SCUOLA DI DOTTORATO
UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA

Department of

Sociology and Social Research

PhD program Urban and Local European Studies and Quality of Life in the Information Society (URBEUR-QUASI)

Cycle XXX

Slowing down the flood, naturally. The integration of local knowledges into flood risk governance: insights from south west England and north Italy

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ACADEMIC YEAR 2016/2017

We are embracing complexity, because we recognize and work with the different relationships between the stream and the land, the landowner and the land, the water, the structures, the risks to town to the downstream. You know, it's easy to simple the story: "here is a wall, and it will protect you forever"

A Flood Risk Project Manager

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Acknowledgments

This research could not have been undertaken without the strong help of my supervisor, Silvia Mugnano and my co-supervisor, Chris Short, who supported my work with comments, advices, discussions and inspirations. I thank them for their patience and for giving me the opportunity to successfully manage the whole research. I really thank the Countryside and Community Research Institute at the University of Gloucestershire (UK) for having hosted me during my visiting period: I really enjoyed my time there, surrounded by very inspiring researchers!

Without the collaboration of all my interviewees in the Stroud valley, Gloucester, the Reggio Emilia area and Bologna, this research would not have been possible. Among them, I really thank Chris Uttley (also for having hosted me for a while) and Alfredo Caggianelli (with his staff and the Central Emilia IDB), the two project managers, because they believed in my research, and gave me the opportunity to undertake my fieldwork and meet the most relevant actors.

I really thank for their advices and stimulating discussions and meetings some colleagues, researchers or professors, who I met across the world during this intense three-year PhD path (some of them are also friends now): Alberto Amore, Guido Anselmi, Gregory Bankoff, Roberto Barrios, Mara Benadusi, Paolo Borghi, Luca Bottini, Dilshaad Bundhoo, Simone Caiello, Lina Calandra, Irena Leisbet Connon, Mattia de Amicis, Francesco De Pascale, Fausto Di Quarto, Marianna D'Ovidio, Irene Falconieri, Ivan Frigerio, AJ Faas, Giuseppe Forino, Peter Gaskell, Maria Teresa Grillo, Giovanni Gugg, Guoyi Han, Susanna Hoffman, the whole editorial board of *Lavoro Culturale*, Matteo Mattavelli, Arianna Mainardi, Cecilia Nessi, Anthony Oliver-Smith, Davide Olori, Lorenzo Pedrini, Enrico Petrilli, Silvia Pitzalis, John Powell, Matt Reed, Ortwin Renn, Pietro Saitta, Silvia Santato, Rajib Shaw, Stefano Ventura, Tang Yun, Barbara Vaccarelli, Amedeo M. Zampaglione, Sara Zizzari.

The patience and support of my future wife Leila are invaluable, she deserves my greatest and most sincere gratitude and love.

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CC: County Council
CE: Central Emilia
CDA: Critical discourse analysis
DC: District Council
DRR: Disaster risk reduction
DEFRA: Department for Environment, food and rural affairs in the UK Government
DHA: Discourse-historical approach
DRM: Disaster risk management
EC: European Commission
EP: European Parliament
ER: Emilia-Romagna
EU: European Union
FAG: Flood Action Group
FRM: Flood Risk Management
FRG: Flood Risk Governance
FD: Floods Directive
GS: Gloucestershire
IB: Irrigation Board
IDB: Internal Drainage Board
LLFA: Lead local flood authority
MATTM: Italian Ministry of Environment and Protection of Land and Sea
NFM: Natural Flood Management
RC: Regional Council
RE: Reggio nell'Emilia
RFCC: Regional Flood and Coastal Committee
RSUDS: Rural Sustainable Drainage System
SFDRR: Sendai Framework for Disaster Risk Reduction
UK: The United Kingdom
UN: United Nations
UNISDR: UN Office for Disaster Risk Reduction
WFD: Water Framework Directive

Abbreviations not included in this list are used to ensure anonymity.

Introduction

Water-related disasters are foreseen to increase in terms of frequency and damage in the next years. We experience daily the impact and challenges brought by an increasing in flood damages, due to climate change, amplifications of social vulnerabilities and inequalities, unsustainable development projects, controversial policies and human interference with ecosystems. Human responsibilities are clear in creating and reiterating the conditions for the next disaster, which will exacerbate losses and inequalities. In my view, this works as a vicious circle that can be stopped only amending a deep reflection on current risk reduction practices and policies. If "environment" as a research object has got little relevance in modern sociology, a great interest emerged between the Eighteenth and Nineteenth centuries, such as Georg Simmel's work on spatial formations and the human ecology perspective developed by the *Chicago School*. Furthermore, an environmental sociology originated from the 70s onwards started dealing with *the environmental issue*: following contemporary environmental and ecological problems to be faced, a redefinition of sociology as research field has been also brought out, which integrated non-human agents in social sciences research and/or tried to overcome the nature/society dichotomy (Mela *et al.* 1998). From the end of the 80s, the emergence of global environmental and catastrophic threats originated a sociological reflection on the concept of "risk" to provide research and solutions to these issues. In parallel, an academic field which crosses sociology, anthropology and geography already constructed "risk" and "disaster" as research objects since the WWII: the *disaster research*. This was indirectly influenced by the Chicago School, through the work of Emilio Quarantelli, one of the first researcher founding a sociological approach for the study of "disasters" (Olori 2015). As I will discuss in the first chapter, one of the highest merits of this approach was to frame the notions of "risk" and "disasters" as socio-cultural processes, thus bringing the social sciences into the academic debate about these concepts. Indeed, "risk" is a very complex notion, which has been traditionally deemed as something linked to objective probabilistic formulas, waiting "out here" for our understanding. Alternatively, risk can be conceived as a mental construction which essentially refers to a distinction between possible and chosen actions (Renn 2008), a distinction that everyone of us makes daily. Sometimes, e.g. while writing this thesis, in every word or behaviour chosen. Due to the etymological origin of the notion and the diffuse technocratic ways usually associated to risk assessment and

management, we are keen on thinking risk as something which can be easily acknowledged, calculated and faced: usually with numbers and the help (or trust) of "experts". Therefore, we are usually shocked when "disasters" or "tragedies" happen. We demand and expect certainty from expert and scientific knowledges. When something is uncertain, little known or unpredictable we rather seek for familiar behaviours or even rituals, which make the "unknown" something finally "known", so that we can evaluate and manage it (Mugnaini 2015).

The challenge of social sciences to take the "naturalness" out of the concept of "natural disaster" (O' Keefe 1976, Kelman 2017; Forino & Carnelli 2017) goes with the development of a perspective, which, starting from the concepts of vulnerability and risk, has challenged a diffuse techno-centric attitude in disaster risk reduction policies and disaster risk management (Carnelli & Ventura 2015). This attitude usually aims at tackle risk with engineering solutions to «meet people's material needs to protect them from extreme events by controlling nature and strengthening infrastructures (the built environment)» (Marincioni 2015: 144)[1]. This is much more evident when dealing with risk and disaster risk reduction. A *positivistic risk paradigm*, which will be outlined in the first chapter, traditionally shapes risk as something "out there", feeding a techno-centric perspective, which is usually adopted in International and National DRR policies (as it will be discussed in chapter three) and favours a quantitative approach. Indeed, this quantitative approach linked to what is defined as a *Knightian* idea of risk (Knight 1921; Lupton 1999) usually fuels the controversial belief that human beings can control nature, resulting in «fake myths of development, which have led legislators and local councillors to misleading regulations and laws» (Marincioni 2015: 144)[2]. Alternatively, very recent flood risk management policies and processes have been showing that different knowledge combinations and processes of mimicking nature (e.g. what is called *Natural flood management* or *nature-based solutions*), rather than controlling it, can have multiple benefits in managing flood risk (EC 2011; SEPA 2015; EA 2017; Waylen et al. 2017; Short *et al.* 2018). A convergence in policies, academic research and practices may be currently identified, and the umbrella notion of "risk governance" can partially account for this change of paradigm across Europe from (engineering) flood defence to flood risk management and governance (Krieger 2013; Alexander *et al.* 2016). Within this convergence, flood risk works as an interesting research object to delve into because it is often deemed by environmental scientist

[1] Translation by the author.
[2] Translation by the author.

as a "known risk", but paradoxically floods are the most frequently experienced disasters in Europe. In this regard, a sort of "knowing more and losing more" paradox can be found in disaster research literature: despite an immense growth of risk-related knowledge systems, it has been noted that insufficient progress has been made in converting research findings into practical Disaster Risk Management applications. So, it makes sense to look at alternative or practical knowledge systems to cope with it. "Local knowledge" has been often brought into the debate as a way to use knowledge in a more effective way (Shaw *et al.* 2009; Hiwasaki *et al.* 2014), while usually underestimated, misinterpreted or little acknowledged. From the policy level, the 2007 EU Floods Directive theoretically built a common European scenario for flood risk management, providing a common flood risk governance perspective, which can give the opportunity to include different knowledges and actors into Disaster Risk Reduction (DRR) policies and practices across Europe. Both academic literature and International and National policies and reports have pointed out the need to engage with local actors and acknowledge for local knowledges in risk management. The point here is to outline how to include these knowledges into flood risk governance-based processes, an issue which has been only partially discussed (Mercer *et al.* 2010; Weichselgartner & Pigeon 2015). Some innovative practices, recently defined in EU policies as *nature-based solutions* or usually acknowledged as *natural flood management*, can provide suitable case studies to look at how different kind of knowledges can interact in tackling a paradigmatic type of risk, such as flood risk, within a risk governance framework. Indeed, *natural flood management* works with natural processes to enhance socio-cultural processes for flood risk reduction with water and land management processes at catchment scale. The engagement with different actors at different governance levels and the use of local knowledges is a threshold for the effectiveness of natural flood management. Without local knowledges, natural flood management can't be implemented in practice. This has the potential to bring new challenges at the interface of (social) science, policy and practice (Nesshöver *et al.* 2017; Short *et al.* 2018) by putting the integration of local knowledges into flood risk governance at the center of the debate.

Therefore, the idea that inspired my research was to focus on the concept of local knowledge as a way to tackle the concept of "risk" to find practical ways to manage it, within a risk governance scenario. For the aforementioned reasons, flood risk worked as a perfect notion/phenomenon to be analysed and *natural flood management* the best real-world scenario for my case-studies (as it will be discussed in chapter four). Indeed, the aim of this work, which is linked to my research questions, is to point out how local knowledges can be integrated into flood risk governance as played out in context of *natural flood management*. My research

question can be stated as follows: How can local knowledges be integrated into natural flood management processes within a flood risk governance framework?

To answer to this question, I identified four research sub-questions, which will face some relevant aspects addressed in the literature, concerning who are the actors involved, how local knowledges are produced, included and visible in the outcome and why there's the need to make use of local knowledge in flood risk management process, especially when *natural flood management* is at stake.

As I will show in detail in chapter four, I've undertaken a qualitative case study approach comparing two case studies in the European Union where decision-making processes have been carried out after the 2007 Floods Directive embracing a flood risk governance framework at local level, too. One study-site is a community and event-driven natural flood management process (following the 2007 major floods occurred in England) largely promoted by local flood action groups in South West England, which is called the *Rural Sustainable Drainage System (RSuDS)*. The other case-study is a EU LIFE+ participatory process implementing river restoration solutions to mitigate flood risk in North Italy, which is called *LIFE RII*[3]. Both have resulted in the "construction" of similar nature-based solutions to reduce peak flow for flood risk mitigation, engaging with local stakeholders and integrating local knowledges into the projects. These two natural flood management processes worked as "best practices" within an integrated EU flood risk governance framework to explore and partially explain how the inclusion of local knowledges can be achieved within a risk governance approach. To collect my data, I've undertaken 22 semi-structured interviews or walking interviews for each case study. I've used critical discourse analysis and thematic analysis to interpret relevant policies, field notes and the coded interviews. The comparison will provide evidence to enhance an inclusive flood risk governance, and therefore enrich both the concepts of "risk" and "local knowledge". This might have also the potential to bridge current European flood risk policies, laypeople knowledges and academic research, as played out in opportunity of natural flood management.

This thesis is structured into seven chapters. The first two chapters will outline a literature review and give a conceptual framework for my research proposal. In the first chapter, the concepts of "risk" and "disaster" will be historically and theoretically unpacked up to current notions of risk governance. The concept of local knowledge together with possible frameworks to integrate it into flood risk governance will be outlined in chapter two.

[3] Rii means "streams" in Italian.

The third chapter will provide an overview of main Disaster Risk Reduction policies: from the International level to the main European Union initiatives, to a recent view on flood risk reduction policies and tools in England and Italy, the two Countries where the processes I've analysed have been undertaken. Furthermore, some innovative policy tools in terms of natural flood management will be brought out and discussed.

In the fourth chapter, I will explain my research problem and research design; I will bring out my research questions and methodological issues: I will explain which methods, techniques and data analysis techniques I've chosen to answer my research questions.

The fifth and sixth chapters are entirely dedicated to my data analysis. These two chapters are divided into two parts, each for case study. In chapter five, I will delve into the notions of flooding and flood risk, to analyse how the different actors frame these concepts and build their relationships with water, eventually resulting in the production of local knowledges. In chapter six, I will unpack the concept of local knowledge, pointing out how and if this concept is integrated into the two flood risk management processes I considered in the two study sites.

In the last chapter, the final discussion derived from the comparison of the two case studies will be brought out. I will answer my research questions and put forward my findings to discuss the integration of local knowledges into flood risk governance at local level.

CHAPTER 1

1. The construction of "risk" and "risk governance" as socio-cultural research objects: insights in *Disaster research*

Disaster research is a very small academic field, which is still not well integrated with mainstream sociology (Tierney 2007): though sociologists and geographers are well represented in this field, the overall core disaster researchers from all social sciences were estimated to be around 200 in 2006 (as reported by Tierney 2007). It has got a multi- and inter-disciplinary history, due to its strong applied nature, with a parallel problem and policy-oriented focus, often opposed to pure research: «researchers have often been more concerned with solving problems that are important for governmental institutions and practitioners than with advancing theory» (Tierney 2007: 520). Likewise, it's actually impossible to outline a "risk studies" field having a common history which can be traced back. Indeed, the first academic *Handbook of risk studies* was edited for Routledge by two sociologists and a professor of law only last year (Burgess, Alemanno and Zinn 2016). In the *Introduction* Burgess clearly states how there have been «few attempts to interrelate risk research in general, drawing together the wide array of work on the science and social science of risk» (Burgess 2016: 6). According to him, the reasons for this are manifold and depend both on the "diffuse nature" of the concept of *risk* and on the fragmentation of risk studies. Among them, as I will argue in this chapter, a quantitative and technocratic perspective dominated a supposed "risk studies" field, due to the origin of the concept of risk itself, too.

For these reasons, my approach to this research stems originally from what is usually called *disaster research/disaster studies* in social sciences, an academic field where qualitative research and sociological issues were still prominent since its beginnings (Phillips 2014). In this chapter, I will outline part of my theoretical and conceptual frameworks, focusing on the notions of risk and risk governance from a social science perspective.

1.1 The emergence of a disaster research

As well-known and reviewed, the earliest works in disaster research that see disasters as socio-cultural processes can be considered (Rodrìguez *et al.* 2007; Benadusi 2015b; Olori 2015): the volume edited by Rousseau on the Lisbon Earthquake (1755) and Samuel Prince's PhD thesis (1920) on social changes after a man-made disaster, the "Halifax explosion" in Canada (1917). Social scientists first began systematically to study disasters in the 1950s in the United States: in sociology, we can bring back academic research to two main Centres: the *Disaster Research Center* (DRC) of the University of Delaware (it started in 1963 at the Ohio University and moved to Delaware in 1985) and the *Natural Hazard Center* (NHC) of the University of Colorado at Boulder, established in 1976 with a more ecological perspective.

In the 50's, the prevalence of structural functionalism and symbolic interactionism in social sciences had influenced the study of disasters and what is referred to as "the classical period": a definition of "disaster" wasn't still clear and early research was mainly about the consequences of WWII bombings or airplane crashes (Perry 2007). A *Disaster Research Group* (DRC) was formed in 1952 at the US National Research Council. Furthermore, under the threat of a nuclear war feeding the Cold war, the earliest disaster research was financed by the U.S. Civil Defence Office. Main topics were a consequence of the idea that a disaster was conceived as the "catalyst" of social disruption of norms and routines (Perry 2007), focusing on laypeople socio-psychological reactions to disasters and threats, too. One of the latest work in this direction was Fritz's *Disaster* (in *Contemporary social problems. An introduction to the sociology of deviant behavior and social organization*, edited by Merton and Nisbet, 1961), where he considered social structure as a dependent variable and defined a disaster as «an event concentrated in time and space, within a society… incurs such losses… that the social structure is disrupted and the fulfilment of all or some of the essential functions of the society is prevented» (cited in Perry 2007:6). These first authors, as Perry noted, tended to emphasize «a cycle of stability-disruption-adjustment that characterizes disasters» (Perry 2007:8), not problematizing the processual dimension.

In the 60's, a research approach influenced by the geographical studies began to focus more on the agent causing the supposed disruption: an approach known as the *hazard tradition/natural hazard research*; Burton and Kates (1964) were the first scholars defining a disaster as the intersection of a potential destructive agent with a social system. The agents

were mostly treated as elements «in the physical environment, harmful to men and caused by forces extraneous to him» (Burton & Kates 1964: 413), but their occurrence and effects began to be difficult to be separated from man-induced hazards (Burton & Kates 1964). In the same years, Quarantelli, Dynes, and other researchers at the DRC (Rodriguez, Quarantelli, Dynes 2007) began to analyse the social aspects involved in disasters. Although their research tended to focus more on the crisis brought into a supposed social order (Benadusi 2015b), they first considered the social structure as a potential cause or force behind disasters and the disaster as a *social phenomenon*. The notion of *vulnerability* slowly started to be at the centre in the occurrence of a disaster, due to it being socially constructed by relationships to be found in the social system. Thus, Quarantelli first succeeded in putting together a classical definition of a disaster (for that time) with a modern one, funding a new branch in the disaster research based on two main ideas: first, the idea that disasters are inherently social phenomena: «the disaster is the impact on individual coping patterns and the inputs and outputs of social systems». (Perry 2007: 12). Second, the idea that disasters are rooted in the social structure and are linked to the processes of social change (Perry 2007). This view has inspired what would have been widely recognized as the *vulnerability approach*, a perspective that had a great influence both on DRR policies (and international expertise ecologies, cf. Benadusi 2015a) and on current *disaster research* (Cutter *et al.* 2003*;* Wisner *et al.* 2004; Wisner *et al.* 2012; Carnelli & Ventura 2015; Frigerio & De Amicis 2016; Kelman *et al.* 2016; Mela *et al.* 2016a; Wisner 2016). Namely, what founded the *vulnerability approach* was the awareness that «the material conditions of daily life, what one might call "normal life", also underlie, or, as Hewitt put it, "prefigure" disasters» (Wisner *et al.* 2004: 20). The geographer Kenneth Hewitt was one the first to identify the "social nature" of a disaster by strongly criticising the «technological reductionism of the dominant view» (Hewitt 1983: 7) of that time. He first pointed out that «it may be accepted that 'hazard', strictly speaking, refers to the *potential* for damage that exists only in the presence of a *vulnerable* human group» (Hewitt 1983: 5). Furthermore, he argued how the presumed "unexpectedness" of a disaster is nothing more than a lack of recognition of the complex and daily human-environment interactions. In his perspective, *uncertainty* –which is, as I mentioned in the introduction and I'll discuss further on, one of the main characteristic of the notion of *risk* - is exactly what legitimates a diffuse technocratic dominant view. Following a quantitative approach on disaster and risk management, this view is usually translated into a probabilistic phenomenon, so that: «if human societies are unprepared or ill prepared for these events mainly because of their rare and uncertain occurrence, then predictability has to be the

essence of the problem of management» (Hewitt 1983: 9). This is a core issue for the developing of a risk governance notion and framework, as I will show in the fourth paragraph.

1.2 From "vulnerability" to "risk"

Following this perspective, the concept of *vulnerability* «draws attention to the intersections of society, culture and nature that become expressed in the disaster process» (Hoffman & Oliver-Smith, 2002: 17) and opened different and richer research frameworks and actions both on disaster research and on Disaster Risk Reduction (DRR) policies (cf. chapter three, *infra*). This is a key concept that informs my perspective on risk governance, even if I won't directly deal with the concept itself, rather with some epistemological and theoretical consequences related to this notion, which paves the way to a social construction of risk. Indeed, "vulnerability" represents an epistemological watershed to study risk and disasters from a sociological perspective. As previously discussed, Wisner *et al.* (2004) best convey this idea: «until the emergence of the idea of vulnerability to explain disasters, there was a range of prevailing views, none of which dealt with the issue of how society creates the conditions in which people face hazards differently» (Wisner *et al.* 2004: 10); therefore, a disaster was considered mainly a disruption of a «"normal" social functioning» (Wisner *et al.* 2004: 10) to be re-solved and to brought back to a sort of normality, after the impact with a triggering natural event. Alternatively, the idea that «the character of past, present and future disastrous occasions stem from social factors» (Perry & Quarantelli 2005: 339) questioned the "naturalness" of a so-called natural disaster (O'Keefe 1976; Oliver-Smith& Hoffman 1999; Hoffman & Oliver-Smith 2002): this should be «the image that we should keep in the forefront of our thinking about disaster planning and managing» (Perry & Quarantelli 2005: 339).

As I have already noted (Carnelli & Frigerio 2016), I argue that the product of root causes and a progressive chain of causal factors can create the preconditions of insecurity factors that turn an event into a disaster; within this perspective and considering the huge amount of literature on the concept of vulnerability (Oliver-Smith 1994; Weichselgartner 2001; Cutter *et al.* 2003; Wisner *et al.* 2004; Adger 2006; IPCC 2014), I define it as the set of «characteristics of a person or group and their situation that influences their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (an extreme natural event or a process)»

(Wisner *et al.* 2004: 11). Furthermore, as underlined by Alexander (1993), vulnerability may be viewed as a set of overlapping differential dimensions. In this regard, the international social science research has identified some main components of vulnerability at a socio-economic level (Cutter *et al.* 2003). The social aspects of vulnerability can work as a theoretical concept which is potentially not quantifiable: to make this concept countable it is necessary to develop a method to make it observable (Hinkel 2011), e.g. the identification of socio-economic variables to assess social vulnerability through the construction of different indicators[4].

One of the currently most applied method for risk management is the "Social Vulnerability Index" (SoVI) derived from the hazard-of-place model approach (Cutter *et al.* 2003). The SoVI index is used by Cutter to grasp the concept of place-vulnerability, by combining the physical dimensions (the geographic context) with the social ones (the social fabric). Many other scientists have developed Cutter's methodology to assess social vulnerability in different backgrounds and there are diverse socio-economic aspects that seem to have a great impact in the determination of social vulnerability. This is not the approach I will refer to, due to my interest in stakeholder engagement through local knowledge. For my purposes, following what Mela *et al.* (2016a) have recently argued, the hazard-of-place model is interesting because it puts forward:

- a practical way to analyse the social dimensions of risk through the concept of social vulnerability

- a way to account for the local/territorial/place dimension

From an epistemologically perspective, what emerges from this framework is twofold: first, the local dimension is what needs to be addressed in dealing with risk and disasters, focusing on the «relationship between material and immaterial assets» (Mela *et al.* 2016a: 19) over time. Second, risk can be analysed as a combination of socio-physical relationships, which is the result of a hazard interacting with elements of vulnerability at different levels over space and time. This way of defining risk stems from a 1994 definition by Blaike *et al.*: they first linked

[4] One of the pioneering studies on Italy are the research by Scolobig *et al.* 2012 and the work developed by Frigerio & De Amicis (2016); in their research, they draw up a map of seismic risk exposure, by matching the official hazard map with a Social Vulnerability index map built through. For the UK, the work of the Flood Hazard Research Centre at the Middlesex University, e.g. Tapsell *et al.* 2012 or the FLOODsite European project (Steinfuehrer *et al.* 2009).

those three notions with a pseudo-equation[5], *R=H * V,* where H stands for hazard and V for vulnerability (Blaikie *et al.* 1994; Wisner *et al.* 2004). This way of defining risk resulted in finally focusing on socio-economic factors in disaster risk management, for the first time. Following these assumptions, Wisner *et al.* (2004) built a twofold model: the Pressure and Release (PAR) model and the Access model, where they put forward structural and contextual factors, which amplify (or even trigger) the effects of the impact of a triggering "natural" agent. In the PAR model (fig. 1.1), a sort of «chain of causation» (Wisner *et al.* 2004: 87) with no clear cause-effects chain: «a sequence of factors and processes that leads us from the disaster event and its proximate causes back to ever more distant factors and processes that initially may seem little to do with causing the disaster» (Wisner *et al.* 2004: 87).

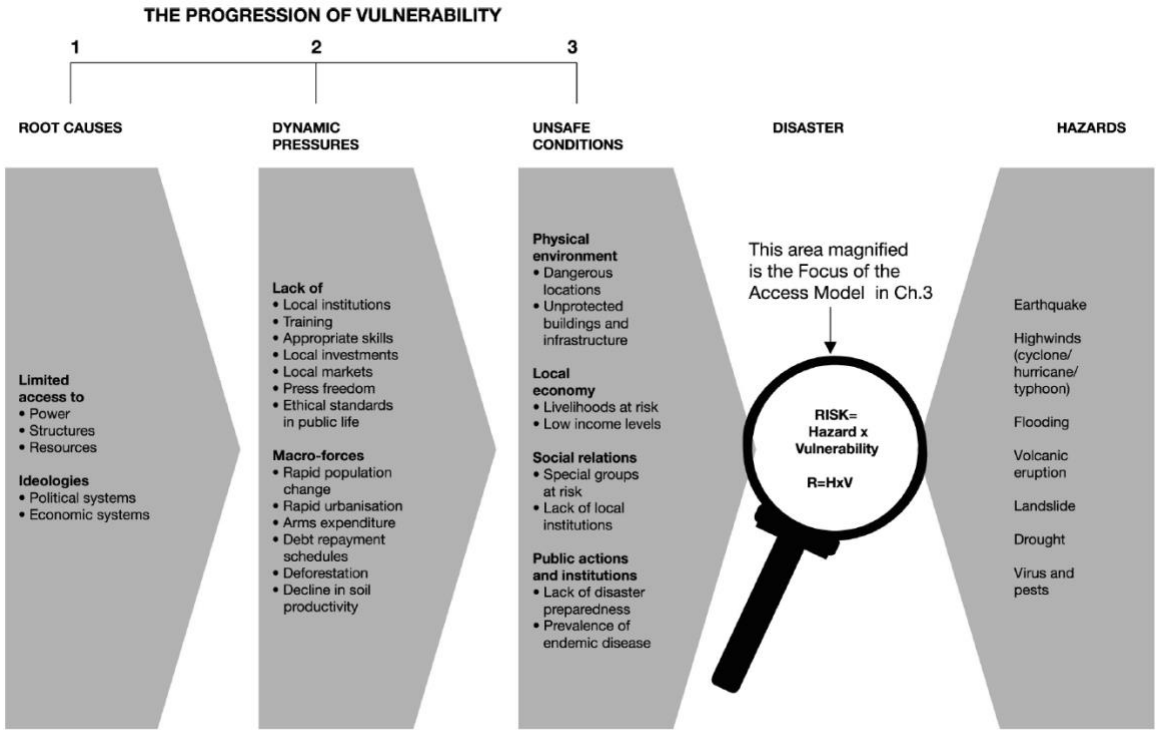

Figure 1. 1 The PAR model and the progression of vulnerability developed by Wisner et al. (2004: 51)

The figure shows how risk reduction is also a matter of "root causes", which are mostly structural or even invisible, to some extent. They are linked to political or economy ideologies and to limited access to power, structures and resources: so, they also concern public

[5] "Pseudo" to the extent to which it's not strictly an equation but it frames a relationship, as Wisner himself pointed out (Benadusi 2015b).

participation and governance structures and processes, which are now acknowledged as related to risk management and assessment. According to Wisner *et al.*, they are «distant» in three senses: spatially distant (arising in a distant centre of economic or political power), temporally distant (in history), and finally, distant in the sense of being so profoundly bound up with cultural assumptions, ideology, beliefs and social relations in the actual lived existence of the people concerned that they are "invisible" and "taken for granted" (Wisner *et al.* 2004: 52). Then, the *dynamic pressures* transfer the «effects of root causes both temporally and spatially into unsafe conditions» (Wisner *et al.* 2004: 53), resulting in a visible disaster after the impact with a hazard. Some of these effects will be reported as risk triggers by the actors engaged in the flood risk governance processes I'll analyse in the next chapters – such as "lack of local investments", "lack of local institutions", "rapid urbanisation" or lack of local knowledge, too.

To sum up, almost four key issues have emerged from the vulnerability approach based on the PAR model, which are useful to my research. Firstly, Blaikie *et al.* (1994) pointed out that the concept of risk is something depending on socio-economic dimensions. Secondly, the connection is made could reduce the impact of disasters, at different spatial and temporal scales: as in a nutcracker, the release pressure (channelling root causes into unsafe conditions) could be reduced, acting on vulnerability. Deputed agencies could manage socio-economic and cultural dimensions of risk, by problematizing vulnerabilities and processes of vulnerabilization in specific contexts. They argued that vulnerability was not a fixed dataset of features, no fixed vulnerable groups could exist, rather vulnerable situations or contexts, due to the results of long term processes. Thirdly, communities could play a more central and proactive role in Disaster Risk Reduction, since they should define their own vulnerabilities and capabilities (Wisner *et al.* 2004): «the employment of the concept of vulnerability as a tool in and by the community also involves a thorough analysis with and by the residents of their own resources and capacities. This is the "other side" of the vulnerability coin» (Wisner *et al.* 2004: 84). From this point, and this is the fourth key issue, the local dimension, both in spatial and political terms, received more attention both in academic as well as in policy-making environments. As Wisner *et al.* reported in the second edition of the volume, the mid-decade term of the *International Decade for Natural Disaster Reduction* (IDNDR)[6] in 1994 had not turned into an enthusiastic one: «dissatisfaction emerged with the top-down, technocratic

[6] Following the resolution 42/169 of 11th December 1987, the UN General Assembly identified the 1990s as a decade for promoting international cooperation in «natural disaster reduction», starting from the so-called developing countries. An International Framework for Action was issued in 1989, to be carried out by 1999 (see http://www.un.org/documents/ga/res/44/a44r236.htm - last access: 26th March 2017).

approach to disasters that had characterised the first half of the decade's activities» (Wisner *et al.* 2004: 21). Otherwise, in the *Yokohama Strategy*[7] socio-economic issues emerged in the PAR and Access models had been considered for the first time due to the editing of Blaikie *et al.*'s volume. In parallel, the involvement of NGOs and local communities was first considered and added in the second half of the IDNDR[8]

At the same time, a cultural turn emerged from the 1990s on, due to the research of some North and South American anthropologists as Anthony Oliver-Smith, Susanna Hoffman, Virginia Garcìa Acosta. They were also engaged in a Latin American association, called LA RED (*La Red de Estudios Sociales en Prevención de Desastres en América Latina*). LA RED was founded in Costa Rica in 1992, and has involved different expertise and countries (11 from the USA to Argentina), by focusing on socio-cultural aspects and socio-economic problems related to political systems and development issues. They also were one of the first academics who managed a dialogue and influenced the work of National and International Institutions in DRR (Benadusi 2015b). Culture became a key issue from this point: a disaster is now conceived as a "multi-dimensional *process*", at the intersection between a destructive agent and a vulnerable context, and experienced in different ways by different groups and individuals (Hoffman & Oliver-Smith 2002). Hoffman & Oliver-Smith (2002) first define a disaster as «a process/event combining a potentially destructive agent/force from the natural, modified, or built environment and a population in a socially and economically produced condition of vulnerability, resulting in a perceived disruption of the customary relative satisfactions of individual and social needs for physical survival, social order, and meaning» (Hoffman & Oliver-Smith 2002: 4). A well-known example of disaster in this sense given by them is what they call the *Perù's five-hundred-year earthquake* (the 1970 Ancash earthquake): according to them (Oliver-Smith & Hoffman 1999), the Spanish *conquistadores* changed so drastically the economic, urban, political, socio-cultural, and architectural main aspects in South America that what turned the 1970 earthquake into a catastrophe can be traced back to the sixteenth Century, hence the five-hundred-year reference. This cultural turn moved forward disaster research, by exploring:

[7] This is the output of the World Conference on Natural Disaster Reduction, held in Yokohama in 1994.

[8] One first example of this is the *Risk Assessment Tools for Diagnosis of Urban Areas Against Seismic Drivers* program, by involving different stakeholders in 84 cities all around the world.

«- *how the social production of disasters take place,*

- *how the cultural, political, and economic forms and conditions that characterize vulnerability are inscribed in an environment, and*

- *the relationship between cultural interpretation and the material world of risk» (Oliver-Smith 2002: 29).*

To my extent, these three issues should be kept in mind concerning how the local dimensions (both knowledges and actors) need to be considered within an inclusive flood risk governance framework (cf. also next chapter, *infra*). In this sense, vulnerability - and risk as well - must be unpacked when addressing the socio-political processes of mitigating and managing flood risk at multiple levels. The first and second issues considered by Oliver-Smith brought him to the idea that a diffuse technocratic way of managing risk (I'll delve into this issue in the next paragraph) is fed by the willingness to control nature, based on the classic nature/culture ontological dualism. He argued that this is a precise Western cultural construction dated back to the seventeenth and eighteen centuries: the human being is constructed as the "other" from nature and nature is something "out there", a resource to dominate and transform to be emancipated. Furthermore, the emergence of a market exchange turned nature into a merely means of extracting values, exploitable to satisfy an unending quest for surplus value: the domination of nature turned into a global hazard, which clearly unveils the human induced causes of what are usually defined as "natural" disasters (Oliver-Smith 2002). A "plasticity myth" (Murphy 1994 cited in Oliver-Smith 2002) that hides long term causes and development and economic models working as root causes. Here lie the reasons why it's currently extremely complex to distinguish natural causes from man-made ones, one of the reasons I will take into consideration a constructivist approach in dealing with risk, too. I will delve into my epistemological social constructivist approach in the next paragraph.

To conclude this reflection on the concept of vulnerability, it's necessary to report that the more this notion has spread out among International DRR policy makers, the more it lost its critical power to influence these policies (Benadusi 2015b). Although this approach had been disseminated by LA RED and other social scientists in numerous International meetings, with the aim of putting forward local communities and "bottom-up" risk and disaster management processes, the standardized frameworks within the International global DRR assemblages (Benadusi 2015a) have de-historicized the concept. It was simplified and reduced to a given dataset to be managed, as Oliver Smith himself (Oliver-Smith 2013 cited in Benadusi 2015b) and Ben Wisner had often pointed out:

> *«the use of post-disaster checklists does not in itself help one to understand why and how those characteristics have come to be associated with a higher probability of injury, death, livelihood disruption and greater difficulty in recovery… the empirical discovery of an association or correlation does not explain the process that give rise to the association» (Wisner et al. 2004: 16-17).*

Furthermore, the "classic" management of a disaster was also interpreted as a «commodification of suffering [and safety] in the political economy of trauma» (James 2012: 55) in which a biopolitical humanitarian technology usually exploits the disruption and vulnerabilities involved in the trauma to subjugate citizens that have become victims to be helped in name of urgency, safety and compassion (Fassin 2012; Carnelli 2013; Castorina and Roccheggiani 2015). Indeed, as one knows how to prepare himself to be less vulnerable and to cope with risk, in a technocratic way, as Lakoff (2008) claims, a preparedness culture could be also treated as a new rationality form in which «as the probability of such complex events is not calculable … the only way to cope with them is being trained to the possibility that they'll happen» (Benadusi *et al.* 2010: 97)[9]. In this regard, it turns into a matter of being *still vulnerable yet already resilient* (Benadusi 2013), being able to react or ready to be helped by agencies of governments, as for example Benadusi well argued in her ethnography of a post 2004 tsunami village in Sri Lanka: survivors were supposed to act, mix and "fit" their "designated" vulnerability and resilience to receive humanitarian assistance. Considering that a "zero risk" scenario can't exist, to be safe (or safe again) one should learn to handle with a hazardous situation, that is addressing risk in an uncertain state, by considering that also uncertainty is «shaped by social relations, cultural conventions and ecological and biological constraints» (Boholm 2015: 9). Again, uncertainty, the main characteristic in the conceptualization of risk turns into what legitimates a technocratic risk management. To conclude, I argued how some approaches and notions developed in disaster research can help to develop my perspective to analyse the integration of local knowledges into risk governance. In particular, the notion of risk emerged as a social factor in disaster risk management, with the extent to which a disaster is defined as a process with socio-cultural triggers. This has the potential to account for a different epistemological and knowledge base to look at the concept of risk from a social science perspective - as I will show in the next paragraph.

[9] Translation by the author

1.3 Risk theories in the academic literature: techno-centric vs socio-centric approaches

The history of disaster research has been crossed by a tension between techno-centric perspectives and socio-centric approaches, with a predominance of the formers in International policies for DRR and disaster management (DM), resulting in a diffuse *top-down prevention* approach at policy level (Revet & Langumier 2015). A critical focus on "vulnerability" and on *processual* dimensions of risk and disaster. As discussed, this led some scholars to assess the socio-cultural aspects involved in a disaster and to put at stake the subjective and socio-cultural dimension of interpretation, in order to highlight that a «disaster is not defined by fixed events, or immutable relationships, but by social constructs, and these are liable to change» (Alexander, 2005:29). I can also assume that root causes for different kind of vulnerabilities could be also found in the practises and tactics (De Certeau, 2010) that human groups adopt in daily life, when a disaster has still not happened.

This tension between the two perspectives is even clearer in the academic research around the notion of "risk". In this regard, as already mentioned, the literature is so vast and manifold, that it is not possible to identify a common definition of what can be termed with the word *risk*. Likewise, risk is not a universal category, rather it is a historically situated category, «having a moment of emergence deeply linked to specific values, social groups and problems» (Doron 2016: 17). Indeed, since it is not possible to outline a well-defined risk studies literature, I will approach it looking at how risk has been differently defined over last decades.

According to Doron (2016) and other scholars (Piron 2004), it was in the Italian peninsula in the second half of the twelfth century that the word *risicum/resicum* firstly originated in a particular context made of negotiations between theology and mercantile practices (Doron 2016). "Risk" derived from the Arabic word *rizq*, which means the chance given by God to each man, but also "luck" (*fortuna*) and "happy chance". The concept of risk gave the opportunity to Medieval merchants and notaries to refer to a juridical subject in dealing with contracts and exchanges in uncertain situations, i.e. within the chance that something could have turned into a good or bad luck. So, the negative effects were not the only ones. If *fortuna* was something concerning God, *resicum* could be assessed and managed by human beings: the "risk" notion made them able to deal with and account for potential events taking place in commercial routes by justifying «the remuneration of a merchant who lent a sum of money and asked for interest, or who lent a boat to facilitate a commercial transaction and asked for a share

of the profits» (Doron 2016:18). So, the theologians of that time helped the development of mercantile practices, because they incorporated within the notion of risk a theoretical distinction from what was absolutely subordinated to "the will of God" (Doron 2016), so that:

- "future" and "time" could be objects of human contracts;

- uncertainty could be estimated, through probabilities and by fixing exchange prices for "taking the risk".

Doron (2016) argued that it is possible to trace back to that reasoning the emergence of a "proto-quantification" of probability of loss and profit, and this could probability be thought separately from the good itself, figuring as the "aleatory contract". Furthermore, he also pointed out that a "radical dissymmetry" between institutions and individuals came out when regularities on probabilities were acknowledged and applied to a new emerging subject beyond the individual: the *population*. This originated a "new political technology" (Foucault 2005), due to a twofold distinction, as follows:

- defining the events at a "population" level, so that they can be managed and governed vs singular events not manageable, left in a state of uncertainty;

- epistemologically legitimizing only expert knowledge and institutions in dealing with risk: «if the true knowledge of potential events implies a capacity to accumulate data and calculate their probability accordingly, it means that only institutions who can aggregate data and experts who can calculate probability with refined techniques can attain this knowledge on risks and claim their expertise, while the individual, even the most experienced, is condemned to uncertainty or, at best to a very biased knowledge» (Doron 2016: 22-23).

This twofold caesura provides evidence for my focus on local knowledges as a way to address flood risk management within a flood risk governance framework as played out in natural flood management contexts. A risk governance approach opens new inclusive and adaptive approaches to flood risk management, which from one hand questions the existence of a univocal technocratic risk assessment and management, from the other hand, it provides an innovative knowledge hybridising within an unprecedented stakeholder engagement and inclusion (Renn 2008; Renn *et al.* 2011; Aven & Renn 2010; Van Asselt & Renn 2011; Klinke & Renn 2012; De Marchi 2015).

To go back to the definitions of risk in the academic literature, "risk" has been mainly defined, depending on the outlook, «as an expected value, a probability distribution, as to uncertainty and as an event» (Aven & Renn 2010: 2); Aven and Renn pointed out at least ten different definitions:

> «1. Risk equals the expected loss (Willis 2007)
> 2. Risk equals the expected disutility (Campbell 2005)
> 3. Risk is the probability of an adverse outcome (Graham and Weiner 1995)
> 4. Risk is a measure of the probability and severity of adverse effects (Lowrance 1976)
> 5. Risk is the combination of probability of an event and its consequences (ISO 2002)
> 6. Risk is defined as a set of scenarios s_i, each of which has a probability p_i and a consequence c_i (Kaplan and Garrick 1981; Kaplan 1991)
> 7. Risk is equal to the two-dimensional combination of events/consequences and associated uncertainties (will the events occur, what will be the consequences) (Aven 2007)
> 8. Risk refers to uncertainty of outcome, of actions and events (Cabinet Office 2002)
> 9. Risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain (Rose 1998, 2003)
> 10. Risk is an uncertain consequence of an event or an activity with respect to something that value humans (IRGC 2005)» (Aven & Renn 2010: 1)

Throughout these definitions, risk is mostly associated with:

- some negative effects expected;
- a likelihood of negative outcomes. If it is not associated with negative effects, the probabilistic/techno-centric explanation prevails.
- If probability is not clearly mentioned, uncertainty is the framework within values and/or socio-cultural factors are sometimes put forward.

These definitions reflect the two main perspectives on risk, historically represented in the academic research literature. From one side, since the 80s onwards it is clear in social sciences that risk framing in everyday life is influenced by values, attitudes, cultural and social identities (Douglas & Wildavsky 1982; Hermans *et al.* 2012). From the other side, a well-established quantitative approach has been as well developed from the 70s onwards,

and it lies with the estimation of the probability of events/losses/actions/processes. This latter approach, initially defined as the *positivistic risk paradigm*, stems from the distinction brought out by Knight (1921) between "risk" and "uncertainty", i.e. the distinction between something we do know its probability of occurrence ("risk", identified with the formula "chance x effect", Hermans *et al.* 2012) and something we cannot know its occurrence (uncertainty). The Knightian perspective, by quantifying a potential damage in terms of probability, would legitimate:

- the identification and assessment of risk, giving rise to the literature on risk assessment (see Hermans *et al.* 2012; Aven 2016);

- the ability to control and take actions on risks, establishing policies to tackle the unacceptability of "risk" and/or its consequences management (i.e. risk management, see Aven 2016).

Contrarily, a first conceptualization of risk as "pure" uncertainty, i.e. something not calculable, neither in a probabilistic way, is included in the economic Keynesian theory. For this reason, some scholars traced a distinction between a Knightian notion of risk (risk=calculable) and a Keynesian one (risk=pure uncertainty) (Lupton 1999). This core distinction crosses the different disciplines and paradigms within risk studies and can be found in all of them. Following Aven *et al.* (2010), four main perspectives can be identified in risk studies as follows:

- the technical risk perspective, linked to statistical, environmental and technical approaches within a rational action framework with a main aim: to «anticipate potential physical harm to human beings, cultural artifacts or ecosystems, and use probabilities and expected values (estimated or assigned) to express uncertainties and frequencies» (Aven *et al.* 2010: 24). Main issues within these perspectives are: explanatory narrowness and lack of precision, due to the average values they are based on and the limited factors they can take account for in face of the huge and volatile factors influencing human beings' relationship with risk.

- The economic perspective, which refers to the expected utility theory. Following this theory, an individual would choose the highest expected utility as the best alternative: «one assesses probabilities and a utility function on the set of outcomes, and then uses

the expected utility to define the preferences between actions. These are the basic principles of what is referred to as rational decision-making» (Aven *et al.* 2010: 28). Different problems are at stake: first of all, the presumed rationality of human behavior in coping with risk. Secondly, the number of factors and actors to be considered to the extent to which the decision-making consequences are almost never confined to the decision makers. Positive findings of this approach are related to cost-benefit based policies, to the extent to which «the treatment of risk in economics has sharpened our vision for conceptualizing risk as a cost factor that can be exchanged, treated or mitigated just like any other cost factor» (Aven *et al.* 2010: 31).

- The psychological perspective, often associated with the *psychometric paradigm*, mainly refers to individual risk perception, analyzing the subjective factors of risk-takers (Aven *et al.* 2010).

- The social sciences' approaches, which consider socio-cultural factors in different ways, as I have partially discussed in the previous paragraph, from the vulnerability and cultural approach up to what I will refer to as the *Science and Technology Studies* (STS) and the *Cultural Theory*.

To my purposes, I will briefly outline and give some examples about the third and fourth perspectives, in order to give a full picture of the theoretical references behind my theoretical and epistemological framework, which paved the way to a risk governance approach.

From the 60s onwards, it originated a line of study that tried to put together quantitative analysis and socio-cultural and normative aspects, giving rise to studies on risk perception, i.e. how individuals perceive risks in their daily lives. After an early study by Starr (1969), among cognitive psychologists what is called the *psychometric paradigm* has been consolidated, which is a still dominant quantitative approach, based on standardized questionnaires to investigate how various factors (emotions included) influence the perception of risk (Slovic *et al.* 1982). Beyond the merit of having placed at the centre the "risk perception" dimension, in my opinion some open issues remain within this approach: the focus on the individual, the perceptive dimension (which implies a stimulus-response analysis model), and above all the assumption of the pre-existence of an "objective risk". This is so defined by scientists and experts, it can be measured and should inform laypeople risk perception.

Opposite to the psychometric paradigm and more focused on social and collective dimensions, it's the *Cultural Theory*. Thanks to the work of Mary Douglas and Aaron

Wildavsky (Douglas & Wildavsky 1982; Douglas 1992), this approach tried to define patterns of cultural beliefs that would result from the adoption of certain values: a well-known typology has been so built up by crossing "groups" and "networks" (fig.1.2).

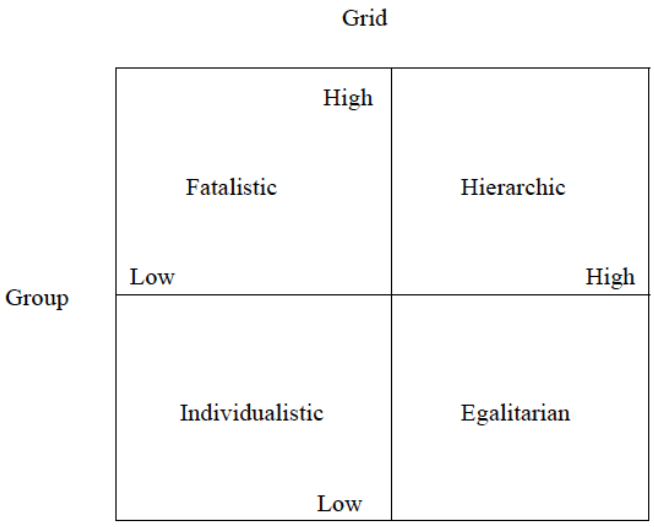

Figure 1. 2 Douglas's grid-group cultural model (taken from Oltedal et al. 2004)

The "group" refers to the membership degree of individuals to social units, which can affect their perception of risk, while the "grid" shows how a social context can be, more or less, restrictive in determining individual behaviour during social interaction. Beyond the problematic nature of the typology and the strong criticism received (e.g. according to Sjöberg 2010, this theory would explain no more than 10% of the variance in risk perception), the greatest advantage of this approach is still to have questioned the existence of an objective/subjective dichotomy in the perception of risk, namely: «the inappropriateness of dividing the problem between objectively and subjectively biases, calculated physical risks and individual perceptions...between private, subjective perception and public, physical science» (Douglas and Wildavsky 1982: 194). In parallel, the Science and Technology Studies (STS) (as far as concerned, in relation to the sociology of scientific knowledge) is an interdisciplinary field that analyses the creation of science and technology in its socio-cultural contexts, usually traced back to the main work by Thomas Kuhn (1962). This approach has widely criticized the role and authority of scientific and technological knowledge as the unique source of truth, in various fields: if science is a "human product", then it cannot result in a pure rational process (Hermans *et al.* 2012), but «what becomes "science" or "risk" is the outcome of complex and

strategic interactions between divergent actors» (Hermans *et al.* 2012: 1099). Consequently, it is questioned the assumption that laypeople, i.e. most citizens, do not understand the "reality" of risks as defined by science, so that their risk representations (including everything that goes with it) are not scientific and thus relegated to the "perception" field. The *Cultural Theory* and STS' findings gave a relevant contribution to open the way for the inclusion of different actors and knowledges in framing and addressing risk, so that a risk governance approach could be developed, as I will describe in the next paragraph. Furthermore, the underground epistemological issue that STS and the Cultural Theory pointed out in risk studies is therefore the acknowledgement of the distinction between an "objective" and a "subjective" risk a distinction that crossed different perspectives on risk, as seen.

As previously mentioned, the field of social sciences theories on risk is huge and diversified. Beyond STS and the Cultural Theory, sociological views on risk-related macro-processes in our Western society can also be found, as in Ulrich Beck (1992) and Michael Foucault (2005; Ewald 1991). Beck is world-known for his first conceptualization of the *Risk Society*, seen as a product of our modernity that needs reflexivity[10] to be addressed, by critically reflecting on expert knowledge itself. In his opinion, reflexivity increases because risks increase and «individuals develop and exercise reflexivity in response to expert knowledge, rather than generating their own risk knowledges through their own experiences of the world» (Lupton 1999: 110). He therefore assumes a rational action framework, which drives human beings coping with risk (Wynne 1998), as explained in the aforementioned technical, economic and psychological perspectives. He doesn't really problematize a supposed naturalness of expert knowledge and he doesn't really take into consideration alternative kinds of knowledges produced by laypeople (Wynne 1998), even if he clearly recognizes the emergence of «parallel systems of competing knowledge claims» (Renn 2008: 27) as a peculiarity of reflexive modernity. Risk is conceived by Beck as something "out there", since he distinguishes between risk (real risk, "out here") and risk perception, alternating a realist with weak social constructivist approach on risk[11] (Beck 1992; Lupton 1999). The same reference to macro socio-political processes can be found in Foucault's work, but within a totally different framework: in his governmentality theory (within a poststructuralist approach), risk is

[10] Reflexivity implies the opportunity to question an "objective" validity.

[11] I should mention here that also the work of the sociologist Anthony Giddens treated risk-related macro-processes. He also associates modernization to "risk", but he claims that our modernity is conceived more "risky", due to our increasing attention and reflexivity towards risks: reflexivity stems from expert knowledge, rather than in a critical opposition to it.

conceived as a strategy of power to monitor and control the population and individuals to achieve neoliberalist goals (Lupton 1999): «to calculate a risk is to master time, to discipline the future» (Ewald 1991: 207). As Lupton pointed out, risk experts problematize and make risk calculable and governable through a set of actors, institutions, knowledges and practices, with the extent to which works as a moral governmental technology (Lupton 1999; Ewald 1991). I consider this analysis as the first attempt to focus on what other scholars (Renn 2008; Aven & Renn 2010; Van Asselt & Renn 2011; De Marchi 2015; Forino *et al.* 2018) would analyze in terms of risk governance afterwards. Another relevant concept useful for our theoretical "toolkit is the Foucauldian concept of discourse, as critical discourse analysis' scholars have used it (Titscher *et al.* 2010; Wodak R. & Meyer M. 2009a). They defined "discourse" as a social practice,

> *«socially constituted, as well as socially conditioned - it constitutes situations, objects of knowledge, and the social identities of and relationships between people and groups of people. It is constitutive both in the sense that it helps sustain and reproduce the social status quo, and in the sense that it contributes to transforming it»* (Wodak 1996 cited in Titscher *et al*. 2010).

I will delve into this concept in the methodological part of this work, discussed in chapter four.

What Foucault and (partially) Beck brought into my theoretical framework is the epistemological perspective through which I will analyze risk and risk governance: a social constructivist approach based on the assumption that «nothing is a risk itself; there's no risk in reality. But on the other hand, anything can be a risk; it all depends on how one analyses the danger, considers the event» (Ewald 1991 cited in Zinn 2010: 109). This is a kind of extremism of the socio-cultural approach developed from the first conceptualization of "vulnerability" in the disaster research literature I considered. The factors resulting in a "risk" are so conceived as something socio-culturally produced: «a risk, therefore, is not a static, objective phenomenon, but is constantly constructed and negotiated as part of the network of social interaction and the formation of meaning» (Lupton 1999: 31). In this regard, considering Beck, Foucault and the perspectives I outlined, Lupton (1999) underpins a distinction between a weak and strong type of constructivism in risk studies, to the extent to which risk is conceived as an objective state of affairs, "out there" (fig 1.3).

Epistemological position	*Associated perspectives and theories*	*Key questions*
Realist: Risk is an objective hazard, threat or danger that exists and can be measured independently of social and cultural processes, but may be distorted or biased through social and cultural frameworks of interpretation.	Technico-scientific perspectives/most cognitive science theories.	What risks exist? How should we manage them? How do people respond cognitively to risks?
Weak constructionist: Risk is an objective hazard, threat or danger that is inevitably mediated through social and cultural processes and can never be known in isolation from these processes.	'Risk society' perspectives/critical structuralism/some psychological approaches.	What is the relationship of risk to the structures and processes of late modernity? How is risk understood in different sociocultural contexts?
	'Cultural/symbolic' perspectives/functional structuralism, psychoanalysis, phenomenology.	Why are some dangers selected as risks and others not? How does risk operate as a symbolic boundary measure? What are the psychodynamics of our risk responses? What is the situated context of risk?
Strong constructionist: Nothing is a risk in itself – what we understand to be a 'risk' (or a hazard, threat or danger) is a product of historically, socially and politically contingent 'ways of seeing'.	'Governmentality' perspectives/poststructuralism.	How do the discourses and practices around risk operate in the construction of subjectivity and social life?

Figure 1. 3 Theoretical perspectives on risk listed by their epistemological positions (Lupton 1999:36).

The constructionism/realism debate was one of the major debate in disaster research and questioned the possibility to undertake objective analysis of risk (Klinke & Renn 2002). As shown in fig 1.3, the realist perspective claims that technical risk estimates are «true representations of observable hazards that can and will affect people as predicted by the calculated results regardless of the beliefs or convictions of the analysists involved» (Klinke & Renn 2002: 1073). Economic, technical and some psychological perspectives follow this

epistemological approach. The social constructivist approach, which can be traced back to the *Cultural Theory*, the Foucauldian approach and to Ulrich Beck[12] (Beck 1992; Lupton 1999; Ewald 1991) can include different nuances, from a weak position which deem risk «as an objective hazard always mediated by socio-cultural processes (Lupton 1999), to some culturalist and symbolic perspectives on risk, up to the idea that discourses and practices construct something "risk".

Considering this epistemological framework and following my theoretical outline, my analysis of local knowledge in risk management and assessment will be carried out within a constructivist approach on risk. As I'll argue in chapter two and three, in the contemporary shifting in European policies from a state-centric management to a multi-level governance system (Renn *et al.* 2011), local knowledges can play a central role in promoting an inclusive risk governance framework, shared and produced by every actor at different levels. Since, as discussed, «what we measure, identify and manage as risks are always constituted via pre-existing knowledges and discourse» (Lupton 1999: 30), the ways in which local knowledges interact with risk management and assessment should be treated within a strong social constructivist epistemological approach. Therefore, I will position myself alternating a weak and a strong constructivist perspective, to the extent to which I will show (in chapter 5, 6 and 7) how it is a matter of building and interpreting relationships (between what I will call a *risk object* and an *object at risk*, following Boholm & Corvellec 2011; Boholm *et al.* 2014; Boholm 2015) what produces different risk constructions driving or influencing flood risk governance in practice (Renn 2008). In the next paragraph, I will delve into the notion of risk governance, by pointing out how it originated and will enrich my analysis.

1.4 A framework for my approach: Renn's inclusive risk governance framework

The notion of "risk governance" is a very recent one. It originated both at European institutional level and in academic literature in the early 2000s. This notion has been enlightened by decades of interdisciplinary research, by drawing from sociological and

[12] In social sciences one of the founding work can be considered *The Social Construction of Reality* (Berger & Luckmann 1966)

psychological research on risk, Science and Technology Studies (STS), and policy and legal scholars (Renn *et al.* 2011). Van Asselt and Renn (2011) traced back the origin of the concept in a three-year program of seminars, called TRUSTNET-*Concerted actions on risk governance* (1997-1999) financed by the European Commission, followed by a case studies analysis in some European Countries at a local, national and transboundary level. The European Union was thus a pioneering institution in promoting a governance approach for risk management, as I'll explain in chapter three referring to Disaster Risk Reduction (DRR) and flood risk policies. The results of the TRUSTNET project were then presented in the first two academic papers written on risk governance: *Present challenges to risk governance* authored by G. Heriard-Dubreuil in a special issue (called *Risk and Governance*) of the *Journal of Hazardous Material* in 2001, and *Risk Governance: is consensus a con?* published in *Science and Culture* by Dave Elliot in the same year. Van Asselt and Renn (2011) noted that a definition of risk governance wasn't really produced at that time and the European Commission has been adopting "risk governance" more likely a notion than a concept, namely «as an umbrella notion "embracing risk identification, assessment, management, and communication"» (Van Asselt & Renn 2011: 4). "Risk governance" was conceived as a way to account for the involvement of stakeholders and experts in dealing with the complexity of modern risks, overcoming the classic division between risk assessment, management and communication. Ortwin Renn, one of the main contemporary sociologist working on risk issues and the main theorist of a risk governance approach was part of the TRUSTNET program and chaired the establishment of the International Risk Governance Council (IRGC) in Switzerland in 2003. IRGC is a think tank, aiming at «the anticipation and governance of global, systemic risk» (Aven & Renn 2011: 4), where policy and the academic levels are intertwined with each other. Indeed, the first academic attempt to define risk governance is a result of the IRGC, published as the "White paper" by Renn in 2005 (IRGC 2005).

