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LIFE CLIMATE ACTION

Life PRIMES Project

LIFE14 CCA/IT/001280

Preventing flooding RIsks by Making resilient communitiES

ACTION D.1
RISK PERCEPTION AND COMMUNITY RESILIENCE ANALYSIS

by Università Politecnica delle Marche

Community Resilience Analysis

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Description	This Report aimed at analyzing the variation of community resilience in the pilot communities after the implementation of the PRIMES activities

Sommario

Introduction

The LIFE PRIMES project aims to build flood resilient communities by fully engaging these communities in the operations of Early Warning and flood risk prevention. The specific objectives of the projects are:

- to homogenize procedures of risk management and flooding prevention moving towards strengthening coordination between different levels of civil protection both on a vertical scale (Region – City - Community) and horizontal scale (Region-Region / City-City / Community- Community);
- to build a web friendly tool kit where all knowledge and necessary information are collected and organized in order activate voluntary and daily actions for the prevention of risks due to climate change;
- to move communities from a passive approach to the risk management, relevant to emergency response, to a pro-active one, supporting the phase of risk prevention through the active participation in implementing soft adaptation measures and actions;
- to allow the knowledge diffusion and innovative collaboration among Civil Protection and the civil society, raising awareness on adaptation to climate change and on the impact of risk alert patterns.

The participation of the vulnerable communities is a crucial aspect of the project and represents the core of each action.

The Department of Life and Environmental Science of the Università Politecnica delle Marche (Ancona, Italy), partner of the LIFE PRIMES project, collaborates with the other partners to the implementation of the various actions of the project (A - Base line scenario and capacity building, C- Building the dialogue and community empowerment through local development plans for civic actions, E – Communication and dissemination, F – Project Management and control), and is responsible for the supervision and execution of Action D (Evaluation of project results).

Such an action has the purpose to monitor the impact of the project's activities, and is divided in two sub-actions (D1 and D2) (Fig. 1).

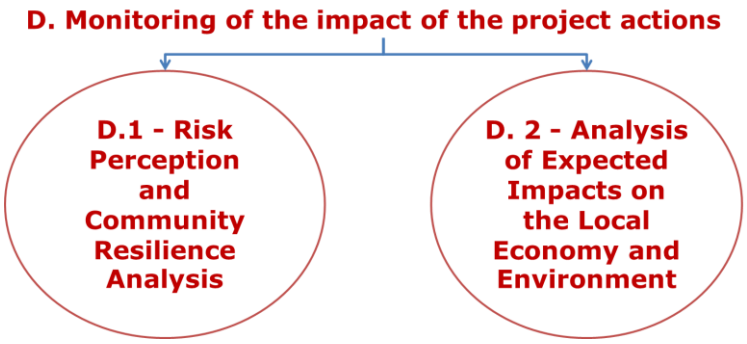


Figure 1 Grafical description of Action D

Also the sub-action D.1 is divided in other two sub-actions (D.1.1 Risk Perception Analysys; D.1.2 Community Resilience Analysis) and aims to assess the increased populations' awareness, after the project's activities, compared to a starting level.

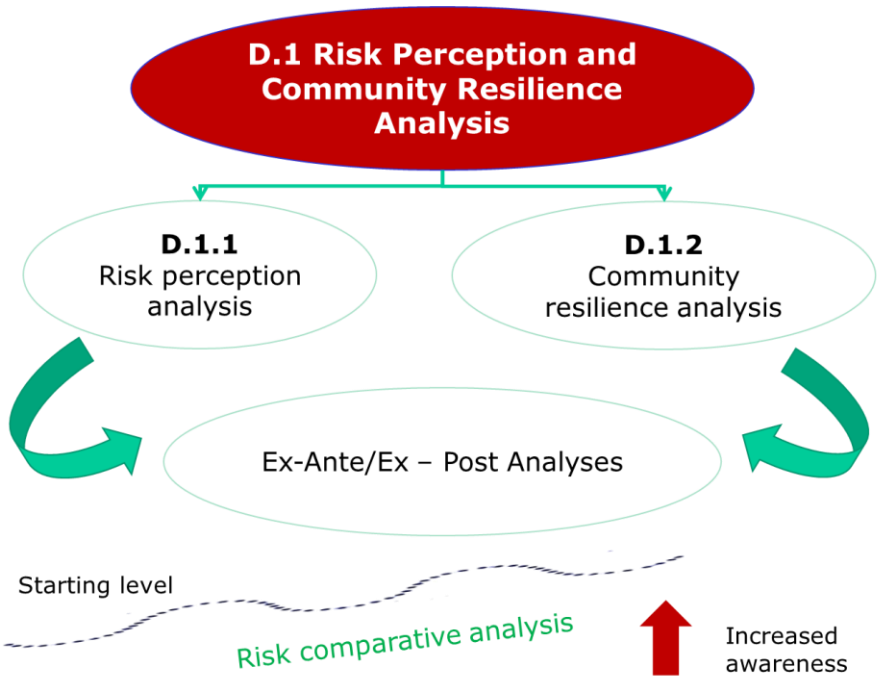


Figure 2 Structure and purpose of the Action D.1

In the present report are presented the results of the Community Resilience Analysis, performed in the ex-ante phase and the assessment of the Social Resilience (ex-ante/ex-post).

Resilience and Social Resilience

In the last decades climate change increases the frequency and intensity of extreme events, exposing an ever increasing number of persons to territorial dangers (Birkmann et al., 2014), almost a third of natural disasters are floods (Madsen, 2014).

Italy, because of flood events, in the last 50 years reached a number of 11,62/year of human loss (IRPI, 2017). Therefore, it is evident that a further effort to mitigate the impacts resulting from floods is needed. Mitigation measure includes structural and non-structural actions. Structural measures generally include the implementation of projects and works to protect flood settlements. Non-structural measures include spatial / temporal planning policies, strategies that encourage mitigation actions, thus working on the organizational, functional and operational aspects of the communities and on its resilience.

The term resilience has its roots in various disciplines and in recent years is gaining increasing value in environmental matters and especially in Disaster Risk Reduction (DRR).

An effective scheme of the link between the different disciplines and the evolution that the term has undergone over time is given by the work of Alexander (2013) (Figure 3).

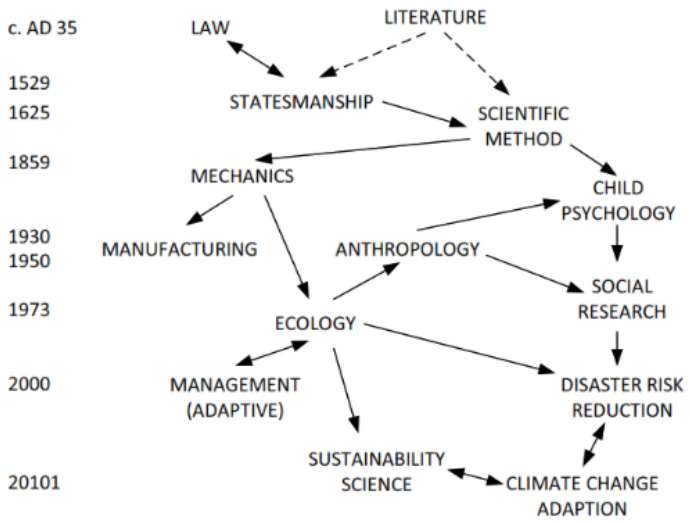


Figure 3 Evolution of the mean of the term Resilience

Precisely because of its multidisciplinary nature, resilience needs to be analysed under different profiles.

The current definition for the resilience term is:

“The ability of a system, community or society exposed to hazard to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions.” (UNISDR, 2009).

In this definition there is a vision of the resilience that underlies the human-environment relationship as a complex and dynamic system, in which both the conditions and the evolution of them are deeply influenced by the human element in the management of the territory. Therefore, this vision, analyses the link and the processes between biological and physical aspects, typical of the environment and social structures.

This is the basis of the contemporary global trends for elaborating projects and strategies that underlie the enhancement in community resilience to cope with the increase in disasters due to climate change.

According with Cutter et al. (2008), literature associates different dimensions with community resilience: infrastructural, economic, institutional, ecological and social.

Social dimension concerns all the social aspects of a community such as communication, sense of community and shared values.

Based on the concept of community resilience as a multidimensional system of adaptive capacity networks, we can identify social resilience in the relations between community resilience and social adaptive capacities.

According to Adger (2000), social resilience refers to a social unit or group of social units that collectively address a disorder resulting from social, political or environmental changes.

Kwok et al. (2016) recognize the strong contribution of social resilience to communities in mitigating the impacts of a disaster during the post-disaster preparation, response and recovery phases.

Considering social resilience, the scientific world begun to attribute to it ever greater value only in recent years (Kahlili et al., 2015; Kwok et al., 2016). Then, the need to explore methods for its evaluation in order to identify the improvements or errors made by the strategies and measures adopted increased.

At the same time, studies looking for factors that could influence social resilience become more numerous. In this regard, most of these studies identify as main elements that influence social resilience the following: risk perception, propensity to adopt measures to mitigate impacts, propensity to prepare for the event with adaptation measures, awareness and knowledge of dangers, communication and information on risks, trust in institutions and cultural background (Bubeck et al., 2012; Puossin et al., 2014; Kahlili et al., 2015).

Given the multidimensionality of resilience in general and social resilience specifically, its assessment remains still a challenge in the last years, even if many authors provided methods for a more quantitative approach (Mayunga 2009; Feofilovs and Romagnoli 2017). In addition, so far there are only few examples of social resilience analysis using multi-criteria approaches (see e.g. Carone, Marincioni & Romagnoli, 2018).

An important factor in influencing social resilience is the previous experience of disaster. Many authors dealt with this specific aspect, approaching the relationship between the disaster and the experience of a disaster.

Some studies analysed the role of experience in influencing mitigation behaviours (Bubeck et al., 2012; Bubeck et al., 2013; Puossin et al. 2014; Osberghaus, 2017), others focused on the influence of experience over the preparedness to a disaster (Sattler et al., 2000; Becker et al., 2017; Hoffmann & Muttarak, 2017, Siegrist & Gutscher, 2008).

For this specific aspect the activities of the LIFE PRIMES project become particularly important, since also simulation activities have been planned.

Indeed, the simulations can be considered as an experience of a disaster, without the negative repercussions.

Becker (2017) actually claims that individuals do not distinguish among different kind of experiences, PRIMES' simulations, then, are a great opportunity to analyse the effect of experience on the interested communities, in order to better manage future further activities.

In this report are described the results of a Community Resilience Analysis and a Social Resilience Analysis, performed by the DISVA Department of the Università Politecnica delle Marche on ten study areas involved in the LIFE PRIMES Project, with the aim to monitor project's activities.

The assessment of the Community Resilience requires longer times compared to the lifespan of LIFE PRIMES, notwithstanding, the analysis of Community Resilience at a specific time it is a great basis of knowledge for providing a clear and objective view of the total resilience of the studied communities. Then this typology of analysis had been carried out in the ex-ante phase, even if the project span does not allow for an ex-post analysis.

Social Resilience assessment, on the contrary, can be performed over shorter times, therefore the analysis of this component of the total resilience had been performed both in the ex-ante and ex-post phase with respect to the LIFE PRIMES activities.

On the basis of what discussed so far the analysis used a holistic Multi Criteria approach.

Methods

Study areas

The PRIMES project, "Preventing floods by making resilient communitiES" involves seven pilot areas, engaging ten municipalities, distributed in three Italian regions (Emilia Romagna: Ravenna - Lido di Savio, Lugo, Sant'Agata sul Santerno, Poggio Renatico, Imola, Mordano; Marche: Senigallia, San Benedetto del Tronto - Sentina; Abruzzo: Pineto – Scerne, Torino di Sangro) (Fig. 4).

These municipalities have different characteristics and different criticalities related to flood risks (Table 1- 4).

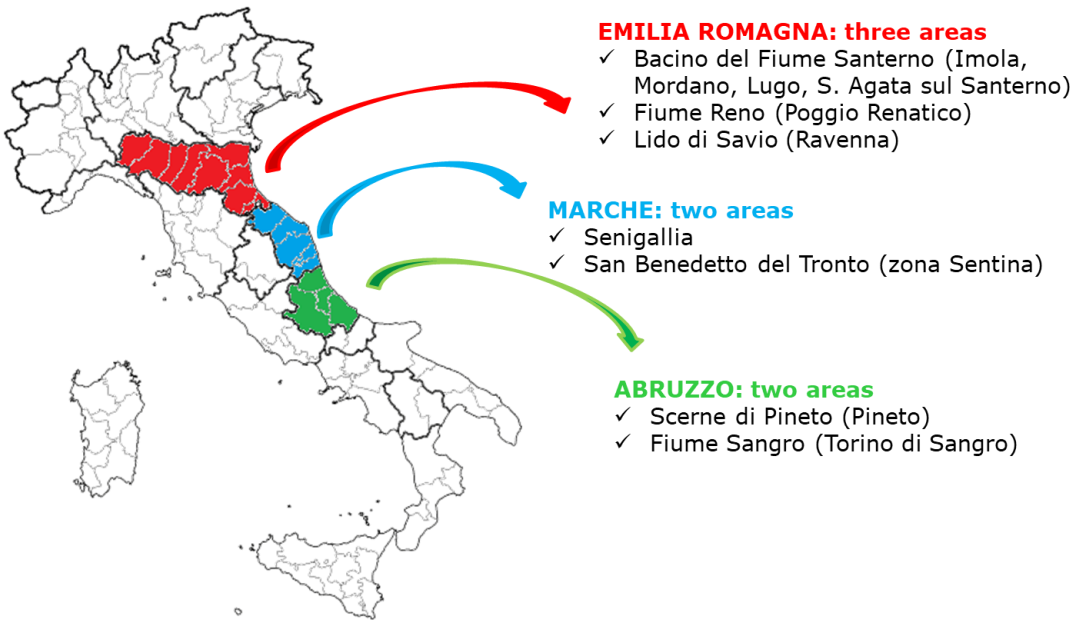


Figure 4 Pilot areas and corresponding study areas in the three Italian regions involved by the LIFE PRIMES Project

Table 1 Study areas and typologies of flood phenomena present

Municipality	Type of flood phenomenon
Poggio Renatico	river flooding, channel flooding
Lugo	channel flooding
Sant'Agata Sul Santerno	channel flooding
Imola	river flooding
Mordano	channel flooding
Lido di Savio	flood from the sea
Senigallia	river flooding
San Benedetto del Tronto	river flooding
Pineto	river flooding, flood from the sea
Torino di Sangro	flood from the sea

Table 2 Study areas of Abruzzo region

Municipality	**Coordinate**	**Extension**	**Altitude**
Pineto (Te)	42°36'38"52 N 14°4'0"84 E	38,11 kmq	4 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	14.904	City Planning	Hydrological Hazard (sea and river)
Municipality	**Coordinate**	**Estensione**	**Altitude**
Torino di Sangro	*42°11'27" N* *14°32'33" E*	32,12 kmq	164 m. slm
	People	**Civil Protection Office**	**Scenarios**
	3.030	City Planning	Hydrological Hazard (sea and river)

Table 3 Study areas of Emilia Romagna Region

Municipality	Coordinate	Extension	Altitude
Lugo 	44°25′16″N 11°54′39″ E	116, 92 kmq	12 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	32.390	Police	Hydrological Hazard (Santerno river)
Municipality	**Coordinate**	**Extension**	**altitudine**
Ravenna (Lido di Savio) 	44°25′04″N 12°11′58″E		2 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	563	Police	Hydrological Hazard (sea)
Municipality	**Coordinate**	**Extension**	**Altitude**
S. Agata sul Santerno 	44°26'35"16 N 11°51'39"96 E	9,49 kmq	14 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	2.862	Environment	Hydrological Hazard (Santerno river)
Municipality	**Coordinate**	**Extension**	**Altitude**
Poggio Renatico 	44°46’0’’84 N 11°29’27’’96 E	80,65 kmq	10 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	9852	Public Works	Hydrological Hazard (Reno river)
Municipality	**Coordinate**	**Extension**	**Altitude**
Mordano 	44°23’56’’04 N 11°48’46’’08 E	21,45 kmq	21 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	4747	Public Works	Hydrological Hazard (Santerno river)
Municipality	**Coordinate**	**Extension**	**Altitude**
Imola 	44°21’32’’ N 11°42’47’’ E	205 kmq	47 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	69638	Civil Protection	Hydrological Hazard (Santerno river)

Table 4 Study areas of Marche Region

MARCHE			
Municipality	**Coordinate**	**Extension**	**Altitude**
S.Benedetto del Tronto 	42°56'8"88 N 13°53'11"76 E	25,41 Kmq	6 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	47.303	Police	Hydrological Hazard (sea and river)
Municipality	**Coordinate**	**Extension**	**Altitude**
Senigallia 	43°42’58’’ N 13°12’31’’ E	117,17 kmq	6 m s.l.m.
	People	**Civil Protection Office**	**Scenarios**
	45.027	Police	Hydrological Hazard (Misa river)

Community Resilience Analysis

Formula, index and parameters

Before to explain the methodology for the analysis of Community Resilience, it is necessary to say that the methodology, with respect to what described in the Application Form, has been further improved. Then in this specific section we will not find the same terminology, but the new one, with additional indexes.

