	**(2)**
Coastal flooding	**!!**	**+**	**+**	**	**(3)**
Accentuation of landslide Risk	**!!**	**+**	**+**	**	**(4)**
Storms	**!!**	**+**	**+**	**	**(5)**
Heat waves	**!**	**+**	**+**	***	**(6)**
Diffusion of pest and alien species	**!**	**+**	**+**	*	**(7)**
Accentuation of fire Risk	**!**	**+**	**+**	*	**(8)**
Water shortage	**!!!**	**+**	**+**	***	**(9)**

KEYLINE !: Low; !!: Moderate; !!!: High | +: Growth ; - : Decline ; =: no change; ? = not know |*: Low; ** Moderate; *** High

Grey cells correspond to additional risks considered in the planning phase even if they were not developed as impact chains in the previous project phase.

(*) Please note that risks, here, are intended as GROUPS OF RISKS: each one is related to a certain IMPACT causing potential damages to different groups of exposed elements, as to say that each line could be interpreted as "risk of damage to people, settlements and economic activities due to…"

RISK	MUNICIPAL RISK LEVEL				OVERALL RISK LEVEL
	Cupra Marittima	Grottammare	Monteprandone	S. Benedetto del Tronto	
River flooding	!!!	!!	!!!	!!!	!!!
Urban flooding	!!!	!!!	!!!	!!!	!!!
Coastal flooding	!	!!	x	!!!	!!
Accentuation of landslide Risk	!!	!!	!!!	!	!!
Storms	!!	!!	!!	!!	!!
Heat waves	!	!	!	!	!
Diffusion of pest and alien species	!	!	!	!	!
Accentuation of fire Risk	!!	!!	!	!	!
Water shortage	!!!	!!!	!!!	!!!	!!!

KEYLINE !: Low; !!: Moderate; !!!: High

Scenario 0 has been developed both for the whole pilot area and for the single municipalities.

The above values were defined according to 4 sources of information:

a) climate projections and elements about exposure and vulnerability from the risk analysis.
b) past events and information from the local media,
c) references to planning tools,
d) results of the stakeholders' consultation (preliminary questionnaire targeted to local managers and extended questionnaire presented during first participation event).

1 – Explanatory note about risks related to <u>RIVER FLOODING</u>:

a) Climate projections indicate a general tendency to less frequent and more intense precipitation events, even if the change is expected to be moderate. Intense precipitation may trigger river flooding events especially in case of very artificialized watercourses as the ones flowing along the Marche coast.
The hazard classification at regional level is not complete and only P2 hazard level map - corresponding to 100Y return time events - is available. The interested river are: Menocchia and S.Egidio (Cupra M.), Tesino (Grottammare), Tronto (S. Benedetto and Monteprandone).

INDICATORS	Cupra Marittima	Grottammare	Monteprandone	San Benedetto del Tronto	*Marche Region*	*Province of Ascoli Piceno*
Population living in areas subject to flooding hazard P2 (=RT 100y)	1165	417	967	2104	*65956*	*13592*
% Population living in areas subject to flooding hazard P2	21,74%	2,58%	7,63%	4,44%	*4,31%*	*6,52%*
Area subject to flooding hazard P2 (Kmq)	0,77	1,61	4,44	4,59	*241*	*41,7*
% Area subject to flooding hazard P2	4,45%	8,92%	16,84%	18,07%	*2,56%*	*3,39%*

Source: Mappa dei rischi dei comuni italiani – ISTAT

b) Among the past flooding events it is worth to mention the 1992 Tronto flood that cumpletely inundated the area of Porto d'Ascoli in southern San Benedetto causing millions of damages.

c) Hydraulic risk mapping is under the responsibilities of the Central Apennine District Authority who draft and update quinquennially the Flood Risk management Plan. Existing risk map focus on the main water network, even if interesting studies concerning the secondary network are in progress and demonstrate the relevance of such risk.

d) River flooding resulted to be one of the most relevant impact according to the opinion of local manager involved in the preliminary consultation. While stakeholders involved in the SECAP participation event attributed to the related risks a slightly lower relevance (average score of 6,7/10).

2 – Explanatory note about risks related to <u>URBAN FLOODING</u>:

a) Climate projections indicate a general tendency to less frequent and more intense precipitation events, these may determinate urban flooding in heavily urbanized areas and context characterized by high soil sealing. The road network is particularly prone to urban flooding due to the high number of railway underpasses.

INDICATORS	Cupra Marittima	Grottammare	Monteprandone	San Benedetto del Tronto	*Marche Region*	*Province of Ascoli Piceno*
Urbanized areas (kmq)	1,31	4,64	3,53	10,68	*509,9*	*59,60*
% Urbanized area	7,54%	25,79%	13,40%	42,05%	*5,42%*	*4,85%*

Source: Mappa dei rischi dei comuni italiani – ISTAT

b) Urban flooding is quite common and local media often report about road interruptions due to this kind of events, especially at railway underpasses.
c) Urban water services management tools refer about shortcomings of the drainage system in all the involved municipalities.
d) Urban flooding resulted to be one of the most relevant impact according to the opinion of local manager involved in the preliminary consultation. While stakeholders involved in the SECAP participation event attributed to the related risks a slightly lower relevance (average score of 6,7/10).

3 – Explanatory note about risks related to <u>COASTAL FLOODING</u>

a) Climate projections indicate a general tendency to less frequent and more intense precipitation events, implying the risk of storm surge and coastal flooding along the low sandy coast, already prone to erosion. The existing breakwaters reduce the related risks except where they are missing as in the Sentina area. The high number of beach facilities mostly hosted by permanent structures represents an element of further exposure.
b) Local media do not frequently report damages from coastal storm. Nevertheless, extreme erosion affects less or not protected beach segments. Among these, it is worth mentioning the railway section in the northern Grottammare put at risk by the deterioration of the existing artificial reef, as well as the Sentina Natural Reserve where the retreating coastline threatens the rare and protected habitat of coastal wetland.
c) Integrated Coastal Zone Management Plan deals with the risk of coastal flooding indicating different elevation thresholds corresponding to events with different return periods: the areas below 2.45 mt are subject to 100 ys coastal flood. Specific measures to protect the railway are mentioned in the ERDF OP 2014-2020. The Sentina Reserve Management Plan proposes specific measures against the coastal erosion.
d) The opinion of stakeholders about coastal flooding impacts is contradictory: not relevant according to the opinion of local manager involved in the preliminary consultation, extremely relevant for the stakeholders involved in the SECAP participation event who attributed to the related risks the highest score (average score of 7,5/10).

INDICATORS	Cupra Marittima	Grottammare	Monteprandone	San Benedetto del Tronto	*Marche Region*	*Province of Ascoli Piceno*
Area below 2,45 mt prone to Coastal flooding Risk RT=100 y (% of municipal area)	1,24	1,83	---	9,02		
% of protected 150mt beach segments (tot.77)	100%(20)	86% (22)	---	66%(35)	*773*	*83*

Source: Own elaboration on data from ICZM Regional Plan

4 – Explanatory note about risks related to <u>ACCENTUATION OF LANDSLIDE</u>

a) Climate projections indicate a general tendency to less frequent and more intense precipitation events, implying the risk of landslide accentuation, especially in the case of events occurring after prolonged dry period. The area exposed to landslide hazard is generally limited - except in the case of Monteprandone where interests more than 10% of the surface - and scarcely populated.
b) Local media frequently reports about minor landslide events causing road interruptions, the most significant among the recent ones occurred in 2014 in Cupra Marittima Castello Sant'Andrea.
c) Landslide risk mapping is under the responsibilities of the former Basin Authorities: Marche regional basins and Tronto river basin, now assimilated by the Central Apennine District Authority. The map, originally released with the Hydrogeologic Structure plans, is under constant update.

INDICATORS	Cupra Marittima	Grottammare	Monteprandone	San Benedetto del Tronto	*Marche Region*	*Province of Ascoli Piceno*
Population living in areas subject to landslide hazard P3+P4 (High-Very High)	47	203	156	12	*32624*	*2877*
% Population living in areas subject to landslide hazard P3+P4	0,88%	1,26%	1,23%	0,03%	*2,13%*	*1,38%*
Area subject to landslide hazard P3+P4 (Kmq)	0,28	0,59	2,83	0,15	*735,55*	*69,31*
% Area subject to landslide hazard P3+P4	1,61%	3,29%	10,72%	0,60%	*7,82%*	*5,64%*

Source: Mappa dei rischi dei comuni italiani - ISTAT

d) The accentuation of landslide hazard resulted as one of the most relevant both according to the opinion of the local manager involved in the preliminary consultation and the stakeholders involved in the first SECAP participation event, resulting the second in order of importance (average score of 7,3/10).

5 – Explanatory note about risks related to <u>STORMS (severe winds accompanied by heavy rains or not)</u>

a) As already mentioned, climate projections indicate a general tendency to less frequent and more intense precipitation events. Even if effects of climate change on winds are very complex to analyse, coasts usually experience a more intense air circulation and are exposed to downbursts and waterspouts, which probability - according to the experts' opinion - is related to the sea temperature increase.
b) Local media occasionally reported about damages to agriculture and beach facilities due to this kind of event. The most recent occurred on July 10th 2019 when 150 km/h wind combined with hailstorm.
c) The considered planning tools do not mention risks related to this kind of events.
d) The local manager involved in the preliminary consultation neglected the storm risk, while the stakeholders involved in the first SECAP participation event considered as relevant as the other risks related to extreme weather conditions excluding coastal flooding (average score of 6,7/10).

6 – Explanatory note about risks related to <u>HEAT WAVES</u>

a) With reference to temperature, all climate models highlight at regional level a general increase for 21st century. The strongest variation of mean temperature is projected in summer while the weakest change is expected in spring. All models agree to predict a future reduction of frost days and an increase of tropical nights, summer days and heat waves.
b) The heat waves tend to be more intensively perceived in dense and compact settlements where the urban heat island effect occurs while on the coast cool and humid breeze from the sea usually contributes to mitigate the temperature extremes.
c) Considered planning tools does not deal directly with the heat wave phenomenon.
d) The stakeholders agreed in considering the risks related to heatwaves as not particularly relevant both during the preliminary consultation and the SECAP participation event (average score of 5,8/10)

7 – Explanatory note about risks related to <u>DIFFUSION OF PEST AND ALIEN SPECIES</u>

a) According to experts' opinion, the temperature increase may contribute to the diffusion of species from southern latitudes and pathogens. Alien species may include pest and vectors implying new risks for agriculture and human health. Moreover, the sea temperature increase, that in the Adriatic sea amounts to 1,5°C in the last 30 years, may determinate the alteration of the fish stock already threatened by overfishing and can cause algal bloom or jellyfish proliferation.

b) In the last years an increasing number of cases of vector based diseases trasmitted by invasive species of mosquitos was detected in Italy (Chikungunya, Dengue e Zika and West Nile) and raised the attention of experts. Concerning the marine environment, the Marche coast is under monitoring for the presence of toxic alga *osteopsis ovata*, Grottammare is one of the monitoring sites, even if any alert was yet. Experts detected a significant increase in the presence of jelly fish in the Mediterranean Sea, including in the Adriatic, the main causes seem to be the decrease of predators and the increase of temperature.

c) Considered planning tools does not deal directly with this phenomenon, but Entomological surveillance plan and protocols are in force at national and regional level.

d) This risk was not explicitly submitted to the attention of the local manager involved in the preliminary consultation, while the stakeholders involved in the first SECAP participation event considered it as quite relevant (average score of 6,7/10).

8 – Explanatory note about risks related to <u>ACCENTUATION OF FIRE RISK</u>

a) Changes in climate that create warmer, drier conditions, increased drought, and a longer fire season are boosting the increases in wildfire risk with potential consequences for people and properties on the wildland/urban interface.

b) Local media do not deal with the accentuation of fire risk due to climate change, small fire are occasionally reported.

c) The wildfire risk is addressed by the civil protection planning tools both at regional and municipal level. The Regional Plan concerning prevision, prevention and forest fire fighting was approved in 2017 and confirmed in 2020. it includes the wildfire risk classification of municipalities below.

% of surface under each WILDFIRE RISK CLASS according to the REGIONAL WILDFIRE RISK MAP	Cupra Marittima	Grottammare	Monteprandone	San Benedetto del Tronto
trascurable	0,20%	3,30%	20,40%	46,60%
low	35,50%	35,20%	67,10%	38,50%
medium	44,10%	50,80%	10,80%	14,90%
high	19,40%	9,90%	1,70%	0%
extreme	0,70%	0,80%	0%	0%

Source: Carta del Rischio Incendi Boschivi – CRIB, Annex 1 DGR N°792 10/7/2017

d) The stakeholders agreed in considering the accentuation of fire risk as not particularly relevant both during the preliminary consultation and the SECAP participation event (average score of 5,7/10)

9 – Explanatory note about risks related to <u>WATER SHORTAGE</u>

a) With reference to precipitation projections, the expected climate change signal is not very clear, even if the range of the projected variations generally results in a moderate decrease of the ensemble mean. Seasonal precipitation results indicate a weak reduction in spring, summer and autumn, whereas in winter wetter conditions are estimated compared to the 1971-2000.

b) Local media report about the night interruption of the water services occurring almost each summer. Media also mention a reduction of the flow rate at the sources occurred as a consequence of the 2016 earthquake.

c) All the planning tools concerning water management and services address water shortage (Regional Water Safeguard Plan, Regional Waterworks plan, regional plan Land for reclamation and irrigation) warning about the decrease of precipitation and the need for a more efficient use of the resource. The agricultural sector deserves particular attention, as particularly suffering for frequent droughts and water shortage. Water Emergency interested the Marche Region in 2017.

d) The stakeholders agreed in considering the risk of water shortage as very relevant both during the preliminary consultation and the SECAP participation event (average score of 7,1/10).

1.1.3 PP3 – Abruzzo Region

The results from the "vulnerability and risk assessment report" are the starting point for the definition of scenario 0. We identified 4 impact chains for both target areas and about 20 indicators for each hazard, exposure and vulnerability component.

The scenario 0 describes the target's area evolution if no intervention on vulnerabilities and risks is undertaken, which means the confirmation the current environmental protection policies but taking into consideration the climatic scenarios by 2030.

We estimated the projection to 2030 considering a linear trend for indicators for which we have historical series, focusing the attention on parameters related to climate hazard factors.

For all the other indicators we adopted a conservative approach, keeping the value unchanged.

The expected change in intensity and in frequency was estimated thanks to the support of scientific reports at National and regional level as listed in the following table.

