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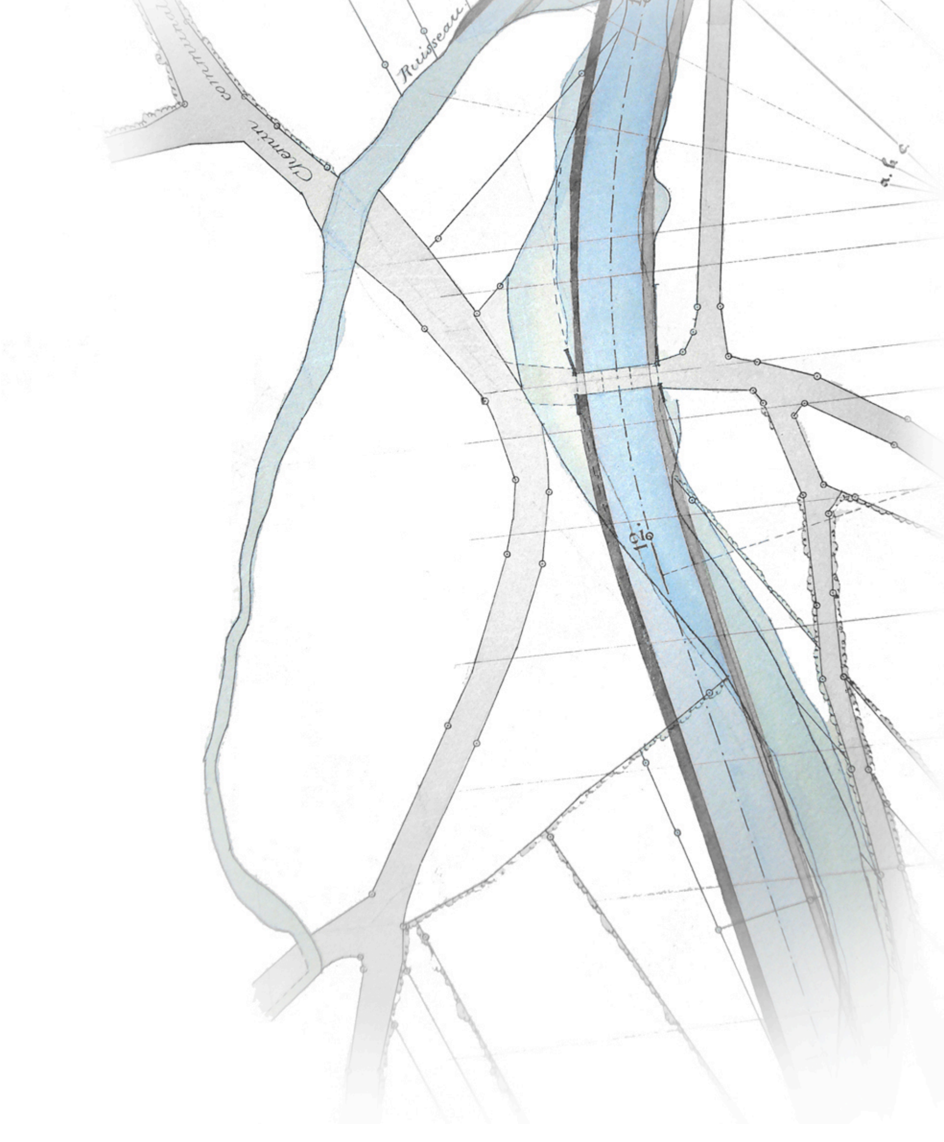

CASE B3: Social processes in natural disaster management. The case of recent floods in Switzerland

By
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Introduction

The last decade has shown that despite the efforts made to control river flooding for over a century (Vischer, 2003), Switzerland is not safe from the danger of flooding. The catastrophic floods of 1987, 1993, 1994, 1999, 2000 and 2005 in different regions of the country are only the most important national events and do not include localised events. These floods show how highly vulnerable Switzerland is to hydrological disasters. The cost of these disasters is more and more important due to the intensive land use and the sophistication of the property effected by flooding, especially in highly urbanised areas. In addition to the damage caused by the flooding and the consequent rebuilding, compensation and insurance processes, which follow, flooding also often leads to large-scale territorial changes (modification of property value, changes in territorial planning) and important changes in the organisation domain (for instance, structure modification in crisis management, institutional changes or the emergence of new actors).