We used an evolution of Varnes (1984) formula, with the introduction of new factors as Resistance and Resilience. For a new perspective and approach to disaster risk reduction (DRR) strategy, we started from the old formula of Risk R= H*V*E (Varnes, 1984), putting inside the models PAR - Pressure and Release and SL - Sustainable Level SL (Mayunga, 2007). Then, we chosen a multi-criteria decision-making method (MCDA), applying an AHP (Analytic Hierarchy Process) methodology. That is because the characteristics of the new formula require a high level of holistic approach, with a high number of parameters to be analysed all together. In this way we obtained a tool for a Decision Support System:

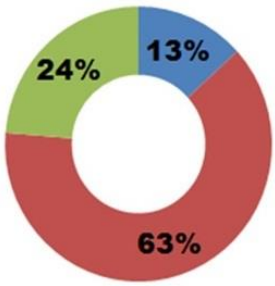
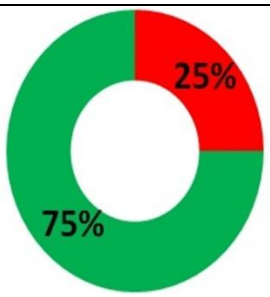
$$\mathbf{DRRi} = \frac{(H+V+E)}{(CDRti+CDRsi)}$$

where:

- DRRi = Disaster Risk reduction Index;
- H = Hazard;
- V = Vulnerability:
- E = Exposure;
- CDRti (R1) = Community Disaster Resistance Index;
- CDRsi (R2) = Community Disaster Resilience Index.

AHP method: hierarchy of dominance and weight of parameters

Table 5 Weighted TCI and ACI components

<table>
<tr><th colspan="4">Disaster Risk Reduction Index (DRRi)</th></tr>
<tr><th colspan="2">TCI
Territorial Critically Index</th><th colspan="2">ACI
Adaptive Capacity Index</th></tr>
<tr><td colspan="2">TCI = H+V+E</td><td colspan="2">ACI = CDRti+CDRsi</td></tr>
<tr><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
<tr><th>Target</th><th>Parameters</th><th>Target</th><th>Parameters</th></tr>
<tr><td>H-Hazard</td><td></td><td>CDRti Resistance (R1)</td><td>▪ Dew (Defence Works)
▪ Rec (Rescue Coordination)
▪ EmC (Emergency Communications)
▪ EmR (Emergency Resources).</td></tr>
<tr><td>V - Vulnerability</td><td>▪ Vs (Structural)
▪ Vf (Functional)
▪ Vse (Socio-economic)</td><td>CDRsi Resilience (R2)</td><td>▪ DrS (Structural Resilience)
▪ DrF (Functional Resilience)
▪ DrSo (Social Resilience)
▪ DrEc (Economic Resilience)
▪ DrSe (Settlement Resilience)
▪ DrEn (Environmental Resilience).</td></tr>
<tr><td>E – Exposure</td><td>▪ E_1 (Temporal-People)
▪ E_2 (Economics-Settlement)</td><td colspan="2"></td></tr>
</table>

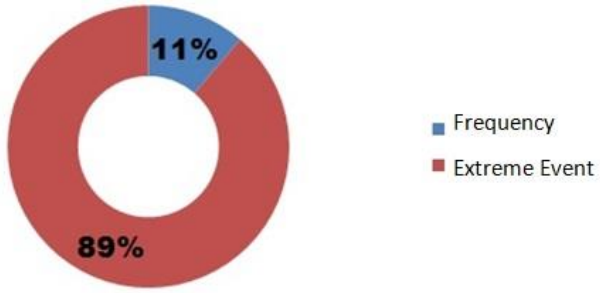
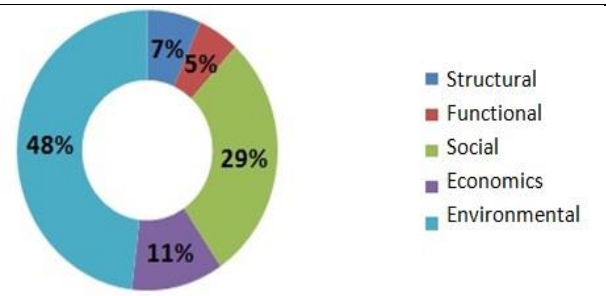
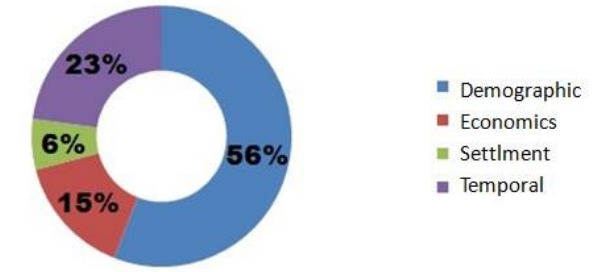
The AHP methodology allows allocating a value (a-dimensional) to every elements of the formula. The value shows the weight of an element compared to the others and it is the first way to understand the hierarchy of all the parameters that make up the formula and describe a scenario. The AHP method shows to the decision maker the most important and strategic elements, suggesting the most performant actions to be done.

$$DRRi = \frac{TCI}{ACI} = \frac{(H+V+E)}{(CDRti+CDRsi)} = \frac{0{,}13\,H + 0{,}63\,V + 0{,}24\,E}{0{,}25\,CDRti + 0{,}75\,CDRsi}$$

The AHP weight do not shows an absolute value, but only one of the possible combinations, with a correct level of consistency. In other words, it is possible to obtain others different weights linked to different points of view about the field of DRR. In PRIMES we propose a point of view where, the elements Vulnerability and Resilience have a central role in DRR strategies, aiming to develop better prevention and mitigation measures compared to relief and response. Thus, in this formula, with these weights it gives this information:

- Territorial Critically Index (TCI): The Vulnerability is the main factor (63%), where we need to concentrate our activities and attentions. Then, we have the Exposure (24%) another important element, but harder than Vulnerability to manage. Finally, we have the factor Hazard (13%). The hazard is obviously the trigger element for a disaster, but with this new approach it has a minor weight in the DRR strategies.
- Adaptive Capacity Index (ACI): it shows an innovative element. Inside ACI we can find the element Capability, composed of Resistance and Resilience. The main role is played from Resilience (75%) rather than Resistance (25%). In this case we assist to an important change of point of view, because we wish to increase the resilient actions in the direction of a more adaptive approach to disasters.

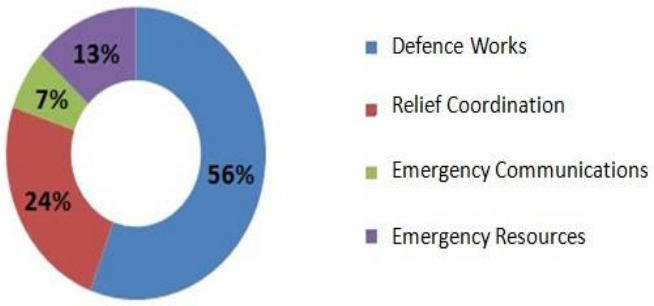
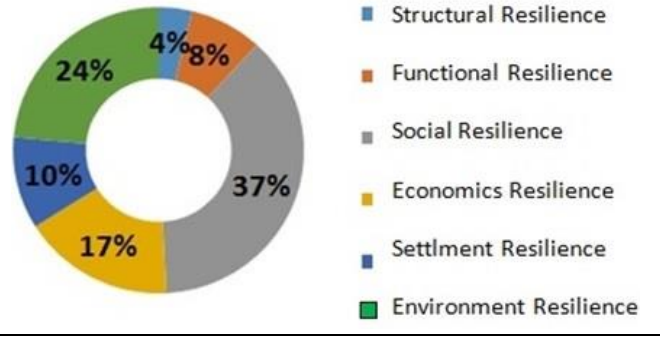
Table 6 *Weighted TCI components*

TCI - Territorial Critically Index		
Target	**Parameter**	**Weight AHP**
H Hazard 13%	▪ Frequency ▪ Extreme Event	
V Vulnerability 64%	▪ Structural ▪ Functional ▪ Social ▪ Economic ▪ Environmental	
E Exposure 23%	▪ Demographic ▪ Economic ▪ Settlement ▪ Temporal	

- **H (Hazard)** → we do not propose actions. The elements of this target show only the characteristics (magnitude) of an extreme event. Their weight inside the TCI is only 13%, it means that to organize and plan actions to reduce H value could be really expensive and, at the same time, gives back poor results;
- **V (Vulnerability)** → maximum level of attention, especially for the parameters Environment and Social. We suggest more attention toward social ecosystemic parameters and factor, than the structural-engineering elements.
- **E (Exposure)** → we underline only the central point of people living in the hazardous areas. It is important to remember the importance of seasonality, especially in the touristic places. A high level of Exposure could cause an extreme level of TCI. In this research, we have divided the

Exposure in two parts: E1 (Demographic-Temporal) and E2 (Economics-Settlement). The reduction of Exposure value could be expensive and not possible everywhere but, in any case, it is important to not forget this factor.

Table 7 *Weighted ACI components*

ACI - Adaptive Capacity Index		
Target	**Parameter**	**Weight AHP**
CDRti R1 Resistance 25%	▪ Defence Works ▪ Relief Coordination ▪ Emergency Communications ▪ Emergency Resources	
CDRsi R2 Resilience 75%	▪ Structural Resilience ▪ Functional Resilience ▪ Social Resilience ▪ Economic Resilience ▪ Settlement Resilience ▪ Environmental Resilience	

- **R1 (Resistance)** → We can divide R1 in two components: defense works (prevention approach) and emergency operation (response approach). The defense works (56%) are fundamental, if we choice to develop a mitigation approach in terms of reduction of direct and indirect causes and effects. A high develop of this part, could be certainly reduce the rescue operation after a shock. The other three elements could play an important role only if developed all together, with a holistic approach;
- **R2 (Resilience)** → The resilience target is deeply complex and linked to Vulnerability factor. They are not two elements in antithesis, but at the same time we can note that a good approach and work in the Resilience field could have a good consequence for Vulnerability too. Or, if we will a low level of Vulnerability, it means that it won't be necessary a high level of Resilience.

In this research, the most important elements of Resilience are: Social Resilience (37%), Environmental Resilience (24%) and Economic Resilience (17%). This is the consequence of a weighted choice, because our final goal is to reinforce the system and prevent a disaster/catastrophe context (where we have socio-economic consequences in a medium-long period).

Territorial threshold analysis

The review of final data permits three different considerations: total, local (single municipality) or municipalities compared analysis.

The final values show a scenario similar to the predictions. The local communities, considered with respect to a hydrologic event, could live a crisis in term of Emergency, but will not live a disaster or catastrophe context.

It is important to underline as the final value is strongly linked to the AHP weight chosen for every parameter.

I.e. if we exchange the weight of Resistance with Resilience (but with the same level of coherence), we will obtain a value of Emergency much lower than previous one and, of course, a level of Disaster and Catastrophe much higher.

So, in this case, which solution is correct? Both! Indeed, it depends from the point of view, the approach and the aim that we had chosen.

Thus, they are important some considerations about the utilized process of analysis. This study does not provide a definitive static framework, but a reasoned interpretation of the target to improve the system.

The Italian civil protection systems are strongly unbalanced in the direction of the reduction of the structural vulnerability or in the field of response management. In other words, they adopted a resistance approach. This strategy has showed a low-level efficiency because, albeit with a good

emergency system, they are normally unable to reduce the magnitude of an emergency, nor much less the disaster or catastrophe threshold.

In other words, if an event happened, also of medium dimension, the system gets really fast in a crisis situation, acquiring quickly the status of a disaster, or in the worst case, of a catastrophe.

This evolution is not a consequence of an extreme event, but the result of wrongs choices, actions and investment. Thus, it means that we can obtain a change if we work to increase other actions, from another point of view: the resilience approach to disasters.

Table 8 *Full list of Territorial Thresholds*

		Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
		$TET = \frac{H+Vs+Vf+E_1}{R_1}$	$TDT = \frac{V+E2}{R2}$	$TCT = \frac{H+V+E}{R1+R2}$
Abruzzo	Pineto	**3,64**	**1,39**	**0,66**
	Torino di Sangro	**1,63**	**2,09**	**0,81**
Emilia Romagna	Imola	**4,31**	**1,29**	**0,66**
	Mordano	**4,05**	**1,06**	**0,65**
	Lido di Savio (Ravenna)	**2,12**	**1,53**	**0,55**
	Lugo	**3,39**	**0,97**	**0,51**
	Sant'Agata sul Santerno	**4,46**	**1,12**	**0,54**
	Poggio Renatico	**3,25**	**0,88**	**0,52**
Marche	San Benedetto del Tronto	**5,62**	**1,32**	**0,68**
	Senigallia	**2,6**	**1,16**	**0,55**

In this table we used the scale on table 9, where the higher is the value compared to the equilibrium (value = 1) the worse is the situation and, the lower is the value compared to the equilibrium, the better is the situation.

Table 9 Scale of gravity

< 0,19	< 0,2	< 0,4	< 0,6	< 0,8	1	< 1,25	< 1,5	< 1,75	< 2	< 3	< 4	< 5	> 5,1

Compared Municipality territorial threshold: analysis

The comparison between municipalities could offer two different interpretations:

- Chromo-spatial analysis (with GIS): where we have a fast ideas about a territory, but we can manage only a small group of territories (normally attached);
- Algebraic analysis: where it is possible to match a high number of elements, with a high level of details.

To develop the second interpretation, it is necessary to use a score scale, or rather to link every parameter to each parameter of an integer value, corresponding to the priority code of each element.

Table 10 *Scale of priority action*

VL	L	M	A	VH	!	!
Very low	Low	Medium	High	Very High	Maximum Positive	Maximum Negative
1	2	3	4	5	0	6

Using the scale, we can have an overall reading of the data, with a useful analysis of every parameters and strategic elements for the DRR field.

The result is important because could help to develop the Country, adopting specific measures applied to territories, communities, systems.

In the last years, i.e., it is clear that it has given a great effort for the reduction of the vulnerability but, at the same time, poor activities organized about Resistance, despite the high number of disaster occurring in Italy. Finally, the resilience sector results extremely fragile and unknown. This is a clear sign of a ‘cultural revolution’ that delays to start in the field of DRR.