The concept of risk governance translated «to the context of risk and risk-related decision-making» (Renn 2008: 8) a notion widely spread in political and sociological sciences, where the idea of governance was introduced to «enlarge the perspective on policy and politics by acknowledging that government is not the only, and may be not even the most important, actor in managing and organizing society as response to new challenges» (Aven & Renn 2011: 5). The State is not solely responsible for public policies, but a joint network of public and private actors can have responsibilities at various levels and in different forms. Risk governance can be defined as «the various ways in which many actors, individuals and institutions, public and private, deal with risk surrounded by uncertainty, complexity and/or ambiguity. It includes

formal institutions and regimes and informal arrangements. It refers to the totality of actors, rules, conventions, processes, and mechanisms concerned with how relevant risk information is collected, analysed, and communicated, and how regulatory decisions are taken» (Renn *et al.* 2011: 234). It can be identified a horizontal level, including the relevant actors within a geographical/functional/administrative unit or a vertical one, focusing on the links among the different levels (from a local to a National or International one), what is called a multi-level governance – which can be polycentric or not, as I'll discuss in the next chapter. Furthermore, Renn points out that the concept can be used a descriptive sense –as I will use it- «to describe and understand the state of affairs pertaining to a particular policy dossier or policy domain» (Van Asselt & Renn 2011: 435), or in a normative sense, by pertaining to frameworks and policies for organizing societies (Van Asselt & Renn 2011).

As Mugnano (2016) recently underpinned, social networks and local communities have a central role in disaster management and the bigger is the role of local communities in risk perception/construction, the more they will be able to adapt to a disaster. In every supposed phase of a process resulting in a disaster (Alexander 2002) to produce and share different kind of knowledges and information is necessary for risk and disaster management (Renn 2008b; Mercer *et al.* 2010; Weichselgartner & Pigeon 2015). If in the disaster research literature it's well analysed how decentralized decision-making and information sharing can positively act on post-disaster housing and reconstruction through the empowerment of local actors and different stakeholders (Davidson *et al.* 2007; Calandra 2012a; Johnson & Lizzaralde 2012), more complex is the role of the different actors within the governance of risk, according to the type of risk, too.

As I already noted (Carnelli & Anselmi 2018), whether simple, systemic or emerging risks should be faced, different levels of complexity, ambiguity and uncertainty need to be addressed through different kind of actions and involving different kind of actors. Uncertainty, I've already discussed, is the main characteristic of a crisis or an event/process framed as "risky", while the desire for certain responses to solve the crisis and "go back" to a "safe" condition is usually strong in every actor involved: the need to culturally deal with uncertainty turns into the claim of being alerted in the right moment and being reassured through supposed scientific or ritual truths (Mugnaini 2015). Complexity refers to «the difficulty to identifying and quantifying causal links between a multitude of potential causal agents and specific observed effects» (Renn 2008: 75), while ambiguity reveals the existence of different interpretations of risk assessments (interpretative ambiguity) or different views on what can be considered tolerable or not as risk (normative ambiguity) (Renn 2008). Ambiguity and complexity justify

the existence of different and potentially opposite views on the ways to assess and appraise the risks, and on which management actions should be considered according to the meaning, interpretation and implications of available risk information (Van Asselt & Renn 2011). Therefore, a risk can be defined as "simple" when «the cause for the risk is well known, the potential negative consequences are obvious, the uncertainty is low and there is hardly any ambiguity with regard to the interpretation of the risk» (Renn *et al.* 2011: 235). Alternatively, systemic risks are characterized by different levels of uncertainty, ambiguity and complexity and cannot be calculated «as a function of probability» and requires «a more holistic approach to hazard identification, risk assessment, and risk management» (Renn *et al.* 2011: 235), beyond a simplistic cause-effect or probabilistic analysis. Therefore, the concept of "risk governance" can be useful in case of a multi-level framework to integrate the classic distinction in risk management (risk assessment, risk management, risk communication) and include different knowledges and different actors, according to the context.

Renn (2008) distinguishes three main possible risk governance frameworks, which influence the degree of involvement of horizontal and vertical actors:

- the *technocratic* model, the less inclusive one. Here (fig. 1.4) risk is considered something objective: science is the only discipline, which can understand risk and consequently directly inform policy-makers: scientists are seen as «the best judges of the tolerability of risks and inform policy-makers directly about what they should do» (Renn 2008: 11)

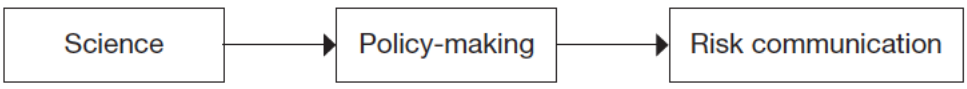

Figure 1. 4 The "technocratic" risk governance model (Renn 2008: 10)

- The *decisionistic* model (fig.1.5): policy makers require and take into account other inputs than the scientific ones: usually values and political aspect are considered in risk management while scientific ones in risk assessment

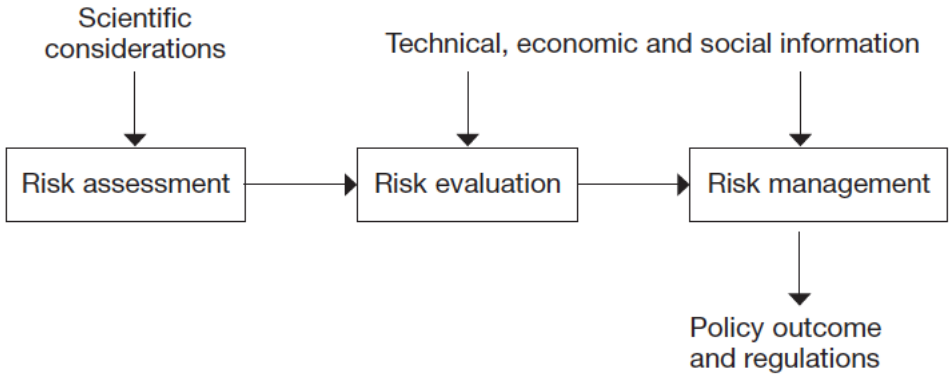

Figure 1. 5 The "decisionistic" risk governance model (Renn 2008: 10)

- The inclusive or "transparent" risk governance model (fig 1.6). It was initially developed by the National Research Council (NRC 1996). Different inputs are considered: socio-economic and political aspect can influence risk assessment and can characterize risk in a broader way. Indeed, economic and social aspects are considered in risk evaluation, that is, different perspectives are deemed to have same epistemological legitimacy in framing the concept of risk, as I'll discuss further on.

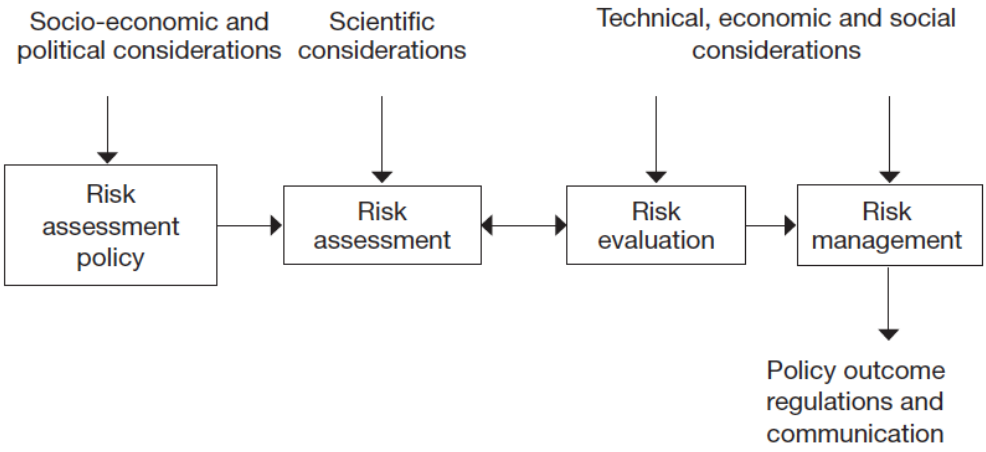

Figure 1. 6 The inclusive or "transparent" risk governance model (Renn 2008: 10)

The risk governance model which Renn then develops is the "inclusive" model, which I will use to interpret my data.

I will discuss now this model as an inclusive risk governance framework, which will be useful to provide an interpretation framework for the flood risk management processes I will analyse in chapter 4, 5 and 6. This framework depends on five different phases, with different kind of knowledges at the centre. These phases have the potential to enlarge the set of criteria

for assessing, characterizing, evaluating and managing risks, beyond the largely technocratic components that have dominated earlier models of risk governance (Renn 2008). I built the following graph to show how risk and risk governance are conceived in Renn's inclusive risk governance framework, by putting forward how the notion of "knowledge" is there relevant (fig. 1.7)

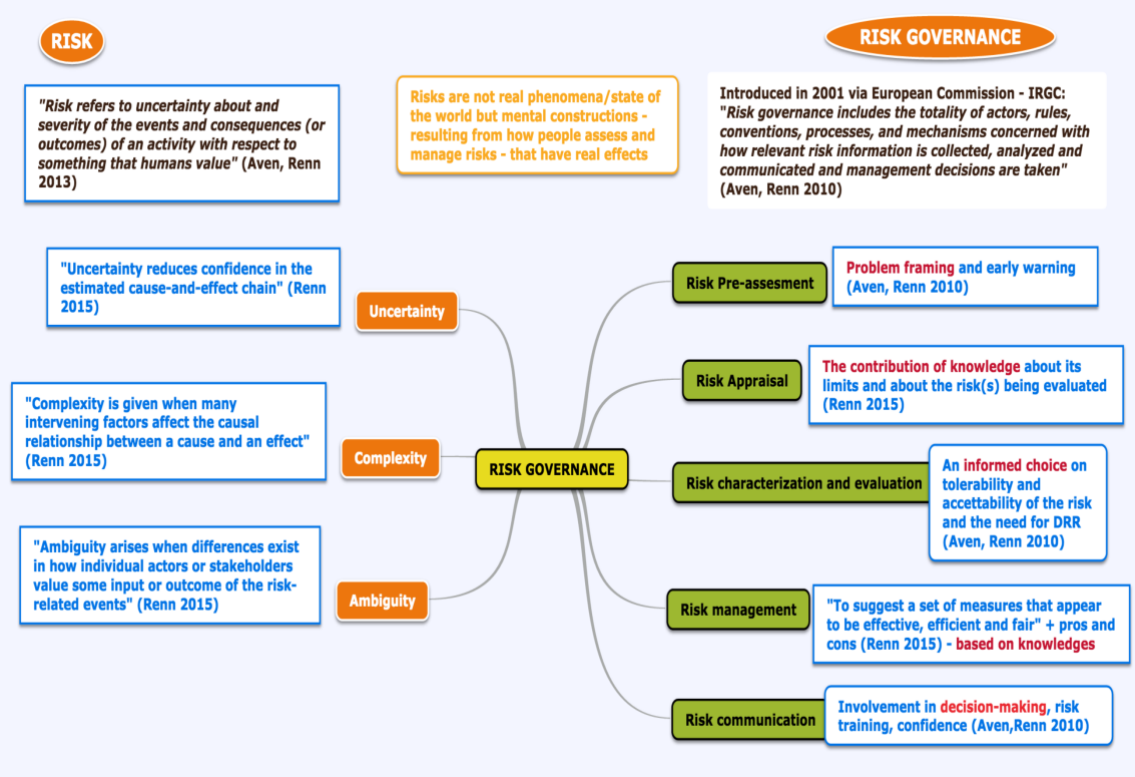

Figure 1. 7 My graphic representation of Renn's inclusive risk governance framework

This framework is thought to be adaptive and integrative in addressing risk to the extent to which «it incorporates the necessary steps in a risk governance process that allow risk managers to reduce, mitigate and control the occurrence of harmful outcomes resulting from collectively relevant risk problems in an effective, efficient and fair manner» (Renn *et al.* 2011: 236). The framework is conceived as an ordered four steps model (risk pre-assessment, risk appraisal, risk characterization, risk management), where risk communication and risk participation (stakeholder and public involvement) are constantly linked within the four phases. Risks are defined not as real phenomena, but rather, following the strong social constructivist epistemological approach I previously discussed, as «mental constructions resulting from how people perceive uncertain phenomena and how their interpretations and responses are determined by social, political, economic and cultural contexts, and judgements» (Renn *et al.*

2011: 238). Before describing the different phases of the framework, and then focusing on risk management and risk participation, I will show two versions of the framework: the first one (fig. 1.8) visualizes the logical connections among the phases, the second one (fig. 1.9) represents the most recent one: it's conceived like a cycle, to be more flexible, inclusive, and adaptive for real contexts (Renn *et al.* 2011).

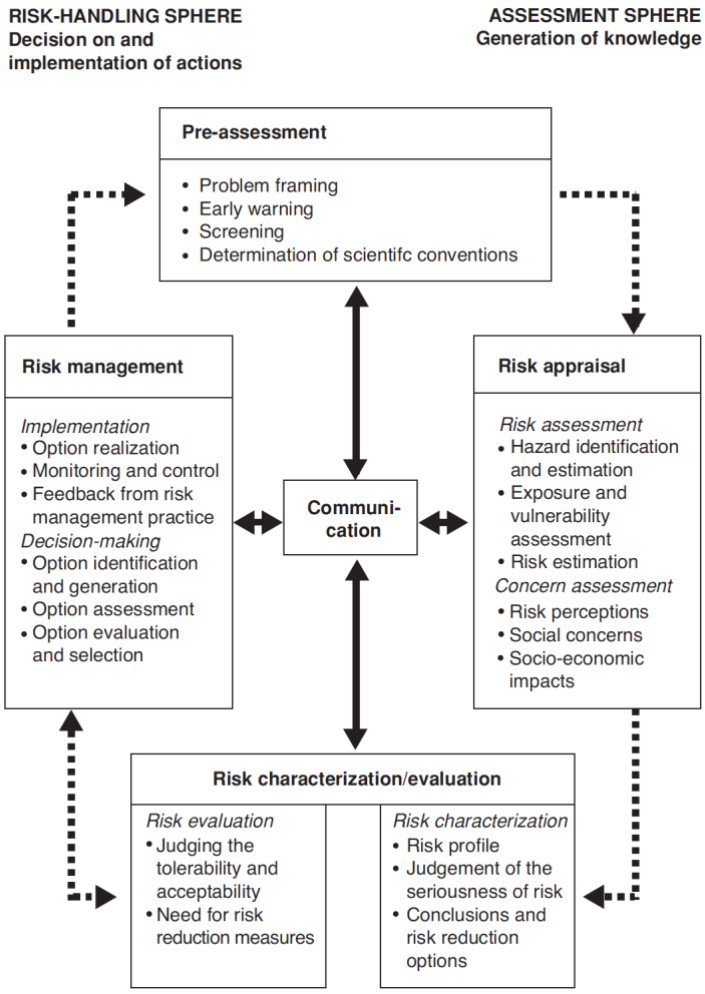

Figure 1. 8 One of the first graphic representations of the risk governance framework designed by the author, Ortwin Renn (Renn 2008: 365)

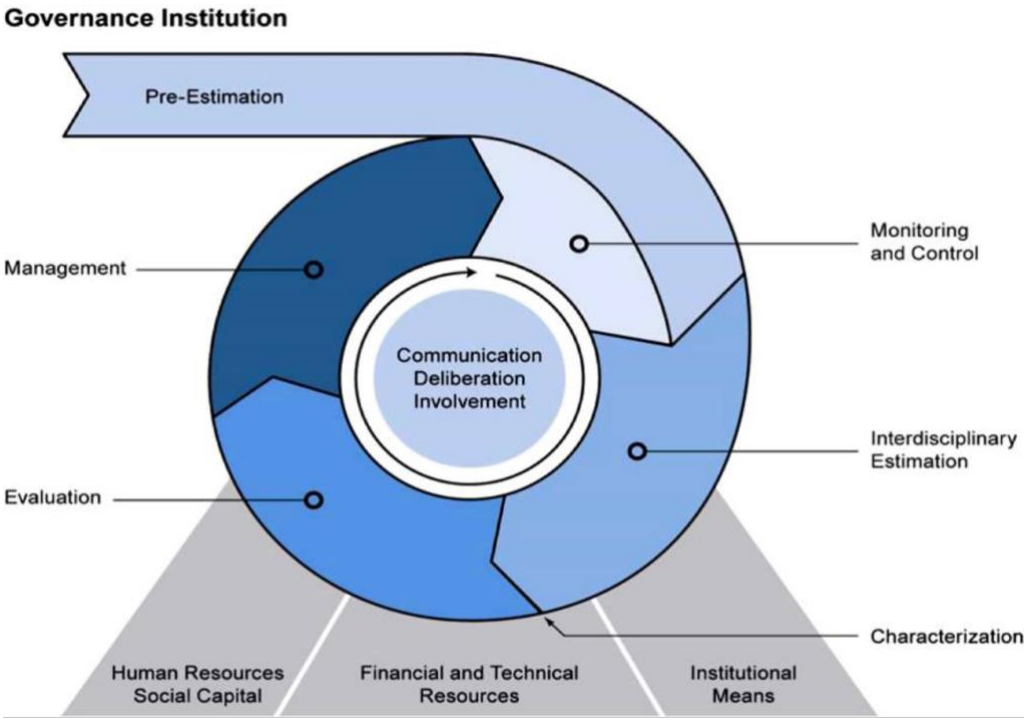

Figure 1. 9 A graphic representation of the latest model of the risk governance framework (Renn et al. 2011: 238)

Keeping in mind the two versions of the framework but considering the latest one, which is conceived as a cycle, I identified four main phases and the issue of risk communication/participation as follows:

1- Pre-estimation: it is related to the process of framing, that is «to select some aspects of a perceived reality and make them more salient» (Renn *et al.* 2011: 238), in order to:

> *«explore what major political and societal actors such as governments, companies, epistemic communities, nongovernmental organizations, and the general public identify as risks and what types of problems they label as problems associated with risk and uncertainty»* (Klinke & Renn 2012: 280).

Since risk is a construct, risk framing is «guided by cultural values, by institutional and financial resources, and by systematic reasoning» (Klinke & Renn 2012: 280): all actors have different views, knowledges and goals; even if they should agree with goals and implications derived from present state of knowledges (Renn 2008), «what counts as risk may vary among these actor groups» (Renn 2008: 49). Beyond this, pre-assessment concerns also early warning and monitoring, the institutional selection of procedures for

risk assessment and management policies (*risk screening*), and the existence of scientific conventions for risk appraisal.

2- Interdisciplinary risk estimation: it is about the ways scientific knowledge produces risk assessment and the inclusion of social and economic implications in scientific risk assessment, through two stages:

   - risk assessment: «experts of natural and technical sciences produce the best estimate of the physical harm that a risk source may induce» (Klinke & Renn 2012: 281)

   - concern assessment: «experts of social sciences including economics identify and analyze the issues that individuals or society as a whole link to a certain risk» (Klinke & Renn 2012: 281)

3- Risk evaluation: it can be defined as the «deliberative effort» (Renn *et al.* 2011: 241) «to judge a given risk and justify an evaluation about its societal acceptability or tolerability» (Klinke & Renn 2012: 282). Based on a scientific assessment (probability/impact including socio-economic factors), risk can be evaluated as acceptable, tolerable or not. Consequent measures and actions can be undertaken afterwards (fig. 1.10).

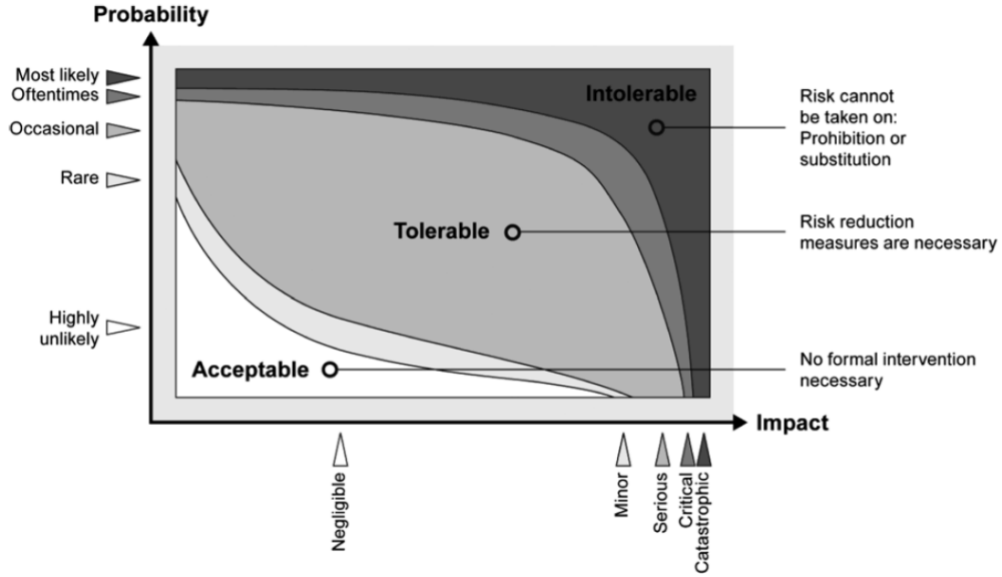

Figure 1. 10 How risk can be evaluated in Renn's risk governance framework (Klinke & Renn 2012: 282)

In this phase, ambiguity should be handled, both in a normative sense (ambiguity of values) and in an interpretative one (ambiguity of evidence). Renn identifies two "functional" sub-phases to account for this differentiation:

- risk characterization: it determines «the evidence-based component for making the necessary judgment on the tolerability and/or acceptability of a risk» (Klinke & Renn 2012: 284);

- risk evaluation: it determines «the value-based component for making this judgment» (Klinke & Renn 2012: 284).

4- Risk management: risk is a construct (framed, assessed and evaluated) and all concepts of risk share one element, i.e. the distinction between possible and chosen action. Therefore, starting from the information produced in the previous three phases, actions are undertaken or not, to the extent to which:

- risk is considered acceptable: no risk reduction is necessary or risk sharing is left to private sectors or demanded on a voluntary basis;
- risk is considered intolerable, public institutions must reduce or eliminate risk sources, vulnerabilities or exposure;
- risk is considered tolerable, risk need to be reduced or handled by public or private actors, or both.
- if risk is in the transition zones of tolerability (fig. 1.11) or there's a dispute, «public risk management needs to design and implement actions that make these risks either acceptable or at least tolerable by introducing reduction strategies» (Klinke & Renn 2012: 285).

Therefore, as I will argue in my data analysis, different steps and criteria can be applied to manage risk (Renn 2008; Renn *et al.* 2011; Klinke & Renn 2012), in order to:

- *identify risk management options* (risk avoidance, risk reduction, risk transfer, self-retention);

- *assess risk management options*, based on possible different criteria (e.g. effectiveness, efficiency, minimization of external side effects, sustainability, fairness, political and legal implementations, ethical acceptability, public acceptance);

- *evaluate risk management options*, by involving decision and policy makers, stakeholders, the general public;

- *select risk management options*, through legitimization by decision makers and/or through participatory processes (cost-benefit or multi-criteria decision analysis);

- *implement these options*, usually delegating the implementation to third parties;

- *monitor the option performance*, through systematic observation of intended and unintended effects, including new risks eventually produced or identified.

Other two steps of the frameworks, which cross the aforementioned phases are:

5- risk communication, which is a key feature of the risk governance framework. It is not intended as a separate stage but it is needed throughout the whole "risk-handling chain", from the framing to the monitoring of the risk management performance (Renn 2008). Communication is conceived as «meaningful interactions in which knowledge, experiences, interpretations, concerns, and perspectives are exchanged» (Renn *et al.* 2011: 241). It's not only conceived as an external tool to inform or gather people, rather is the core of risk governance, based on social learning among decision makers, stakeholders and the general public, in order to find ways to address uncertainty, complexity and ambiguity. It's a way to include people in risk participation.

6- Risk participation and inclusion: this is what risk governance strongly implies and promotes. As I will show in the next chapter, local knowledge and its inclusion are deeply intertwined with each other. Indeed, inclusion «does not just mean that various actors are included, but that they play a key role in framing the risk» (Renn *et al.* 2011: 241): who is included? What is included? And what is the scope and mandate of the

process? (Renn *et al.* 2011) are the *key questions to answer* to explain how risk is assessed and managed in an inclusive and adaptive risk governance framework (Renn 2008; Renn *et al.* 2011; Klinke *et al.* 2012). Renn suggests it is necessary:

- to know «what the various actors label as risk problems» (Renn *et al.* 2011: 241), to integrate all relevant knowledges and include all relevant concerns. Local knowledge (see chapter 2) can play a central role in such a framework

- to assume that inclusion should be the end of the processes, not just a means, in order to promote a collective decision-making in all phases of the risk governance framework

- to assess whom and what to include: «more inclusion does not equal better risk governance» (Renn *et al.* 2011: 242): the challenge, Renn argues, is to arrange "productive and meaningful communication" within a range of actors «who have complementary roles and diverging interests» (Renn *et al.* 2011: 242), to the extent to which, complexity, uncertainty and ambiguity are addressed in a "proper" way.

So, different kind of actors to be involved in risk governance and be identified as follows:

- *«stakeholders: socially organized groups, «who are or will be either affected by or have a strong interest in the outcome» (Renn 2008: 273) of the risk source or of the process/activities of risk management/mitigation*
- *directly affected public: individuals and non-organized groups «who will experience positive or negative impacts from the outcome» (Renn 2008: 273) of the risk source or of the process/activities of risk management/mitigation*
- *observing public: media or opinion leader/cultural elite who may influence public opinion*
- *general public: who is not directly affected by the risk or risk management/mitigation but are «part of the emerging public opinion on the issue» (Renn 2008: 273).*

Then, according to uncertainty, complexity and ambiguity, Renn identifies four risk management strategies (Renn 2008; Renn *et al.* 2011; Klinke & Renn 2012), including different types of actors (fig 1.11):

- *linear risk problems*, e.g. car accidents or known food or health problems: traditional risk-risk trade-offs, risk-benefit and cost-benefit analysis are the tools for finding the most appropriate risk reduction measures (Renn 2008) when complexity, uncertainty and ambiguity are low. A classic instrumental analysis by governmental policy-makers and statistical risk analysis can be carried out. Renn *et al.* (2011) mention "flood risk management" as an example of such risk problem, unless climate change or societal actors' resistances increase ambiguity or uncertainty. Then, he will add to this point that "if necessary", stakeholders may be included in the deliberations, due to their owning information and know-how that may be useful for being more efficient (Klinke & Renn 2012).

- *complex risk problems*, when uncertainty and ambiguity are low, but complexity not: a risk-informed management is needed, where scientists and experts need a better risk assessment. Kilnke and Renn argue that «it does not make much sense to integrate public concerns, perceptions, or any other social aspects for resolving complexity unless specific knowledge from the concern assessment helps to untangle complexity» (Klinke & Renn 2012: 285). Otherwise, it is required an "epistemic processing" (involving different epistemic communities) promoting "dialogue and deliberation" among different kind of experts, both natural and social scientists; sometimes more uncertainty or ambiguity could be found.

- *risk problems due to high unresolved uncertainty*: in case of unknown uncertainties, to inform the risk characterization process, affected stakeholders and public interest groups need to be involved in a "broader deliberative arena": in order to discuss and balance trade-offs between over- and under-protection (Klinke & Renn 2012). A reflexive process (through different tools, such as roundtables, open forums, advisory committees) is needed to reach a possible consensus among tolerable risk mitigation measures, basically following a

precautionary principle.

- *risk problems due to interpretative and normative ambiguity*: in this case, Klinke & Renn suggest that «ambiguity would require the most inclusive strategy for involvement because not only directly affected groups but also those indirectly affected should have an opportunity to contribute to this debate» (Klinke & Renn 2012: 288). An open participatory process is required to discuss "competing arguments, beliefs, and values" to identify common values to rely on.

The next diagram shows the logical connections between risk management and the different phases (fig. 1.11).

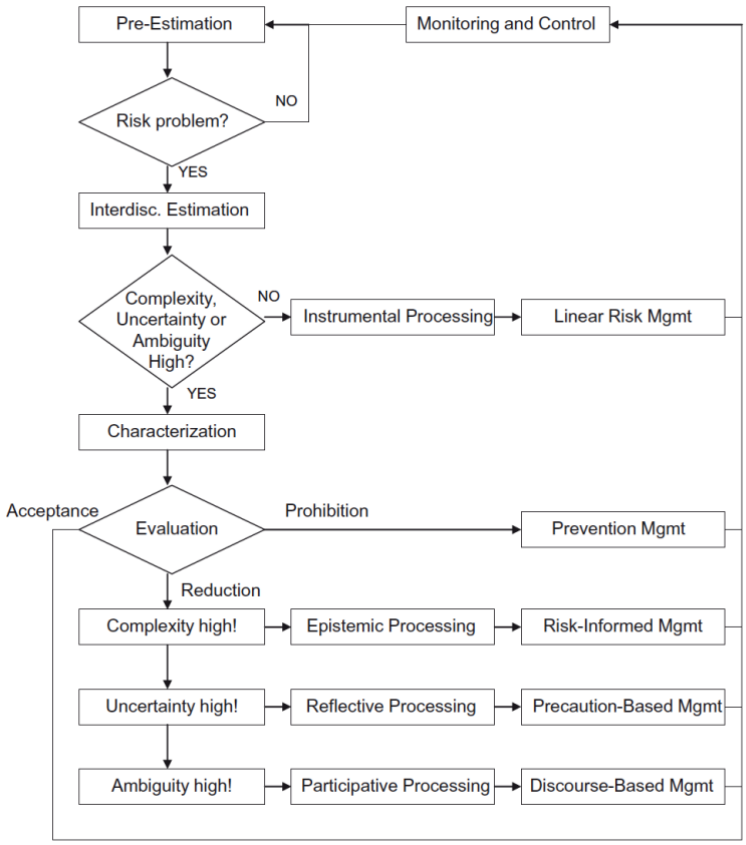

Figure 1. 11 A final synthesis of Renn's inclusive risk governance framework with risk managements strategies

What I outlined in this last part is obviously a model, which is mainly thought for policy makers or institutional actors. It is difficult to literally implement it, by following every steps

and logical connections for every actor involved. Since the flood risk management processes I've analysed have not be driven by this model, I'll use it as a framework for my purposes.

Indeed, due to the complex, multifaceted and interdisciplinary epistemological nature of risk, in this first chapter I've outlined a literature review to bring out some concepts useful to my theoretical framework mainly from disaster research and "risk studies". It emerged how there are two opposite perspective on risk and disasters, and how some social scientists managed to unpack these two concepts. The concept of "risk" etymologically legitimized the possibility to control, measure and manipulate uncertainty and nature, in the name of science and quantitative probabilistic ways of assessment and management. But, the growing acknowledgment of uncertainty, complexity and ambiguity as constitutive components of risks and disasters defined as socio-cultural phenomena paved the way to the inclusion of different factors, knowledges and actors in risk management and governance.

1.5 Epistemological notes

As I will argue through the thesis, flood risk can be deemed an unusual research object in social sciences, while quite normal, as seen, in disaster research, due to its inter-disciplinary and applied nature. For these reasons, I will provide here some epistemological keys to better frame my research problem and discuss also some environmental aspects related to some processes behind "floods", "flood risk" management and mitigation. According to the first approach in disaster research I've presented in the first paragraph, the *hazard approach*, flood risk could be conceived as the probable/possible damage caused by physical agents in the natural or human-modified environment (Parker 2000). We can identify riverine, estuarine and coastal floods and we could define a flood as «a body of water which rises to overflow land which is not normally submerged (Ward 1978 in Parker 2000). The causal agent can be considered mainly water, through:

- *«rapid input of excessive quantities of water» or*
- *«blockages within the drainage network» or*

- *«high tides and onshore winds that can create both sea and estuarine floods»* (Jones 2000:93).

The trigger agent can be heavy rainfall, meltwater or freshwater ice. Flood risk is so built upon the frequency, the intensity and the duration of the event (Jones 2000). We can identify many agents interacting with water in co-causing the rapid input, the blockage or high tides, as the following table shows (fig. 4.8).

Agent	*Details and example*
Rainfall	Riverine or non riverine Slow onset or flash flood Convectional/frontal/orographic Torrential rainfall floods
Snowmelt	Riverine Overland flow
Icemelt	Glacial meltwater (rise in air temperature) Glacial meltwater (geothermal heat source) – jökulhlaup Spate floods
Flooding during freeze-up	Riverine
Flooding by ice breakup	Riverine (also called ice-jam floods)
Mudfloods	Floods with high sediment content
Coastal/sea/tidal floods	Storm surge (tropical or temperate induced) Ocean swell floods Percolation floods Tsunamis (induced by geological process)
Dam	Dam-break flood Dam overtopping
Sewer/urban drain flood	Storm discharge to sewers and drains exceeds capacity
Rising water tables (high groundwater levels)	Many causal factors including land subsidence. Rising sea levels, temporal reduction in water abstractions from aquifers
Combined events	Examples include: riverine/tidal flooding; rain on snow floods
Note: Flood types are not necessarily mutually exclusive. For example, convectional rainfall may generate flash floods and frontal rainfall may be influenced by topography, generating orographic rainfall floods	

Table 4. 1 Types of floods (Parker 2000: 23)

In our research, I will focus on river floods caused by heavy rainfall. The worst floods may result from maximizing a «combination of rainfall intensity, duration, area and location relative to the drainage network» (Parker 2000: 93). The so-called *flash floods* tend to result from «shorter and more localized, but extremely intense, storm» (Parker 2000: 93). Heavy rain is

usually formed in «strong updraughts, in intense large-scale low atmospheric pressure systems like mid-latitude depressions, or localized convection» (Parker 2000: 93). And river floods are usually caused by «the hillslopes yielding water too rapidly for the river channel to hold it» (Jones 2000: 95). Therefore, most alleviation schemes usually focus on preventing water overflowing, acting on symptoms rather than causes (Jones 2000). Contrarily, following Jones, from an engineering point of view only (i.e. looking only at the physics of flows) we should manage flood risk's root causes by managing the whole basin and addressing «hillslope characteristics that make the river susceptible to overload». To prevent or mitigate flooding, we should act on the basin characteristics that make the water overflow: «the general form of hillslopes and drainage networks, and the specific properties of materials, surface, or channel roughness and channel cross sections» (Jones 2000: 96).

Paradoxically, due to the aforementioned technical knowledges and repetitive patterns, on the one hand most kinds of floods are deemed «known risk» (White 1942, Wisner *et al.* 2004): «as a result of earlier events, and by conforming to predictable patterns, the places affected by flood hazards are generally known» (Wisner *et al.* 2004: 205). On the other hand, flooding is one of the commonest form of hazard and disaster in the world (Parker 2000) and as already noted floods are the most frequently experienced disasters in Europe (Hegger *et al.* 2013). No European country is risk-free and the economic losses are relevant, even because people is still killed by floods, in Europe, nowadays. Considering the economic losses at European level and normalising the values according to «inflation, inter-country price differences, population and per capita wealth at the country level» (Barredo 2009: 100), the total losses caused by the major floods over the 1970–2006 period «amounted to 140 billion [2006 US$], with an average annual flood loss of 3.8 billion» (Barredo 2009: 101).

Indeed, following the *vulnerability approach*, floods can be seen as processes caused by both physical and societal factors. For instance, another possible definition of flood defines it as «the product of meteorology times land form, where land form is modified to some extent by land use» (Hegger *et al.* 2013: 5). Therefore, following the PAR and Access model (Wisner *et al.* 2004) flood risk could be mitigated working on the «chain of causation» (Wisner *et al.* 2004: 87), by reducing root causes, dynamic pressures and current unsafe conditions eventually resulting in a disaster. Furthermore, Renn's inclusive risk governance framework led me to disentangle the chain of causation and actors, due to uncertainty, complexity and ambiguity issues involved in addressing "risk". Following Oliver Smith's recommendations (1999) that led him to criticize the nature/culture ontological dualism and drove his innovative approach in disaster research, my theoretical framework will focus on how risk is socially produced and

inscribed in local contexts. My argumentation in the next chapter will highlight the *situatedness* of local knowledge, on «the local level», by operating «in close contact to everyday and professional experiences» (Matthiesen 2005: 8). The same way, Boholm *et al.* (2011) argued how risk definitions are always «situated within and inherently linked with risk management actions and operations» (Boholm *et al.* 2011: 3), that is, «to assume that objects are simply waiting in the world to be perceived or defined as risky is fundamentally unsociological» (Hilgartner 1992: 41).

The crux is here twofold. From one point, my focus on local knowledges underpins the need to put forward the differently local situated dimension (according to the diverse actors) in the risk governance analysis. At the hearth of recent international policies (see chapter 3), this is a key issue of the recent attempt to re-found an Italian sociology of disasters as well (Mela et al 2016a; 2016b): «each event has its own peculiarity, which is not only connected to the nature of the phenomenon that triggers the disaster, but also (at least as far as sociology is concerned) to the special features of each area as well as to the peculiar interaction between social systems and both natural and built environment» (Mela *et al.* 2016a: 14). The interpretation of such local interactions can turn into the peculiar contribution of the Italian environmental sociology (Mela *et al.* 2016a; 2016b) to the international debate in disaster and risk research, as our research might also contribute to. From the other point, the only way to focus on risk governance through local knowledge is to fully follow a social constructivist approach and stop thinking risk as a dependent variable, as Boholm and Hilgartner suggest in their relational theory of risk. Indeed, to Renn's definition of risk as a mental construct, I can add that «a risk is always a danger of something (sometimes natural, sometimes social) to somebody in a given social nexus» (Boholm & Corvellec 2011: 183). Therefore, it's necessary to identify risk as a construct embedded in a relationship between two entities: "something causing a possible/probable harm" and "something potentially affected by the risk source", linked by a form of causation. My definition of risk should then include: «an *object* deemed to "pose" the risk, a putative *harm*, and a *linkage* alleging some form of causation between the object and the harm» (Hilgartner 1992: 40). Following Boholm and Hilgartner, it is possible to define the source of a possible harm as a "risk object", meaning with "object" everything that "pose hazards", being an activity, a law, a thing, an entity, a human being. For instance, the risk object of flooding can be considered "heavy rain", "water", "land use", "urbanization", "corruption", "steep slopes", "digging the river channel" or "draining water in the most efficient way". Objects refer to «any kind of physical, cultural, or social artefact that can be lineated and singled out» (Boholm & Corvellec 2011: 177).

The issue, given a "situated" inclusive risk governance, is to explore the ways in which «people construct and develop meaningful networks of causally linked risk objects» (Boholm & Corvellec 2011: 177), which costruct local knowledges. Therefore, risk sources are not objective, "out there", rather they are designated as risky through a social act embedded in a network of practices, discourses and representations (how it will emerge from the data analysis in the next two chapters). Indeed, risks objects are social «in the sense that they are part of social practices and representations, both by being influenced by them and by participating in creating and sustaining them» (Boholm & Corvellec 2011: 179). The putative harm, following Boholm, can be defined as the "object at risk". In flood risk management, *object at risk* can be, for instance, "homes", "fields", "properties at a County level", a "river bed", a "hydroelectric power plant", "human life", and so on. Furthermore, the act itself of designating an *object at risk* (through practices, discourses, representations) is an act implicating a value, "validating something" (Boholm et Corvellec 2011). Therefore, as Boholm et Corvellec suggest, «risk management and governance strive to keep the risk object *out* and the object at risk *in* by developing an adequate risk management regime» (Boholm et Corvellec 2011: 180). So, *object at risk* are emplaced and displaced in different relationships/interactions working as chains of causation in diverse ways «as probabilities, models, laboratory tests, narratives, or else» (Boholm et Corvellec 2011: 180). Therefore, from an epistemological perspective, my main research question turns into: "how local knowledges will construct something as object at risk and risk object and how these objects are emplaced and displaced within a risk governance framework in two natural flood management processes?".

To conclude this chapter, I described in detail both the construction of the notion of risk from a particular socio-cultural and epistemological perspective and a recent inclusive risk governance framework. This will serve the purpose to frame the two natural flood management processes and to provide a first theoretical framework. Indeed, as mentioned in the introduction, the flood risk management processes I will analyse in my case studies will be risk governance examples as played out in context of natural flood management. They will work as "best practices" for the inclusion of local knowledges into these processes. Other theoretical and conceptual tools are still needed and will be discussed in the next chapter, where the notion of local knowledge and some tools to integrate it within a risk governance approach will be pointed out.

CHAPTER 2

2. Local knowledge as a conceptual tool for flood risk governance

In this chapter I will define the notion of local knowledge and bring out some additional theoretical references to provide a broader conceptual basis for my research. First of all, I will point out the relevance of "local knowledge" both in current public debate and from an academic and DRR policies-related perspective. Then, I will trace back the origin of the concept and propose a suitable definition for my research purposes. At the end of the chapter, I will discuss if an adaptive co-management framework, usually adopted in environmental resources management, can work as a suitable tool for integrating local knowledges within a risk governance framework.

2.1 Why local knowledge(s)? A controversial issue between Disaster Risk Reduction policies and post-disaster contexts

In the last decade, there has been a growing interest in the role of knowledge in disaster risk reduction: in disaster research, in the public debate following major events, and in International DRR policies (e.g. the 2005 Hyogo Framework and the 2015 Sendai Framework, see next chapter). Some attempts have been put forward to deal with what has been reported as a sort of *knowledge paradox,* i.e. we don't actually register a decrease in losses/damage, despite an increase growing of knowledge systems in DRR management (Weichselgartner & Pigeon 2015). In these regards, if the gap between scientists and policy makers has been debated, it's recent the awareness that:

> *«many aspects of the complex interface between information sharing, knowledge-making and decision-making are still unexplored and better appraisal is needed to effectively integrate information, knowledge, and expertise into the efforts directed at DDR, in particular with regard to*

> *mechanisms for positive exchange between science, policy, practice and the public»* (Spiekermann et al. 2015: 97).

Spiekermann *et al.* (2015) suggest we need to look deeper at how knowledge implementation in DRR can be improved, instead of focusing on research-based knowledge. This should be done in order to understand how knowledge, its production, sharing and use work. For instance, White *et al.* (2001) provided four reasons to explain the *knowing more-losing more* paradox, pointing out that:

- knowledge continues to be flawed by areas of ignorance;

- knowledge is available but not used effectively. This is about the gap between policy and research, starting from the knowledge sharing issue and resulting in having integrated risk governance;

- knowledge is used effectively but takes a long time to have effect;

- knowledge is used effectively in some respects but it is overwhelmed by different sorts of vulnerabilities, which preclude its implementation.

The issue of implementing and converting knowledge into diverse concrete applications lies at the core of the problem. Likewise, I will discuss further on that local knowledge is the notion usually brought into the debate and constantly evoked as a tool for using knowledge in a more effectively way (Shaw *et al.* 2009; Hiwasaki *et al.* 2014), while usually underestimated or little acknowledged.

Furthermore, local knowledge is usually controversially put forward as a key solution in post-disaster contexts. For instance, also in Italy and in England plenty of discussions and papers have been analyzing how local knowledges and local practices hadn't or should have been considered in risk, emergency, recovery and reconstruction management phases. And this happened more after major disastrous events (Alexander 2010; Benadusi 2015a; 2016; Calandra 2012a, 2012b; Carnelli 2012a, 2012b, 2015; Carnelli *et al.* 2016; Carnelli & Ventura 2015; Ciccozzi 2011, 2013; Forino 2015a; Gugg 2016; Haughton *et al.* 2015; McEwen & Jones 2012; McEwen *et al.* 2014 McEwen *et al.* 2017; Mela *et al.* 2016a, 2016b; Saitta 2015).

In Italy, the 2009 L'Aquila earthquake worked as a watershed in disaster research in the Italian social sciences (Benadusi 2015b; Carnelli *et al. 2016*). In the UK, the 2007 floods

triggered a broad academic reflection on risk and disaster issues in scholars working in the English Academia (Haughton *et al.* 2015; Krause 2016; Lane *et al.* 2011; McEwen & Jones 2012; McEwen *et al.* 2016; Whatmore 2009; Whatmore *et al.* 2010). In the UK, the 2007 summer was the wettest ever recorded by the Met Office (BBC 2008) and after the floods the role of local communities and local actors in flood risk governance became a pressing issue in media coverage: local and national enquiries (e.g. Pitt 2008) have been undertaken immediately afterwards. As Haughton *et al.* (2015) noted, «the need to make better use of local expertise» (Haughton *et al.* 2015: 375) was one of the main concerns of the reports.

In the Italian context, beyond the failure in considering local needs in risk and recovery management in recent Italian earthquakes (Carnelli & Forino 2017), a huge national and international debate spread after the first instance judgement for multiple manslaughter and injuries (issued in October 2012, Carnelli & Ventura 2015), which was issued against some members of the Italian National Commission for prediction and prevention against major risks (INGV). Due to a prolonged seismic swarm, this Commission was summoned in L'Aquila one week before the main disastrous shock. They reassured L'Aquila citizens and public institutions about the occurrence of a major earthquake, which conversely left 309 people dead and around 30.000 homeless exactly one week after that meeting (Ciccozzi 2013). So, the prosecution accused the INGV scientists to have put people in danger with their risk pre-assessment, evaluation and communication. They increased the social vulnerability conditions of L'Aquila inhabitants affecting the "local anthropological culture", by persuading part of the population to change some local practices of risk management. Those days, the reassurances by the INGV scientists spread via media changed commonsensical and "traditional" practices in dealing with seismic risk (Ciccozzi 2013) based on the precautionary principle consisting of staying out of the houses during a seismic swarm (Ciccozzi 2013; Benadusi 2015a) and following two shocks (Carnelli 2013). At the end of the trial, the Appeal Court put forward the informality of that meeting (Benadusi 2015a) and relied on the *mantra* invoked by the accused and then acquitted scientists: they claimed the unpredictability of earthquakes and the absence of earthquake-proof standard requirements as univocal causes. In their opinion, people died and were injured just because houses had collapsed, without considering any local aspects of risk governance linked to local knowledge and risk communication/inclusion. For our interest and referring to the L'Aquila trial, Benadusi defined local knowledge's components as a «local anthropological culture», «seismic culture, or «precautionary norms of local culture which had been shaped over time by previous earthquake experiences» (Benadusi 2015a: 20).

Looking at the context in England, the concept of "local knowledge" was explicitly mentioned in reports and academic papers debating the 2007 flood. Haughton *et al.* (2015) noted how post-flood reports highlighted that «the impact of flooding was exacerbated by the loss of engineers on the ground with high levels of relevant local knowledge and experience» (Haughton *et al.* 2015: 375): they mention that, due to the privatization of the water industry (after 1989), local authorities couldn't replace retired drainage engineers owning an «accumulated historical knowledge about how local drainage systems operated» (Haughton *et al.* 2015: 375). A heated debate about knowledge controversies and «local, lay, expert, national and international sources of expertise» (Haughton *et al.* 2015: 376) went mediatic, with a Minister on TV claiming that they were wrong to listen experts and Dutch engineers coming to help British people building up flood risk expertise. The debate, as it happens in a similar way in Italy, put forward a clear distinction between expert and local knowledge, the former deemed a scientific one, the latter seen as produced by lay people. Alternatively, I will argue that «local flood knowledge is not simply the preserve of communities and lay people, however: it can also be found in different professions operating at the local level» (Haughton *et al.* 2015: 377-378). Therefore, following Haughton *et al.* (2015), I agree that the construction of some types of scientific knowledges as "local" is different to the ways in which local knowledges is usually defined in academic research, where it is typically attributed to lay people, e.g. farmers and residents. Moreover, in their analysis of the discussions arose after the 2007 floods in Hull (*East Riding of Yorkshire* County) between the Environment Agency (EA)[13] and locals, they underpin how both the EA and local citizens claimed to be the bearers of a presumed "local knowledge", even if they relied on engineering models and drainage engineers to figure out the best risk management solution. In this case, the concept of local knowledge turned into a sort of "malleable concept" (Haugton *et al.* 2015) to justify one's own position and self-legitimization in addressing flood risk. The two scholars finally argued that «there is no such thing as pure local knowledge: it only ever exists as part of hybrid knowledge formation practices» (Haughton *et al.* 2015: 384). Alternatively, in recent decades, local knowledge has been constantly evoked in National and International DRR policies as a main tool for risk mitigation, as I will discuss in the next chapter (Hiwasaki *et al.* 2014).

The issue arose by what I brought into my reasoning up here results in being almost fourfold and allows me to acknowledge for a "local knowledge issue" to be tackled in my research. Firstly, knowledge sharing, as we noted in the first chapter, is one of the risk governance pillars

[13] The main statutory institution in England for flood risk management, as I'll show in chapters three and four.

and makes every risk governance phase being carried out and accomplished. An inclusive risk governance approach provides a framework for the inclusion of different kinds of knowledge in the different phases of a sort of "risk mitigation cycle". The different actor's perspectives can be considered and be intertwined in framing, assessing and managing a risk, by recognizing a relational and social constructivist conceptualization of the notion of risk itself. Only by acknowledging an epistemological (and political) legitimation of different alternative knowledge sources and different forms of participation and active interaction of policy makers, stakeholders and the public is possible to unpack the *knowing more-losing more* paradox. Local knowledge can be a useful tool for different reasons. Furthermore, a strong relationship with the environment at local level (e.g. a catchment-based approach for flood risk management) will be another relevant issue to be discussed to integrate the different knowledges, as I will argue in the last paragraph of this chapter. Natural flood management (see next chapter) can work as a perfect scenario to tackle this issue.

Secondly and consequently, the issue of the inadequacy of science in dealing with contemporary risks has been pointed by different scholars (De Marchi 2008; 2015; Funtowicz & Ravetz 1992), resulting in the need to integrate different kinds of knowledges in inclusive ways in addressing risk and environmental policies: from Renn's risk governance framework, up to the concept of "post-normal science" or the awareness that science has been always informed by what had been defined as "folk knowledge" (Sillitoe 2007). To this extent, the integration of local and expert/scientific knowledge results in a pioneering issue among scholars dealing with risk and disasters (Bankoff 2001; Hiwasaki *et al.* 2014; Spiekerman *et al.* 2015; Mercer 2012; 2015; Whatmore 2009). This issue was firstly discussed in development and environmental risk literature (Blaikie *et al.* 1997; De Marchi *et al.* 2001; Fischer 2000) and in disaster research mainly with case studies located outside the Western world, by accounting for the concept of "indigenous knowledge", as we will discuss in the next paragraph.

In parallel, and this is the third point, the same issue has been raised at policy level (Hiwasaki *et al.* 2014). At this regard, as previously briefly mentioned, one of the five priority actions of the HYOGO framework for Action 2005-2015 (*HFA: Building Resilience of Nations and Communities to Disasters*, the report adopted during the second UN World Conference on Disaster Risk Reduction held in Kobe, Japan) is to "Know the risks and take actions", that is: «Use knowledge, innovation and education to build a culture of safety» (UN 2005:9). This supported the idea to tackle risk from a supposed cultural way. One of the key activities of this action has been identified in acting on information management and exchange, with the idea that «disasters can be substantially reduced if people are well informed and motivated towards

a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities» (UN 2005:9). In order to reach this goal, it's necessary to provide information on risks and protection measures and to encourage people to take action for DRR. This information «should incorporate relevant traditional and indigenous knowledge and culture heritage and be tailored to different target audiences, taking into account cultural and social factors» (UN 2005:9). The need to exchange knowledges between practitioners and stakeholders has been constantly evoked in UN International DRR policies since the 1980s and an agency, the Inter-Agency Task Force for Disaster Reduction was even created in 2000 to provide this. Furthermore, a more people-centered approach, partially accounting for the most vulnerable groups apparently drove the Sendai Framework for Disaster Risk Reduction, the report adopted at the Third UN World Conference on Disaster Risk Reduction in 2015, whose targets should be achieved by 2030. Despite the effectiveness of its targets and the absence of detailed measures for tackling the most vulnerable groups (Forino 2015b), one of the priority turned into the strengthening of disaster governance by acting in every phases of the "disaster cycle" and involving the participation of relevant stakeholders in order to «empower local authorities, as appropriate, through regulatory and financial means to work and coordinate with civil society, communities and indigenous peoples and migrants in disaster risk management at the local level» (UNISRD 2015:14). About the role of stakeholders is dedicated one whole section of the report, highlighting that «their commitment, goodwill, knowledge, experience and resources will be required» (UNISDR 2015: 20). At the same time, elderly and indigenous peoples are mentioned as relevant actors due to their experience, traditional knowledge and skills, which should be included in policies, planning and early warning. Finally, to achieve the very first priority of the Sendai framework, the "understanding of disaster risk", is necessary to «ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies» (UNISDR 2015: 11). Therefore, the call for a risk governance framework which can be based on the inclusion of local actors and "traditional, indigenous and local knowledge and practices" is one of the main point proposed by International DRR policies, the matter is how to do this and what "traditional, indigenous and local knowledge" is meant to be.

Fourthly, it has been noted that «traditionally, knowledge of natural hazards has been a product of research within physical science disciplines (Mercer 2012: 97). Indeed, quantitative research has been broadly spread, also due to the origin of the concept of "risk" (see chapter

one). Likewise, as already discussed, social sciences approach to risk is recent and was hazard-centered at the beginning. These reasons explained the prevalence of a diffuse top-down approach in DRR (Mercer 2012) and the very recent demand for inclusion of different knowledges, practices and actors in DRR and DRM. At these regards, the 2004 Tsunami became one of the most internationally cited "disaster", where local (also called indigenous) knowledge was a relevant issue in saving people's life from the imminent tsunami. In face of 300.000 killed people, including many Western tourists, among *Moken* and *Simeulueans*, two indigenous groups, almost every community survived. A lullaby reminded people to move to higher places after receding sea water level following an earthquake. This lullaby passed on through generations and saved the *Simeulueans* (Dalisay 2014). The Moken and some of the tourists they were bringing around as tourist guides were "saved" by the *Legend of the Seven Rollers and the Laboon*, which «tells of several precursors to a tsunami», including «a receding shoreline and the silencing of cicadas» (Dalisay 2014: 76): both were noted by an elder, who informed everyone in the area. Many cases, beyond the ones discussed at the beginning of this paragraph, are cited in disaster research literature. With "local knowledge", they usually refer to: traditional anti-seismic building codes (Krueger *et al.* 2015), signs in the built environment/epigraphic markings (Carnelli 2013; De Marchi 2015; McEwen *et al.* 2016); collective or personal narratives (De Marchi 2015; McEwen *et al.* 2016); traditional ecological knowledge or practices (De Marchi 2015; Molina 2016; Wynne 1996), toponyms (Mugnano & Carnelli 2016), rituals and ceremonies (Gugg 2016; Hiwasaki *et al.* 2014; Mugnaini 2015). Since the 1970s, but with more and more frequency in the last decade, the concept of local knowledge has been constantly evoked in the academic debate on DRR and on international and national DRR policies. Alternatively, there is still no agreement on what local knowledge is and how it can be defined. Moreover, different terms, such as *traditional knowledge, indigenous knowledge, laypeople knowledge, folk knowledge, ethnoscience, people's science, traditional ecological knowledge, local environmental knowledge, rural people's knowledge* (Ellen & Harris 2000) have been used to refer to potentially overlapping or different local ways/knowledges/practices in tackling risk and/or adapting to a specific environment. In the following paragraph, I will trace back the origin of the notion of local knowledge, starting from a research field where this concept has been quite relevant: Development and Environmental Studies.

2.2 The emergence of "local knowledge": from Development and Environmental Studies to Disaster Research

The emergence of the concept of local/traditional/indigenous knowledge as an issue can be traced back to projects/analysis/reports mainly focusing on Countries outside the "Western world", where the notion of "indigenous knowledge" was preferred. This notion mainly derived from *resource management, development and environmental management* and *governance* studies: «the growing interest in local knowledge [in Disaster research literature] included in disaster management and preparedness, should be understood in the context of governance issues and the movement to participatory approaches in development and resource management» (Dekens 2007: 10-11). Alternatively, the usual dismissal of local knowledge in the Western world have been fed by the trust in top-down approaches driven by expert and scientific knowledges, which still enlightens «the propensity by Western to generalize strategies from the situation in which they were developed to other similar situations, without taking into account potentially important local differences» (Mercer 2012: 100). Moreover, the emergence of this issue in non-Western countries-related research may justify a possible confusion between the two concepts of indigenous and local knowledge. Indeed, as just mentioned, in academic research in general - with some exceptions (Wisner 2009) - there's nothing such a univocal distinction between the two concepts, which have been often deemed interchangeable (Mercer *et al.* 2010; Gaillard & Mercer 2012).

In development studies, indigenous knowledge was firstly conceived (first academic works can be traced back to the 1960s) as a way to «live in harmony with nature for generations» (Briggs 2005:100) and represented «a shift from the preoccupation with the centralised, technically oriented solutions of the past decades that failed to alter life prospects for a majority of the peasants and small farmers of the world» (Agrawal 1995: 414 as cited in Briggs 2005:100). The focus and institutionalization of the concept of indigenous knowledge was so linked to the one of sustainability in the so-called developing countries, mainly concerning traditional and local environmental knowledges and techniques, but often without questioning the economic and socio-cultural contexts in which such knowledge was used (Briggs 2005). In the different paradigms spread in development studies (Blaikie *et al.* 1997), local/indigenous knowledge has been either conceived as a «scapegoat for underdevelopment» (in the classic one) or as «a panacea for sustainability» (partially in other paradigms) (Nygren 1999: 268); a

third paradigm, called *neo-populist* one (Blaikie *et al.* 1997) stressed the need to include indigenous technical knowledge (ITK) and local knowledge within a participatory framing and decision-making processes. The idea that the beneficiaries and the decision-makers were often different was a triggering issue, too. In environmental management studies and then in environmental governance research in the Western world, I found references to the concept of local knowledge, defined as a kind of knowledge «held by non-scientist that is based on local wisdom, experience, and practices that are adapted to the local ecosystem» (Taylor & de Loë 2012: 1208). It has been juxtaposed with science (Taylor & de Loë 2012) and it has been acknowledged by some researchers as based «on the length of the individuals' relationship with their local environment» (Taylor & de Loë 2012: 1208). A relevant issue to be noted here and useful for my research (it will be deeper explored in the next paragraph) is not the implicit assumption of local knowledge as a culturally bounded product (Nygren 2012), rather the *local-ity/situatedness* of the relations involved in local knowledge. "Being culturally bounded" was an idea which could have been originated from both the notion of "indigeneity" and the terms "ecological" and "traditional", being it represented as a sort of self-feeding stereotyped and trivialized concept. Alternatively, "situated" can have multiple meanings. Gherardi (2008) acknowledged four different types of "being situated" linked to the knowledge/practice relationship: in the body, in the dynamics of interaction, in the language and in a physical context. I will refer to "situated" as "situated in the dynamics of interactions", which are also influenced by physical contexts, due to the relationships built between human beings and non-human elements. In environmental management studies, it also came out the notion of traditional ecological knowledge, which has been deemed a unique form of local knowledge, «on the basis that indigenous people hold a long-standing and holistic version of human-environment interaction that is built upon knowledge accumulated through trial and error adaptation over time, through multiple generation» (Taylor & de Loë 2012: 1208). And again, a differentiation between the concept of local, traditional and indigenous knowledge may result confusing.