Factor	Report	Level
Extreme heat	National plan for adaptation and climate change - Annex 1 "Analysis of current and future climatic conditions "	National - macroregions
Heavy precipitation	National plan for adaptation and climate change - Annex 1 "Analysis of current and future climatic conditions " Results from Life "Primes" project	National macroregions/ Regional
Sea level rise	National plan for adaptation and climate change - Annex 1 "Analysis of current and future climatic conditions "	National - macroregions
Flood	Results from Life"Primes" project	Regional
Drought and water scarcity	National plan for adaptation and climate change - Annex 1 "Analysis of current and future climatic conditions	National - macroregions
Mass movement	Results from the publication "Landslides in a changing climate «	National
Wild fires	Result from the "Regional Forest Firefighting Plan	Regional

The Scenario zero is structured in order to be coherent with the guidelines developed within the Joint Secap project and with the CoM template which has been revised in 2020. In particular, the risk and vulnerabilities assessment sheet from the CoM template consists of four steps: climate hazards; vulnerable sectors, adaptive capacity and vulnerable population groups. Please refer to the full report "Definition of climate scenarios" for further information.

The following tables summarise in a qualitative way for each target area the risk level, the expected change in intensity and in frequency, the reliability of estimation.

RISK FOR TARGET AREA 1 – HILLY AREA	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of damage for extreme precipitations to buildings, tourism, agriculture & forest and industry sectors (flood risk)	!!	?	?	*
Risk of damage for extreme precipitations to buildings, tourism, agriculture & forest and industry sectors (landslide risk)	!!!	?	?	*
Risk of damage for drought to population, tourism, agricolture & forest and industry sectors	!!	=	++	***
Risk of damage for extreme heat and increase of temperature to population, tourism, agricolture & forest and industry sectors	!!!	=	+	***
Risk of damage for extreme heat and drought to population, tourism, agricolture & forest and industry sectors for forest fires	!!	=	+	***

RISK FOR TARGET AREA 2 – COASTAL AREA	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of damage for extreme precipitations to buildings, tourism, agriculture & forest and industry sectors (flood risk)	!!!	?	+	*
Risk of damage for extreme precipitations to buildings, tourism, agriculture & forest and industry sectors (landslide risk)	!!	?	+	*
Risk of damage for extreme weather conditions to population, tourism, environment and biodiversity sectors for coast erosion	!!	?	+	*
Risk of damage for drought to population, tourism, agricolture & forest and industry sectors	!!	+	+	***
Risk of damage for extreme heat and increase of temperature to population, tourism, agricolture & forest and industry sectors	!!	+	+	***

!: Low; !!: Moderate; !!!: High
+: Growth ; _: Decline ; =: no change; ? = not known
*: Low; ** Moderate; *** High

1.1.4 PP4 – Municipality of Pescara

The estimation of the scenario zero to assess the risk to 2030 was carried out considering the risk levels retrieved in the risk and vulnerability assessment and the expected changes of the hazards related to the different risk, considering the above analysis based on the Copernicus Climate Service and PNACC. For the reliability of the estimation of the expected changes of the frequency and intensity of risk level was considered low for all the risks due limitations and uncertainties of the projections in terms of spatial and temporal average explained above. In Table 1 are summarized the estimated risk to 2030 where the risk levels are reported according to three classes: Low, Moderate and High. For the future changes in terms of intensity and frequency of the risk four classes are used to synthetize the projections: Growth, Decline, 'no change', and 'not know'.

Table 1. Estimation of the risk to 2030 where the risk levels are reported according to the following classes: !: Low; !!: Moderate; !!!: High. The expected changes and frequency are categorised as follow: +: Growth; _: Decline; =: no change; ? = not know. The reliability of the estimation has the following three classes: *: Low; ** Moderate; *** High.

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of extreme precipitation for shops and stores (business activities)	**!!!**	**?**	**?**	*
Risk of extreme precipitation for Critical infrastructures in flood prone areas	**!!**	**?**	**?**	*
Risk of extreme precipitation for Farming activities and cultivation in flood prone areas	**!!**	**?**	**?**	*
Risk of Heat waves for Elderly citizens	**!!**	**+**	**+**	*
Risk of Heat waves in Tourism and Fishing economy	**!**	**+**	**+**	*
Risk of Drought in Aquatic parks, and swimming pool activities	**!**	**+**	**+**	*
Risk of Drought in Farming activities and cultivations	**!**	**+**	**+**	*

1.1.5 PP5 – SDEWES Centre

The current situation shows there is a moderate risk of drought impact on agriculture and water supply, and moderate risk of heatwaves for the healthcare and tourism sector. The estimations show that it is expected that all those risks will increase slightly in the near future. For the CO2 emissions, the baseline emission inventory was taken the year 2015, when there was 227 970 tCO2/a emitted in the targeted area. Most of the emissions were coming from the road transportation sector – 44.71%.

In scenario 0 with no adaptation measures being implemented we can expect greater losses in the agriculture sector in the coming years, impacted by the droughts and problems in the water supply systems. From the heatwaves, we can expect an increase in mortality, especially among the elderly population, higher cost for the healthcare system and impact on the income from tourism. With no mitigation measures, we can expect a certain increase in CO2 emissions by 2030 up to 239 759 tCO2/a.

The increase of the sea temperature is a threat for the aquaculture and fishing industry. Many species could flee to the north and deeper areas with the colder seawater. Also due to the rise of the sea level, it will come to the change in salinity of it. We can expect that this risk will increase in the future. Due to lack of data on the topic, reliability is considered low. In the shoreline there is a risk of flooding, due to strong currents and sea level rise. It is expected that the intensity and frequency of this will rise in the future, but the sea level rise is a process that will show its greatest threat in the longer period (after 2030.). Since until the 2030 the risk of the sea level rise will not increase greatly, reliability of this estimation is considered moderate.

While developing Climate Scenarios and Vulnerability and Risk Assessment it was difficult to get the latest data for every municipality within the targeted area.

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of drought in agriculture	**!!**	**+**	**+**	****
Risk of heatwaves for the healthcare	**!!**	**+**	**+**	*****
Risk of drought in water supply	**!!**	**+**	**+**	****
Risk of heatwaves for the tourism	**!!**	**+**	**+**	*****
Risk for fishing sector and aquaculture	**!!**	**+**	**+**	*****

Risk for the shoreline flooding	**!!**	**+**	**+**	****

!: Low; !!: Moderate; !!!: High
+: Growth ; _: Decline ; =: no change; ? = not know
*: Low; ** Moderate; *** High

1.1.6 PP6 – Primorje - Gorski Kotar County

The following table represents risk estimation parameters for the target area in Primorje Gorski Kotar County. Estimation process was highly dependent on data availability for the target area.

For all sectors, risks have been estimated as moderate. Expected changes in the future, in terms of intensity and frequency, are all estimated as increasing. Due to lack of certain specific data and thresholds, the reliability of these estimations can be considered moderate.

Table 1: Risk estimation – target area PGC, Croatia

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk to water supply due to extensive drought periods	!!	+	+	*
Risk of increasing interventions related to heat waves in health sector	!!	+	+	*
Risk of economic damage to the tourism sector due to extreme weather conditions	!!	+	+	**

!: Low; !!: Moderate; !!!: High
+: Growth ; _: Decline ; =: no change; ? = not know
*: Low; ** Moderate; *** High

With regards to possible consequences to the target area should no intervention on vulnerabilities and risks is undertaken i.e. with no additional adaptation measures applied, the following can be expected:

- **Water supply sector**
  - Lack of water for households and / or more frequent and longer periods of unavailability of healthy water for human consumption
  - Lack of water for industry (including tourism)
  - Lack of water for irrigation
- **Health sector**
  - Increase in mortality and hospitalization due to, above all, circulatory diseases
  - Overload on the health system due to higher number of patients and treatment costs
- **Tourism**
  - Reduced tourist demand in the summer months (high temperatures, extreme weather conditions) which can lead to a drop in income and thus employment
  - Reduction and loss of ecosystem services due to climate change
  - Occurrence of damages and / or reduced functionality of various infrastructure systems such as: beach infrastructure, horticulture, and ecosystems, biodiversity and culture in general, heritage important to tourism due to the indirect and direct effects of climate change

1.1.7 PP7 – Split - Dalmatia County

The risk estimation process for the island of Brač was highly dependent on data availability. Due to lack of specific data and information, risks to fisheries and coastal management were assumed the same as the the national level. For other sectors, risk estimation was performed on municipality level. The latter should be duly regarded when comparing the results.

The following table represents risk estimation parameters for the island of Brač as the target area in Split-Dalmatia County. For most sectors, risks have been estimated as moderate except for tourism where high level risk was assessed (but not for all municipalities). Risks for fisheries and costal management on national level are estimated as high. Expected changes in the future, in terms of intensity and frequency, are all estimated as increasing. Due to lack of certain specific data and thresholds, the reliability of these estimations can be considered low to moderate.

Table 1: Risk estimation – island Brač, Croatia

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of drought in agriculture	!!	+	+	**
Risk of heat waves in health sector	!!	+	+	**
Risk of drought in water supply system	!!	+	+	**
Risk of extreme temperatures and precipitation in tourism sector	!!! (Sutivan, Supetar, Bol, Milna, Postira) !! (Selca, Nerežišća, Pučišća)	+	+	**
Risk to fisheries due to sea temperature rise, changes in water circulation, sea level rise and increase in sea acidity	!!! (except sea level rise !!)	+	+	**
Risk of coastal flooding	!!!	+	+	**

!: Low; !!: Moderate; !!!: High
+: Growth ; _: Decline ; =: no change; ? = not know
*: Low; ** Moderate; *** High

With regards to possible consequences to the target area should no intervention on vulnerabilities and risks is undertaken i.e. with no additional adaptation measures applied, the following can be expected:

- Agriculture sector
  - lower yields followed by a decrease in incomes and consequently decrease in employment
  - higher needs for irrigation
  - changes in duration of the vegetation period (e.g. earlier maturation of olives, shorter vegetation period for wine)
  - decrease in the number of family farms
- Water supply sector
  - Lack of water for households and / or more frequent and longer periods of unavailability of healthy water for human consumption
  - Lack of water for industry (including tourism)
  - Lack of water for irrigation
- Health sector

- Increase in mortality and hospitalization due to, above all, circulatory diseases
- Overload on the health system due to higher number of patients and treatment costs

➢ Tourism
- Reduced tourist demand in the summer months (high temperatures, extreme weather conditions) which can lead to a drop in income and thus employment
- Reduction and loss of ecosystem services due to climate change
- Occurrence of damages and / or reduced functionality of various infrastructure systems such as: beach infrastructure, horticulture, and ecosystems, biodiversity and culture in general, heritage important to tourism due to the indirect and direct effects of climate change

➢ Fisheries
- Decline in catch and consequently a decrease in income and employment

➢ Coastal management
- Direct damage on property (in settlements, on infrastructure etc)
- Direct damages to the environment, protected areas, cultural heritage which decreases the attractiveness of the area

1.1.8 PP8 – Municipality of Vela Luka

The table below represents risk estimation parameters for the island of Korčula. The estimation process was highly dependent on data availability for the target area. Due to lack of specific data and information, risks to fisheries and coastal management were assumed the same as the national level. For other sectors, risk estimation was performed on municipality level. The latter should be duly regarded when comparing the results.

For most sectors, risks have been estimated as moderate except for forestry and tourism sectors where high level risk was assessed (but not for all municipalities). Expected changes in the future, in terms of intensity and frequency, are all estimated as an increase. Due to lack of certain specific data and thresholds, the reliability of these estimations can be considered low to moderate.

Table 1 Risk estimation – island Korčula, Croatia

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of drought in agriculture	!!	+	+	**
Risk of fire in forestry	!!! (Korčula, Blato) !! (Lumbarda, Vela Luka, Smokvica)	+	+	**
Risk of heat waves in health sector	!!	+	+	**
Risk of drought in water supply system	!!	+	+	**
Risk of extreme temperatures and precipitation in tourism sector	!!! (Lumbarda, Korčula) !! (Vela Luka, Blato, Smokvica)	+	+	**
Risk to fisheries due to sea temperature rise, changes in water circulation, sea level rise and increase in sea acidity	!!! (except sea level rise !!)	+	+	**
Risk of coastal flooding	!!!	+	+	**

!: Low; !!: Moderate; !!!: High
+: Growth ; _: Decline ; =: no change; ? = not know
*: Low; ** Moderate; *** High

With regards to possible consequences to the target area should no intervention on vulnerabilities and risks is undertaken i.e. with no additional adaptation measures applied, the following can be expected:

- Agriculture sector
  - lower yields followed by a decrease in incomes and consequently decrease in employment
  - higher needs for irrigation
  - changes in duration of the vegetation period (e.g. earlier maturation of olives, shorter vegetation period for wine)
  - decrease in the number of family farms
- Forestry sector
  - damages of forest ecosystems and decreased value of their functions of general benefit
  - reduced possibility for economic exploitation of forests followed by a decrease in incomes and consequently decrease in employment

- Water supply sector
  - Lack of water for households and / or more frequent and longer periods of unavailability of healthy water for human consumption
  - Lack of water for industry (including tourism)
  - Lack of water for irrigation
- Health sector
  - Increase in mortality and hospitalization due to, above all, circulatory diseases
  - Overload on the health system due to higher number of patients and treatment costs
- Tourism
  - Reduced tourist demand in the summer months (high temperatures, extreme weather conditions) which can lead to a drop in income and thus employment
  - Reduction and loss of ecosystem services due to climate change
  - Occurrence of damages and / or reduced functionality of various infrastructure systems such as: beach infrastructure, horticulture, and ecosystems, biodiversity and culture in general, heritage important to tourism due to the indirect and direct effects of climate change
- Fisheries
  - Decline in catch and consequently a decrease in income and employment
- Coastal management
  - Direct damage on property (in settlements, on infrastructure etc)
  - Direct damages to the environment, protected areas, cultural heritage which decreases the attractiveness of the area

1.2 Final scenario

Final (optimal) scenario assumes that in the near future there will be certain changes i.e. adaptation measures will be implemented which will result in avoidance or a reduction of climate change negative effects or in an increase of the climate change resilience. This scenario was developed by applying the focus group approach meaning gathering diverse stakeholders in one place with the aim to discuss current situation/problems and possible actions to alleviate expected consequences of climate change as well as to define adaptation measures that would constitute an optimal scenario.