Table 11 Target Vulnerability – Priority actions analysis

VULNERABILITY REDUCTION			*Abruzzo*		*Emilia Romagna*						*Marche*	
			Pineto	*Torino di Sangro*	*Imola*	*Lugo*	*Mordano*	*Poggio Renatico*	*Lido Savio*	*S.Agata*	*S.Benedetto*	*Senigallia*
V	**Vstr** Structural (0,07)	**MoI**-Mobility Infrastuctures	2	0	1	2	1	2	2	2	1	-
		SeI-Service Infrastructures	1	0	1	1	1	-	1	1	1	1
		SpA-Special Areas	3	1	2	3	1	3	3	3	2	1
		SES – Strategic Emergency Service	3	-	1	4	1	-	4	4	3	4
	Vfun Functional (0,05)	**MoI**-Mobility Infrastuctures	2	1	1	2	6	2	2	2	2	2
		SeI-Service Infrastructures	1	2	2	2	1	-	2	2	2	1
		SpA-Special Areas	2	2	2	2	1	-	2	2	2	0
		SES – Strategic Emergency Service	2	-	2	3	4	-	3	3	3	2
	Vsoc Social (0,29)	**PSW** – Public Services	0	1	2	0	0	-	0	0	0	0
		NeM – Mobility Network	1	2	2	2	1	1	1	1	1	1
		Pop - People	3	3	4	4	1	4	4	4	4	4
	Veco Economics (0,11)	**EnS** – Energy Sector	1	-	1	-	-	-	-	-	1	1
		Agr - Agriculture	1	1	6	1	1	-	1	1	1	1
		HaS – Handcraft sector	1	3	2		0	-			2	1
		InS – Industrial Sector	3	6	2		0	-			3	3
		SeS – Service	1	2	2		2	-			1	1

		Industry										
		ToS – Tourism Sector	1	2	2		2	-			1	2
	Venv Environmental (0,48)	**SoU –** Soil use	1	1	1	1	1	1	1	1	1	1
		USW – MSW concentration	2	2	-	3	3	-	3	3	3	-
		EFP – Ecological foot print	2	2	-	2	2	-	2	2	2	-
		DeR – Deforestation rate	1	1	3	1	1	1	1	1	1	1
		Bio Biocapacity	1	2	2	2	2	2	2	2	2	2

In terms of priority actions, the parameters of Target Vulnerability do not show critical issues. In particular:

- **Structural Vulnerability**: low priority (L) linked to local roads. More important for Special Areas (houses and industries) and Strategic Areas (Operation rooms). This indicates, and it is a consequence of a low protection of this structures compared to the hydrological hazard:
  - The priority action will regard the reduction of structural vulnerability by local Emergency Rooms (Civil Protection Rooms, Relief Rooms, etc.)
- **Functional Vulnerability**: it is a similar situation of Structural Vulnerability. It is underlined a loss of capacity from Emergency/Rescue Structures:
  - The priority action (for 3 Municipalities over 6) will regard a reinforcement of functional capacity of Operational Rooms compared to the hydrological hazard.
- **Social Vulnerability**: maximum level of attention for people (old, single and foreign people):
  - The priority actions will regard the reduction/protection of the weakest groups of the community.
- **Economic Vulnerability:** no particular relief, only a higher protection of industrial areas:
  - We recommend the reinforcement of every possible action to safeguard the industrial sector.

- **Environment Vulnerability:** the final data are homogeneous among all the municipalities, because directly linked to national choices and situations. Every Municipality could make more in the sector or Waste (where it is possible a higher autonomy of work):
  - We recommend a reinforcement of separate waste collection.

Table 12 General framework Priority actions – target 'Reduction of Exposure'

EXPOSURE REDUCTION			*Abruzzo*		*Emilia Romagna*						*Marche*	
			Pineto	*Torino di Sangro*	*Imola*	*Lugo*	*Mordano*	*Poggio Renatico*	*Lido Savio*	*S.Agata*	*S.Benedetto*	*Senigallia*
E	**Dem** Demographic (0,56)	**Pop –** Population	5	3	6	6	5	5	0	6	6	4
		PeR - Refugee	1	0	0	2	0	0	2	2	1	0
		FoR – Foreign residents	1	0	0	1	0	0	1	1	1	0
	Eco Economics (0,15)	**TyE** Type of Economy	1	3	2	3	3	3	5	4	4	2
		Emp - Employement	3	2	2	2	2	2	2	2	1	1
	Set Settlment (0,06)	**Rur** – Rural	1	1	1	1	1	6	1	1	1	1
		Ind - Industrial	2	0	2	2	0	3	-	2	2	2
		Adm – Administrative	1	0	1	1	!	1	-	1	1	1
		Com - Commercial	1	0	1	1	0	1	2	1	1	1
		HAT Historical-Artistic-Tourism	2	1	2	2	1	2	2	1	2	2
		Res – Residential	1	1	1	1	1	1	1	1	2	1
	Tem Temporal (0,23)	**Tim** - Time	4	4	4	0	4	4	5	3	5	4
		Day – Day	1	1	1	0	1	2	2	1	2	2

With an overall view, the target Exposure shows homogeneous data for all the municipalities. The most important and dangerous parameter is the Population. It is important to underline that this analysis regard only the official citizen of every Municipality, and do not analyze the real number of people living in these places, especially during summer. During the summer, people living in the coastal areas could be 3 times more. It means that the real value of Exposure will be higher for Pineto, Lido di Savio, S.Benedetto, Senigallia. In particular:

- **Demographic Exposure**: it is the most famous parameter to describe the concept of Exposure. In this research it shows extreme values in most municipalities. It is not a value that we can easily reduce:
  - No direct action. We suggest having a high level of attention in the planning activity (reinforcement of resilience and resistance activities);
- **Economic Exposure:** it is high in the most of Municipalities. It indicates a high propensity to damage in case of hydrological event. The economics damage and loss will be devastating for touristic territories:
  - No direct action suggested.
- **Settlement Exposure:** in the most of municipalities, the settlement areas are a small part compared to overall territory.
  - No direct action suggested, but it is important to not forget this element in the mitigation activities of vulnerability.
- **Temporal Exposure:** this factor is strictly linked to Demographic and Settlement Exposure. Especially in the touristic and coastal places, where we observe a high difference of population between winter and summer, this parameter is really important to show the difference between day and night, free and work days. This factor could deep amplify the final value of Exposure:
  - No direct action suggested. We suggest only maintaining a high attention to this specific factor in the emergency planning actions.

Table 13 Target Resistance – Priority actions analysis

RESISTANCE INCREASE			*Abruzzo*		*Emilia Romagna*						*Marche*	
			Pineto	*Torino di Sangro*	*Imola*	*Lugo*	*Mordano*	*Poggio Renatico*	*Lido Savio*	*S.Agata*	*S.Benedetto*	*Senigallia*
R1	**Dew** Defence Works (0,56)	**Mie** – Mitigation Effect	3	0	2	1	2	0	0	5	2	2
		DeI – Defence Infrastructure	3	3	6	5	6	6	5	5	5	5
		DSA Defence Strategic Areas	4	6	5	5	6	5	0	5	5	5
	ReC Rescue Coordination (0,25)	**Pla** – Emergency Plan	2	3	3	2	0	2	2	2	2	1
		CaC Command & Control	3	4	4	4	-	4	3	4	4	1
		Ope -Operations	4	5	5	4	-	5	5	0	0	5
	EmC Emergency Communication (0,07)	**REC** – Rescue Emergency Communications	0	3	2	2	6	2	0	2	2	0
		ECS Emergency Communication Service	4	6	6	5	6	5	5	5	5	6
		CEC – Citizen Emergency Communications	5	6	4	5	6	5	0	0	5	0
	EmR Emergency Resources (0,13)	**HuR** Human Resources	4	4	3	2	3	5	2	2	3	2
		TeR – Technical Resources	4	5	3	0	-	4	0	0	4	4
		StR – Structural Resources	5	5	5	5	5	5	5	5	5	-

The parameters of the target Resistance show a worrying framework. The most part of parameters requires actions of Attention (A) and Maximum Attention (MA). It means that the local emergency and rescue systems and all it is possible to connect to the concept of Resistance, they are inadequate or underestimated compared to the real necessity of territories/communities. It is to remember as the resistance action has a weight of only 25% in the Adaptive Capacity Index (ACI), but it plays a crucial role in the definition of the Emergency Threshold. In particular:

- **Defense Works:** the worst value concern infrastructures and strategic areas. Really low the presence of mitigation works of natural phenomena:
  - We suggest to increase the mitigation works and the level of infrastructure resistance to roads and railways network and services;
- **Relief coordination:** formally every Municipality has an emergency plan, but none of these is a really useful document in case in emergency. They are unclear the command chain and the operational capacity of rescue organizations:
  - We suggest both, developing a check of every part of plans (exercises, training, multi-risk-plan, annual updating), and increasing civil protection technicians. With a better planning, we could have a benefit in term of time of rescue, recovery and response;
- **Emergency Communications:** These sub-parameters are split in two components: the emergency communication system for rescuer and citizen. The rescuer component appears to be more adequate to answer to the necessity of a territory, than the citizen component. The limits and bugs of the emergency communication network has a direct link and consequence with the quality of communications:
  - We suggest adopting, in every Municipality, an expert in emergency communication. Furthermore, we suggest realizing specific emergency communication plans for citizen, emergency communication campaigns and early warning systems.

- **Emergency Resources:** it is detected an absolutely alarming situation about structural and human resources for emergency and rescue activities. Normally, it is invested money for equipment and vehicles, but not for training and human resources. The number of rescuer (professional or volunteer) is really low compared to the needs and characteristic of territories. We wish to underline that the professional and volunteer system are not in antithesis but, could be a good complementary system with an high level of community self-protection:
- We suggest increasing the number of volunteer organizations, especially in the field of civil protection, trough logistic and economic support or specific training activities. Furthermore, we suggest reinforcing the professional structure of emergency, in terms of technicians, beds in hospital, quality and quantity of emergency activities that work simultaneously.

Table 14 Target Resilience – Priority actions analysis

RESILIENCE INCREASE			*Abruzzo*		*Emilia Romagna*						*Marche*	
			Pineto	*Torino di Sangro*	*Imola*	*Lugo*	*Mordano*	*Poggio Renatico*	*Lido Savio*	*S.Agata*	*S.Benedetto*	*Senigallia*
R2	**DRs** Structural (0,04)	**Inf**-Infrastructure	3	4	4	3	2	2	3	3	3	4
		StS – Strategic Services	4	5	3	3	6	4		5	4	4
		StA – Strategic Areas	5	6	4	5	4	6	6	5	5	0
		SEA – Strategic Emergency Areas	5	-	5	5	6	5		5	5	5
	DRf Functional (0,08)	**Inf** Infrastructures	5	4	5	4	5	5	4	4	5	4
		StS – Strategic Services	2	3	5	2	5	4	2	3	2	4
		StA – Strategic Emergency Areas	5	4	4	3	4	5	3	3	3	0
	DRso Social (0,37)	**Edu** – Education	4	5	4	4	5	5	4	5	4	4
		TrK – Training Knowledge		5	5	5	5	6	5	5	5	4
		Inf - Information		6	6	4	6	5	3	4	4	3
		SoL – Social Life	3	5	5	5	5	5	5	5	5	5
		WeL -Welfare	2	3	0	0	2	2	4	2	3	-
	DRec Economics (0,17)	**EnN** – Energy Network		-	-		-	-	5	-	5	-
		CoN - Communication Network		-	6		-	-	4	-	5	-
		PuS – Public Services		5	-	5	5	5	-	5	5	-
		IHS – Industrial – Handcraft Sector.		3	-	3	4	-	-	3	5	-
		Agr-Agriculture		5	-	5	-	-	-	5	5	-
		SaT – Service-Tourism		5	-	4	-	-	5	5	5	-
		Eco- Economy	0	0	0	0	0	0	0	0	0	0
	DRse Settlement	**StP** - Strategic City Planning		6	0	5	6	6	5	5	5	0

	(0,10)	**FCP -** Functional City planning		5	5	5	5	5	0	5	0	0
		SCP - Social City Planning		6	0	4	6	2	2	4	5	-
	DRen Environmental (0,24)	**Law**- Laws	1	2	1	1	2	1	2	1	1	1
		Act – Actions		3	-	2	3	4	0	3	3	3

The parameters of the target Resilience show a worrying framework, but not unexpected for a sector-approach not still known. The most part of parameters requires actions of Attention (A) and Maximum Attention (MA). This describes the low level of sensibility and knowledge about the strong link between resilience and the DRRR strategies. The development of these parameters is really important, because they represent the 75% (in weight) of Adaptive Capacity Index (CAI). In particular:

- **Structural Resilience:** the worst value concerns the sub parameters Strategic and Emergency. It describes a situation with an inadequate approach to DRR dynamics. It is important to underline the shortages about Strategic Services, foundation of an assistance or emergency system in a territory:
  - We suggest developing a new model of Strategic Areas and Emergency Areas, trough plans for the relocation in safe areas; more founding for building safety; projects (and laws) for building new modern and safety houses. About the services network, we suggest adopting uninterruptible power supplies with high level of storage.
- **Functional Resilience**: the most important elements are railway and road conditions. These two elements could play an important role during an emergency or a post-event, in term of speed of response and recovery. In particular:
  - We suggest adopting measures to maintain a high level of roads functionality with the aim to avoid the collapse of road network during a severe event. Inside the strategic emergency areas, we suggest adopting internal emergency plans; redundancy of services and resources, extra human resources for emergency. The final goal is easy: to avoid the collapse of the system;
- **Social Resilience**: the parameters Education, Training and Social Life show the greater criticality. They are parameters with a high influence from regional and national decisions. The low level of training (school, technical, and formal, unformal) is a real problem, with

important consequence when we wish to adopt a resilience approach to disaster. Indeed, it is clear the link between low educational level and a high level of vulnerability. We have a similar interpretation for the Social Life parameter. The most resilience community has normally a high level of cohesion, however the opposite is that we had analyzed in this research. In particular:

- We suggest adopting actions for increasing the level of schools; more graduate citizens; more organizations (social, sport, clubs…). We suggest deveoping an adequate communication-information system with particular attention to children and old people;

- **Economic Resilience:** it is a data not easy to read, because we have important difference between the municipalities' studied in this work. Overall, we can confirm a low level of capacity to model an answer during an emergency. As a consequence, we have a high level of economic damages, long times of recovery and a concrete possibility to a stop of local economy. In particular:
  - We suggest developing an insurance system, fast plans for emergency, business continuity programs, increase of the knowledge of technicians and employers.
- **Settlement Resilience**: Social and urban fabrics are two important elements that could play an important role in the building of a resilient community or, for the same reason, to have an important responsibility in a vulnerable community. After this research emerges that Urban and Social planning show the most important criticality and, for this reason, it is the most important priority action to develop. In particular:
  - We suggest developing urban plans linked to civil protection plans. A particular attention must be done to the dislocation of strategic structures in safest areas. It is necessary to avoid areas with high level of vulnerability, especially in the suburbs compared to the town center, develop plan to reduce the distance between the city and suburbs (services, transports, schools…);

- **Environment Resilience:** there are not critical situations. There are sufficient laws, but sometimes there is not a sufficient number of actions, campaigns, activities able to realize the contents of the laws:
- We suggest developing specific actions and campaigns for children, schools, students, and citizens.