The floods of 1987 are considered to be the key-event that has changed the flood protection policy in Switzerland. For over a century, the Swiss federal state had organised the policy around two types of action: forest management in the high watersheds and dyke building – and other active protection infrastructures like dams – along the rivers and alpine torrents (Reynard et al., 2001; Vischer, 2003; Zaugg, 2002). The policy was a success and allowed the reconstruction of the alpine forests overexploited during the 19th century and the development of intensive agriculture along the valleys of the Alps and the Swiss Plateau. The floods that occurred in July and August 1987 in a large surface of Switzerland and that cut the international Gothard communication axe for several days showed, however, that the so-called active measures (building) were not sufficient in order to reduce disasters due to intense flooding. A report on the floods' causes and consequences (OFEE/SHGN, 1991) concluded that it was necessary to consider flood risk in an integral way, and that the active measures should be completed by passive measures aimed at preventing disasters (e.g. building forbidden in flood areas; danger maps) and managing the crisis when it occurs (e.g. crisis management, insurances). The importance of the integration of the territorial planning and flood protection policies was also recognised (OFEE/SHGN, 1991: 44). The conclusions of the report provoked a profound change in the philosophy of flood management in Switzerland, that aimed at giving more space for watercourses and their dynamics (Zaugg, 2002) and at integrating the flood protection and territorial planning policies (ARE/OFEG/OFEFP, 2005).

One of the consequences of the 1987 floods – and other natural disasters that occurred in the following years –, is the creation in 1997 of the national platform on natural hazards (PLANAT) that aims in priority at the prevention of natural hazards in Switzerland. Its strategic objectives are to pass from a policy of mere defence against natural hazards to an integrative risk management policy. The platform has, therefore, adopted a global approach of risk, synthesised by a "risk cycle" model (see fig. 1 in Introduction) that was developed some years before by the Federal Office of Population Protection.

This model has the advantage of being clear and easy to use by planners and risk managers. It is nevertheless quite simple and should be completed in order to take the actors and institutional configurations, and the temporal and spatial effects of floods and flood management actions more into account. Four key-elements should, therefore, be taken into account:

- The model has been designed by and for risk managers (planners, engineers). It divides the actions made by professionals into several categories, but does not take into account the role of other actors like NGOs, the population, institutional actors of other administrative sectors, etc.
- The model is considered as a road map for risk managers, but it does not take into account the fact that even in this group of actors, the knowledge of risk, natural processes and territorial elements is very different from one person to another.
- The circular presentation of the model does not show the temporal characteristics of each element sufficiently: for example, the alert is reduced to a few minutes, whereas the preparation is a constant of risk management.
- The spatial implications of each action are not taken into account. In particular, the model does not give any information concerning the scale (e.g. local, regional, national) of each element of the system.
- Finally, the model does not take the institutional framework, that changes drastically according to the case (e.g. from one country to another one) and that constitutes the reference framework for the managers, sufficiently into account.

Starting from these remarks, the aims of this paper are to define the "risk cycle" model, by taking into account the role of actors, their very different knowledge of risk and its management, as well as the spatial and temporal variability of their actions. The analysis is based on two case studies on floods occurred in Saillon (canton of Valais) in 2000 and Lully (canton of Geneva) in 2002 (November et al., 2006). Firstly, we present the two events, and then we analyse successively the risk knowledge by the actors, the information channels, and the territorial dynamics of risk (temporal and spatial implications of the events and their management).

The two floods

Case 1: Saillon, 15-16 October 2000

Saillon is a small commune (1700 inhabitants) situated in the Rhone River valley, between the towns of Sion and Martigny (Figure 3-17). With regards to the floods the village may be divided in three parts: the medieval village built on a rock hill and surrounded by castle vestiges; the torrential fan of the Salentse river, an affluent of the Rhone river; and the alluvial plain of the Rhone river. New houses and commercial and industrial buildings have radically occupied this last sector during the last decades, mainly since the 1960s, which constitutes a general trend in the Rhone River valley (Stäuble and Reynard, 2005).

The alluvial plain was drastically different in the 19th century. The Rhone River was still completely natural and alternated braided and meandering sectors. The trajectory of the river was guided by the presence of numerous alluvial fans of secondary rivers. Several depressions were characterised by wetlands and marshes due to damming by alluvial fans and hydrological connections with the Rhone River. The area of Saillon was one of these wet sectors and in the 1850s, the river plain in that sector alternated wet meadows and alluvial forests. The Rhone River was then regulated in two steps, respectively in 1863-1894 and 1930-1960 (De Torrenté, 1964). The meanders were reduced and the river was dyked. In 1873, the Valais government established a large project for wetlands reduction along the Rhone River valley, which was completed only after the Second World War. That allowed the important development of intensive agriculture, with cultures mainly situated below the level of the river, giving most of the area a feature of polder (Loup, 1965). Another consequence of the drainage works was the creation of several drainage channels connected with the Rhone River.