1.2.1 PP1 – IRENA - Istrian Regional Energy Agency

Respecting the basic concept of risk assessment and its three components (dangerous event, vulnerability with its two dimensions - sensitivity and capacity, exposure), adaptation measures actually reduce the risk by reducing system vulnerabilities, whether sensitivity decreases or capacity increases, and in some cases reducing exposure. Therefore, the basic basis for the proposal of adaptation measures was "Climate change vulnerability and risk assessment" for each individual local self-government from which the vulnerability of individual sectors is evident. The focus group method, which consisted of various relevant stakeholders, was applied for the sake of quality and constructive discussions about the general state of a number of systems / sectors and development goals, and appropriate adjustment measures that would be components of the optimal scenario. In this regard, the optimal scenario and the accompanying measures of adaptation to climate change are the result of the focus groups work.

In principle, according to their character, measures can be:

- Preparatory - include the preparation of analyses / bases necessary for the implementation of a particular measures concrete adaptive effect, are usually short-term

- Implementational - measures with concrete adaptive effect, usually medium - term or long-term

- Educational-promotional - raise the level of knowledge and awareness, usually continuous applications or are repeated at certain time intervals

Capacity is further divided into coping capacity and adaptation capacity. There are a number of factors that form an integral part of adaptive capacity such as: level of knowledge, awareness and education on climate change and its possible effects, availability of new and/or more advanced technologies, capacities and efficiency of institutions and application of the legislative framework, economic parameters (GDP, employment rate etc.).)

In order to evaluate climate change adaptation measures that would form the optimal scenario action, certain criteria are defined as follows:

CRITERIA	DESCRIPTION	RESULT
Significance	Risk diminishment potential	High / Medium / Low
Urgency	Are consequences already being felt? Is the measure implementation process log?	Yes / No
Feasibility	Are there any obstacles to the implementation process? If so, which ones?	Yes / No
Cost efficiency	What is the measure effect and invested funds ratio?	High / Medium / Low
Multiple usability	Does the measure bring benefit independently from climate change?	Yes / No
Synergy effect	Does the measure have positive effect also on other sectors/areas? If so, which ones?	Yes / No

Climate change adaptation measures that are high risk reduction potential should be implemented as soon as possible, also measures without significant obstacles to concrete implementation, cost effective measures, measures with positive effects on other areas/sectors as well as bringing benefits even regardless of climate change are assessed as the relatively most appropriate measures where it is estimated that each criteria has the same weight factor or equally contributes to the convenience of the measure.

However, although individual measures are evaluated according to the above criteria, and although some of them do not have a concrete adaptive effect (or very small, which especially refers to the preparatory measures), i.e they are not optimal by all criteria, they are necessary as a whole and in that sense the final result should be observed. At the same time an advantage is given to measures in the jurisdiction of self-government units or related institutions (in relation to measures at the state level).

Measures are also divided by sector (agriculture, health, water supply, tourism, coastal zone, etc.) and are as such presented later in this document along with their evaluation tables. It should be noted that the result of the focus group showed the need for a holistic view and acting in the context of the optimal scenario, the introduction of measures in both the drainage and spatial sectors planning, which were not

an integral part of climate change vulnerability and risk assessment document. Also, no special adjustment measures have been proposed for the Fisheries sector due to the unavailability of relevant information regarding the situation in the sector and the effects of climate change up to today.

Agriculture sector

Drought has already affected the area of Istrian County several times. According to the 2003 Census of Agriculture, the irrigation rate in the area of Buje, Novigrad and Brtonigla was low (on average about only 1%) which often encourages farmers to produce two-year-old seedlings which bring faster revenue. In addition to the above, the agricultural sector is a significant source of income, especially for Brtonigla and Buje. There is a significant number of family farms, almost 10% of all family farms in the County are family farms of these three local self-government units.

In the context of expected climate change or drought, there are certain sector weaknesses, and it is necessary to upgrade knowledge in the field of irrigation as well as to implement it on concrete projects. In this regard, the optimal scenario envisages three measures in the agricultural sector as follows:

SECTOR	HAZARD	MEASURES
Agriculture (3)	Drought	Education of farmers in the field of financial support for project development and entrepreneurial knowledge
		Construction of mini and micro reservoirs for irrigation
		Continued co-financing of crop, animal and plant insurance premiums

Health sector

Heat waves are not uncommon in the Adriatic area in the summer months. In 2017, the Ministry of Health prepared a "Protocol on actions and recommendations for protection from the heat. " It includes the necessary procedures for preparedness and action at national and local level in case of danger of heat waves, as well as recommendations to reduce the risk to individuals and in institutional settings. It also sets out the obligations of individual participants after heat wave forecasts and tips on how to react and behave during high heat waves. In the context of expected climate change, with more frequent and/or more intense heat waves being possible and the consequent high risk of heat stroke, full implementation is very important of the said protocol at the local level.

Furthermore, when it comes to the adjustment of the Health sector, health coverage of the population (including tourists) is also extremely important. Since comprehensive health care is provided in Pula and Rijeka, an hour or more away, the local population usually used the services in Isola, Slovenia. The focus group also recognized the importance of green infrastructure in the context of heat waves. Following all

of the above, the optimal scenario for the Health sector foresees 4 adjustment measures for climate change as follows:

SECTOR	HAZARD	MEASURES
Health (4)	Heat wave	Implementation of the Protocol on Procedures and Recommendations for Protection against Heat
		Establishment of a new or transformation of an existing health institution in order of improving health care coverage
		Installation of green and smart canopies at public transport stops and public car parks
		Integrating green infrastructure into spatial plans

Water supply sector

Water supply in the area of operation of Istarski vodovod d.o.o. is very high and amounts to about 99.7%. In the area of Buje, the highest percentage of water consumers is the household sector (with a share of somewhat more than 70%) while in other considered areas (Novigrad, Brtonigla) in recent years it is still the industrial or tertiary sector (with a share of slightly more than 50%). Irrigation seems to have a small share in water consumption in the whole area (on average 4-7%).

Water supply and drainage should be viewed in the context of climate change and sustainability of natural resource management. In this sense, consumption and user behavior are important (public awareness). For example, in the municipality of Brtonigla the largest consumption of water is realized during the summer months for irrigation of green park areas and for showers on the beach in Karigador. The latter can be assumed for other local government units in the area. According to available information, there are no special educational programs to raise public awareness of efficient water consumption.

In terms of losses in the water supply network, at the level of Istarski vodovod d.o.o. that share amounts to about 17.88%, which is twice less than the EU average (34%), but also significantly less compared to the average of public water supply systems in Croatia (about 40%). However, in the context of sustainable management of natural resources, respecting their limitations as well as the aging of the system, further efforts should be made to minimize these network losses. Furthermore, the problem of floods is not significantly pronounced for the considered area but is relevant in the context of expected extreme rainfalls. Following all of the above, the optimal scenario for the water supply and sewerage sector would include five measures as follows:

SECTOR	HAZARD	MEASURES
Water supply (5)	Drought	Reconstruction of the water supply network
		Implementation of educational programs on efficient water consumption
		Water consumption savings in LGU buildings
		Introduction of eco-smart showers on public beaches
		Construction of a comprehensive public wastewater drainage system, inclusive with purification system for water reuse

Tourism sector

Insight into the development documents of individual local self-government units of the target area, both in the domain of general and in domain of tourism development (where they exist), shows that the connection with climate change in this regard is not sufficiently recognized (with the exception of the City of Buje-Buie where the 2018-2025 Tourism Development Strategy directly describes the issue of climate change and the sensitivity of the City space through natural risks). Namely, most local governments see the importance of diversifying the tourist offer, reducing seasonality and dependence on sun and sea product, but not in the context of expected climate changes. Although due to the complexity of the topic and different interdependencies, some set objectives will contribute to some extent to increasing the capacity of adapting to climate change, in the long run it is important to integrate the domain of climate change into strategic-planning-development documents.

The focus group also recognized the importance of raising the capacity of knowledge in the tourism sector as well as a unique marketing activity for the entire considered area or the entire cluster of NW Istria (which belongs to Umag). All tourist boards of the Buje region participate in the cluster of NW Istria, but also some of the largest tourist companies have facilities in the area and in this regard the existing cooperation and coordination of activities can be considered satisfactory.

Following all of the above, the optimal scenario would involve a series of climate adaptation measures changes as follows:

SECTOR	HAZARD	MEASURES
Tourism (6)	Extreme temperatures and high precipitation	Integrating the domain of climate change into strategic planning documents of tourism development
		Encouraging the development of sports and recreational tourism
		Encouraging the development of cultural tourism
		Encouraging the development of agritourism
		Education of tourism workers on climate change
		Development of a unique Marketing Plan for the development of tourism in the NW Istria cluster

Coastal belt

Measurements of mean sea level rise in the Adriatic area indicate that the rise was very small between 1950-1990 and that it has since accelerated and in recent decades has been around 3 mm/year or about 30 cm in 100 years. Occasional extreme sea level which in turn led to flooding of coastal areas and coastal erosion should also be added.

Estimates of sea level rise with the added effects of occasional extreme sea levels show extreme intermittent sea levels rise ranging from about 1.4m to even 2.2m by 2100. However, on top of the fact that almost the entire Croatian coast is endangered by high risk of sea floods, it should be noted that there is a large disparity in the level of vulnerabilities and risks of certain parts of the Croatian coast. In this regard, additional space is needed for specific research as one of the preconditions for the development of the coastal zone. Discussion within the focus group articulated certain difficulties, due to the lack of up-to-date hydrographic data that forms the basis for further design of coastal infrastructure (it is primarily zero sea level which has proved in practice to no longer correspond to real sea levels). Also, it is stated that the reconstruction of the existing and possibly the construction of new breakwaters is needed because the existing infrastructure do not meet the existing conditions.

SECTOR	HAZARD	MEASURES
Coastal belt (3)		Climate change Vulnerability and risk assessment of the coastal belt of Buje-Buie, Novigrad-Cittanova and Brtonigla-Verteneglio area
		Continuous updating of the hydrographic database
		Reconstruction of existing breakwaters and/or construction of new ones

Spatial planning

The basic precondition for the sustainable development of a whole, such as an island, is certainly integrative spatial planning. In order to find a long-term sustainable solution that optimally uses the available resources, protects the environment and nature and prevents conflicts of different stakeholders for the same space, it is necessary to apply integrative spatial planning. Recognizing the complexity of climate change impacts and a parallel impact on a number of sectors, this concept is all the more significant. Therefore, the listed measure certainly constitutes a basic component of the optimal adaptation scenario:

SECTOR	HAZARD	MEASURES
Spatial planning (1)		Education of decision makers in the domain of integrative spatial planning

The influence of participation and consultation on the final scenario is listed in the previous text. The stakeholders who contributed the most include the local government units of the City of Buje, City of Novigrad and Municipality of Brtonigla, as well as Umag Port Authority.

1.2.2 PP2 – City of San Benedetto Del Tronto

The final scenario construction has been developed with a significant integration of the participatory process, as described in the appropriate deliverable 4.1.2.

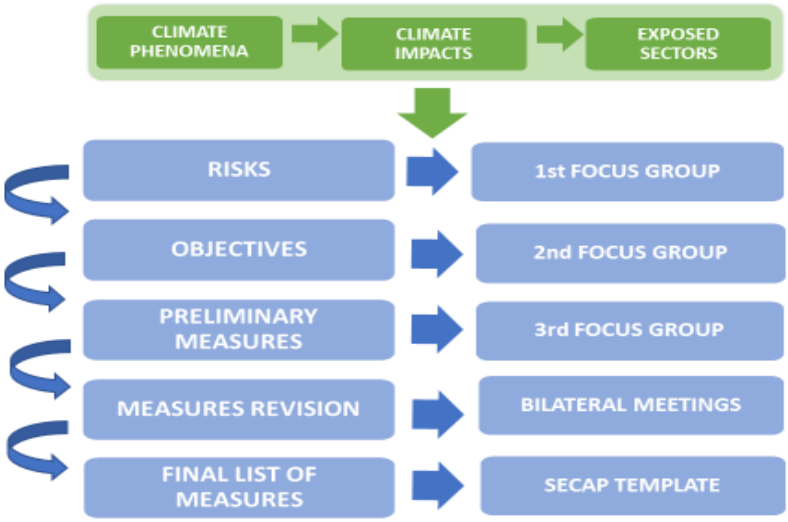
The process has started on the basis of the results produced by Scenario zero and Vulnerability Risk Assessment (cfr. Fig 1) and it followed the logical steps described below:

I. Risk definition (1st Focus Group)
II. Objectives definition (2nd Focus Group)
III. Preliminary measures definition (3rd Focus Group)
IV. Measures revision (Bilateral web meetings with each of the 4 Municipalities)
V. Final list of measures and compilation of the measures-sheet.

Every step has been shared with stakeholders and particularly steps 1-2-3 have been discussed during the focus groups (public meetings with the stakeholders). Steps 4 and 5 have been examined during appropriate Bilateral web meetings, conducted with each of the 4 Municipalities – following the conclusion of the 3rd focus group[1]. Each single step is shortly described below.

[1] The three focus groups have been managed like that:
- the group of experts provided the stakeholders with a a list of potential risks/objectives/measures – depending on the focus
- the list was described at a very deep level

Figure 1 – Final scenario construction process

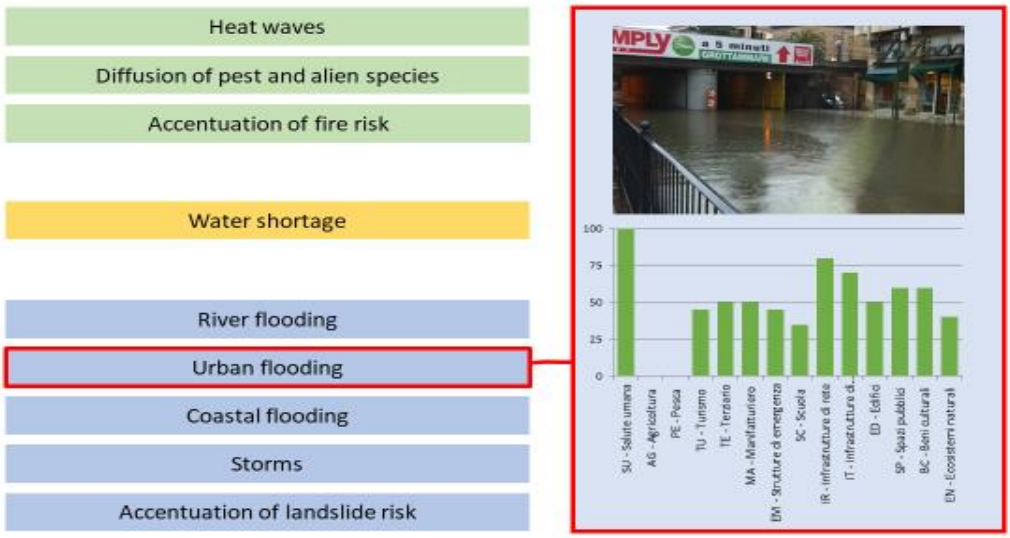


I. Risk definition

On the basis of all the information collected in the previous activities, particularly in the Vulnerability and Risk Assessment and the analysis of existing land-use Plans/Programs, and of scientific, academic and institutional sources and references, it was possible to define a list of the main potential risks that can possibly impact the pilot area, deriving from the most relevant climate impacts on the exposed sectors – as defined by the CoM. A risk is indeed "any potential threat of adverse effects of a climate hazard on a territory, its living organisms, the environment, its activities, etc." (IPPC 2018).