Overview of parameters: list of priority

Using the same score scale, we can sum together the scores of all the parameters for all the municipalities. In this way we obtained a general list of priority for all the parameters. This specific list could be useful for a comprehensive analysis of the project. The priority list permits an over-municipality management. The top list parameters coincide with the highest value: there are area/sectors where it is important to invest in priority. The down list parameters coincide with the lowest value: there are area/sectors where it is less important to invest in priority. If we work on targets V and E, we will obtain a decrease of the final value of Territorial Critically Index TCI). If we work on targets R1 and R2, we will obtain an increase of the final value of Adaptive Capacity Index (ACI). In any case, we suggest operating on both the Indexes, which is the best and fast way to elevate the value of community resilience. We report here the most important parameters:

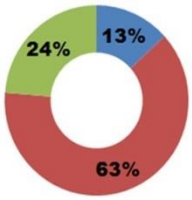
Table 15 List of priority actions

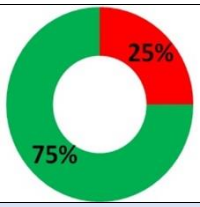
TARGET	CRITERIA	SUBCRITERIA	VALUE
R1 - Resistance	Emergency Communications	Services and Communication for emergency	53
R1 - Resistance	Defence Works	Infrastructures	49
R2 - Resilience	Social Resilience	Social Life	48
R1 - Resistance	Defence Works	Defence Strategic Areas	46
R2 - Resilience	Social Resilience	Training	45
R1 - Resistance	Emergency Resources	Structural Resources	45
E - Exposure	Demographic	People	45
R2 - Resilience	Functional Resilience	Infrastructures	45
R2 - Resilience	Structural Resilience	Emergency Areas	41
R2 - Resilience	Settlement Resilience	Urban planning	38
E - Exposure	Temporal	Hours	37
R1 - Resistance	Emergency Communications	Citizen Emergency Communications	36
V – Vulnerability	Environment	Foot Ecological	36
V – Vulnerability	Social	People	36
R2 – Resilience	Functional	Strategic Areas	34
R1 – Resistance	Rescue Coordination	Operations	33
R1 – Resistance	Rescue Coordination	Command and Control	31
R1 – Resistance	Emergency Resources	Human Resources	30
E – Exposure	Economics	Type of economy	30
R2 – Resilience	Economics	Public Service	30
R2 – Resilience	Settlement	Services	30
R2 – Resilience	Environment	Waste	26
R2 – Resilience	Economy	Tourism-Service Sector	24
R2 – Resilience	Environment	Actions	21
V - Vulnerability	Functional	Mobility Infrastructure	22
V – Vulnerability	Structural	Special Areas	21
V – Vulnerability	Structural	Strategic Areas for Emergency	20
V – Vulnerability	Functional	Strategic Areas for Emergency	19
E – Exposure	Economics	Employed	19
E – Exposure	Settlement	Tourism, Artistic	17
E – Exposure	Economics	Industrial sector	17
E – Exposure	Settlement	Industrial	15
V – Vulnerability	Economic	Agricultural sector	13
V - Vulnerability	Social	Mobility network	12

Municipalities details

Table 16 Summary sheet municipality of Pineto

	Municipality of **PINETO**						
Region	*Abruzzo*	District		*Teramo*			
Coordinate	*42°36'38"52 N 14°4'0"84 E*	Altitude	*4 m*	Kmq	38,11	citizen	14.904

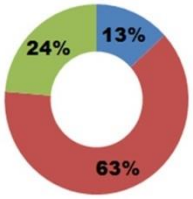
Territorial Critically Index (H+V+E)	
Factor	**Index**
 H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

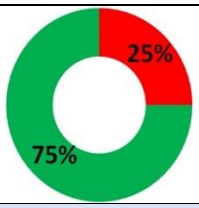
Adaptive Capacity Index (R1+R2)	
Factor	**Index**
 R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
3,64	**1,39**	**0,66**
The score TET is high and far from the equilibrium value 1. This result means that the system is absolutly unprepared to absorb a hydrological event. The possibility of an emergency context is real, because there is spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index).. In particular we note a high level of Exposure (expecially during the Summer) and structural-functional Vulnerability and, at the same time, a low level of Resistance, in terms of emergency management.	The score TDT is just above the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. We suggest some activities to reduce the vulnerability factors and increase the resilience parameters. In this way, with a bit of resources, we might obtain a final score under the value 1	The TCT score is under the equilibrium value 1. It means that will be really hard to have damages on medium-long period, in terms of socio-economic changes. The system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Table 17 Summary sheet municipality of Torino di Sangro

	Municipality of **TORINO di SANGRO**						
Region	*Abruzzo*	District		*Chieti*			
Coordinate	*42°11'27" N 14°32'33" E*	Altitude	*164 m*	Kmq	*32,12*	Citizen	*3030*

Territorial Critically Index (H+V+E)	
Factor	**Index**
	
H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

Adaptive Capacity Index (R1+R2)	
Factor	**Index**
	
R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
1,63	**2,09**	**0,81**
The score TET is higher than the equilibrium value 1. This result means that the system is not totally ready to absorb a hydrological event. The possibility of an emergency context is real, because there is a spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index). Howewer, the level of damages will be low and, as consequence, the level of emergency will be low too. Could be a problem the Exposure value during the Summer, expecially if we observe the low level of resources and capacity in the field of emergency management.	The score TDT is higher than the equilibrium value 1. That means a real possibility to live a disaster context as consequence of a hydrological event. In particular there are some industries near the most dangerous rivers and they show a critically situation. We suggest activities to reduce the vulnerability factors and increase the resilience parameters. In this way, with a bit of resources, we might obtain a final score under near the value 1	The TCT score is just under the equilibrium value 1. It means, at the same time, both that will be hard to have damages on medium-long period, in terms of socio-economic changes, both that it is crucial to adopt a concrete approach and control of the territory to prevent disasters. The system has a good adaptive capacity to oppose to an extreme event only because the main part of the city and activities are far from the rivers.

Table 18 Summary sheet municipality of San Benedetto del Tronto

	Municipality of **SAN BENEDETTO DEL TRONTO**						
Region	*Marche*	District		*Ascoli Piceno*			
Coordinate	42°56'8"88 N 13°53'11"76 E	Altitude	*6 m*	Kmq	*25,41*	Citizen	*47.303*

Territorial Critically Index (H+V+E)	
Factor	**Index**
H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

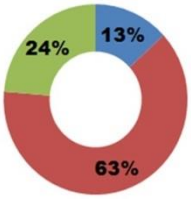
Adaptive Capacity Index (R1+R2)	
Factor	**Index**
R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
5,62	**1,32**	**0,68**
The score TET is really high and really far from the equilibrium value 1. This result means that the system is absolutly unprepared to absorb a hydrological event. In case of event, the local community will live a severe emergency context. The distance between the dimension of the problem and the resources of the local community are unacettable. In particular we note a high level of Exposure (expecially during the Summer) that must request a high level of Resistance actions.	The score TDT is just above the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. We suggest some activities to reduce the vulnerability factors and increase the resilience parameters. In this way, with a bit of resources, we might obtain a final score under the value 1	The TCT score is under the equilibrium value 1. It means that will be really hard to have damages on medium-long period, in terms of socio-economic changes. The system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

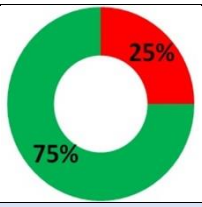
Table 19 Summary sheet municipality of Senigallia

	Municipality of **SENIGALLIA**						
Region	*Marche*	District		*Ancona*			
Coordinate	*43°42'58'' N 13°12'31'' E*	Altitude	*6 m*	Kmq	*117,17*	Citizen	*45.027*

Territorial Critically Index (H+V+E)

Factor	Index
 H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

Adaptive Capacity Index (R1+R2)

Factor	Index
 R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS

Territorial Emergency Threshold (TET)	Territorial Disaster Threshold (TDT)	Territorial Catastrophe Threshold (TCT)
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
2,6	**1,16**	**0,55**
The score TET is high compared to the equilibrium value 1. This result means that the system is unprepared to absorb a hydrological event. The possibility of an emergency context is real, because there is a sensible spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index). In particular we note a high level of Exposure (expecially during the Summer) and structural - functional Vulnerability and, at the same time, a low level of Resistance, in terms of emergency management.	The score TDT is just above the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. We suggest some activities to reduce the vulnerability factors and increase the resilience parameters. In this way, with a bit of resources, we might obtain a final score under the value 1	The TCT score is under the equilibrium value 1.In terms of medium-long socio-economic damages, it will be really hard to have consequence for the local community. Thus, the system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Table 20 Summary sheet municipality of Lugo

	Municipality of **LUGO**						
Region	*Emilia Romagna*	District		*Ravenna*			
Coordinate	*44°25'16"N 11°54'39" E*	Altitude	*12 m*	Kmq	*116,92*	Citizen	*32.390*

Territorial Critically Index (H+V+E)	
Factor	**Index**
H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

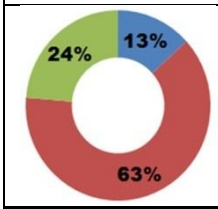
Adaptive Capacity Index (R1+R2)	
Factor	**Index**
R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

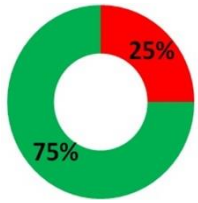
THRESHOLDS

Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
3,39	**0,97**	**0,51**
The score TET is real far from the equilibrium value 1. This result means that the system is absolutly unprepared to absorb a hydrological event. The possibility of an emergency context is real, because there is an important spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index). In particular we note a high level of structural-functional Vulnerability and, at the same time, a low level of Resistance, in terms of emergency management and resources.	The score TDT is just under the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. However, we suggest reinforcing the activities to reduce the vulnerability factors and to plan an organized system of resilient community, because the equilibrium value 1 is really close for this territory.	The TCT score is under the equilibrium value 1.In terms of medium-long socio-economic damages, it will be really hard to have consequence for the local community. Thus, the system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Table 21 Summary sheet municipality of Lido di Savio (Ravenna)

	Municipality of **RAVENNA (LIDO S.)**						
Region	*Emilia Romagna*	District		*Ravenna*			
Coordinate	*44°25'04"N 12°11'58"E*	Altitude	*2 m*	Kmq		Citizen	*563*

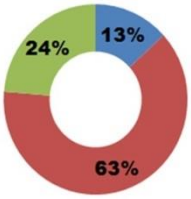
Territorial Critically Index (H+V+E)		
Factor		**Index**
	H – Hazard	
	V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
	E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

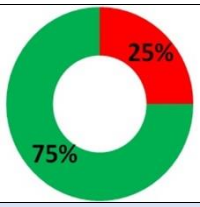
Adaptive Capacity Index (R1+R2)		
Factor		**Index**
	R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
	R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
2,12	**1,53**	**0,55**
The score TET is high compared to the equilibrium value 1. This result means that the system is unprepared to absorb a hydrological event. The possibility of an emergency context is real, because there is a sensible spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index). In particular we note a high level of Exposure (during the Summer) and a really low level of Resistance, in terms of emergency resources.	The score TDT is just above the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. It is possible to have short-medium period consequence. We suggest some activities to reduce the vulnerability factors and increase the resilience parameters, especially in the tourism field. In this way, with a bit of resources, we might obtain a final score under the value 1	The TCT score is under the equilibrium value 1.In terms of medium-long socio-economic damages, it will be really hard to have consequence for the local community. Thus, the system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Table 22 Summary sheet municipality of Sant'Agata sul Santerno

	Municipality of **SANT'AGATA SUL SANTERNO**						
Region	*Emilia Romagna*	District		*Ravenna*			
Coordinate	*44°26'35"16 N 11°51'39"96 E*	Altitude	*14 m*	Kmq	*9,49*	Citizen	*2.862*

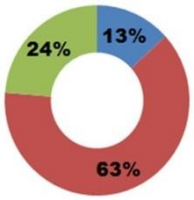
Territorial Critically Index (H+V+E)	
Factor	**Index**
 H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

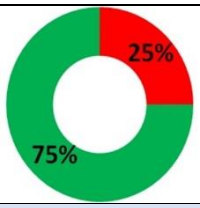
Adaptive Capacity Index (R1+R2)	
Factor	**Index**
 R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
4,46	**1,12**	**0,54**
The score TET is really high and really far from the equilibrium value 1. This result means that the system is absolutly unprepared to absorb a hydrological event. In case of event, the local community will live a severe emergency context. The distance between the dimension of the problem and the resources of the local community are unacettable. The spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index) is severe. In particular we note a high level of Vulnerability and a low value of sistems of mitigation. It is mandatory to reinforce the all the Resistance elements.	The score TDT is just above the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. . It is low the possibility of short-medium period consequence. We suggest some activities to reduce the vulnerability factors and increase the resilience parameters. In this way, with a bit of resources, we might obtain a final score under the value 1.	The TCT score is under the equilibrium value 1.In terms of medium-long socio-economic damages, it will be really hard to have consequence for the local community. Thus, the system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Table 23 Summary sheet municipality of Poggio Renatico

	Municipality of **POGGIO RENATICO**						
Region	*Emilia Romagna*	District		*Ferrara*			
Coordinate	*44°46'0''84 N 11°29'27''96 E*	Altitude	*10 m*	Kmq	*80,65*	Citizen	*9.852*

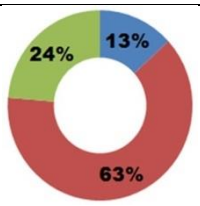
Territorial Critically Index (H+V+E)	
Factor	**Index**
 H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

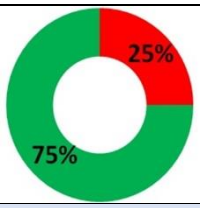
Adaptive Capacity Index (R1+R2)	
Factor	**Index**
 R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
3,25	**0,88**	**0,52**
The score TET is real far from the equilibrium value 1. This result means that the system is absolutly unprepared to absorb a hydrological event. The possibility of an emergency context is real, because there is an important spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index). In particular we note a high level of Vulnerability and, at the same time, a low level of Resistance, in terms of emergency management and resources.	The score TDT is just under the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. However, we suggest reinforcing the activities to reduce the vulnerability factors and to plan an organized system of resilient community, because the equilibrium value 1 is really close for this territory.	The TCT score is under the equilibrium value 1.In terms of medium-long socio-economic damages, it will be really hard to have consequence for the local community. Thus, the system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Table 24 Summary sheet municipality of Mordano

	Municipality of **MORDANO**						
Region	*Emilia Romagna*	District		*Bologna*			
Coordinate	*44°23'56''04 N* *11°48'46''08 E*	Altitude	*21 m*	Kmq	*21,45*	Citizen	*4.747*

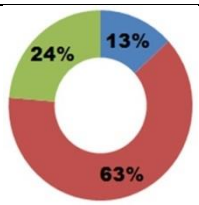
Territorial Critically Index (H+V+E)	
Factor	**Index**
 H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

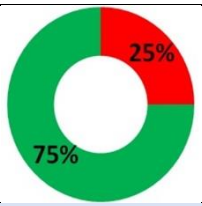
Adaptive Capacity Index (R1+R2)	
Factor	**Index**
 R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
4,05	**1,06**	**0,65**
The score TET is really high and really far from the equilibrium value 1. This result means that the system is absolutly unprepared to absorb a hydrological event. In case of event, the local community will live a severe emergency context. The distance between the dimension of the problem and the resources of the local community are unacettable. The spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index) is severe. In particular we note a high level of Vulnerability and a low value of sistems of mitigation. It is mandatory to reinforce the all the Resistance elements.	The score TDT is just above the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. . It is low the possibility of short-medium period consequence. We suggest some activities to reduce the vulnerability factors and increase the resilience parameters. In this way, with a bit of resources, we might obtain a final score under the value 1.	The TCT score is under the equilibrium value 1. It will not so easy to have damage, in terms of medium-long period. Or, in other words socio-economic changes. The system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Table 25 Summary sheet municipality of Imola

	Municipality of **IMOLA**						
Region	*Emilia Romagna*	District		*Bologna*			
Coordinate	*44°21'32'' N 11°42'47'' E*	Altitude	*47 m*	Kmq	*205*	Citizen	*69.638*

Territorial Critically Index (H+V+E)	
Factor	**Index**
 H – Hazard	
V – Vulnerability	Vs (Structural) – Vf (Functional) – Vse (Socio-economic)
E – Exposure	E_1 (Temporal-People) – E_2 (Economic-Settlement)

Adaptive Capacity Index (R1+R2)	
Factor	**Index**
 R1 Resistance	Dew (Defence Works) – ReR (Rescue Coordinations) – EmC (Emergency Communications) – EmR (Emergency Resources).
R2 Resilience	DrS (Structural) – DrF (Functional) – DrSo (Social) – DrEc (Economic) – DrSe (Settlement) – DrEn (Environment).

THRESHOLDS		
Territorial Emergency Threshold (TET)	**Territorial Disaster Threshold (TDT)**	**Territorial Catastrophe Threshold (TCT)**
$SET = \frac{H + Vs + Vf + E_1}{R_1}$	$SDT = \frac{V + E_2}{R_2}$	$SCT = \frac{H + V + E}{R1 + R2}$
4,31	**1,29**	**0,66**
The score TET is really high and really far from the equilibrium value 1. especially for a big city as Imola. This result means that the system is absolutly unprepared to absorb a hydrological event. In case of event, the local community will live a severe emergency context. The distance, between the dimension of the problem and the resources of the local community, are unacettable. The spread between the value of TCI (Territorial Critically Index) and the resources of the local community ACI (Adaptive Capacity Index) is severe. In particular we note a high level of Vulnerability and a low value of sistems of mitigation. It is mandatory to reinforce the all the Resistance elements.	The score TDT is just above the equilibrium value 1. That means a low possibility to live a disaster context as consequence of a hydrological event. . It is low the possibility of short-medium period consequence. We suggest some activities to reduce the vulnerability factors and increase the resilience parameters. In this way, with a bit of resources, we might obtain a final score under the value 1.	The TCT score is under the equilibrium value 1. It will not so easy to have damage, in terms of medium-long period. Or, in other words socio-economic changes. The system has a good adaptive capacity to oppose to an extreme event. Of course, we can obtain an again better result, if we increase the resilience elements.