Coming back to the notion of indigenous knowledge, from the 1970s till nowadays it also persists a "binary tension" (Briggs 2005; Tylor & de Loë 2012) between scientific and indigenous knowledge, which has been enhanced by different methodological and epistemological frameworks. The former has been conceived as abstract, universal, formally transmitted, and linked to reductionism, objectivism, positivism and neopositivism (Appiah-Opoku 2005; Blaikie *et al.* 1997); the latter as context-specific, holistic, subjective (not universally valid or applicable/provable), informally transmitted, and linked to beliefs,

practices, experiences (Appiah-Opoku 2005; Blaikie *et al.* 1997). Often in policy science literature, local knowledge has been conceived as a kind of «knowledge that does not owe its origin, testing degree of verification, truth, status, or currency to distinctive…professional techniques, but rather to common sense, casual empiricism, or thoughtful speculation and analysis» (Corburn 2003: 420). This partially reveals why the integration of *indigenous/local knowledge* in development/risk projects have been originated outside Western countries: for many reasons, among them the hegemonic status of scientific knowledge (reproducing the aforementioned opposition between local and scientific knowledges) in Western ones.

Indeed, *Western* local knowledge has been usually relegated to "folk knowledge", a term which brought with a negative connotation, which doesn't fit into the Western nature/culture ontological dualism driven by science (see chapter 1). As already discussed, the technocratic top-down classic disaster risk management derived from this epistemological perspective «the West often assumes that it has no IK that is relevant, in the sense of "folk" knowledge, that once existed but has now disappeared, and that somehow science and technology have become its traditional knowledge» (Ellen & Harris 2000:6). Within the classic development studies paradigm, tradition was something to overcome even in developing countries, where scientific and western model were considered superior and replicable in an ethnocentric way, in order to better control nature, populations and extract resources (Ellen & Harris 2000). Sometimes, even in environmentalism or in more inclusive approaches in development studies, indigenous knowledge easily turned into a «convenient abstraction, consisting of bite-sized chunks that can be slotted into western paradigms, fragmented, decontextualized» (Ellen & Harris 2000: 15) into an "universalizing discourse" by applying indigenous knowledge as a panacea for western ethnocentrism (Ellen & Harris 2000). A slippery risk we should strongly avoid in looking at local knowledge as a way to tackle flood risk within an inclusive risk governance framework.

Coming back to our Western world, from one side folk (local) knowledge hasn't disappeared with the development of scientific knowledge, as beliefs, local and traditional practices, and holistic perspectives still exist nowadays. As I will show in chapter 5 and 6, a *differential* perspective on knowledge and daily practices, which are useful to cope with what cannot be controlled (this is the case of risk) always existed, as the *L'Aquila trial* and decades of folklore studies (Bausinger 2005; Clemente & Mugnaini 2001; Mugnaini 2015) reveal, e.g. «the age of scientific knowledge, for instance, hasn't resulted in a missing mythical-mystical view on earthquakes, which continues to act upon a devotional practices coverage, being it official or

not»[14] (Mugnaini 2015: 102). Furthermore, a revival folklore has been well studied by cultural anthropologists in last decades (Bendix 1997; Kirschenblatt-Gimblett 1998; Clemente & Mugnaini 2001), resulting in Western folk and traditional knowledges being «reified, reinvented, celebrated and commoditized» (Ellen & Harris 2000:7) in search of a romanticist authenticity or for commercial reasons. From the other side, folk/local/traditional knowledge had contributed to the constitution of Western science as we know it: «what we now recognize as scientific knowledge of the natural world was, therefore, constituted during the eighteenth and nineteenth century in a way which absorbed such pre-existing local folk knowledge as was absorbable and, ultimately, confined what was not to oblivion». For long time, personal experience, place-based knowledge, oral traditions and rituals have fed what was meant to be an expert or scientific knowledge. And the idea of trail-and-error learning, as meant in indigenous adaptation knowledge systems, sounds as something also shared by the Western scientific method, resulting in areas of overlapping (Williams & Hardison 2013; Berkes *et al.* 2000). Indeed, some authors challenge a distinction of the two, which tend to self-reproduce the distinction itself, so that individuals can hold and mix both knowledges, being impossible to unpack the two (Taylor & de Loë 2012). Some others claim that some differences remain anyway:

> *«Scientists commonly aim to produce validated and transportable knowledge objects that are held to be universally true and objective regardless of cultural background … This may be contrasted with traditional ways of knowing which are place-based, localized, and may carry prescriptions related to their use»* (Williams & Hardison 2013:533).

A persisting context-specific boundary and an informal/inter-relational knowledge production it's what seems to persist. Also in disaster research literature, indigenous knowledge is linked to a prolonged place-based adaptation, with informal and practical components, which are transmitted and disseminated through generations. In this study area, indigenous knowledge has been defined as:

> *«the methods and practices developed by a group of people from an advanced understanding of the local environment, which has formed over numerous generations of habitation … originating within the community, maintaining a non-formal means of dissemination, collectively owned, developed over several generations and subject to adaptation, and imbedded*

[14] Translation by the author.

in a community's way of life as a means of survival» (Baumwoll in Shaw & Uy 2008:VII).

Therefore, what are the main characteristics of indigenous knowledge, which can enrich the concept of local knowledge? Indigeneity should be something to overcome, as it includes in its meaning a moral judgement or a subaltern connotation (Ellen & Harris 2000). It can also result somewhat tautological, as in the definition proposed by Posey, where indigenous people are defined as «indigenous and local communities embodying traditional lifestyles» (Posey 1996 in Ellen & Harris 2000:3). Other researches underline the cultural-bounded nature of indigeneity, linked to rural and "tribal" relations, strong adaptation abilities, and lack of power and subordinate living conditions in general (Appiah-Opoku 2005). Thus, the issue of power is something strictly linked both to indigenous knowledge and to local knowledge, due to the issue of indigeneity and the marginalization of local knowledge in general (as being defined as "traditional", "folk" or "local"). Indeed, from one side, local knowledge is not something homogenous and well defined, both in research literature, and for real: it is not an «internally uncontested systems arising from a communal commitment» (Nygren 1999:277). Contrarily, diverse social actors wish to impose their own interests, needs and agenda (Dekens 2007) using their knowledge, since the use of local knowledge is obviously political (Blaikie 1999; Dekens 2007; Nygren 1999) and can be a matter of power relations: holding knowledge means holding power and shaping institutional frameworks. Adopting an inclusive governance framework as a lens to analyze flood risk management in natural flood management contexts can account for power relations in defining and constructing local knowledge itself. Indeed, these issues will come out in the critical discourse analysis of both relevant policies and diverse actors' perspectives in interacting and accounting for risk and knowledge dimensions.

To conclude with this part on Environmental and Development studies, the characteristic of indigenous knowledge, which can be further use to inform the one of local knowledge can be summed up starting from the critical perspective given by the life-long work of the social anthropologist Roy Ellen in environmental studies. He outlines the commonest characteristics of indigenous knowledge, to operationalize them:

- «IK is local: is rooted to a particular place and set of experiences, and generated by people living in those places». The issue here is the transferability to other places, global-local dynamics and the importance of place.

- «IK is orally transmitted, or transmitted through imitation and demonstration». Repetition is something that helps its acquisition and transmission.

- «IK is the consequence of practical engagement in everyday life and is constantly reinforced by experience, trial and error, and deliberate experiment».

- IK tend to be a functional know-how, an empirical and hypothetical knowledge, rather than a theoretical one.

- Even if it's often represented as somehow static, it's always changing and re-adapting.

- «IK is characteristically shared to a much greater degree than other forms of knowledge», for this reason it's even called "people's science". Anyway, it's differently socially distributed.

- It's «characteristically holistic, integrative and situated within broader cultural traditions. Separating the technical from the non-technical, the rational from the non-rational is problematic».

- «It does not exist in its totality in any one place or individual. Indeed, to a considerable extent it is devolved not from individual to individual at all, but in the practices and interactions in which people themselves engage» (Ellen & Harris 2000: 4-5).

Last marks are my starting points to addressing local knowledge within the risk governance framework, by figuring out how during a natural flood management process local knowledges are defined, identified, redefined, considered, "practiced", transmitted, accumulated, used, shared, referred to. The main points risen here, are: the holistic, not static and situated components; its emergence from daily situated practices and interactions, derived from direct experience, functional know-how, and empirical and hypothetical knowledge. It is also something more, which can incorporate theoretical and expert forms of knowledge. Repetition is thus something which helps its transmission, but local knowledge is not only orally transmitted and not strictly linked to a matter of "indigeneity", rather to *situatedness*, i.e. derived from local interactions and relationships.

Furthermore, it should be notice here that a concept which can bridge indigenous and local knowledge is the one of *traditional ecological knowledge*, which derived from pioneering studies in ethno-science from the 60's and has recently inspired the development of an adaptive

framework for environmental governance (Berkes *et al.* 2000), which will be discussed in the last paragraph. Traditional ecological knowledge has been defined as a «cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment» (Berkes *et al.* 2000: 1252). It thus unveils the situated dimension of local knowledge derived from built interactions and relationships, that I would consider a crux both in the notion of local knowledge I will use and in the way to integrate it in natural flood management processes. Before delving into this, I would point out in the next paragraph how knowledge and local knowledge have been brought into current Disaster Research Literature.

2.3 A definition of local knowledge for risk governance

Before defining my use of the concept of local knowledge, a definition of what can be meant with "knowledge" should be given. From a philosophical/epistemological perspective, following one of the first distinctions of this kind - the one proposed by Aristotle - three forms of knowledge can be distinguished depending on the aim to be delivered (*telos*): theoretical, productive, and practical knowledge (Spiekermann *et al.* 2015). The former one is a speculative form of knowledge, driven by the intellect and seeking the truth. Productive knowledge is about knowing how to produce something, while the latter one is linked to actions and decision-making. As Spiekermann *et al.* (2015) pointed out, the latter form of knowledge is obviously the most useful but less analysed in disaster research literature. If all three kinds of knowledge can have positive effects, and the practical one is somehow missing, knowledge gained by experience has been deemed relevant as well: «such knowledge is not acquired by information received from an external source, but rather from lessons learned and one's own personal experience» (Spiekermann *et al.* 2015: 98). Given that, I would prefer having a definition of knowledge as much broader as possible, aiming at informing both the concept of local knowledge and the one of risk within the diverse perspectives involved in the governance framework. Indeed, one of the most important issues still not really pointed out in the literature is this, so that «it remains unclear what local participants in collaborative governance process

think about local knowledge and how their attitudes compare with those of scientists and other state actors who privilege scientific information» (Taylor *et al.* 2012: 1208). It is something I will explore in my data analysis, indeed. Therefore, I would define knowledge in very broad terms as «information and/or skills acquired through education and experiences» (Mercer 2012: 98), which are organized in different forms and in different contexts, in systems made of relations and practices which appear to be coherent for who "knows".

Furthermore, Gaillard and Mercer (2012) highlighted how the field of DRR can be seen as a «battlefield of knowledge and action» (Gaillard & Mercer 2012: 94), which often results in poor risk reduction measures for the most vulnerable subjects. In this battlefield, it has been put forward the urgency of:

- «recognising that different forms of knowledge are valuable in addressing disaster risk,
- that actions at different scales, from the top down and from the bottom up, are necessary to reduce risk of disaster in sustainable manner,
- and that both previous points require a large array of stakeholders operating across different scales to collaborate» (Gaillard & Mercer 2012: 95).

A snapshot of this reasoning has been also provided by the aforementioned authors (fig. 2.1).

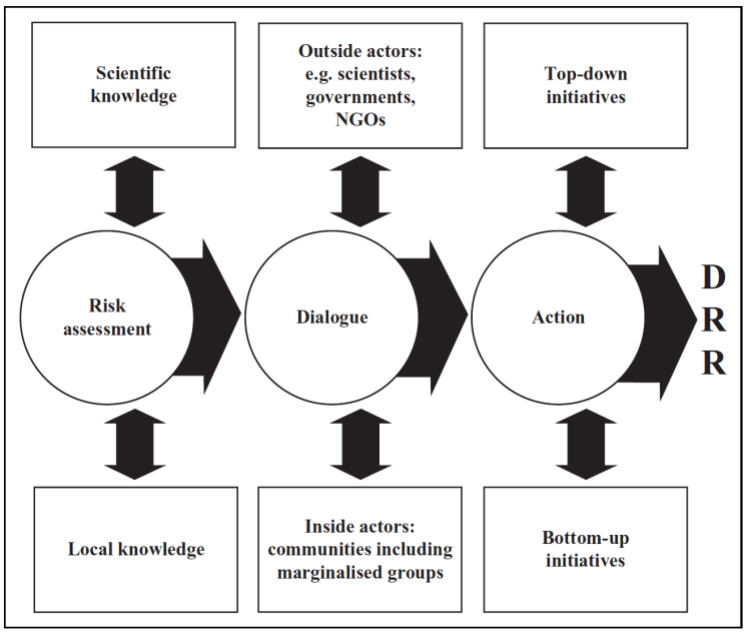

Figure 2. 1 A roadmap for integrating knowledge, actions and stakeholders for disaster risk reduction. Taken from Gaillard & Mercer 2012: 95.

The “roadmap” above shows, without directly mentioning it, the need for a risk governance approach to tackle the issue. A horizontal inclusive governance is supported alongside a vertical one, aiming at planning a joint risk assessment and management. A risk assessment which can integrate both scientific knowledge and local knowledge and a dialogue between actors at different scales for action, have been recently proposed in many papers, as previously mentioned. The need to include local knowledge in risk governance is still deemed as a pressing and neglected issue in DRR policies and practices, together with the need of including different kind of actors to achieve effectively DRR actions.

Likewise, it should be contested but it is usually not, that local knowledge is not «necessarily contrary or alternative to scientific knowledge or, put it the other way around, that the latter is contrary or alternative to the former» (De Marchi 2015: 156). Contrarily, as previously mentioned, it has been widely noted in the academic literature the need to integrate local/indigenous and scientific knowledge. I summed up the most relevant positions which support this perspective in Disaster Research as follows:

- the need to stop considering scientific knowledge universally applicable and superior to other forms of knowledge (Gaillard & Mercer 2012), indeed «the dismissal of local knowledge by scientists dangerously ignores valuable resources which could greatly enhance the capacity of local communities to reduce the risk of disaster» (Mercer 2015:100).

- The failure of top-down policies in preventing disaster and the development of a community based approach to deploy local knowledges and resources (Gaillard & Mercer 2012).

- The acknowledgement of the failure in applying the same emergency model (often handled by the army or civil protection, relying on military chains of command, Alexander 2002; Gaillard & Mercer 2012) in every context, without considering the different components of social vulnerability (Carnelli & Frigerio 2016) and local knowledges: «the Western culture of relief aid provision after an emergency, rather than contributing to community development, has led in some cases to increased vulnerability of local community to natural hazards, due to a loss of local knowledge» (Mercer 2015:100).

- The issues of overcoming technocratic approaches (Benadusi 2016a; Ellen & Harris 2000, Gaillard & Mercer 2012) and of translating local knowledge in a usable tool for DRR, due to «the context-specific and embedded nature» (Gaillard & Mercer 2012:100) of it.

- The acknowledgement that the integration of different knowledge types in DDR while invoked is rarely achieved (Gaillard & Mercer 2012). The proposal of a risk governance framework in terms of policies and practices needs some issues to overcome: «Integrating knowledge, actions and stakeholders in DDR turns out to be difficult in policy and practice essentially because of the lack of trust that prevails between stakeholders which interact, often in autonomy, at different scales» (Gaillard & Mercer 2012: 99).

- The development of spaces of dialogue and multi-stakeholder platforms made by tools crossing power relationships and «mutually trusted by all stakeholders and which make all forms of knowledge tangible to all, thus fostering dialogue between different actors of DDR» (Gaillard & Mercer 2012: 102). These tools are often only technical and quantitative, non-contextual, unclear to the most and usually «designed by outsiders for local communities to fit the global standards of science» (Gaillard & Mercer 2012: 102).

- A proposal to move beyond the distinction between local and scientific knowledge, deemed as "potentially ridiculous" (Agrawal 1995; Mercer *et al.* 2010).

Furthermore, to tackle these points in order to integrate both local and scientific knowledges, and bottom-up and top-down actions, Gaillard and Mercer (2012) suggested three main issues to be faced:

- the need for consensual tools, which can be trusted by all actors, in order to integrate actions and knowledges. One of the priorities highlighted by the authors is to make local knowledge «tangible and credible to both community members and their NGO partner on one side, and scientist and government officials on the other hand» (Gaillard & Mercer 2012: 103). This has the potential to build consensus upon the sharing of knowledge and fostering the dialogue, promoting collaboration through tools (e.g. scaled participatory mapping or participatory 3D mapping), which allow a dialogue among all actors, even within top-down actions.

- The construction of practical frameworks to integrate perspectives and stakeholders.

- The change of national policies to support the interaction between policy, science, and local and practical actions for DRR. The change in this direction should be developed engaging stakeholders and considering «the interlinkages between social, cultural, physical, political, economical and environmental factors» (Gaillard & Mercer 2012: 105).

Beyond the change of national policies (it will be discussed in the next chapter), the need for knowledge validation, consensual tools and a practical framework rises the issue of who validates and govern what. This issue will be considered in the last paragraph, by discussing how the governance can be polycentric and experimentation can create the basis for promoting dialogue and alternative solutions to classic cost-benefit tools, which are usually "one-way" technical approaches. I'll show in the data analysis how the concept of local knowledge can work as a tool to promote knowledge sharing, stakeholder engagement and overcome technocratic and emergency "one-way" risk and disaster management models.

Mercer (2012) refers also to local knowledge as a form of "inside knowledge", «acquired by local people over a period of time through accumulation of experiences, society-nature relationships, community practices and institutions, and through passing it down through generations» (Mercer 2012: 99). She also links this kind of knowledge to the concept of tacit knowledge, a knowledge which is «not necessarily articulated in written or verbal forms but it is implicit in the actions and practices of individuals or group» (Mercer 2012: 98), as a part of daily life. She also contraposes it to what she defines an "outside knowledge", an explicit knowledge typically Western and scientific-based, universally applicable. What emerges from Mercer's perspective is still the need to integrate the two forms of knowledge into a hybrid one, combining and making accessible, tangible, applicable, appropriate and context-specific the result of this combination (Mercer 2012). Hybrid knowledge can be also deemed as a kind of local knowledge meant in a broader sense, if we start seeing «local communities as workshops of knowledge production, not just museums of tradition» (Wisner 2009: 5). This hybrid knowledge, mixing expert, scientific and local knowledge in discourses, policies, practices and projects at local level is what I mean with the concept of local knowledge in this research. Following Wisner (2005), Haughton *et al.* (2015) and Mercer (2012), we should put *situated* relationships at the centre of DRR policies and practices, considering them as a combination of physical and socio-cultural characteristics to be dealt at the same time by different actors with different perspectives. This has the potential to turn local knowledge into something that «comprises the totality of perceptions, beliefs, understandings, and skills that one or more members of a community uses or potentially uses to communicate about and manipulate the world» (Wisner 2009: 1): this is the definition proposed by Ben Wisner, that fits into my research design. The main characteristics of this concept to be considered within an inclusive risk governance framework are the ones pointed out by Wisner himself in a speech he gave at the *Global Platform for Disaster Reduction* held in Geneva in 2009:

- Local knowledge is essentially social - resulting from a relation, I would add.

- «Local knowledge is not entirely "traditional" (passed by generations). It is more» (Wisner 2009:2).

- It can incorporate part/version of outside/scientific knowledges.

- It's not static and tend to mix and hybridise.

- For the aforementioned reasons, "Local" must overcome the notions of "indigenous" and "traditional", which cover only partially the concept.

- It's not uniformly distributed within a community and depends on socio-cultural and socio-demographics characteristics (e.g. age, gender,…), and on daily life contexts, as well.

- It can be a source of power and status, like scientific knowledge.

- It can appear irrational or with any physical or biological basis or efficacy to a Western observer.

- «Local knowledge may not be explicitly spoken about those who have it. It is sometimes tacit or implicit in their practices and acts» (Wisner 2009: 3).

In my opinion, the notion proposed by Wisner overcomes the issues discussed in this chapter: the stereotyped notion of indigenous/local knowledge, being something static, traditional, orally transmitted, uniformly owned by a fixed community, irrational and opposed to scientific knowledge. The "binary tension" can be sorted by acknowledging the different components and sources through which this kind of knowledge is built upon (produced, identified, transmitted and used) at the local level. Situated practices, knowledge sharing and hybridization, daily prolonged interactions and implicit meanings need to be explored to unpack the concept, so that, «risk reduction will have to be carried out at the end of the day by *people in places*» (Wisner 2009: 5). To set the *situatedness* of local knowledge I would therefore consider how the meaning of "local" is brought into discourses, practices and policies' produced by the diverse "interacting" actors in the construction of something as an *object-at-risk* and a *risk-object*. The context in which these objects are emplaced and displaced by the different actors within a risk governance framework, should cover the *situated* "local".

Furthermore, due to the gap between the broad definition of local knowledge I took into account and main definitions (where traditional, indigenous and local knowledges often overlap), plus the process of sense-making the diverse actors activate through the notion of "local knowledge", I will use the term "local knowledges" to refer to the concept I've just defined. To use and integrate local knowledges, I'll show in the next paragraph which steps should be faced. I will point out some recent examples in considering local knowledges in environmental and risk governance-related studies, in order to outline how we can discuss the integration of local knowledges in the final chapter.

2.4 The integration of local knowledges into flood risk governance: a framework

As a consequence of what I've just outlined, the integration of local knowledges in risk governance, despite the claims of International policies, it's something complicated to achieve and there have been few attempts in this direction. Most of them can be found in environmental management studies and/or about the integration of local knowledges into scientific knowledge within or without a risk governance framework. Indeed, if stakeholder or public engagement in environmental governance has been explored (Huitema *et al.* 2009; Newig & Fritsch 2009; Newig *et al.* 2017; Reed *et al.* 2017), very recent research has focused on public engagement in flood risk management through collaborative or participatory flood risk governance (Newig *et al.* 2014; Challier *et al.* 2016; Thaler & Levin-Keitel 2016)[15].

For instance, in Disaster Research, Mercer *et al.* (2009) outlined a framework called "process framework" to promote community engagement to reduce vulnerability through the integration of local and scientific knowledge. The integration could be achieved by being utilised «in an ongoing process of adaptation as the community continually adjusts to the impact of environmental change» (Mercer *et al.* 2012: 221). The community engagement should be undertaken starting from the disaster history of a place, involving the elderly and local experts to identify local vulnerabilities to be reduced: a triangulation of the data with the whole community and stakeholders should be then carried out to point out root causes,

[15] Some of the references mentioned are so recent that they have been published while I was undertaking my fieldwork.

priorities and solutions in a *collaborative* way (neither top-down, nor bottom-up, the authors claim).

At this regard, Gadgil *et al.* (2004) bring out the development of adaptive co-management systems to incorporate different form of knowledges in ecosystem management. Comparing three different case studies (crayfish management in Sweden, the impact of a hydroelectric power plant in Canada, forest resources management in India), they argue that local knowledge cannot be used only by being fitted into an established science-driven top-down approach, but finding ways to maintain its peculiarities as a «knowledge-practice-belief system» (Gadgil *et al.* 2004: 206). I would add that the links between these three elements should be highlighted in the production, coding/interpretation, sharing, transmission, and implementation of local knowledges. According to Gadgil *et al.* (2004), this aim can be accomplished by:

- promoting participatory processes
- keeping information sharing across scales
- making the best use of existing knowledge
- developing indicators to monitor ecosystem dynamics
- transforming existing institutions toward an ecosystem management

So, the first three points can inform my analysis in the need for:

- avoid «sharp boundaries» between local knowledges and expert/scientific knowledge: «local knowledge repertoires are a result of knowledge encounters in which local and global, and traditional and modern are intricately intermingled» (Nygren 1999:82). Furthermore, an essentialist representations of knowledges, often functional to a top-down expert-driven approach, should be avoided, too.
- Local institutions and actors need to be nested and integrated in institutional and organizational settings: information, knowledges and practices should be linked «both horizontally (across space), and vertically (across levels of organization)» (Gadgil *et al.* 2004: 207)

These points bring out three main aspects of local knowledge useful for my analysis.

First, a relevant component of knowledge hybridization through practices and beliefs: in the way that people undertake their activities and product discourses/beliefs to support their activities and knowledges.

Second, the issue of co-management through situated interactions lies at the core of the concept of local knowledges and their integration within risk governance. Indeed, if risk can be defined by complexity, ambiguity and uncertainty (see chapter one), co-management can account for the «dynamic link between social and ecological landscapes that recognizes the complexity of ecological systems, inherent uncertainty, and unknown feedbacks stemming from social actions taken to manage ecological resources» (Chaffin *et al.* 2014: 63) and hazards as well. Berkes *et al.* (2000) right identifies "traditional ecological knowledge" as a case of adaptive environmental governance, as depending on local social mechanisms. They argue that the generation, accumulation and transmission of this knowledge function only if embedded in social institutions and local social norms, through social mechanisms that go from local knowledge to locally established world view. Furthermore, this kind of knowledge/governance acknowledges that environmental (and social, I would add) conditions will always change and nature cannot be controlled. Third, the issue of how to practically integrate local knowledge in a comanagement framework within a risk governance perspective.

To integrate local knowledge into a governance framework three main needs have emerged:

- The need to identify and use this kind of knowledge
- The need to validate it
- The need to be able to learn and receive local knowledge by sharing it.

But how local knowledge can be identified, produced, validated, shared, learnt, received, used, applied and integrated by the different actors involved in flood risk governance, especially in the case of natural flood management?

One of the first attempt to provide an applied research for the effective co-production of knowledges to face natural flood risk management through stakeholders' engagement has been undertaken in Pickering (UK) by a research group driven by the University of Oxford right after the 2007 floods. An «experiment in public engagement» had been undertaken using environmental controversies «as a generative force» (Landström *et al.* 2011: 1618) to effective collaborations between scientists and the public. The issue of legitimacy and "epistemological

anxiety" towards local knowledge (Taylor & De Loe 2012) was tackled by creating decision-making settings within a governance approach, called *Competency groups*, where knowledge controversies was sorted by:

- «focusing on «the practice of knowledge-production as well as the nature of the knowledge produced» (The Ryedale Flood Research Group 2008: 6);

- treating the research/knowledge controversy as «a collaborative process in which the people and things involved make a difference» (The Ryedale Flood Research Group 2008: 6);

- bringing local people and expert together to produce new knowledges and competencies;

- creating new communities of knowledges, not including only pre-existent stakeholder groups.

Beyond the creation of spaces of dialogues and "battlefields of knowledge and actions" (Gaillard & Mercer 2012), the notion of "practice", experienced as a direct and prolonged experience (I would add), still emerge. A practice-based learning by doing, which points out the context-dependency of local knowledge through its relational aspect. Some scholars (Reed *et al*. 2010; Benson *et al.* 2016) refers to this knowledge exchange as social learning, if:

- it shows that a «change in understanding has taken place in the individuals involved, either superficially in terms of new knowledge gained or via deeper attitudinal change» (Benson et al. 2016:327);

- a process of learning that goes beyond individual change to become situated within wider social unit through social interactions happens (Benson et al. 2016).

Therefore, the two main issues for integrating different kind of knowledge in flood risk management become: the identification and integration of knowledge and its co-production and hybridizing through the collaboration and co-learning of different interacting actors. I will discuss these two points as the way to integrate local knowledge within a flood risk governance framework, accounting first for the integration of different types of knowledge and then for the integration in the governance process.

First of all, it is necessary to identify, engage, evaluate and apply local knowledge in flood risk management. To this extent, Raymond *et al.* developed a conceptual framework to «assist

project teams to consider and address the challenges associated with integrating different types of knowledge for environmental management» (Raymond *et al.* 2010: 1767). The added value of this framework is to account for the different epistemological perspectives incorporated by the actors involved which are rarely considered but are a key point for a risk-based governance perspective, as seen in chapter one. The work on the integration of local and scientific knowledge and identify four steps for this:

- identifying existing knowledges
- engaging different knowledges
- evaluating different knowledges
- applying integrated knowledges

They view this process as a «cyclic process of reflection and learning from problem identification to the application of integrated knowledges» (Raymond *et al.* 2010: 1771), by answering to seven questions throughout the four steps (fig. 2.2)

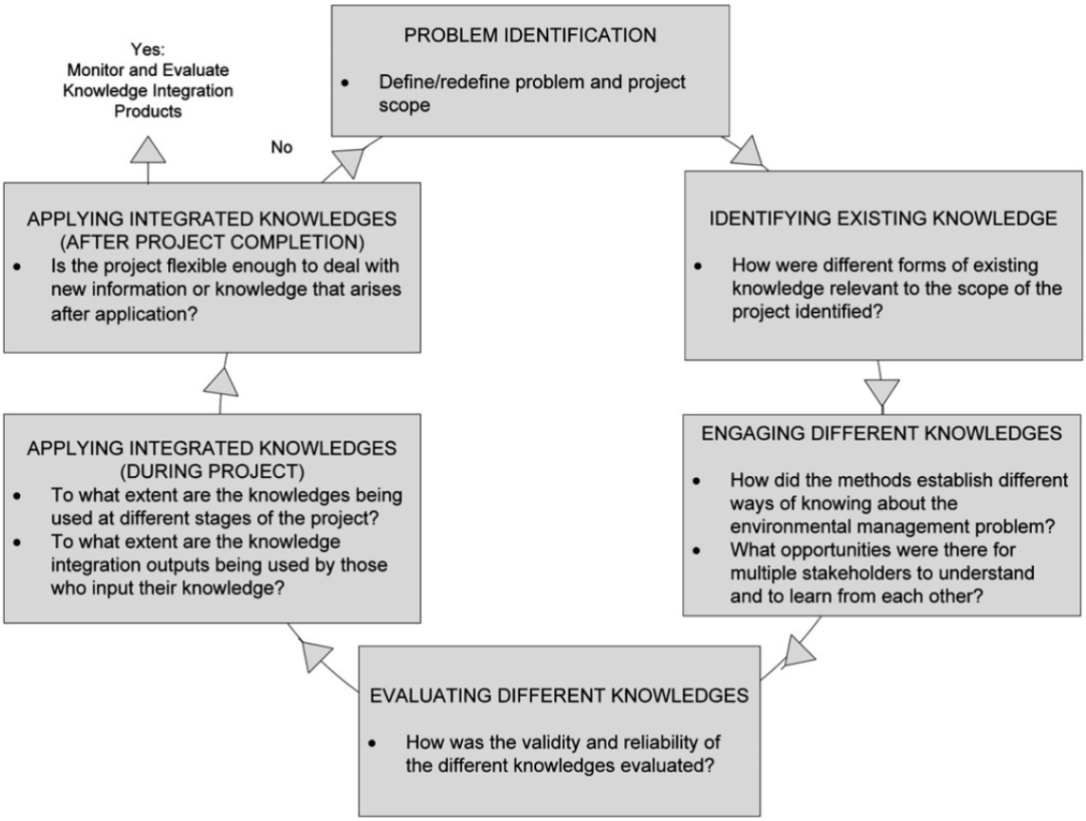

Figure 2. 2 Question to ask and steps to face when integrating different types of knowledges for environmental management (Raymond et al. 2010: 1771)

As already argued, the distinction between different types of knowledge can be difficult; furthermore, due to the nature of knowledge and the three dimensions of risk (complexity, uncertainty, ambiguity) different actors can interpret the same information in different ways, either ignore or not acknowledge forms of knowledge: both knowledge and risk are not "out there" and should be interpreted to be identified. So, what kind of knowledges are necessary and how they can be relevant for a flood risk management project should be considered. This will be answered in my first sub-question (as I will discuss in chapter four, the methodological part of my thesis). Secondly, it is necessary –as brought out by the Pickering project- to engage different knowledges, by providing «mechanisms to support mutual learning and deliberation of those examining existing, or providing new knowledge in the integration process» (Raymond *et al.* 2010: 1770): knowledge sharing should be promoted through active discussion, and a continual negotiation of the different epistemological perspectives should be ensured. Who are the actors involved and how local knowledge are produced will the object of my second and third sub-questions. Furthermore, the inclusion of local knowledge in a project (my third sub-question), as the diagram (fig. 2.2) shows in the third box needs a previous validation. Indeed, before integrating different knowledges, the project teams need to «establish acceptable ways to evaluating the validity and reliability of different forms of knowledge» (Raymond *et al.* 2010: 1770) and knowledge claims should be evaluated in a collaborative (and adaptive and inclusive, I would add) way. Then, the integration of knowledges should be undertaken in every phase of the project, adopting a cyclic perspective that account for:

- «differences in world views of participants and external experts
- differences in institutional power or control over access to and management of local resources
- change in perceptions about the benefits generated by the projects» (Raymond *et al.* 2010: 1770)

Raymond *et al.* (2010) point out here the need for participatory evaluation and a flexible institutional environment, like the one proposed in the so-called adaptive co-management framework, recently developed by some scholars (Berkes 2009; Huitema *et al.* 2009). Before delving into this framework, which can give some institutional prescriptions for the knowledge integration process, some other features of local knowledge should be mentioned. First of all,

I mentioned the hybrid nature of local knowledge. Hybridizing can be seen also a result of the integration process, through mutual learning and situated relationships activated.

Furthermore, in the specific case of flood risk, local knowledges can bring with them other specific features, which I haven't mentioned yet, such as:

- the observation/direct experience (McEwen & Jones 2012) of the behavior of the river and the characteristics of the environment, such as: «the movement of the wind, colour of the river, celestial bodies (e.g. moon, stars, animal behavior, flora and fauna) that serve as early warning signal for occurrence of the change of season, a particular hazard or disaster» (Molina 2016: 170-171). Connected to this, the prolonged experience and production and reproduction of socio-physical relations, what Krause calls "hydrosocial relations": it is about how people negotiate the simultaneously social and hydrological fields of relationships in which they live their lives, inhabit their homes, and travel to work. Through these relationships, people are linked to (or separated from) not only each other, but also the river, the floodplain, and the drinking-water and wastewater infrastructures» (Krause 2016: 5).

- The materialization of past flood memories/material culture (McEwen & Jones 2012; McEwen *et al.* 2014; Molina 2016): digital and edited archives/pictures, emotions and affects, stories and anecdotes, active forgetting, epigraphic markings.

- Preparedness practices, i.e. «people's actions on prevention and mitigation of possible disaster impacts» (Molina 2016: 172), at domestic, local or regional level. Here lies also the matter of the accumulation and transmission of local knowledge, up to different scales (horizontal and vertical, and through space and time).

The point is how to make visible and legitimate local knowledges. Collaborative participation, situated interactions, experimentation, tacit and informal issues are what should be integrated in an inclusive risk governance framework.

Many scholars have proposed two different frameworks to integrate knowledges into water and environmental management: adaptive management and the co-management approaches. The former emphasizes «learning and uses structured experimentation in combination with flexibility as ways to achieve this» (Huitema *et al.* 2009: 26). Learning and knowledge exchange are pillars of participation (Challies *et al.* 2016) and local knowledge integration as well. In case of flood risk governance, uncertainty, ambiguity and complexity need to be faced. As discusses in the previous chapter, this led to conflicting risk framings, conflicting interests

and choices. To handle divergent interests and to provide the flexibility needed (Becker *et al.* 2015), a recent management concept, labelled as adaptive comanagement (ACM) has been developed. The two terms refer to two specific meanings:

> *«- adaptive refers to the ability to manage uncertainty through "learning by doing", by testing of hypotheses, and using an experimental approach to management*
>
> *- comanagement indicates the collaboration of a wide range of actors from government and civil society in sharing managing power and responsibilities across local, regional, and national levels, emphasizing inclusive decision making and knowledge provision from different sources»* (Becker *et al.* 2015: 1)

This concept mainly derived from the unpredictability of ecosystems and their response to human actions. Main institutional prescriptions identified by Huitema *et al.* (2009) to be followed within this adaptive comanagement are as follows:

- a polycentric governance: «a management system should have multiple centers of power rather than one center of control» (Huitema *et al.* 2009: 28);

- public participation, referring to «collaboration between governmental and non-governmental stakeholders» (Huitema *et al.* 2009: 30), which can be very different according to who is involved and in which phase of the risk governance process, as seen in the previous chapter;

- experimentation, which refers to management as itself a form of experimentation: «this approach acknowledges that management is always based on incomplete and uncertain information and consequently has a hypothetical character, and all management can, therefore, can be seen as a kind of hypothesis testing» (Huitema *et al.* 2009: 32). This is also deemed to fit better in a constructivist approach to flood risk management;

- a bioregional perspective, which usually goes beyond administrative boundaries to embrace the basin/catchment scale for flood risk management. This is one core thread of natural flood management projects.

Within an inclusive risk governance framework (the role of public participation has been widely discussed), a polycentric structure together with experimentation ensures a redundancy

in power relations to face disturbances and face uncertainty, ambiguity and complexity. Who should participate and in which phase has been already outlined in the first chapter. Furthermore, Chaffin *et al.* (2014) point out that being polycentric «requires a structure of nested institutions (complex, redundant, and layered) and institutional diversity (a mixture of market, state, and community organizations) at the local, regional, and state levels, connected by formal and informal social networks». In parallel, the target of this framework for natural flood management projects needs to be nature-based, that is set on geophysical characteristics, e.g. at catchment scale for flood risk management.

In this chapter I discussed how the need for local knowledge and the engagement of local actors is often claimed but few attempts have been made to find practical applications to manage flood risk integrating local knowledges within a flood risk governance framework. Some examples can be found in environmental governance, such as the adaptive co-management framework proposed by Huitema *et al.* (2009). Furthermore, the concept of local knowledge can be misinterpreted and it is often not clear what it should be deemed "local knowledge" and how a classic "binary tension" between local and scientific knowledge should be framed. The use of the concept and its cognate notions in Environmental and Development studies has shown how this tension may be solved by looking at situated relationships and interactions that shape knowledges at local level, combining expert, "traditional", implicit, social and holistic knowledges. The point is how to identify, engage with, evaluate and apply these knowledges at local level in flood risk management processes. Natural flood management processes, as they are catchment-based, can provide excellent case studies to unpack the concept and analyse how it works in practice within a flood risk governance framework.

In the next chapter I will outline the institutional and governance frameworks, from International and National policies on DRR up to the regional flood risk governance frameworks of my two study sites. In addition, in chapter four I will outline the local governance of the two flood risk management processes I've analysed in the Stroud and Reggio Emilia areas. The aforementioned institutional prescriptions for adaptive co-management and the knowledge integration process analyzed can thus provide a framework to compare my two case studies and frame my analysis (see chapter four for the research problem in detail). Analyzing my empirical data and comparing my two case studies (chapter 4, 5, 6 and 7), I will show how these frameworks can work to integrate local knowledges within an inclusive flood risk governance perspective. The research design and my research questions will be detailed at the beginning of chapter four.

CHAPTER 3

3. The policy background. From International DRR and EU Flood Risk policies to flood risk management processes at National and local level

My research project has been also inspired by the 2007 Floods Directive (FD), which provided an integrated management approach to flood risk management in the European Union. It also enhanced the identification of National, Regional and local targets, and the development of risk assessment and management tools (maps and plans) «focusing on prevention, protection and preparedness» (EC 2007:2) coordinated at river basin district. Flood risk has been defined as «the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event» (EC 2007:1), that is the combination of hazard (3 levels of intensity) and potential damage (number of inhabitants, type of economic activity, technical information). Principles of solidarity and subsidiarity were considered, while flood risk maps and plans are also based on «best practices» and «the best technologies available» (EC 2007:2).

Local knowledges and practices are not explicitly mentioned in the Directive, rather implicitly mentioned through these indications. In order to include local knowledges into flood risk management, it is necessary to downscale the analysis, define the flood risk actors involved at regional and local level, the type of knowledges they are using and how this knowledge interacts with local risk management practices and situated local knowledges, as I will explore in chapter 5 and 6. To do this it is necessary to give first an overview of the main International Disaster Risk Reduction policies at International and European Level and their eventual implementation in terms of policies and tools in England and Italy, the National contexts where the RSUDS and LIFE RII projects took place. Furthermore, complementary policy and practical tools, such as natural flood management and river contracts, will be brought out as practical scenarios for integrating local knowledges into flood risk governance.

3.1 International Disaster Risk Reduction policies

Last May (22nd-26th May, 2017) in Cancun (Mexico), the fifth biennial Global Platform for Disaster Risk Reduction was held to gather different actors worldwide to promote dialogue among governmental and non-governmental stakeholders. *From commitment to action* was the slogan of this fifth edition, highlighting in a way the issue of implementing knowledges and policies into practical Disaster Risk Reduction (DRR) applications, a crux in current disaster research, as seen in the second chapter. The platform has been defined as the «main forum at the global level for strategic advice, coordination, partnership development and the review of progress in the implementation of international instruments on disaster risk reduction» (UNISDR 2017a:1). Stakeholder engagement, partnership-building, information and knowledge sharing and co-production have been basically presented as key points to

> *«enable governments, NGOs, scientists, practitioners, and UN organizations to share experience and formulate strategic guidance for the implementation of global disaster risk reduction agreements: the 2005 Hyogo Framework for Action and its post-2015 successor the Sendai Framework» (UNISDR 2017a:1)*

As already mentioned in the second chapter, stakeholder engagement and inclusion of local, traditional and indigenous knowledges within a risk governance approach are core outcomes of the aforementioned 2005 and 2015 UN DRR Frameworks. One of the main documents produced by the biennial forum Platform (*the Cancun high-level communiquè*) recognized the rising direct and indirect losses from disasters worldwide (1.4 trillion US dollars as direct economic losses in the last decade) and a "close nexus" between climate change and water-related disasters, «which account for almost 90% of the 1,000 most disastrous events since 1990» (UNISDR 2017b: 2). An Integrated Water Resources Management was proposed as an effective way to build both resilience for DRR and adaptation to climate change. The promotion of «people-centred» approaches, including the most vulnerable and the support of «multi-stakeholder and socially-inclusive partnerships initiatives», were fostered, too. This document can be deemed as a high-level non-binding *communiquè*, belonging to the fields of statement of intentions informing international policies. In its last section, dedicated to the "commitments", intertextual links between other International meetings/statement of intentions (the Sustainable Development Goals (2015), The Paris Agreement on Climate Change (2016),

the New Urban Agenda (2016)) and the main DRR Policy Framework ongoing (The Sendai Framework) outcome are briefly mentioned, by supporting the claim of linking development and disaster risk reduction, via the slogan *building better from the start*. The partners or target addressed by the statements are conceived as generalized categories such as "the poor", "all actors", "stakeholders" "civil society", while the concept of risk is always related to the one of disaster, to the extent to which working on different kinds of vulnerabilities is deemed as resulting in reducing disaster-related losses and effects. Claims of strengthening people-centred and multi-stakeholder vertical risk governance, and the inclusion of vulnerable people in DRM, improving risk assessment (to be addressed locally) and information collection, promoting risk transfer mechanism and acting on development and normative/regulatory frameworks for tacking vulnerability by acting on physical vulnerability and exposure. As incontrovertible proofs of evidence for taking actions, both scientific models based on statistics and economic losses calculation, and sociological assertions are considered. The formers supported by data, the latter by argumentation shared with the academic vulnerability approach literature, as this statement makes clear:

> *«We recognize that the poor suffer disproportionately from natural and man-made hazards as poverty significantly undermines people's socio-economic resilience to disasters, and disasters further erode livelihood and wellbeing and deplete resilience, thus exacerbating poverty and non-economic losses. Moreover, low-income households affected by disasters have a cut on food intake, health care and education expenditures, threatening their prospect of escaping poverty and amplifying the transmission of poverty from parents to children» (UNISDR 2017b: 2).*

The concept of "resilience" is broadly used with the one of "sustainability" while the concept of "risk" is always linked to the one of "disaster", to the extent to which working on different kinds of vulnerabilities is deemed as resulting in reducing disaster-related losses and effects. A risk governance approach is evoked, as well as the inclusion of indigenous people and local contexts, with the aim to take «into account the cultural heritage of indigenous peoples and addressing intensive and extensive risk, underlying risk drivers, and ensuring that they are tailored to local contexts» (UNISDR 2017b: 4).

This global platform has been launched by the UNISDR, the UN Office for Disaster Reduction created in December 1999 (with the General Assembly (GA) resolution 54/219) as an outcome of the International Decade for Natural Disaster Reduction (IDNDR), with the aim

to implement the International Strategy for Disaster Reduction (ISDR) forecast by the same GA resolution. UNISDR so represents «the focal point in the United Nations system for the coordination of disaster reduction and to ensure synergies among the disaster reduction activities of the United Nations system and regional organizations and activities in socio-economic and humanitarian fields» (UNISDR 2017a:1).

Disaster Risk Reduction at International policy level has changed over the years, as seen in the second chapter. It's interesting to note that the change in policies often followed major disasters occurring worldwide and consequent progress in disaster research. Indeed, "disasters" were still deemed as exceptional events in UN policies until the 70s, while in the 80s pre-disaster preparedness[16] was at the centre and led to the UN International Decade of Natural Disaster Reduction (1990–1999) (Shaw 2016). As noted in the first chapter, the publication of the volume *At Risk* (Blaikie *et al.* 1994) and the work of academic researchers founding the *vulnerability approach* had an influence to the course of these meetings, so that «the first half of the decade focused mainly on government actions, up to the 1994 Yokohama Conference», while «the "Yokohama Plan of Action for a Safer World," possibly the first official document agreed upon by the UN member states that strongly emphasized the role of communities and NGOs in disaster risk reduction approaches[17]» (Shaw 2016: 6). Then, after the disastrous 1995 Kobe earthquake (or Great Hanshin earthquake, with more than 6,000 people left dead), which affected one of the most disaster-proof country in the world, a rethinking of pre-disaster measures and of the involvement of local people and stakeholders in DRM has been undertaken. The 2004 Indian Ocean Tsunami was again a turning point in DRR international policies, after killing more than 200,000 people from more than 65 countries (Shaw 2016). As argued in the second chapter, a clear change of perspective from a disaster-centred perspective to a risk-centred one inspired the 2005 Hyogo framework for Actions and the 2015 Sendai framework for disaster risk reduction (SFDRR). Therefore "disasters" have been finally linked to the concept of "risk reduction", and some measureable indicators had been identified to monitor the progress in DRM policies worldwide (Shaw 2016). Different interesting claims were considered in the SFDRR (UNISDR 2015), in the 2016-2021 UNISDR Strategic

[16] «We must, above all, shift from a culture of reaction to a culture of prevention. Prevention is not only more humane than cure; it is also much cheaper... Above all, let us not forget that disaster prevention is a moral imperative, no less than reducing the risks of war» (UNISDR 2017a:1)

[17] «All countries are called upon to: aim at the application of traditional knowledge, practices and values of local communities for disaster reduction, thereby recognizing these traditional coping mechanisms as a valuable contribution to the empowerment of local communities and the enabling of their spontaneous cooperation in all disaster reduction programmes» (UN 1994: 15).

Framework (UNISDR 2016b), and in the UN Plan of Action on Disaster Risk Reduction for Resilience (UNISDR 2016a). These three documents aim at building upon an interdiscursive framework, which can link Development, Sustainability and Disaster Risk Reduction, so that: «Disaster risk is [now] part of the DNA of social and economic development, rooted in poverty and inequality, evolving over time. Consequently, managing disaster risk cannot be separated from the broader governance of social and economic development» (UNISDR 2016b: 4). The four priorities recently identified by the latest Sendai DRR Framework are:

- Understanding disaster risk
- Strengthening disaster risk governance to manage disaster risk
- Investing in disaster risk reduction for resilience
- Enhancing disaster preparedness for effective response and to "Build back better" in recovery, rehabilitation and reconstruction

General claims found in the guiding principles and in the first two priorities underpin in many points how much crucial is the "local" dimension:

- about risk governance: beyond the central role of the State as main responsible for DRR, it's necessary to define clear responsibilities across public and private stakeholders within DRR and to «empower local authorities and local communities to reduce disaster risk, including through resources, incentives and decision-making responsibilities, as appropriate», by «a multi-hazard approach and inclusive risk-informed decision-making», which should be science-based but complemented by traditional knowledge. Furthermore, a multi-sectorial coordination at local level should contribute to national and local DRM plans and policies.

- About risk: local and specific characteristics must be understood to determine DRR measure.

- About stakeholder engagement: «to enhance collaboration among people at the local level to disseminate, disaster risk information through the involvement of community-based organizations and non-governmental organizations» (UNISDR 2015: 15). Linked with this is the need «to promote a culture of disaster prevention, resilience and responsible citizenship, generate understanding of disaster risk, support mutual learning and share experiences» (UNISDR 2015: 16) and to define clear roles and tasks to community representatives within DRM process, institutions, public consultations and legal frameworks.

- About local knowledge, beyond supporting global user-friendly systems and services for the exchange of good practices, as already mentioned, to achieve the first priority is important to «ensure the use of traditional, indigenous and local knowledges and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programmes of specific sectors, with a cross-sectorial approach, which should be tailored to localities and to the context» (UNISDR 2015: 15). Furthermore, community participation is crucial to build sustainability and long-term community resilience (UNISDR 2017c).

These challenging and promising points restates a multi-stakeholder inclusive (and polycentric?) risk governance approach and put forward the relevance of risk-informed decision-making (Shaw 2016), by focusing on the complexity of the "risk" dimension more than the "disaster" one. They also embrace a vulnerability approach, strongly stating that «there is no such thing as a natural disaster, only natural hazards» (UNISDR 2017a:1). Despite this, no further definition is given in these policy documents, as risk is still deemed a technical concept, informed by a technocratic approach to risk. Risk is so defined by UNISDR as «the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity» (UNISDR 2017a:1). Furthermore, the "risk" definition provided by the UNISDR contains an annotation which accounts for the influence of socio-cultural aspects in the perception of risk and the possibility to acknowledge them but not to quantify them either:

> *«disaster risk comprises different types of potential losses which are often difficult to quantify … It is important to consider the social and economic contexts in which disaster risks occur and that people do not necessarily share the same perceptions of risk and their underlying risk factors» (UNISDR 2017a:1)*

The naturalness of "risk" is therefore not seen as a relationship constructed in different ways by different actors (as a social constructivist approach would suggest), rather as a function of probability, even though some factors cannot be accounted for. Likewise, no definition of local knowledge is provided, rather traditional, indigenous and local knowledge are mentioned as

part of a similar concept to be ancillary to scientific knowledge and help the development of policies which can fit into local contexts[18].

The Sendai Framework constitutes a voluntary agreement to a new global approach to DRR policies, representing a shift from a disaster management to a disaster risk management approach: risk lies at the core of the shift, aiming at preventing new and reducing existing disaster risks «through an all-of society and all-hazards risk approach across economic, social, and environmental policy areas, with a view to reduce vulnerability and increase resilience» (EP 2016: 1). In the next paragraph, I will consider the main DRR and flood risk policies at European Union level, which are linked to the policy developed by the UNISDR.

3.2 Flood risk policies at European Union level

The European Union had both a key role in outlining the Sendai framework and in implementing the outcomes, through different policies and tools at different levels, in coordination with other international agreements, such as the 2030 Agenda for Sustainable Development, the 2015 Addis Abeba Action Agenda, the 2015 Paris agreement on Climate Change, the World Humanitarian Summit, and the 2012 new UN HABITAT Urban Agenda. In parallel, comprehensive strong effort in Disaster Risk Management has been undertaken by the EU. Since the EU commitment in DRM is huge, I selected the main policies and agencies for my research purposes, as follows:

- risk assessment (by creating the Index for Risk Management, INFORM[19], and through WFD and Floods Directive, as we'll see as follows);

- risk mapping (through the Floods Directive and the Copernicus Programme[20] for the satellite mapping of damage);

[18] One last thing to note here is the current lack of correspondence between the interdiscursive approach built upon DRR, Climate Change and Sustainability by the SFDRR and the difficulties in meshing these fields in academic research: if «there is no doubt that climate change affects aspects of disasters and of disaster risk reduction», there's still lots of difficulties in realistically bringing «climate change, disaster risk reduction, and sustainable development under one umbrella due to academic territorialism and lock-into the separate global processes» (Kelman 2015: 188).

[19] This is an open-source risk assessment tool to support decisions (EP 2016), cf. www.inform-index.org.

[20] See http://copernicus.eu.

- risk preparedness: through the Union Civil Protection Mechanism which entered force in 2014 and the EU Risk Management Capability Guidelines, through which, «in undertaking a risk assessment, the aim should be to reach a common understanding, with all relevant stakeholders of the risks faced and their relative priority» (EC 2015: 3). Risk management capability is so defined as «the ability of a Member State or its regions to reduce, adapt to or mitigate risks (impacts and likelihood of a disaster), identified in its risk assessments to levels that are acceptable in that Member State» (EC 2015: 2). No mention of local knowledge has been done;

- climate change adaptation through the 2013 EU Climate Change Strategy, which have been adopted by all Member State by March 2016 and aim at developing adaptation strategies which will influence risk mitigation;

- land use planning and building codes;

- data analysis through the development of a National Disaster Loss database for Disaster Loss accounting;

- the science-policy interface and the work of the European Environmental Agency established in 1990, the 7th Framework Programme just ended, the H2020 call for research and innovation, the recently established EC Disaster Risk Management Knowledge Centre, the JRC research centres, the European Climate Adaptation Platform (CLIMATE-ADAPT)[21], the Water Information System for Europe (WISE)[22], the Biodiversity Information System for Europe (BISE)[23], and the Natural Water Retention Measures Platform.

From the aforementioned huge set of European tools and policies it's quite clear that flood risk is one of the priority put forward by the European Union in the last two decades, and I'll point out some more specific reasons as follows.

Firstly, the effort that EU is undertaking in Climate Change (CC) adaptation: through the 2013 CC strategy, which has been implemented by the member States. It's noteworthy the acknowledgement of a link between CC (forecasted heavier precipitation in some parts of Europe) and the amplification of flood risk, coastal risk and erosion. The aim is to work further

[21] See http://climate-adapt.eea.europa.eu/about.
[22] See http://water.europa.eu/info.
[23] See http://biodiversity.europa.eu/.

with Member States and stakeholders «to identify adaptation knowledge gaps and the relevant tools and methodologies to address them» (EP 2013:2), and to improve the policy-science-business interface with Research Programmes, such as Horizon 2020 Program.

Secondly, two European Directives addressed Water management and water-related problems, so that the EU has taken over certain responsibilities and challenging guidelines in water and flood risk management. The Water Framework Directive (WFD), issued in 2000, defined common integrated and sustainable policies on water management in order to protect all surface and ground waters, actively involve all interested parties and develop a consultation of the general public (Newig *et al.* 2014). The Floods Directive (FD), issued in 2007, tried for the first time to build a common risk policy framework to manage flood risk: it defines what is flood risk, some actions to be undertaken (flood hazard and flood risk maps, flood risk management plans), the units of management. Furthermore, it tries to ensure the involvement of all interested parties (Newig *et al.* 2014). Indeed, as already noted, floods are the most frequently experienced disasters in Europe; no European country is risk-free and the economic losses are relevant, even because people is still killed by floods, in Europe, nowadays. Brazdil *et al.* (2006) state that since 1950 to 2005, 25% of events, 7% of casualties and 25% of economic losses worldwide have been caused by flooding. And «floods are the most prevalent natural hazard in Europe» argues Bakker *et al.* (2013), who count over 213 major flooding just between 1998 and 2009. It has been exactly after the disastrous 2002 Elbe and Danube flood that «a core group led by the Netherlands and France prepared a guide on *Best practices on flood prevention, protection and mitigation* thereby initiating a shift in attention from protection against floods to managing flood risks» (Bakker *et al.* 2013: 4). Anyhow, some researchers (Priest *et al.* 2016) consider the FD as "the daughter directive" of WFD, because WFD main concepts are restates in FD, such as, following Priest *et al.* (2016): a river basin approach, the coordination of water quality and water management, the coordination with other policy fields (e.g. nature conservation and spatial planning), an adaptive and planning cycle approach, transboundary cooperation, and the promotion of public participation. The Water Framework Directive main aim is requiring the EU member states to «achieve "good status" of all inland ground and surface waters by 2015» (EP 2000:2), by developing River Basin Management plans and Programmes of Measure assessing water conditions and actions to be taken. Complementarily, the Floods Directive aims at reducing «the risk of adverse consequences, especially for human health and life, the environment, cultural heritage, economic activity and infrastructure associated with floods» (EP 2007:1). In terms of risk governance, it's remarkable to note the development of a new approach to EU environmental

policy, which Newig *et al.* (2014) discussed as a "mandated participatory planning" approach to policy implementation, a sort of institutionalization of participatory governance outlined as a «secondary policy-cycle nested within a larger cycle of European public policy–making and implementation» (Newig *et al.* 2014:5). Both directives prescribe the presence of joint plans to be periodically updated through stakeholder participation. In fig. 3.1 and fig. 3.2 it's outlined the policy cycle foreseen by both Directives, which Newig *et al.* (2014) defined as a nested one:

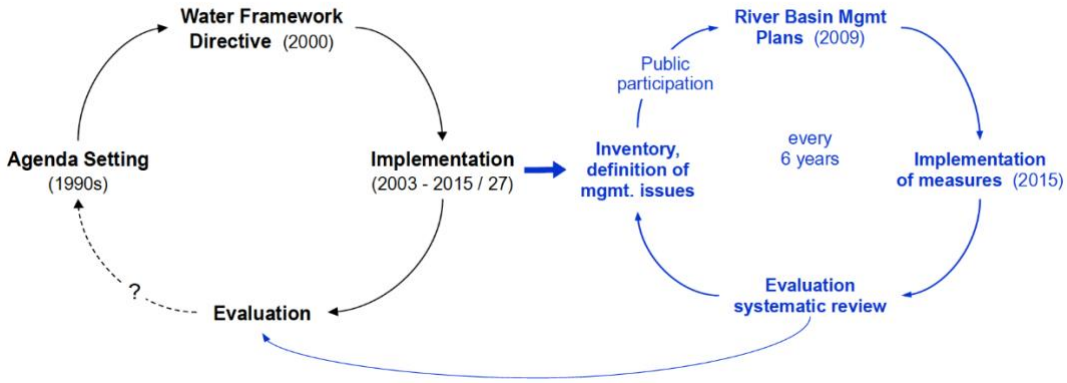

Figure 3. 1 Nested policy cycle of the Water Framework Directive, elaborated by Newig et al. (2014: 3)

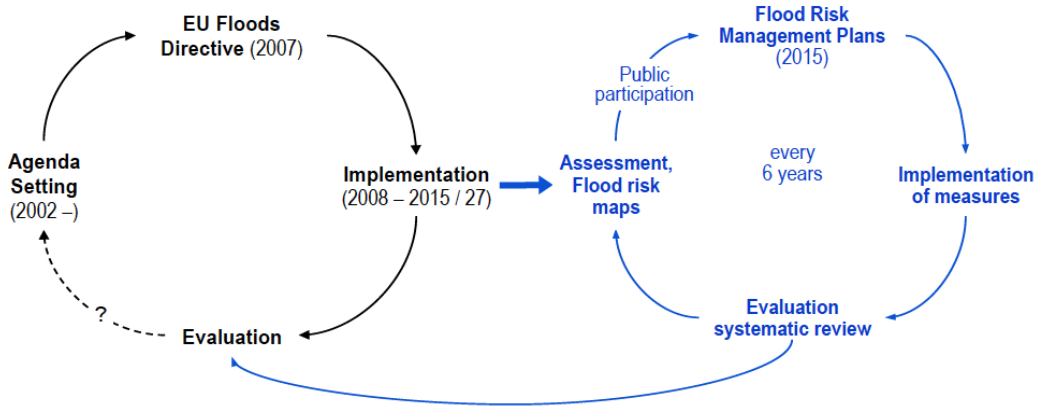

Figure 3. 2 Nested policy cycle of the Floods Directive, elaborated by Newig et al. (2014: 4)

It's noteworthy the cyclical evaluation of the implementation of the measures resulted from the Management Plans at river basin level. Therefore, the outcomes will turn into future drivers for the definition of water management and flood risk assessment and management matters,

which will result in management plans following public involvement. Namely, every six years the FD requires member state to:

- undertake preliminary flood risk assessments (starting from December 2011);

- draw flood hazard and flood risk maps, identifying high risk areas (starting from December 2013);

- carry out flood risk management plan (starting from December 2015).