- the group of experts provided a web survey to the stakeholders, following the previous discussion
- the stakeholders responded to the survey with their point of view and their priorities
- the group of experts collected the infomation, analyzed the answers and elaborated a shared list, that provided the baisis for the process continuation

Figure 2 – Climate impact effects on the exposed sectors: urban flooding example



The whole list of potential risks was shared with the stakeholders. The group of experts described in depth the risks, their meaning and some examples, and finally submitted it to the stakeholders in the form of an online survey, inviting them to express, in a hierarchical scale, the relevance of each of the presented risks, and then to add some notes to give further information.

The group of experts collected and elaborated the information, including weighing and statistical models application, then, arranged it hierarchically, so to draft a new revised list of risks, with some comments, better illustrating the stakeholders' point of view.

Tab. 1 shows the final list composed by 73 risks, each of them related both to a climate impact and a sector. The list includes 27 risks related to the increase of temperature, 6 risks related to the decrease of precipitation and 40 risks connected with the extreme weather events – which appeared to be definitely the most relevant risks perceived by local actors.

Tab 1 – List of potential risks

climate phenomena	Climate impact	Exposed sectors	Risk
Increasing temperature	Heat waves	HUM	Increase in cardio-respiratory diseases, allergic and asthmatic attacks and heat strokes
		FAR	Decrease in agricultural productivity due to phenology cycles alteration, organic substance and soil humidity loss
		TOU	Decrease in touristic attractivity because of worsening of microclimate
		MAN	Alteration of productive processes caused by high temperatures (agri-food industry and cold chain)
		EME	Increase in sanitary intervention requests with consequential overloaded emergency medical services (ER)
		INF	Electric energy disruption due to overloaded networks caused by demand peaks or decrease in the supply
		TRA	Increased wear of transport infrastructure (asphalt and railway)
		BUI	Worsening of buildings performing features
		PUB	Decrease in the wellbeing in public spaces
		HER	Buildings deterioration acceleration (thermal stress damages and increase in humidity cycles)
		ECO	Phenology cycles alterations
	Diffusion of pest and alien species	HUM	Increase of infectious diseases from insect vectors
		FAR	Decrease in agricultural productivity due to the spread of phytopathologies
		FIS	Fishing stock alteration
		TOU	Algal bloom or diffusion of jellyfish with impacts on bathing
		ECO	Ecosystem alteration
	Accentuation of fire risk	HUM	Safety risk for the population
		FAR	Damages to crops
		TER	Loss of stored material
		MAN	Loss of stored material and related accidents due to the presence of flammable materials
		EME	Reduced accessibility to emergency services and increase in sanitary intervention requests
		INF	Disruption of public utility services due to structure damages
		TRA	Traffic circulation disruption
		BUI	Buildings structural damages
		PUB	Damages to urban greening/green areas
		HER	Damages to structures and historical elements
		ECO	Loss of habitat and species
Decrease in Average Precipitation	Water shortage	HUM	Decrease in water availability for civil use
		FAR	Decrease in agricultural productivity due to water scarcity or quality worsening for irrigation purposes
		MAN	Decrease in water availability for industrial use
		INF	Water supply disruption/pressure drops, increased withdrawals in aquifers with salt intrusion accentuation, increased necessity of water treatment
		PUB	Management difficulties of public spaces and urban green areas
		ECO	Reduced watercourse capacity / of sediment supply with salt intrusion accentuation / of coastal erosion
Extreme weather events	River flooding	HUM	Safety risk for the population
		FAR	Damages to crops
		TER	Loss of stored material due to flooding
		MAN	Loss of stored material due to flooding
		EME	Reduced accessibility to emergency services
		INF	Disruption of public utility services due to structure damages

		TRA	Traffic circulation disruption
		BUI	Buildings structural damages
		HER	Damages to structures and historical elements
	Urban flooding	HUM	Safety risk for the population
		TOU	Limited bathing due to temporary (marine) pollution
		TER	Loss of stored material due to flooding
		MAN	Loss of stored material due to flooding
		EME	Reduced accessibility to emergency services
		EDU	Reduced accessibility to education services
		INF	Overloaded drainage networks with activation of spillways
		TRA	Traffic circulation disruption
		BUI	Buildings ground floors flooding
		PUB	Impracticability and damages to public spaces due to flooding
		HER	Damages to structures and historical elements
		ECO	Accidental water pollution
	Coastal flooding	HUM	Safety risk for the population
		FIS	Damages to fishing boats and equipment
		TOU	Damages to seaside/beach structures and equipment
		TRA	Damages to the railway network
		PUB	Damages to beachside public spaces and equipment
		ECO	Habitat losses due to the increase in coastal erosion
	Storms	HUM	Safety risk for the population
		FAR	Damages to crops
		TOU	Damages to seaside/beach structures and equipment
		EDU	Damages to structures and education service disruption
		INF	Electric energy disruption due to structural damages
		TRA	Traffic circulation disruption
		BUI	Damages to seaside/beach structures and equipment
		PUB	Public spaces damages
	Accentuation of landslide risk	HUM	Safety risk for the population
		INF	Disruption of public utility services due to structure damages
		TRA	Traffic circulation disruption
		BUI	Buildings damages
		HER	Damages to (raised) medieval centers

II. Objectives definition

Second working step – carried out in the 2nd focus group - regards the definition of the objectives that the Plan aims to reach, to prevent, to minimize, to manage the previously identified risks.

In the sequence risk/objective/action, the objective is the central factor, that represents the answer to a risk, and that will be concretely accomplished by an action.

The SECAP adaptation objectives are extremely important to set the vision of the Plan, to understand which are the main issues faced by it and the main sectors involved, to properly catch which direction it foresees to fight climate change, particularly referring to adaptation issues.

The methodology was the same of the one used for risks definition: the group of experts shared and deeply described a potential list of objectives2, their meaning and some examples, and thereafter the list has been submitted to the stakeholders in the form of an online survey, inviting them again to express the relevance of each of the presented objectives, in a hierarchical scale, and then to add some notes to give any further useful information.

The group of experts collected and elaborated the information – both qualitative and quantitative - and drafted a new revised list of objectives, with some comments, taking into account even more the stakeholders' point of view.

Tab. 2 shows the final revised list composed by 23 objectives, each of them related both to a climate impact and a sector. The list includes different kinds of objectives: there are several objectives related to a single climate impact, and some others regarding more than one impact, and in some cases also more than one sector.

Tab.2 – SECAP Objectives list

climate phenomena	Objectives
Increasing temperature	Improve private and public buildings climate comfort (insulation, cooling, and shading)
	Improve public open spaces climate comfort (greening and urban and peri-urban reforestation)
	Ensure the continuity of electric energy and water supply even during demand peaks
	Promote resilient agriculture to increasing temperatures
	Adapt tourist promotion strategies (seasonal adjustment, structure adaptation, etc.)
	Reduce primary sector (agriculture and fishing) and natural habitats vulnerability with respect to the spread of new diseases
	Prevent fire risk in urban and peri-urban areas
Decrease in Average	Encourage an efficient use of water resources in private uses, economic activities and in agriculture
	Monitor water capacity and promote the maintenance of minimum flows
Extreme weather events	Improve the territorial water system response (safeguard works, flows regulation, drainage systems, open spaces permeability, etc.)
	Promote public and private buildings flood proofing in urban areas
	Improve the urban water system response (open spaces permeability, greening, maintenance of water invariance, etc.)
	Ensure efficient urban drainage and depuration systems
	Reduce infrastructure /equipment vulnerability
	Protect the coast with anti-erosion measures
	Decrease crops vulnerability (protective tools against hail, drainage systems, etc.)
	Guarantee regular maintenance of green urban areas
	Improve slope stability
General objectives	Improve the population's knowledge on impacts, preventive behavior, efficient use of resources, and behavior during emergencies
	Improve the answering capacity of emergency infrastructures (Civil protection and first aid/emergency response)
	Adopt insurance protection systems
	Improve monitoring and early warning systems to prevent risks
	Ensure the monitoring of buildings and natural ecosystems

[2] Among the main references: Climate Adaptation National Plan and Strategy, IPCC Reports, JRC/Com Reports, Good practices of Regional Climate Plans in Italy

III.-IV. Preliminary measures definition and measures revision

The third step of the process is the measures definition. It is the central phase of the planning process in which local authorities are called to identify the actions and the concrete measures that the Plan foresees in order to achieve its intervention strategy.

The Plan has been structured referring to some main general criteria:

- The cross character of the SECAP Plan – particularly of the adaptation issues – that implies the progressive integration of the plan actions into the ordinary planning instruments
- The SECAP nature that identifies the Plan as a "container" of actions and measures already foreseen in local or supralocal existing plans, and that within the SECAP Plan, will be further finalized and strengthened.

Main information sources for the preliminary measures' definition are:

- The previsions of the supralocal existing Plans (e.g., Flood Risks Management Plan, Regional Integrated Coastal Zone Management Plan, etc.)
- The international and national references at scientific and institutional level [3]
- The geographical maps resulting from the Risks and Vulnerability Assessment
- The stakeholders' recommendations, collected during the participatory process.

On these bases it was possible to compile a list of preliminary potential measures, related both to a climate impact and to a sector. This list contains 63 measures. The group of experts intentionally chose to propose to stakeholders a high number of measures in order to further encourage them to express their opinion and better seek for their optimal answer; the presentation of an extremely detailed list of actions, sometimes really accurate, allowed a better comprehension of the meaning and the potential effects of each action - from the stakeholders, giving a meaningful and effective contribution to the planning process.

Once the stakeholders gave their advice and opinion on the proposed measures through the online survey, it was possible to draft a revised list of measures, better organized, which greatly corresponds to the stakeholders' opinion, much shorter and more representative at the same time - than the initial one.

After the three focus groups meetings, another participatory activity was carried out: 4 bilateral web meetings were organized with each of the 4 municipalities of the pilot area. This step allowed a more

[3] Among the main references: Data base CLIMATE–ADAPT (EEA, European Environmental Agency); Data base of Climate Adptation National Plan; JRC/Com guidelines and data base; Good practices of SECAP or Climate Plans in Italy

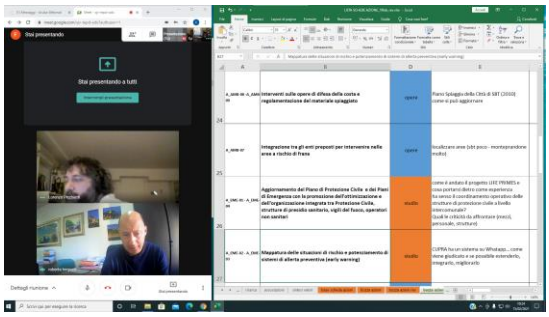
suitable moment for exchange of views and discussion on a “private” level, that has definitely been useful to deepen the single plan measures, and to recognize the effective priorities of the local actors (see fig 3).

Moreover, during each meeting the group of experts collected some important information necessary to fill in the measures sheet (see point 6. below).

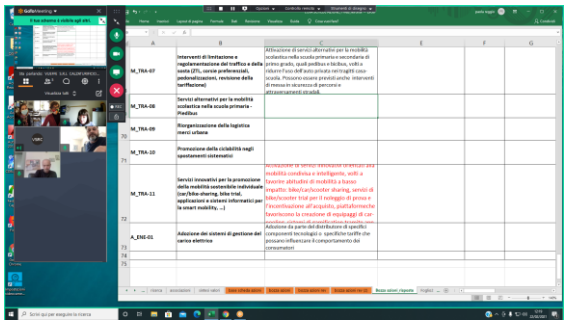
At the end of the consultation activities as described above, the final list of measures, that the SECAP will include, was drafted (see tab. 3).

Generally, all the stakeholders have actively contributed to the planning process; particularly the local administration, at local and regional level, and the representatives of university and associations.

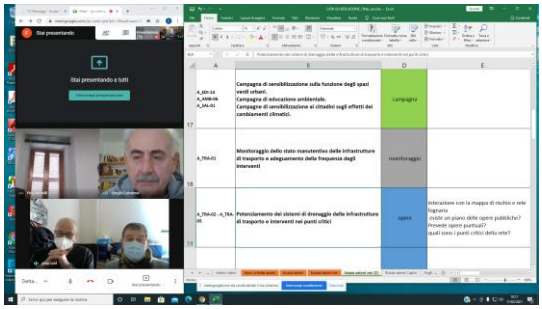
Figure 3 – Screenshots of the bilateral web meetings



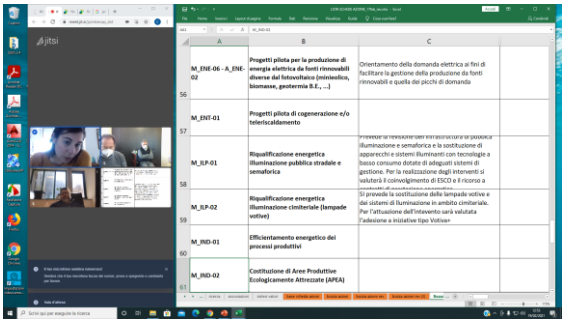
Cupra Marittima (15/02/2021)



Grottammare (22/02/2021)



Monteprandone (17/02/2021)



San Benedetto del Tronto (19/02/2021)

Tab. 3 - SECAP measures list – adaptation

SECTOR	HAZARD	MEASURE
Water	water shortage	Water supply network adjustment
		Sewage system adjustment
	water shortage / extreme weather events	Waterbody maintenance and monitoring
Agriculture & Forestry	water shortage	Irrigation system adjustment
	increased temperatures / extreme weather events	Services to support resilient agriculture development
Environment & Biodiversity	increased temperatures / extreme weather events	Coastal protection and development interventions
Buildings	extreme weather events	Sustainable urban drainage interventions
	increased temperatures	Interventions of urban reforestation
	increased temperatures / extreme weather events	Interventions in landslide risk areas
Education	water shortage	Awareness raising campaign on the efficient use of water resource
	extreme weather events / water shortage / increased temperatures	Awareness raising campaigns on climate change impacts for citizens
Civil Protection & Emergency	extreme weather events	Optimization of the Civil protection system
		Development of early warning systems
Land Use Planning	extreme weather events / water shortage / increased temperatures	Adjustment of municipal planning tools to climate change impacts
	increased temperatures	Implementation of Green Infrastructure planning tools
	extreme weather events	Promotion of River and Coastal Contracts
Tourism	increased temperatures / extreme weather events	Services to support sustainable tourism development

V. Final list of measures and compilation of the measures-sheet.

The final draft of measures represents the final scenario of intervention foreseen by the pilot area. It will include both individual and joint actions.