Social Resilience Analysis

Data collection design

The UNIVPM activities aim to clarify: (i) awareness of living in a territory with a specific climate related hazard; (ii) knowledge about the available data on flooding phenomena and their homogeneity; (iii) knowledge of the of alert system procedures.

On the basis of the points listed above and with the aim of providing responses to each of them, in the ex-ante phase paper questionnaires targeted for different typologies of interviewed had been constructed: citizens, technicians and school children. The questionnaire targeted for citizens was also delivered through internet channels:

- Website of partners and Pilot areas
- Facebook municipal pages
- Facebook territorial pages

In addition, in the same phase, short interviews had been performed for citizens and technicians. The data collection design for the ex-ante phase is described in Figure 5.

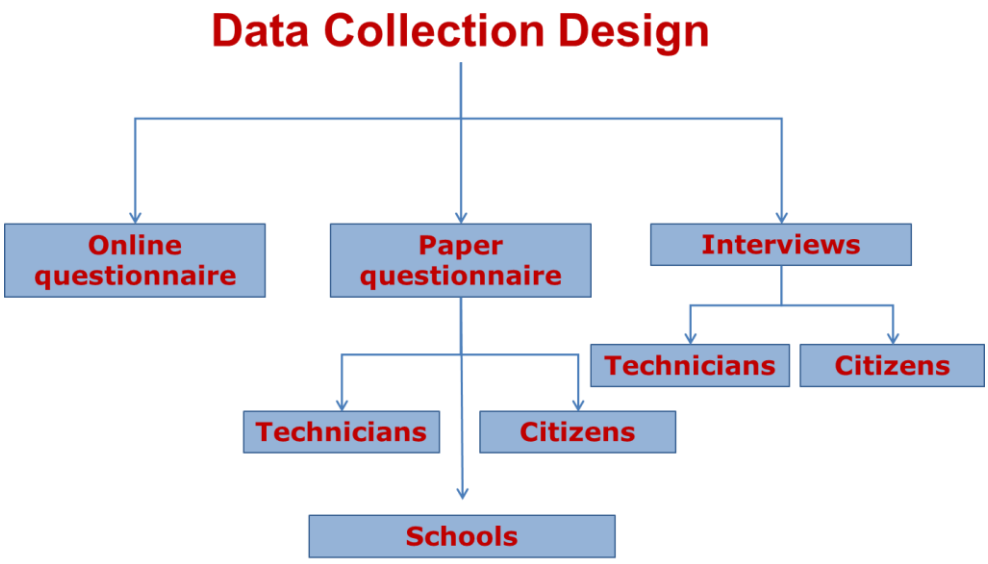


Figure 5 Structure of the data collection design used for the Ex-Ante Risk Perception Analysis

In the ex-post phase paper questionnaires had been delivered only to citizens, that represented the target for the projects' activities, and then it had been possible to make a comparison.

The ex-ante data collection had been performed from May 2016 to July 2017 (schools from May 2016 to December 2016), the ex-post phase from December 2017 to October 2018, accordingly with the PRIMES activities in the different areas.

Questionnaire structure

Questionnaires were devoted to collect information and to analyse the perception of citizens about the following topics, in an ex-ante and ex-post phase with respect to the LIFE PRIMES Projects' activities:

- ✓ **Awareness** about territorial critical issues and climate related hazards (focusing on floods and hydrogeological hazards);
- ✓ **Knowledge** of alert systems and emergency procedures;
- ✓ **Availability** and **accessibility** of data, information and services, **inhomogeneity** of data, information and services;
- ✓ **Uniformity** of warning and alert systems and procedures;
- ✓ Channels of **communication** and information;
- ✓ **Trust in institutions;**
- ✓ **Cultural background.**

For the present analysis questionnaire has 45 questions divided in a specific part, devoted to the study and a general one, with the profile of respondents (see Annex 1 for the ex-post questionnaire and Annex 2 for the ex-ante questionnaire).

Based on the type of statement on the questions, different typologies of answer had been identified:

- Likert scale (which indicates the degree of agreement with the assumed statement);
- Multiple choice with the assignment of a specific importance to every answer;
- Multiple choice without assignment of a specific importance;
- Open-ended answers

For the questions with multiple answers was also given the chance to freely add an additional option.

In the ex-ante phase the questionnaires were administered by following two different strategies, on the basis of the preference of the interested municipalities:

- administration of the questionnaire through the organization of public meetings, selected by Torino di Sangro, Pineto and Ravenna;
- distribution of the questionnaires to the population and then retrieving them at a later stage, selected by Imola, Lugo, Mordano, Sant'Agata sul Santerno, San Benedetto del Tronto and Senigallia.

In the ex-post phase were considered only citizens, since PIMES activities were mainly aimed to them, then it was the target which makes possible the monitoring ex-post.

The questionnaires were administered on the road, to citizens that expressed their interest in collaborating. For the five areas involved by the flood drills planned by the project (Imola, San'Agata sul Santerno, Senigallia, San Benedetto – Sentina, Scerne di Pineto) the administration of questionnaires was performed after the simulation activities.

The data collection, for citizens, was performed by using a non-parametric per-quote method and a cross-sectional approach.

The non-parametric sampling starts from a stratified sampling system, where the interested variable is the residence on the studied areas.

Based on the distribution of the chosen variable, it is possible, by a proportion, to obtain the sample quotas to be drawn for each group.

Quotas (i.e. the number of samples to be collected in each municipality) were obtained in proportion to the total population considered by the PRIMES project.

Data analysis

The data were stored in a SPSS worksheet, then for each variable descriptive statistics were calculated.

Social Resilience Analysis was performed by using a Multi Criteria Decision Analysis with the software Promethee.

Promethee provides a ranking of actions (choices or alternatives) based on preference degrees, which allows for a classification of the studied areas in terms of social resilience.

The PROMETHEE method is based on the computation of pairwise preference degrees, which expresses how an action/criterion is preferred over another action/criterion, from the decision maker's point of view.

In order to obtain the final classification were followed these general steps:

1. Identification of macro-criteria, on the basis of the main objectives of the PRIMES projects and the existing literature;
2. Identification of sub-criteria characterizing the above mentioned macro-criteria;
3. Weight assignment to each macro-criterion;
4. Choice of the preference function, in this case the Level preference function, considered the best for the typology of data (Ishizaka & Nemery, 2013);
5. Computation of the outranking flows;
6. Pairwise comparison and ranking definition;
7. Sensitivity analysis and final ranking definition.

1) Identification of macro-criteria: For the analysis five macro-criteria were identified: three of them on the basis of the main objectives of PRIMES project (1 – Awareness of territory critical issues; 2 – knowledge of alert systems and emergency procedures; 3 – Information system and services), the other two (4 – Trust in institutions; 5 – Cultural Background) on the basis of the existing literature, for their importance in influencing social resilience (Boyd & Richerson 2009; Terpstra, Lindell, & Gutteling 2009; Terpstra 2011; Bubeck, Botzen, & Aerts 2012; Khalili, Harre, & Morley 2015).
2) Identification of sub-criteria: each macro-indicator is described by a specific group of question in the questionnaire. Each question was used for the construction of a numerical matrix by translating the qualitative judgements in quantitative ones, then weighing their relative contribution to social resilience in general and to the corresponding macro-indicator specifically (Greco 2005; Ishizaka and Nemery 2013);
3) Weight assignment to macro-criteria was performed contacting a panel of 10 Italian experts and then averaging their judgements.
4) Choice of the preference function: this is done on the basis of the typology of data, in our case, for qualitative data, the best preference function is the Level function (Brans, Mareshal, & Vincke, 1986). The full preference of an alternative *ai* over *aj* is expressed with a preference degree 1 (i.e. full preference) and 0 (i.e. no preference). The shape of the preference function *Pk* can be defined as:

$$P_k(a_i, a_j) = P_k\left[d_k(a_{i,} a_j)\right]$$

$$0 \le P_k(a_i, a_j) \le 1$$

It follows that the decision maker must fix the definition of an indifference threshold *qk* (i.e. the largest negligible deviation among two alternatives) and a preference threshold *pk* (i.e. the smallest sufficient deviation between two alternatives to generate a full preference) for each criterion *gk*. There are six preference functions to be selected (Vincke & Brans, 1985) named: usual criterion, quasi-criterion (U-shape), criterion with linear preference (V-shape), level criterion, criterion with linear preference and indifference area (linear), and Gaussian criterion. In the case of the Gaussian curve the inflection is the only preference parameter that must be defined. The global preference of *ai* over *aj* concerning all the selected criteria can be defined through the preference index which considers the weights *wk* for each criterion and can be represented as follows:

$$\pi(a_i, a_j) = \sum_{k=1}^{q} P_k\left[d_k(a_i, a_j)\right] \cdot \omega_k$$

$$\omega_k \geq 0 \text{ and } \sum_{k=1}^{q} \omega_k = 1$$

5) Computation of the outranking flows: for the definition of the ranking two flows must be defined: positive (i.e. leaving flow) and negative (i.e. entering flow). These respectively represent on average how much stronger the preference of an action *ai* is (or more preferable) than the remaining actions x of the set A and vice-versa. The formula is reported below:

$$\phi^{+}(a_i) = \frac{1}{n-1} \sum_{x \in A} \pi(a_i, x)$$

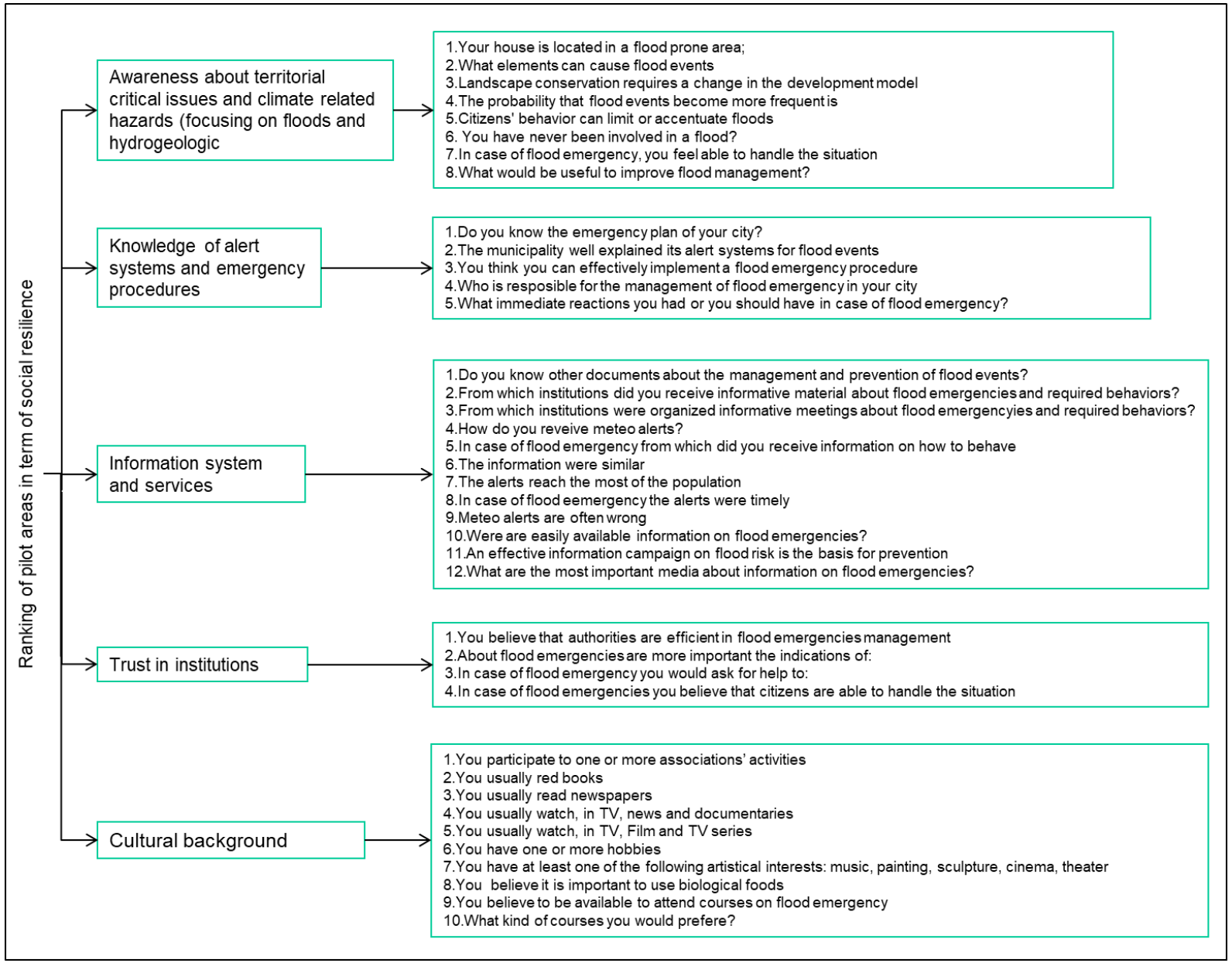
$$\phi^{-}(a_i) = \frac{1}{n-1} \sum_{x \in A} \pi(x, a_i)$$

6) The final complete ranking can be then generated depending on the net flows of the alternatives.

7) Sensitivity analysis: is a useful tool for testing the robustness of the final ranking. It is performed by changing the weight of the chosen macro-criteria and recalculating the ranking accordingly. If a small variation of one single criterion induces significant changes in the final ranking, then it is not stable.

The hierarchical organization of the chosen macro-criteria and their sub-criteria is outlined in Figure 6.

Figure 6 Outline of the hierarchical organization of macro-criteria and sub-criteria



Results of Social Resilience Analysis

In the ex-post phase the number of compiled questionnaires is very similar to the ex-ante phase. The only study area that shows a significant lower number of compilations is Poggio Renatico (Figure 7).

Pilot areas	N. Ex-ante	N. Ex-post
Imola	101	106
Lugo	80	82
Mordano	23	23
Poggio Renatico	25	15
Sant'Agata sul Santerno	12	11
Ravenna (Lido di Savio)	16	11
Senigallia	67	70
San Benedetto del Tronto -Sentina	18	18
Pineto - Scerne di Pineto	22	22
Torino di Sangro	13	12
Totale	377	370

Figure 7 Number of compiled questionnaires from each studied areas in the ex-ant and ex-post phase

The hierarchical Promethee approach allowed for the individuation of a final ranking of studied areas in term of social resilience, for the ex-ante and the ex-post phases.

This final ranking, as shown in Table 26 and Table 27, in the ex-ante phase places in the first position the Torino di Sangro study area, followed by Lido di Savio at the second place and Imola at the third place. At the last position is the municipality of Mordano.

This classification is provided by the calculation of the total net flow performed for the five chosen macro-criterion: Awareness, Knowledge, Information, Trust and Culture.

Table 26 Ex Ante MCDA Final Ranking

Studied Areas	Phi ex-ante
Torino di Sangro	0,1582
Lido di Savio	0,1043
Imola	0,1030
Senigallia	0,0602
Poggio Renatico	-0,0280
Lugo	-0,0334
Sant'Agata sul Santerno	-0,0463
San Benedetto del Tronto - Sentina	-0,0600
Scerne di Pineto	-0,0704
Mordano	-0,1877

Table 27 Ex Post MCDA Final Ranking

Studied Areas	Phi ex-ante
Sant'Agata sul Santerno	0,2862
Scerne di Pineto	0,2638
Senigallia	0,1197
San Benedetto del Tronto – Sentina	0,1073
Poggio Renatico	-0,0082
Mordano	-0,0121
Lugo	-0,0888
Imola	-0,1603
Lido di Savio	-0,1754
Torino di Sangro	-0,3323

In the ex-post phase final ranking completely changes, and we see Sant'Agata sul Santerno and Scerne di Pineto at the first positions, whereas at the last there are Lido di Savio and Torino di Sangro.