Furthermore, the River basin level is the unit of management, as prescribed by the adaptive co-management framework discussed in the previous chapter. The nested policy cycle can also have positive effects in terms of participation and decision-making linked to polycentric governance.

Since the EU Directives provide goals that should be reached, without prescribing the way in which they should be achieved (Priest *et al.* 2016), I'll delve into the flood risk governance derived from the FD in the next paragraphs, while analysing flood risk governance at national and regional level. Anyhow, in terms of stakeholder engagement the WFD is deemed the first attempt to require active involvement, consultation and access to information as forms of participation in EU environmental policies. Significantly for my research, it has been noted that «unlike the WFD, the FD remains purely procedural, leaving definition of goals for flood protection and the reduction of flood risk to the member states (or sub-/cross-national administrations)» (Newig *et al.* 2014: 5), which can be controversial. If a general «active involvement of the «interested parts» is «encouraged» in both Directives, according to the art. 10 of the FD «the public must be granted access to preliminary flood risk assessments, flood hazard maps and flood risk maps, implying 'ex post' access and mandating no public involvement in the drafting of these documents» (Newig *et al.* 2014: 5). Therefore, even if in the Common Implementation Strategy Guidance Document for both Directives (EC 2013) expected outcomes of participation are outlined as «awareness rising, knowledge elicitation and social learning» (Newig *et al.* 2014: 7), in practice less involvement is foreseen by the FD, maybe due to a partially different policy field covered. Indeed, due to the relational nature of risk (see next chapter) and the large variety of potentially affected stakeholders, potentially everyone (and with different participation means) can be part of flood risk management. If «stake under the WFD is mainly determined by actors' position and role in the hydrologic

cycle» (Newig et. 2014: 7), who has a potential role in the flood risk cycle? Who has been legitimated to decide for matters of acceptability/tolerability and define what is flood risk and how can be assessed and managed? The complexity of the concept of "risk" and the recently development of inclusive risk governance frameworks (as discussed in the first chapter) exactly justifies the needs put forward by my research to analyse the involvement of stakeholders and the integration of local knowledges in flood risk management processes.

It is also interesting to note that –unlike the UN SFDRR - there is no mention of the concepts of "risk governance" and "local knowledge" in the text of the Directive, even if discursive claims on risk governance and other forms of knowledge are put forward, as in case of stakeholder engagement and natural flood management. Furthermore, risk is defined in a quite classic technocratic way, as «the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event» (EP 2007:3). But a clear influence of the vulnerability approach and of International DRR policies can be seen in the definition of floods as «natural phenomena which cannot be prevented», and in saying that «some human activities (such as increasing human settlements and economic assets in floodplains and the reduction of the natural water retention by land use) and climate change contribute to an increase in the likelihood and adverse impacts of flood events» (EP 2007:1). Moreover, a link between the advantages of some natural measures to reduce flood risk are brought out, too. But, as Newig *et al.* again noted, the risk maps to be produced «only have to define measures for flood risk management, but need not address how flood protection will be achieved» (Newig *et al.* 2014: 5), with the risk of resulting whether an exercise of reflexive governance (in Newig *et al.*'s opinion), or just a test of different perspectives and ideas on what flood risk is and how can be tackled.

The third point developed by the EU policies is the use of nature-based solutions (and natural flood management) as a recent tool to reduce flood risk and improve water management, as I will discuss in the fifth paragraph, where I will outline some interesting policy tools for the purposes of my research. In the next two paragraphs, I will provide a brief overview of the National and Regional flood risk governance frameworks in Gloucestershire and Emilia-Romagna, the two Regional areas within the flood risk management projects I will analysed were undertaken.

3.3 Flood risk governance in England and Gloucestershire: polices and actors

As well known, the European Directives have binding objectives, but don't prescribe how to reach them, they need to be transposed in State members' national laws (Priest *et al.* 2016). The implementation of the FD Directive in England (with the Water Flood Act 2010 and the 2009 Flood Risk Regulations) exactly followed one of the biggest flooding event recorded in the country, the 2007 floods. During the wettest summer ever recorded (414.1mm), on June 24th/25th and July 20th/21st heavy rain hit Yorkshire, Derbyshire, Lincolnshire, Nottinghamshire and Worcestershire, South West England and South East parts of Wales. 3 were found dead and around 56,000 properties were flooded, according to the Environment Agency. Gloucestershire was particularly severely affected, with 5,000 property flooded (80% hit by flash floods) and 1,950 people assisted in temporary housings, 500 business affected and around 140,000 homes remained without water supplies for up to 17 days (source: GCC). As seen in the previous chapters, a heated debate followed the floods in the whole Country, resulting in diverse surveys, reports and policy recommendations (e.g. the Pitt Review, see chapter 5). England is potentially affected by flooding from several different sources and it is estimated that «one sixth residential and commercial properties are at risk from fluvial, coastal or surface water flooding» (Alexander et al 2016: 9; EA 2009). One of the worst flood ever registered in the UK occurred in 1947 triggered by heavy snowfall and rainfall. Major floods hit the UK in recent history: in 1947 (the worst riverine flood before the 2007 ones), 1953 (the so called East Coast Floods, triggered both by meteorological causes and an exceptional northern gale), 1998 (the Easter flood over the Midlands), 2000 (the Midlands by heavy rain), 2000 (York, Shrewsbury, Lewes and Maidstone), 2007 (Gloucestershire were the worst affected) and again in 2012 (a 150-year flooding caused by prolonged rain) and winter 2013-204 across England (mainly Somerset Levels from winter storms and Devon, Dorset and Cornwall by coastal flooding). Alexander et. al. (2016) reports that a full range of flood risk management strategies has been adopted in the UK. I identified three main shifts in flood risk policies to be acknowledged:

- «a movement away from a focus on rural protection and land drainage» to a focus on flood defence (then termed 'flood alleviation')» (Alexander *et al.* 2016: 30), which led a great trust in flood defences schemes during the 1980s and 1990s

- a shift towards a more sustainable flood management from the 1990s through a gradual «transition towards a more strategic, multi-method, and integrated approach to land and water management: a flood risk management approach» (Tunstall *et al.* 2004: 3)

- since the 2000s, an ongoing shift towards a flood risk governance approach, which is still multi-faceted. An initial move from «an ideology concerned with "keeping flood water out" to one in which its citizens are being asked to "make space for water"» (Johnson & priest 2008: 513) is currently turning into a Nature-based solutions paradigm, called by DEFRA and EA "Working with natural processes to reduce flood risk". First applications and results of this paradigm were available while revising this thesis, and the Stroud case study is covered in key findings[24].

Before describing current main flood risk management governance actors, it's noteworthy to note that also flood risk management reflected the gradual decentralisation of political decision-making in the UK with the creation of the Scottish Parliament and the Welsh National Assembly resulting in different legislations covering flood management with the existence of delivery organisations (Alexander *et al.* 2016). For this reason, with "national level" I will refer to flood risk governance in England.

In terms of current flood risk governance, following the 2007 FD, the 2009 Flood Risk Regulations and the 2010 Flood and Water Management Act designate the Environment Agency and Lead Local Flood Authorities (LLFAs) as competent authorities in terms of flood risk management. The National Department for Environment, Food and Rural affairs has overall responsibility for flood risk management in England, but don't directly handle practical implementations or management issues, such as defence buildings, flood warnings, planning decisions or emergency plans: it relies on three main authorities at different levels to deliver its policies (Johnson & Priest 2008): the Environment Agency (at national and regional level), Lead Local Flood Authorities (LLFAs, at County or City level), Internal Drainage Boards (at local level). These agencies act as «the government' operating arm in the delivery of its Flood Risk Management policies» (Johnson & Priest 2008: 517). Furthermore, it should be mentioned here the distinction between the legal distinction between duties, rights and responsibilities. Indeed, Johnson & Priest (2008) notice how DEFRA has no operational responsibilities, rather EA, LLFAs and IDBs responsibilities «are based almost entirely on statutory powers to alleviate flooding rather than any duty to prevent it»: therefore they «*may* undertake flood

[24] Cf. https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk, published on line the 31st October 2017.

defence works and maintenance but have no *duty* to do so» (Johnson & Priest 2008: 517). The only duty by the EA is again an "overall supervision" for flood risk mapping and the issuing of flood risk warnings (Johnson & Priest 2008). Consequently, duties to intervene may derive from failings to prevent flooding from operating agencies, resulting in being the landowners the responsible for doing «all that is *reasonable* to prevent or minimize risk to others from flooding on their land». Indeed, ultimately, «these duties rely on the legal interpretation of what is considered *reasonable* in the mix of public and private risk responsibilities» (Johnson & Priest 2008: 517), eventually considering also other agencies, such as Private Water Companies or Highways Authorities. Furthermore, riparian owners are the one who have legislative responsibilities in terms of flooding. For my research purposes, a map of main actors in flood risk governance in England can be outlined as follows (fig. 3.3 for a deeper analysis):

- DEFRA with an overall responsibility for manging flood risk without operational responsibilities (National level)

- The EA oversees implementing the 2009 Flood Risk Regulations (via FD). It has an overall supervision for all types of floods and operational responsibilities for flood risk management from main rivers, reservoirs, estuaries and the sea.
  It is a multi-scalar actor, being national and regional/local at the same time: it manages National funding at local level and support local planning authorities (National – Regional –Local levels)

- The Regional Flood and Coastal Committee is a Regional Committee formed by the EA under the 2010 Flood and Water Management Act that gather LLFAs and independent members. It must be consulted for target and funding in flood risk and coastal flood erosion (Regional level)

- The Water Companies manage water and sewerage. They are mainly responsible for risk from ground water and sewerage (Regional/County level)

- Internal Drainage Boards (Regional/County level) are independent public bodies responsible for water management low lying areas (up to 10 meters above the sea level). They have operational responsibilities for ordinary watercourses and drainage maintenance (Sub regional level– not in the whole Country)

- Lead Local Authorities was formed under the 2010 Act. They have lead responsibilities for ordinary watercourses, surface water and ground water (i.e. not main rivers) and have also to

maintain drainage. They develop the Local Flood Risk Management Strategy working in partnerships with local stakeholders, maintain a register of flood risk assets and implement FD duties. They work within the County Councillors (County level)

- Local planning authority: as District Councils, they are responsible for local planning decisions, following flood risk assessment. They also develop a Strategic Flood Risk Assessment for development purposes. (District level)

- Parish and town Councils: they aren't involved in flood or water management but they may be involved in local development plans and may provide local "flood wardens" on a voluntary. (Neighbourhood level)

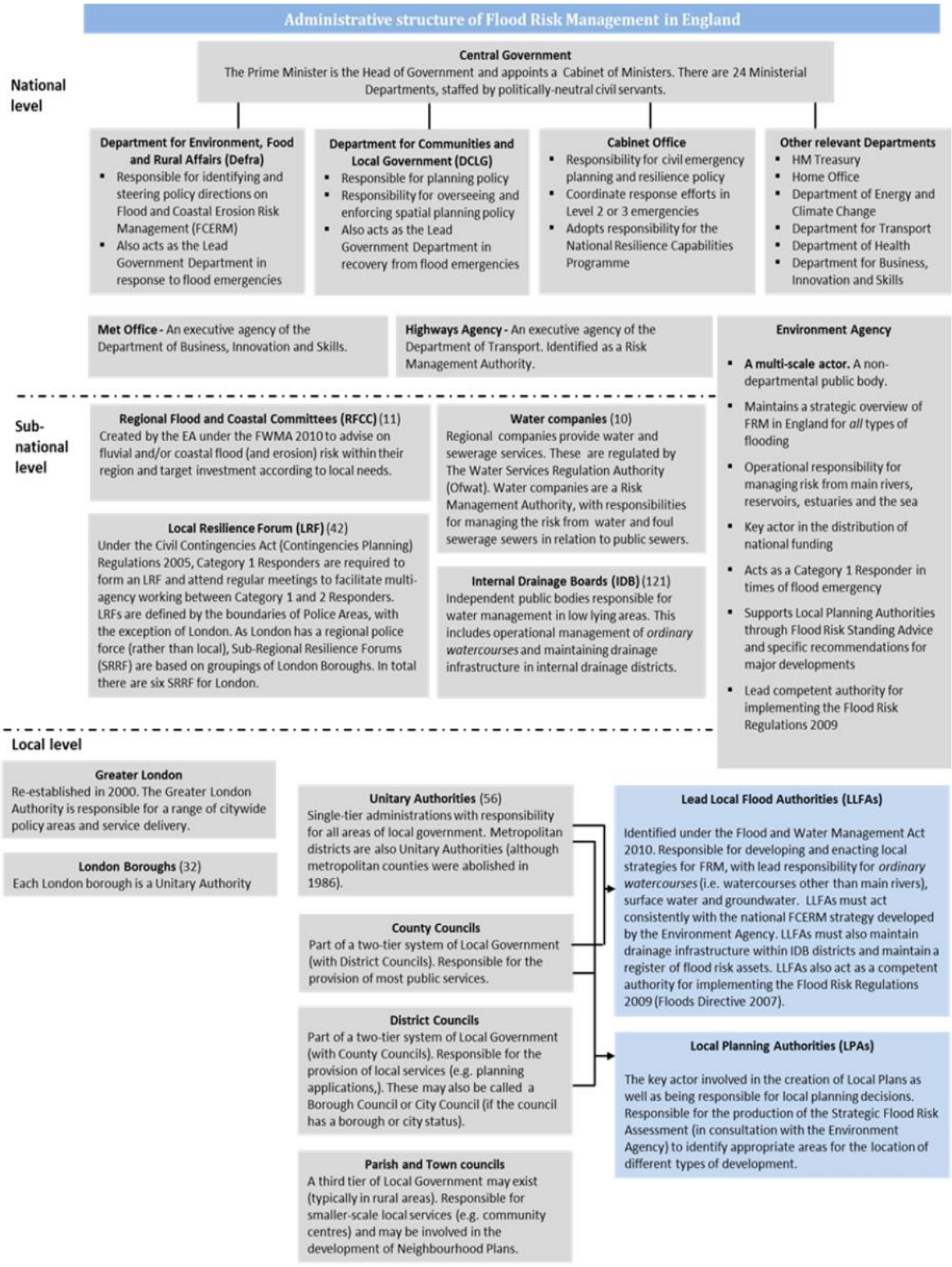

Figure 3. 3 Flood risk governance structure with main actors and different levels in England (developed by Alexander et al. 2016: 13)

As I'll show more in detail in the next chapter, scaling down to the Stroud area, my English case study contexts, LLFA in Gloucestershire is the County Council. It owns responsibilities for the management of flood risk related to groundwater, surface runoff and ordinary watercourse flooding, which is referred to as "local flood risk" (GCC 2014). It usually has operational responsibilities for ordinary water courses and develops a *Local Flood Risk Management* Strategy for the Gloucestershire area consistent with the National Flood and Coastal Erosion Risk Management Strategy by DEFRA and Environment Agency (EA), having the latter a strategic overview on flood risk management for all kinds of flooding and being responsible for main rivers, reservoirs, estuaries ad the sea. The 2010 Act gave GCC also the statutory duty to develop and maintain a Local Flood Risk Management Strategy. According to this strategy, GCC has also responsibilities for managing flood risk from the highway network and planning for emergencies. In 2012, the Gloucestershire County Council has devolved to the local District Councils the powers to undertake enforcement to maintain proper flow of water within ordinary watercourses without a necessary consent. And in the Frome Catchment area, the catchment where Stroud is located, the English Severn and Wye Regional Flood and Coastal Committee (RFCC) established by the EA shall be consulted to ensure the consent to local levy funded scheme for flood risk alleviation.

3.4 Flood risk governance in Italy and Emilia-Romagna: policies and actors

Italy is prone to different kinds of natural hazards, but many efforts are still necessary to increase physical and social vulnerability: 67% of the Italian territory is in a seismic risk area, but 75% of the housing stock was not built following anti-seismic modern code (Marino 2016). According to Mysiak (2013), given Italy's peculiar topography and the Mediterranean climate variability, «the areas prone to significant flood and/or landslide risk exceed 29 500 km2 (~9.8% of the Italian territory) and affect more than 6600 (~82 %) municipalities» (Mysiak 2013:2883). Furthermore, exposure is often increased by negligence in planning: a 2010 study by Legambiente (the major National NGO in terms of environmental protection) and the National Department of Civil Protection underlines how «was common that dwellings or whole residential quarters were located in floodplains or areas exposed to landslides» (Mysiak 2013:2883) and 6% of Italian population is daily at risk. Between 1951 and 2011, 1394 people

were killed by flooding, and thousands lost their homes, after 55 flood major events (Lastoria *et al.* 2006); according to newspaper sources, in the last ten years we even registered 38 major events floods that caused 134 causalities. Flooding is a relevant problem in Italy, and if earthquakes cause lots of causalities in few seconds, floods produce as many (or even more) economic losses as earthquakes.

Emilia-Romagna (ER), the Region where my Italian case study is located, is the Region with the highest number of people living in risky areas in Italy (63,6%). This Region has got a peculiar geographical territory: one quarter is mountainous, one quarter hilly, and half consists of the plain geologically formed by the detritus deposited by the flowing of the Po river basin watercourses, the longest Italy's river. This plain is even the most industrialized and populated area of the Country (9.3% of Emilia-Romagna territory is urbanized[25]), while ER is crossed by nine main rivers, 23 minor rivers or streams and by more than fifty artificial channels or small streams. In the last 6 years, the region was hit by 6 major floods, with huge economic losses and 6 causalities; the 2014 flood has even affected an area recently hit by a disastrous earthquake.

The changes in flood risk reduction policies in Italy has been similarly driven by both disasters (Mysiak 2013) and European policies. Three big shifts in water (and flood risk) management can be identified:

- The *National Conference on Water*, with the aim to regulate water management and define National needs.

- After the 1966 disastrous flood, which occurred in North Italy and Tuscany, the first inter-ministerial Commission (called *De Marchi Commission*) was formed to «design principles of modern flood risk management in Italy, and to develop flood management standards tailor-made for the disaster-afflicted country» (Mysiak 2013:2884). The concept of River catchment plan was first conceived to manage rivers from the source to the sea at a catchment scale.

- Only 20 years afterwards, a National law was issued in order to manage water and flood risk, at a catchment scale, following principles close to the European guidelines outlined in the WFD and FD. In 1989, the law 183/89 foresaw: river basins as units of planning and management, the

[25] http://territorio.regione.emilia-romagna.it/notizie/notizie-2012/l2019uso-del-suolo-in-emilia-romagna-e-la-rigenerazione-urbana

subject of statutory flood risk, landslide risk and emergency plans. But these plans (called PAI, *piani di assetto idrogeologico*) have become effective only since the year 2000 (Mysiak 2013).

This reflected the aforementioned European change of paradigm, from a "flood defence" approach, based on the willingness to control natural resources (Rainaldi 2009), to a flood management and a flood risk governance paradigm, based on an integrated water resources and water basin management.

The 2007 FD has been implemented in Italy with the law 49 in 2010, resulting in the three principal steps: conducting a preliminary flood risk assessment by 2011, preparing flood hazard maps and flood risk maps by 2013, and defining Flood Risk Management Plans (FRMP) by 2015. A preliminary evaluation of flood hazard maps has been elaborated at different scale 1:10.000 and 1:25.000 for each hydrographic basin. Within this approach, risk maps are the result of the combination (using a risk matrix) between flood hazard maps and physical vulnerability.

For my research purposes, a map of main actors in flood risk governance in Italy can be outlined as follows. Due to the Po river being the main river in Italy, the risk governance framework of this area is peculiar:

- The Ministry for Environment, Territory and Sea Protection with an overall responsibility for environmental priorities and funding (National level).

- The Department for Civil Protection has legal responsibilities for emergency planning and operational responsibilities for flood warnings, information and emergency management. Furthermore, every mayor is in charge for Civil Protection for each Municipality (National/local level).

- The Po River Basin Authority (Autorità di Bacino del Fiume Po, ADBPO) develops flood risk maps and the Flood Risk Management Plan for main rivers. It has planning responsibilities and it is formed by members of the National Government, The Regional Council and Civil Protection (Inter-regional level).

- The Inter-Regional Agency for the Po River (Agenzia Inter-Regionale del Fiume Po, ex-Magistrato del Po, AIPO) has operational and project responsibilities for flood risk and maintenance of the Po river and all its tributaries, defined as "second class" rivers, i.e. mainly embanked ones (Inter-regional level)

- The Catchment Technical Service has planning responsibilities in terms of flood risk and water management for watercourses which are neither main rivers not "second class" rivers. They also contribute to develop the flood risk management plan delivered by the ADB PO (Regional level).

- The Internal drainage boards are public/private bodies which have operational responsibilities for drainage in plain and for drainage infrastructures (Regional/Provincial level)

- Irrigation Boards are private boards that manage drainage and water supply mainly in farming lands (Provincial/local level)

- The Municipalities haven't statutory or operational responsibilities in terms of flood risk. Anyway, their duty is to guarantee citizens safety and security and the mayor is the highest Civil Protection authority at local level, with statutory duties in case of emergencies (Local level)

As I'll show more in detail in the next chapter, scaling down to my Italian case study contexts, the main actors of the flood risk governance of the area are the Central Emilia Internal Drainage Board, the ER Regional Council, and The Po River Basin District. The latter is responsible for major river catchments of National relevance; the Emilia Romagna Regional Council is usually responsible for minor river catchment on hillside and mountain areas, jointly with the Central Emilia IDB in flat areas, which is usually responsible for surface runoff, irrigation and drainage. Due to Civil Protection duties, Italian Municipalities have also statutory obligations in terms of prevision, prevention and protection for the local community from all kind of hazards (including floods). Among the flood risk actors, the Po River Basin Authority (ADBPO) and the Inter-regional Po Agency (AIPO) weren't involved in the project, due to their statutory duties.

3.5 Some useful policy tools for an inclusive risk governance in context of natural flood management

In this last part, I will bring some examples in terms of current policy tools, which have been used or implemented in my two study areas to boost an inclusive flood risk governance framework. These tools are obviously implemented in the two flood risk management processes I will analyse in the next two chapters. They are inspired or are practical applications of Natural Flood Management (NFM) and of a river restoration approach applied to flood risk management within a governance framework.

As previously discussed for the English context as a consequence of major flood events, climate change adaptation and societal pressure, a sustainable flood management approach has emerged as a «philosophy which prioritises risk reduction through a range of measures that can include structural measures, but are more economically and environmentally sustainable than relying on structural measures alone» (Waylen *et al.* 2017). According to Wayen *et al.* (2017) this new approach was undertaken in England using related terms, such as "Making space for the river", "Working with Natural Processes", "Working with Nature", "Ecosystem-based Flood Risk Management" or "Engineering with Nature". Burgess-Gamble *et al.* (EA 2017), in a very recent report commissioned by the Environment Agency, refer to Natural Flood Management (NFM) as a term interchangeable with other notions, as reported in fig.1.

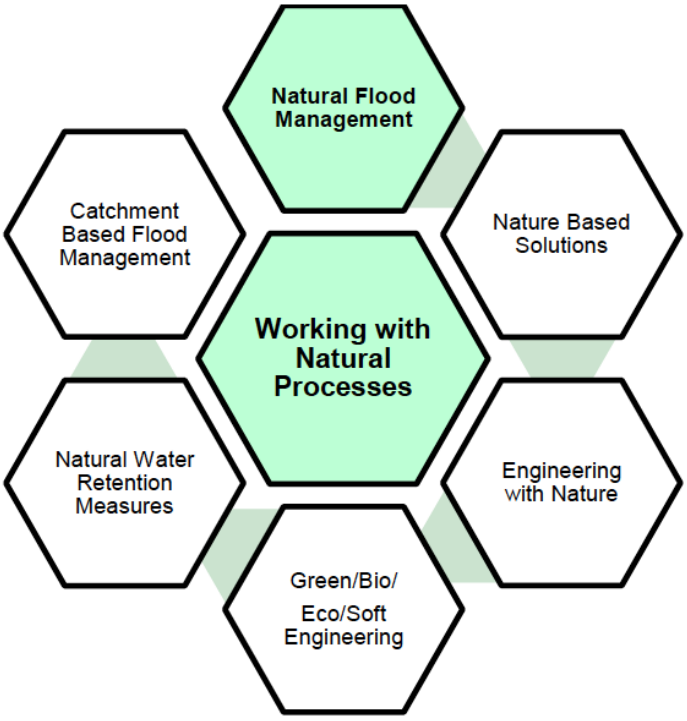

Figure 3. 4 Alternative terms to indicate Natural flood management (EA 2017)

The notion of "Working with Natural Process" (WWNP) is used as an inclusive term to outline the mission to «protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast» (EA 2017: 4). Alternatively, the concept of Natural Flood Management is also defined as a subset of *catchment-based flood management*, which tries to enhance socio-natural processes at catchment level to reduce flood hazard, while also sustaining or enhancing other potentially significant co-benefits. They also have «enhanced ecosystem services (aquatic, riparian and terrestrial) such as greater biodiversity, improved soil and water quality, carbon sequestration, reduced soil erosion, greater agricultural productivity and improved public health and well-being» (Dadson *et al.* 2017: 2). Common threads of this approach can be listed as follows:

- a catchment based approach
- natural processes emulation
- flood risk mitigation
- multiple benefits

Multiple benefits concern both ecosystem services and broad risk governance aspects. A report by SEPA (2016) was the first report ever issued, which pointed out NFM as a way «to encourage communities and land managers to come together and seek out solutions that they themselves can deliver» (Forbes *et al.* 2016: 7). The involvement of the different actors in land and water management at different levels thus constitutes a threshold for effectiveness to implement NFM from the understanding to the assessment, evaluation, planning and projecting: an effective co-management should be undertaken to overcome possible difficulties. Adaptation and learning by doing, situated practices and interactions, and hybridizing of knowledges are key policy recommendations put forward within what can be considered as a bioregional approach recently outlined by the EA within the "Working with Natural Process" scheme (EA. 2017). Having the EA an overall supervision and operational responsibilities in managing flood risk at National level, these advices could turn into policy tools or practical applications. Positive effects in having a catchment-based approach are described by the EA as follows:

- *«Plan and implement NFM measures at a catchment scale to tackle problems at source and fully realise opportunities.*
- *Think 'the whole is greater than the sum of its parts' – a catchment-wide network of interconnected measures has greater benefit than a small number of disparate features*
- *Think of WWNP as an 'adaptive buffer' – a means of making your catchment and your flood risk scheme adaptable and more resilient to the impacts of climate change*
- *Think 'source to sea' – there is always a 'downstream' below the location of your project.*
- *Integrate catchment management plans to achieve joint objectives and multiple long-term benefits to society.*
- *Work with others:*
    - *Engage with stakeholders and seek out experts to establish common ownership of problems and solutions, building active partnerships to help implement actions that will achieve shared objectives.*
- *Learn through doing:*
    - *Monitor the effectiveness of NFM measures so that the ability to design and implement measures that work can be improved while also filling research gaps*
    - *Share the learning (good, bad and ugly) with the wider WWNP community so that all can learn from each other's successes and mistakes» (EA 2017: 12)*

This integrated perspective for multiple benefits constitutes also the strength of the concept of nature-based solutions (Faivre *et al.* 2017), which has been turning into a widespread term in the EU Environmental policies and could be also applied to the works done in both my case studies. The first mention of the potential of natural solutions for flood risk management can be found in a note of the EU DG Environment: the search for the better environmental option, (including cost-benefit), which can have multiple benefits, triggered the idea that building dams and dykes (and rebuilding them where they've failed) results in being very costly, while:

> *«Best environmental options can thus be achieved by investing in Green Infrastructure, which combines the restoration of ecosystem functioning (such as the investment in water and carbon cycles and restoring connectivity) with the provision of a service (in particular for climate change adaptation and disaster prevention). Protecting upper catchment forests and restoring wetlands and water courses, as well as increasing soil water*

> *retention and groundwater recharge reduce the risks from climate-related floods and droughts, thereby protecting people's welfare and helping to minimise the loss of life, properties and other assets – all underpinned by integrated spatial management»* (EC 2011: 2)

Therefore, green infrastructures and Water Retention Measures, thanks to the work of the Water Information System for Europe, have been considered a way to manage flood in a more "natural way", resulting in what is now also referred to as Natural Flood Management: green infrastructures and natural water retention measures are examples of such measures[26]. This approach has been developed as a consequence of an interdiscursive ecosystemic approach in EU environmental protection and management policies. Indeed, the need to restore freshwater biodiversity, due to pollution and «major physical changes in the rivers, lakes and wetlands (resulting among others from straightening of the river beds, dredging, constructing levees, building weirs, dams and artificial water reservoirs for numerous purposes including flood control)» (EC 2011: 5) led to the 1992 EU Habitats (and then the 2009 Birds Directives) on the conservation of natural habitats and wild fauna and flora. Then, the river catchment[27] approach to water management foreseen by the WFD inspired an integrated water and flood risk management, which considered forestry, soil erosion, agriculture and the different ecosystems present in a river catchment. The river catchment so resulted both in the WFD and the FD as the minimum unit of management for the flood hazard maps and flood risk management plans.

Natural flood management is also the notion usually used in EU policies and by a very recent paper (Lane 2017) to refer to this kind of approach. EU defined Natural Flood Management a process that:

[26] In the Water Information System for Europe website these measures are so defines: «Natural Water Retention Measures (NWRM) are multi-functional measures that aim to protect and manage water resources using natural means and processes, therefore building up Green Infrastructure, for example, by restoring ecosystems and changing land use. NWRM have the potential to provide multiple benefits, including flood risk reduction, water quality improvement, groundwater recharge and habitat improvement. As such, they can help achieve the goals of key EU policies such as the Water Framework Directive (WFD), the Floods Directive (FD) and Habitats and Birds Directive»

[27] A river catchment is so defined by EU policies: «A hydrological catchment, also referred to as a drainage basin, river basin or watershed, is a unit of land in which all surface water is gathered into small watercourses and eventually into a single river channel at the outflow from the catchment. Catchments vary in size but all include an array of storage features including soils, wetland ecosystems, hollows and also a network of watercourses including ditches, streams and rivers»

«considers the hydrological processes across the whole catchment of a river or along a stretch of coast to identify where measures can best be applied, with a focus on increasing water retention capacities», such «as:

- restoring natural flows by realignment of coastal areas, or re-connection of rivers with their floodplain.
- restoration of wetlands which can store flood water and help "slow the flow" of flood waters.
- reservoirs in agricultural areas which can store flood water during flood events, and otherwise be high nature value areas.
- urban Green Infrastructure such as green spaces, sustainable urban drainage and green roofs» (EC 2016b)

Strong multiple benefits are acknowledged by the European Commission, which not really include societal benefit derived from community involvement and an inclusive risk governance approach, aspects that need still to be addressed, and will be partially in this research. The EC mention these aspects:

- maintaining and restoring biodiversity, by strengthening the functionality of ecosystems.
- provision of nature protection areas which can also be valuable for recreation and increasing life quality.
- improving water quality and restoring water resources.
- contributing to the development of a green economy by providing jobs and business opportunities in addition to environmental advantages.

This kind of approach is not explicitly mentioned in the FD Directive, but a deeper analysis of it, following the European Commission's note by the EU DG Environment on the opportunity to development better environmental options for flood risk management (EC 2011), shows that in Article 7 related issues are so addressed:

- Member States shall establish appropriate objectives for the management of flood risks for the areas identified … focusing on the reduction of potential adverse consequences of flooding for human health, the environment, cultural heritage and economic activity, and, if considered appropriate, on non-structural initiatives and/or on the reduction of the likelihood of flooding

- Flood risk management plans shall take into account relevant aspects such as costs and benefits, flood extent and flood conveyance routes and areas which have the potential to retain flood

water, such as natural floodplains, the environmental objectives of Article 4 of Directive 2000/60/EC, soil and water management, spatial planning, land use, nature conservation, navigation and port infrastructure

- Flood risk management plans may also include the promotion of sustainable land use practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event.

Therefore, Natural Flood Management turns into a "non-structural measure", which can be chosen at national level if considered "appropriate", as an ancillary role. Indeed, the use of nature measures, such as water retention areas or sustainable land use practices may be, but not shall be, included in flood risk management by Member States.

To conclude, due to the very recentness of this approach, I report here other terms, which have been using by different actors in different contexts. Lane (2017), reports the following ones:

- Natural Flood Management as defined by the Scottish branch WWF and the Scottish Environment Protection Agency, which recently published and handbook, defining NFM as «techniques that aim to work with natural hydrological and morphological processes, features and characteristics to manage the sources and pathways of flood waters. These techniques include the restoration, enhancement and alteration of natural features and characteristics, but exclude traditional flood defence engineering that works against or disrupts these natural processes'» (SEPA 2016: 1)

- Nature Based Solutions (NBS) is a very recent notion popular in both NGOs and International Organizations (e.g. in the International Union for the Conservation of Nature or within the European Commission's Horizon 2020 Societal Challenge 5 *Climate Action, Environment, Resource Efficiency and Raw Materials* programme). As already noted (Short *et al.* 2018), it is the latest in a number of terms that are beginning to influence policy debates on urban regeneration, responses to climate change as well as nature conservation. They describe «the restoration of natural ecosystem functions to enable holistic environmental management, including flood risk» (Lane 2017: 5). Furthermore, it can enhance «the use of biodiversity by society in a sustainable manner while also integrating social factors such as socio-economic development and effective governance» (Short *et al.* 2018).

- Different initiatives or policies have undertaken flood risk scheme working with nature and/or within a river catchment approach, such as the 1900s Dutch "Room for the river" approach, one of the first ever recorded of this kind. The Dutch initiative *Building with Water*, the English policy *Making Space with water*, that advocates a catchment approach to flood risk management, including rural land management.

Indeed, in my Italian case study, a broader approach was at stake to manage flood risk with "soft-engineering structures". What is usually defined as a river restoration approach (Regione Emilia-Romagna 2015; ECRR 2017) was implemented to get an integrated hydraulic and environmental river restoration to both reduce flood risk and improve water quality and the ecological status. Indeed, river restoration usually refers to

> *«a large variety of ecological, physical, spatial and management measures and practices. These are aimed at restoring the natural state and functioning of the river system in support of biodiversity, recreation, flood management and landscape development»* (ECRR 2017:1)

The idea is that restoring natural conditions will improve the whole "resilience" of the "river system" (ECRR 2017). The inspiring principles are close to Natural flood management but more linked to water management and the Water Framework Directive. Indeed, the LIFE RII project, as I will show in the next chapters, had the aim to implement FD and WFD jointly, by implementing river restoration techniques to the minor water network, in order to manage flood risk in an integrated way. This will practically result in Natural Flood Management techniques, even if the catchment scale hasn't been so precisely defined.

"Participation" was also a big issue to implement these techniques with a flood risk governance approach in Emilia Romagna. Following the European guidelines mentioned in the FD, Emilia Romagna arranged a three-year regional participatory process (called *Seinonda*[28]), to «ensure consultation and active participation on flood risk, sharing knowledges and responsibilities and enhancing the awareness of involved subjects» (Franceschini *et al.* 2016: 16). Focusing on communication and different participatory methods (on-line and off-line), this project aimed to:

- «make available for citizens and institutions/associations the hazard and risk maps;

[28] Available on line: http://partecipazione.regione.emilia-romagna.it/iopartecipo/valutazione-e-gestione-del-rischio-di-alluvioni/verso-il-piano-di-gestione-del-rischio-di-alluvioni

- ensure and encourage the involvement of citizens and institutions/associations in every phase;
- educate for "right" actions and behaviours in case of flooding;
- collect suggestions for possible mitigation measures in the definition and elaboration of the Plan;
- to create useful partnership among involved actors» (Franceschini *et al.* 2016: 16).

This participatory tool clearly inspired the LIFE RII project as a way to engage with local actors in flood risk governance as played out in the context of natural flood management. The participatory method to manage the meetings of the project (the EASW technique, discussed in the next chapter) was the same used in the LIFE RII project, too. Indeed, since 1993 Emilia Romagna has been promoting and supporting actions and plans for landscape protection and enhancement at local level; since 2000 it adopted integrated and experimental projects provided by the Regional Territorial and Landscape Plan (PTRP, *Piano territoriale paesistico regionale*) and the Regional law 20/2000 on protection and land use: the PTRP highlighted how the physical and environmental characteristics of an area are historical landmarks for local development models based on local cultures and local economies (Bastiani 2011). These projects are now more and more integrated in terms of actors involved and areas of interventions. The rivers turned into a sort of "structural invariants" in the morphology, landscape and local development of this Region, working as catalysts of projects for the whole territory (Bastiani 2011). Following this path, the emergence of a participatory toll, called "river contract" took the form of landscape-river contracts, in which different instances and planning experiences converged into a holistic perspective for local communities. This policy toll, called *river contract* was also one of the results the LIFE RII project led to. A river contract can be defined as a «voluntary agreement, attributable to the negotiated strategic planning, which provides a broad mobilization of local actors, in order to identify a shared action plan aimed at addressing environmental problems of a river basin, according to an integrated approach to multidisciplinary» (Bastiani 2011:4). River contracts were favoured by the spreading of environmental and ecological education in France in the 80's: the increasing awareness of the "local" dimension and the willingness to take actions locally (Bastiani 2011, Calandra 2012a) and be involved in democratic processes went together with the new European policy framework inspired by the WFD and FD but also in the *Public access to Environmental information* Directive (2003/4/CE) and in the 2000 European Landscape Convention. River contracts have the potential to provide a system of rules where «public utility, economic performance, social value, sustainability equally interact to find solutions for the river basin

regeneration» (Bastiani 2011:5). Main objectives of river contracts are to tackle «security, mitigation and risk prevention, environmental balance and landscape improvement, sustainable use of resources, sustainable tourism, to spread the culture of water (Carta Nazionale dei Contratti di Fiume, 2010:2[29]). Flood risk reduction and water management are thus deemed as the same aspects of a common governance process for «the transformation of the river basin areas that refers to an eco-system approach [that] should leverage on the responsibility of society, which recognizes in the basin the matrix of its own cultural identity» (Carta Nazionale dei Contratti di Fiume, 2010:2). A National Committee of River Contracts has been established in 2008 to coordinate a common effort at national level; the Ninth National Meeting in Venice was entirely dedicated to flood risk: "A pact for our rivers: from emergency politics to prevention". The following map[30] shows the distribution of river contracts in Italy in 2013.

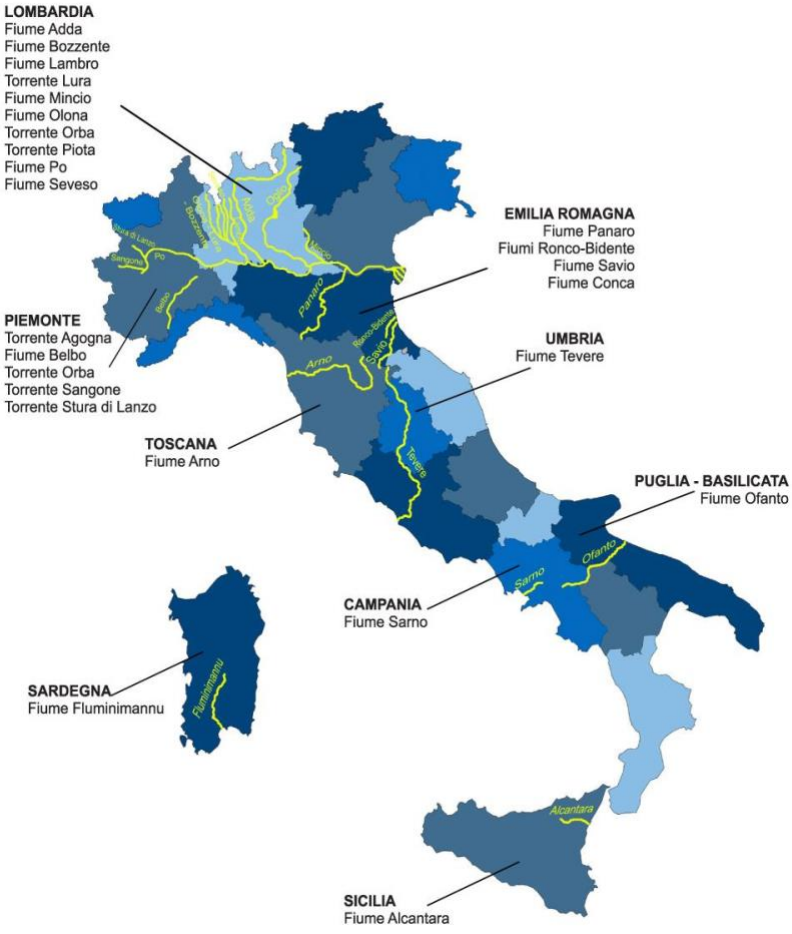

Figure 3. 5 The distribution of river contracts in Italy sorted by Region in 2013

[29] Available at the following website: http://ambiente.regione.emilia-romagna.it/notizie-daisiti/allegati/carta_contratti_di_fiume (accessed on 10th September, 2016).
[30] Available at the following website: http://blog.zonageografia.scuola.com/2013/il-monviso-nuova-riserva-della-biosfera-unesco/

In 2013, 24 river contracts have been undertaken, mainly in the North of the country (19 river contracts) and four have been carried out in the Emilia Romagna Region. Concernign my research, the LIFE RII project was the first participatory process in Italy which has led to a river contract to mitigate flood risk, as I'll explain in the next chapter. Indeed, flood risk was never meant to be the driver of a participatory process within an inclusive risk governance approach in Italy.

In the next chapter I will describe in detail the flood risk management processes I considered as case studies for my research. Before doing this, I will outline my research problem and the methodological issues concerning my research design.

CHAPTER 4

4. Methodology, Research design and Case-studies description

4.1 The research design: methods, techniques and constraints

As mentioned in the first chapter, Disaster Research in social sciences has been linked to qualitative research since the beginning of this field. As pointed out by Phillips (2014) and, in the Italian context, by Olori (2015), qualitative research triggered Disaster Research, and the number of qualitative studies in this field is dominant. Generally being the context what can differentiate qualitative Disaster Research from general qualitative ones (Phillips 2014), the context itself is what requires having «flexible research designs and creative researchers able to gain entrée and gather meaningful data» (Phillips 2004: 3). Indeed, the disruption of general assets and livelihood makes difficult to have reliable data and comparable case studies, being a disaster a process resulting in complex and sometimes unique consequences. The same is required in considering risk management and governance strongly linked to socio-cultural processes, as argued in chapter 1 and 2. When looking at risk and disasters from a broader social science perspective, risk is deeply linked to structural problems of societies, and disaster risk reduction measures couldn't be found only in hazard reduction ones (Forino & Carnelli 2017). Since risk can be seen as «the product of the interaction between an extreme event (or more often a series of processes) and a context determined by its socio-economics relations, political changes and local cultures» (Forino & Carnelli 2017), a core question is «which idea of future one community builds upon risk management and what kind of solution one choses to mitigate it» (Carnelli & Ventura 2015: 10). Another key aspect is again the local *situatedness*/context of disasters, which can explain «the interaction between biopsychical and social variables, which are also strongly connected» (Mela *et al.* 2016: 17). To understand these kinds of key issues it is necessary a strong qualitative perspective, which, like the constructivist approach, can understand that «a "risk" (or a hazard, treat or danger) is a product of historically, socially and politically contingent "ways of seeing"» (Lupton 1999:36). This is necessary to face the "knowing more and losing more" (Weichselgartner & Obersteiner 2002) paradox in

disaster research literature, as mentioned in previous chapters: despite an immense growth of risk-related knowledge systems (and policies, I would add), Weichselgartner and Pigeon (2015) noted that insufficient progress has been made in converting research findings into practical DRM applications. In parallel, as already argued, a convergence in academic literature and International and national policies and reports has been bringing out the need to engage with local actors and acknowledge for local knowledges in risk management.

The focus on local knowledge was justified by four reasons, at least. The fact that few researchers have pointed out how to use this notion within a risk governance framework and it is relatively unexplored in natural flood management processes; second, its characteristics can account for the different perspectives of the actors engaged within risk governance and give some feedback on practical applications in terms of socio-centric approaches to DRR. Third, as seen, the notion of local knowledge was the subject of public debate after major disasters in the Countries of my study sites. Furthermore, natural flood management process can't be undertaken without the use of local knowledges, so "local knowledge" works as a threshold for effectiveness. Then, I chose flood risk to analyze this kind of issue for four reasons, at least. First of all, flood risk is often deemed by environmental scientist as a "known risk" but paradoxically floods are the most frequently experienced disasters in Europe flooding (Green *et al.* 2013). Secondly, water-related disasters are expected to increase in number. Thirdly, considering other kinds of risks, flood risk is more suitable for a case study research, due to its frequency and less devastating impact if compared to seismic risk, for instance. Fourthly, the 2007 FD gave me the extraordinary opportunity to have a common risk policy framework. In practice, my research design started from the 2007 FD, which provided an integrated management approach to flood risk management. As seen, in order to include local knowledges, it is necessary to downscale the analysis, define flood the risk actors involved at regional and local level, which type of knowledges they are referring to and how this knowledge interacts with local risk management practices and local knowledge in local areas. To grab my research problem, the unit of analysis must be the local context, where to identify the natural flood management projects working as best practices in different National contexts, so to have an instrumental (and some explanatory) weight within a European framework in context of natural flood management. In the logic of a multiple case-study approach, the two natural flood management processes worked as real-world scenarios where "local knowledge" and "risk governance" are essential notions to be faced to make these processes "real" and effective. Therefore, I identified a research questions and four research questions with an inductive qualitative approach, which, as outlined by Phillips (2014), can:

- «Look at the meanings produced by social actors through social interactions, that "the whole is more than the sum of its parts» (Phillips 2014: 4).

- Understand both the broader context and the specific acts.

- Interpret actor's behaviours.

- Be not deterministic, rather use non-standardized techniques, being it emergent, flexible.

Furthermore, since many qualitative disaster studies are undertaken after the impact of a hazard, that is in the emergency, recovery or reconstruction phases (Phillips 2014), few research deal with the notion of risk before a disaster occurred (Carnelli & Ventura 2015). Very recent studies have been dealing with the engagement of stakeholders and local actors in flood risk management (Dekens 2007; Shaw *et al.* 2009; Newig *et al.* 2014; Challies *et al.* 2016; Evers *et al.* 2016; Thaler & Levin-Keital 2016) and few focusing on the integration of local knowledge for risk and disaster management (Hiwasaki *et al.* 2014; Mercer *et al.* 2010; Shaw *et al.* 2008, 2009; Gaillard & Mercer 2012; Mercer *et al.* 2010). Only recent studies are deeply exploring the integration of different knowledges and actors in natural flood management processes (Howgate 2009; Kabisch *et al.* 2016; Nesshöver *et al.* 2017; Short *et al.* 2018). Being flood risk governance a recent issue both in policies and in academic research, and being risk a quite complex and vague concept, this research is quite experimental: the researcher should act as an interpretative *bricoleur*, who «produces a bricolage, that is, a pieced-together set of representations that are fitted to the specifics of a complex situation» (Denzin & Lincoln 2018:11) - complexity is an essential aspect of risk, with ambiguity and uncertainty, as well. Therefore, my main research question has an instrumental, descriptive and partially explanatory aim. It can provide new insights to delve into still unexplored issues if referred to local knowledge within risk governance as played out in the context of natural flood management:

- How can local knowledges be integrated into natural flood management processes within a flood risk governance framework?

First of all, to answer this question is relevant to understand why the need for local knowledge emerged in the study site. Indeed, as mentioned in the introduction, a convergence in policies, research and practices on the need for local knowledges can be found in flood risk management processes (Gaillard & Mercer 2012; Haughton *et al.* 2015), but additional research and study sites are needed to bring examples around motivations and needs based on local contexts, above all for natural flood management processes (Howgate *et al.* 2009; Short *et al.* 2018). Furthermore, the integration of local knowledges, as discussed in chapter 2, needs a process of identification/production, evaluation, sharing and implementation (Raymond *et al.* 2010) not always visible to all actors (or, alternatively, they may not be aware of it) and/or in the outcome of a process, which can be not always linear (Renn 2008). Furthermore, even if it's clear the necessity of landowners' cooperation for undertaking natural flood management (Howgate *et al.* 2009; Short *et al.* 2018), my lens through which natural flood management has been analyzed (i.e. flood risk governance) implies that the engaged actors can/should vary according to the type of risk to be faced, i.e. its complexity, ambiguity and uncertainty (Renn 2008; Van Asselt & Renn 2011) – as discussed in chapter 1. Therefore, my research sub-questions were identified as follows:

- Why is there the need to include local knowledges in the project and which conditions triggered the local process?
- Who are the actors involved?
- How are local knowledges produced and included in the project? Who are the bearers?
- How are local knowledges implemented and visible in the outcome of the local project?

To conclude this part, I'll argue why I chose a case-study approach. First of all, according to Yin's theorizing of case study research, my research design fits a case study approach because:

- I need to answer to a "how" research question
- I couldn't control the events on going in my study sites
- Contemporary phenomena were ongoing in real-life contexts.

The comparison of the two case studies derived from the need to use the case studies as "grounded in the lived reality" to get a comparable "real-world" scenario within a common-but-different risk governance framework (Hodkinson & Hodkinson 2001). This approach was

used to understand "complex inter-relationships" (Hodkinson & Hodkinson 2001) in an instrumental and descriptive way (Yin 1994; Baxter & Jack 2008; Schwandt & Gates 2018). With "instrumental" I mean a case study which is «looked at in depth, its contexts scrutinized, its ordinary activities detailed» because «it helps the researcher pursue the external interest», but it «may or may not be seen as typical of other cases» (Baxter & Jack 2008: 548), playing a supportive role to understand something else. More generally, four purposes can be identified in choosing a case study approach (Schwandt & Gates 2018), that is for:

- Description
- Hypothesis generation or theory development
- Hypothesis and theory testing
- Development of normative theory

Being my research one of the first of this kind, my main purpose was first description and then a theory development/testing. Using case studies for description usually aims at developing a detail picture of a phenomenon and to give voice to marginalized/excluded/vulnerable (Schwandt & Gates 2018). Both purposes have been achieved, considering in my case studies the "excluded ones" as who are partially/not included in DRR policies or usually only mentioned. Furthermore, they were thought as instrumental and partially explanatory case studies not with the intention to systematically generalize the results, rather to find commonalities to generate hypothesis to have some practical DRM applications.

So, my case studies have been chosen for several reasons. First of all, they should focus on flood risk management within a flood risk governance framework, engaging with local actors. Secondly, they should work as "best practice", due to my instrumental and explanatory intentions. Thirdly, the process should have been completed or got some relevant results in terms of interventions undertaken, but being the FD issued in 2007 and implemented at National level in 2010, it was not easy at all. Fourthly, I was obviously looking for projects where engineering solutions weren't considered, rather initiatives were inspired by local knowledges or clearly included them: my interest was also to unpack the concept, so I needed to find projects where local knowledges were clearly mentioned or widely used, such as natural flood management processes. Another constraint was European Union, since my idea was to find possible commonalities and policy suggestions within a shared flood risk governance framework, as the one defined in the 2007 FD. So, considering my language competencies, I

had to choose a case study in an English, Italian or German-speaking EU Country, thus located in the UK, Malta, Italy, Germany and Austria. Indeed, one of the requirements of my PhD board was the need to have two case studies in two different Countries, in order to have a comparison at European level; this need went together with having the opportunity to compare two different-but-similar flood risk governance frameworks, aiming at finding commonalities as played out in context of natural flood management. Furthermore, other requirements were put forward by me: to have a similar geomorphological environment, a similar built environment and, ideally, not being affected by a flood. One and a half year ago it was very difficult to find such projects, which were completed and have engaged with local people right on flood risk, since flood risk – though considered a "known" risk – was not usually an issue of public engagement, as it is now. Many recent projects have been dealing with environmental issues or water quality/management, such as some river contracts in Italy (see chapter three) or many small initiatives of Sustainable drainage systems in urban areas in England. Since the former were mainly participatory processes but not on flood risk, for the latter it usually happened often the opposite. After a review of some case studies in Italy and in the UK, an implicit constraint was that the two projects shall have occurred in the same time span, that is in the last six/seven years. So, I've first found a case study who perfectly fitted into my requirements a project called *Slowing the flow*[31], which took place in Pickering and was driven by EA, local Council and the University of Oxford, engaging the community. After contacting prof. Whatmore, she suggested me to avoid using it as a case study, due to a severe "research fatigue" suffered from the town of Pickering, becoming it the "go to" place to study flooding. In the meantime, I had found a possible case study in Italy and contacted the main actors. Even if also here the project was driven by the impact of a recent flood, this case study (*Con la trebbia* river contract) had some results and involved local actors in some small towns in the Apennines area of the Emilia-Romagna Region. Finally, a natural flood management project, the Rural Sustainable Drainage System (RSUDS) ongoing in Stroud (Gloucestershire), which was suggested by prof. Whatmore, fitted almost all my requirements, being it in England[32], being locally driven in a small town, including stakeholder's engagement and diverse governance levels, having completed a significant amount of interventions and explicitly mentioning and using local knowledge. Unfortunately, the participatory project ongoing in Italy was partially interrupted during the 2016. So, I finally managed to find a LIFE + project

[31] Cf. http://welcometopickering.co.uk/about-pickering/about-the-town/slowing-the-flow/
[32] The Brexit referendum hadn't taken place yet at that time.

in the same region, which was likely a natural flood management project and the engaging of local actors was strongly required. Furthermore, the municipalities involved in the project are little towns, so comparable with Stroud and geomorphological characteristics were similar, too. Also, an initial ideal requirement was now fulfilled, that is the absence of a major flood triggering the LIFE RII, even if I had some doubts about comparing a European project with a local one. A deeper analysis of these case studies make me think it was almost impossible to find a community-driven project on flood risk, which wasn't strictly event-driven. The opportunity to compare a community and event-driven project like the Stroud one with a top-down one, which took place in a similar environmental context without a major flood triggering it, could thus unveil relevant implications on the integration of local knowledges into flood risk governance. Indeed, if the two case studies differ for two –and not one, as it is usually suggested for a strict comparison with explanatory intentions, cf. Pickvance 2005 – requirements, these are quite enough for instrumental intentions. Furthermore, due to a strong link between a major flood event and being flood risk an issue of public debate and policy actions at all levels (see chapter two), comparing a top-down project with no major flood events and an event/community-driven that followed a major event can also work as an explanatory attempt, due to their being both natural flood management projects. Moreover, the use of similar nature-based solutions (Faivre *et al.* 2017) in both case studies created unique positive links among the two case studies in terms of local knowledge.

Due to the experimental and instrumental character of my research, in acting as an interpretative *bricoleur*, I intertwined four research methods within the case study method. I'll argue here why I chose the following methods and data analysis techniques: interviewing, document analysis, focused observation and visual notes as methods; thematic and critical discourse analysis as data analysis techniques.