A final activity will complete the planning process: the punctual description of each measure, that will be filled in the appropriate measure-sheets, provided by action 4.3 of Joint SECAP project, and totally consistent with the guidelines of Covenant of Mayor.

The measure-sheets will include all the information about the measure implementation, a short description, the climate impact addressed, the sectors involved, the nature of the action (hard/soft/grey/green), the actors involved, the implementation methods, the time horizons, etc. (see Deliverable 4.3).

1.2.3 PP3 – Abruzzo Region

Developing optimal scenarios for adaptation is a strategic medium- to long- term planning tool. In order to build the base of optimal scenario we selected general objectives on the basis of the common vision already shared during face to face meetings with municipalities involved in the project. Five are the main objectives: tackle the territorial instability, enhance green infrastructure, increase the resilience of the urban environment, reduce land use, set up a resilient community. For a better definition of the optimal scenario option, we decided to organize participatory activities with the involvement of stakeholders through focus groups, managed by the Joint Action coordinator in order to select climate measures at a wider territorial level, necessary for climate adaptation plans.

Adaptation actions are actions aiming at managing the climate risks posed to human and natural systems as well as taking advantage of any positive opportunities that may arise. This means that adaptation actions may be addressed to reduce sensitivity and/or exposure to climate change or to enhance adaptive capacity.

Also, adaptation options aim therefore at:

- Accepting the impacts and bearing the losses that result from risks
- Off-setting losses by sharing or spreading risks
- Avoiding or reducing exposure to climate risks
- Exploiting new opportunities.

To build a portfolio of actions, firstly a desktop review was undertaken of the existing literature and information on climate change adaptation actions available at:

- the European level from JRC;
- the national level from PNACC;
- the local level - Adaptation plans from the Italian municipalities involved in the Life Sec Adapt project. They are in Marche Region and they are facing similar problems in similar geographical contexts.

42 options of actions were selected starting from the results of R&V assessment and literature review. They take into account the real competences of the municipal administrations, that include:

- communication activities,
- regulatory activities,
- design of public works,
- territorial and urban planning activities
- monitoring activities.

The selected adaptation options were categorized in grey, green and soft measures:

- grey: correspond to physical interventions using engineering services to make buildings and infrastructure more capable of withstanding extreme events.
- green: contribute to the increase of ecosystems resilience and can halt biodiversity loss, degradation of ecosystem and restore water cycles. The underlying principle is that healthy ecosystems can play a vital role in maintaining and increasing resilience to climate change and in reducing climate- related risk and vulnerability.
- soft non-structural approaches, correspond to design and application of policies and procedures, land-use controls, information, dissemination and economic incentives to reduce vulnerability, encourage adaptive behaviour or avoid maladaptation. They require careful management of the underlying human systems. Some of these measures can facilitate the implementation of grey or green measures (e.g. funding, integration of climate change into regulations). Soft options include, therefore, policy, legal, social, management and financial measures that can alter human behaviour and styles of governance, contributing to improve adaptation capacity and to increase awareness on climate change issues.

Adaptation actions can also contribute to the development of new skills and professionals.

The criteria used to select the actions give priority to:

- **“win to win” actions** that are able to mitigate the impacts of climate change on the territory, with an effectiveness both in terms of mitigation and adaptation;
- **“no-regret” actions** are cost-effective under the current climate conditions and would be further justified under the increased risks of projected climate change;
- **"low-regret" actions** options include adaptive measures with relatively low associated costs and potentially large benefits under the future climate conditions.

It's important to stress the attention on the participatory process, that is a fundamental part of Joint Secap project.
We have worked on how best to address the risks of the target areas, by identifying a range of adaptation options and then selecting, through a participatory process, preferred adaptation options using specific criteria. Therefore, the group of municipalities of each target area jointly have elaborated a single set of actions in which distinguish among the common actions (undertaken by the signatories altogether), and the ones undertaken by individual signatories.

In the following tables for each target area are highlighted the Joint actions that will be implemented.

Sectors and hazards selected are coherent with the ones provided by the CoM. In particular, the climate hazards relevant for the two target areas are:

- extreme heat;
- heavy precipitation (heavy rainfall);
- drought and water scarcity;
- mass movement (landslides);
- coastal erosion (only for target area n.2 –coastal area);
- wild fires (only for target area n.1 – hill area).

The vulnerable sectors most relevant for each climate hazard encompass buildings; agriculture and forestry; environment and biodiversity; civil protection and emergency; tourism.

TARGET AREA 1 - HILLY AREA		
SECTOR	**HAZARD**	**MEASURES**
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Wild fire	Communication activities for private companies
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Wild fire	Communication activities for citizens
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Wild fire	Communication activities for tourism sector

TARGET AREA 1 - HILLY AREA		
SECTOR	**HAZARD**	**MEASURES**
Buildings Agriculture and forestry Tourism	Extreme heat Drought and water scarcity	Promotion activities for water saving, recycling and reuse
Buildings Agriculture and forestry Tourism	Extreme heat Drought and water scarcity	Encouragement of water consumption from public aqueducts
Buildings	Extreme heat Heavy precipitations	Promotion of thermal insulation for private buildings
Environment and biodiversity	EXTRA	Promotion of the "Plastic free" campaign at school
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations	Monitoring and warning of extreme events in the urban environment
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Wild fire	Common methodology for the monitoring of the actions of the Plan
Buildings Environment and biodiversity	Extreme heat Heavy precipitations Drought and water scarcity	Update of the building regulations
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations Mass movement Wild fire	Update of the urban and rural police regulation
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations Mass movement Wild fire	Update of the Implementing Technical Standards and variations to the Town Planning
Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations Wild fire	Drafting of the risk management plan for trees
Agriculture and forestry Environment and biodiversity Civil protection and emergency	Heavy precipitations Mass movement	Identification of the road network at risk of flooding and implementation of optimal management of water drainage

TARGET AREA 1 - HILLY AREA		
SECTOR	**HAZARD**	**MEASURES**
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Wild fire	Creation of a working group among JS Municipalities
Civil protection and emergency	Heavy precipitations Mass movement Wild fire	Update of the municipal emergency plan for civil protection
Agriculture and forestry Environment and biodiversity	Extreme heat Heavy precipitations	Cadaster of trees affected by alien species
Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Wild fire	Implementation of river contracts
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Mass movement Wild fire	Forest fire cadaster update and application of restrictions to cadastral parcels
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Wild fire	Public works program for works related to the risks faced by the Plan (including hydrogeological risk)
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency	Heavy precipitations Mass movement	Protection of banks of water bodies at risk of flooding in industrial, residential, agricultural and infrastructure areas
Buildings	Extreme heat Heavy precipitations	Thermal insulation in public buildings
Environment and biodiversity Tourism	EXTRA	Installation of charging stations for electric cars
Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations	Maintenance of natural areas (agricultural, wetlands, lakes) where to allow the flooding of rivers

TARGET AREA 1 - HILLY AREA		
SECTOR	**HAZARD**	**MEASURES**
Buildings Agriculture and forestry Environment and biodiversity Tourism	Extreme heat Heavy precipitations Mass movement	Urban greening
Agriculture and forestry Environment and biodiversity Civil protection and emergency	Heavy precipitations Drought and water scarcity Mass movement Wild fire	Strengthening the maintenance of water courses

TARGET AREA 2 - COASTAL AREA		
SECTOR	**HAZARD**	**MEASURES**
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Coastal erosion	Communication activities for citizens
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Coastal erosion	Communication activities for tourism sector
Buildings Agriculture and forestry Tourism	Extreme heat Drought and water scarcity	Promotion activities for water saving, recycling and reuse
Buildings	Extreme heat Heavy precipitations	Promotion of thermal insulation for private buildings
Tourism	EXTRA	Encouragement of the bike sharing service
Environment and biodiversity	EXTRA	Promotion of the "Plastic free" campaign at school
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations	Monitoring and warning of extreme events in the urban environment

Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Coastal erosion	Common methodology for the monitoring of the actions of the Plan
Buildings Environment and biodiversity	Extreme heat Heavy precipitations Drought and water scarcity	Update of the building regulations
Agriculture and forestry Environment and biodiversity Civil protection and emergency	Extreme heat Heavy precipitations	Drafting of the risk management plan for trees
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Coastal erosion	Creation of a working group among JS Municipalities
Civil protection and emergency	Heavy precipitations Mass movement Wild fire	Update of the municipal emergency plan for civil protection
Agriculture and forestry Environment and biodiversity	Extreme heat Heavy precipitations	Cadaster of trees affected by alien species
Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement	Implementation of river contracts
Buildings Agriculture and forestry Environment and biodiversity Tourism	EXTRA	"Blue Flag" certification
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Coastal erosion	Program agreements with other local authorities for public works and adaptation measures
Buildings Agriculture and forestry Environment and biodiversity Civil protection and emergency Tourism	Extreme heat Heavy precipitations Drought and water scarcity Mass movement Coastal erosion	Public works program for works related to the risks faced by the Plan (including hydrogeological risk and coastal erosion)

Environment and biodiversity	Drought and water scarcity	Installation of tap timers in public buildings
Environment and biodiversity Tourism	EXTRA	Installation of charging stations for electric cars
Environment and biodiversity Tourism	EXTRA	Strengthening cycle paths
Environment and biodiversity	Coastal erosion	Promotion of mitigation actions against coastal marine erosion by favoring and increasing the vegetation
Buildings Agriculture and forestry Environment and biodiversity Tourism	Extreme heat Heavy precipitations Mass movement	Urban greening
Agriculture and forestry Environment and biodiversity Civil protection and emergency	Heavy precipitations Drought and water scarcity Mass movement Coastal erosion	Strengthening the maintenance of water courses

1.2.4 PP4 – Municipality of Pescara

The final scenario is the result of the following three phases: 1) a participatory process, 2) data analysis of the stakeholder surveys, 3) final elaboration. The participatory process was organized as focus groups on two steps: 1) the first focus group (carried out on 9th of December) was organized to give to the municipality technicians and administrators of the target area and to stakeholders an introduction to the basic concept of climate change, adaptation and the analysis of the climate profile of the target area. After this introduction was shown the risk and vulnerability of the area and, finally, the process and the analysis that resulting in the scenario 0. After that a survey of more than 32 actions divided in 6 sectors (water, energy, transport, environment, land use, ICT) was introduced and discussed. The surveys were not collected at the end of the focus group, to give a time to the participants to share it with colleagues and expert of each sector of their organizations to have more reliable responses. After few days the Municipality of Pescara collected the surveys and was carried out the data analysis. The results of these analysis was a selection of the sectors and actions more important from the target area. The output of this activities was the identification of 5 sectors and 12 actions more relevant for the target area. The second focus group was carried out on 24th of January, again with the municipality technicians and administrators of the target area and stakeholder. In that meeting, after a short introduction, was shown the results of the first focus group survey and was explained the 12 more important actions that were the core of the second survey. For each action the participant had to select the priority among three classes (high, medium, low) and the implementation timing (short, medium and long term). Also, for this survey

was given more time to the participants to fill it after discussion with respective colleagues and experts of each sector of their organizations. After the collection of the surveys, they were analysed to understand the actions with higher common priority and those which are considered implementable in the short period. The sectors and actions more important and with a high chance to be implemented in the short period were identified using the convolution between priority and implementation timing with a common normalization to have the final result with the same score (1 to 3, that means low, medium and high) used for priority and for implementation time. The results are summarised in the table 2.

Table 2. Actions and sectors with higher priority and with shorter implementation time

SECTOR	HAZARD	MEASURES	SCORE (1-3)*
Land Use	Extreme precipitation	Policies to discourage Land Consumption	2.52
		Public natural areas self-managed by citizens	2.50
	Drought	Policies to discourage Land Consumption	2.52
Transport	Heatwaves	Promotion of sharing services (bicycles, scooters...)	2.29
		Installation of electric vehicle charging stations	2.52
Energy	Heatwaves	Energy efficiency in public buildings	2.06
ICT	Extreme precipitation	Digitization of administrative procedures	2.06
	Heatwaves		
	Drought		

* Score legend: 1 = low priority & long term, 2= medium priority& timing, 3= high priority & short implementation time

After the survey analysis was studied the impact of these actions on the scenario 0 to retrieve the final scenario. According to literature and previous research the actions do not impact substantially the risk level identified in the scenario 0 (table 1), since their influence are marginal for the risks identified. From previous experiences what we can argue is that the expected change of the intensity and frequency level, at least for the extreme precipitation hazard from 'not know' of the scenario 0 can be considered 'no change', see table 3.

Table 3. Final estimation of the risk to 2030 where the risk levels are reported according to the following classes: !: Low; !!: Moderate; !!!: High. The expected changes and frequency are categorised as follow: +: Growth; _: Decline; =: no change; ? = not know. The reliability of the estimation has the following three classes: *: Low; ** Moderate; *** High.

RISK	RISK LEVEL	EXPECTED CHANGE IN INTENSITY	EXPECTED CHANGE IN FREQUENCY	RELIABILITY OF ESTIMATION
Risk of extreme precipitation for shop and store (business activities)	**!!!**	**=**	**=**	*
Risk of extreme precipitation for Critical infrastructures in flood prone areas	**!!**	**=**	**=**	*
Risk of extreme precipitation for Farming activities and cultivation in flood prone areas	**!!**	**=**	**=**	*
Risk of Heat waves for Elderly citizen	**!!**	**+**	**+**	*
Risk of Heat waves in Tourism and Fishing economy	**!**	**+**	**+**	*
Risk of Drought in Aquatic parks, and swimming pool activities	**!**	**+**	**+**	*
Risk of Drought in Farming activities and cultivation	**!**	**+**	**+**	*

The participation and consultation results were central to identify the final scenario, to give the central role in this process to the local administrators, technicians and stakeholders. However, we experienced difficulties to have inputs form stakeholders and among the administrators and technicians of the Municipalities involved in the target area the most actives were those from Pescara, Montesilvano, San Giovanni Teatino and Spoltore. Administrators and technicians of Chieti, due to a change of the governance after last year election were not very active, whereas those of Francavilla, even if participated to the focus group meetings had problem to collect information and therefore to fill the final survey.