If we make a difference between the net flows of the ex-post phase and the net flows of the ex-ante phase (Table 28), we can observe an improvement on the Phi values in the majority of the areas, with the exception of Imola, Lido di Savio, Lugo and Torino di Sangro. These improvements are more important for the smaller areas and less important for the bigger ones.

In addition, Sant'Agata sul Santerno and Pineto, the smallest areas that hosted the simulations have the best values of improvements.

Table 28 Differences between the net flows fo the x-post phase and the net flows of the ex-ante phase

Studied Areas	**Δ Phi**
Imola	-0,2633
Lido di Savio	-0,2797
Lugo	-0,0554
Mordano	0,1756
Poggio Renatico	0,0198
San Benedetto del Tronto – Sentina	0,1673
Sant'Agata sul Santerno	0,3325
Scerne di Pineto	0,3342
Senigallia	0,0595
Torino di Sangro	-0,4905

Final ranking can be shown also in a two-dimensional representation as the one provided by the GAIA Promethee tool.

The GAIA representation contains all the aspects of the decision problem (Figure 8):

- the red line represents the decision axis, which accommodates all the weights of the chosen macro-indicators;
- the actions to be ranked, the studied areas in this case, are represented by bullets;
- the macro-indicators (also called macro-criteria) by arrows.

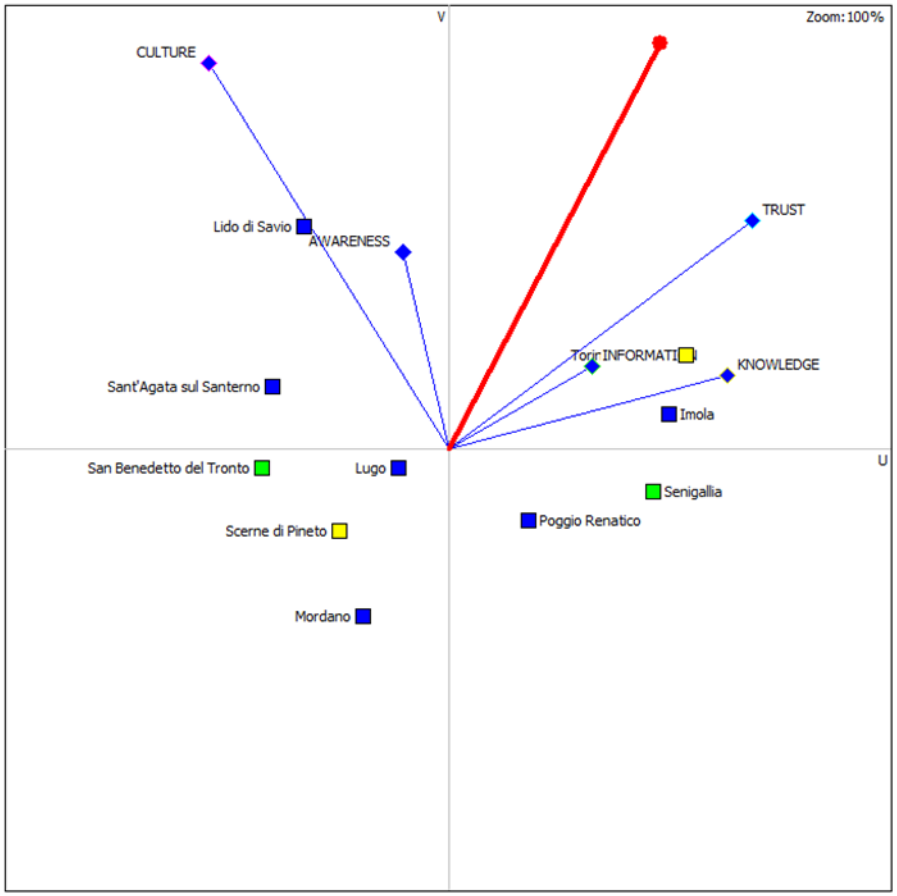
The position of the areas on the plane gives an idea of their similarities:

- the closer are the bullets representing the studied areas between them, the more similar they are;
- the closer they are to the red line, the better they answer to the decision axis, in this case with best resilience's values;
- the better they are oriented through the decision axis, the better they answer to the decision axis.

Also the orientation of the macro-indicators axes gives indications: when they are oriented through a similar direction they are according, on the contrary, when they are in different planes they are conflicting each other.

Finally, the length of the arrow represents the discriminating power of the criterion: the more the length, the more the discriminating power.

The first thing that it is possible to observe in Figure 8 is that the axes of macro-indicators are better oriented respect to the decision axis in the ex-post phase.



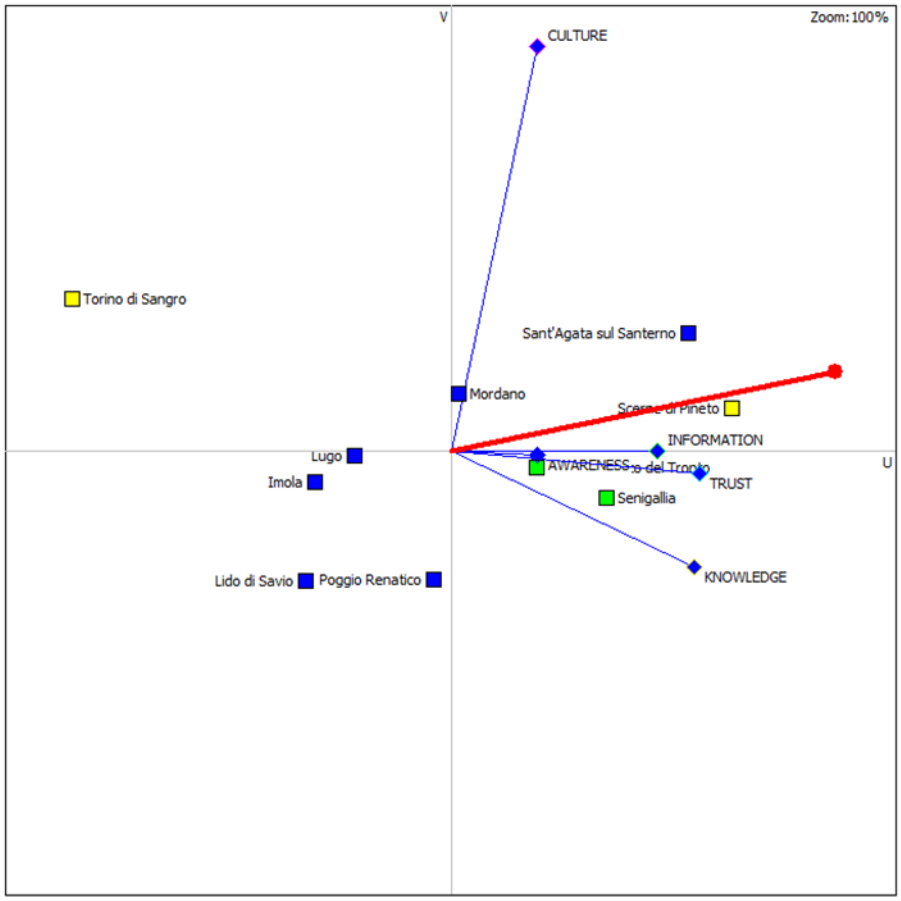


Figure 8 Gaia two-dimensional representation of the decision problem

The positions of the studied areas on the plane clearly show what the final ranking expressed.

In the ex-ante phase Scerne di Pineto and Mordano had an orientation in contrast with one of the decision axis, whereas Torino di Sangro, Imola and Senigallia were closer to it, reflecting their positions in the final ranking.

Information, Trust and Knowledge are the macro-indicators more influential in this representation.

In the ex-post phase, on the contrary, Torino di Sangro is located very far from the decision axis and oriented in contrast with its direction, on the contrary San'Agata sul Santerno and Scerne di Pineto reach better positions.

Awareness, Trust and Knowledge, in this case, are the macro-indicators more influential for the areas, which show the best positions in the final ranking.

Sensitivity analysis

In order to be sure that the final ranking can be considered as a stable solution, a sensitivity analysis is needed.

In fact, if a small variation of one single parameter induces a complete change in the ranking that means the ranking is unstable.

The sensitivity analysis performed for this set of macro-criteria tested their contribution to the final ranking variating their weight from -50% to + 50%.

In Figure 9 and 10 are reported the results of that analysis for both phases, showing, for each pilot area, the probability of occupying a specific place in the final ranking.

MUNICIPALITIES	1	2	3	4	5	6	7	8	9	10	TOT%
IMOLA	0	50	50	0	0	0	0	0	0	0	100
LUGO	0	0	0	0	20	74	6	0	0	0	100
MORDANO	0	0	0	0	0	0	0	0	0	100	100
SANT'AGATA	0	0	0	0	6	0	74	14	6	0	100
LIDO DI SAVIO	0	50	44	6	0	0	0	0	0	0	100
POGGIO RENATICO	0	0	0	0	74	20	3	0	3	0	100
SENIGALLIA	0	0	6	94	0	0	0	0	0	0	100
SAN BENEDETTO DEL TRONTO	0	0	0	0	0	6	10	84	0	0	100
PINETO	0	0	0	0	0	0	6	17	77	0	100
TORINO DI SANGRO	100	0	0	0	0	0	0	0	0	0	100

0% 1-40% 41-70% 71-100%

Figure 9 Sensitivity analysis for the ex-ante phase

As it is possible to see, every position occupied by each study area is confirmed, with very high percentages, by the sensitivity analysis.

In the ex-post phase these probabilities become even higher, confirming the robustness of the obtained rankings.

MUNICIPALITIES	1	2	3	4	5	6	7	8	9	10	TOT%
IMOLA	0	0	0	0	0	0	0	87	13	0	100
LUGO	0	0	0	0	0	0	100	0	0	0	100
MORDANO	0	0	0	0	20	80	0	0	0	0	100
SANT'AGATA	97	3	0	0	0	0	0	0	0	0	100
LIDO DI SAVIO	0	0	0	0	0	0	0	13	87	0	100
POGGIO RENATICO	0	0	0	0	80	20	0	0	0	0	100
SENIGALLIA	0	0	77	23	0	0	0	0	0	0	100
SAN BENEDETTO DEL TRONTO	0	0	23	77	0	0	0	0	0	0	100
PINETO	3	97	0	0	0	0	0	0	0	0	100
TORINO DI SANGRO	0	0	0	0	0	0	0	0	0	100	100

Figure 10 Sensitivity analysis for the ex-post phase

Discussion and Conclusion

Based on the results described so far and on the main objectives of Primes project it is possible to shortly discuss the derived information from the social resilience analysis.

The studied areas, in general show a better level of social resilience, except for Lido di Savio Imola, and Torino di Sangro, Lugo does not shows big variations. The improvement in levels of social resilience is better evident in smaller communities compared to bigger ones and in particular in those that hosted simulation activities.

This result is particular important, because it means that LIFE PRIMES project achieved its aims overall with general activities, but in particular with specific activities as had been the drills.

Indeed, Lido di Savio did not host a simulated experience, but it experienced a real flood in September 2014.

This event, which fortunately did not have serious negative consequences, affected the activities of the community enhancing his social resilience in the ex-ante phase. The ex-ante data collection for PRIMES was performed about a year after the real flood event, which was still very vivid in the memory of citizens. Not surprisingly, in such ex-ante survey Lido di Savio ranked first position for social resilience, as social memory has a fundamental role in building resilience (Mistry et al., 2014). The lowered ranking achieved in ex-post survey can be explained with the effect of the temporal decay, well known in literature (Alexander, 2000).

The more influential macro-indicators for the improvement in social resilience seem to be Trust, Awareness and Knowledge.

This result is mainly evident in areas as Scerne di Pineto, which in the ex-ante phase had a satisfactory level of Awareness, giving the recent flood experience with respect to the data collection, but a very bad level of Trust in institutions.

Therefore LIFE PRIMES projects activities influenced not only aspect linked to the strict knowledge of flood phenomena, but also other aspects much more sensitive, such as trust in institutions, that are strongly influential for the overall resilience.

This is particularly important also considering that Imola, which has a very efficient information system, does not maintain its level of resilience, because lowered other indicators as Trust and Awareness.

This happened in spite of the fact that Imola was one of the areas that hosted a flood simulation in its territory.

Indeed, a social community with the dimension of Imola greatly influences the process of knowledge deriving from a simulation experience, because in bigger communities there is an increase of misunderstanding of social relationships worsening communication effectiveness.
Kwok et al. (2016) claim that the information exchange is an efficient contribution to social resilience and it is influenced by the community dimension. On this basis, a small town can be considered as a uniform community, while a big town, including differences between its neighbourhoods, cannot be. Alexander (2000) justifies this with the spatial decay phenomenon within a community.

In conclusion, PRIMES activities positively affected social resilience in the majority of studied areas, but not in all of them.

The most important influence is evident in small areas which host simulation activities.

Big areas with the experience of simulation activities did not show the same improvement, actually the biggest one, Imola, underlines even a decreasing of its previous resilience level.

Results suggest that information given to the population, without direct experience, could be not completely efficacy in small areas (see e.g. Lido di Savio), and also simulation activities could be not beneficial for big communities (see e.g. Imola) when there are localized restricted experiences in a wide area.

In conclusion, among the various activities provided by LIFE PRIMES project for small areas the best way for improving social resilience seems to be the simulated experience. For bigger areas it could be interesting to further investigate whether a greater number of clustered yet spatially well-distributed simulated experiences may enhance the social resilience.

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Annex 1 – Ex-post questionnaire

ANNEX 1

LIFE14CCA/IT/001280

PROGETTO
LIFE PRIMES
Prevenire il rischio alluvioni rendendo le comunità resilienti

ANALISI DI PERCEZIONE DEL RISCHIO

QUESTIONARIO POPOLAZIONE

COMUNE _____

Nazionalità _____

PROGETTO LIFE PRIMES

Il Progetto LIFE PRIMES (Prevenire il rischio alluvioni rendendo le comunità resilienti - Preventing flooding RIsks by Making resilient communitiES) ha lo scopo di costruire comunità resilienti al rischio alluvione mediante il diretto coinvolgimento delle comunità stesse nelle operazioni di Early Warning e di prevenzione del rischio.

Il progetto riguarda tre regioni (Emilia Romagna, Marche ed Abruzzo), nei cui territori sono state individuate specifiche aree pilota.

La partecipazione delle comunità vulnerabili è un aspetto cruciale del progetto.

Mediante la compilazione di questo questionario, rivolto ai cittadini delle aree soggette ad indagine (Imola, Lugo, Mordano, Pineto, Poggio Renatico, San Benedetto del Tronto, Sant'Agata sul Santerno, Senigallia, Ravenna e Torino di Sangro) sarà possibile un'accurata analisi della percezione del rischio nei territori studiati.

Grazie a tutti per la collaborazione!

1. La sua casa è ubicata in un'area esondabile

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

2. Tra i seguenti elementi quali, secondo lei, possono causare gli eventi alluvionali?

☐ Agricoltura

☐ Industria

☐ Distribuzione dell'edificato

☐ Disboscamento

☐ Eccessivo consumo delle risorse naturali

☐ Eccessiva produzione di rifiuti

☐ Mezzi di trasporto

☐ Cattiva progettazione/costruzione, manutenzione delle infrastrutture urbane

☐ Altro _____

3. La probabilità che nel suo territorio gli eventi alluvionali diventino più frequenti è:

☐ Molto alta

☐ Alta

☐ Media

☐ Bassa

☐ Molto bassa

4. La salvaguardia del territorio richiede un cambiamento del modello di sviluppo

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

5. Da quali istituzioni ha ricevuto materiale informativo o sono stati organizzati incontri sulle alluvioni e sui comportamenti da tenere?