Interviewing was used both as a research instrument and a social practice (Brinkmann 2018). I've opted for semi-structured interviews as a way to build a «conversational partnership in which researchers and interviewees work together to produce meaningful information» (Phillips 2014: 87), in order to shed light in meaning constructions, relationships building, governance dynamics and practices. Indeed, by interviewing, the researcher can reach «areas of reality that would otherwise remain inaccessible» and overcome distances both in space and time (Peräkylä & Ruusuvuori 2018: 669). Life histories or in-depth interviews were partially suitable because my aim was specific: I had to unpack meanings, and piece them together to point out relationships, dynamics and practices for specific aims. Indeed, I've also undertaken in-depth interviews with key actors, above all in the English context, due to the need to

reconstruct the history of the project I've analysed: no official documents, which describe the process stages, exist. Being the Italian case study a European project, much more documents were available. Anyway, every single actor's perspective was important, so semi-structured interviews were necessary to account for the different perspectives at stake, following my interview guide (in the Appendix), which reflected my research and concept frameworks. As I'll better explain in the next paragraph, I outlined the actor's map for each case studies and I have undertaken 44 semi-structured interviewees, 22 for each case study. The field was first accessed by contacting the two project leaders in both case studies. Through them and through the actors identified in the map, the whole sample has been reached. Mainly between mid-October 2016 and June 2017, I spent around 6 weeks in the towns included in the Italian project and around 9 weeks in the town of the English one[33]: I had three visits in each context, alternating my stay in the two case studies to better adjust and standardise my data collection. During my field trips, I've also undertaken focused ethnography, walking interviews and I took visual notes. Indeed, as argued in the previous two chapters, from one point the relationships with water, the watercourses, the environment, built environment and local places are essential, and practices as well. Due to time constraints and the impossibility to undertake a classic participant observation in both case studies (6 months for each case study is usually the minimum for this kind of method), focused ethnography gave me the opportunity to «focus on a specific and defined element…analysing specific actions, interactions and social contexts, which referred to a broader context»[34] (De Lillo 2010:47). This method has been mostly applied to disentangle the various component of local knowledge and risk as well. It was supported by walking interviews, a recent emerging method. Regarding this method, most geographers and some sociologists (Kusenbach 2003; Anderson 2004; Jones *et al.* 2008; Carpiano 2009; Clark & Emmel 2010; Evans & Jones 2011) had already shown the power of walking interviews and the prompting role of space and built environment in influencing the interview. Evans and Jones (2011) depicted a typology of walking interviews considering the determination of the route and the familiarity with the area: if the route is determined by the interviewee who knows well the area we can speak about go-alongs (Kusenbach 2003; Carpiano 2009) or participatory walking interviews, and we could use even GPS technology to precisely trace and relate places and subjects (Jones *et al.* 2008; Evans & Jones 2011); when it is undetermined (Anderson 2004) we can call these interviews "bimbles"[4]. In a research with

[33] More time was needed due to the language and the lack of official documents about the project
[34] Translation by the author

the aim of testing the effectiveness of walking interviews, Evans and Jones argued how in walking interviews, places are mentioned more spontaneously and described more in detail, diminishing interviewer requests and pressure on the interviewee; on the contrary, they noticed that in classic interviews some places are described different than they are in reality and «approximately 7% of places mentioned in each interview sample no longer existed» (Evans & Jones 2011: 856); hence sedentary interviews seem to «take a biographical format and thus might have been expected to produce more historical places than either no longer exist» (Evans & Jones 2011: 856). Furthermore, according to Clark and Emmel (2010) this kind of method «can afford participants a greater degree of control over the research process, deciding where to take the researcher for example» (Clark & Emmel 2010: 2) and increases «opportunities for the serendipitous and the unanticipated» (Clark & Emmel 2010: 2). While it also permits to redefine tacit and daily concepts (as the ones linked to local knowledge) by disentangling them. Due to it being a time-consuming method, local actors (such as land owners, NGO or FAG representatives, IDB and local officers) were keener on this method than policy-makers or Regional and National institutional actors. Therefore, go-along and some «bimbles» were the type of walking interviews I've carried out, resulting in around one third of my sample. To collect the result of these interviews and visual notes, I've used an on-line application installed on my smartphone, called *One Note*. With this software, I got the opportunity to collect at the same time writing notes, recordings and pictures, by taking down simultaneously these different media on the same virtual space.

Pictures and visual notes, mainly produced by me, were used to make more understandable the object of the focused ethnography and as a way to translate walking interviews into a text: they are not presented and analyzed as visual data, rather as ethnographic notes driven by my research questions. Indeed, non-discursive practices contributed to unveil the *situatedness* and implementation of local knowledges and allowed me to touch with hands causes and effects of risks, as they are mental images or beliefs, not immediately visible unless in their disastrous consequences, i.e. when risk had turned into a disaster.

About my last method, document analysis, I've obviously tried to get more documents as possible, in order to understand policies, processes and local contexts. I've collected local and national media, policy documents at European, National, Regional and local level, surveys and reports on flood risk, flood risk management and governance issued by the different agencies, relevant National, Regional/County and local laws, plus every kind of available minutes or reports of meetings related to the two projects. The Italian project was particularly rich in documents and assessment.

To analyze my data, I've undertaken both a classic thematic analysis and a critical discourse analysis to undertake a descriptive, exploratory and explanatory analysis. The thematic analysis was conducted on main documents, and classic and walking-interviews. Interviews were transcribed and manually coded to ensure anonymity, then useful excerpts will be reported[35] into the data analysis (mainly chapter 5 and 6). Excerpts from the interviews and from any kind of relevant documents were also analyzed using critical discourse analysis, when relevant and possible. As known, discourse analysis may refer to different approaches of analysis of written and spoken texts (Titscher *et al.* 2000; Gee 2011; Wodak & Meyer 2009a; Wodak & Meyer 2009b; Peräkylä & Ruusuvuori 2018), which aims at «uncovering the features of text that maintain coherence in units larger than sentence (Peräkylä & Ruusuvuori 2018: 672). The choice and use of excerpts in the data analysis chapters reflects the idea to report discourses to be analysed. Discourse can be defined as «a form of "social practice"», which

> *«implies a dialectical relationship between a particular discursive event and the situation(s), institutions(s), and social structure(s), which frame it: the discursive event is shaped by them, but it also shapes them. That is, a discourse is socially constitutive as well as socially conditioned – it constitutes situations, objects of knowledge, and the social identities of the relationships between people and groups of people» (Fairclough & Wodak 1997: 258 cited in Wodak & Meyer 2009a: 5-6).*

This is a definition provided following the discourse-historical approach (DHA) of Critical discourse analysis (CDA), mainly used to focus on the field of politics to develop conceptual frameworks for political discourses (Wodak & Meyer 2009a). My interest in this kind of approach was more likely as an analytical tool than a methodological one. Since it's well known that CDA «does not constitute a well-defined empirical methodology, but rather a bulk of approaches with theoretical similarities» (Wodak & Meyer 2009a: 27), I've opted for a light version of DHA in order to identify how discourses constitutes relationships and knowledges and vice versa. Indeed, as seen in chapter two, risk and knowledge are peculiar research objects: they don't really exist "out here" and deep strategies of analysis should be found to proper analyze them. DHA is suitable to the extent to which it is three-dimensional, allowing the researchers to identify:

[35] Verbatim transcription has been used only when this is relevant for my research purposes

- the main *topos* carried by the discourse
- what the social actor claims and though which discursive strategies
- and eventually which linguistic token are used to constitute the discourse, through texts and contexts (Reisigl & Wodak 2009).

To conclude this part, I'll try to put forward some possible methodological constraints of my research. First of all, to ensure a richer and stronger constructivist perspective a longer and proper fieldwork could have been undertaken, but time constraints due to the PhD structure hadn't made it possible. Second, the choice of the case studies has been forced by the lack of real-world examples strictly dealing with flood risk governance. Two similar projects (i.e. both top-down or in the same Country) could have given a broad explanatory power to my work, due to a greater control of all variables. The fact that the Stroud project was triggered by many factors, which can be traced back to the 2007 flood and therefore it is impossible to fully account for them. Alternatively, by using the selected research methods (in particular, walking interviews and critical discourse analysis) and my epistemological approach I tried, and I think I managed, to analyse and deepen as many factors as possible. Indeed, the two case-studies shared natural flood management as a similar way to manage flood risk: this has made possible to have a common scenario, where "real-world" differences have indeed enriched my findings to theoretically cover two possible ways of acting with similar consequences. In the next paragraphs, I will describe the two case-studies' contexts, reconstructing the local contexts and dynamics, and the local governance frameworks through the actors interviewed.

4.2 The two case studies: actors, local contexts and dynamics

The choice of the interviewees reflected three main criteria. First, their engagement in the project. Second, their vertical risk governance level. Third, their horizontal governance level, and their role in making or not the works in practice. So, after having outlined a map of the actor involved in the two projects, I've successfully tried to have an actor for every vertical level, from the National to the Interregional, County/Regional, Local and very local one. As

shown in tables 1 and 2, I got in England: 2 National actors, 3(4)[36] Regional, 3 County, 4 District and 10(11) local; while in Italy: 2 National actors, 4(5) Regional, 3(4) Provincial, 5 Municipal, 8 local. Being the English context driven by one District council, while the Italian one by the Regional Council with four different Municipalities, I think I've got a balanced number of actors from a vertical governance perspective. Furthermore, some governance levels weren't involved in the project, mostly due to different duties/competencies – such as GV1E, CC1E, DB1E and GV1I GV2I, IB1I (tab. 4.1 and 4.2). Being them actors in key agencies for flood risk management in the area, I chose to interview them to give a better picture of the risk governance framework in the area. To explain my choice in terms of horizontal governance and outline who are the interviewees and which role they had in the project, I will describe now in two different subparagraphs the local contexts and local dynamics ongoing in the two projects.

[36] Since some actors have double roles, I put in brackets the sum of all roles

Code	*Governance Level*	*Agency/Type*	*Role*	*Length*
DC1E	District/Local	Stroud DC – Env. Health Office + Ruscombe Brook Action Group	Project leader + FAG chair	3:04’
DC2E	District/Local	Stroud DC – Env. Health Office	Water resource engineer	52’
DC3E	District/Local	Stroud DC – Env. Health Office	Chief	1:19’
DC4E	District/Local	Stroud DC	Steering Group Chair	1:06’
PS1E	Local/Parish	Woodchester Parish	Clerk	43’
CC1E	County	Gloucestershire County Council	Flood Risk manager	57’
RC1E	Regional/County	Severn and Wye Regional Flood and Coastal Committee/GCC/IDB	Councillor	1:35’
EA1E	Regional	Environment Agency	Env. Programming Adviser	1:56’
DB1E	Regional	Lower Severn IDB	Chair	32’
GV1E	National	House of Commons	Local MP	45’
GV2E	National	Local Nature Partnership	Former Chief Executive Countryside Com.	58’
FG1E	County/Local	Slad Flood Action Group/GCC	Councillor + FAG chair	1:58’
FG2E	Local	Painswick Stream Management Group	FAG chair	1:05’
FG3E	Local	Chalford River Group	FAG chair	46'
FG4E	Local	Brigend Against Flood Risk	FAG chair	3:12’
NG1E	Local	Water 21 NGO	Local water expert	2:05’
NG2E	Local/National	National Trust NGO	Local Ranger	53’
LC1E	Local	Slad FAG + flooded inhabitant	FAG Secretary	1:42’
LC2E	Local	Local hydrologist	Consultant	55’
FA1E	Local	Wickstreet Farm	Farmer	44’
LO1E	Local	Landowner	Landowner	46’
CT1E	Local	Contractor	Contractor	21’

Table 4. 2 A list of the interviewees with their role in the project and in flood risk governance in the English case study. The length of the interview is also reported.

Code	*Governance Level*	*Agency/Type*	*Role*	*Lenght*
DC1I	Municipal/Local	Quattro Castella Municipality	Environment, energy, heritage, development and civil protection Councillor	31’
DC2I	Municipal/Local	Quattro Castella Municipality	Environment Officer	38’
DC3I	Municipal/Local	San Polo d’Enza Municipality	Environment and Green areas Officer	1:05’
DC4I	Municipal/Local	Albinea Municipality	Environment Office Manager	21’
DC5I	Municipal/Local	Bibbiano Municipality	Natural and built Heritage Office Manager	20’
CC1I	Regional	Emilia-Romagna Region	Project leader/ Drainage and irrigation projects Office manager	2:12’
CC2I	Regional	Emilia-Romagna Region	Hydraulic and hydrogeological project officer	25’
CC3I	Regional	Emilia-Romagna Region	Soil and costal protection, civil protection and environment policies Councillor	37’
GV1I	Inter-regional/National	Po River Basin Authority	Risk management officer	55’
GV2I	Inter-regional/ National	Inter-regional Po River Agency	Environmental issues officer	1:01’
DB1I	Provincial	Central Emilia IDB	Agro-forestry area Manager	34’
DB2I	Provincial	Central Emilia IDB	Agro-forestry area Officer	2:15’
DB3I	Provincial	Central Emilia IDB	Coordinator of “Dugaroli” (see ch. 6)	1:35’
IB1I	Local	Bibbiano Irrigation Board	Chair	26’
NG1I	Local/Regional	CIRF (National River Restoration NGO)/ Central Emilia IDB	Project manager, consultant and CIRF Regional chair	1:06’
NG2I	Local	Legambiente (NGO)	Local associate member	1:27’

NG3I	Local/Provincial	LIPU (NGO)	Provincial Chair	42’
NG4I	Local	Pronatura/Local education centre on natural environemnt	Local associate member	1:14’
NG5I	Local	Amici del Bianello (local NGO)/ Landowner	Associate Members and local landowners	1:25’
NG6I	Local	Guardie Ecologiche Volontarie (NGO)	Provincial chair	1:00’
LO1I	Local	Landowner/Legambiente NGO	Provincial Chair	1:43’
FA1I	Provincial	CIA – Italian Association Farmers	Provincial Chair	42’

Table 4. 3 A list of the interviewees with their role in the project and in flood risk governance in the Italian case study. The length of the interview is also reported.

4.2.1 The RSUDS Project in Gloucestershire (United Kingdom)

The study site is located in Stroud in South West England, in a protected lowland landscape of permanent pasture and broadleaved woodland in steep valleys and arable and pasture on upper plateau. Based on the Köppen-Geiger climate classification, this area has an oceanic climate with cool winters and warmer summers, with precipitation all year long, more often in winter (mean annual rainfall is 679mm, up to 2000mm in higher ground). Climate change is expected to increase the winter precipitation and result in more extreme events.

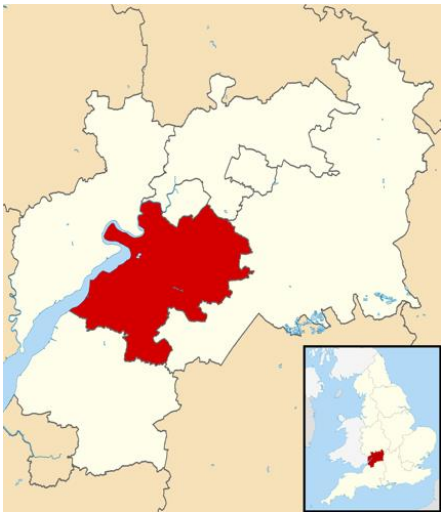

Figure 4. 1 Stroud District Council area in Gloucestershire County (left) and location of Gloucestershire in the United Kingdom

The River Frome flows in this area and its catchment covers 260km² and flows directly into the lower reaches of the River Severn. For centuries, the Frome catchment has been used for drinking water, agricultural and industrial purposes, which has inevitably resulted in numerous modifications to manipulate and control flow. The Lower Frome through Stroud and Stonehouse remains heavily industrialised and there is increasing and ongoing residential development of former industrial sites and mill buildings. There are also many complex interactions between the Frome, its tributaries, springs and the Stroudwater Canal. The full extent of these are not fully understood. In the Stroud area from steep calcareous valley upstream, run-off and tributaries flow downstream in urban areas, with some culverted stretches.

This area was strongly affected by the 2007 floods: in July 2007 the Upper Frome, Painswick Stream and Slad Brook flooded, over 200 properties in Stroud were affected: «summer flooding, as in 2007, was also recorded in July 1907 and August 1931, with one event reporting water levels to have risen 10 feet in 15 minutes. The two largest historic flood events on record occurred in 1965 and 1968 where a large number of properties along the Frome valley were flooded» (Short *et al.* 2018). In November and December 2012 15 properties in Chalford again flooded. The most widespread flooding occurs after sustained periods of rainfall, subsequent increased groundwater levels/flow causing increased base-flow combined with increased runoff response from land areas.

Figure 4. 2 The effects of the 2007 flood at the bottom of the Slad Road in Stroud (source: SDC)

Following the 2007 major flood, a three-year project called Rural Sustainable Drainage System (RSUDS), led by the local government, Stroud District Council (DC3E), was established in 2014. A full-time project officer, DC1E, was appointed in May 2014 along with RFCC (RC1E) funding to facilitate ongoing establishment of Natural Flood Management interventions, this scheme has now been extended to March 2020. In July 2017 the project has worked with 16 land managers (12 Private and 4 NGO's) and 300 interventions have been delivered, including: 170 Large Woody Debris Dams, 50 minor deflectors, 1 dry-stone wall deflector, 3 spring fed & 3 solar cattle drinking troughs, 5 large earth bunds, 10 small earth bunds/check dams, 6 gulley systems stuffed, 1.7km streamside fencing, 1 large dry pond, 400 trees planted, and many minor interventions. Contractors for the works were usually landowners favoured contractors or landowners or farmers themselves.

To analyse the project, I identified three main phases of the process:

- 2007-2010: following the 2007 floods, four flood action groups were respectively formed along four streams in the Stroud valley (FG1E, FG2E, FG4E, DC1E) and promote many meetings with the different flood risk management agencies (among them, EA1E, DC3E, RC1E, GV1E) and stakeholders (among them, FG1E, FG2E, LC1E). They stand up to find solutions to mitigate flood risk to avoid future flooding and elaborates some alternative solutions at catchment scale, with the help of NG1E, a local NGO working for water and environmental sustainability since decades. In parallel the Environment Agency (EA1E) was doing the same and came out with contested engineering solutions to reduce flood risk in the area

- 2010-2014: the solutions proposed by the EA wasn't suitable for geomorphological and funding reasons. The four action groups formed the Stroud Valley Water Forum and lobbied to find alternative solutions to mitigate flood risk. Natural flood management came out from one of this Action Group, The Slad Flood Action Group. After many controversial meetings, a scoping report was financed by the EA to provide evidence for a Natural Flood management project as pilot project. After the report, the RFCC (via RC1E) financed the RSUDS project and the partnership led by the SDC (DC3E) was formed.

- 2014-2016: the project leader (DC1E) completed a first phase of interventions working with NGO's (among them, NG2E), landowners and farmers to reach consensus, install the works and understand how to best implement the mitigation scheme while doing it. The governance arrangements of the project include a Strategic group, with representatives from local and national authorities and NGO's with SDC in charge of delivery under the guidance of the national statutory authority, the Environment Agency (EA).

In terms of flood risk governance of the area, as seen in chapter three, the 2009 Flood Risk Regulations and the 2010 Flood and Water Management Act designate the Environment Agency and Lead Local Flood Authorities (LLFAs) as competent authorities in terms of flood risk management. LLFA in Gloucestershire is the County Council, which has responsibilities for the management of flood risk related to groundwater, surface runoff and ordinary watercourse flooding, which is referred to as "local flood risk" (GCC 2014). It usually has operational responsibilities for ordinary water courses (fig. 4.3) and develops a local flood risk management strategy for the Gloucestershire area consistent with the National Flood and Coastal Erosion Risk Management Strategy by Defra and Environment Agency (EA), having the latter a strategic overview on flood risk management for all kinds of flooding and being responsible for main rivers (fig. 4.3), reservoirs, estuaries and the sea. But in 2012, Gloucestershire County Council has devolved to the local district councils the powers to undertake enforcement to maintain proper flow of water within ordinary watercourses without a necessary consent. Furthermore, the Lower Severn Drainage Board (DB1E) has duties to maintain drainage channels and watercourses up to 8 meters above sea levels (fig. 4.3), so mainly outside the areas to potentially build interventions to slow the flood upstream. Other actors involved in flood risk governance in the area are: Gloucestershire Highways responsible to drainage water from main roads and the Severn and Trent Water Company, responsible for sewage and ground water.

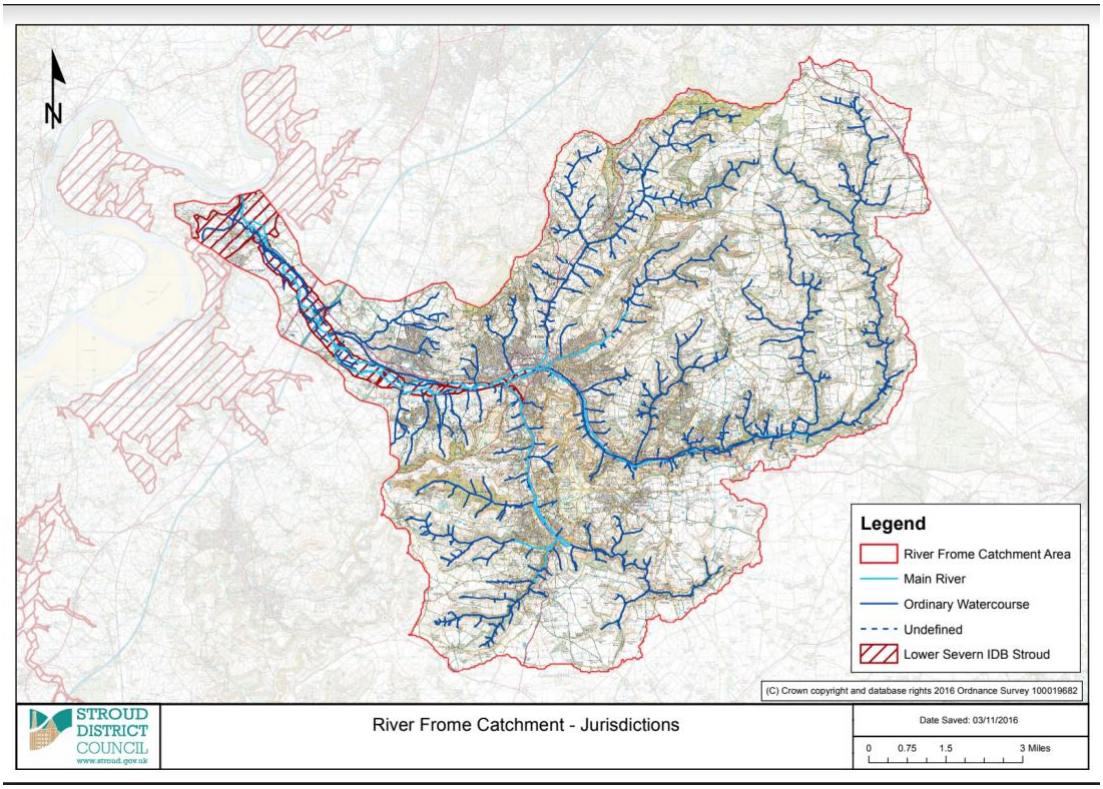

Figure 4. 3 Flood risk management jurisdiction areas in the Frome catchment (Map by SDC)

In the first phase of the project main actors were: the five flood action groups, a NGO, the District Council and the EA. In particular, two flood action groups were very active: the *Slad Action Group* and *Brigend Against River Flood*. They have been working from time to time jointly, trying to find the best solution to reduce flood risk. As I'll show in the next two chapters, since their very first meetings they started to build relationships with the main flood risk agencies in order to better understand how to manage flood risk in the area. The Slad FAG managed to have some small interventions done by the Water Company to improve a part of the culvert of the Slad brook. They also contacted an NGO based in Stroud who was working on river restoration and sustainable water management since years. They started a dialogue with the EA's local representatives, without any practical solutions immediately delivered.

Indeed, the EA proposed the construction of two big ponds to reduce flood risk in the Slad valley, but the intervention was contested by the public and resulted in a failure, also due to lack of money and geomorphological reasons. In this phase, the District Council was undertaking classic solutions (such as clearing out the streams or flood risk communication campaigns), while the County Council and the IDB were not included in any meeting, being them not responsible. The other four groups were working autonomously to find solutions for

their own stream/brook, being the Brigend FAG the only one which tried to promote meetings with the other FAGs.

In the second phase, there were two parallel dynamics: as time passed and no practical solutions for the whole catchment were found, interest decreased among the public and within the FAG themselves. Only few people were still gathering at the meetings, but these people were determined to find solutions at a catchment scale and formed a Stroud Valley Action Forum. FG1E and FG4E, respectively chairs of the Slad FAG and the Chalford FAG, incorporated multiple roles and had a broad social network: they live in usually flooded areas and already owned or acquired local knowledges of watercourses behaviours. They have been also political representatives of the Labour and Green party. FG3E had close contacts also with the local MP, few journalists and the EA officials: he deliberately thought on strategies to campaign and "make noise" in order to achieve some results. Being FG1E a County Councillor and being the County the Lead Local Flood Authority since 2010, she had access to key actors for funding.

In parallel, the EA needed to find some solutions, because the Slad Brook was partially designed as a main river and as a Rapid Response Catchment in 2012 (so under its responsibility), with 112 properties at risk. After the failure of the proposed solutions, the EA suggested technical and partial measures; among them, the *Individual Property Protection* (IPP) solutions, that is, small interventions at household level to protect only properties at highest risk. In parallel, they continued to find solutions by promoting the dialogue with the flood action groups. Among them, the role of DC1E emerged and the flood action groups started to work with a joint programme to do works upstream to slow down the flood with Natural Flood Management solutions. The main issue in this phase was to provide a cost-benefit analysis to account for a Natural Flood Management scheme, because only projects with clear targets (in terms of the amount of property to be protected according to the amount of money) can be legally funded. The cost-benefit ratio for projects to be funded by the CC should be 1:5, that is a project can be funded with local levy if benefit will raise 5 times the investment. The key role of FG1E, lobbying in the CC and in the RFCC, with the help of DC1E and the other FAG chairs, made possible to have a scoping report, which assessed a natural flood management project in the Stroud valley. The report gave some hydraulic and scientific evidence to obtain the funding from the CC via the RFCC, defining the RSUDS a pilot project. DC1E, which was chairing the Ruscombe FAG has been hired as project officer, and must report to a steering group which is chaired by an elected member of the Stroud District Council (DC4E) and includes members of the local community flood action groups.

In the third and last phase, the key role was played by DC1E, which acted as a sort of "local knowledge mediator", negotiated with landowners, farmers, NGOs and local communities how (and where) to adjust the works to be done. In order to plan the work, DC1E acquired a strong local knowledge of the area[37], mixing up his expert and scientific knowledge (as marine biologist) with direct knowledge of water behavior, from the catchment to the micro-scale, down to the soil or the micro-gulley formed by rain falling. To do the works he contacted local contractors (DB1E) or landowners (LO1E), farmers (FA1E), and tenants (NG2E), using their local knowledge about forestry and land management in the area. Obviously, the choice of the actors was not made by chance, rather first driven by flood risk-related needs, second by social capital, third by having actors who could support the works - such as NG2E, who is a big NGO taking care of natural and cultural heritage. For instance, visibility and support given by this NGO could have been exploited to show how this experimental initiative would have positively worked. Furthermore, the social network created by the FAG groups or by local officers, such as PS1E, a parish councilor, was useful to find supportive landowners. Another very supportive NGO in the area was the Gloucestershire Wildlife Trust; in the area, there weren't NGOs specifically working on flood risk, rather on environmental and wildlife issues. Anyway, the great advantage of RSUDS compared to engineering solutions was the lack of need to build a unique big solution in a precise place to make the hydraulic modelling working. Contrarily, the opportunity to build little many interventions where possible: a key factor in developing measures was that these solutions were installed in locations which the landowner considers appropriate and thus minimises a potential socio-economic impact.

4.2.2 The LIFE RII Project in Emilia-Romagna (Italy)

The study site (fig. 4.5, in green circle) is located in Emilia-Romagna Region (ER, fig. 4.4) in North Italy. The pedo-climatic zone of this region is subcontinental temperate climate in the Po Plain and hill areas, while in the mountain range the climate is cool temperate. Based on the Köppen-Geiger climate classification, the northeast half of the region has a temperate climate, fully humid with hot summers, and the southwest half has an entirely humid climate with warm

[37] DC1E wasn't born in the area but moved there around a decade ago.

summer. Precipitation ranges between 650-800 mm annually in the plain areas while the precipitation exceeds 2000 mms in the upper Apennines. Over the last decade, climate change effects on hydrological condition such as water resources and agricultural production. As seen ER Region is most people living in high risky areas in Italy.

Figure 4. 4 The location of Emilia Romagna in Northern Italy

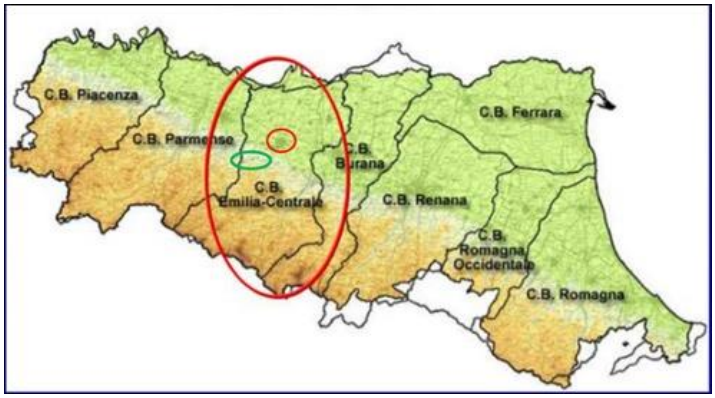

Figure 4. 5 Emilia-Romagna with its IDB. In the big red circle the Central Emilia IDB area of competence (provincial level), in the smaller one the main city (Reggio Emilia). The green circle points the area covered by the LIFE+ RII project

Given the presence of high flood hazard areas and some flooding episodes over the last decade, the ER Regional Council led a 4 years EU LIFE project (2012-2016). The project tackled the Reggio Emilia foothill, which has a peculiar geomorphological structure located at the base of the Apennines (fig. 4.5): limestone steep valleys drop into a highly-urbanized flat area, with some arable lands. The area (fig. 4.4) has been defined by administrative boundaries (4 Municipalities, 150km2, 38000 inhabitants) and it is included in the Crostolo river catchment (410km2). Due to the presence of steep limestone slopes upstream and culverted

and hanging stretches of the streams in highly urbanized areas downstream, the ER Regional Office for Soil and Coastal protection, and drainage area (Manager and Officer: CC1I, CC3I) and the Central Emilia IDB (DB1I) have taken initiative for a river restoration approach. The geomorphological characteristics and the impact of the built environment hindered classic engineering solutions and some of the solutions suggested by the EU Floods and Water Framework Directives. Main aim is to implement the EU Floods and Water Framework Directives, by developing an inclusive governance approach to the minor drainage networks, usually excluded by major projects. The reduction of peak flow for reducing flood risk can be thus achieved by the design river restoration interventions in the minor drainage network. The implementation of these solutions has been considered in woodland and small grassland areas both upstream and downstream. The initiative aims at integrating flood risk mitigation, water quality improvement and biodiversity restoring, by engaging stakeholders and local actors and reducing building and maintenance costs. Six streams flowing through the four Municipalities were chosen: Rio Bianello, Rio Bottazzo, Rio Enzola, Rio Montefalcone, Rio Arianna, Rio Lavezza (fig. 4.6). And a seventh stream, Rio Montefalcone, has been added while doing the participatory process. The four Municipalities (Albinea, Bibbiano, Quattro Castella, San Polo d'Enza) were chosen due to similar environmental characteristics and previous or ongoing shared initiatives.

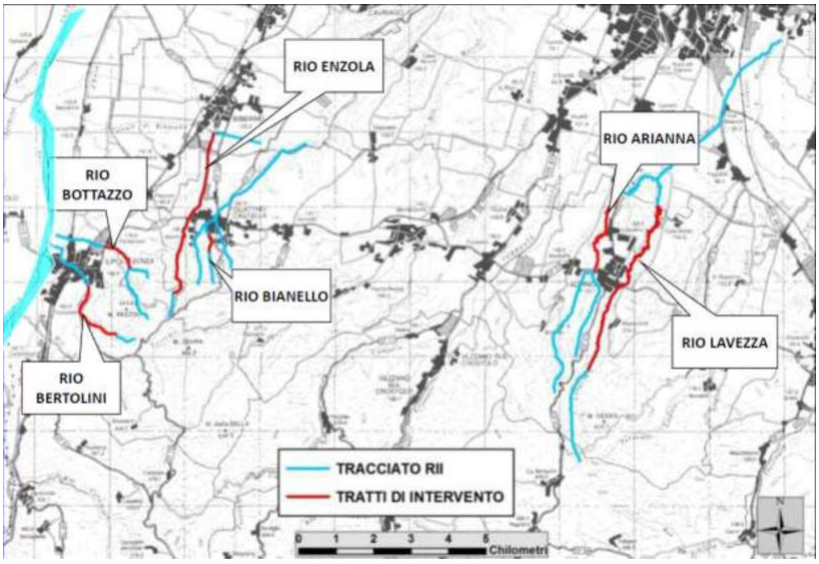

Figure 4. 6 In blue the streams/brook covered by the projects and in red areas of interventions

Main actors of the flood risk governance of the area are the Central Emilia Internal Drainage Board (DB1I) the ER Regional Council (CC3I) and The Po River Basin District (Interregional

and National agency, GV1I). The latter is responsible for major river catchments of national relevance, the Regional Council is usually responsible for minor river catchment on hillside and mountain areas, jointly with the IDB in flat areas, which is usually responsible for surface runoff, irrigation and drainage. By the Civil Protection plan the Italian Municipalities have also statutory obligations in terms of prevision, prevention and protection for the local community from all kind of hazards (including floods). Among the flood risk actors, the Po River Basin Authority (*Autorità di Bacino del Fiume Po*, ADBPO) and the Inter-regional Po Agency (*Agenzia Inter-Regionale del Fiume Po*, *ex-Magistrato del Po*, AIPO) weren't involved in the project, due to their statutory duties. The former has got some similar duties of the English EA, being responsible for main rivers and outlining strategic planning for flood risk management: they are responsible to develop flood risk maps and flood risk management plans for main River basins, according to FD. The latter is mainly responsible for embanked main rivers. While relevant end-user and stakeholders in the area (that shows a rich landscape of associations working in this Region) are:

- the Municipalities: Albinea, Bibbiano, Quattro Castella, San Polo d'Enza (DC1I, DC2I, DC3I, DC4I, DC5I).
- The Italian Association for River restoration: *Centro Italiano di Riqualificazione Fluviale* (CIRF, NG1I).
- Regional and local NGO's: *Legambiente Emilia-Romagna*, (the regional section of the most important environment NGIO in Italy), *Legambiente Val d'Enza* (the local section of the aforementioned environment association: NG2I, LO1I), LIPU (Association for wildlife protection, NG3I), An association of "ecological wardens" (*Guardie Ecologiche Volontarie*, NG6I).
- Farmer Unions: CIA (FA1I), *Coldiretti.*
- The local committee of the Italian Federation of Sport Fishing and Underwater Activities (FIPSAS).
- Farmers, riparian owners (LO1I, NG5I).
- Local environment associations (e.g. NG4I) and a local area of outstanding beauty (Oasi del Bianello, associated with LIPU, NG3I).

Due to constant lack of resources (both lack of revenue and of capital), ER Region couldn't properly manage flood risk in the area. Resources were channelled there only in case of emergencies, without clear planning strategies. For these reasons, flood risk was usually informally managed by the IDB (DB2, DB3) in cooperation with the Municipalities (DC1I,

DC2I, DC3I, DC4I, DC5I), due to a better knowledge of the area and the local availability of workers and work tools. EU funding and the EU FD and WDF gave a framework and a real opportunity for the ER Region to fix maintenance problems and rethink flood risk management in the area. Despite a constant lack of resources, ER Regional managers and officers have been very keen to promote many European and National projects on environmental issues and risk mitigation over the last years. Furthermore, ER also strengthened the active participation of citizens and stakeholders in local and regional policies' issues with a Regional Law in 2010. Therefore, with the help of a National NGO (CIRF), which campaigns for river restoration schemes since the 1999, an EU LIFE+ project proposal called LIFE RII (which means "streams" in Italian) was written down and submitted on behalf of the ER Region. The project was presented as a three-year partnership between ER, IDB and the four Municipalities, so making effective what was an informal flood risk governance scheme until then. The LIFE RII project was funded in 2013 and foresaw a participatory process to engage local stakeholders in an «integrated plan for the hydraulic-environmental restoration of the area» (LIFE RII 2011: 20). Some monitoring actions (geomorphological, chemical, environmental and flood risk related) were planned before and after the interventions to demonstrate possible and effective benefits, too. In 2017, a total of 81 river restoration interventions were carried out, including leaky dams, flexible and permeable embankments, old flood meadows, natural hydraulic bridles, flow deflectors and others (fig. 4.7). Thousands of native trees were planted and 20 km2 of floodplains were recreated (fig. 4.7). The interventions were monitored and resulted in having some benefits in the area (see chapter six).

Figure 4. 7 Examples of the interventions undertaken

To analyse the project, I identified three main phases:

- 2009 - 2013: due to a progressively lack of resources, the streams involved in the project had severe maintenance problems. Classic engineering solutions were hard to be implemented upstream due to bio-physical restrictions. Similar techniques would have been very costly to be implemented downstream. Indeed, after a training promoted by the NGO chair (NG1I) and some minor flooding events, a homogenous area in the Reggio Emilia foothills was chosen to test an experimental project of natural flood management, river restoration and biodiversity restoration to reduce flow peaks. The proposal was written with the help of a hydraulic model and a steering group was formed. The steering group included the actors that informally have been managing flood risk in the area.

- 2013 – 2015: The project was funded and it was driven by the ER Region. The participatory process thought to project the works was undertaken and the solutions were built. During this process, the need to engage with stakeholders and make flood risk governance effective increased the number of participatory meetings. Walking experiences along the streams were also proposed during the meetings led by the project leader with the IDB, CIRF (CC1I, DB1I, NG1I) and the different Municipalities' representatives (DC1I, DC2I, DC3I, DC4I, DC5I).

- 2015 – 2017: The construction of the works kept going, but a new participatory project to write and sign a River Contract was proposed by ER and the CE IDB to make this experimental approach to flood risk management durable. Indeed, one of the outputs of the LIFE project resulted in a change in flood risk governance, which will be driven by the River Contract next years. The River Contract consisted of a voluntary planning agreement, which has the potential to undertake inclusive flood risk management in the area: a pivotal 5 years (2017-2022) IDB-driven flood risk management agreement and a shared River Contract were so issued at the end of the LIFE project.

The first phase was already discussed in the description of the study site, when I previously described how the LIFE RII was thought and funded. The second phase foresaw five main actions to monitor different aspects related to the efficacy of the project:

- participation issues and stakeholder engagement
- environment monitoring
- vegetation and wild life monitoring
- flood risk, chemical and geomorphological monitoring

- executive planning of the interventions

Eight meetings were organized mainly to undertake the participatory process: four of them (one for each municipality) were led using the European Awareness Scenario Workshop methodology, a participatory technique usually used in European project with the aim to mitigate knowledge conflicts among policy makers and end-users. Two of the meetings aimed at acquiring a direct local knowledge of the streams: they took place walking along the streams. In these eight meetings, the interventions were presented: they were set to the public needs, following four main themes: flood risk, water quality, environment and landscape quality, possible tourist promotion. According to the LIFE RII participation monitoring[38], the participant to these meetings were: 41% public agencies (mainly CC1I, CC2I, DB1I, FG1I, FG2I, FG3I, FG4I, FG5I), 29% riparian owners/local citizens (among them LO1I, NG5I), 21% NGO's or local associations (among them NG1I, NG3I, NG4I, NG5I, NG6I), 8% self-employers, 4% consultants. A web platform was also used as a tool to boost participation but it didn't really work, so it was not considered in my research[39]. Local knowledges were transferred into the project during these public meetings, the walks and while doing the interventions. Indeed, riparian owners usually came to see the building of the works, as they reported to me. In addition, five more meeting were organized to show the progress of the interventions in 2014.

In the third phase of the project, five meetings were organized to define the River Contract. According to the participation monitoring, they were attended by: 51% public agencies (mainly CC1I, CC2I, DB1I, FG1I, FG2I, FG3I, FG4I, FG5I), 20% riparian owners/local citizens, 9% environment NGOs/associations (among them NG1I, NG2I, NG3I, NG4I, NG5I, NG6I, 9% professional associations (e.g. FA1I), 4% self-employers, 2% consultants. Due to the more political connotation of these meetings, being them dedicated to the reframing of flood risk governance in the area, a greater presence of institutional and professional actors was reported. Also in this phase, a web platform was used as a tool to boost participation but it didn't work as a participatory tool.

[38] In the project a qualitative survey on the effectiveness of participation was foreseen. The survey was undertaken by a researcher based at the University of Bologna.

[39] I also interviewed who managed the web platform, but the information she gave to me wasn't relevant for my purposes, mainly due to a lack of proposals coming out from the public through the web platform, which was mostly used as a website to get information on the project.

Considering my theoretical and epistemological framework, in the next two chapters I will analyse and discuss my data, by looking at discourses, interactions and practices in the two case-studies.

CHAPTER 5

5. Flooding and flood risk constructions in the two case-studies

As noted in the second and third chapter, there's a close link between changes in flood risk governance, flood risk management policies and practices, and flood events. In this chapter I will delve into the notions of flooding and flood risk, to analyse how the different actors frame these concepts and build their relationships with water, eventually resulting in the production of local knowledges. This chapter and the next one are divided into two parts, each for case study, while chapter seven will host the final discussion derived from the comparison between the two case studies.

Due to the peculiarities already mentioned, the experience of flooding (and flood triggers) is indeed more experienced in the English context, while river restoration and environmental issues are more relevant in the Italian one.

PART I – The English context

As previously discussed, the RSUDS project can be seen as both an event- and community-driven process, since 2007 floods in England worked as a big trigger in making people taking actions - and driving the project. In the first part of this chapter I'll explore how flooding, flood risk and flood risk management are conceived, experienced, defined and practiced by the different actors and agencies involved in the RSUDS project and in flood risk governance in Gloucestershire.

5.1 The construction of flooding: flood triggers and effects

As seen in previous chapters, the 2007 floods represented a big issue in the whole country. Even Camilla, the Duchess of Cornwall, in the foreword of a book published immediately after

the floods (Thomas & Wilson 2007) defined them as a shock and commends the «stoically» way in which the affected people had reacted and coped with it. This year (2017), a local web newspaper edited a special issue for the tenth anniversary, where the 2007 floods have been described as «the county's worst natural disaster in living memory» and the recovery in the following terms: «what this county proved too is that its spirit, its will and its people are strong beyond description» (*Gloucestershire Live 2017*). As it usually happens, media have conveyed the idea that a «natural» disaster unfortunately happened and brave people managed to rescue victims and cope with it, while «disaster does not happen unless people and cities are vulnerable due to marginalisation, discrimination, and inequitable access to resources, knowledge and support» (Chmutina *et al.* 2017) and «calling them "natural disasters" artificially naturalises the harms they cause» (Chmutina *et al.* 2017). And, obviously, different opinions and explanations have been put forward by the different agencies dealing with flood risk.

At National level, flood risk management and vulnerability issues have been well acknowledged as relevant in several reports. For instance, the 2008 Pitt Reviews explicitly mention these issues, such as:

- development plans in flood risk areas, and the «right to connect surface water drainage of new developments to the sewerage system» (Pitt 2008: xvi)

- as well as flood risk governance problems emerged after the 2007 floods, such as the need for a stronger national coordination and for a stronger local perspective including the engagement of local actors.

It's useful to mention some of these recommendations for my research purposes. The most relevant ones are listed as follows:

- *The Environment Agency should be a national overview of all flood risk, including surface water and groundwater flood risk, with immediate effect (Recommendation 2)*

- *The Environment Agency should provide a specialised site-specific flood warning service for infrastructure operators, offering longer lead times and greater levels of detail about the velocity and depth of flooding (Recommendation 33)*

- *The Environment Agency should work with local responders to raise awareness in flood risk areas and identify a range of mechanisms to warn the public, particularly the vulnerable, in response to flooding (Recommendation 61)*

- *Local authorities should lead on the management of local flood risk, with the support of the relevant organisations (Recommendation 14)*

- *Local authorities should positively tackle local problems of flooding by working with all relevant parties, establishing ownership and legal responsibility (Recommendation 15)*

- *Local authorities should coordinate a systematic programme of community engagement in their area during the recovery phase (Recommendation 76)*

As the aforementioned recommendations point out, the need to have a broader view on flood risk (the inclusion of *surface water and groundwater flood risk*) and the engagement of communities and stakeholders are encouraged. The engagement of different actors is suggested at local level in the recovery and warning phases, but also in the local flood risk management. The point is not only to raise risk awareness in the public, but also to boost the involvement of *all relevant parties* in risk governance to include local knowledges in flood risk management practices at local level.

Definitely, also hydrological scientists provided an explanation for 2007 floods. For instance, the Centre for Ecology and Hydrology developed a scientific report funded by the Natural Environment Research Council, «a leading funder of independent research, training and innovation in environmental science in the UK»[40]. In the conclusion of this report, they explain the flooding dynamics in this way:

> *«The 2007 flooding was remarkable in its extent and severity, and truly outstanding for a summer event. Widespread flooding was inevitable given the magnitude and intensity of rainfall which has no close modern parallel in the summer. Many areas experienced a wide range of flood types, from the local effects of surface runoff to extensive floodplain inundations. A*

[40]As defined in his Twitter account.

> *distinguishing feature was the very high proportion of properties and commercial premises inundated by non-fluvial flooding. In the worst affected areas, the rainfall and river flows were of a greater magnitude than the design limit of some flood alleviation schemes and many urban drainage systems. The flooding underlined the UK's continuing vulnerability to climatic extremes. However, long-term rainfall and river flow records confirm the exceptional rarity of the hydrological conditions experienced in 2007. Climate change scenarios indicate that summers may become both warmer and drier; rainfall patterns may also become more variable with an increased frequency of intense storms. But considerable uncertainty attends such scenarios, especially in relation to extreme rainfall events*» (CEH 2007)

This overview put forward the 2007 flooding as being an exceptional event, as the Pitt Review did: «The floods of last year caused the country's largest peacetime emergency since World War II» (Pitt 2008: vii). If in the Pitt Review links with climate change are put forward and the need for adaptation strongly encouraged, here the links are defined weaker: "may" is the verb used. It's remarkable the definition of flooding as something "inevitable", again mixing up, in my opinion, the "hazard" with the "disaster": if the amount of rainfall was something never recorded in the UK, the resulting disaster is obviously the product of different factors associated with flood risk, as the fact that the failure of the attenuation schemes would suggest. So, the *topos* of inevitability seems to justify here (without argumentation, rather with the linguistic means of nomination and hyperbole) two conflicting stances: the failure of flood risk reduction measures and being affected by an extreme event. From a technical perspective, this can be properly justified by the amount of non-fluvial water (like surface run-off, sewerage water and groundwater) that, as the local interviewees confirmed to me, increased the damage.

To get back to the National level, the National Flood and Coastal Erosion Risk Management Strategy for England by DEFRA, the overarching strategy informing flood risk management at all levels, insisted that «it is not possible to prevent all flooding or coastal erosion but there are actions that can be taken to manage these risks and reduce the impacts on communities» (DEFRA 2012:1). Furthermore, a strong link with climate change and human activities was given again, by stating that «Flood and coastal erosion risk in England is expected to increase due to climate change and development in areas at risk», a statement that sounds more as a widely accepted true than a controversial issue, because no argumentation is put forward in this strategic policy document - just a reference to the 2008 Climate Change Act. Land management was thus another issue, which is strictly interrelated with flood risk management, as outlined also at County and District level, e.g.: in the Gloucestershire County Council, *Local Flood Risk Management Strategy* and in the Stroud District Council *Strategic Flood Risk*

Assessment. In particular, the latter is required by the *Planning Policy Statement 25*, in order to steer new development away from areas at risk of flooding, due to the District Council being responsible for local planning.

In his flood risk management strategy, the *GS's Local Flood Risk Management Strategy*, the County Council embraced a very technical perspective in terms of flood risk management but acknowledged the need to work with stakeholders and all relevant parts for an integrated flood risk management: «successful local flood risk management can only be achieved if Risk Management Authorities, other stakeholders and local communities work together to better understand and manage flood risk» (GCC 2013: 10). The changing policies triggered by the 2007 floods and the need for engineering measures to prevent flooding, which have been undertaken afterwards, are clearly mentioned by RC1E, County Councillor, RFCC and IDB member:

> *«Post 2007 the Government certainly started to take seriously the issue, even after the 2000 flood, but I think it was the 2007 one that really, focuses the minds of Government.*
>
> *…*
>
> *It was quite obvious Gloucestershire was a little underprepared for the events of 2007. So, the Cabinet Member of that day was very brave, enable us to do a lot of projects around flood risk in order to, should we say, reduce the risk of flooding into the properties that reached about in 2007. We reckon some of the schemes, because we had repeated flooded in 2015, not only 2007, but we think our investment from 2008 through, it was probably to protect, I would say, probably 780 properties that would have flooded if it wouldn't have been for the investment» (RC1E, County Councillor, RFCC and IDB member - 21.12.2016)*

Flood risk management is conceived in a classic technical way by the GCC, which is represented by RC1E. He has been a CC elected councillor (for 16 years), and also one councillor for the RFCC (for the last 3 years) and for IDB (for the last 12 years). His ideas mainly reflect how flood risk management is conceived by these three agencies: flood risk management aims at reducing the number of properties being potentially flooded, as the FD foresees. Being RC1E also a IDB member, has also got personal flood and water–related experiences, as he grew up in a farm, he was ex-Mayor of a flooded town in 2007 and his grandfather worked in a River Authority. In his view on the flood triggers, it can be interesting

to mention how he reports a mix of beliefs, politics and life experience within a discourse made of personal beliefs, which contributes to his local knowledge related to flooding:

> *«I mean, it depends on whether or not you believe in Climate Change. But I don't think, I don't think it's about Climate Change, it's much about extreme weather patterns? I know people say that the two things are the same, but I'm not quite, I mean… climate change, they say, is melting the sea ice, etc., which is gonna increase the sea level. We are seeing far more frequent, what I would call abnormal storm event, and I think that's our problem, because, it's like, the storms are coming across Europe, you see more and more what you would normally associate with tropical storms.*
>
> *…*
>
> *I still don't think we are careful enough about where we do development, we need those green open spaces… I think as Nation, I think this push-push-push for development, development without measuring the consequences.*
>
> *…*
>
> *So, to a degree, tidal push isn't gonna be as bad as… because of the lunar cycle changing - it's all interlinked, and I'm not an astrologist, I'm not a hydrologist, but all of things were interlinked. Ah yeah, I always had this theory about something will happen every 7 years, because we had it in 2007, we had in 2000, 2007, 2015» (RC1E, County Councillor, RFCC and IDB member - 21.12.2016)*

Despite representing the GCC, the discourse here turns into a subjective one, and the "we" turns into an "I". A general link with development is still made (the link between social vulnerability and risk is so acknowledged) but a very personal view on climate change is given, where "climate change" is perhaps treated as a political discourse: two usually interlinked phenomena ("abnormal storm events" and "melting the sea ice") are deemed as not being interlinked. It maybe stems from the problematic view the Conservative party (RC1E is a member of it and the party is in charge at the County Council) has got on climate change (Vaughan 2014) and on the European Union[41]. Furthermore, an alleged influence of the moon is brought into the discourse, mixing up personal beliefs and local knowledge, due to a generalized symbolical justification put forward.

About climate change, it's quite interesting to notice that it is not usually mentioned nor as a RSUDS driver neither as a flood risk amplifier by almost any actors interviewed, even if it is

[41] In a part of the interview he criticizes the European Directives in general.

well acknowledged as flood risk amplifier by many policy documents at National, County and Local level (SDC 2008; Pitt 2008; GCC 2014). The exception is mainly represented by who got a direct experience and awareness of environmental issues such as the majority of the FAG representatives (FG1E, FG2E and FG4E), the project leader (DC1E, SDC officer) and his colleague working at the RSUDS project in the DC (DC2E), and the NGO's representatives (NG1E and NG2E). They usually state that we should expect more frequently and more extreme events, and DC and NGO's representatives effectively recognise climate change as part of environmental or flood risk mitigation strategies.

Around the interlinkages among floods, climate change and extreme events, I think it's interesting to report NG1E (Local NGO member and "water expert") narration of the 2007 flood. It's not an official version brought by his NGO, but it sounds literally like as follows

> *«So, in 2007 we had the big flood in Gloucestershire and it was just a few months after Y died, very strange the timing. And, in fact, the spring of 2007, we had a severe drought, we had a very dry Winter. By April, all our fields were dead, the grass in our fields were brown, in April! It was a very bizarre year! Ehm, and Y killed herself just outside here, in April, this is not for your story, but then, on the day of her funeral, which was a big funeral, the Cathedral, in Gloucester, it started raining. Literally, as the body, the coffin was brought into the church…Booom! As a big clap, very dramatic…lot of lightning, and started raining and continue raining, very heavy continuous rain, until we had the big flood. And, actually, the worst rainfall was further north, we only had about one-in-25-years rainfall event…» (NG1E, Local NGO member and "water expert" - 3.2.2017)*

The association between the grief and a period of extreme rainfall resulting in a flooding reflects something associated with extremes and the impossibility of controlling and managing something uncertain and unknown, thus intrinsically linked to the notion of risk, as seen in chapter 1. Following my constructivist perspective, a paradox can be unveiled here: the association of an extreme event with a death that didn't occur at that time[42], thus symbolically highlighting two dimensions in common, being the claim of this discourse: flooding is both framed as a shock and as something impossible to control. Contrarily, he frames the occurrence of the rainfall event as a probability (a 1/25 event), following the technical definition of risk proposed by the FD and used by his NGO's – that is, as a way to control and reduce the general

[42] The death mentioned by NG1E occurred in December, not in June or July 2007.

impact of flood risk; indeed, he will confirm it in the interview, reflecting his NGO's perspective, by saying that «flood risk can be empirically measured». Furthermore, when he refers to the flood, he says "we had", implicitly highlighting a shared passive condition. So, a technical framing of risk goes against the shock brought by his memory about the events he experienced locally.

The memorialisation of the flooding (McEwen & Jones 2012) is something mainly linked to having directly experienced a flood locally. Indeed, who among the interviewees started spontaneously to describe/remember the effects of a flooding is who has been directly affected by the 2007 flood, thus having acquired a direct "local" knowledge of the event, which necessarily influences in a way his/her *risk awareness* (Scolobig *et al.* 2012), *risk framing* and *risk governance*'s role. These actors are mainly representatives of the flood action groups, or better, they set up these groups, after the impact of the 2007 flood. Among them, there are also riparian owners, who also joined the FAG, like LC1E. She illustrates her experience of the 2007 flooding as follows and links the flooding to the Slad FAG's constitution:

> *«The July 2007 absolutely pulverized people, they couldn't believe that this is happened again. Houses were flooded once more, all the kitchens were destroyed and it was after the June 2007, that we got together and formed… had a meeting to ask people who had been flooded to come to this meeting"*
>
> *…*
>
> *The first was just an information meeting really to see what people sort about it, and then, out of that we thought we must form an action group. But before we could actually instigate that, the second flood came» (LC1E, Riparian owner and FAG member - 27.1.2017)*

The shock locally produced by the impact of two flood events in two months was huge and triggered the formation of almost all FAGs[43]. The claim here is a juxtaposition between something traumatic that generally happens, affecting a general subject, defined as "everyone" "the people" "they", and a personal framing of risk. This means "taking action" as a personal ("I") reaction to do something – even if shared with other FAG members. Indeed "doing something" was conceived by some flooded local people as to gather a group of people, a "we" that would have been the flood action group, in this case the Slad Flood Action Group: action

[43] Except for the Chalford FAG, which was formed after the 2000 flood.

is the response to flooding at very local (Slad Valley) level after the damage caused by a major event.

Also the memorialization of flooding was something mostly activated by the 2007 floods, not by other events of stories/elements. Even in local NGO's this claim can be found. NG2E is a land manager and local area ranger for a National NGO, which owns a big property. The NGO isn't an actor in flood risk governance, indeed he also argues that he has never thought about flood risk before the 2007 flood. Even if his NGO's aims are to look after natural and built heritage, as far as he knows, they have never worked locally with the Environment Agency or agencies dealing with flood risk. Since problems were locals and little ones (such as some soil erosion) and buildings have never been affected, he has never been really worried about this and never be said what to do by his NGO, until:

> *«In 2007, we had the rainfall and we saw the effect of that water heading down our fields into the watercourses, which most of time only have a trickle of water, most of the time, at the base flow is very low… I was there when that happened and we witnessed that… the torrent of water heading downstream, and thought "oh, that's gonna be quite dramatic!"» (NG2E, National NGO Local Ranger - 20.12.2016)*

NG2E's words show again the link between *risk awareness* and daily direct observations, from one side confirming the unpreparedness to face the 2007 event at different levels, from the other side the shock and the role of run-off water in flooding, which was a big issue both in 2007 flood and also the RSUDS project. So, even if landowners or NGO managing local lands weren't aware of flood risk, they acquired in a way some direct local knowledge of flooding dynamics, just by experiencing them. Obviously, this wasn't always translated into practices or policies, unless the flood strongly affected some properties, at least. This is again the case of FAG representatives, which had the opportunity to get a daily relationship with the watercourses, even if it was usually tacit and not linked to flood risk.

5.2 The relationships with the watercourses

The relationships with local actors and the watercourses is indeed essential and can unveil how local knowledges are produced, accumulated and used, or not, by the FAGs, who drove the first phase of the process resulting in the RSUDS project.

For instance, FG1E and FG2E, as FAG chairs, confirm the strong link between "risk" awareness and historical/direct (local) knowledge, or better which links they do incorporate. FG2E's opinion on risk is quite common in both case studies among the public, indeed. In her understanding, "risk" is mixed up with "hazard": the risk-object is deemed being the river, the hazard a personal direct and historical (local) knowledge of the river behaviour, the object-at-risk her the concept of home: risk becomes a product of this reframed concept by her personal experience. Furthermore, the 2007 was perceived as a shock, as also her broken voice and her stumbling over her talking of her flood during the interview witness:

> *«Nobody knew there was a risk, it sounds "crazy" because you live by water, but nothing had happened for 50 years. So, a certain, compliance comes in…and then the flood happens and it's a massive shock, and then people changed their behaviour and start share…*
>
> *…*
>
> *Once you had been flooded and it's horrible, you smell the mud, and it's just… and you lose confidence in your property, you lose confidence in your house, because… we all think our house is where we're safe and… it takes, I think, at least 5 years to get that back, ehm… and so, you look at the stream… straight away after the flood you look at the stream, it's up a little bit, you say: "Oh my God!". But, later, after 5, 6,7 years, when your memory… is, is reduced, you look at it and say: "It's fine". It's about the expect…the long you live, where you do… understand, you can read, you can understand what's going to happen. So, I look at websites, ehm, forecasting how much rain is gonna fall, ehm, I have a rain gauge, which tells me how has fallen, ehm, and…» (FG2E, Painswick FAG chair - 12.4.2017)*

This excerpt makes clear a widespread attitude towards the watercourses and it is interesting for different reasons. First of all, unless water does not come into a house (e.g. during a minor

flood in 2012[44]), a *risk pre-estimation* understanding is not even considered, so that «nobody knew there was a risk». The risk-object and the hazard are something usually ignored, before the 2007 flood, that is after the disaster. Even if a flood occurred in 2012, flooding is conceived in terms of flood risk only when it is not tolerable any more: only following something not tolerable, a *risk evaluation* is taken into consideration; then and only then, a *risk pre-estimation* is acknowledged, opposite to the logical order proposed in Renn's RGF (see chapter 1). Furthermore, ambiguity can be locally handled as FG2E (Painswick FAG chair) did, that is: first in an interpretative way, then in a normative one: only after getting evidence of flood risk (*risk characterization),* a *risk evaluation* in terms of value-based judgement is made. After water had come into her property, she judged the event and the chance it could have happened again simply not tolerable, she started feeling unsafe at home, and framed the risk of flooding as something real and linked to heavy rainfall and the consequent rising of the stream's water level. So, the daily (and "private", see fig. 5.1 and 5.2 below) relationship with the stream can mitigate or increase risk awareness to the extent to how much close in space (home) and time the flooding event has occurred[45].