1.2.5 PP5 – SDEWES Centre

In the final, optimal scenario, the goal is to mitigate the CO2 emission by 40 % in the targeted area in comparison with the baseline emissions inventory, to achieve that, the mitigation measures need to be implemented. Due to inevitable climate changes and change in intensity and frequency of hazards, it is important to implement the adaptation measures and create a resilient society in the targeted areas. Most important adaptation measures are shown in the table below.

SECTOR	HAZARD	MEASURES
Agriculture	Drought	Development of the irrigation systems
		Analysis of the availability of reusing filtered wastewater and rainwater for irrigation purposes
		Education of the farmers
		Develop cadaster of the agricultural fields
Healthcare	Heatwaves	Improve warning info system for the heatwave threats
		Develop Analysis on the climate change impact to the disease frequency of citizens
Water supply	Drought	Educate the citizens about the importance of water savings
		Manage the water losses in the supply systems
		Cut the water consumption used for the irrigation of the green public areas and washing the streets
		Rationalization of water management in the public buildings
Tourism	Heatwaves	Develop tourist potential indicators considering biodiversity and environment around the targeted area
		Develop a Potential assessment and a Plan for the increase of the green areas
		Develop adaptation capacity to climate change in the tourism sector

Focus groups with the local stakeholders were a great help for the development of the measures – we got insight which measures should be modified to achieve greater impact, which entities from the area should be included for the implementation of the measures and could offer additional help. Also, we got

interesting suggestions for additional measures, for dealing with the problems the locals are familiar with. The scenarios will be further modified and updated during the development and implementation of Joint_SECAP.

1.2.6 PP6 – Primorje - Gorski Kotar County

Sectors analysed in RVA, in order to constitute an optimal scenario, have been extended as follows:

- **Water supply sector - Water management and the environment**
- **Health sector - Health sector and civil protection**
- **Tourism - Economy and tourism**

The reason for this is because sectors (defined in RVA) need to be observed in a broader context, when it comes to application of the measures.

Definition of the optimal (final) scenario was performed through several actions:

1. **The first action** consisted of bilateral meetings with the involved local governments (Kastav, Opatija, Čavle, Matulji, Viškovo). Representatives of each municipality /city discussed what are the plans, programs and projects in sectors concerned as well as which measures are most significant in their opinion. Based on these bilateral meetings, a list of proposed measures was developed, to be discussed further during the joint focus group workshop.
2. **The second action** was holding a focus group workshop which gathered a diverse group of attendees, from local to County level experts, different associations, utilities etc. Each participant contributed to the development of the final scenario through group discussion, filling out an onsite survey (which was defined to facilitate the estimation of the importance of measures proposed) and sectoral, intragroup sessions. Actors who have contributed the most, by detailing the situation in their sectors of expertise, are representatives from Liburnijske vode (water management company), from regional health centre, Opatija Tourist Board etc.
3. **The third action** was fine tuning of the measures and the optimal scenario, bilaterally with representatives of each municipality/city, based on additional criteria (urgency, feasibility, etc.).

The full scope of criteria used to evaluate measures are as follows:

CRITERIA	DESCRIPTION	EVALUATION
Importance	The potential to reduce the risk	Likert scale (1- not important to 5- very important)
Urgency	Are there consequences already? Is the measure implementation process long?	Yes/no
Feasibility	Are there any obstacles for the implementation? If yes, what and how intense are they?	Yes/no
Cost effectiveness	What is the ration between the adaptation impact and invested finances?	High/medium/low
Multiple usefulness	Does the measure bring welfare regardless of climate change?	Yes/no
Synergistic effect	Does the measure have positive effects on other sectors/areas as well? If yes, which one?	Yes/no

Estimation of the importance of each measure, carried out during the focus group using a specific survey, indicated that the majority of measures were important or very important (on average about 70-80% of such responses). For several measures where this was not the case, grading was mostly neutral i.e. moderate suggesting indecisiveness and uncertainty of the participants rather than lower importance. Survey results were thus a relevant indication and basis for further development of the final (optimal) scenario finalized through additional consultations and discussions in smaller groups.

Evaluation results are presented in the tables ahead. When analyzing the overall results, one should also bear in mind that, although certain measures are not optimal by all criteria, they are still considered necessary to form an integral, complete and sustainable adaptation.

Table 1. Evaluation of adaptation measures in the sector: Water management and the environment

CRITERIA	VOD-01	VOD-02	VOD-03	VOD-04	VOD-05	VOD-06	VOD-07	VOD-08	VOD-09
Importance*	high	moderate	high	high	high	high	moderate	high	high
Urgency	yes	no	yes	yes	yes	yes	yes	yes	yes
Feasibility	yes	yes	yes	yes	yes	yes	yes	yes, demanding	yes
Cost effectiveness	high	medium	high	high	medium to high	medium	medium to high	medium to high	high
Multiple usefulness	yes	yes	yes	yes	yes	yes	yes	yes	yes
Synergistic effect	yes	yes	not particularly	yes	not particularly	not particularly	yes	yes	yes

*High importance (≥70% of responses are important or very important), moderate importance (≥40% of responses are important or very important), low importance (<40% of responses are important or very important)

Table 2. Evaluation of adaptation measures in the sector: Health sector and civil protection

CRITERIA	ZDR-01	ZDR-02	ZDR-03	ZDR-04	ZDR-05	ZDR-06	ZDR-07
Importance*	high	moderate	high	high	moderate	moderate	high
Urgency	yes	yes	yes	yes	yes	yes	yes
Feasibility	yes	yes	yes	yes	yes	yes	yes
Cost effectiveness	high	medium	medium to high	medium to high	medium	high	high
Multiple usefulness	yes	not particularly	yes	yes	yes	yes	not particularly
Synergistic effect	yes	not particularly	yes	yes	not particularly	yes	not particularly

*High importance (≥70% of responses are important or very important), moderate importance (≥40% of responses are important or very important), low importance (<40% of responses are important or very important)

Table 3. Evaluation of adaptation measures in the sector: **Economy and tourism**

CRITERIA	TUR-01	TUR-02	TUR-03	TUR-04	TUR-05	TUR-06
Importance*	high	high	high	high	high	high
Urgency	yes	yes	yes	yes	yes	yes
Feasibility	yes	yes	yes	yes	yes	yes
Cost effectiveness	high	medium to high	medium	medium	medium	medium to high
Multiple usefulness	yes	yes	yes	yes	yes	yes
Synergistic effect	yes	yes	yes	yes	yes	not particularly

*High importance (≥70% of responses are important or very important), moderate importance (≥40% of responses are important or very important), low importance (<40% of responses are important or very important)

Overall, it can be concluded that the focus group approach worked well for the definition of the final scenario. The final result, i.e. final scenario encompasses 22 measures, with water management having the highest number of actions deemed necessary.

Measures agreed for the target area are as follows:

SECTOR	HAZARD	ADAPTATION MEASURE	TAGS
WATER MANAGEMENT AND THE ENVIRONMENT (9)	***Drought***	Assessing the economic value of groundwater and valorisation of water sources in target area	VOD-01
		Identifying social groups and assets critically endangered by possible floods	VOD-02
		Reconstruction of the water supply network and smart equipment installation in order to enable the monitoring of the water supply system	VOD-03
		Raising public awareness on the importance of water consumption in households and the impact of climate change on water as an environmental component	VOD-04
		Reducing the water consumption in the maintenance of public green spaces, plant nurseries, recreational and sports areas	VOD-05
		Reducing the water consumption in public buildings	VOD-06
		Analysing the impact of the sea level rise in the coastal part of target area	VOD-07
		Increasing the resilience of the communal and water infrastructure in the coastal part of target area	VOD-08
		Analysing the possibility to introduce wastewater recycling methods and rainwater harvesting solutions	VOD-09
HEALTH SECTOR AND CIVIL PROTECTION (7)	***Heat waves***	Implementation of the national Protocol on procedure and recommendations for protection from heat	ZDR-01
		Analysing the potential of the increase in the incidence of disease due to the effects of climate change	ZDR-02
		Upgrading the healthcare infrastructure in order to meet the requirements imposed by extreme weather conditions and seasonality in tourism	ZDR-03

		Upgrading the infrastructure and programs implemented by retirement homes and hospices in target area	ZDR-04
		Planning and building shelters which could be used in case of extreme weather events	ZDR-05
		Installing sun blinds and awnings on public transport stations	ZDR-06
		Installing automated external defibrillators in public buildings and conducting courses of cardiopulmonary resuscitation for employees	ZDR-07
ECONOMY AND TOURISM (6)	***High temperatures and precipitation (Extreme weather conditions)***	Encouraging entrepreneurship and establishing business incubators focused on areas of energy efficiency, climate changes, organic production, sustainable development, and green technologies	TUR-01
		Increasing climate change resilience in the tourism sector (public display of the current UV index and air temperature, also indicating the availability of potable water in public spaces and catering establishments, and offering UV protection tips)	TUR-02
		Developing and encouraging tourism activities which are compatible with extreme weather events (service diversification in target area)	TUR-03
		Raising awareness among tourism industry professionals concerning the impact, risks, and the possibility to adapt to climate changes	TUR-04
		Increasing the resilience of the tourism industry infrastructure to various weather extreme events (construction of swimming pools, indoor spa & wellness services, air-conditioned areas, areas with snowmaking facilities	TUR-05
		Raising climate change awareness among students enrolled in all levels of tourism and hospitality education	TUR-06

1.2.7 PP7 – Split - Dalmatia County

In the course of evaluating adaptation measures to assess whether or not they could comprise the optimal (final) scenario for the island of Brač, the following six criteria were used:

CRITERIA	DESCRIPTION	EVALUATION
Significance	The potential to reduce the risk	High/medium/low
Urgency	Are there consequences already? Is the measure implementation process long?	Yes/no
Feasibility	Are there any obstacles for the implementation? If yes, what and how intense are they?	Yes/no
Cost effectiveness	What is the ration between the adaptation impact and invested finances?	High/medium/low
Multiple usefulness	Does the measure bring welfare regardless of climate change?	Yes/no
Synergistic effect	Does the measure have positive effects on other sectors/areas as well? If yes, which one?	Yes/no

The same weighing factor was assumed for each criterion. Measures which are significant i.e. have high potential to reduce the risk, urgent, with no significant obstacles for their implementation (feasible), which are cost efficient and with positive impacts on other sectors/areas as well as bringing benefits regardless of climate change were considered as the most appropriate ones. However, in considering the results, it should be emphasized that although certain measures are not optimal per all criteria or they might not even have an adaptive effect (e.g. measures with preparatory character), they are still necessary to provide a complete impact. Measures that are also under the jurisdiction of local governments and associated organizations were regarded as more advantageous than measures on the national level. Measures were divided per sector analysed during the risk and vulnerability assessment for Brač island.

Selection of criteria and adaptation measures which could constitute the optimal (final) scenario were fully discussed and agreed among the focus group participants. The focus group was a highly diverse group of attendees, from local to County level experts, different associations, utilities etc. Participants contributed to the development of the final scenario, especially representatives of the County, island municipalities and volunteer fire department. Sectors that attracted most attention were water management, health and tourism. The focus group articulated the importance of fire protection and forestry; hence the latter sector was included as well. Furthermore, the discussion did not reveal the need to define and divide the measures per municipality but rather measures that would bring well-being to the entire island and enhance cooperation between the local governments.

Overall, it can be concluded that focus group approach worked well for the definition of the final scenario. The final result i.e. final scenario encompasses 27 measures, with water management, health, tourism and forestry having the highest number of measures.

Adaptation actions agreed are as follows:

SECTOR	HAZARD	ADAPTATION MEASURE
Agriculture (2)	***Drought***	Education of farmers with regards to financial support and entrepreneurial skills, with emphasis on drought protection
		Financial support for building mini and micro irrigation accumulations
		Full implementation of the national Protocol on practice and recommendations for protection from heat
Health (6)	***Heat waves***	Establishing an incentive system for medical staff
		Integrating green infrastructure in spatial planning
		Implementing eco-smart roofing of public transport stops, parking lots and seaports/piers
		Purchase of an emergency boat
		Building and putting in full function mode the helidrome in Mirca (Supetar)
		Implementing educational programs on efficient usage of water
Water supply and drainage (7)	***Drought***	Reconstruction of the water supply network
		Reduction of water consumption in public buildings
		Renewal of rainwater storage tanks
		Implementation of eco-smart showers on public beaches
		Prescribing conditions related to water treatment and circular water management in spatial planning documentation for planned touristic zones
		Development of an integral public drainage system, including treatment in order to be recirculated
		Integrating climate change into general and tourism related strategic and planning documents
Tourism (5)	***High temperatures and precipitation***	Stimulating the development of the sport-recreational tourism
		Stimulating the development of the gastro-eno tourism
		Stimulating the development of the cultural tourism
		Preparing a Marketing plan for tourism development of the entire island of Brač
		Vulnerability assessment of the Brač coastline to climate change
Coastal management (1)	***Seal level rise and floods***	Education of decision makers on integrated spatial planning

Spatial planning (1)	***All***	Continuous maintenance and construction of new forest fire prevention infrastructure
Forestry and fire protection (5)	***Fires***	Construction of fire stations
		Improvement of fire protection services through enhanced cooperation between Croatian Forests Ltd and volunteer fire departments
		Education of population on fire prevention
		Definition of a model for timely vehicle renewal

1.2.8 PP8 – Municipality of Vela Luka

Evaluation of adaptation measures, to assess whether or not they could comprise the optimal (final) scenario for the island of Korčula, was based on the following six criteria:

CRITERIA	DESCRIPTION	EVALUATION
Significance	The potential to reduce the risk	High/medium/low
Urgency	Are there consequences already? Is the measure implementation process long?	Yes/no
Feasibility	Are there any obstacles for the implementation? If yes, what and how intense are they?	Yes/no
Cost effectiveness	What is the ration between the adaptation impact and invested finances?	High/medium/low
Multiple usefulness	Does the measure bring welfare regardless of climate change?	Yes/no
Synergistic effect	Does the measure have positive effects on other sectors/areas as well? If yes, which one?	Yes/no

The same weighing factor was assumed for each criterion. Measures which are significant i.e. have high potential to reduce the risk, urgent, with no significant obstacles for their implementation, which are cost efficient and with positive impacts on other sectors/areas as well and bring benefits regardless of climate change were considered as the most appropriate ones. However, in considering the results, it should be emphasized that although certain measures are not optimal per all criteria or they might not even have an adaptive effect (e.g. measures with preparatory character), they are still necessary to provide a complete impact. Measures that are also under the jurisdiction of local governments and associated organizations were regarded as more advantageous than measures on the national level. Measures were divided per sector analysed during the risk and vulnerability assessment for Korčula island.