Dal Comune	☐ **materiale**	☐ **incontri**
Dalla Regione	☐ **materiale**	☐ **incontri**
Dalla Protezione Civile	☐ **materiale**	☐ **incontri**
Altro _____	☐ **materiale**	☐ **incontri**

☐ Non ho ricevuto nessun materiale informativo

☐ Non è stato organizzato nessun incontro informativo

6. Ritiene che le autorità preposte siano efficienti nella gestione del rischio alluvione:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

7. **Chi è responsabile della gestione delle emergenze alluvionali nel suo territorio?**

_____

8. **Conosce il piano di emergenza della sua città?**

- ☐ Si
- ☐ No
- ☐ Non so cosa sia

9. **Conosce altri documenti, compresa la legislazione, sulla gestione e prevenzione degli eventi alluvionali?**

- ☐ Direttive europee
- ☐ Leggi quadro nazionali
- ☐ Leggi regionali
- ☐ Bollettini informativi
- ☐ Piani di evacuazione
- ☐ Opuscoli informativi sulle procedure di emergenza
- ☐ Rapporti scientifici
- ☐ Altro_____
- ☐ Non sono a conoscenza di tale documentazione

10. **Una efficace campagna informativa sul rischio alluvionale è alla base della prevenzione:**

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

11. **Si ritiene disponibile a frequentare corsi di preparazione alle alluvioni:**

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

12. **Se si, quali tipologie di formazione preferirebbe?**

- ☐ Incontri pubblici sulle cause di tali eventi
- ☐ Incontri pubblici sul comportamento da tenere
- ☐ Corsi sulle tecniche di primo soccorso
- ☐ Corsi online
- ☐ Corsi aziendali
- ☐ Altro _____

13. Le informazioni sulle alluvioni sono facilmente reperibili su:

- ☐ Sito web comunale
- ☐ Sito web regionale
- ☐ Siti web protezione civile
- ☐ Motore di ricerca web
- ☐ Programmi televisivi dedicati
- ☐ Riviste scientifiche
- ☐ Libri
- ☐ Altro _____
- ☐ In nessun modo

14. Le allerte raggiungono la maggior parte della popolazione:

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

15. In caso di emergenza, le allerte sono state date per tempo:

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

16. Le allerte meteo sono spesso sbagliate:

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

17. Quali sono i mezzi di comunicazione più importanti per l'informazione pubblica sulle alluvioni?

- ☐ Sito web comunale
- ☐ Sito web regionale
- ☐ Sito web protezione civile
- ☐ Motore di ricerca web
- ☐ Telegiornale
- ☐ Programmi televisivi
- ☐ Radiogiornale
- ☐ Programmi radiofonici
- ☐ Giornali
- ☐ Riviste scientifiche o Libri
- ☐ Esperti
- ☐ Persone di fiducia
- ☐ Social networks
- ☐ Passaparola
- ☐ Nessuno
- ☐ Altro _____

18. I comportamenti dei cittadini possono limitare o accentuare le alluvioni

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

19. Sul tema alluvioni sono più importanti le indicazioni fornite da:

- ☐ Sindaco
- ☐ Funzionario Protezione civile
- ☐ Persona del nucleo familiare (specificare _____)
- ☐ Persona con esperienza personale pregressa
- ☐ Personale delle forze dell'ordine
- ☐ Amici\parenti
- ☐ Esperto scientifico
- ☐ Personaggio pubblico (specificare _____)
- ☐ Altro: _____

20. Quali reazioni immediate ha messo in atto o pensa attuerebbe se vivesse un'alluvione:

- ☐ Fuggire a piedi per allontanarsi dal luogo dell'evento
- ☐ Fuggire in macchina per allontanarsi dal luogo dell'evento
- ☐ Nascondersi
- ☐ Raggiungere una postazione ritenuta sicura (salire ai piani più alti)
- ☐ Chiamare i soccorsi
- ☐ Andare in aiuto dei propri familiari
- ☐ Andare in aiuto di altre persone
- ☐ Cercare di controllare l'evento
- ☐ Mettere in sicurezza i propri beni materiali
- ☐ Altro _____

21. Come riceve le allerte meteoclimatiche?

- ☐ A mezzo televisione
- ☐ Radio
- ☐ Comunicati alla popolazione da parte della Municipalità
- ☐ Forze dell'ordine
- ☐ Protezione civile
- ☐ Canali internet
- ☐ Social media
- ☐ Passaparola
- ☐ Altro _____

22. In caso di emergenza ha avuto informazioni su come comportarsi da:

- ☐ Televisione
- ☐ Radio
- ☐ Comunicati alla popolazione da parte della Municipalità
- ☐ Forze dell'ordine
- ☐ Protezione civile
- ☐ Canali internet
- ☐ Social media
- ☐ Passaparola
- ☐ Altro _____
- ☐ Non sono state diramate informazioni su come comportarsi in caso di emergenza

23. Le informazioni ricevute dalle varie istituzioni erano simili

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

24. Il Comune ha spiegato bene i propri sistemi di allarme alluvione (sirene, sms, comunicato radio/TV, ecc.):

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

25. Ritiene di essere in grado di attuare efficacemente una procedura di emergenza alluvione (es. allontanarsi dal fiume, non attraversare ponti, salire ai piani superiori, ecc.):

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

26. Ritiene che la popolazione del suo territorio sia preparata ad affrontare un'emergenza alluvione:

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

27. In caso di emergenza a chi si è rivolto o a chi si rivolgerebbe per chiedere aiuto?

☐ Sindaco

☐ Funzionario Protezione civile

☐ Persona del nucleo familiare (specificare _____)

☐ Persona con esperienza personale pregressa

☐ Personale delle forze dell'ordine

☐ Amici\parenti

☐ Altro: _____

28. In caso di emergenza si è sentito o si sentirebbe in grado di gestire la situazione:

☐ Da solo

☐ Se aiutato da tecnici preposti (es. vigili del fuoco, protezione civile, ecc.)

☐ Se aiutato da familiari

☐ Se aiutato da amici/parenti

☐ Non in grado di gestire la situazione, ma fiducioso di ricevere aiuto

☐ Non in grado di gestire la situazione e in balia degli eventi

29. È mai rimasto coinvolto in un'alluvione?

☐ In prima persona

☐ Parenti

☐ Amici

☐ Conoscenti

☐ Vicini/concittadini

☐ Non ho mai avuto questo tipo di esperienza

30. Cosa sarebbe utile a migliorare la gestione delle alluvioni?

☐ Formazione ed esercitazioni

☐ Un maggior numero di tecnici

☐ Investimenti sulla prevenzione

☐ Sensibilizzazione degli amministratori e decisori politici

☐ Sensibilizzazione della popolazione

☐ Pianificare l'uso del territorio in modo sostenibile

☐ Rendere più efficaci le arginazioni fluviali

☐ Altro (specificare _____)

PARTE GENERALE

1. **Età** (anni): _____

2. **Sesso**:

☐ Maschio

☐ Femmina

3. **Occupazione**: _____

4. **Grado di istruzione**:

☐ Elementari

☐ Medie

☐ Scuole superiori (indicare quale _____)

☐ Università (indicare tipologia): _____

☐ Studi post universitari (indicare tipologia): _____

5. **Qual è il suo ruolo all'interno del nucleo familiare?**

☐ Madre

☐ Padre

☐ Figlio/figlia

☐ Nonno/nonna

☐ Altro _____

6. **Ha figli piccoli?**:

☐ Si

☐ No

7. **Sarei disposto a cambiare il luogo dove vivo al fine di diminuire l'esposizione alle alluvioni:**

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

8. **Tipologia di abitazione e collocazione**:

☐ Appartamento in centro

☐ Appartamento in periferia

☐ Casa singola in centro

☐ Casa singola in periferia

☐ Villetta monofamiliare

☐ Villetta plurifamiliare

9. **L'abitazione dista dai fiumi principali:**

☐ < 200 metri

☐ 200 < 500 metri

☐ 500 < 1 km

☐ > 1 km

☐ Non so

10. Per l'alimentazione ritiene sia importante prediligere prodotti di provenienza biologica:

- ☐ Completamente d'accordo
- ☐ D'accordo
- ☐ Incerto
- ☐ In disaccordo
- ☐ In completo disaccordo

11. Relativamente agli interessi elencati di seguito, barri le caselle che la riguardano maggiormente:

	SI	NO	Indicare quali
Partecipa alle attività di una o più associazioni	☐	☐	_____
Legge abitualmente libri	☐	☐	_____
Legge abitualmente quotidiani	☐	☐	_____
In tv guarda abitualmente notiziari e/o documentari	☐	☐	_____
In tv guarda abitualmente programmi di intrattenimento	☐	☐	_____
In tv guarda abitualmente film e/o serie televisive	☐	☐	_____
Ha uno o più hobby	☐	☐	_____
Ha almeno uno dei seguenti interessi artistici: musica, pittura, scultura, teatro, cinema	☐	☐	_____

SE HA VISSUTO UN'ALLUVIONE DESCRIVA LE COSE CHE HA FATTO IMMEDIATAMENTE, PRIMA DI COMINCIARE A RAGIONARE SU QUELLO CHE STAVA SUCCEDENDO:

Annex 2 - Ex-ante questionnaire

ANNEX 2

LIFE14CCA/IT/001280

PROGETTO LIFE PRIMES

Prevenire il rischio alluvioni rendendo le comunità resilienti

ANALISI DI PERCEZIONE DEL RISCHIO

QUESTIONARIO POPOLAZIONE

COMUNE _____

Nazionalità _____

PROGETTO LIFE PRIMES

Il Progetto LIFE PRIMES (Prevenire il rischio alluvioni rendendo le comunità resilienti - Preventing flooding RIsks by Making resilient communitiES) ha lo scopo di costruire comunità resilienti al rischio alluvione mediante il diretto coinvolgimento delle comunità stesse nelle operazioni di Early Warning e di prevenzione del rischio.

Il progetto riguarda tre regioni (Emilia Romagna, Marche ed Abruzzo), nei cui territori sono state individuate specifiche aree pilota.

La partecipazione delle comunità vulnerabili è un aspetto cruciale del progetto.

Mediante la compilazione di questo questionario, rivolto ai cittadini delle aree soggette ad indagine (Imola, Lugo, Mordano, Pineto, Poggio Renatico, San Benedetto del Tronto, Sant'Agata sul Santerno, Senigallia, Ravenna e Torino di Sangro) sarà possibile un'accurata analisi della percezione del rischio nei territori studiati.

Grazie a tutti!

PRECEDENTI ESPERIENZE E CONOSCENZA DEL PROBLEMA

1. La sua casa è ubicata in un'area esondabile

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

2. In una scala da 0 (nulla) a 5 (molto) quanto i seguenti elementi possono causare gli eventi alluvionali? (inserire i voti nelle caselle):

☐ Agricoltura

☐ Industria

☐ Distribuzione dell'edificato

☐ Disboscamento

☐ Eccessivo consumo delle risorse naturali

☐ Eccessiva produzione di rifiuti

☐ Mezzi di trasporto

☐ Cattiva progettazione, costruzione e manutenzione delle infrastrutture urbane

☐ Altro _____

3. La salvaguardia del territorio richiede un cambiamento del modello di sviluppo

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

4. Nel territorio del suo Comune le alluvioni sono eventi eccezionali (poco frequenti o rarissimi):

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

5. La probabilità che gli eventi alluvionali diventino più frequenti è:

☐ Molto alta

☐ Alta

☐ Media

☐ Bassa

☐ Molto bassa

6. In quale stagione il suo territorio è maggiormente esposto al rischio alluvione?

☐ Inverno

☐ Primavera

☐ Estate

☐ Autunno

7. In una scala da 0 (nulla) a 5 (molto) una violenta alluvione nel suo territorio creerebbe danni materiali a (inserire i voti nelle caselle):

☐ Tutto

☐ Parte urbana

☐ Agricoltura

☐ Persone (specificare la categoria più vulnerabile

_____)

☐ Industria

☐ Beni culturali

☐ Altro_____

8. In una scala da 0 (nulla) a 5 (molto) una violenta alluvione nel suo territorio creerebbe danni psicologici principalmente (inserire i voti nelle caselle):

☐ Agli anziani

☐ Ai bambini

☐ Alle persone con disabilità

☐ Alla popolazione in genere

☐ Non creerebbe danni psicologici

☐ Altro _____

9. Le alluvioni non sono solo distruzione, ma anche opportunità (economiche, strutturali, ecc.):

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

10. Conosce il piano di emergenza della sua città?

☐ Si

☐ No

☐ Non so cosa sia

11. Conosce altri documenti, compresa la legislazione, sulla gestione e prevenzione degli eventi alluvionali?

☐ Direttive europee

☐ Leggi quadro nazionali

☐ Leggi regionali

☐ Bollettini informativi

☐ Piani di evacuazione

☐ Opuscoli informativi sulle procedure di emergenza

☐ Rapporti scientifici

☐ Altro_____

☐ Non sono a conoscenza di tale documentazione

12. Da quali istituzioni ha ricevuto materiale informativo sulle alluvioni e sui comportamenti da tenere?

☐ Dal Comune

☐ Dalla Regione

☐ Dalla Protezione Civile

☐ Altro
_____-

☐ Non ho ricevuto materiale informativo

13. Da quali istituzioni sono stati organizzati incontri formativi pubblici sulle alluvioni e sui comportamenti da tenere:

☐ Dal Comune

☐ Dalla Regione

☐ Dalla Protezione Civile

☐ Altro _____

☐ Non sono stati organizzati incontri formativi pubblici

14. Ritiene che le autorità preposte siano efficienti nella gestione del rischio alluvione:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

15. Chi è responsabile della gestione delle emergenze alluvionali nel suo territorio?

_____

16. Una efficace campagna informativa sul rischio alluvionale è alla base della prevenzione:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

17. In una scala da 0 (nulla) a 4 (molto) quali sono i mezzi di comunicazione più importanti per l'informazione pubblica sulle alluvioni? (inserire i voti nelle caselle)

☐ Telegiornale

☐ Programmi televisivi

☐ Radiogiornale

☐ Programmi radiofonici

☐ Giornali

☐ Social networks

☐ Passaparola

18. In una scala da 0 (nulla) a 5 (molto) Quali sono i mezzi di comunicazione più affidabili? (inserire i voti nelle caselle)

☐ Telegiornale

☐ Programmi televisivi

☐ Radiogiornale

☐ Programmi radiofonici

☐ Giornali

☐ Social networks

☐ Passaparola

☐ Altro _____

19. In una scala da 0 (nulla) a 5 (molto) i media parlano delle alluvioni in termini di (inserire i voti nelle caselle):

☐ Spettacolarizzazione

☐ Dimensione politica

☐ Dimensione ambientale

☐ Dimensione economica

☐ Dimensione sociale

20. Quanto sono importanti i seguenti mezzi per informarsi sulle alluvioni e le loro cause? (barrare le caselle su ogni riga)

	Per nulla	**Poco**	**Abbastanza**	**Molto**	**Moltissimo**
Sito web comunale	☐	☐	☐	☐	☐
Sito web regionale	☐	☐	☐	☐	☐

Siti web protezione civile	☐	☐	☐	☐	☐
Motore di ricerca web	☐	☐	☐	☐	☐
Programmi televisivi dedicati	☐	☐	☐	☐	☐
Riviste scientifiche	☐	☐	☐	☐	☐
Libri	☐	☐	☐	☐	☐
Esperti	☐	☐	☐	☐	☐
Persone di fiducia	☐	☐	☐	☐	☐
Nessuno	☐	☐	☐	☐	☐
Altro (_____)	☐	☐	☐	☐	☐

21. In una scala da 0 (nulla) a 5 (molto) le informazioni sulle alluvioni sono facilmente reperibili su (inserire i voti nelle caselle):

☐ Sito web comunale

☐ Sito web regionale

☐ Siti web protezione civile

☐ Motore di ricerca web

☐ Programmi televisivi dedicati

☐ Riviste scientifiche

☐ Libri

☐ Altro _____

☐ In nessun modo

22. Si ritiene disponibile a frequentare corsi di preparazione alle alluvioni:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

23. In una scala da 0 (nulla) a 5 (molto) quali tipologie di formazione preferirebbe? (inserire i voti nelle caselle):

☐ Incontri pubblici sulle cause di tali eventi

☐ Incontri pubblici sul comportamento da tenere

☐ Corsi sulle tecniche di primo soccorso

☐ Corsi online

☐ Corsi aziendali

☐ Non ho preferenze

24. In una scala da 0 (nulla) a 5 (molto) sul tema alluvioni sono più importanti le indicazioni fornite da (inserire i voti nelle caselle):

☐ Sindaco

☐ Funzionario Protezione civile

☐ Persona del nucleo familiare (specificare _____)

☐ Persona con esperienza personale pregressa

☐ Personale delle forze dell'ordine

☐ Amici\parenti

☐ Esperto scientifico

☐ Personaggio pubblico (specificare _____)

☐ Altro: _____

25. In una scala da 0 (nulla) a 5 (molto) nelle scuole, l'argomento disastri (alluvioni), dovrebbe essere insegnato tramite (inserire i voti nelle caselle):

☐ Lezioni frontali

☐ Esercitazioni pratiche con tecnici del settore

☐ Escursioni sui luoghi interessati da alluvioni

☐ Altro _____

☐ Non ritengo utile una didattica scolastica dedicata al problema

26. I comportamenti dei cittadini possono limitare o accentuare le alluvioni

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

27. In una scala da 0 (nulla) a 5 (molto) quali abitudini ritiene utili a limitare le alluvioni (inserire i voti nelle caselle):

☐ Usare i mezzi pubblici

☐ Usare la bicicletta

☐ Fare la raccolta differenziata

☐ Ridurre l'acquisto di beni per la propria persona

☐ Ridurre l'uso di combustili ed energia elettrica nella propria abitazione

☐ Ridurre il consumo d'acqua

☐ Dotare la propria abitazione di sistemi per l'energia alternativa

☐ Non ritengo che le abitudini dei cittadini possano influenzare il problema

☐ Altro _____

28. Delle abitudini sotto elencate quale effettivamente mette in pratica:

☐ Usare i mezzi pubblici

☐ Usare la bicicletta

☐ Fare la raccolta differenziata

☐ Ridurre l'acquisto di beni per la propria persona

☐ Ridurre l'uso di combustili ed energia elettrica nella propria abitazione

☐ Ridurre il consumo d'acqua

☐ Dotare la propria abitazione di sistemi per l'energia alternativa

☐ Non sono disposto a mettere in pratica particolari abitudini per una migliore gestione del problema

☐ Ritengo inutile mettere in pratica particolari abitudini per una migliore gestione del problema

☐ Altro _____

PERCEZIONE DEL RISCHIO E COMUNICAZIONE

29. È mai rimasto coinvolto in un'alluvione?