Figure 5. 1 The Painswick brook flowing under FG2E house. It is clear it was an old mill.

[44] She also adds that: «in 2012 there was a tiny bit of water in the lane, but that much, we had flood boards up and… we stayed dry, and I think, I don't know of anybody, who, flooded».

[45] In the next chapter, I'll discuss how local knowledge here is shaped (as result of a relation) and then integrated in flood risk governance within the perspective of a flood action group's representative.

Figure 5. 2 The Painswick brook flowing along FG2E garden, right in her property

Moreover, following Renn's inclusive risk governance framework, following the risk-related problem's framing, early warning was considered one of the first option of risk management: a rain gauge, which transmits water level information is installed by herself. This was also an intervention promoted by the DC following the 2007 floods. One diffuse local need to tackle flood risk obviously resulted in getting more information as possible about risk-objects, that is: the real-time amount of rainfall and the amount of water flowing into the river. So, local knowledge for riparian owners can be equal to learning to «read» the behaviour of the stream flowing under one's own house in order to try to predict how and if water will flow into a property. This micro-scale can be very important for flood risk agencies, as I'll show in the next chapter. The point is how to share or transmit this local knowledge in order to make it work as a useful tool of risk mitigation and how to enable local knowledges. In fact, sometimes a missing link between direct experience and flood risk can be found in some actors.

For instance, in her self-definition of flood risk the claim is partially consistent with the technical one reported by main policy documents, even if the concept of risk is still mixed up with the concept of hazard, so that she reports that:

> *«Flood risk is the chance of very heavy rainfall in a short period of time, ehm, making the river rise of… the stream rises too quickly before you can prepare and put your defences in place. I think you can't stop it, I think it can help the smaller events» (FG2E, FAG chair - 12.4.2017)*

The classic aspects associated with risk (discussed in the first chapter), such as the likelihood of an adverse outcome, which cannot be eliminated but only reduced. Flood risk can be also associated with the impossibility to be prepared and control it with private flood defences. Paradoxically, private flood defences, defined as *Individual Property Protection*, were one of the flood risk mitigation measures proposed by the EA in the second phase of the process, like a possible solution for flood risk mitigation. The issue here is how to link a bio-regional approach with local knowledges and needs of riparian owners and FAG chairs. Indeed, sometimes a direct experience of the watercourse or a local knowledge of it could not be translated into action, being tacit or "private", or even being linked to one own personal memory.

Like the run-off water issue, invisibility of both flood risk and flood hazard was something relevant in one of the most affected valley ending up in the town. Indeed, not seeing the brook, again a lack of direct (local) knowledge, increases flood risk, as one of the key actor, FG1E (FAG chair), points out:

> *«It's all covered over, so the brook has disappeared, it's covered, culverted... This is the Slad brook, and so, where the brook comes into the town, into the Stroud town, it's very hidden from people, you don't often see it, so it's in the back of gardens, it's really well far down from the road… you forget… you can't get into the brook, you can't puddle in it… it forms no part of people's life in the town, you know?» (FG1E, FAG chai rand County Councillor - 3.11.2016)*

The reasoning proposed here is very linear, as my ethnographic visual notes show (fig. 5.3-5.6). This *topos* will be found also in the Italian case study: if the source of the hazard is invisible and it is not part of people's life, flood risk is usually ignored. FG1E is a FAG chair and a County Councillor, she obviously knows very well (now) the stream, but she uses also the "you" subject to explain how the culverted brook makes you "forget" about having a water course underneath.

Figure 5. 3 The Slad valley upstream. The brook flows across the trees, but it's not visible from the road

Figure 5. 4 The bottom of the Slad valley, where I have been living during my fieldwork. This area was flooded many times but the stream is invisible: it flows behind the houses on the left and it is culverted from the end of this road

Figure 5. 5 The Slad brook downstream. The brook flows in the backyard of the houses, down the road. We can read "Streamside 10d" on the house, but any reference to place names has never been mentioned

Figure 5. 6 The Slad brook flowing behind the houses downstream. Here the culvert begins. The grid has been put here after the 2007 flood to avoid blockage causing flooding (see next paragraph)

And the brook being culverted was one of the cause of the 2007 flood: both decreasing flood risk awareness and physically making the stream overflowing. To my purpose, it's interesting to report that there was also the need to find a scapegoat for the flooding: a common belief spreading afterward was that someone caused the flood by opening some lock in his/her property. FG1E (FAG chair), reports that:

> *«There was the perception that the flooding was caused by somebody protecting their properties by opening… wheels, but it just wasn't, you know, it wasn't what happened at all, but rumours started, you know, that must to be what caused huge deluge… landowners opening up, draining their lake to protect their property, which caused the flooding for the downstream» (FG1E, FAG chair - 3.11.2016)*

Contrarily, the dynamic of the 2007 flood in the Slad valley is well described by some flooded riparian owners and by Slad FAG members, because this was discussed during the various meeting in the first phase of the process. For instance, FG1E lives at the bottom of the Slad valley (fig. 5.4): again, she accumulated a local knowledge of the brooks behaviour in the valley and in the whole District Council, being an elected Councillor of the DC and CC, and a Green Party member, as known:

> *«So, the water from the highway drains, goes into the sewage, ok? And there's more and more water on the highway going into the sewerage, more more housing is being built, which is also connected to our sewerage, and we can't take it… when the sewage is full, overflows, and overflows into the brooks, so what was happening and still happens in the UK: every time we have a rainfall event, even a minor rainfall event, we just get the whole sewerage in our streams» (FGE1, FAG chair and County Councillor 3.11.2016)*

Her words are the result of the monthly meetings of the Slad FAG, when riparian owners, experts and flood risk agencies representatives met in the first and second phase of the process. However, this punctual knowledge of the flood dynamics in the Slad valley derives again from a direct (local) knowledge acquired by riparian owners, like LC1E (Riparian owner and FAG member):

> *«We were also getting flooded from the road because the drain was blocked as well. And not only a flooding from the road, but the sewage erupted, and all people downstairs toilet erupted and so sewage came up to people's homes as well» (LC1E, Riparian owner and FAG member - 27.1.2017)*

They both seem quite sure in their argumentation, bringing out the point of view of the Slad FAG, one of the FAG group that mostly campaigned to get the RSUDS project funded. Among the flood triggers, relevant are also the links with the urban development mentioned by EA1E (Environment Agency Officer) and acknowledged at County and District level. This version corresponds to the one registered in official reports at National and Regional level, as seen at the beginning of this chapter.

5.3 The concepts of "flood risk"

To conclude this part, I'll delve into the concept of flood risk. Indeed, this notion is never defined in the flood risk policy strategies, but the definition these policy documents referred to, is the one defined by the National and European flood risk agenda (see chapter three), like the 2010 Flood and Water Management Act, which is the implementation of the EU FD. In this act, flood «includes any case where land not normally covered by water becomes covered by water» (UK Parliament 2010:1), a definition based on natural sciences, the one I mentioned in the epistemological notes in the first chapter.

And flood risk is defined as follow:

> *«"Risk" means a risk in respect of an occurrence assessed and expressed (as for insurance and scientific purposes) as a combination of the probability of the occurrence with its potential consequences» (UK Parliament 2010:2)*

So, risk is defined as something that happens, an "occurrence", unpredictable in a strict sense, whose frequency can be assessed and managed as the probability of the potential consequences provoked by the occurrence of a hazard. This definition obviously reflects the one proposed by the European Union, where floods are defined as:

> *«natural phenomena which cannot be prevented. However, some human activities (such as increasing human settlements and economic assets in floodplains and the reduction of the natural water retention by land use) and climate change contribute to an increase in the likelihood and adverse impacts of flood events» (EC 2007)*

and

> *«'flood risk' means the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event» (EC 2007)*

The inevitability of flooding is put forward stronger, by defining it as a natural phenomenon. But the link with human activities is made in a very precise way, suggesting fields of interventions (development and land use, climate change adaptation). Again, flood risk is defined as a probability of a hazardous event causing (only adverse here) consequences on four peculiar issues related to the presence of human beings, we should take action on. Thus, the definition reflects again the classic one, but uncertainty is not mentioned: uncertain is flooding, while flood risk can be assessed and managed as a probability - something clear in the flood risk management plans foreseen by the FD (see chapter three)

To conclude this first part dedicated to my English case study, it's noteworthy to look at how flood risk is framed and/or defined by the different actors involved in the RSUDS project. Most them explicitly adopts the aforementioned definition, be they flood action groups representatives, local people or institutional actors. For instance, FA1E, the only farmer interviewed answered that flood risk is:

> *«the probability of something happening which could have an adverse effect on the livestock, I guess» (FA1E, Farmer - 1.6.2017)*

while EA1E, representing the main agency in flood risk governance at National level conceive it as:

> *«a purely statistical probability that flood water will impact on a property at certain stages» (EA1E, Environment Agency Officer - 2.11.2016)*

The same definition is used at the District level, as DC2E, the local *Water resource engineer*, reports:

> *«Risk is a function of probability and impact. So, we look at an area: my concern is where properties flood, where people live» (DC2E, District Council Water engineer - 1.6.2017)*

The idea of risk as a probability is something taken for granted, which informs almost every actor's and institutions' flood risk framing/pre-estimation. What distinguishes the idea of risk from the concept of hazard is the presence of human beings and the potential of (usually negative) consequences on their properties, which are usually considered when experienced. Like in the classic definition, exposure, that is the presence of properties is what "turns" hazard into a risk. This opinion is very diffuse, even at the Parish level (which hasn't flood risk statutory duties), as PC1E, the parish clerk, clearly confirms:

> *«I guess where there's a potential for residence to be affected, because if flooding happens on agricultural land it's less of a worry for the parish council, but if people are affected, people are likely to be stuck in their homes, then…» (PC1E, Parish clerk - 13.4.2017)*

What is not strongly considered or slightly hidden in all these definitions and in the classic notion of flood risk is the process that results in flooding, that is, flooding is not an event but a process. However, this important understanding of flooding can be found in local flood risk strategies (at County and District level) and in UN policy documents.

Risk is defined by UNISDR as:

> *«the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity» (UNISDR 2017a).*

Furthermore, the "risk" definition provided by the UNISDR contains an annotation which accounts for the influence of socio-cultural aspects in the perception of risk and the possibility to acknowledge them but not to quantify them either:

> *«disaster risk comprises different types of potential losses which are often difficult to quantify … It is important to consider the social and economic contexts in which disaster risks occur and that people do not necessarily share the same perceptions of risk and their underlying risk factors» (UNISDR 2017a).*

The naturalness of risk is not seen as a relationship constructed by different actors (as a social constructivist approach would suggest), rather as a probability function, even though some factors cannot be accounted for.

While the *GS Local Flood Risk Management Strategy* defines flooding as:

> *«a natural process which shapes the environment, providing benefits including the recharge of ground water, improvement of soil fertility, maintenance of ecosystem in river corridors, and floodplain biodiversity. However, floods can also threaten life and cause substantial negative social and economic effects» (GCC 2014:1)*

And a similar definition is given by the DC, in their strategic framework of risk assessment, due to their role based on development planning, not on flood risk management (the CC has been designated as Lead Local Flood Risk Authority, as seen in chapter three):

> *Flooding is a natural process which shapes the natural environment, but also threatens life and can cause substantial distress and damage to property. The effects of weather events can be increased in severity as consequences of past decisions about the location, design and nature of development and as a consequence of climate change. While flooding cannot be wholly prevented, its impact can be avoided and reduced through good planning and management (SDC 2008:8)*

From these last words, it is finally clear the claim of "flooding" being defined as a process, not as an event: a natural process/phenomenon which is potentially harmful, and whose effects are linked to human actions (again development and climate change). This perspective potentially justifies wider perspectives in flood risk management at local levels and holistic approaches based on a long-term and relational approach. This is exactly the idea of the RSUDS project, which DC1E (District Council Officer), the responsible of the project, had clear in mind to implement it:

«a flood is not a binary event, there isn't "a flood" or "no flood"... it's not here you have 50 people flooded and over there no flood, it's a continuum, and so when people say to me "does it work?" [the RSUDS project] I always say "yes, of course it works!". But, you know, at which point is it working? If the flood would have caused 60 people to flood, but now only ten people flood: has it worked? Yes, of course it has! But, the ten people who flooded, they say "no"» (DC1E, District Council Officer and Project manager 19.10.2016)

This excerpt, which has been recorded while walking for the first time in one of the sites of the RSUDS works at the bottom of the Slad Valley, reflects the complexity of flood risk management and how direct and local knowledges are relevant to shape this notion. All actors interviewed confirmed that, despite their similar risk framing ideas, their risk pre-estimation in practice, their risk evaluation and the translation of these notions into risk management practices are completely different. Their direct experience of flooding and their local knowledges work as something that directly influence their involvement in risk management practices and in the governance of flood risk at local level. FG1E, FG2E (FAG chairs), NG2E (National NGO local Ranger) and RC1E (County Councillor, RFCC and IDB member) interviews' excerpts have clearly shown how the lack of direct knowledge of the river behaviour (both not seeing it and having the river flowing in your own property) influences flood risk awareness and management, while the understanding of flood triggers vary widely from magic/beliefs to different ideas on climate change to hydraulic and land use issues, including a self-made knowledge of run-off water and riverine water behaviour. Another essential point is the matter of laypeople: it is not clear how to adapt technical and hydraulic notions to laypeople behaviour and nobody really delves into it. In the next chapter I will analyse how local knowledges are produced, transmitted and included in flood risk governance under the framing and implementation of the RSUDS project.

In the next part of this chapter, I will now analyse how the issues analysed in this part emerged in the Italian context.

PART II – The Italian context

The LIFE RII project is clearly a top-down project, due to its being driven by the ER Regional Council and financed by EU funding. Anyhow, it has been partially bottom-up driven, for the reasons I'll show in this part. Furthermore, community engagement is highly recommended by the European Commission in the *LIFE+* funding scheme. Web presence, transparency and the need to issue public reports of every actions undertaken are necessary requirements as well[46]. Furthermore, participation is one of the pillars of ER policies: a broad participation process has been led by the Regional Council to define the Po River Basin Flood Risk Management Plan (as foreseen by the FD), and the Regional Law 3/2010 on participation is one of the first and most innovative law of this kind in Italy.

In order to understand how local knowledges can be integrated in flood risk governance, in this part of the chapter I'll deal with flooding, flood risk and flood risk management in the LIFE RII project and in flood risk governance in Emilia Romagna. I'll delve into the ways these notions are conceived, experienced, defined and practiced by the different actors and agencies involved in the project.

5.4 The construction of flooding: flood triggers and effects

As seen in previous chapters, a major disastrous flood event, which rose public awareness or drove the project, didn't occur in the Italian case study area. Actually, it was also a bit challenging to outline the dynamics of recent past flooding events, since these were minor ones and caused damages only at a very local level. As I'll show indeed, only actors with a good direct knowledge of the watercourses (brooks, canals and ditches) or media at local level could provide some clear information on these events. Anyhow, as seen (see chapter 3), ER is the Italian region with the highest number of people living in risky area: this region was also hit by 6 major floods in the last 6 years. For these and other reasons[47], some of the results of the

[46] Cf. http://ec.europa.eu/environment/life/toolkit/comtools/requirements.htm

[47] For instance, the Regional law 3/10, which «promotes the right for the active participation of citizens to issue local and regional policies» or the Regional Directive 3939/1994, which recommends, if possible, the

Seinonda project[48] (see chapter three) were to both focus on river restoration measures and on a "participatory management" of the watercourses with the support of pilot projects and shared agreements between institutions, associations and local citizens. For instance, challenges to be undertaken in terms of flood risk governance in the Region, as result of one of the meeting of the *Seinonda* participatory process have been defined as follows:

- «To develop new capacities of joint commitment among different subjects working on the same policy;

- To discuss around technical problems with laypeople and local communities (non-expert stakeholders);

- Feedback and participation measures are necessary to develop effective policies;

- The need for public participation in decision-making» (Ercoli & Franceschini 2016: 25).

Even if local knowledges are not mentioned, it's clear the willingness (at Regional level) to find ways to use different knowledges to tackle flood risk engaging with laypeople both in decision-making and in facing technical problems, pushing participation and including different perspectives in policy-making and technical schemes. Indeed, the notions of flooding and flood risk (the process has been built upon) are partially defined following the FD:

> *«Flooding: temporary inundation of areas being normally dry, due to meteorological events. The inundation can bring with sediments. Floods are inundations caused by lakes, natural and artificial watercourses and the sea»*
>
> *…*
>
> *Flood risk: it refers to potential negative consequences caused by flooding to human health, territories, properties, the environment, cultural heritage and economic and social assets. As the notion of "damage", it can be measured according to what we consider, such as human lives, thousands of euros, years to be recovered. In Flood Risk Management Plans we find four risk levels» (Franceschini et al. 2016: 52,57)*

implementation of natural engineering solutions to manage environmental risks – more than 20 years ago. Moreover, ER is one the Italian Regions with the strongest presence of associations and NGOs in Italy.

[48] The participatory phase for the definition of the Flood Risk Management Plans, as foreseen by the FD.

If the "objects-at-risk" considered in the definition of flood risk is similar to the one mentioned in the FD, it's really meaningful the absence of any references to the probabilistic dimension of risk: a generic "potential" is mentioned. Alternatively, the potential for a damage that can be measured is what defines here flood risk, which is more linked to the "exposure" dimension, than to the "hazard" one. So, it's likely the effects on the object-at-risk which can better make "risk" "real".

Furthermore, flooding is not really framed as a process, rather more as a consequence of some events. It is so relevant the causal link between meteorological events and flooding -even if climate change is not really mentioned in the definition, unlikely in the FD -, that could be the claim put forward by this definition: the risk object is here the meteorological events interacting with existing "watery elements". Other potential sources of flooding, which were the ones put forward in reviewing flood risk mitigation national policies in England after the 2007 floods (e.g. surface run-off or groundwater) are here not considered.

Meteorological events are also mentioned by almost all interviewees involved in the project (representing the different governance levels) as one of the first flood triggers: they usually explain how extreme storm events and climate change increase flood risk and the possibility of flooding, so justifying the need for the LIFE RII project. Probably, current visible changes in climate in this Region[49] have been influencing their risk characterization, crossing all actors' view on flooding and flood risk, despite their lack of direct experience with flooding. From one side, a direct experience of extreme events may turn into evidence to take actions and avoid intolerable risks; from the other side, it could might become a scapegoat. Analyzing the words of most actors and comparing them to their organizations, the first option seems to be the most plausible one. Both from local and NGO actors:

> *«Up to 60 years ago ... these things couldn't happen! Farmers were used to clear out and the flash floods that we experience today didn't occur... (NG5I Local NGO and landowners, 15.11.2016)*[50]

[49] As reported by national media, drought, flooding, storms and small tornados have hit this part of Italy very often in the last decade. Even an earthquake hit the region; since the last big disastrous earthquake occurred almost 500 hundred years ago there, seismic risk was underrated.

[50] Translation by the author. All excerpts in Italian are translated by the authors.

«And then, as we've seen with changes occurring in climate, we can't hide it! Climate change is real, we are aware of it ... (FA1I, Farmer Union - 9.2.2017)

And from institutional ones:

«We began to focus on prevention because we've actually realized that we have got these rainstorms, for that I confirm that it's due to climate change because it is something that we, as technicians, are facing day by day. To date, the situation is under control, because we worked with this view in mind, and so we did LIFE RI…I» (DC4I, Albinea Municipal Officer - 3.3.2017)

«Hydraulic risk has changed much precisely because climate changes exist (DC1I, Quattro Castella Municipal Councillor - 3.3.2017)

«In the sense that climate change concentrates extreme events in a very short time and this is a problem for us. We have got two problems: climate change and urbanization: the whole water network has been sized in the 1920s ... so the flow rate of those channels is sized to the 1920s ... and the impermeability towards soils, water has not been absorbed, it flows very fast into the channel. Well, due to climate change, heavy rainfall occurred in a very short time, it is clear that such water network can't easily function, but we have to handle them ... (DB1I, IDB Manager - 13.2.2017)

«In the sense that they obviously can't store such amount of water, which now, due to new climate events are becoming more and more common in our area, too ... And they consist of - in the space of a few hours- these torrential downpours, drop quantities of water that in the past would normally fall in the range of 2 up to 3 months.

…

Perhaps in the past the idea of being close to, living by a river, it was a good thing; this is true in reality, but in fact, about the issue of how you protect yourself and fell afe, even in the face of the consequences of climate change, it is evident that throughout history this wasn't such a relevant harm, but now it turns into a risk component» (CC3I, Regional Councillor 13.7.2017)

It's noteworthy to notice how the discourse on climate change is built upon from local associations (and riparian owners as well) up to the Regional level of flood risk governance (and to the National level, as I'll show further on). Climate change is associated by all actors to an increasing of massive rainfall events, which concentrates in few hours the average monthly amount of water. This definition of climate change was just questioned by RC1E, one of the most relevant delegate for Gloucestershire flood risk policies (County Councillor, RFCC and IDB member). Alternatively, the direct (local) experience of this kind of phenomenon by all actors fuels the belief that climate change is one of the main flooding trigger in this area. Climate change was clearly also one of the driver of the project at a regional and municipal level, since it was an issue spontaneously coming out during lots of interviews. From these excerpts, different claims and different inter-discoursive relations emerge. At a very local level, the Municipalities put forward a sense of powerless associated with extreme events and the loose of traditional practices of land management usually undertaken by farmers. The idea of having lost the good traditional practice of clearing out streams and ditches, and cutting the vegetation along the brooks is put forward and linked to the mechanization of agriculture and the rent of agricultural lands (something similar was going on in the English context, but I'll delve into these components of local knowledge in the next chapter). A direct causal link between flooding and extreme events is claimed by local institutions (DC4I, DC1I: Municipal Officer and Councillor), while at Regional and Provincial level (CC1I, Regional Manager and Project leader and DB1I, IDB Manager) they point out the *topos* of human responsibility and link the discourse on climate change to the discourse about development. So, flooding is caused by the impact of extreme rainfalls on an interconnected network of brooks, ditches and channels that can't support water drainage, due to the process of "urbanization". As seen in the first part, the same link has been acknowledged in the English context by the main flood risk management agency (Environment Agency, EA1E) and in the National Flood and Coastal Erosion Risk Management Strategy for England by DEFRA, but no argumentation is still adduced. It is interesting to note the use of the word "urbanization", which refers to a big historical process, made by bad political choices and hard to reverse. DB1I (IDB Manager), who now represents the main flood risk management actor manages in the area (see chapter four), explains that channels and ditches were built to drain water in a built environment which is not the current one, with a much lower rate of permeable soil. So, urban development and climate change are presented as something obvious: risk mitigation and the LIFE RII project are seen as plausible practical interventions to reduce flood risk in this kind of area.

Another issue emerged from CC3I (Regional Councillor) words is that living close to a river should be reconsidered in housing choices. In reality, the Slad FAG representatives in England revealed a strong link between risk awareness and daily direct observations in some contexts, so it can be considered as a controversial claim, which can be interpreted in two opposite ways: a lack of direct local knowledge of flooding dynamics or an implicit reference to development and excessive land use. Indeed, I found a general lack of direct experiences in flooding in the Italian context, due to the lack of major floods occurred there. Furthermore, many interviewees mentioned the occurrence of flood events without really knowing when they occurred. In this regard, a lack of local knowledge of the area is risen by the project leader, referring to the Regional level of policy making:

> *«We haven't got a direct knowledge of the area, of the floods ... here we manage it from our office, in the office to make to assess values, damage estimates, that stuff. Floods are known by local technicians» (CC1I, 2.3.2017)*

The agency, who has got a good local (direct) knowledge of flood risk in the area is the Internal Drainage Board, due to its history, a strong presence of its workers on the ground, its role in managing water drainage and its effective but informal role in managing flood risk in the area. To this regard and to understand how flood risk is framed at local level, I report a whole conversation between me and NG1I, who wrote the LIFE RII proposal and then was hired as IDB officer during the LIFE RII project:

> *«So, aren't there any previous flood? This was not a reason why maybe the local citizen argued "my town is flooded ... I'll allow the works in my land...?» (researcher)*
>
> *«No, because indeed, although hydraulic models make it clear that it is evident there is a risk, we hadn't heavy rainfall events that really…» (NG1I, National NGO and IDB officer - 13.2.2017)*
>
> *«But, I mean the 2007 ones?» (researcher)*
>
> *«Yes, but not there. This is the big issue of risk, that is, there is no risk perception. That is, you don't see hydraulic risks every year ... well, people say "eh, but it's 30 years, I'm living here since 30 years but the stream never flooded", but it doesn't mean anything, because…» (NG1I, National NGO and IDB officer - 13.2.2017)*

«So, did you approach the project looking at flood risk maps? But, anyway… the Municipality of Quattro Castella has been flooded! » (researcher)

«Yes, that is, there were floods, but not as catastrophic as you could expect from the hydraulic studies, that is, if there were very extreme rains, we would come across very extreme situations, but ehhhhhh …. because you don't see it, the problem is not there, until you'll see it!!» (NG1I, National NGO and IDB officer - 13.2.2017)

NG1I (National NGO and IDB officer) doesn't really give so much importance to the occurrence of past floods in this area. The claims adduced by NG1I are three: the occurrence of extreme events and the consequent need for risk mitigation measures, a trust in hydraulic modelling and the lack of a "right" risk awareness of local people fed by the absence of disastrous events. The third aspect was reiterated in the English context and in the academic literature (Scolobig *et al.* 2012), and will raise questions on the use of historical knowledge (see next chapter). The discourse on flooding triggers and effects is quite technical here, since his argumentation sounds like that: hydraulic modelling demonstrates the presence of high flood risk areas, so we need to take risk mitigation measures, although the lack of disastrous flood – which can have bigger return periods.

The documents produced for the first phase of the LIFE RII project, which are obviously hydraulic analysis, also confirm his reasoning. Taking as most significant examples the brooks generally considered being the most dangerous rivers among the ones considered, Rio Enzola and Rio Bianello, we can read on this analysis that: the causes of possible flooding (defined as 10-year flood) are explained respectively as follows.

«The main cause for this situation is the removal of flooding areas along the stream, due to both the construction of river banks in the plain and urbanization in floodable areas. The construction of an urban belt by the foothills also limits almost completely the presence of detention areas/floodplains upstream the inhabited area, a situation worsened by culverted stretches in the urban area, which are built with hydraulically insufficient sections» (LIFE RII 2013: 10)[51]

[51] Translation by the author

> *«Main causes for this situation are: the culvert which goes through Quattro Castella historical centre, which causes flooding in the urban area; and the removal of flooding areas along the stream causing flooding downstream the urban area. This removal happened due to the construction of river banks in the plain the and urbanization in floodable areas»* (LIFERII 2013: 11).

The hydrological analysis reiterates the diffuse opinion around the causes of flood. It also added two more triggers: the geomorphological and terrain characteristics, and the presence of culverted river stretches, as I'll discuss in the next paragraph.

Concerning the flooding awareness issue, NG1I (National NGO and IDB officer) confirmed my difficulty in finding precise information about past floods in the area. For instance, LO1I, who is a riparian owner but also the local chair of one of the most important environment association in Italy, referred to have never experienced floods in the area. IDB3I, being a recently hired IDB technician and not living in the area, didn't really remember them. Contrarily, DC1I (Regional Manager and Project Leader) reported that there were lots of minor floods and maybe a bigger one in 2005, because the Rio Enzola is partially flowing above the street level, due to soil removal to provide clay for an old furnace. She also underpinned how the Rio Bianello is "dangerous" to the extent to which it is culverted and could easily flood the town of Quattro Castella. Also FA1I (Farmer Union) reported some problems of minor flooding caused by the Rio Enzola (without mentioning when) and solved by the IDB intervention. This was another reasons for starting the LIFE RII project:

> *«but we had some problem of flooding even nearby the Enzola stream, it flooded nearby the Bibbiano town, where the IDB practically intervened, with the Regional Soil Protection Office... so these interventions should allow ... and this is part of the project ... to prevent hydrogeological erosion»* (FA1I, Farmer Union - 9.2.2017)

It was not possible to find many explicit details on local media around past floods, too. It is possible to trace back some news of past big floods (1972 and 1973, 300 displaced and 2 people killed) caused by a bigger creek, where some of the streams of the LIFE RII project flow into. The newspaper article was published in 2011 and it concludes evoking stronger efforts not to

lose this memory under the concrete of urban development, to the extent to which water was a pillar of local identity of this area[52].

Some local news I found report that the Rio Enzola flooded in 2013 and hit some houses and factories:

> *«On March 6, 2013, Rio Enzola overflew between the municipalities of Quattro Castella and Bibbiano, affecting houses and industrial buildings. The cause of the flooding was the blockage of the streambed by some trunks, which were cut and abandoned in the streambed and formed a dam blocking debris. Flooded water was drained out thanks to the joint intervention of the Internal Drainage Board technicians, the Fire Brigade and the Municipality of Quattro Castella. The LIFE + RII project is intended to help solving these hydraulic problems and improving the ecological status of the Rio Enzola...»* (ER Region, 2013[53])

> *«The waterways maintenance must be guaranteed, of course. But hydrogeological risk is also caused, above all, by excessive urbanization of the land. "At the beginning of the Twentieth Century the 2 percent of the area was urbanized in our plain, we are now at 20 percent. And an urbanized ground becomes impermeable to rainfall; it drains into sewers, canals and streams an amount of water thirty times above a natural, permeable soil. This is perhaps enough to understand the risk that our territory runs in a context of extreme climate change»* (ReggioOnLine, 2017[54])

The argumentation of the reported news exactly followed the most common discourse put forward by the interviewees: urbanization, climate change and extreme rainfall events. Another cause is put forward here: the lack of clearing out causing blockages, due to the presence of trunks, vegetation and branches. This point partially calls some triggers of the Slad brook flooding, being dangerous the presence of woody debris downstream. However, it's not clear

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[52] «The episode of 1973? It's been in the memory of a few, and the Crostolo came back to sleep, with its crust, now leaning out between its concrete banks, narrow among cycle lanes and countryside footpaths. On this anniversary, and on the eve of the referendum that sees water as protagonist, it is good that water returns into the public eye. It's hard to imagine today, but our city, our province, and the entire Padanian territory is somehow a son of water and water management, among drainage, ditches and canalizations works. Water is part of our identity, and it can't be ignored by in projecting of our bio-historical path of life» (Gazzetta di Reggio, 9.6.2011, available on line at the following link: http://gazzettadireggio.gelocal.it/reggio/cronaca/2011/06/09/news/trentotto-anni-fa-l-esondazione-del-torrente-crostolo-1.328600. Translation by the author.)

[53] Available at the following link: http://ambiente.regione.emilia-romagna.it/life-rii/notizie/2013/esondazione-del-rio-enzola. Translation by the author.

[54] Available at the following link: http://www.reggionline.com/reggio-emilia-dissesto-idrogeologico-rischio-250-km-canali-video/. Translation by the author.

where these trunks were placed or came from, that is, who was responsible for lack of care or simply lack of local knowledge.

5.5 The relationships with the watercourses

Direct local experiences of floods could be collected only from two local actors, NG4I, representing a local association of environmental education and DB3I, a *dugarolo*, a dialectal term meaning "who manages the locks to drain water", a clear element of local knowledge used by the IDB, indeed. NG4I (Local NGO) explained that:

> *«Here (fig. 5.7) the culverted stretch, which goes through our town, ends. This, as you can see, gave rise to several problems of debris accumulation and therefore the potential of flooding. This connection was built for a final stretch to clear away part of the debris, this is quite relevant in rainy times. Despite being these streams very small, they are connected to a large basin. In case of heavy rain, since the soil is mainly clay, water accumulates very quickly and this stretch ... the problems were mainly two here: the vegetation that grows, goes over the banks... this stretch as you can see is channeled, elevated, above the ground level (fig 5.8), because in the past it was consented to make excavations of land very badly, there was a clay for a furnace ... but obviously if you dig out the soil ... meanwhile the canal became hanging ... it looks like a canal!»* (NG4I, Local NGO - 3.3.2017)

Figure 5. 7 The Rio Enzola flows culverted in Bibbiano town

Figure 5. 8 The Rio Enzola flows like a channel and is elevated above the ground level (on the left side)

As an environmental educator and member of the local section of a national environment association, NG4I knows very well the watercourses in the area. He usually brings there students to observe natural and geomorphological dynamics. He was also hired in the LIFE RII project to produce a "Chemical-physical, vegetation and fauna, geomorphological and hydraulic monitoring", so he owned an expert knowledge of the area. He knows how the river and the river bed should be, where and what are flooding triggers, lots of physical and geomorphological issues. In his excerpt, he appears to be very confident in what he is saying, arguing that a bad maintenance of the stream (collapsing banks, too much vegetation, being above the field level) can cause flooding. Being this brook stretch culverted and channeled in a urban environment it's hard to implement natural flood management, thus proper flood risk mitigation works should be built upstream. In the scoping report he produced –but it's a common opinion among my interviewees- it's well described the peculiar characteristic of the areas, determining the relationships between the locals and water. A clear difference with the English context is the public status of watercourses in Italy and the duty to consent public access for interventions (and the prohibition to build anything) within 5 meters for each side from the center of the watercourse. So, I couldn't find streams or rivers flowing through someone's property, affecting his/her daily life. A lack of direct daily experience in terms of

flood risk affecting one's own property may clearly have consequences on flood risk awareness and flood risk management, following the reasoning of GV2I (AIPO Officer): «Being it public, nobody cares» (GV2I, 5.4.2017). The opposite can also be found:

> *«The idea that "this is all my property, even if it's public!" "It's mine up there. I always managed it, I have never seen anyone here, so I decide how to do it by myself! "» (NG1I, National NGO and IDB Officer - 13.2.2017)*

For instance, this idea goes with the complexity of flood risk governance in ER, as noted in chapter 4, and remarked by GV2I (AIPO officer):

> *«In the sense that there are many, many, many, many functions the watercourses incorporates... there is the watercourse ... many functions, many values, many institutions overseeing functions and values, for instance»* (GV2I, AIPO Officer - 5.4.2017)

Despite this complexity of functions, competencies and values involved, the landscape of the actors involved in the project is surrounded by watercourses: canals, channels, streams, brooks and river flowing in the biggest flood plain of the Country. It exists a daily relationship with water and water is theoretically acknowledged as a risk-object, the point is how to manage it and who is going to do what. Due to the absence of major floods, there isn't a pressure "to a zero risk", rather to do something and better manage risk and water quality. Everyone involved in the project has got a clear idea of the behaviour of these watercourses: being stuck in steep valleys upstream (fig. 5.9), flowing in a narrow bed in the woodland (fig. 5.10) and then being channelized and culverted.

Figure 5. 9 Badlands and steep valleys few kilometers above the Municipalities

Figure 5. 10 The Rio Bertolini flowing towards San Polo d'Enza town

The bad status of these watercourses reflects the loss of a positive and active relationship with the watercourse, the habits to be surrounded by them maybe turned into loss of awareness. Indeed, someone should be responsible for urban development and intensive agriculture destroying natural habitats, biodiversity and water-human relationships. If water flowing still unveils political relationships, fig. 5.7 and 5.8, like ethnographic notes, clearly shows the general willingness to constrain water to flow hidden to gain more land and development as

possible. Current bad practices in water management are reported by the Ecological wardens, as NG6I explains that:

> *« The management of the banks was a traditional one, so there weren't banks that caused troubles, like where the locus tree is, there could be ... planting trees was subjected to ... everyone knew there were rules to follow ... and there were the "dugaroli", who were very careful, and they went all around with weapons, that is, they were armed and could make sanctions… About the flood risk? Actually, I have never heard of it, there was just the 1967 or 1976 the flood in the area, do you know that flood? Because they built where they weren't allow to build…*
>
> …
>
> *let's talk about San Polo, for example: there was a stream, which is close to one of the ones [covered by the project], and was completely blocked, because where people find a hole, close by some houses, where there's a hole and they never see the water flowing, they throw away woods, throw away the garbage. Then somebody in this area called me, "NG6I., you know that there are problems here ... then we went over there, and we were horrified, because it was just by a culvert .... There are no controls, there is no control across this area. You wouldn't expect it from local citizens, but in practice ... many times they don't even know what that channel is there for, there is no understanding...»* (NG6I, Provincial NGO Chair 14.11.2016)

The claims adduced here say something interesting on the relationships of the locals with the watercourses. It recalls the loss of confidence in water management, due to a lack of local knowledge about the surrounding environment. Reasons advanced here are taken from the *topos* of a nostalgic past when everything was perfect and worked well. What it is interesting here is the link between the existence of traditional workers managing water (the *dugaroli* - I'll delve into this in the next chapter), their constant presence in the countryside and a bigger awareness of environmental issues, which may contradict the current growth in environmental awareness that triggered natural flood management projects like LIFE RII. In the opinion of her NGO, a better local water management and a diffuse knowledge of simple rules of traditional forestry is associated with the absence of flood risk, which had resulted in flooding only once because of human responsibilities. A topic that sounds quite familiar, similar to the one introduced by DC1E. Contrarily, a missing experience of water and water management is

leading to bad practices and an increasing in flood risk[55]. Indeed, during the meetings of the project, local citizens were demanding ways to make the watercourses more accessible, such as footpaths or cycle lanes along the banks, green areas, river regeneration - in terms of historical and natural heritage – projects. One of the most important things experienced during the project, which activated the relationships with the watercourse and local knowledges therefore, was walking along the watercourses and regain a direct experience of them (see next chapter). As it will be discussed further on, what is relevant to our research here is still the loss of a direct (local) relationships with the brooks involved in the projects, now experienced only by some IDB technicians (like DB3I, IDB "dugarolo-in-chief") or by the elderly (like NG6I, Provincial NGO Chair, or as LOI1, National NGO and riparian owner, reports). In this regard, it's years that Legambiente has campaigned for a "cultural change", which is needed to change bad practices, such as illegal dumping, culvert leaks and:

> *«What is not acceptable is the cultural discourse, that is, it's not acceptable "there is money, we do it, there isn't, we don't do it". The other unacceptable thing is dumping management... that is, the problem of illegal dumping is an objective problem ... they are connected directly without permission ... and from a cultural point of view it was not considered to intervene... »* (NG2I, National NGO Local member - 9.2.2017)

To my question about what can be considered unacceptable in flood risk management, he carried on the perspective of his environment association: he argues that environmental protection should be deemed an objective issue and cultural change should drive water and risk management policies. A clear "watershed" between "them" and him is set up, by calling into question general habits and past and current regional and local flood risk and water management policies. Indeed, Legambiente (he and LO1I) complained about starting the LIFE RII only due to EU funding, which was mainly true – but not easy to overcome. But, as mentioned in chapter four, Officer and manager at Regional and National levels (e.g. CC1I, Regional Manager and Project Leader, GV1I and GV2I, ADBPO and AIPO Officers) reported a constant cut in funding over the last two decades, which has been almost reduced by ten times.

[55] As noticed, one of the main causes of the 2013 flood was the presence of dumbed debris, which let the brook to overflow.

5.6 The concepts of "flood risk"

In terms of flood risk policies, the concept of flood risk used in the Regional Flood Risk Strategy (The *Po River Basin Risk Management Plan*) is the one mentioned in the Law Decree n.49/2010, which converted the EU FD into the Italian legal framework. Here flood risk is defined as:

> *«the combination of the probability of the occurrence of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and social and economic activities resulting from such flood event»* (ER 2013: 14)

This definition is the same used in the FD:

> *«"flood risk" means the combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activities associated with a flood event»* (EP 2007: 3)

The two definitions are clearly identical, and very similar to the flood risk notion identified by the British Government, as seen in the first part of this chapter. Again, too much space is given to the occurrence of a "flood event", rather than underpinning flooding as a process. "Inevitability" is not claimed in this definition, and no field of interventions are suggested as well. Probability is the way to represent risk in a technical and (alleged) understandable way to take actions and built risk management options upon. It's remarkable the insertion of "social activities" by the Regional Strategy, to the extent to which socio-cultural aspects are equally affected by flood risk and should be potentially taken into account. Obviously, the same definition is shared by some interviewees (above all at National and Regional level, e.g. GOV1I, GOV2I, CC2I, respectively ADBPO, AIPO and Regional Officers) even if in the Italian context a greater differentiation is at stake. For instance, CC1I, the project leader, didn't provide me a clear definition of it, but reiterated the need to spend public money in a smart way, by experimenting and finding new efficient solutions to new problem within a climate change adaptation perspective. It is also necessary, he reported on behalf of the Regional "Soil and Coastal Protection and Drainage Office" Area, to change mindsets and policies in order to

fix past mistakes concerning urban developments and environmental protection with young experts having a better environmental awareness[56]. Other two technical actors insisted on the need to overcome the logic of emergency, which usually drives DRR intervention, due to lack of resources and planning. So, to my question about defining flood risk, one, GV2I brought the view of the AIPO (The Inter-Regional Agency for the Po River, see chapter four). She replies to me as follows:

> *«Well, planning ... in the sense that there are planning tools that identify, based on risk and hence of the hazard, the fact that an event would occur with a defined return time, and that the flood event, however, is likely to affect needs, goods and properties. This means, we need to identify what are the needs for an area to be safe»* (GV2I, AIPO Officer - 5.4.2017)

She confirmed how AIPO is usually working following the technical definition proposed by the EU. She insisted on the opportunity to manage and control flood risk with long time planning to mitigate the hazard and increase property protection: here the risk-object is still the hazard source and the objects-at-risk are goods and properties. Indeed,[57] she defines planning as «how the river must work to ensure safety», persisting in a technocratic view on flood risk management. Alternatively, CC2I (Regional Officer), an environmental scientist, well described how the Regional "Soil and Coastal Protection, and Drainage Area Managers" are tempted to pedantically follow the technical definition, but he argued as follows:

> *«[flood risk]is the combination of diverse factors. I obviously see it as a technician, that is, I would like to answer you by school textbook it as the product of a number of factors, which are first the natural ones: let's say the elements, which are naturally dangerous, naturally occurring in an area, the frequency of rain, the geology; so the probability that an event may occur multiplied by exposure, that is the combination of the location of people rather than things and activities and their intrinsic value, that makes them*

[56] Here are his words: «*Well, I'm not planner, so I've got a different idea. In my opinion, it means to spend public money in a smart way to prevent risk: this is at best, if in the most efficient way. Well, probably the factors are so many: climate change, because the events occurring now ... we had in September this year rainfall concentrated in a few hours: the IDB technicians who did the surveys said that they have never experienced something like this, but it's not just this: it's partly due to climate change, partly due to lack of money for maintenance and maintenance is now really poor, then perhaps in the past wrong choices have been made. Now younger administrators are much aware of past wrong choices, sensitivity has changed and well, old recipes are no longer sustainable from both a financial and environmental point of view. You have to experiment for something new, because if the conditions have changed, you need to change the answers as well» (CC1I, 2.3.2017)*

[57] The public agency where GV2I (AIPO Officer) was not involved in the project, since it hasn't got legal duties on the watercourses covered by the LIFE RII project

> *exposed to the fact that that element can provoke damage. This is the definition which is usually given. But each of us perceives risk as being a human being, as a homo-sapiens, but it doesn't mean risk is always perceived as such by everyone, not everyone perceives the risk of a little stream, for instance»* (CC2I, Regional Officer - 2.3.2017)

His reasoning was elaborated (and maybe it will be included in future policies, starting from the River Contract) after the LIFE RII project: engaging with different actors in flood risk management and governance made him think that every actor can perceive (and construct, I would add) risk in a different way. He derived this thought from how much difficult is to communicate risk to non-technicians, to the extent to which risk is not only a probability, but risk-objects and the object-at-risk may vary, as argued in chapter one and four. Thus, a stream could easily not be perceived as a risk-object, above all when this is a torrential stream (without water for six months long), or the stream is hidden, channelized, culverted or simply unnoticed or any relationship is built upon it. In addition, flooding is a combination of different factors over space and time, more likely a process (as discussed in the first part of this chapter) than a series of events. For analogous reasons, also practitioners have got their own view on flood risk. For example, FA1I, representing the farmers' view, sees flood risk as something that affects agriculture, although fields are never deemed to be proper objects-at-risk in official flood risk reports:

> *«Flood risk is when, basically, in an area ... since the most vulnerable is the farmer ... and when these streams overflow you go flooded and the crops are damaged. Best-case scenario, in the case of fodder crops, you will lose a cut, but then it is likely to suffer damage where we have vineyards»* (FA1I, Farmer Union Chair - 9.2.2017)

Who is most affected by flood risk are famers, in FA1I (Farmer Union Chair) opinion. He frames the risk-objects as a combination of extreme events and streams' behaviour, while the object-at-risk results in crops damage. Alternatively, the IDB sees flood risk as a critical amount of water flowing downstream to channels that potentially creats blockages:

> *«Well, you know we're here upstream, big issues are always downstream because the more you go downstream the more water drain. Here the biggest*

risk is maybe a blockage in the channel, so it is more about maintenance and prevention» (DB3I, IDB "dugarolo-in-chief" 9.2.2017).

Due to DB3I (IDB "dugarolo-in-chief") working as a local water manager, by opening or closing locks for irrigation, flood risk turns into an unmanageable amount of water flowing downstream, so that reducing flood risk means to drain water as fast as possible: this is right what natural flood management and river restoration will never foresee to mitigate flood risk. Furthermore, Legambiente, the most relevant NGO in the area, admits that they never really handled flood risk, rather only environmental-related problems. This statement underpins how complicated is still today to have a holistic approach to risk in general or even frame and evaluate risk:

«We don't deal with it because you need to be very technical but what you see it's that when some interventions are undertaken in watercourses, these interventions are devastating: when they [who does the interventions] arrive they cut everything but you are cutting hundred-year poplars, this is crazy! And it isn't right like that, because you have been creating land erosion and when it starts being eroded, then it's complicated to manage it» (LO1I, National NGO and riparian owner - 9.2.2017)

Anyway, this excerpt highlights how her understanding of river restoration principles remains consistent, to the extent to which a direct (local) knowledge of forestry management can make the difference in flood risk management, even without being experts.

To conclude, the environment and development Councillor of one of the four municipalities well defines risk, because he is able to read the critical issues of an area, as a result of a process, which can be mitigated if possible:

«In my opinion, hydraulic risk means being able to read the critical issues of a territory and trying to prevent them as far as possible wherever you can» (DC1I, Quattro Castella Municipal Councillor - 3.3.2017)

At local level, being able to "read" the environment and to interlink different practices (e.g. forestry management, land use, flood risk management) is what can contribute to manage flood risk in a better way: a holistic, polycentric, and catchment scale approach could fit into this view, as carried on by one of the Municipalities involved in the project. Furthermore, this broad differentiation in flood risk definitions and constructions points out how different views on flood risk should and could interact, as I'll argue in the next two chapters.

CHAPTER 6

6. The inclusion of local knowledges in the two flood risk management projects

Like the previous chapter, this chapter is divided into two parts, each one analysing a case study. In both parts I will delve into the concept of local knowledge, figuring out how this concept triggered and was included into the two natural flood management projects I've been considering.

PART I - The English context

6.1 Managing flood risk with local knowledges

Differently from the prevailing opinion, the Brigend FAG Chair deemed the 2007 flood was not a rare, inevitable, «freak event»[58], rather something "normal". Indeed, he lives in a flood-prone area downstream, along three watercourses, thus getting all run-off and flooding water coming from upstream. The *Brigend* location is exactly what makes peculiar flood risk here: three different kind of watercourses managed by three different authorities (Environment Agency, County Council and Highway Authority) resulting in a confusing flood risk governance. The confusion is also marked by a "low number" of properties "at risk" and by the peripheral location, far away from the main town. To tackle this flood risk context, characterized by high risk, a direct knowledge of flooding and a confuse risk governance, FG4E started to learn by himself how to manage flood risk, and then to share his findings to the members of his FAG. From his words, a constant and direct experience of flooding seems the

[58] His words.

most important driver of his behaviour, what triggered him to push the institutions (in the first and second phase of the process) to have and keep a catchment approach to flood risk. In his case, local knowledge becomes a sort of "citizen science" (McEwen & Jones 2012), from the micro scale of his garden to the catchment scale. His learning and self-legitimization have been driven by common-sense, direct experience and social capital (as discussed in chapter four): «*because I saw it, because I watched where water goes and I watched how it moves and goes through»,* he repeated to me many times. Watching the water flowing, he acquired a local knowledge of water behaviour. He built first a local water geography at a micro-scale (McEwen& Jones 2012), then starting to manage flood risk in informal ways. His way to manage flood risk started with a *risk evaluation* step, which didn't follow the Renn's RGF. Unlike FG2E (Painswick FAG chair), he tackled ambiguity in a normative sense, judging tolerability according to his knowledges and experience. This means there are differences in the local knowledges brought by the different action groups, eventually depending on the micro-local contexts. In this case, FG4E (Brigend FAG chair) saw many times water coming into his garden before the 2007 flood and started "reading" the water behaviour. So, he adapted his garden by temporary storing water in some parts of it and keeping water flowing without flooding his house. While walking in his garden he explained to me how he managed to do this over the last years. I will report some quotes and my visual notes as follows:

> *«You can't, you can't stop it [flooding]... that's the moment, so once you've realized how - 'cos I've seen it happening...living here… Well, I thought...first I thought it has been scary and then we've sort of began to get used to it, we started to learn… we start at looking around the place and thinking, ah that's what that, so another kind of… oh you will go through a little walk and you will see everything we do, we now rebuilt to resist floods*
>
> …
>
> *That filed (fig. 6.1) fills up with water, and then it came straight through here, we build this road (fig. 6.2) like a levee… that was our, one of the first time we were in trouble, we would monitor that field (fig. 6.3) and this is (fig. 6.1) where the water is gonna come through the garden: this is raised up…. I used to drive...years ago before I worked at university, I used to drive mechanical diggers, so this is stop to me "I can do this" quite easily" "Well, I can understand the principle of RSUDS, Ok? And this, this shed here (fig.6.3), I would say… so what I did was...this levee comes around here (fig.6.2), it comes through here (fig.6.3), and by those trees (fig. 6.2) this is the river, ok? (FG4E, Brigend FAG Chair - 9.12.2016)*

Figure 6. 1 Into FG4 garden. This space has been left empty not to store too much water in the garden. It can be thus canalized during a flood

Figure 6. 2 Into FG4 property. The road was elevated to work as a levee. On the left side, one of the watercourse flows; on the right, there's FG4's house

Figure 6. 3 Into FG4 garden. Here the water eventually coming from behind the shed (where the river flows) is held up and can't damage anything because everything has been raised up, as shown in the picture

Figure 6. 4 Into FG4 garden. Here the water eventually coming from behind the shed (where the river flows) flows underneath and can't damage anything because everything has been raised up, as shown in the picture

Different claims can be found in this excerpt. He confirms the *topos* of the inevitability of flooding and the potential to shock, which was found both in all official policy documents at National, Regional and Local level, and in most interviewees. Contrarily from what discussed in the previous chapter, this perspective resulted from his learning around the river behaviour: he learnt how to deal with the river and to have a flood-resistant built environment. Practical knowledge, direct experience, historical knowledge[59] and common-sense contributed to produce both experimentation and a local knowledge around flooding and flood risk management. Local knowledges about flood risk management are experimented in order to be safe at home, a house chosen right because of its position and beauty, as he put forward in his interview[60]. As sometimes happens, aesthetic and economic reasons are more important than supposed "risky" ones (Scolobig *et al.* 2012), even if a direct experience of flood risk was determinant to acquire a strong local knowledge about flood risk.

6.2 Towards RSUDS: the role of local knowledges in triggering the project

The relational aspect of local knowledge clearly emerged from other direct experiences involving FAG members, but in different ways. For instance, the Painswick FAG chair acquired some local knowledges of the stream flowing into her property only after the 2007 flooding. Though the stream flows under her house, she started observing it, learning its behaviour and also exchanging opinions with her neighbours only after the flood, after attending the meetings organized by her action group - as seen for the Slad FAG in chapter five. FG2E (Painswick FAG Chair) admitted that she started talking with their neighbours after the 2007 flood, in order to get information about flood risk and flooding in her area:

> *There was no understanding from one neighbour to another, but actually there is one lady, just above the K. mill: her husband was born in the house*

[59] He (like the other FAG chairs and members) started also to search for historical information about the place they have been living for years. For instance, he found out that his house was previously an eighteenth-century mill. So, water has been there for three hundred years, at least.

[60] «Well, because you can just, you just adapt to your environment! You know, it's a very fertile little valley, because every night and again we get a whole bench silt put onto the ground from the farmland and the valleys up there, so it's a fertile little valley, it's southwest facing, it's got a microclimate, which is fantastic RPP , and we get warm winds and wet, and warm rains from the Atlantic, North Atlantic drift constraint of the Bristol channel and comes up through here, so I deal for…» (FG4E, Brigend FAG Chair)

and he lived there all his life, and he was said "once it starts to rain, it's too late to raise the gate and then keep the pond… (FG2E, Painswick FAG Chair -12.4.2017)

So, the accumulation and transmission of local knowledges were achieved by local FAG members by talking to each other, with the willingness to learn how to "read" the behaviour of riverine and surface run-off water within a local perspective. Historical and traditional knowledges can also be part of this, even if they should be selected, as I will argue further on.

So far, it has emerged the "work" of FAG chairs to build a local knowledge of flood risk in their "areas of expertise", I would say. And *situatedness* and the "relational" feature are key components: local knowledges produced by the FAGs are embedded in relationships, relationships with people (neighbours in FG2E excerpt) and with the surrounding environment (FG4E, Brigend FAG Chair, with his garden and his house) over time. As Kraus properly noticed right for Gloucestershire, «water flows are more widely relational, and political: as the water disappears from one place, it goes somewhere else» (Kraus 2016: 8). As seen, the flowing (and flooding) of water has built relationships: emotional, social and political. Furthermore, keeping the water flowing can have social and political effects in term of damage. This was most evident in every "traditional" engineering solutions proposed at local or property level by the EA, DC and CC in the first two phases of the process. For instance, clearing out the streams (see chapter four) means to keep more water flowing downstream, solving the problems upstream but amplifying it downstream. Or building IPP (individual property protection, as carried out by the EA in the second phase of the process, i.e. at the bottom of the Slad Valley –fig. 6.5- or in Brigend - fig. 6.6) could potentially break social relationships, protecting some properties (the ones defined as risky on the flood hazard map) but not alleviating flood risk in the whole area.

Figure 6. 5 Individual property protection (bulkhead) built by the EA at the bottom of the Slad Valley

Figure 6. 6 Individual property protection (wall and bulkhead) built by the EA in front of FG4 house

Contrarily, political relationships are determining this approach, due to the need of cost-benefit analysis: indeed, engineering solutions or IPP locations are placed by hydraulic models in precise locations, working as few interventions, so that every potential effect can be managed and controlled (as the project leader of the LIFE RII project will also point out in the next part).

Furthermore, the flooding of water unveils how to "deal with" and be involved in flood risk governance to cope with flood risk in his area. Indeed, the FAGs have been formed for three main reasons: to solve flood risk related problem as quickly as possible, to be aware of "who is responsible for what" (i.e. the risk governance framework), to campaign and lobby for being

protected against floods. FG4E (Brigend FAG chair) well explained this common perspective among the FAGs:

> *We wanted to kick… to make a big noise, so they listen to us, were aware of us…. There was a lot of press releases that said things as "we are forgotten", "these are our homes" "ta ta ta ta ta…"*
>
> *The other strategy was to work out who is responsible for what, yeah? Now at that point we started -that interested me-, so I started unpicking national and local legislation and responsibilities and I realized EA was responsible for the main rivers, not ordinary water courses, the DC ordinary water courses, the CC holds the funds, G. Highways is responsible for the roads and drains, the IDB had responsibilities up to a certain point within this; we started unpicking all the local authority responsibilities and then strategically attacking at certain points, so you would attack… (FG4E, Brigend FAG chair - 9.12.2016)*

The work to unpick who is responsible for what and the need to be listened reveals a clearly perceived big distance between two subjects, a "we" and a "they": the presence of a personal and community dimension linked to flood risk, which seems not to be included both in the cost-benefit ratio[61] and in the governance framework. The inhabitants who have been hit by floods seem not to be part of the decision-making process, mining public participation: the argumentation here supports a lack of moral and political responsibility in tackling flood risk and the need to "attack" to protect "our homes"; again, flood risk protection is linked to personal feelings of rage and frustration, a feeling of being powerless, despite a strong understanding of flood risk produced by a mix of direct and practical experience resulting in possessing a great deal of local knowledge about surface run-off and riverine water.

Indeed, the common-sense drivers of the work informally done in his garden and previously described by him and put forward by the FAGs look like the ones used in the project (see chapter four[62]).

The aim of these techniques, as seen, is to use nature-based solutions (fig. 6.12) to imitate nature in slowing down flood peak and flood water speed, to reduce flood risk and increase

[61] RC1E (County Councillor, RFCC and IDB member) states that the cost-benefit ratio should be 1:5, that is, a project can be funded with local levy if the benefit will be 5 times the investment.

[62] An accurate description is also provided by Chris Short reporting DC1E (Project leader) ways of doing: «We are using a wide range of natural flood management techniques, including the building of large woody leaky dams across streams, excavating dry ponds and diverting flood water into natural soakaways. Some structures work by spreading water over the neighbouring land, others act like baffles, physically slowing down flood flows. All the structures provide great habitats for wildlife, reduce the amount of silt travelling downstream and importantly, slow the rate at which floods travel down the valleys, lowering the peak water height» (Short 2016)

biodiversity. This is important for my research to the extent to which local knowledge is included and how in the different phases of the project, as I will argue in the next paragraph. The point here is that having and applying local knowledges can result in some benefits for flood risk management at local level.