Selection of criteria and adaptation measures which could constitute the optimal (final) scenario were fully discussed and agreed among the focus group participants. The focus group was a highly diverse group of attendees, from local to County level experts, different associations, utilities etc. Each participant contributed to the development of the final scenario, especially representatives of Korčula municipalities and County spatial planning experts. Sectors that attracted most attention were agriculture, water supply and tourism. Furthermore, the discussion did not reveal the need to define and divide the measures per municipality but rather measures that would bring well-being to the entire island and enhance cooperation between the local governments.

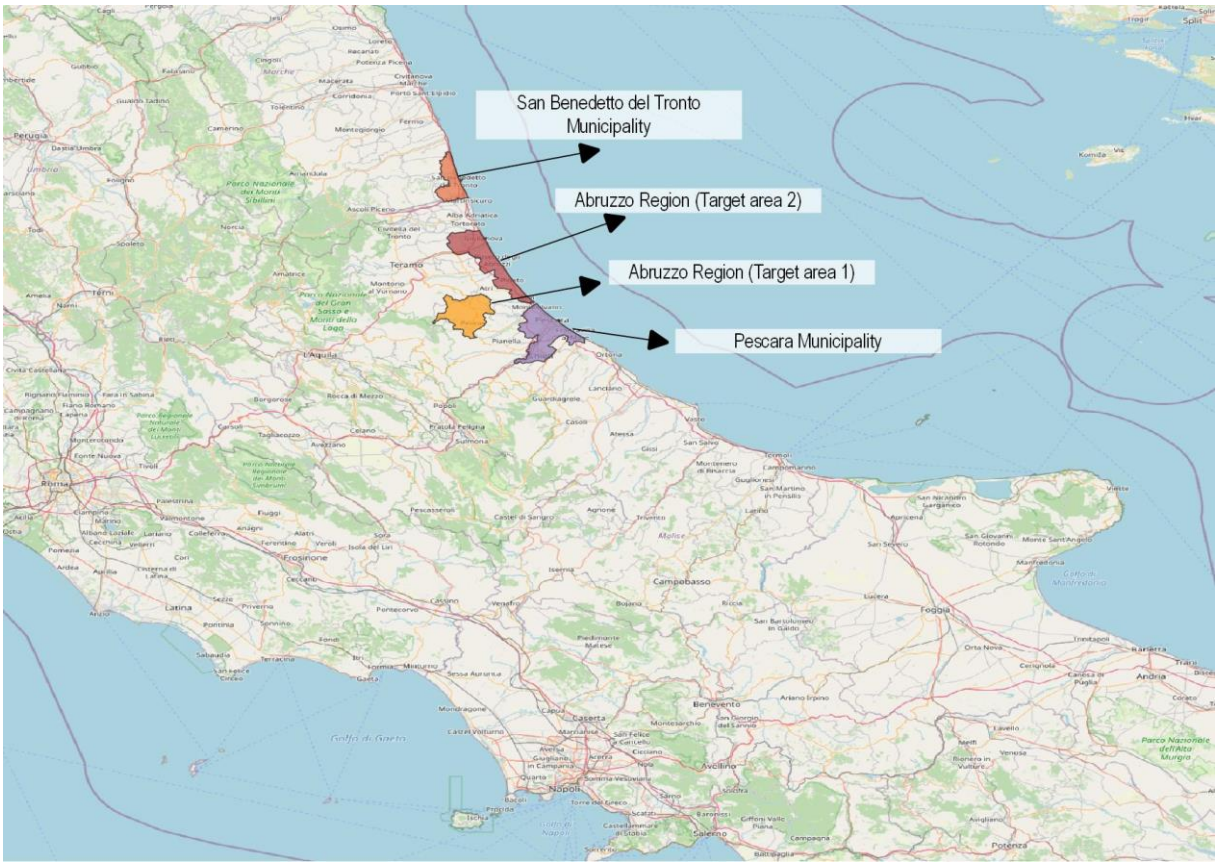
Overall, it can be concluded that focus group approach worked well for the definition of the final scenario. The final result i.e. final scenario encompasses 22 measures, with tourism and forestry having the highest number of measures followed by health and water supply. Measures are as follows:

SECTOR	HAZARD	ADAPTATION MEASURE
Agriculture (3)	***Drought***	Education of farmers with regards to financial support and entrepreneurial skills
		Selection of locations for irrigation accumulations
		Building irrigation accumulation
Forestry (4)	***Fires***	Introducing fire prevention video surveillance in state forests
		Improving fire surveillance in private forests
		Constructing forest fire protection infrastructure in private forests
		Education of population on fire prevention
Health (2)	***Heat waves***	Full implementation of the national Protocol on practice and recommendations for protection from heat
		Improving population's health care coverage – employing new doctors
Water supply (4)	***Drought***	Implementing educational programs on efficient usage of water
		Reconstruction of the water supply network
		Research of possible local water supply sources
		Putting local water supply sources into function
Tourism (7)	***High temperatures and precipitation***	Integrating climate change into general and tourism related strategic and planning documents
		Stimulating the development of the sport-recreational tourism
		Stimulating the development of the gastro-eno tourism
		Preparing a Marketing plan for tourism development of the entire island of Korčula
		Stimulating the development of the cultural tourism
		Stimulating the development of the health tourism
		Establishing Working group of tourist boards of island of Korčula
Coastal management (1)	***Seal level rise and floods***	Vulnerability assessment of the Korčula coastline to climate change
Spatial planning (1)	***All***	Education of decision makers on integrated spatial planning

2. Comparison of final scenarios among partners

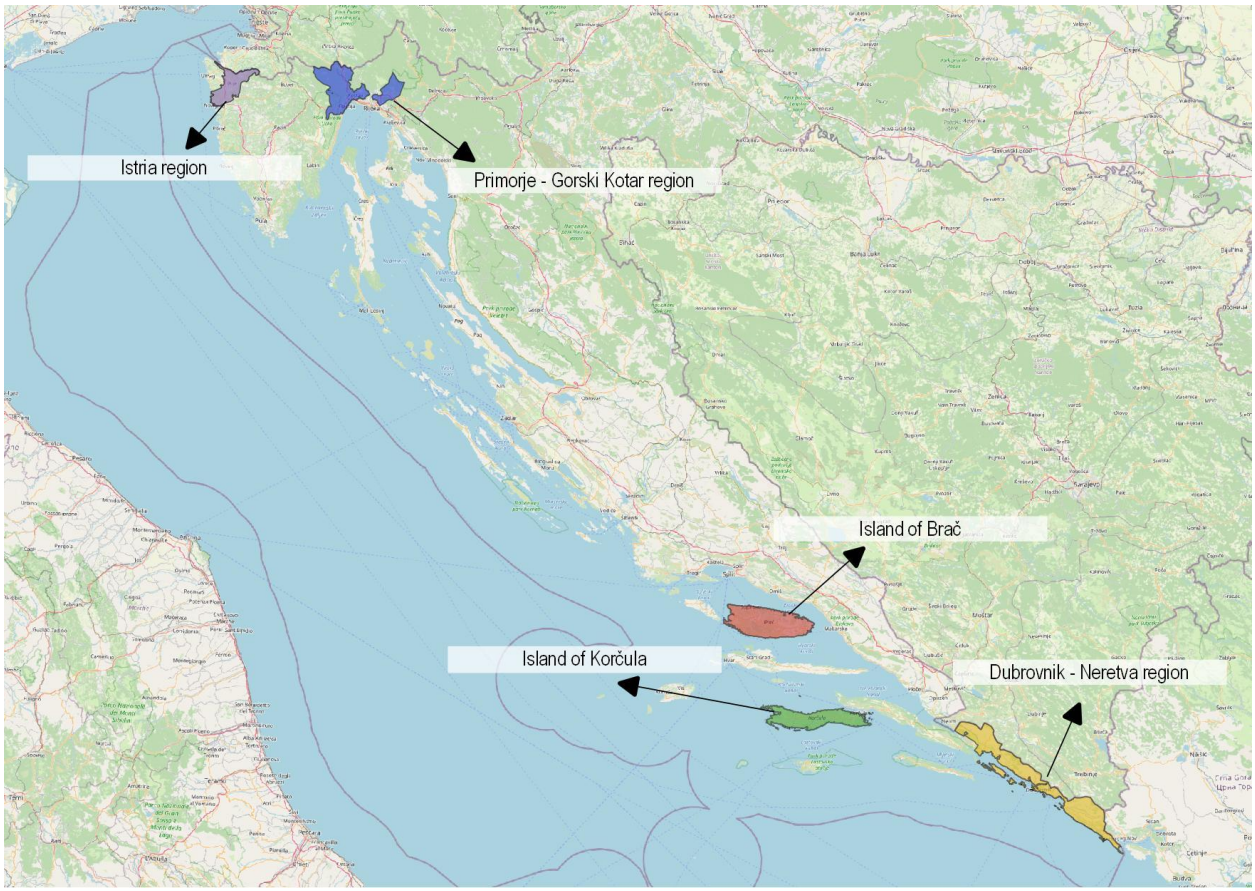
This chapter encompasses a comparative analysis of the final scenarios and the accompanying, adaptation measures for the target areas. Target areas of the Joint SECAP project are as follows:

1. Italian side
    - Abruzzo Region (involves two target areas; target area 1 with 4 municipalities Penne, Elice, Castilenti e Castiglione Messer Raimondo and target area 2 with 5 municipalities Giulianova, Roseto degli Abruzzi, Pineto, Silvi and Mosciano S. Angelo)
    - Pescara municipality (including Pescara and neighbouring San Giovanni Teatino, Spoltore, Montesilvano, Chieti and Francavilla al Mare)
    - San Benedetto del Tronto region (including San Benedetto del Tronto and neighbouring Cupra Marittima, Grottammare and Monteprandone)



Target areas in Italy

2. Croatian side
   - Korčula island in Dubrovnik-Neretva County
   - Brač island in Split-Dalmatia County
   - Primorje-Gorski kotar region (municipalities Kastav, Opatija, Čavle, Matulji and Viškovo)
   - Dubrovnik-Neretva region (City of Dubrovnik, Župa Dubrovačka, Konavle and Dubrovačko Primorje)
   - Istria region (Novigrad-Cittanova, Buje-Buie, Brtonigla-Verteneglio)



Target areas in Croatia

Considering inputs attained, firstly the analysis was performed for each side of the Adriatic in order to make conclusions for the entire project region.

Italian side

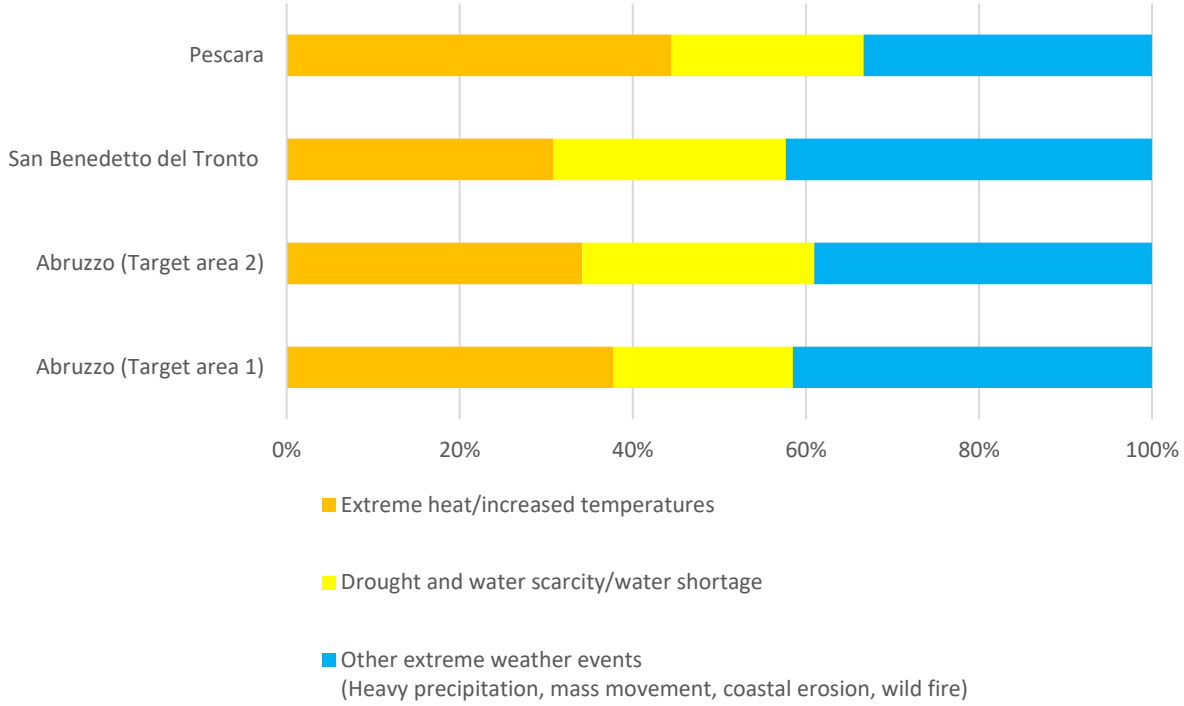
The development of final scenarios for the target areas in Italy had somewhat different approaches and terminology. For example, mass movement and heavy precipitation were recognized as separated hazards for Abruzzo region while for San Benedetto del Tronto these hazards were considered as a single hazard named "extreme weather events". Also, due to different needs of target areas, area sizes, existing risks, sectors' relevance for the specific target area and data/research availability, somewhat different methodological approaches were implemented for defining those scenarios. While there are certain differences in the needs of target areas, recognized hazards are almost identical.

The following table shows the number of adaptation measures proposed for specific hazard in the target areas while the figure below shows their share per each hazard category. Clearly, lots of attention is devoted to extreme heat in all Italian target areas. It is important to point out that some of adaptation measures are joint for several hazards.

Number of adaptation measures proposed for specific hazard

Hazard	Measures*			
	Abruzzo region		San Benedetto del Tronto	Pescara
	Target area 1	Target area 2		
Extreme heat/increased temperatures	20	14	8	4
Drought and water scarcity	11	11	7	2
Other extreme weather events (heavy precipitation, mass movement, coastal erosion, wildfire)	22	16	11	3

*The number of measures listed below, takes in account that some of the measures regard more than one hazard



Share of adaptation measures per specific hazard

Comparison of potentially affected sectors, in terms of their number and type, revealed more similarities between San Benedetto del Tronto municipality and Abruzzo region while Pescara municipality implemented somewhat different approach (see table below). Within the Italian target area, San Benedetto del Tronto municipality included the highest number of sectors in their final scenario, followed by Abruzzo region and then Pescara municipality. Interestingly, there is not a single sector common to all three target areas.