☐ In prima persona

☐ Parenti

☐ Amici

☐ Conoscenti

☐ Vicini/concittadini

☐ Non ho mai avuto questo tipo di esperienza

30. In una scala da 0 (nulla) a 5 (molto) quale emozione ha provato o pensa proverebbe se vivesse tale esperienza? (inserire i voti nelle caselle):

☐ Calma

☐ Preoccupazione

☐ Ansia

☐ Nervosismo **(continua)**

☐ Paura

☐ Terrore

☐ Rabbia

☐ Altro _____

31. In una scala da 0 (nulla) a 5 (molto) quali reazioni immediate ha messo in atto o pensa attuerebbe se vivesse tale esperienza (inserire i voti nelle caselle):

☐ Fuggire a piedi per allontanarsi dal luogo dell'evento

☐ Fuggire in macchina per allontanarsi dal luogo dell'evento

☐ Nascondersi

☐ Raggiungere una postazione ritenuta sicura (salire ai piani più alti)

☐ Chiamare i soccorsi

☐ Andare in aiuto di altre persone

☐ Cercare di controllare l'evento

☐ Mettere in sicurezza i propri beni materiali

☐ Altro _____

32. In una scala da 0 (nulla) a 5 (molto) se vivesse tale esperienza si preoccuperebbe maggiormente per (inserire i voti nelle caselle):

☐ Se stesso

☐ I propri familiari

☐ Parenti

☐ Amici

☐ Vicini e popolazione

☐ I propri animali da compagnia

☐ Altro _____

33. In una scala da 0 (nulla) a 5 (molto) che tipo di impatto le alluvioni possono lasciare alle future generazioni? (inserire i voti nelle caselle)

☐ Danni materiali

☐ Danni psicologici

☐ Nessun danno di lungo termine

☐ Altro _____

34. In una scala da 0 (nulla) a 5 (molto) come riceve le allerte meteoclimatiche? (inserire i voti nelle caselle)

☐ A mezzo televisione

☐ Radio

☐ Comunicati alla popolazione da parte della Municipalità

☐ Forze dell'ordine

☐ Protezione civile

☐ Canali internet

☐ Social media

☐ Passaparola

☐ Altro _____

35. Le allerte diramate hanno raggiunto la maggior parte della popolazione:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

36. Le allerte diramate sono state tempestive (hanno lasciato tempo sufficiente per la risposta):

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

37. Le allerte meteo sono spesso sbagliate:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

38. Durante l'emergenza informazioni su come comportarsi sono state diramate a mezzo di:

☐ Televisione

☐ Radio

☐ Comunicati alla popolazione da parte della Municipalità

☐ Forze dell'ordine

☐ Protezione civile

☐ Canali internet

☐ Social media **(continua)**

☐ Passaparola

☐ Altro _____

☐ Non sono state diramate informazioni su come comportarsi in caso di emergenza

39. Che tipo di informazioni ha ricevuto?

_____

_____

40. Le informazioni ricevute dalle varie istituzioni erano simili

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

41. Il Comune ha spiegato bene i propri sistemi di allarme alluvione (sirene, sms, comunicato radio/TV, ecc.):

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

42. Ritiene di essere in grado di attuare efficacemente una procedura di emergenza alluvione (es. allontanarsi dal fiume, non attraversare ponti, salire ai piani superiori, ecc.):

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

43. Ritiene che la popolazione del suo territorio sia preparata ad affrontare un'emergenza alluvione:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

IN CASO DI EVENTO ALLUVIONALE ESTREMO

44. In una scala da 0 (nulla) a 5 (molto) in caso di emergenza a chi si è rivolto o a chi si rivolgerebbe per chiedere aiuto? (inserire i voti nelle caselle):

☐ Sindaco

☐ Funzionario Protezione civile

☐ Persona del nucleo familiare (specificare _____)

☐ Persona con esperienza personale pregressa

☐ Personale delle forze dell'ordine

☐ Amici\parenti

☐ Altro: _____

45. In una scala da 0 (nulla) a 5 (molto) in caso di emergenza si è sentito o si sentirebbe in grado di gestire la situazione (inserire i voti nelle caselle):

☐ Da solo

☐ Se aiutato da tecnici preposti (es. vigili del fuoco, protezione civile, ecc.)

☐ Se aiutato da familiari

☐ Se aiutato da amici/parenti

☐ Non in grado di gestire la situazione, ma fiducioso di ricevere aiuto

☐ Non in grado di gestire la situazione e in balia degli eventi

☐ Altro: _____

46. L'intervento dei soccorsi è stato tempestivo:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

47. Passata l'emergenza, in quanto tempo si è ritornati alla normalità?

☐ In modo molto lento

☐ In modo lento

☐ In modo rapido

☐ In modo molto rapido

☐ Non si è ritornati a condizioni di normalità, ma sono fiducioso che vi si tornerà

☐ Non ritengo possibile ritornare a condizioni di normalità

48. In una scala da 0 (nulla) a 5 (molto) cosa è utile a migliorare la gestione delle alluvioni (inserire i voti nelle caselle)?

☐ Formazione ed esercitazioni

☐ Un maggior numero di tecnici

☐ Investimenti sulla prevenzione

☐ Sensibilizzazione degli amministratori e decisori politici

☐ Sensibilizzazione della popolazione

☐ Pianificare l'uso del territorio in modo sostenibile

☐ Rendere più efficaci le arginazioni fluviali

☐ Altro (specificare _____)

PARTE GENERALE

49. Età (anni): _____

50. Sesso:

☐ Maschio

☐ Femmina

51. Occupazione: _____

52. Orientamento politico (descrivere le proprie propensioni, non è necessario indicare un partito di appartenenza):

_____

_____

53. Grado di istruzione:

☐ Elementari

☐ Medie

☐ Scuole superiori (indicare quale _____)

☐ Università (indicare tipologia e tema):

_____

☐ Studi post universitari (indicare tipologia e tema):

_____

54. Livello di istruzione e professione dei genitori:

Padre_____

Madre_____

55. Orientamento religioso (es. cattolica, buddista, musulmano, ecc):

_____

55.1 Se religioso:

☐ Praticante

☐ Non praticante

56. I principi religiosi nella sua vita ha un ruolo importante:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

57. Scelta alimentare:

☐ Onnivora (nessuna restrizione)

☐ Vegetariana

☐ Vegana

☐ Crudista

☐ Altro (indicare) _____

58. Per l'alimentazione ritiene sia importante prediligere prodotti di provenienza biologica:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

59. Tipologia di cure mediche:

☐ convenzionale

☐ non convenzionale

59.1 Se non convenzionale indicare quale:

_____

60. Hobbies (specificare):

_____

_____

61. Partecipazione ad associazioni:

☐ Volontariato (protezione civile, croce rossa, ecc.)

☐ Ambientaliste

☐ Religiose

☐ Politiche

☐ Ricreative/Sportive

☐ Culturali

☐ Altro _____

☐ Nessuna associazione

62. In una scala da 0 (nulla) a 5 (molto) cosa legge nel tempo libero? (inserire i voti nelle caselle)

☐ Fumetti

☐ Riviste d'evasione

☐ Riviste specifiche

☐ Giornali

☐ Libri

☐ Altro (specificare) _____

☐ Niente

62.1 Indicare il genere di libri e/o riviste:

_____

_____

63. In una scala da 0 (nulla) a 5 (molto) quali sono i suoi interessi artistici (inserire i voti nelle caselle):

☐ Musica

☐ Pittura

☐ Scultura

☐ Teatro

☐ Cinema

☐ Altro (specificare) _____

☐ Niente

64. In una scala da 0 (nulla) a 5 (molto) quali sono i suoi programmi televisivi favoriti?

☐ Programmi di intrattenimento musicale

☐ Talk show

☐ Reality show

☐ Film

☐ Serie televisive

☐ Documentari

☐ Notiziari

☐ Niente

65. Pratica qualche sport?

☐ SI

☐ NO

65.1 Se si, specificare che tipo di sport:

_____

66. Nucleo familiare (compresa la presenza di animali):

Numero adulti: _____

Numero bambini ed età: _____

Presenza animali domestici:

☐ SI

☐ NO

Indicare quali e numero:

_____

66.1 Gli animali, se presenti, vivono in casa (si, no) e che ruolo rivestono all'interno del nucleo familiare:

_____

_____

67. Qual è il suo ruolo all'interno del nucleo familiare?

☐ Madre

☐ Padre

☐ Figlio/figlia

☐ Nonno/nonna

☐ Altro _____

68. È soddisfatto di quanto ha ottenuto dalla sua vita:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

69. In generale, quando si trova in difficoltà (relativamente alla vita personale, non in caso di emergenza alluvione), solitamente si rivolge a:

☐ una persona che ritiene esperta del problema

☐ un familiare (indicare _____)

☐ un caro amico

☐ chiedo il parere di più persone

☐ non chiedo pareri, sono abituato a risolvere i problemi da solo

70. Descriva, con 5 aggettivi, le caratteristiche essenziali del capo ideale:

_____

_____

_____

71. In generale, per farsi un'opinione su un argomento (relativamente ad un qualsiasi aspetto, ma non in caso di emergenza alluvione), tiene in considerazione il parere di:

☐ Una persona che ritiene esperta della questione

☐ Un familiare (indicare _____)

☐ Un caro amico

☐ Della maggioranza

☐ Mi informo autonomamente

72. Se ha già un'opinione su un argomento il confronto con un gruppo in cui la maggioranza abbia un'opinione diversa (relativamente ad un qualsiasi aspetto, ma non in caso di emergenza alluvione):

☐ Non mi interessa, l'opinione degli altri sugli argomenti per me importanti

☐ Non mi interessa, c'è molta altra gente che la pensa come me

☐ Sarebbe stimolante, è interessante confrontarsi con idee diverse

☐ Mi creerebbe disagio, avrei difficoltà ad argomentare

☐ Mi creerebbe disagio, potrei cambiare opinione

73. In generale, il comportamento del singolo può cambiare il corso degli eventi:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

74. Sta affrontando una situazione nuova e rischiosa di cui non ha informazioni sufficienti, qual è il suo livello di preoccupazione?

☐ Mi piacciono le situazioni sconosciute e rischiose

☐ Anche se so affrontare i rischi preferisco non correrli

☐ Non mi piace non avere sufficienti informazioni

☐ Non sapere cosa aspettarmi mi crea forte disagio

☐ Preferirei non affrontare la situazione

75. Sta affrontando una situazione da cui potrebbe ricavare un considerevole vantaggio, ha poche informazioni e molte incertezze sui rischi nel lungo termine, come si comporta?

☐ Non faccio valutazioni, mi affido puramente all'istinto

☐ Valuto al meglio i pro e i contro cercando di correre meno rischi possibili

☐ Valuto al meglio i pro e i contro cercando di ottenere il maggiore vantaggio

☐ Non riesco a scegliere, l'incertezza mi spaventa

☐ Non riesco a scegliere, l'incertezza mi confonde

76. Secondo lei la tecnologia:

☐ Potrebbe risolvere ogni tipo di problema

☐ Ha prodotto grandi vantaggi, ma non è la soluzione a tutto

☐ Ha prodotti grandi vantaggi, ma anche molti svantaggi

☐ Ha prodotto molti svantaggi e pochi vantaggi

☐ Ha causato la rovina dell'uomo, che ha perso completamente il contatto con la natura

77. Tipologia di abitazione e collocazione:

☐ Appartamento in centro

☐ Appartamento in periferia

☐ Casa singola in centro

☐ Casa singola in periferia

☐ Villetta monofamiliare

☐ Villetta plurifamiliare

78. L'abitazione dista dai fiumi principali:

☐ < 200 metri

☐ 200 < 500 metri

☐ 500 < 1 km

☐ > 1 km

☐ Non so

79. Sono disposto a cambiare il luogo dove vivo al fine di diminuire l'esposizione alle alluvioni:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

UTILIZZO DEI SOCIAL MEDIA (TIPO FORUM)

80. Presenza su Facebook:

☐ Si collega poco frequentemente

☐ Si collega molto frequentemente, ma legge soltanto

☐ Si collega molto frequentemente e interviene attivamente

☐ Non sono presente su Facebook

81. Numero di contatti su Facebook:

☐ Fino a 100

☐ Da 101 a 500

☐ Da 501 a 2500

☐ Sopra i 2500

82. Collegamento a gruppi Facebook:

☐ sono iscritto a meno di 10 gruppi

☐ sono iscritto a più di 10 gruppi

☐ sono amministratore di _____ gruppi (scrivere il numero)

☐ non sono iscritto a gruppi

82.1 Indicare il genere dei gruppi a cui si è iscritti:

_____

_____

83. Su Facebook:

☐ Tendo a mostrare le cose migliori di quelle che sono

☐ Tendo a mostrare le cose peggiori di quelle che sono

☐ Mostro le cose esattamente come stanno

☐ Non posto cose personali su Facebook, solo neutre

☐ Non posto su Facebook

84. Le discussioni su Facebook aumentano la sua irritabilità su argomenti cui tiene particolarmente:

☐ Completamente d'accordo

☐ D'accordo

☐ Incerto

☐ In disaccordo

☐ In completo disaccordo

85. Se non è iscritto a Facebook, perché?

☐ Non ne sento la necessità

☐ Trovo sia un mondo falsato

☐ Non ne ho la possibilità altrimenti mi iscriverei

☐ Ero iscritto, ma ho chiuso l'account

☐ Non ho tempo da dedicare ai social

SOLO PER CHI HA VISSUTO L'ESPERIENZA DI UN'ALLUVIONE

DESCRIVA LE COSE CHE HA FATTO IMMEDIATAMENTE, PRIMA DI COMINICARE A RAGIONARE SU QUELLO CHE STAVA SUCCEDENDO:

RIPORTI DI SEGUITO, SE NE HA, LE SUE OSSERVAZIONI RIGUARDO AL QUESTIONARIO:

GRAZIE PER LA COLLABORAZIONE!