Indeed, the flood risk governance outlined in the third chapter is deemed to be complicated even by whom is working in local institutions: this is also local knowledge. For instance, the DC puts forward the issue of responsibility in flood risk management:

> *It's very complicated in terms of the political structure that we have here and who is responsible for what. It's fine for me when you work with it all the time, but for an outsider, even someone in the UK, for the community, certainly in the beginning, the community simply did not understand where any responsibility lay, there's something we are a lot better doing now and, yes, a lot of communication we did after 2007, we put a lot of information on our web around responsibilities, and things they can do if there's a flood wherever we should be prepared… (DC3E, District Council Office Chief 3.11.2016)*

The flowing/flooding of water unveils again the political connotations of something, like water, which cannot be easily managed and whose movements and relationships don't follow administrative or statutory duties. The need for polycentric governance should go with a clearer share of responsibilities. The powerless feeling turned into the willingness "to do something" and "make noise", which drove the creation of the four action groups and the RSUDS project. Even CC1E (County Flood Risk Manager), being strongly involved in the local flood risk management strategy, admits that:

> *it's complex, it remains very complex and members of the public and most people don't understand… you know, it's difficult to say "we're not responsible for this sort of flood…" They really don't want to know that, they just want to know what's the solution and who's gonna make it better (CC1E, County Flood Risk Manager - 31.1.2017)*

Another relevant point here is the persistent thought, which turned into a need or a desire, both from the public and from some institutions, to deem flooding as a binary event, so that flood risk should be "reset to zero" or simple evidence should be obviously put forward. Furthermore, some points at the crossroads of public participation and polycentric governance

are put forward. Evidence is a crux in triggering the project from main perspectives. Most of laypeople (as FG4E, Brigend FAG Chair, mentioned) needed to see some real intervention to feel safe or need to see what causes the flooding for real (as FG1E, Slad FAG Chair and County Councillor, mentioned in the previous chapter or as also FG3E, Chalford FAG Chair, mentioned to me, the idea that someone provoked the flood by opening a lock). The same logic applies for both the initial intervention of the agencies and the public.

I will analyse now more in detail one of the brook upstream and the steps that drove the project, always referring to the project as a whole. I chose to focus on this brook because its characteristics make it very dangerous and lots of different actors have been involved in its management: the Slad brook has been designed as Rapid Response Catchment in 2012 (flash flood is possible), it is located upstream, it is partially culverted while flowing across the town, big damage were registered in 2007, and the first works have been done here. Most members of the Slad flood action group didn't know much about the Slad Brook, for the reasons we mentioned in the previous chapter. They also didn't know that as riparian owners they have legal duties to clear up and maintain the watercourse. After forming the action group, they first organized some meetings to dialogue with the deputed agencies and enquired what had provoked the flooding. In the first meeting (before the July flood) they invited members from the EA, DC, CC, an environmental engineer and the local MP. They found out problems concerning the culvert and river maintenance, which should be managed together with the EA, due to the Slad brook being partially designated as a "critical watercourse" and a "main river"– a part is managed by the EA, a part by the DC. Action proposed were the cleaning of the culvert to be done by the EA (because «it will be difficult for those with riparian rights to organise»[63]) and of the road drains to be done by the CC and Gloucestershire Highways. The aim of the action group was described as the need to «minimise the flood risk and to maximise the quality and biodiversity of the Slad brook» by getting an assessment of the problems of the brook, raising awareness, working with others and doing what fits to reduce flood risk. It's a learning by doing: finding out who manages what, who is responsible for what and what to do to reduce a vague idea of flood risk. Meetings are organized and policy makers, experts and locals are invited to gather information and understanding what to do. Furthermore, a research on previous floods was undertaken, finding four major flood events in the previous seven years. Beyond "the culvert issue", the first statements coming out from the first meetings (two and a half month after the June 2007 flood) were as follows:

[63] Taken from the first meeting minutes (10.07.2007).

What we want is a flood management scheme for Slad Brook. The present culvert system is totally inadequate.

This is a solvable problem, we are not on a flood plain, we are uphill from the river Frome This is a case for water management. There are solutions:

- *a Storm Drain by pass system at the lower end of ladS Road*[64]*, to take the water under the road that has been built up by the old Police Station, directly to the River Frome*
- *holding lakes/attenuation ponds at the middle and upper end of S brook*
- *dredging out of the culverts*
- *regular cleaning and servicing of the culverts*
- *regular cleaning of all drains and sluices (Slad FAG minutes, 4.9.2017)*

Despite the initial shock, there is already a strong awareness of what to do, which is brought out by the FAG. The claim of inevitability of flooding is turned into a matter of water management, making it clearer. The willingness to do something to solve the problem appears to be quite strong. Classic technical issues (such as holding ponds, draining water, the cleaning of drains and culverts) are mixed with local knowledges: where to do the work, historical recordings of flooding, building relationship with people and take community action as a flood group in order to have a political influence. Then, different meetings with the different agencies (Gloucestershire Highways, the Water company, the EA, the CC and DC), which have duties in terms of flood risk and water management at local and regional level, are generally proposed. They bring forward an overall picture of the water behaviour, looking at surface run-off, ground water and riverine water: a grill to avoid blockage into the culvert, a bigger culverted drain, attenuation ponds upstream. An NGO with water experts working since the 80s on these issues and living in the area was asked to join the group: they came out with the idea of a flood alleviation scheme, following holistic water management[65] principles and including the active involvement of local people. This idea obviously inspired the natural flood management approach of the RSUDS project but it still results controversial the way in which this idea

[64] I was living exactly there during my fieldwork.

[65] Defined as follows: «Holistic water management recognizes the wide-reaching web of inter-connections of water within the environment and community, and the need for plans enabling a cross-cutting, multi-disciplinary, multi-benefit solution to resolve a range of problems» (Broadhead 2009: 5)

influenced the RSUDS project. Some actors recognized that the idea behind RSUDS was personally proposed by NG1E (Local NGO member and "water expert"), some others noticed that its principles were already acknowledged in flood risk management policies at National level (cf. EA 2012b, SEPA 2015); some others mentioned to me it came out while talking during the FAG meetings organized after the 2007 floods. Looking back now at those meetings, which had been held over 7 years since 2007, it's obviously difficult to find out what really happened. To our purpose, according to my collected data, FG1E's (Slad FAG chair and County Councillor) opinion seems to be the most trustful one in describing this dynamic:

> *So, we determined that we didn't want to impact on the flooding of people downstream, we understood about holding water up in the landscape. I understood it from NG1E [Local NGO member and "water expert"], and talking with other people and reading stuff and so, it wasn't called NFM, but it's, you know, it's a very easy understood idea. It was introduced to me by NG1E from the W21 NGO, they introduce it to me before the flood and then after the flood NG1E came to the group and explained it to the group and a deep understood about it, and we saw that we can hold the water up before Slas, we can protect Slad, and also protect Brigend and the properties low down. And so, we ended up asking the EA to understand that kind of management system of the flooding and they came up with this proposal that will cost… (FG1E, Slad FAG chair and County Councillor 3.11.2016)*

Only for few local actors from the FAGs, the idea of holding water upstream sounded something common-sense, as FG4E (Brigend FAG chair) showed on a small scale in his garden. Public participation thus results here a relevant trigger for the RSUDS project. But, its delivery needed to target three diverse aspects at the same time: first of all, it was against local flood risk management practices; second, it was not easy to explain how to do it on the ground and how to justify it in terms of both cost-benefit ratio (as required by flood risk management public projects) and flood risk reduction (how to measure benefits); third, it needed the engagement of local people with their local knowledges, which can differ from expert ones or can be complementary. I'll delve now into these three issues, which lies at the core of my research.

6.3 The inclusion of local knowledges in the RSUDS project

Local farmers, as FA1 confirms, got used to drain water for food production: to drain water as fast as possible can be deemed the "traditional" local way of managing water by farmers. Unless the occurrence of flooding, flood risk management was more deemed as a water management. And "traditional" refers here to usually consolidated practices, more linked to the modern capitalistic way of production:

> *I'm sure they were looking to save their land, I suppose to thinking perhaps to not gonna affect… a lot of the land around here were drained to, the better quality land would have been drained directly into the stream*
>
> *…*
>
> *I think probably farmers in generally, they would like to think they would clean streams and ditches to keep them free from debris and dig the silt out. But, I think it's probably being kind of productive because that increases the volume of water coming down to the town, which here would had been a big mistake, because a lot of the water is going into the town … but now I appreciate the benefit of what we have been done (FA1E, Farmer - 1.6.2017)*

So, paradoxically – DC1E (District Council Officer and RSUDS Project manager) sometimes made me jokes on it – the work undertaken by the DC during the project (in the third phase of the process) was to reverse "traditional" local practices of water management in order to alleviate flood risk. To this extent, public participation could have led to wrong practices of flood risk management, if not driven by expert (local) knowledge. Avoiding that water flows straight as quick as possible and finding nature-based solution to slow down the flow and hold water upstream within the catchment: this is the principle which has been driving DC1E work, as I'll show further on. Food production, cattle feeding, economic aspects are the reasons behind this "traditional" local way of managing water. Some of these practices and local knowledges were so rooted in common-sense, but they have legal basis, too. Indeed, the 1991 Land Drainage Act partially supports this idea, as well as a bye-laws[66] issues by the local

[66] «Byelaws are local laws made by a local council under an enabling power contained in a public general act or a local act requiring something to be done – or not done – in a specified area. They are accompanied by some sanction or penalty for their non-observance» (https://www.gov.uk/guidance/local-government-legislation-byelaws)

District Council right after the 2001 flood to prevent flood risk. One point of this bye-laws says:

> *No person shall, so as directly or indirectly to obstruct, impede or interfere with the flow of water in, into or out of any watercourse or so as to damage the bank (SDC 2002: 5)*

But the DC confirmed how RSUDS changed the mind-set of their local flood risk practices (and policies, eventually):

> *«It's strange, isn't it?! Because I was still the manager at that time… looking back, knowing the knowledge that I have now, with the RSUDS project, we wouldn't have done that, but at that time, in 2007, everyone's thinking was: the flooding is happened because the water got stuck and we just need to clear everything out and get the water down and through and away as quickly as possible» (DC3E, District Council Office Chief - 1.6.2017)*

This excerpt clearly puts forward the complexity of the concept of local knowledge as I have framed it. (Wisner 2009) Here the tacit dimension is acknowledged, as local practices of water management by farmers were even used to manage flood risk after the 2007 floods, considering them "normal" practices based on common-sense. For instance, FG3E is the spokesmen of the first flood action group formed in Slad, immediately after the 2001 flood, the Chalford river team. Their first actions after the 2001 floods were to clear out the streams, and «flooding wasn't an issue», he states in the interview.

But then, after the community-driven process, this attitude has been questioned by every actor involved in the project, thus showing the relational aspect of local knowledges and its changing over time. Furthermore, something considered common-sense turns now into something irrational. Indeed, local knowledges are thus more than "traditional" ones (Wisner 2009) or cannot even be traditional, but they are «essentially social» (Wisner 2009). Their production and transmission have been undertaken both during the meetings that triggered the project and during the project itself. The path towards the project was rough and not linear. The Slad action group was campaigning and carried on a lobbying effort on many fronts. They also built contacts with other action groups, like the Painswick flood action group and Brigend against river Frome flooding, also participating to a sort of flood risk forum at District level which was created in 2009. Their main purpose was to find different kinds of solutions which

could solve the problem at a catchment level. A collaboration with the deputed agencies has been also sought, being FG1E a District Councillor and then County Councillor, so lobbying the CC and the RFCC through RC1E (County Councillor, RFCC and IDB member).

The main issue concerning NFM in the Slad brook and Slad valley was to provide a cost-benefit ratio, which was the only way to justify a public funded flood risk management project. (a key point in starting the third phase of the project). The issue of cost-benefit and the prevalence of an engineering technocratic approach in the local flood risk governance (as seen in FG4E (Brigend FAG chair) words at the beginning of the chapter), partially overcame[67] or ignored local needs and knowledges. For example, the difficulties emerged with a possible implementation of the initial project proposed by the EA (see chapter four) and the mismatch between local needs and technical solutions unveiled other relevant aspects of local knowledges which drove the RSUDS project. For instance, important matters of historical knowledges, to be included or questioned by local ones. First of all, the NGOs also put forward historical justifications for a natural flood management in the valley. It was found that the place name "Stroud":

> *«derives from ancient word "Ströd", which means "a marshy place with brushwood (willow - Salix)". The loss of these natural wetlands profoundly altered the hydraulic response of local watercourses to rainfall, heightening flood (and drought) risk, as well as loss of water quality benefits. The S Brook comprised extensive ströd, well into the 18th century. Any flood attenuation plans here should restore both the hydrologic and ecologic benefits of these where feasible» (Pretto 2008:16)*

The historical knowledge of a place name can provide complementary basis or even a starting point to a local perspective on flood risk management[68]. A local hydraulic engineer, who was involved as consultant in providing a modelling of the paleo-alveus of a part of Slad brook catchment confirms how historical knowledge can be:

> *a combination, for me, of anecdotal information, so what I eventually see on a regularly basis, can you see regularly… and then for me it's also a case of*

[67] As FG4E (Brigend FAG Chair) puts forward criticizing IPP solutions at the beginning of this chapter.
[68] Another interesting example were provided by DC2E in his daily work as local officer: «sometimes I smile when someone phoned me from "Marsh mill" and the guy can't work out 'cos the land is so wet!» (DC2E, 1.6.2017).

really knowing somewhere from a technical perspective, you know (LC2E, Local Hydrologist - 23.5.2017)

She usually uses in her work historical and anecdotal knowledge to understand better how a river works, gathering this information from local people and local authorities by talking with them and adjusting her modelling according to this mix of local and expert knowledges.

Furthermore, historical and anecdotal knowledges can work as a sort of natural conditions to be re-established in order to restore a sort of environmental balance, which has been lost. This is a *topos* highlighted also in the perspective of the W21 NGO, which justify a holistic approach with some local knowledge components: the point is how to activate, transmit and implement them. Relational and differential aspects of local knowledges are here more evident, as it being differently activated by different actors in different ways. For instance, even from a National Government perspective is clearly put forward a greater expertise of local actors derived from local knowledges. It was highlighted at the beginning of the previous chapter and confirmed, for instance by GV1E (Local MP). He admits that FG4E (Brigend FAG Chair) *«got much more expertise than I have»*, being constantly flooded (as previously seen). Or FG2E (Painswick FAG Chair) explains how, as seen, the event enabled local knowledges in FAG members:

it's very very important, because without it [local knowledge], mmhh… we are all fishing in the dark, and 2007 there was no local knowledge! We all lived in our houses and we didn't know each other, we didn't talk, there was no interaction with SDC or the Environment Agency, or anybody! We lived in isolation, we lived in our nice houses and water was here, and suddenly, like that, the water is up here and everybody panics and realizes there's no local knowledge! Because, when all mills were working in 17th-18th century, on a Monday morning, at a set time, everybody opens their sluice gates in the right order, to bottom down first, then up and up, to the top of the stream. When they were all open, the water went through, washed all the rubbish away and then closes the gate, in the right order. So, it was all managed. But because of that… the mills don't work anymore, and there is no management…» (FG2E, Painswick FAG Chair - 14.4.2017)

First of all, risk/hazard awareness is here strictly linked to local knowledges, even if a direct knowledge has been always there (see chapter 5) but wasn't activated by relationships between people and people and the environment. Its being "essentially social" and situated clearly emerged in this excerpt: she puts forward how water was "here" but it wasn't present in her

life. The flooding literally enabled the relationships between her, a FAG member, the water and her own neighbours (other potentially FAG members), as also the verbal tense turned into a present tense.

Secondly, we shall notice here that historical local knowledges can be also misunderstood or misinterpreted, as clear in the work of the District Council:

> *That's tricky! There's another problem with using historical evidences, that become somehow corrupted. There's a number of people involved in flood information in the area, who are convinced that a hundred years ago nothing ever flooded because it was all managed properly and everyone knew how to do things the traditional way*
>
> *...*
>
> *If you walk up the valley, you'll find mill, and each of them had control structures on the river, but those control structures won't manage flood, they would manage the running, the energy derived from the mill.*
>
> *...*
>
> *it's diffuse the false premise that back with all those mills were in operation, they would never any flood problems ... It's definitely not! ... You know, it wasn't a pretty picture! Ehm, and at the same time there was great stories, the story that gathers a lot of the... is Cider with Rosie by Laurie Lee, in which he records the fear his mother lived in their house if their house flooded, regularly... (DC2E, District Council Water Engineer - 1.6.2017)*

As local engineer, managing now flood risk at local level, DC2E (District Council Water Engineer) reported that there was a sort of idealization of the past linked to the presence of mills, whose role wasn't really to manage and mitigate flood risk. Contrarily, some FAG members and chairs (like FG2E, Painswick FAG Chair) were convinced that the presence of the mill was linked to an "historical" way of managing water working as a flood mitigation scheme. Alternatively, the mill –as also reported in a classic British author, Laurie Lee[69], living right in the Slad valley – were often flooded but there were other practices to tackle flood risk and flooding wasn't a big issue, as mills were designed to be periodically inundated – where maybe now there's a living room in a restored mill or old house, earlier the room was designed

[69] The volume is *Cider with Rose*. Cf. e.g. «The countryside still marched to the relentless, inexorable beat of the seasons and the cottage still flooded when the winter rains swept down off the wooded hillside, bringing with them blackened cabbages and the pagan flesh of rotting badgers that we fell upon with glee»

to be flooded, without any damageable stuff inside. Being now a restored house on a floodplain[70] doesn't mean it has never be flooded, rather a different framing of flood risk and consequent different local practices of risk management are at stake. Indeed, this was a diffuse opinion among some local actors interviewed: «Hey why is it flooded, how can it flood? they wouldn't it build here if it'll be flooded!» (DC2E, District Council Water Engineer - 1.6.2017) is a sort of tacit knowledge, which DC2E – working in the DC - has acquired while daily being contacted by people having flood problems. Anecdotes, like the ones linked to place names turned into local knowledges if shared with him, who keeps a GIS based flooding register at local level, integrating modelling, technical knowledges and historical and anecdotal knowledges collected by people who interacts with him. Relations with laypeople works again as a trigger for acquiring and transmitting local knowledges.

Back to the RSUDS project, relations have thus been partially enabled through direct knowledge and direct engagement with local people, as also the Environment Agency acknowledges:

> *«It was a combination really of the community saying what, yeah, what alternatives are there and primarily, myself, saying, these techniques could work*
>
> *…*
>
> *They were involved in the primary phase and they were involved once we've got the approval for the project and its funding. They were involved in determining, first of all, exactly what DC1's role was gonna be and how he was going to work… they were, they very much had a… "steering role", I think it's the best for saying it, isn't it? They worked with us to see where the priorities were, how best to work, how best to deliver those priorities allowing a sufficient scope. So, we were timing specifically, ok the idea was, we know we need the project off, so we need we go to out and talk with landowners and develop projects, but it wasn't known specifically which little projects were going to be delivered, or when and where: that was the project officer determining (EA1E, Environment Agency Officer - 2.11.2016)*

EA1E (Environment Agency Officer) referred how public participation influenced the work of the EA in delivering and driving the project[71]: the claim here is "steering the process", not

[70] Like FG2E (Painswick FAG chair) house, see fig.1 and fig.2 in the previous chapter.

[71] For instance, also RC1E («The triggers for defences started with local actors and local knowledge») and DC1 («It couldn't happen without them. Without the local… people, the local flood groups campaigning hard to get something done, you know, they don't care, they want something done!" "They must be, yeah, they are the drivers, because always decisions are political!») completely agree with this statement).

deciding what to do (in his opinion), but keep pushing experimentation, transmitting direct knowledge, allowing the works to be done (as in case of landowners, I'll show), criticizing classic engineering works, lobbying, campaigning and building and rebuilding relationships with water, themselves and among institutional actors, within a risk governance perspective. At the same time, even if this excerpt highlighted a clear risk governance scheme – through the use of "we"= flood risk main authority and "they"= local people –, the need to engage with people was clearly claimed: "we need to go out and talk". The relationships with local "people in places", that is *situated* relationships among different governance actors, is what makes the flood risk management possible, as the walking interview technique has been putting forward. Furthermore, in the relational aspect of local knowledges, the knowledge sharing works as a mutual learning, which is initially activated by the community but greatly developed by the project leader, DC1E (District Council Officer and RSUDS Project manager), while doing his works.

For instance, from one side, during the process towards RSUDS, Slad Action group members highly criticized the feasibility of the engineering project proposed by the EA (also in the first phase of the process), before it was officially dismissed:

> *«They have concerns about level of engineering required and the height of the dam at the lower end of the brook, which will be 6 metres high from the river bed. This will cope a 150 year event. W21 do not recommend the EA proposals but they will be back it as they do consider this is to be the best offer on the table to protect us at the present time. A. then went on to give us a very interesting presentation of W21's complimentary scheme, part of which they are already implementing, with the Landowners consent, on D1 Farm and D2 Farm. Part of this scheme involves silt retrieval. Their aim is to offer the EA a complementary, cost effective, "community led" scheme» (Slad FAG minutes, 8.9.2009)*

A mix of expert and direct knowledge at local level is still here evident and relevant to shape a proper local knowledge to flood risk management. It's somehow impressive how the risk awareness of some FAG actors contributed in delivering the project in the first and second phase, as the previous excerpts shows. It's noteworthy also to note that a higher awareness of owning local knowledges can be found among more actors at local level than in the ones at County, Regional and National level. Regardless of the usefulness or not for the project in terms of flood risk management, to my asking for a definition of the notion of local knowledge,

local actors are likely to show a bigger awareness of it. For instance, these are the answers local actors gave me to provide me a definition of local knowledge:

> *First of all, mitigation in terms of the streams, I mean there are people who, councillors walk regularly round, so they were looking whether the streams were blocked (PS1E, Parish clerk - 13.4.2017).*

> *I think it's, it's, it's the community working together and talking, because you don't actually understand how much you as an individual know or understand, until you put that knowledge together. So, my understanding of here, this property, ehm, has, is only one part of the whole stream, so if you all get together… this a direct knowledge, shared, exactly (FG2E, Painswick FAG Chair - 12.4.2017).*

> *Managing the land, to know where the potential problems are, but DC1 knows where benefits potentially are, not only for the farm but also for the downstream… knowing, specifically knowing how water levels change locally, and how quickly, ehm, how quickly things alter (FA1E, Farmer - 1.6.2017).*

> *Which is within landowners or famers about how water moves through their land and, you know…: across land, drainage, surface flow and into the stream… and their conditions (DC1E, District Council Officer and RSUDS Project manager - 26.1. 2017).*

> *Local knowledge is our baseline… well, we know where we had flooding, what level is flooded, too… as far back as we got history of that. Where the local community have got their own pictures and videos, and stuff like that*
>
> *…*
>
> *Local knowledge now also helps DC1E in delivering his role, ehm, because the local population are able to help with information around who own a piece of land, where the watercourse is and this sort of thing, which is something valuable in, to delivering the project (DC3E, District Council Water Engineer - 03.11. 2016).*

All the themes I've already pointed out likely emerged from the excerpts above: a direct knowledge acquired by walking, talking, knowing or experiencing how the river and water behave, where flooding occurs historically (and recently), relational aspects linked to public

engagement and knowledge sharing, issues concerning land management or flood mitigation measures. Nor tacit and traditional practices neither expert knowledge or beliefs at local level have been reported. This really fits into my definition of local knowledges, showing also that it is «not uniformly distributed within a community» and «may be not be explicitly spoken about those who have it» (Wisner 2009: 3). About this last point, it's quite clear the central role of the project leader, DC1E, in making it interpreting, translating or mixing it while doing the works. In the third phase of the project, DC1E (District Council Officer and RSUDS Project manager) was acting as a "local knowledge mediator" to deliver the NFM scheme, as I will show in the next paragraph.

6.4 The role of the project leader in delivering the RSUDS project

The very idea of natural flood management is something that DC1E (District Council Officer and RSUDS Project manager) embraced and developed, due also to his being a marine biologist involved in previous environmental policies at national level and having chaired a flood action group after the 2007 floods. He's quite sure about the project efficacy, based on natural flood management:

> *«we know if we block the stream, we know the result, so to me the question of proof it's a bit like saying: if we build a wall, a flood defense and it's like 5 cm high it will work for a short period and you understand the wall works? The question is how high the wall needs to be big. Well, with this work it's a parallel question you say, we understand it works, the question is how much and how many we need to build to make the difference and that's where the knowledge… (DC1E, District Council Officer and RSUDS Project manager - 18.10.2016)*

This is what he told me the first day of my fieldwork, the first time I saw the works walking along the Slad brook in the Slad valley. The main claim of this excerpt is the legitimacy of the work he has been doing, based on common-sense ("we know") and expert knowledge. He almost compared engineering work and natural flood management to the extent to which both are efficient. The only point about NFM is how many works are needed to make the difference. Indeed, the project involved land management interventions aimed at

> *«attenuating high flows to reduce flood risk achieved through creating structures on land used for agriculture and forestry land that will reduce peak flows in surface water courses through increased infiltration and attenuation areas. Measures have been constructed in a wide variety of ways using a range of methods. In all cases, contracts for construction and installation are awarded on a hierarchy that favours construction by the landowner or farmer as first option» (Short et al. 2018).*

Thus, the inclusion of local knowledges and the engagement of local people turns into something essential to implement the measures for flood risk management. This is also the perspective supported by the EA:

> *«They haven't told us how to manage flood risk, what they have told us more how refine, what we had to do, it's refine our understanding of what's happening in terms of flood flows, so that we can then actually look at how best to manage it. They [the community] are not the experts in how to manage the flood, but they do know where floods are coming and how is affecting and that's something which quite doesn't come out in computerizing mapping, and modelling and all that kind of stuff» (EA1E, Environment Agency Officer 2.11.2016).*

DC1E goes further in describing how the interventions were undertaken on the ground:

> *«The "what" to build is a combination of re-use, deciding this might work here, the "where" is a combination of that early work, technical and us just looking and saying actually, on a micro-scale, this place is better than this place, so let's do it here…» (DC1E, District Council Officer and RSUDS Project manager - 2.11.2016)*

Although the way to manage flood risk has been partially framed together with the different stakeholders, as previously shown, it is here reiterated the extremely relevance of local (historical and direct) knowledges in knowing the flood dynamics and "where", at a micro-scale, the works should have been done. Traditional practices of water management haven't been used, rather traditional practices of forestry and land management have been converted into (new) local practises of flood risk management. For instance, coppicing, a traditional technique of forestry management, has been applied by the Project leader for building "leaky dams" following natural flood management principles and common-sense: «to slow down the

flow of flood peaks into the valley and divert water onto small floodplains»[72]. For instance, in a farm of the Slad Valley 15 *leaky dams*/*woody debris* have been built from tree trunks and benches to have a partial blockage of the brook and increase biodiversity (fig. 6.7, 6.8, 6.9).

Figure 6. 7 Leaky dams built with tree trunks in the Slad brook

Figure 6. 8 Leaky dams built with tree trunks in the Slad brook

[72] Taken from www.stroud.gov.uk/rsuds

Figure 6. 9 A sign along the Slad brook warning not to remove woods from the stream

"Keeping trunks into a river" goes in a way against the 1991 Land Drainage Act, the 2002 SDC drainage byelaws, traditional practices of farmers' water management and partially our common-sense, too. For this reason, signs have been set along the streams in order to warn not to remove woods from the brook. Two opposite common-sense reasoning have been put in place here, opting for the one against the law – therefore a specific consent was issued by DC2E (District Council Water engineer) for doing the works at local level. Trees and woody material are sourced as close to the site as possible, using trees coppiced or felled in the riparian area or floodplain. Sometimes, fallen trees have been directly left onto the stream to result the more natural as possible (fig. 6.10).

Figure 6. 10 Has the tree fallen into the stream or has it been cut?

Other techniques used have been so thought and called by DC1E (District Council Officer and RSUDS Project manager) as follows:

- *flow deflectors*: flows are diverted into an attenuation area where they are temporarily stored until they evaporate or infiltrate (fig. 6.11).

Figure 6. 11 A tree trunk eventually diverting surface run off in the Painswick valley

- gulley stuffing: to fill gulley with branches to slow down run-off water, prevent erosion and traps silt and sediment. This gulley is usually shaped by run-off water. (fig. 6.12);

Figure 6. 12 Gulley stuffing in the Painswick valley

- earth bunds (fig. 6.13): to temporary store water and reduce the speed of the surface run-off in case of rainfall events. Otherwise, they are unnoticed (fig. 6.13);

Figure 6. 13 The bundle is placed in the middle of the picture and almost invisible

- solar pump powered livestock drinking troughs: to avoid banks erosion from the cattle, streams were fenced and troughs provided for the livestock;

- grips and culverts: to stop the erosion, increase infiltration rates and allow silt and sediment to be removed from surface waters, thus improving water quality.

The pictures taken while DC1E (the RSUDS Project manager) has been describing the different measures adopted well account for the complex mix of expert and local knowledges at stake. Beyond coppicing, it appears quite clear that where to build earth bunds could be only achieved by perfectly knowing how water behaves in that area and in the whole catchment. The same for the other measures. This local knowledge has been acquired by DC1E both walking and exploring the areas, and talking with landowners, farmers, NGOs, locals. For instance, DC1E first chose properties owned by NGOs, to have an easier access to them – National Trust and Gloucestershire Wildlife Trust. Their stronger engagement in environmental issues facilitated the works. Indeed, much "hiking" has been arranged by DC1E with policy makers and local people at all levels, to show the first works done to engage with more and more landowners by showing the benefits. Furthermore, most landowners involved in the projects didn't have an active role in Flood Action Groups, because they were not the people being usually flooded, as they have been living upstream and not downstream in the catchment. For this reason, their engagement has been exclusively negotiated by DC1E, partially with his social network[73]. Indeed, one of the key aspects of natural flood management is the flexibility of the works to be done: it's not necessary to build big structures in specific places set by hydraulic models, rather to build many small interventions as possible where the local knowledges of available landowners, tenants, flood action groups, farmers or local contractors would inform the decision-making process. For instance, LO1E (Local Landowner) was contacted by DC1E also because he sells firewood and had his deposit close to DC1E house. Due to his job, he perfectly knows which part of his property usually fills up with water: he has been working there for 10 years and he has an expertise in tree surgery, tree felling and woodland management, which will be used by DC1E do build the interventions. He had a track in his property damaged by the 2007 floods and some other problems in the wood, but he didn't

[73] He has been helped by some councilors or by FAGs (like FG1E, FG2E, FG3E, FG4E, PS1E) in finding who was likely willing to be engaged with the project. He also asked to his friends or friends of friends, as Stroud is a small town.

really know what to do to manage flood risk. When contacted by DC1E he trusted him, both due to his institutional role and because:

> *«He [DC1E, Project leader] got more knowledge on it than I do… you've got a trust in somebody's knowledge*
>
> *…*
>
> *The thing is: if you got to try something, if you won't try you'll never know! With the cost of the track being replaced from the water damage, it costs a lot of money to get it fixed. Because before the hole in the track was about 3-4 feet deep when the water came down, which it means we couldn't have get any vehicle into the wood, so we had to fix the track, but we don't wanna be in the same position a year later with water keep coming through and down the track. We're just a very very small part in the valley, if you mean where water's coming down, but if more little things and little projects like this were scatter about, it would help the bigger picture» (LOE1, Local landonwe - 16.12.2016)*

It's clear here his willingness to experiment practices of flood risk management, due to not being affected any more and contribute to solve the problem for everyone in the valley. He knows some notions in forestry management and did himself the work under DC1E leading guide (fig. 6.14), because he trusted him because of his expertise, understand common-sense principles of natural flood management and take the opportunity to fix some problems in his property without spending money, but doing the interventions.

Figure 6. 14 LO1E (Local landowner) is explaining to me flood dynamics in his property and which works he has built under DC1E supervision

The negotiation between DC1E and landowners can be seen also in terms of risk trade-offs, as DC1E himself does:

> *«There's the big risk, the danger of flooding, let's say, "risk number 1, the total risk, the whole, you know...", our flash flood", but then each discussion with the landowner, is really about the compromise between the risk to their... business or to their interest, compared to the bigger risk of flooding, and... the... you know, different landowners, because they're different people, would say there's a trade-off, so they want to help the community reduce flooding, but they don't want to subject themselves to increase risk about ...so the whole things that come up, an informal compromise, and that's why, technically, we could build bigger structure and we could store more water, but...if you think… I only need one mistake and the whole project would be damaged, so it's better for me to build safely, then to do some mistake» (DC1E, District Council Officer and RSUDS Project manager - 15.12. 2016)*

Natural flood management allowed the District Council to evaluate risk at local level beyond a strictly technical risk characterization. This consented to frame the "risk problem" as a "catchment issue" to be faced by building lots of small relationships between people, water, and the Project leader. It can be literally seen as an adaptive co-management, as I'll also discuss in the next chapter.

Another important element of DC1E work is literally his way of "learning by walking". If few days were used for doing the work, weeks have been spent walking, talking and looking at soil, water and natural environment. Using his own words collected through my interviews recorded in different moments, the process of implementing RSUDS can be sum up as follows.

First of all, the acquisition of local knowledge by directly observing places and water behaviour at micro-scale, and then building relationships with landowners:

> *«So, you think: "I get into the jobs, I don't know anyone, apart from, you know, a few people. I've studied the maps, I look at obvious places to go, I go for a walk and then I find there are places owned by Gloucestershire Wildlife Trust and National Trust. So, I made an assumption that they will be sympathetic. So, I go there, have a look, says "yes this is fantastic, we can do something here!*
>
> *…*
>
> *I want to see how the stream, how water moves through the environment, that's what I'm doing. So, I want to see how it works from a water point of view, ehm, I'm looking at the bed of the stream, so the bed of the stream gives me a lot of information about the geology, about impacts, whether or not*

there's soil or silt on the bed. I'm not guessing when I say "the stream bed should be 2 meters higher", I can see where the stream bed used to be historically.

Then the validation of local knowledges and the delivering of the works by hybridising knowledges and experimenting through diffuse relationships:

…

I'm piecing together different pieces of information, geology, water, ecology… but the trees, ehm, so… someone like CT1E [local contractor], his expertise comes in.. in… if I say "I like this tree, here", he has the expertise to be able to make that happen in a way that I could make that… you still need the expertise from the people on the ground to be able to transfer my idea into an item!

…

We are embracing complexity, because we recognize and work with the different relationships between the stream and the land, the landowner and the land, the water, the structures, the risks to town to the downstream. You know, it's easy to simple the story: "here is a wall, and it will protect you forever". So, I would almost say the reverse, we are working with complexity, we acknowledge that, the complexity, and we do our best to work with it and create structures that are safe» (DC1E, District Council Officer and RSUDS Project manager - different meetings)

Also the position put forward in the DC about his role confirms his words:

«DC1's work with the contractors was educating the people that work the land, and we are seeing some benefits from that, as well from a couple of people... and that's how you will see a mindset change, over the longer term, and see this started to be embedded in normal land management practice. It shouldn't be something specifically separate, it should be part of normal land management» (DC3E, District Council Office Chief - 1.6.2017)

The engagement of local people and the inclusion of local knowledges result in being essential for many reasons which led the RSUDS implementation. First of all, the narration of rainfall events and water behaviours is indispensable for DC1E (District Council Officer and RSUDS Project manager) to understand the stream behaviour. No maps or other tools can better evaluate risk than a mix of talking, walking and looking, that is direct knowledge mediated by relationships. So, risk framing resulted in a mix of diverse kind of knowledges,

which drove risk evaluation, characterization and management. Ambiguity is here tackled trusting people's expertise in their own areas, assessing risk conditions through direct knowledge and expert one. The notion of "traditional" is locally questioned but not totally rejected: traditional, historical, and local practices and knowledges are mixed up starting from a classic definition of flood risk, which is implemented in a more experimental way. So, uncertainty is reduced not to a probability but to a process of building relationships with local actors and water, trying to imitate nature under some common-sense principles. Local knowledges led and shaped the process at the same time, even if public agencies had a clear driving role, even if open to adaptation and consultation. Complexity is so literally embraced. I'll sum up in the next chapter how complexity is unpicked and local knowledges are integrated in the risk governance framework as part of an adaptive co-management process.

In the next part of this chapter, I will account for the inclusion of local knowledges in the Life RII project, analysing the same issues emerged in this first part.

PART II – The Italian context

6.5 Managing flood risk with local knowledges

Since among the actors involved in the LIFE RII project I couldn't find actors who have been flooded, it's quite interesting to look at local practices and ways of dealing with an alleged flood risk, i.e. which local knowledges aspects are at stake in "watery" relationships (Krause & Strang 2016). For instance, differently from the prevailing opinion among my interviewees, there was a riparian owner, LO1I (National NGO and riparian owner), who didn't judge flood risk as high in her area. As previously discussed, being affected by a flood had a big influence on risk evaluation and risk framing related aspects, being usually risk evaluation a step back risk framing in practice. Being an environmentalist and almost a riparian owner, LO1I has acquired a direct local knowledge of the Bertolini stream behaviour, both concerning environmental aspects and historical ones. First of all, she alternatively calls the area surrounding the stream where she lives or the stream itself "Ca' do 'Rio" (fig. 6.14), an old place name meaning "House/street of the stream", currently used by locals there. Secondly,

she knows many details of the stream flowing in front of her house. For instance, she knows how the banks looked like 20 years ago (fig. 6.16), changes in the stream bed (fig. 6.16), environment characteristics around the stream (fig. 6.15) or bad practices/inaccuracy in water management. She learnt how to read the river behaviour by talking with her elderly neighbours and looking at the stream over the time. Thus, she criticized the LIFE RII project for not considering a broad "cultural regeneration" project based on the stream to regain a local knowledge of it in order to build new relationships with water upon:

> *«You may carry out a more complete historical promotion project ... Just change it, do a survey to get a full picture, because through history you can also understand the changes in the watercourse. Usually when you know ... I usually take care more, if I do not know, I don't care. This is the Bertolini stream passing through the square (fig. 6.15), the inhabitants of Ca' do Rio consider it as being their stream and the old residents look after it. I know my neighbors living there. They are keen on maintaining the stream, they have planted those trees, look at that, there is a birch, there was ... they cleared out because this is their brook*
>
> *…*
>
> *And here many elderly live ... there an eighty-year-old man, a ninety-year-old man over there, and they've got the idea that the stream has been somehow neglected. So, I remember this, they lived so much contact with the stream: once there was a waterfall where they were usually swimming, it was an area full of water, for the elderly ling here water is a bit like ... I've learned from them ... water was so important ... that is without the Rio ... consider that in the summer when it's hot you hear the Rio flowing, the Rio was your companion, and a bit for everyone. I've learned this when I moved here. The neighborhood used to meet here (fig.6.16), there was a meeting place... the bridge over the Rio, so the evening we met all there ... now they are all dead» (LO1I, National NGO and riparian owner - 9.2.2017).*

Figure 6. 15 The Rio Bertolini flowing in Ca' do Rio, close to LO1I's house

Figure 6. 16 LO1I reported that the stream banks and part of the street on the right are made by the debris of the old shed of a farmer living there, who had pulled down it and dropped it into the stream

Figure 6. 17 LO1I reported that the trees on the left side were part of the stream bed in the 90s. On the right, the wood at the bottom has grown up on an ancient landslide

Figure 6. 18 LO1I reported that this bridge over the Bertolini stream was 1.5m high in the past

In her words, recorded while walking along the stream, any references to flood risk or flooding can't be found, as these episodes never happened on this stream (as she reported). Her framing of risk derived from the relationships activated by traditional and anecdotal knowledges acquired while living there and sharing experiences and life histories with her old neighbours. If the *topos* of a lost idealized past is evoked, her argumentation sounds quite

realistic: knowing more means to take more responsible choices, and taking care of the stream to maintain it and its environment. Her claims are identified as follows: the existence of a social network built upon water flowing (Krause 2016), the need to rebuild relationships among local people and between locals and the stream to reframe the stream and better manage flood risk and water; and the relevance of different kind of knowledges for managing flood risk. For instance, beyond anecdotal and historical knowledges, tacit knowledge is what is shared through the lost sense of belonging evoked by her. Tacit knowledge is now invisible, as my visual ethnographic notes clearly show. A way to make it explicit was to walk along the stream and through her familiar places, which have been turning into a tool of flood risk management as soon as they were evoked. Tacit knowledge can be also part of expert (local) knowledge, as the work of "dugaroli" brings out. They are traditional figures, who are responsible to drain water for irrigation. Indeed, in the biggest floodplain of the country, water drainage for health and agriculture and be traced back to the Roman Empire. The most recent big interventions (XV Century and the beginning of the XIX Century, under the Fascist dictatorship) led the setting up of Private Irrigation Boards and Internal Drainage Boards, which are partially still in place nowadays. Private Irrigation Boards' duties mostly concern:

> *«We look after the maintenance of locks and ditches, and we clear out the ditches. And while we do these things, we consequently manage the hydraulic network, because when the ditches are cleared out, the water flows straightforward, we've got no problems» (IB1I, Irrigation Board Chair - 9.2.2017)*

As IB1I – the President of the only Bibbiano IB in the area of the project – pointed out that the water management scheme serves to drain water as fast as possible, by clearing out channels and ditches and maintaining locks and banks. This could be deemed normal in an urbanized floodplain area where it's difficult to find "room for water". The point here is twofold. First of all, the idea that the entire hydraulic system is well working when Irrigation Boards are draining water as fast as possible. Secondly, the lack of a joint idea of flood risk governance. But, what is important here is again a local knowledge accumulated and transmitted through years (and centuries). Indeed, this private IB was founded in 1335, while the IDB responsible for flood risk management in the area was born in 2009 as a result of a merger between two IDBs founded in the XIX century. The experience and expert knowledge to manage water through

locks is a type of tacit local knowledge accumulated through the years (and the centuries), indeed. DB3I, who is the "dugarolo-in-chief", explained his job as follows:

> *«You eyeballed, you open a lock and you already know how many spins you need to do (fig 6.20). I learned it from the old "dugaroli" working here earlier ... I was hired because a "dugarolo" retired, I've spent a year with him.*
>
> *…*
>
> *I do everything by memory, I always know which locks are open, there are plenty of them, with all channels. When I'm on the field showing some technicians the maintenance I so, they always ask to me: "How can you remember everything?" It's everything a matter of… I'm working here since 13, 14 years, and as time goes by, I remember everything, it's just happen ... it's like this.*
>
> *…*
>
> *But if you remember whether the ditch was so "working" there, how water flowing in the channel behaved in the past… and if you are lucky to find three elders who can tell you everything. If not, it's all new residents who don't know anything about it» (DB3I, IDB "dugarolo" - 3.3.2017)*

Figure 6. 19 A lock and with its drains downstream the LIFE RII project's area (in Bibbiano town)

Figure 6. 20 The lock with its gears to be spun

"Dugarolo" is a dialectal word deriving from another dialectal word, "dugare", which means "little drain". Thus, his duty is to drain water for irrigation purposes, but also to adjust the water flow rate in case of rainfall events/water run-off. His local expertise is a tacit one, as claimed by his words: every moment he knows how and where water is flowing in his area. His work on behalf of the IDB is to know how to spin the gears of the lock to regulate the water flow rate (no instruction is obviously provided, cf. fig. 6.20) and what are the consequences in terms of water flow rate in the whole water network. He learnt how to manage water by learning from old (now retired) *dugaroli,* looking daily at water behaviour and talking with local elderly. Through daily observation, relationships and historical/traditional knowledge, he acquired a tacit local knowledge, which makes for him possible to have a broad understanding of water (and flood risk) management in the area.

6.6 Towards LIFE RII: local knowledges triggering the project

The same tacit knowledge appears to be forgotten by most of the public. For the reasons discussed in the second part of the previous chapters, some relationships with watercourses are

"hidden" under the urban environment or "lost" within a complex flood risk governance framework. The local NGOs remark that:

> *«The management of the banks was a traditional one, so there weren't banks that caused troubles, like where the locus tree is, there could be ... planting trees was subjected to ... everyone knew there were rules to follow ... and there were the "dugaroli", who were very careful, and they went all around with weapons, that is, they were armed and could make sanctions…*
>
> *…*
>
> *There were a lot of employees in the IDB and the AIPO earlier ... the State ownership was managed everywhere. Now it changed. Twenty to thirty years ago, there were offices full of staff. What is missing now, it is being on the ground, so that, I've realized by myself these were the problems to face. I, personally don't know the streams covered by the LIFE RII project very well, because they are not very long streams» (NG6I, 14.11.2016)*

This excerpt puts forward again the claim of the existence of an alleged better way to manage drainage and water, which was traditionally shared: there were implicit rules of riparian vegetation management that everyone knew and which have been enforced by armed *dugaroli*. Again, the *topos* of a better past (when "things worked better") emerges. What is relevant here is both the existence of a shared traditional knowledge of drainage and riparian vegetation management and the apparent irrelevance of flood risk. Obviously, these techniques have also the potential to mitigate flood risk, even if they are not considered in her reasoning. She reiterated the idea that unless a major flooding event directly did affect a place, no risk management options would have been considered. That is, following Renn's framework, flood risk is deemed acceptable by most of the public and no risk management option are considered, indeed. Her argumentation (and others previously discussed) is clear: if flood risk is now a problem is due to urban developments (and climate change), due to (recent) human interventions. Otherwise, a traditional drainage management and a constant direct presence "on the ground" would be sufficient to evaluate risk as acceptable. Thus, given the lack of recent major events (i.e. no evidence for risk characterization), risk evaluation will bring out the watershed between a diffuse past tacit and traditional knowledge of water management and the current lack of a direct local knowledge of watercourses, driving flood risk problems, due to human factors. For these reasons, this project apparently got more top-down triggers than bottom-up ones. Actually, the main triggers were three, locally-related, in a way. First of all, the river regeneration approach to

flood risk, which mainly came out from NG1I. He wrote the proposal for the IDB to be funded from the European Commission. Over the last decade, he succeeded in convincing major regional actors in undertaking river restoration techniques to manage flood risk and including it in Regional Policies (ER 2015):

> *«Well, I was involved, that is, in fact, it has been rather triggered by me, in the sense that I work with the CIRF and, in short, few ideas have been developed like a framework for ... that is, the idea that you can tackle flood risk with river restoration, then…*
>
> …
>
> *in the end it depends on individuals, that is, there are those who say "no" and that's it, because it is difficult to make things changing; some others say "let's try to experiment", maybe they've seen it like an opportunity, because then you must also have economic resources. The Region has spent 500,000 euros and 600,000 came from the European Union. The initial risk sounds like that: "I pay a few thousand euros to write the proposal, if I don't pass, I lost them, otherwise, I would gain 1 million euros", well….*
>
> …
>
> *«Well, these things were born ... It's not a top-down process, these things were bottom-up, and then they must be up for it... "» (NG1I, National NGO and IDB officer - 13.2.2017)*

Apparently, no local knowledge or knowledge of the local drove the LIFE RII project, since the idea of river restoration was transmitted to local and regional policy makers through some classes coordinated by the National NGO in which NG1I is a Regional coordinator. After having prepared the "cultural environment", he tried many times and then succeed in being engaged by the Drainage and Irrigation Projects Office manager (CC1I) of the "Soil and costal protection, and drainage" Office Area. In consequence, even if the LIFE RII project can be deemed as a top-down project, it was bottom-up triggered at the local level by a National NGO. His argumentation is quite clear, he has acquired a knowledge of the local and regional flood risk governance framework, by working as a consultant and proposing updating courses on river restoration techniques. He hadn't got a direct (local) knowledge of the area, but he acquired an implicit knowledge of local policy-making by interacting with policy makers, technicians and drainage and flood risk office managers. Secondly, his commitment and willingness in taking his ideas forward have been supported both at the Regional and at the local Municipal level. Mainly due to lack of resources (see

the previous chapter) and the alleged impact of climate change and past mistakes concerning urban development, experimentation was a way to tackle flood risk at the regional level:

> *«Now that younger administrators are much aware of wrong choices made in the past, sensitivity has changed and well, old recipes are no longer sustainable from both a financial and environmental point of view. You have to experiment for something new, because if the conditions have changed, you need to change the answers as well» (CCI1, Regional Manager and Project leader - 2.3.2017)*

The need for experimentation is put forward by the project leader as something necessary to manage flood risk in present times, facing new challenges with few resources. This is the claim brought by him and supported at different policy levels. Furthermore, the *topos* he adduces here is clearly opposite to the one pointed out by NG6I (Local NGO): a new generation of younger policy makers is now much more aware of environmental issues that earlier. This *topos* could theoretically co-exist with the one shaping NG6I's discourse, being the risk governance levels different. From one point of view what is at stake here is again a tacit dimension of local knowledge concerning policy-making practices, activated by constant direct relationships between some NGO members and policy makers at Regional level. Knowing how to exploit this tacit dimension and succeed in changing flood risk management practices in local areas could be also seen as a turn in local knowledges in those areas, as the argumentation of CCI1 (the project leader) pointed out. As outlined by Wisner (2009), local knowledge can incorporate a version of outside scientific or expert knowledge and make it local, I would add. The point is how and if local policies and local risk governance practices will be modified by these interaction between bottom-up and top-down triggers, as I'll discuss at the end of this chapter. This change in policy making mindset occurred both at local and regional level, as previously mentioned. For instance, a bigger awareness is at stake in the Municipality of Quattro Castella, where some minor flooding occurred in the past. A hydraulic scoping report has been commissioned by the Municipality and served as a first step to have some evidence of flood risk in the area. Like in the English context, the need for a cost-benefit analysis was an essential part of the project, they had to provide hydraulic modelling and chemical, geo-morphological, vegetation and fauna analysis pointing which benefits the project would have achieved, as I'll show in the next paragraph. At the Regional level, the willingness to undertake experimentation, enhance public participation and encourage a polycentric flood risk

governance is clear in the words of the Cabinet member for Soil and costal protection, civil protection and environment policies:

> *«The Regional Council believes in participation and in this case, referring to the LIFE project, Europe clearly believes in participation, every projects and planning might clearly be based on it. I claim this because we organized exactly a participatory process to elaborate the flood risk management plan, I think a very important one»*
>
> *…*
>
> *«We are talking about a kind of participation, which need to be driven, it needs to enhance time for discussion, needs a lot of knowledge, it is transversal and integrated ... because often, i.e. river contracts, maybe they are risen by issue of safety, however, it is clear that they then embrace the whole life of the river. The river is made of its at times tourist value, its history, is made by those who live in connection with it, such as fishermen, or by those who live the river as a farmer, in short it is made of a life that can be found within the objectives of the river contract – which are, among other things, a negotiated and participatory planning» (CC3I, Regional Councillor - 13.7.2017).*

Of course, the *topos* of public participation is always a win-win one, above all among policy makers. Three interesting claims can be discussed here: one is the willingness to delve into the different aspects around the river. So, the river is not only deemed as a hazard-related source, a risk-object or an area surrounded by probable flooded area on a map, rather an "object" with its own history, which can shape different relationships with different actors on different aspects. If very actor has its own experience with the river, then it's necessary to collect them locally and local knowledges, being them social, relational, mixed and hybridized (Wisner 2009, can provide a tool to enhance flood risk governance (see chapters 1 and 2). The second claim is the use of river contracts as policy tools and the third one is the willingness to integrate different kind of knowledges in participation projects to manage flood risk. Before discussing these claims (in the next paragraph) brought by who was responsible for funding the project in the Italian context, I'm going to discuss the third local-related element. In the first phase (see chapter four) of the LIFE RII project, that is the first participatory project to collect ideas and plan the works on the streams (summer 2013), a stream has been added to the six streams originally involved in the project proposal. In the very first meeting (3.7.2013) the locals complained about the absence of another brook, the Rio Montefalcone, which, in their opinion,

has been neglected despite some flooding occurred few years before[74]. This action clearly illustrated the main purpose of the LIFE RII project, as thought by CCI1 (Regional Manager and Project Leader) and DB1I (IDB Manager) and defined in the project proposal:

> *«The general aim of the project RII is to demonstrate that the Directive 2000/60/EC establishing a framework for Community action in the field of water policy and the Directive 2007/60/EC on the assessment and management of flood risks key concepts, about the opportunity and necessity of reducing flood risk and improving water bodies ecological status at the same time, can be applied also to:*
>
> - *minor drainage network, not directly involved in the Directives;*
> - *heavy urbanized areas, placed along the borders between hilly mountainous territory and the plain, where minor drainage network is typically modified; these zones are typically characterized in the Emilia-Romagna Region, in Italy and Europe as well, and they need an arrangement of the strategies sketched out by the two Directives» (Regione Emilia-Romagna 2011: 19)*

So, to meet the aim of implementing the EU Directives on the minor drainage network in urbanized areas, one of most straight way was to engage with local actors and integrate local knowledges, even due to the lack of risk data on these watercourses. Indeed, following a bio-regional and natural flood management perspective, minor watercourse, ditches and even run-off related gullies should be considered, as it was also done by DC1E (District Council Officer and RSUDS Project manager) in the English context. Furthermore, to include these kind of water bodies local knowledge is necessary: they aren't reported on flood risk maps and not usually included in policies at Regional and National level, as the previous excerpt point out. Neither hydraulic models or hazard maps are usually available to flood risk mitigation purposes. To conclude this reasoning, even if the project has been promoted by a Regional Council, some implicit and explicit triggers can be explained by local knowledge-related issues.

[74] From the LIFE RII minutes: «Scarsa attenzione al Rio Montefalcone, critico dal punto di vista del rischio esondazioni, già avvenuto anni fa» and Prevedere una variante al progetto Life con interventi sul Rio Montefalcone» (3.7.2013)

6.7 The inclusion of local knowledges in the LIFE RII project

Coming back to the "Rio Montefalcone issue", the inclusion of this brook into the project was just driven by the direct experience of minor flooding events. The only one who remembered exactly this event is DB3I, (IDB "dugarolo-in-chief") who was involved in managing the flooding, it was in 2005:

> *«On October 25, 2005, both the Montefalcone stream and Enzola stream flooded. In Bibbiano we have been working continuously since October, from two days after the flood (except the night of flooding), we brought the pumps and dag holes to try to... then we went there with the Region technicians to work with the excavator. Unfortunately it was drastic, we would have cut down three thousand plants to restore the stream flowing because it was gone! Too many plants, the Montefalcone had disappeared, it turned into a small ditch like this here and no one had noticed it! Because the Region didn't have any money, they haven't been managing anything since years ... and it wasn't our responsibility as well. Furthermore, unless it happens something, citizens say nothing, indeed if they can, they would throw something in there! You do not know how much garbage we pulled out, how much wreckage, how much garbage, because here they are still used to throw the garbage into the ditch as we did before...»* (DB3I, IDB "dugarolo-in-chief - 3.3.2017)

It's quite clear how much important a direct knowledge of the Rio Montefalcone is again relevant for flood risk management, and likewise a supposed lack of local knowledge by the locals. In fact, the *topos* of negligence is at the core of this excerpt: a diffuse negligence in environmental issues, lack of water, forestry and flood risk management, bad urban planning, illegal dumping. The following pictures can give an idea of how the brook was maintained before the project (fig. 6.21, 6.22)

Figure 6. 21 The Rio Montefalcone channeled and culverted in the middle of Bibbiano town (source LIFE RII)

Figure 6. 22 The Rio Montefalcone channeled and culverted in the middle of Bibbiano town (source LIFE RII)

The claim put forward by DB3I is twofold and co-related: past bad management, lack of resources and a complex (so perceived) flood risk governance framework fed carelessness. So, the stream is no more acknowledged as a watercourse, rather as a ditch or a drain and illegal dumping is no really fined. No local relationship with the brook, which has been hidden by the culvert, the houses and vegetation, is so established. The flooding is the only "trigger" of local knowledges to mitigate flood risk: if regional policy makers didn't acquire a local knowledge of this stream, local citizens have been pushed into action by water overflowing into their private properties:

«The Rio Montefalcone has been chosen by the citizens, brought as an example, so the owners played a role! The citizens in Bibbiano, where the streets flooded ... they saw the sewers leaking, water was on the streets, so the citizens pushed the Municipal administration saying: "Here is all flooded, you must sort it out!". However, we are still paying for wild urbanization, that is the mistake of having culverted the Rio Montefalcone... Then they've also built new developments... and what did they even do afterwards? "Look at this, we can build also our dumping!!" Can you imagine?!» (DB2I, IDB officer 13.2.2017)

DB2I (IDB officer) reiterated the twofold claim brought out by DB3I (IDB "dugarolo-in-chief): a vicious circle of human responsibilities, which were apparently stopped by the flooding[75]. This again rises the issue of how flood risk is differently constructed by the different actors and how different relationships with the watercourses are at stake: DB3I (IDB "dugarolo-in-chief) has got both an expert and a local knowledge of the drainage system complemented by a direct (tacit) knowledge of the water/locks behavior. Local landowners have been acquiring a local knowledge of the water behaviour only after the flooding, or better, they got an awareness of which risk-object eventually was. Earlier this was a ditch culverted and covered by trees, just a part of the urban environment. According to the two technicians, there's a diffuse apparent carelessness among local citizens, driven both by poor urban planning and by forgotten relationships with the watercourses. Then, after the flooding, flood risk was framed by local landowners by something that should be sorted out by the Municipality, even if the Region should be legally responsible for this. Indeed, the Region haven't got neither resources nor a local knowledge of the area (which is not on the flood risk maps). Furthermore, a very local area was affected by minor damage. As shown in the previous two excerpts, the agency, usually delegated to intervene in case of emergencies or for doing some works, was the IDB, even if it was not responsible for this. Among the reasons reported to explain this active role of the IDB, the most mentioned were an availability of greater monetary and technical resources and a better local knowledge of local areas acquired by a constant monitoring of the drainage network by their workers - who manage water in the area.