Number of adaptation measures proposed for specific sector

Sector	Measures			
	Abruzzo region		San Benedetto del Tronto	Pescara
	Target area 1	Target area 2		
Environment and biodiversity	21	19	1	/
Agriculture and forestry	20	14	2	/
Civil protection and emergency	17	11	2	/
Buildings	17	12	3	/
Tourism	11	13	1	/
Water	/	/	3	/
Education	/	/	2	/
Land Use Planning	/	/	3	3
Transport	/	/	/	2
Energy	/	/	/	1
ICT	/	/	/	1

For the purposes of further comparison, given the nature of proposed measures, they were categorized in three groups:

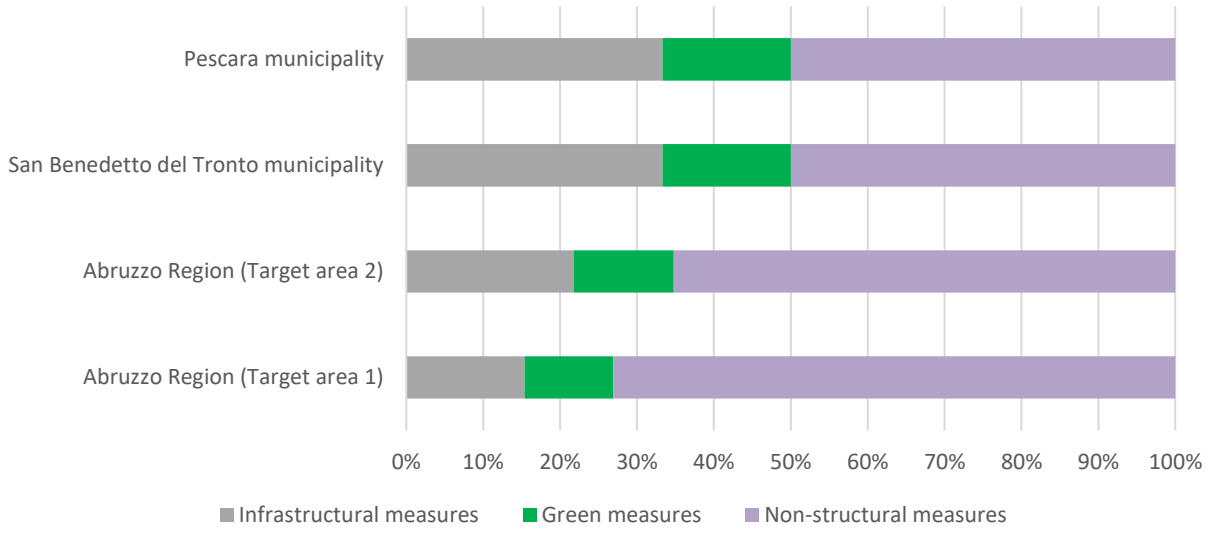
- Infrastructural measures - measures whose activities include the modification/improvement of existing infrastructure or construction of new infrastructure and similar physical interventions
- Green measures - measures that include interventions in the environment with the aim of improving natural and semi-natural habitats
- Non-structural measures - the activities do not include physical interventions but are rather aimed at education, promotion, changes in existing legislation, etc.

The following table and figure show the results of such comparison between the Italian target regions.

Number of adaptation measures per category

Category	Abruzzo region		San Benedetto del Tronto*	Pescara
	Target area 1	Target area 2		
Infrastructural measures	4	5	8	2
Green measures	3	3	4	1
Non-structural measures	19	15	12	3

*The number of measures listed below, takes in account that some of the measures are simultaneously infrastructural and non-structural measures



Share of adaptation measures per category

According to the categorization, most adaptation measures (around 50% to 75%) in all target areas are non-structural measures, followed by infrastructural ones (around 15% to 35%) and finally green measures.

Analysis of adaptation measures themselves indicated most similarity between target areas of Abruzzo Region (16 common measures), especially in the categories of non-structural measures. Also, further analysis indicated more similarity between target areas of Abruzzo region and San Benedetto del Tronto municipality (8 common measures of Abruzzo Region Target area 2 and San Benedetto del Tronto municipality; 7 common measures of Abruzzo Region Target area 1 and San Benedetto del Tronto municipality), especially in the categories of non-structural and green measures, and to a lesser extent

between Pescara municipality and Abruzzo region (2 common measures of Abruzzo Region Target area 1 and Pescara municipality; 2 common measures of Abruzzo Region Target area 2 and Pescara municipality). Similarities between San Benedetto del Tronto municipality and Pescara municipality have not been identified nor have common measure/s between all three target areas. Similarities/differences between measures are the result of similarities/differences in the needs of specific target areas.

Common measures proposed

	Abruzzo Region (Target area 1)	Abruzzo Region (Target area 2)	San Benedetto del Tronto municipality	Pescara municipality
Abruzzo Region (Target area 1)		**16**	**7**	**2**
Abruzzo Region (Target area 2)	**16**		**8**	**2**
San Benedetto del Tronto municipality	**7**	**8**		**0**
Pescara municipality	**2**	**2**	**0**	

Common measures to target areas of Abruzzo region and target area of San Benedetto del Tronto municipality relate to communications activities, water saving, warning and civil protection systems, urban greening, waterbody maintenance and coastal protection while common measures of Pescara municipality and target areas of Abruzzo region are energy related.

Croatian side

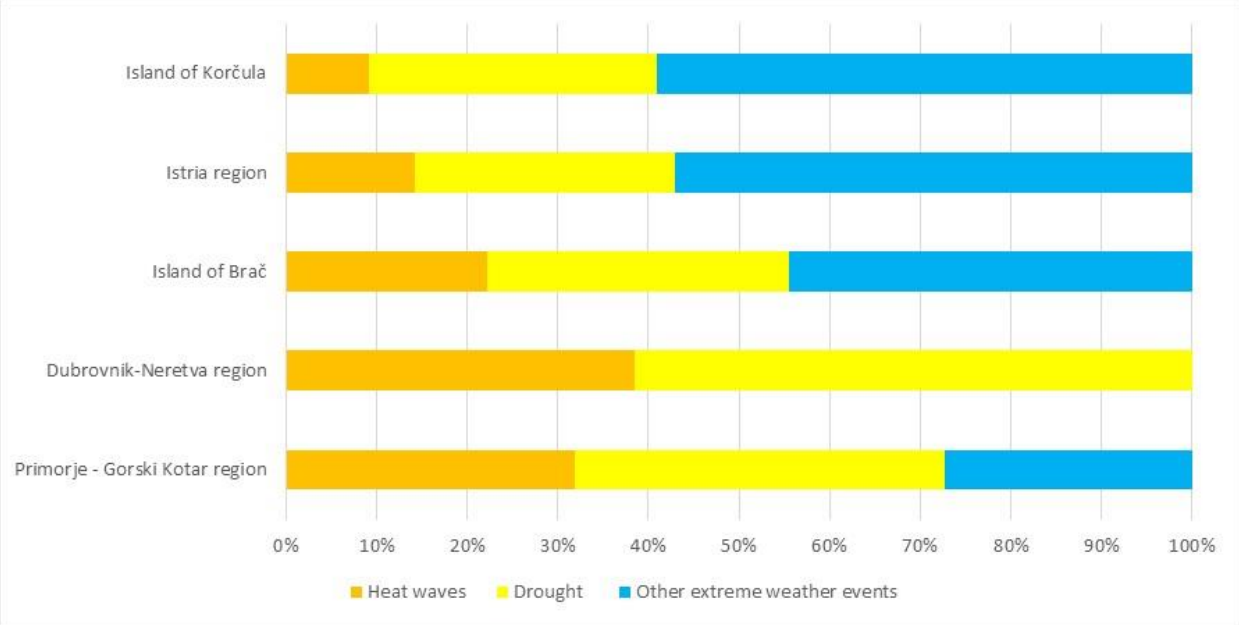
The development of final scenarios for the target areas in Croatia had somewhat different approaches and terminology as it was the case for Italian target areas, and for the same reasons. This should be well noted when analysing the results further on. Available information was uniformed in the same way as in Italian part in order to make the comparison easier.

The following table shows the number of adaptation measures proposed for specific hazard in the target areas while the figure below shows their share per each hazard category. Clearly, lots of attention is devoted to drought and water scarcity in all Croatian target areas.

Number of adaptation measures proposed for specific hazard

Hazard	Measures				
	Primorje - Gorski Kotar region	Dubrovnik-Neretva region	Island of Brač	Istria region	Island of Korčula
Heat waves	7	5	6	4	2
Drought	9	8	9	8	7
Other extreme weather events*	6	/	12	16	13
TOTAL	**22**	**13**	**27**	**22**	**22**

**Includes sea level rise, floods and fires, high temperatures and precipitation*



Share of adaptation measures per specific hazard

Comparison of potentially affected sectors, in terms of their number and type, revealed more similarities between Island of Brač, Istria region and Island of Korčula. The highest number of adaptation measures on Croatian side is defined for Water sector and Economy/Tourism sector while the smallest number of

measures relate to Land use (spatial) planning sector. These results indicate important requirements in overall water management, especially water supply and drainage systems.

Number of adaptation measures proposed for specific sector

Sector	Measures				
	Primorje - Gorski Kotar region**	**Dubrovnik-Neretva region**	**Island of Brač**	**Istria region**	**Island of Korčula**
Agriculture/Forestry		4	7	3	7
Civil protection and emergency/healthcare	7	2	6	4	2
Economy/Tourism	6	3	5	6	7
Water*	9	4	7	5	4
Land Use Planning	/	/	1	1	1
Coastal management	/	/	1	3	1

* *Including water management, water supply and drainage*

***This region identified one sector called Environment and Water management having*

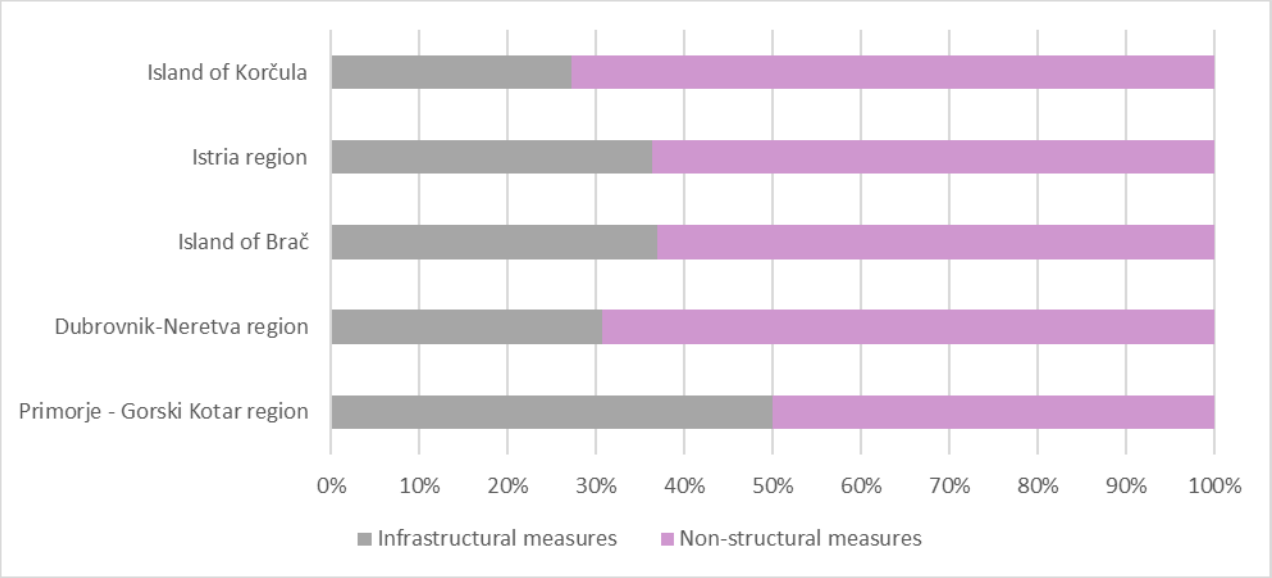
For the purposes of further comparison, given the nature of proposed measures, they were categorized in two groups:

- Infrastructural measures - measures whose activities include the modification/improvement of existing infrastructure or construction of new infrastructure and similar physical interventions
- Non-structural measures - the activities do not include physical interventions but are rather aimed at education, promotion, changes in existing legislation, etc.

Unlike Italian side, target areas within Croatian side do not consider at this point so called “green measures” (measures that include interventions in the environment with the aim of improving natural and semi-natural habitats). The following table and figure show the results of such comparison between the Croatian target regions.

Number of adaptation measures per category

Category	Primorje - Gorski Kotar region	Dubrovnik-Neretva region	Island of Brač	Istria region	Island of Korčula
Infrastructural measures	11	4	10	8	6
Non-structural measures	11	9	17	14	16



Share of adaptation measures per category

According to the categorization, most adaptation measures in target areas are non-structural measures (> 60%) with exception of Primorje – Gorski Kotar region where the share of non-structural and infrastructural measures is equal.

Further analysis of adaptation measures themselves indicated most similarity between island of Brač, island of Korčula and Istria region, especially in the categories of non-structural measures. Target area of Primorje – Gorski Kotar and Dubrovnik-Neretva region have the least common measures with other areas. No measure is common to all target areas. Similarities/differences between measures are the result of similarities/differences in the needs of specific target areas.

The following table shows an example of the most common measures for all target areas.

Example of the most common measures in Croatian target areas

Measure	Primorje - Gorski Kotar region	Dubrovnik-Neretva region	Island of Brač	Istria region	Island of Korčula
Reconstruction of the water supply network		+	+	+	+
Education of farmers		+	+	+	+
Reducing the water consumption in public buildings	+	+	+	+	
Analyzing the impact of the sea level rise in the coastal part of target area	+		+	+	+
Implementation of the Protocol on Procedures and Recommendations for Protection against Heat	+		+	+	+

Based on the comparative analyses of both Croatian and Italian target areas, it can be concluded that there are no joint measures for the entire project area; however, there are important similarities. Most common measures are the non-structural ones, majority of which is focused on capacity building/education of various stakeholders. Improvements in water management and agriculture sector are also pointed out throughout the project area. Croatian target areas are mostly concerned with drought while the Italian side is more focused on extreme heat.