[75] But there's also another view on this issue, that is the inclusion of this brook was supported by a big landowner to ensure flood risk mitigation for future investments/development: «*Rumors said that the Rio Montefalcone had been included in the project because a big landowner bought the entire valley and therefore they included it, and he was in a pitiful situation and had to build nearby ... indeed, the builder puts himself in safe situation. Indeed, if you looks at the streams flowing in San Polo, there is Ca' Do Rio and Enzola, actually they skipped one, the Montefalcone, so it can be logical to include it, and there are some houses on the streams, then…»* (LO1I,National NGO and riparian owner - 9.2.2016)

The Environment Office Manager of Albinea and the Municipal Councillor of Quattro Castella, explain this as follows:

> *«We asked to the IDB, even if it was a legal duty by the Region], because unfortunately the answer from the Region was that resources were only available if a "State of emergency" was declared. Indeed, there are IDB fees, a budget must be spent on a yearly basis at request of the Municipalities, so the Municipalities could claim it when they needed it – e.g. a broken grid to be repaired- ... they used the IDB money ... they asked for consent from the Regional "Soil and Coastal Protection" Office to do the interventions, therefore it was a contradiction! But on the other hand, the Region would not have done the interventions, because they had said there was no resources»* (DC4I, Albinea Municipal Officer - 3.3.2017)

> *«Here is some schizophrenia, because the management of certain risks and resources are in charge of certain agencies, right? That is, the agency in charge of the channels is not the Municipality, but if something occurs by chance, the first being called is the Municipality. So, basically, they are somehow managing flood risk...»* (DC1I, Quattro Castella Municipal Councillor - 3.3.2017)

As I'll argue at the end of this part, there were local practices of flood risk management, which didn't strictly reflect the legal duties foreseen to manage flood risk. The claims put forward by the two previous excerpts made clear that from one side in Italy the risk governance framework was confusing, from the other side lack of resources made impossible to follow legal procedures. So, the main responsible for maintaining these watercourses hasn't got money and tools for doing this, but took usually action only during emergencies, that is when a "state of emergency" is declared and extra money can be spent. In parallel, even if the Municipality is not responsible for flood risk, it has got a sort of moral duty (as seen in the English context). Furthermore, in case of emergency, the main responsible for emergency management at local level is the Mayor: this is a vicious circle, where the (unofficial) local practice of risk management was to delegate the IDB (under the permission of the Regional "Soil and costal protection, and drainage Office") to do maintenance and flood risk management works even in the streams, because some streams are flowing into the channels managed by the IDB and the IDB has got annual memberships fees, which can be used for such interventions. This is something that wasn't really pointed by the interviewees as linked to local knowledges. Contrarily, in my opinion this is strictly related to local practices of flood risk management,

which can be included in the notion of local knowledges. Indeed, this was the unofficial "traditional" way of managing flood risk over the last twenty years. And this traditional local way became official under the river contract signed at the end of the LIFE RII project, after that the relationships with the different actors within the local flood risk governance framework have been re-activated by the project itself. This change in flood risk governance policies brought out how notions like "traditional" or "relational" are relative concepts and constantly dialogues with local knowledges. If this change in flood risk policies and (official) governance was one of the aim and result of the four-year project, I will detail now how local knowledges were included in the different phases of the project, mainly considering the most dangerous streams, the Rio Bianello and the Rio Enzola.

In the preparatory phase, the project planning and a technical description and assessment of the interventions with risk reduction objectives were prepared by the main flood risk authorities (Region and IDB, with the help of specialized consultants). In terms of flood risk, a probabilistic definition was used and a decrease of the 10% of flooding for 30-year floods were proposed. For the Rio Enzola (which caused lots of troubles, as seen in chapter 5), a decrease of the 50% has been achieved, while for the Rio Bianello (which never flooded but had the potential and could cause big damage, as seen in chapter 5) a decrease of the 10% has been met. Then, the first official phase of the project was undertaken in the summer 2013: the proposed river restoration projects were presented and a participatory process, with the purpose to be informative, consultative and have some co-planning meetings, started. Main aims were defined as follows:

> *«- to increase knowledge, awareness and accountability of the involved actors about hydraulic and ecological issues of the watercourses which flow through their territory. And about the technical, economic and social constraints to which the watercourses are subjected, due to the peculiarity of places and contexts*
>
> *- to communicate the RII Project and its triggers in a simple, clear and transparent way*
>
> *- collect and use knowledge, expectations, concerns and proposals to improve planning so that it better responds to stakeholders' needs*
>
> *- to enhance the governance between local actors and competent bodies*
>
> *- to optimize engagement and consensus around the Project*
>
> *- to achieve an effective inclusion of citizens and their organizations in decision-making processes under the authority of Public Administration, in*

the full sharing of the objectives and values described in the Regional Law 3/2010, about participatory process' planning» (LIFE RII 2012a: 3)

Local knowledges were never really mentioned in the participatory project's proposal, but a bi-directional knowledge sharing was promoted in the intentions, with some space given to knowledges, desires and needs from the locals, with the aim to improve the flood risk mitigation scheme and enhance collaboration and participation. Indeed, the project proposal contains some general guidelines, but the types of works to build and their location were shared and discussed during the participatory process (LIFE RII 2012b). In the three participatory phases of the projects some local knowledges were explicitly taken into account by who wrote the project proposal, NG1I (National NGO and IDB officer). I report below a whole excerpt of his interview with my questions, to get a better understanding of this issue:

«Well, so LIFE RII… the ideas emerged can be of various kinds, they can be simply perceptive, that is: "I remember that the river was once done in this way, I was used to swim, walk along.... and so I'd like to have it as it was" This therefore gives you the idea of how you would like to design the river; then there were those who were perhaps more technical, who were members of local associations, i.e. NG2I and NG3I, etc., or just professionals who told me "but look at that intervention there, I would do it like that and not there". So, there were these two kind of advices, more cultural and more technical. Furthermore, they gave some suggestions "take into account the water quality issue", because you talk about hydraulic risk, vegetation, etc., but here there's a big problem of water quality, because there are sewerage spillways» (NG1I, 13.2.2017)

«But do you remember some examples, i.e. some case where citizens or associations have really changed or modified...?» (researcher)

«Well, the project has been changed enough from this point of view, so to say, concerning water quality, this has been taken into account and, in the phase, i.e. after the LIFE RII project, the River Contract has been starting. And under the River Contract, there is the control of drains, the verification of where they are, their census, and therefore it has been added thanks to these suggestions..» (NG1I, 13.2.2017)

«And what about risk? On risk prevention works?» (researcher)

«On risk, they quite agree with the project proposals, indeed.... there were no...» (NG1I, 13.2.2017)

«But were the changes made maybe on where to do the work.... not on which work has to be done, this was already decided, wasn't it?» (researcher)

«Eh ehm, yes.... it was decided, but it was... anyway, we were quite open, that is, in the sense, we really wanted to try to meet their requests... but, basically, concerning the type of works, they have quite accepted it…» (NG1I, National NGO and IDB Officer - 13.2.2017)

NG1I (National NGO and IDB officer) identified two main topics and three different layers concerning the inclusion of local knowledges through the three participatory phases. The need to take into consideration and enhance the environmental management is something that most of the institutional interviewees acknowledge to the public. In the meetings' minutes is reported that the awareness of the presence of non-autochthone vegetation, weed and illegal dumping was quite diffuse, and the need for cultural regeneration projects associated to the streams, footpaths or cycle lanes alongside is very relevant. There were also classic engineering solutions proposed, such as detention basins or the clearing out, and a precise request for monitoring illegal dumping. One core issue, which can be inferred from NG1I's words, is again how much difficult is to frame (and communicate) the notion of flood risk (cf. also cap. 5, second part): what is the risk-object? And the object at risk? How can we take action to manage it? On which fields of action? The three different layers that he brought out are: the cultural dimension, the expert one, and the direct experience of the stream behaviour. The first dimension has been already previously discussed. The second aspect unveils an expert component among the local participants of the process. To analyze this aspect, it can be useful to check what kind of suggestions emerged in the first participatory phase. Thanks to the minutes of the meetings[76], I chose to report them in the following table, by referring to the main three streams, Rio Enzola, Rio Bianello. and Rio Bertolini.:

Rio Enzola and Rio Bianello	Rio Bertolini	Rio Enzola
• The covering of the reinforcements with willow cuttings or organic piling, or in any case with insertions in the local landscape • Finding actions that can be implemented in a subsequent step. From "extraordinary to regular" maintenance	• Enlargement of the left bank. • The Municipality must take actions against some riparian owners to remove "illegal" bends and other works • To remove the 3 slipways built in reinforced concrete in Ca' Do Rio.	• To hold water upstream to better manage the downstream. • Differences between the upstream and the downstream in Quattro Castella • It is needed to keep a regular maintenance of the vegetation by the citizens

[76] The meetings took place in the four Municipalities on 3rd-10th, July 2013. In one meeting Rio Enzola and Rio Bianello were discussed together, then a second meeting focused again on the Rio Enzola, that's why Rio Enzola is also in two columns of table 6.1.

• The project should need to empower citizens in land use planning • Enlargement of the stream bed with detention areas upstream and differentiation in agricultural timing. • To provide a variation to the Life project with interventions on the Rio Montefalcone • To secure residential areas • The enlargement of the stream bed. • Regular clearing out of selective grids • Guards (walls / reinforcements) in the Bianello stream by the culvert • Extend the interventions ahead the culvert (in Bibbiano)		• The interventions must be fixed on the ground

Table 6. 1 Suggestions on flood risk management proposed by the participants in the first phase of the participatory process

Therefore, different perspectives are stake:

- traditional engineering measures, such as detention basins, grids, the need to fix the works, the clearing out of the stream;
- river restoration techniques, such as to enlarge the banks, natural works on the banks, to manage the stream upstream to reduce flood risk downstream, to remove concrete or illegal interventions, to increase the number of natural flood management interventions;
- there are also precise references to some problems of the streams and the willingness to manage flood risk in some way;

- the need to include the Rio M. into the project.

Anyway, these results sound very top-down and expert driven, and it's not clear (because it's not explained in the minutes) who brought these issues into the debate. Indeed, some interviews (mainly NG2I and LO1I, National NGO local members) complained that the interventions had been already defined and no effective engagement has been supported. Furthermore, the previous excerpt by NGI1 (IDB officer) unveils a strong pre-planning phase and the willingness to "educate the public" to this kind of approach. In a report issued by the Region to evaluate public participation is reported that the level of involvement was between "consultation" and "co-planning", so it was more than a weak consultation, some decisions have been shared and modified according to the participants. In addition to the points already discussed, what was negotiated and got a strong input from direct experiences of laypeople was the "where", as CC1I (Regional manager and project manager) clearly reports:

> *«they know very well some critical points ... the citizens who live there, e.g. they know where the embankment is thinner and then where it is more dangerous...»* (CC1I, Regional Manager and Project Manager - 2.3.2017)

Thus, also in the Italian context, "where" to build the interventions was something adjusted with local knowledges of the area. In fact, a walk along the streams with stakeholders and school kids was foreseen in the project proposal. But, during the first meetings the need to go along the streams spontaneously emerged, so two walks were organized with the stakeholders and some labs with school kids. According to some technicians, it was the most interesting thing they've organized and the most "educational" one:

> *«In my opinion, the most interesting thing ... and what I really liked most was when we accompanied the locals along the streams, because in addition to the classic meetings, we went with them to see how things work. So, after bringing the citizens along the stream and explaining it to them, they responded by telling us their direct experiences. For us as technicians it was such an experience… of their life histories, because you may not know - especially about a stream - the story linked to that place»* (DC4I, Albinea Municipal Officer 3.3.2017)

She claimed that engaging with the streams enabled a sharing of knowledges at the local level, which triggered direct experiences, life histories and discourses about how water and the streams were differently experienced by the local actors. It's curious that this experience was

something new for the Environment Office Manager of the Municipality of Albinea: she hadn't got a local knowledge of the streams, which could be part of environmental policies. So, as the walking interview technique has demonstrated (see chapter four), DC4I (Albinea Municipal Officer), and local residents also acquired some (new) local knowledges and learnt something about the streams flowing in her town after the meetings organized along the river. Indeed, as seen in the English context, walking and observing the environment along the stream and in the stream bed means to read water flowing behaviour and to acquire a direct local knowledge to reduce flood risk. To show how this works, it can be useful to mention a whole argumentation by the NGO that triggered the project, referred by NG1I (National NGO and IDB officer):

> *«So, what kind of knowledges have you put into play in this project? Technical skills? Engineering knowledges? Direct knowledge about the behavior of the river?» (researcher)*
>
> *«Yes, in the sense ... technical know-how certainly, naturalistic knowledges as well ... and then I must say that in the end the greatest part was going along the streams to see how they really were» (NG1I, 13.2.2017)*
>
> *«Have you also gone there, then?» (researcher)*
>
> *«Oh, I went there 100 times! Yes ... I've also done some morphological monitoring, I went n times, oh! (NG1I, 13.2.2017)*
>
> *«Also before the project had started?» (researcher)*
>
> *«Yes, we did some surveys while writing the project proposal because we had to understand what to do in principle. Then when we passed, it was funded, we came back along the streams because at that point we had to start thinking about the project in detail so we went to see them again. And then we went n times, during the design phase! (NG1I, 13.2.2017)*
>
> *«How has this affected the project…in what?» (researcher)*
>
> *«Eh, well, it was fundamental, because from the initial idea to designing what you want to do, it's a big leap! Just understanding where public or private properties are, and where are bridges, crossings, which are really hard to localize on the map ... then you need walk along them, that is, you have to do it, you have to walk and see where it is precisely ... where problems are hidden and where you would have opportunities, because in fact it is like this» (NG1I, National NGO and IDB Officer - 13.2.2017)*

Here local knowledge is what informs scientific knowledge to be effective and efficient. The claim is which local knowledges about the stream morphology and behavior are essential

to manage flood risk with a river restoration scheme. In the minutes reported after the walks (second participatory phase), what emerged is: where was better to build the works but also the socio-cultural aspects pointed out by LO1I (National NGO and riparian owner) and the bad practices of water and flood risk management already discussed, such as:

- which meanders or which part of the banks have been artificially created
- where to reduce the flow speed and consent flooding areas;
- where enlarge the stream because of poor urban planning
- where illegal dumping is
- which type of vegetation could be cut, which not and where eventually build leaky dams
- geomorphological problem for biodiversity
- cultural aspects through life histories

The issues emerged were the ones discussed in the first paragraph of this chapter, and were risen mainly by the NGOs and (some) riparian owners living along the streams. As DC4I (Albinea Municipal Officer) previously noted, the walks were also a way to make the technicians at regional and local level aware of local knowledges, which didn't correspond with their "traditional" one. Indeed, the traditional way of managing flood risk was an engineering one, by rising banks, channeling and draining water as fast as possible, the opposite than river restoration techniques. For these reasons, some actors working as water or drainage technician (like DB2I, for instance) noted how difficult was initially to communicate risk with the public and how much more difficult was to implement the works, due to their being experimental and innovative:

> *«The problem is that traditional techniques are safe, that is, they have a quite limited margin of uncertainty: you can just raise the embankment - the hydraulic model says this, it says that it's ok to be prepared for the five-hundred-years flood. By the technician… because I talk to the IDB engineers to deliver traditional projects ... so I'm sure I achieve my aims! The problem is that these projects here have a margin of uncertainty, so I step into the public technician's shoes, who says: "Well, I do not risk" So what happens? That this project was funded because it is experimental!»* (CC1I, Regional Manager and Project Leader - 2.3.2017)

Engineering solutions were thus "traditionally" deemed safer than river restoration interventions, due to hydraulic modelling and probabilistic definitions of flood risk built upon

it. Furthermore, some interventions were also criticized by the landowners themselves. For instance, some riparian owners had the impression that NG5I (Local NGO and landowners) expressed while walking along the stream with me. While walking, he pointed the recent works (fig. 6.24, 6.25) and complained that:

> *«Anyway, the clearing out has not been done yet, after having done the pond (fig.6.25), the Bentivoglio [the old name of the IDB] must do it. The stream need to be cleared out, vegetation must be removed even upstream...it has been already growing...otherwise it will drag it behind and create some dams and then it overflows. Now with the abandonment of peasants there are no more...before (40-50 years ago) it was clean and there weren't such plants...»*
>
> …
>
> *«So, he left those plants in the middle of the stream (fig.6.24) ... but we think that if water is really running, water can slowly dig and erode and if a tree falls down and you don't remove it, you have to pull it off but if ... if not, I can't realize this attitude to leave trunks in the middle of the stream... in short, it was better to put some big stones that could really stop the water flow... » (NG5I, Local NGO and landowners - 16.11.2016)*

Figure 6. 23 One of the interventions: leaky dams with tree roots in the Rio Bianello to slow down the flow

Figure 6. 24 One of the works: enlarging the stream bed and keeping trees in it to reduce the water speed

Figure 6. 25 One of the works: an enlargement (on the left) and then a narrowing (on the right) of the stream bed to provide flooding areas upstream for slowing down the flow

What was commonsensically true by some landowners in the English context, was deemed as having the potential to (commonsensically) increase flood risk in this area by local landowners. The *topos* of a better flood risk management undertaken in the past, due to

traditional practices of farmers was again brought out. But this was partially true: if the presence of less farmers had influenced the maintenance of the land, it's true that, like in the English context, to drain water as fast as possible was the "traditional" way of water management:

> *«In Italy, farmers' associations, which are very powerful, aren't so keen on all this stuff. They see agriculture in a very traditional way, i.e. it takes a lot of water to irrigate... it takes a lot of water to irrigate, to make business, as agriculture always aims for, and with mechanization ...» (CC1I, Regional Manager and Project Leader - 2.3.2017)*

To conclude, the experimentation driven by the project dialogued with local knowledges and enable/built some relationships, while some others were discharged. The way local knowledges are conceived like tacit, traditional, expert or direct experiences is unpicked and rebuilt by the different actors and by whom drove the project. Experimentation was made possible by a flood risk governance which included public participation and tried to be polycentric, even if formally top-down driven. Indeed, the result of the project has been translated into a negotiated planning tool, the river contract, or better, the "Streams Contract" (Patto di Rii):

> *«The Contract is a River Contract, an integrated and procedural tool for a new institutional and participative dynamic of territorial and landscape management. This is essentially an Action Planning that identifies the strategic actions for that area and the most appropriate ways to locally translate the European principles of integrated governance: from the integration of the various sector policies, to the coordination of the different planning tools; from ecological quality restoration, to the improvement of the use of water resources; from hydraulic risk reduction, to the valorization of the territory. The Pact is the result of a participatory decision-making process based on information sharing, requests collection, proposals evaluation, and shared commitments. The Pact therefore constitutes a consensual agreement between different actors and institutions (institutional, technical and social in associate form) working on the same territory, each for its own competence (Patto di Rii, art. 2)*

Finally, the need to define unique criteria for collaboration and an integration of flood risk management and environmental issues led to set a locally characterized flood risk governance framework, where the actors engaged in the LIFE RII project could contribute to it - each with

his competencies and local knowledges. This negotiated plan as a result at the end of the project was necessary to formalize the informal local flood risk governance I previously described and to provide the area a set of rules to bridge the forgotten relationships with water and with the streams. In the next chapter I will discuss my findings and compare the two flood risk management processes to answer my research questions and sum up my reflections on the integration of local knowledges into natural flood management processes within an inclusive risk governance framework.

7. Final discussion. The integration of local knowledges into flood risk governance in context of natural flood management

In this last part, I will finally answer my research question and sub-questions and I will discuss my research findings about the integration of local knowledges in flood risk governance as played out in context of natural flood management by comparing the two case studies.

7.1 The need for local knowledges

As discussed in the third chapter, the need for local knowledge and for a general risk governance approach in DRR is put forward in risk and flood risk policies at different levels.

Two of the SFDRR priorities require the inclusion of different actors and perspectives to be achieved. The need to empower local authorities in risk governance different phases to both ensure the use of local knowledges and tailor policies, plans and programs to local contexts is explicitly mentioned. Obviously, it is not mentioned how to do this, but «if appropriate», the use of «traditional, indigenous, and local knowledges and practices» should be ensured to complement scientific knowledge in risk assessment, management and policies. Furthermore, the SFDRR «points to the importance of promoting "the collection, analysis, management, and use of relevant data and practical information" at national and local levels, as well as to "ensure its dissemination, taking into account the needs of different categories of users"» Weichselgartner & Pigeon 2015: 110). If risk governance and local knowledges are not explicitly mentioned in the FD, the Common Implementation Strategy Guidance Document for FD and WFD states that expected outcomes of participation should generally result in «awareness rising, knowledge elicitation and social learning» (EC 2013:5). If a nested policy cycle (Newig *et al.* 2014) generally improves participatory planning and promotes a polycentric governance, it's hard to identify the definite role of each single actor and of the different knowledges in flood risk governance, even at local level. For instance, in the policy documents at Regional level in Italy few mentions appear of local knowledges, even if flood

risk maps and management plans has been delivered through a participatory process, in England as well.

Alternatively, as seen in chapter three, interesting references to the engagement of stakeholders and the integration of local knowledges can be found in some documents developed by the Local Lead Flood Authorities and the EA, so at Regional level in England. For instance, in 2001 a report was commissioned to fulfil the need for the EA to «play a proactive role in terms of citizens and community engagement» (EA & DEFRA 2005). And as discussed, the *GS Local Flood Risk Management Strategy* acknowledges the need to work with stakeholders and communities to get the best understanding and management of flood risk, following the first SFDRR priority: «successful local flood risk management can only be achieved if Risk Management Authorities, other stakeholders and local communities work together to better understand and manage flood risk» (GCC 2013: 10). From a technical perspective, the EA also produced some reports promoting the implementation of natural flood management, referred as *Rural sustainable drainage system* (EA 2012b) or *Working with natural processes* (EA 2017) mainly at catchment scale (DEFRA 2013) – defined as «a geographic area defined naturally by surface water hydrology» (DEFRA 2013:3). If these reports were mainly focusing on finding a technical evidence base, the 2017 report, (issued in November 2017, while concluding this thesis) pointed out the essential role of stakeholders' cooperation and learning by doing in natural flood management at policy level for the first time (as discussed in par. 3.5). In parallel, In Italy, *River Contracts* provided a policy tool to account for local knowledge sharing through negotiated strategic planning in river restoration projects, as discussed at the end of third chapter. Alternatively, as seen in the previous chapter for the Italian context, one of main point brought out by the LIFE RII project proposal was to include different actors to «increase knowledge, awareness and accountability of the involved actors about hydraulic and ecological issues of the watercourses which flow through their territory» (LIFE RII 2012a: 3). Concerning the Italian context, it may be also helpful to my reasoning to mention here that a better precise reference on what is local knowledge and how it can be used in terms of flood risk governance can be found in the report issued during the *Seinonda* project (see par. 3.5, *infra*) – the participatory project that resulted in the Flood Risk Management Plan at Regional Level. Among the results of the consultation undertaken with flood risk institutional actors and stakeholders, the contribution of laypeople and local stakeholders has been defined as follows (Ercoli 2013: 28-29)[77]:

[77] Translations by the author.

- «historical information on past floods
- to improve the knowledge of the territory and areas at risk
- what is the acceptable level of risk?
- in flood risk management plans they can identify more specific actions, contribute to define emergency management and coordination framework at local level
- possible contribution in detailing and updating flood risk maps
- alternative proactive proposals
- contribution in defining self-protection measures and priorities in planning
- risk perception, risk awareness and knowledges and right behaviours
- to bring understanding in risk perception upscaled to the community level
- the definition of which risk the citizen is willingness to accept.

It's impressive how these aspects overlap the ones described in my research: direct observation and historical information, self-protection measures and coordination at local level, and the issue of acceptability as a trigger point for risk awareness and preparedness, as argued in the data analysis. The point is that these notes weren't really considered in the LIFE RII project proposal but emerged only during the project. Despite this, the ER Regional Council, as seen in chapter four, acknowledged the need to use different knowledges to tackle flood risk engaging with laypeople both in decision-making and in facing technical problems, pushing participation and including different perspectives in policy making and technical schemes. And in both projects, there was the need to get more information and include different perspectives to understand how to better assess and manage flood risk, due to their being natural flood management projects. I will discuss these points in the following paragraphs.

To answer my first research sub-question, the need to include local knowledges in both case studies can be analyzed in different ways, following the different stages I identified in the two flood risk management processes. First of all, in the first phase of the process, this need emerged for two main practical reasons:

- the impossibility to use classic engineering interventions;

- lack of resources: lack of capital in Stroud, both lack of capital and revenue in Italy.

Lack of funding was the main motivation pushing the Italian process, which was delivered only due to European Union funding. In the English context, it was more likely a sum of lack

of capital and geomorphological and environmental reasons. So, alternative solutions needed to be found. Furthermore, the lack of hydraulic modelling of the local area worked both as trigger and as a hamper for the RSUDS project. Indeed, without a cost-benefit analysis, the EA (via the RFCC, as discussed) can't finance any project. At the same time, it is right the lack of modelling and of an alleged legitimacy of local knowledge what made it available and usable for the natural flood management project itself.

And, which conditions do let the local process start? That is, which root and contingent causes did generally bring the need to include local knowledges into flood risk management? Fundamentally, the flood events, climate change perception, and a polycentric risk governance framework.

The flooding events in England and climate change perceptions (the perception of an increase of extreme events) in Italy fed risk pre-estimation/awareness in many actors, together with the classic technical tools (such as flood risk maps and flood risk management plans and strategies) for the institutional actors. Indeed, for most actors, risk characterization (in terms of evidence) or risk evaluation (in terms of value) are the triggers of risk pre-estimation in the light of a lack of tolerability of flood risk. In simple terms, in face of a non-tolerable risk due to evidence or values, most of the actors started to take action and identify or use local knowledges. Indeed, among FAGs or local NGOs an awareness of local knowledges has usually emerged after the flood events. What is likely to have made people "aware of" local knowledges is either their risk framing or a direct (active) relationships with the watercourses. The former was always produced after "the disaster": it was the shock and the feeling of being unsafe that triggered the production of local knowledges among most of the FAG or NGOs members. Only some specific environmental NGOs (but not all) or landowners/riparian owners had some local knowledges concerning flood risk, independently from their risk evaluation/characterization. Indeed, being risk a complex invisible notion, environmental issues are still not linked to flood risk. Given that in the Italian context there wasn't a major flooding, a generally change in extreme rainfall events' frequency - informing the perception of climate change as an issue - have been leading all actors (from local to Regional ones) to take some actions for climate change adaptation, starting from flood risk. So, during the process but mainly before the projects started or at their very beginning (in the first and second phase in the RSUDS, in the second phase in LIFE RII), a need for local knowledge emerged from local actors due to the perception of unsafe conditions.

Another point, which influenced the need for local knowledge, was the "bottom-up" willingness to make the current flood risk governance framework more understandable and

effective. Even though it was encouraged and enhanced at EU, National and Regional level, the potential for an inclusive risk governance came out from the limits of a technocratic approach usually top-down driven in both local contexts. This approach was the classic cost-benefit analysis, which usually conceives flood risk as a known risk to be handled with expensive hydraulic modelling and engineering solutions to protect a precise number of properties. This approach to risk governance (see par 1.4, *infra*) was contested in both local contexts due to political and geomorphological reasons, and thanks to the strong role that three of the five FAGs in Stroud, and the National NGO promoting River Restoration in Italy had. Indeed, the FAGs in Stroud were formed for three main reasons: to solve flood risk-related problems as quick as possible, to make current flood risk governance in the area understandable and effective, to campaign and lobby for being protected against floods (i.e. to have safe conditions). In Italy, the river restoration approach (campaigned by the National NGO who strongly promoted the project) was successfully brought into the governance process to promote a catchment-based approach through the role of an engineer, who managed to convince the main Flood Risk Authority, ER Region, to experiment this approach. Furthermore, the polycentric flood risk governance in both contexts was perceived by most actors (including some institutional ones) as confusing; in parallel, this governance structure allowed some local actors to experiment alternative flood risk management solutions (e.g. at household level in Stroud) or to have informal management schemes (e.g. the role of the IDB in managing risk in the Reggio Emilia foothill). So, a polycentric governance which was inclusive in different ways as in the two projects considered gave space and opportunities to local knowledges to be considered and implemented.

One last point, which emerged during both project (in the first and third phase of RSUDS, and mostly in the second phase of LIFE RII) concerning the need for local knowledge is strictly linked to Natural Flood Management and flood risk management in minor networks. As discussed, the scale of the interventions is very local and the streams and areas affected by them are usually not represented in flood risk maps. To allow this kind of interventions it is essential both to own a direct local knowledge of water behaviour in those areas and to get the collaboration and help of local actors, such as landowners/local tenants, riparian owners and farmers. Local knowledges are needed both to practically deliver the works and to make the works effective in terms of flood risk reduction.

I will discuss now the links between the production of local knowledge and the actors involved, so answering to my second and third sub-questions, which are strictly interlinked.

7.2 The actors involved in the two natural flood management processes

As already discussed, the engagement of different actors was promoted by different policy documents at all levels. Generally, the term "stakeholders" is used to refer to these actors. As discussed in the first chapter, Renn (2008) distinguishes between:

- *«stakeholders: socially organized groups, «who are or will be either affected by or have a strong interest in the outcome» (Renn 2008: 273) of the risk source or of the process/activities of risk management/mitigation*
- *directly affected public: individuals and non-organized groups «who will experience positive or negative impacts from the outcome» (Renn 2008: 273) of the risk source or of the process/activities of risk management/mitigation*
- *observing public: media or opinion leader/cultural elite who may influence public opinion*
- *general public: who is not directly affected by the risk or risk management/mitigation but are «part of the emerging public opinion on the issue» (Renn 2008: 273).*

Renn (2008; Renn *et al.* 2011) also suggested how risk-related problems can be tackled by including different actors according to the type of risk context. As discussed in chapter one, he identified: a *linear risk problem*, which can be coped with statistical analysis and no stakeholder participation. A *complex risk problem* to be handled with the inclusion of different epistemological experts. A *risk problem characterized by high unresolved uncertainty*, to be faced with the inclusion of affected stakeholders and public interest groups. And a *risk problem due to interpretative and normative ambiguity* which needs to include also the public. In this regard, for instance, the Pitt Review (2008), commissioned by the UK Parliament after the 2007 floods, alternatively suggested to boost the involvement of *all relevant parties* in risk governance and to include local knowledges in flood risk management practices at local level. But, who are these relevant parties?

In my case studies, the two project leaders represented two different governance levels: in LIFE RII, the project leader works in the Regional Office responsible for the flood risk management of the chosen streams, which were bad maintained. He hadn't got local knowledges of these streams' behaviour at all. In RSUDS, the project leader was hired by the

District Council and acquired a strong local knowledge of the area during the first phases of the process. Who wrote the project proposal in Italy was the Regional Chair of the National NGO promoting river restoration in Italy, who was then hired by the local IDB, the deputed agency for managing flood risk in the area[78]. Both had to negotiate the works with locals, mainly landowners, riparian owners and NGOs or FAGs representatives, using local knowledges to build and implement the works, as previously mentioned. In both projects, actors at higher level in terms of flood risk governance, were marginal and got no local knowledge, except for the Environmental Agency representative. Due to the multiscale presence of this Agency, a process of local knowledges acquisition involved its representatives, who were actively learning from local actors how water was flowing in the Stroud area. In terms of governance level and inclusion, due to their legal role, Regional and District/Municipal actors were involved: in RSUDS, the EA and the RFCC with overall responsibilities, and the SDC with operational responsibilities; in LIFE RII the Region with overall responsibilities, the IDB with operational duties and the Municipalities with advisory and operational responsibilities. So, the governance framework was similar, except for the IDB, which is not competent in the Stroud area, but has acquired a relevant role in the LIFE RII project. As discussed, the IDB in LIFERII got a relevant role, the same as the SDC got thanks to the project leader. But the project leader in Stroud got a unique relevant position, due to his capacity of mediating with different knowledges and having an expert background together with a strong local knowledge of the area, due to its strong commitment in the FAGs. In LIFE RII, the IDB supplied this role as an agency specialized in drainage and with an extensive expert and local knowledge of the areas acquired over the years. This institutional local dimension has been fundamental to provide and to keep (since the River Contract at the end of the project has set out the IDB as the main flood risk authority until 2022) the catchment scale as unit of management: the bioregional approach is what can give the right scale to make local knowledge usable, transmittable and effectively implementable. The catchment scale didn't overlap with the whole flood risk governance scale, resulting in a non-overlapping polycentric governance, which helped the management of risk by providing a more adaptive environment to cope with ambiguity and uncertainty. Indeed, the presence of actors with multiple roles was a key factor in triggering and delivering the process in Stroud. In both processes, what facilitated the knowledge exchange has been the local social networks eased by the adopted inclusive approach to flood risk: key actors in both processes had multiple roles and personally

[78] Before the project informally, after the project legally.

knew some relevant flood risk governance actors. For instance, in the Slad Valley the connection between the FAGs, the CC and the RFCC was incorporated by the Slad FAG chair, who was also a CC councillor. In the Italian context, the regional chair of the main NGO was then hired by the IDB and already worked for the Regional Soil and Coastal Protection Office, providing a link between local and regional instances. In LIFE RII, the local level was initially underrepresented (in the first "triggering" phase) but the two participatory processes foreseen consented an engagement of main stakeholders through consultation and some co-planning. As seen, the allocation of power among the different actors was not obviously equal, with DEFRA and EA in England and the MATTM and the Region in Italy at the top. But many actors dealing with water, from riparian owners and farmers to the Regional Flood risk managers were consulted and engaged in both case studies. Since public participation is a pillar of an adaptive co-management approach and is often invoked at all policy levels, who needed to be included when flood risk constitutes what to deal with? As discussed in chapter one, Renn (Renn 2008; Klinke & Renn 2012) identified different actors to be included according to the level of complexity, ambiguity and uncertainty. And he referred to flood risk as *a linear risk problem*, where no stakeholder engagement is theoretically required. Both processes have involved policy makers, engineers, affected stakeholders and the affected public. Therefore, following Renn's inclusive framework (Renn 2008; Klinke & Renn 2012) the type of risk dealt by LIFE RII and RSUDS should have been a *risk problem with a high unresolved uncertainty*. Indeed, uncertainty was due to the conflicting experimental solutions emerged (or proposed) in both processes. Due to the impossibility of building classic engineering solutions, complexity and uncertainty at institutional level increased in both case studies, while ambiguity was something existing among the public involved, like some landowners, farmers and riparian owners. Furthermore, the catchment based approach led to include actors who are usually not affected by flood risk, due to the need to work upstream to reduce the flow peak. This increased ambiguity and turned the problem into a *risk problem due to interpretative and normative ambiguity*, which needs to cope with risk evaluation and risk characterization, that is, with the need to cope with risk assessment based on evidence and/or on values – the issue of acceptability previously discussed. Following this reasoning and Renn's framework, an adaptive co-management approach applied as an inclusive flood risk governance thus acted in different ways on the different risk dimensions:

- it increased complexity at institutional level and among local stakeholders
- it increased uncertainty and ambiguity at the institutional level

- it decreases ambiguity and uncertainty among local stakeholders

These statements underpin how the inclusion of different actors in the governance framework changed decision-making and risk-related practices. To better explain these claims, in the next paragraph I will account for how flood risk was framed by the different actors and how local knowledges were identified, produced and integrated into the flood risk management processes.

7.3 The production of flood risk-related local knowledges and their integration into the flood risk management processes

In both contexts, as discussed in chapter five, I registered the presence of diverse concepts of flood risk. It was quite interesting to note that the community and event-driven process, the RSUDS, unveiled a prevailing technical definition of flood risk, while the "top-down" Italian process included a broader range of flood risk definitions. Generally, by both institutional actors and some local stakeholders, flood risk was treated as a linear risk problem, as Renn (2008) suggested. But the idea of flooding as a process, with manifold triggers over space and time is what usually increases uncertainty, ambiguity and complexity in flood risk assessment and management, resulting in the need to include local stakeholders in the risk governance process. This aspect was particularly clear to the RSUDS project leader, who was aware of uncertainty and complexity in undertaking the interventions. As seen at the end of chapter six, he explicitly mentioned complexity and uncertainty in his reasoning. He expressed and followed the need to piece together different knowledges, which derived from a processual and relational notion of flood risk: flood risk is thus not only deemed as the probability to affect some properties due to a hazard (being the object-at-risk one's own home and the risk-object the amount of water), rather a process concerning water flowing, land use and socio-political relationships. Paradoxically, this understanding of flood risk is what decreased ambiguity among the affected stakeholders: if flooding is triggered by different "known" but interconnected causes, then it's sufficient to take a holistic and catchment-based approach to mitigate flood risk. In the Italian process, despite similar technical flood risk definitions reported in National and Regional policies, a broader range of flood risk definitions was put

forward, so increasing ambiguity in risk management. Every different actor/organization appeared to conceive flood risk in a different way: a farming issue, a matter of planning, being able to read a territory, the amount of water flowing downstream, a probability, the awareness of having different risk concept constructions.

Alternatively, the notion of local knowledge hasn't been directly identified and integrated into the risk governance framework, but came out from the interaction between local stakeholders and institutional actors. No institutional actor at Regional and National level claimed the notion as a trigger of the processes, rather it was both something that drove the processes from bottom-up and something emerged during the processes (in the second and third phase, as described in chapter four).

Bearers of local knowledges were mainly non-governmental actors, except for the IDB in the Italian case study and for the District Council in the English study site. Indeed, these two agencies rightly became the main flood risk governance actor at the local level as an outcome of the two projects. This confirmed the essential role of local knowledge in the flood risk governance of natural flood management projects.

In order to integrate local knowledges into flood risk management - as discussed in chapter two – to identify, validate and share knowledges across scales is a key aspect (Gadgil *et al.* 2004). As seen in the previous chapters, the relational and combined nature of local knowledge to face complexity, ambiguity and uncertainty needed always to be validate in order to be applied to flood risk assessment and management. For instance, in both case studies I found controversial stances of "traditional" and anecdotal or historical local knowledge, which didn't fit into the project. The references to an ideal past, the mill thought to be a flood risk attenuation structure, traditional farming and public practices of draining water to manage flood risk: they were all part of a local knowledge domain, which should have been validated. Alternatively, some tacit knowledges and practices, which shaped local knowledges, needed first to be identified in order to be interpreted and used. Like the knowledge of water and locks behaviour by the *dugarolo-in-chief* or the informal practices of local risk governance in the Italian context, or water flowing behaviour into private properties, or old place names in the Stroud area. Local knowledges must be identified, acquired, engaged, validated and then can be integrated as Raymond *et al.* (2010) have shown (see par. 2.4, *infra*). In both case studies, as discussed, the term local knowledge was used with the following different meanings:

- It was the result of direct observation of water flowing, which was acknowledged after the beginning of the project or after a major flood event.

- It was the result of a prolonged daily observation of water behaviour due to affective or working reasons.

- It was historical knowledge, sometimes mixed with anecdotal beliefs or active remembering. The act of talking and certain interactions were feeding it.

- It was acquired through intentionally prolonged observation by walking along the streams and looking at water behaviour. This was mixed with expert and scientific knowledge to validate the observation.

- It was a tacit way of doing, of assessing and managing water behaviour.

- It was a tacit knowledge of governance practices.

- It was a traditional water management practice, which practically increased flood risk.

- It was situated, being encapsulated or produced in situated interactions/relationships.

It consisted of different components, sometimes diverse, which are locally produced through certain interactions/relationships, between water flowing and certain actors, and among certain actors.

In RSUDS, the FAG chairs and members were the first to identify, acquire and transmit local knowledges with the willingness to manage flood risk in the Stroud area to reduce peak flow. The acquisition process happened by talking with each other, meeting neighbours, meeting institutional officers overseeing flood risk, walking along the streams and exchanging opinions. Local knowledges were activated, used, incorporated and transmitted only through situated relationships. These actors usually first came across scientific and technical knowledges, because these are the easiest knowledges to find and understand, due to their broad use and diffusion, as already discussed. During the RSUDS project, the project leader had the role to negotiate with local actors, in order to mediate different knowledges to integrate all aforementioned aspects into flood risk governance. Using both his scientific expertise and a prolonged daily observation of water behaviour, he needed to validate beliefs, historical anecdotes, direct and tacit knowledges to build the interventions: identifying which landowner to contact, finding out "where" and how to build the interventions. In the outcomes of the

project, aspects related to local knowledges are still visible and had been preserved. In LIFE RII, the opposite happened in the first phase of the project: the two project leaders had to identify and acquire local knowledges in order to submit the proposal: by walking along the streams and meeting experts. The "expert filter" was higher, due to the nature of the project itself. During the project, local knowledges exchange was less intense, but led to meetings and comments on the works. During the works, an active participation of landowners and riparian owners was achieved: advices on "where" doing the works have been embraced. The outcomes were often not so clear to some involved stakeholders in terms of flood risk or water management.

In both case studies, the (aforementioned) identified aspects of local knowledges were considered. This confirmed the need to unpack the concept in order to enable the integration of local knowledges into the governance frameworks at local level.

To sum up my findings, these two case studies provided an example of best practices in terms of flood risk management as played out in context of natural flood management within a risk governance approach. The risk governance approach, from the EU down to the local level, allowed in both case studies and theoretically in the whole EU in general, to include different actors in flood risk assessment and management. Not all actors are usually included: the risk governance framework is inclusive when the same epistemological legitimacy in framing the concept of risk is given to some actors, according to the level of ambiguity, complexity and uncertainty. Depending on stages and actors, flood risk can also turn into a risk problem *due to an unresolved uncertainty* or *to interpretative and normative ambiguity*. Indeed, due to most recent academic research and scientific previsions, flood risk can't be deemed as a "known linear risk", it can be noteworthy and necessary to increase ambiguity and uncertainty at institutional level in order to decrease them among local stakeholders. By adopting a strong social constructivist approach, it was possible to frame the notion of risk as a relationship between a risk-object and an object at risk. In this way, an inclusive risk governance framework, which acknowledges the different epistemic positions is put forward. From my case studies, it emerged how the risk-object/object-at-risk relationship was usually constructed after unsafe or non-tolerable conditions were experienced or imagined/feared, such as after a major flood, due to climate change or risk perception or following technical risk models. Local knowledges constituted a relevant part of the knowledges at stake in natural flood risk management. The inclusive risk governance framework unveiled the potential to experiment and use alternative solutions to face unprecedented problems: lack of resources, unavailability of engineering solutions and hydraulic models, and geomorphological conditions. To

implement effective solutions in such context, local knowledges played a relevant role in triggering at least one of the process and in making both processes possible and successful. In both processes, the implementation of natural flood management principles initially set the catchment scale as the "local" risk governance scale. Indeed, the process of mimicking nature to reduce flood risk through natural flood management required the integration of local knowledges into a co-adaptive and inclusive risk governance framework. This was identified as an adaptive comanagement process, where:

- the bio-regional approach has paved the way for public participation and knowledge engagement and sharing. Relationships between actors and watercourses and among actors at different governance levels led local knowledge identification, acquisition and integration

- Experimentation has enabled to consider and mix up different kind of knowledges and practices, beyond classic cost-benefit analysis and a technocratic approach

- Public participation has developed co-sharing contexts by building relationships, so framing local knowledges and acting on the dimensions of risk

- Polycentric governance created a stronger link between governance levels and acted on ambiguity and uncertainty. It also partially resulted in a social learning process and in a stronger local flood risk governance as a consequence of both processes.

In RSUDS, the community groups, which were mainly created after the flood, forced the risk governance to be polycentric to produce and include local knowledges into the framework. Alternatively, in LIFE RII, the river restoration approach allowed the main flood risk actor to identify a homogenous geomorphological area to be covered. There, a network of flood risk actors was built around a local authority, likely the FAGs did in their stream catchment. The identification and validation of local knowledges were possible only if embedded in a network of relationships and interactions. Rather, local knowledges were exactly situated relationships and practices between human actors and human and non-human actors, including different kind of practices (forestry management, land use, environmental and flood risk management).

Tacit, historical, anecdotal, direct, expert and scientific knowledges were constituted as local knowledges through the risk management process: fig 7.1 represents a graphic representation of this process.

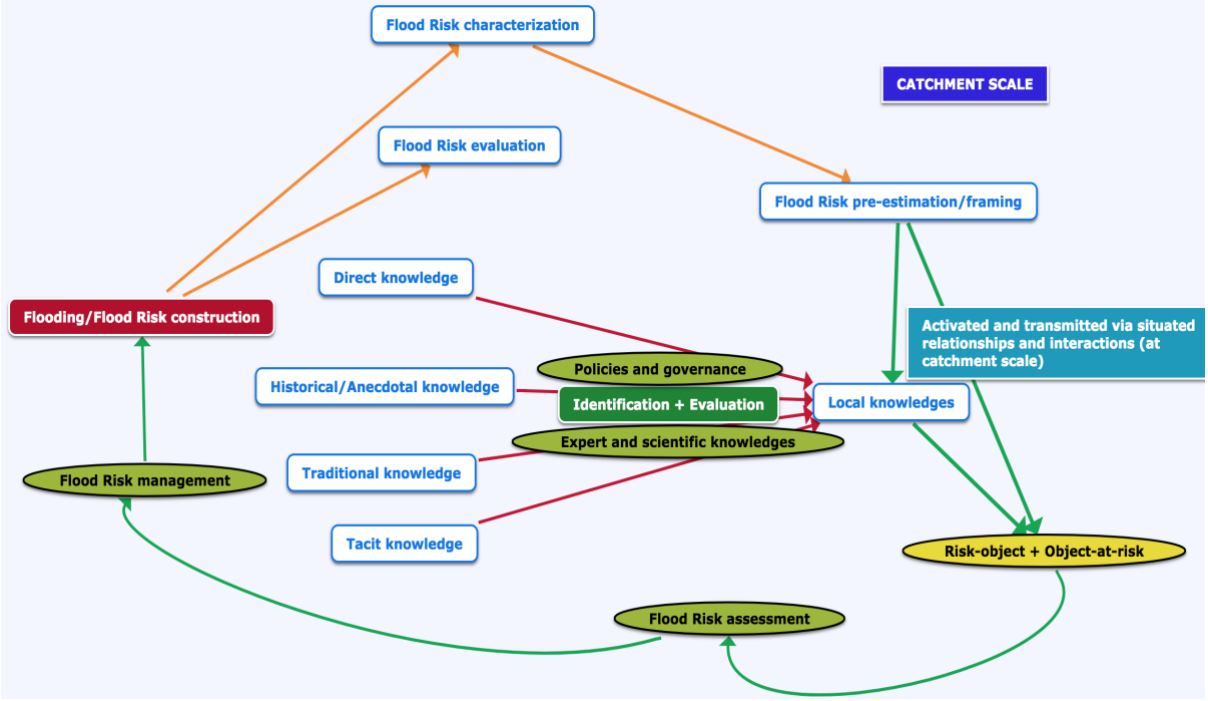

Figure 7. 1 My graphic representation of the integration of local knowledges into flood risk management processes involving natural flood management

Furthermore, experimentation enabled the institutional actors to try new ways as pilots and include new actors in the framework in both case studies. Behind this, it lies the bioregional approach underlying the adaptive co-management, which translated into a catchment scale concerning flood risk. Therefore, it's water what should be follow in building and rebuilding political and risk governance relationships among the different actors. Indeed, public participation was driven by the water behaviour, if acknowledged. If not, flooding was forcing public participation in shaping flood risk framing through risk characterisation (evidence based, if living by water) or evaluation (usually if damaged). Local knowledge could have been activated, acknowledged or produced if and only if some awareness about water and land use were socially embedded in flood risk governance. Following this reasoning, water flowing should not be considered a risk-object but the object-at-risk. Its flowing turns into a risk only if a political/social relationship is built around it: risk is a socio-cultural construction and it's the relationships between water flowing and risk governance actors to be dealt. So, only the willingness to adopt a catchment based flood risk governance approach, which includes both

local actors (at different scales) and situated relationships with water flowing provide the conditions for the engagement of different types of actor. This is what is required at European and local level to manage flood risk within a risk governance approach – what the WFD, FD, River Contracts or the recent "Working with Natural Process" policy by the EA prescribes (EA 2017). In the end, still the relationships enabled by water flowing, which are the basis to implement Natural Flood Management on a micro-scale, led inclusion and adaptation from local to regional level.

To conclude, this research, as pointed out in the methodological part, is an experimental one. So, it can have a strong descriptive and exploratory power, but explanatory limits, due to the small number of case-studies taken into consideration. The epistemological[79] and ethnographic level of the analysis together with the kind of comparison undertaken provided a deep understanding of the integration of local knowledges into flood risk management processes in context of natural flood management. Future research perspectives could firstly include an increase in the number of the case studies to be considered, to bring evidence of my analysis of natural flood management. Indeed, my two case studies have been included in a H2020 Call with other 14 study sites to bring evidence on large scale demonstrators on nature-based solutions for hydro-meteorological risk reduction, which reached the second stage evaluation. With the inclusion of more case studies in the analysis to enhance an explanatory power, policy guidelines could be recommended to potentially turn this framework into a practical DRR application to naturally reduce flood risk with multiple benefits; in this regard, some of my reflection on RSUDS are now part of a co-authored paper (Short *et al.* 2018) to demonstrate the multiple societal benefits of this governance perspective for natural flood management. Furthermore, different kind of inclusive flood risk management processes, such as Individual Property Protection (see chapter 6) or participatory processes/river contracts not specifically around natural flood management processes could be potentially considered to enlarge the explanatory power of the framework. Furthermore, socio-cultural vulnerability and broader sociological issues related to natural flood management could be also part of future research projects within an interdisciplinary perspective on inclusive flood risk governance to both reduce flood risk and provide multiple societal benefits.

[79] Some epistemological and methodological issues discussed in this research are part of a paper under revision.

Conclusions

I've analysed two flood risk management processes where complexity, ambiguity and uncertainty have been tackled engaging with stakeholders and local actors. My findings have shown that local knowledge is a notion that can be integrated to better assess, characterize, evaluate and manage flood risk. The notion of local knowledge needs to be unpacked to be acknowledged, used and shared by the different actors, so that they can be included in flood risk management processes, especially in the context of natural flood management. Local knowledges need also to be hybridized to be integrated into an inclusive and adaptive risk governance perspective at local level. Indeed, inclusion guarantees the epistemological acknowledgment of the different risk constructions, because risk is not a probabilistic notion "out there", as it is usually conceived in DRR practices and policies. The different actors assess, characterize, evaluate and manage risk entangling and disentangling "risk" in risk-objects and objects-at-risk. Adaptation is needed to unchain and follow watery relationships through public participation, a catchment wide scale, experimentation and a polycentric governance. To develop the latter point, a higher numbers of case studies should be considered. But some reflections on this topic can been put forward. Situated relationships and practices activate and produce local knowledges, due to the role of water flowing in shaping risk and risk framing, characterization/evaluation and assessment. In flood risk assessment and management, local dimensions and scale -sometimes a micro-scale- turn into the relevant scale of action to mitigate flood risk within a risk governance perspective. The different actors are bearers of different kind of knowledges, which interact at local level, driven by relationships between actors and between actors and water catchments. It's a learning by walking, talking doing and flooding: the flowing of water turns into a socio-political element of risk governance, by enhancing or weakening relationships.

Local knowledge is not only something "traditional", linked to an idealized past, irrational and hard to be managed: it is the combination of knowledges negotiated at *situated* regional and local level. It incorporates tacit practices –concerning both risk assessment and management-, socio-physical relationships, expert and scientific knowledges, common-sense, traditions, memory and memorialization. The issue is how to identify, acquire, engage with, validate, transmit, accumulate and use this kind of knowledge, to face the "knowing more and

losing more" paradox. As discussed, after or during a process of knowledge identification and evaluation, an adaptive comanagement process within an inclusive risk governance framework can be a valid framework to identify/produce, negotiate, validate and use/transmit these local competencies.

Therefore, the concept of "local knowledge" in natural flood management processes can enrich the notion discussed in the literature for different reasons. My findings confirmed this is a "malleable concept" (Haughton *et al.* 2015): different actors can have different views on this notion or they can't acknowledge it at all. This highlighted how "traditional", "indigenous" and "local knowledge" can refer to different notions in natural flood management and adaptive co-management, questioning the issue of indigeneity as something "static" and culturally bounded. "Local wisdom" (Taylor & de Loë 2012) should not be considered a synonymous of a "context-specific" and "holistic" (Blaikie *et al.* 1997) knowledge, if not identified, shared and evaluated.

In the adaptive co-management framework identified to integrate local knowledges into natural flood management, the local context coincides with the catchment scale, that is «the geographic area defined naturally by surface water hydrology» (DEFRA 2013:3). Therefore, if local knowledge, as Wisner claimed, is «essentially social» (Wisner 2009:3), being social to naturally mitigate flood risk, means being shaped by water-humans' relationships at catchment scale. Risk is so unveiled as a socio-cultural construction at the interface between nature and society (Renn 2008; Forino & Carnelli 2017). I've argued how only thinking water flowing as an "object-at-risk" in risk framing, makes possible to identify and activate local knowledges for flood risk governance. The rigid distinction found in the literature between a rational and universally applicable scientific knowledge and an irrational, subjective and informal local knowledge is therefore not useful in this context. It's the hybridising of knowledges (Wisner 2009; Gaillard & Mercer 2012; Haughton *et al.* 2015) through situated relationships and interactions at catchment scale what defines the localness of local knowledges to be integrated in flood risk governance in natural flood management processes. In this regard, among the notions of "local knowledge" I discussed in the literature review (see chapter 2), the concept of traditional ecological knowledge, as defined by Berkes *et al.*, which can be applied, with some changes, to local knowledges in natural flood management processes, i.e. a «cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment» (Berkes *et al.* 2000: 1252). Indeed, "the transmission through generations" should be strictly linked to the evaluation through practices,

expert knowledges and water-humans' relationships at catchment scale. In adaptive co-management, it's public participation through a polycentric governance within a catchment scale what makes possible to engage with, share and transmit local knowledges. As already discussed, it is the interaction between risk characterization/evaluation and risk framings, and between risk construction and the relationships with the watercourses what makes local knowledges actionable.

The transmission and sharing obviously depend on the social networks activated and by the institutional risk governance framework. In this regard, even if a bigger number of case-studies should have been analysed to get an explanatory framework, some suggestions can be brought out to inform policy and practice about the integration of local knowledges into flood risk governance in opportunity of natural flood management processes. As widely discussed, the need to better understand "risk" and to strengthen disaster risk governance to manage disaster risk are two of the main priorities at UN level in terms of DRR policies (UNISDR 2015). With the FD and WFD, the EU acknowledged the role of multiple stakeholders and local communities in DRR, and claimed a better collaboration, mutual learning and experience sharing among them. Furthermore, the role of "local knowledge" (with "traditional" and "indigenous knowledge") is encouraged in the SFDRR to «complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programmes» (UNISDR 2015:15). To achieve this, it is relevant to acknowledge the role of local knowledges in risk framing, first. I demonstrated how without a relationship with the watercourses and with the socio-cultural aspect linked to it, risk characterization and risk evaluation are not considered, usually resulting in a lack of risk awareness. Second, the "where" is a core issue in integrating local knowledges in natural flood management. Field of actions for flood risk governance should be both the micro-scale and the catchment scale. Therefore, there's the need both to include local actors with their relationships with water in the framework, and local institutions. Local agencies should lead the flood risk management process having the catchment as their competence area in terms of water and flood risk management, such as the IDB in the Italian context and the Municipality together with the EA have shown. Third, as discussed, the relationships between local and scientific knowledge result in a sort of situated hybridising, made of knowledge exchanges through situated relationships at very local scale. Landowners, farmers and riparian owners sometimes know how watercourses flow and flood on a micro scale. Some NGOs eventually know the most innovative measures to make sustainable and cheap choices. Flood action groups or landowners/riparian owners can historically and socially incorporate relationships, which make

local knowledges available and actionable. Local agencies dealing with water and flood risk management can work as mediator of expert and local knowledges, due to their diffuse and constant presence on a local context. Multiscale actors are the ones who can make the difference in delivering projects where knowledges can be hybridised at local level. What is usually considered a linear risk problems, flood risk, (with increasing damage), may become in some phases a complex risk problems, in others a risk problem *due to an unresolved uncertainty or an interpretative and normative ambiguity*, and then again, a linear one, depending on adaptation and inclusion through local knowledges. Who and how to engage with, according to the level of ambiguity, complexity and uncertainty must be highly evaluated. Simply because, beyond the different epistemological positions on risk, some of them (e.g. riparian owners, landowners or farmer) were or will be never affected by flood, so increasing the level of ambiguity to be faced. In parallel, risk could be constructed in very different ways. As discussed, the integration of local knowledges can increase uncertainty, complexity and ambiguity at institutional level, while potentially reducing ambiguity and uncertainty among local actors. Therefore, the polycentric nature of the adaptive co-management framework should be set to face these aspects through participation and experimentation at catchment scale.

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Appendix

Interview schedule

To choose the actor to interview, socio-graphic features to be considered were: governance level/project/direct involvement in the works.

Flood risk governance

1. How do you/your organization think we can prevent flooding? What did cause floods in this region?
2. What is not tolerable or acceptable according to your role?
3. What are the risk drivers?
4. Which are the priorities to handle with? In which phases of risk is relevant to act (assessment, management, communication, participation)?
5. Which measures do need to be taken (mitigation/prevention/resilience/early warning)?
6. What is flood risk/How would you define it - according to your role?
7. Complexity, uncertainty, ambiguity can be considered the main aspects of risk: how do you cope with issues?

Local knowledges and the "local" dimension

1. Are local actors relevant in flood risk? Why?
2. Are local knowledges/competencies relevant in flood risk? What role do they have? Why?
3. What do you mean with "local" and with "local knowledges"?
4. Do you know some local practices of risk management or flood risk mitigation? – as subject OR Do you include local knowledges in your policies? (as organization)
5. A direct experience with rivers/water? What kind of? (as subject or in risk management as organization)

6. What did you learn as organization from previous experiences/past flood memories materializations? Some practices/actions/policies carried out after past floods?

Project involvement and governance

Beginning

1. Who did you know/work with before RSUDS/LIFE RII? How? (List of actors with relationships) Who did you meet during the project?
2. Which were the triggers of the project? How did it start?
3. Why and when did you join the project RSUDS/ LIFERII? Which phase were you involved in? Was climate change considered?

During

4. What was your role? [+ Governance level]
5. Have you directly done the works?
6. What kind of relationship/knowledge do you have (as subject) with/of the places affected by flooding/included in the project? OR What kind of legal competencies (as risk management organization) do you have over the places affected by flooding/included in the project?
7. At which spatial scale?
8. Which law/docs/bylaws (MSW, LFS, EU, FRMP, FHM) did you refer to?
9. Were local actors involved, in your opinion/according to your organization? How?
10. What about local knowledge of these subjects/organizations? Have their knowledges/expertise (as organization) been considered? In which phases of the project? How?
11. Which skills/knowledges did you use/refer to?
12. What about your local knowledges? Were your local knowledges relevant in the project (the beginning/In risk assessment/In the decision-making/In the measures taken?)

Outcome

13. Did they influence the project's outcome? How?

14. Has current local flood risk governance positively influenced the project? Has it changed after (or because of) the project?

15. Did you change your behaviour (as subject)? OR Did you change your policies (as organization)?

16. Were you satisfied with the project? Critics?