These channels played an important role during the 2000 event. Between the 10th and the 16th October 2000, intense precipitations coming from the Mediterranean Sea affected the South side of the Alps, and the maximal values were registered in the area of Simplon. The Rhone River watershed was heavily affected by the meteorological event, and the recurrence time of the high water is estimated to be 200-300 years in the area of Sion-Martigny (OFEG, 2002). The 15th October in the afternoon, the dyke broke in the area of Riddes, some kilometres above Saillon. The water flooded first the plain situated above the Salentse alluvial fan (not visible on Figure 3-17), and then occupied two drainage channels. One of them broke on the evening of the 16th October and waters flooded 144 ha in the Saillon plain, causing damage of more than 25 million Swiss francs, and provoked the evacuation of about 500 persons.

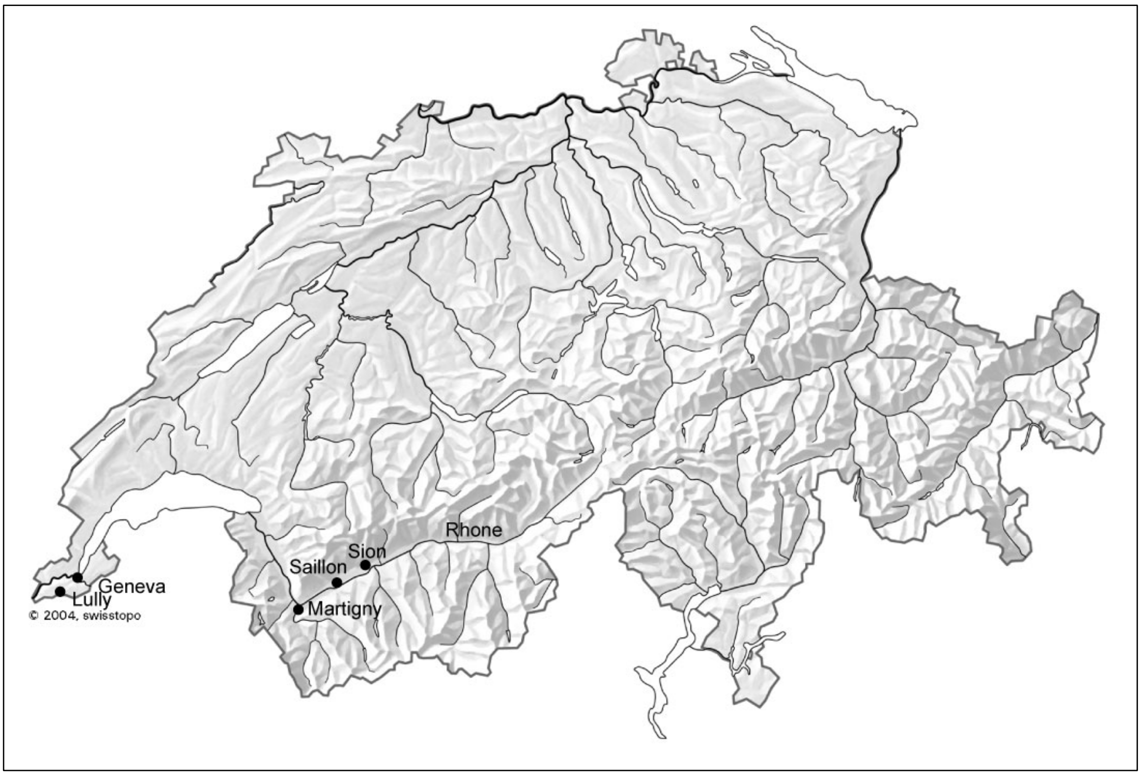

Figure 3-17 Localisation of the two case studies.

Case 2: Lully, 14-15 November 2002

Lully is also a small village (1800 inhabitants) situated in the Geneva surroundings (Figure 3-17), on the commune of Bernex (9300 inhabitants). The village is situated in a depression of the Aire River plain. Until recently, the area was mainly used for agriculture (market gardening). As in the Saillon area, the plain was occupied by marshes until the 19th century and in 1907 a drainage plan was developed. The river itself was corrected respectively in 1888 and between 1925 and 1933. The development of Lully initiated in the 1960s, and since the 1980s, due to the intense urbanisation of the Geneva agglomeration, the village has grown drastically. The upper side of the Aire watershed is situated in France (St-Julien-en-Genevois), an area that has also been progressively urbanised.

The flood of November 2002 was due to extreme precipitations (51 mm the 14th November; 98 mm the 15th November). The precipitations caused the Aire flow's growth – that did not break the dykes –, and intense runoff on the plain itself. The superficial runoff provoked the flood of the Bas-Lully sector that occurred during the night of 15th November. The flood did not provoke any human losses – although several inhabitants were sleeping in the basements and were rescued just before the disaster –, but material damage were, like in Saillon, quite important (Figure 3-19).

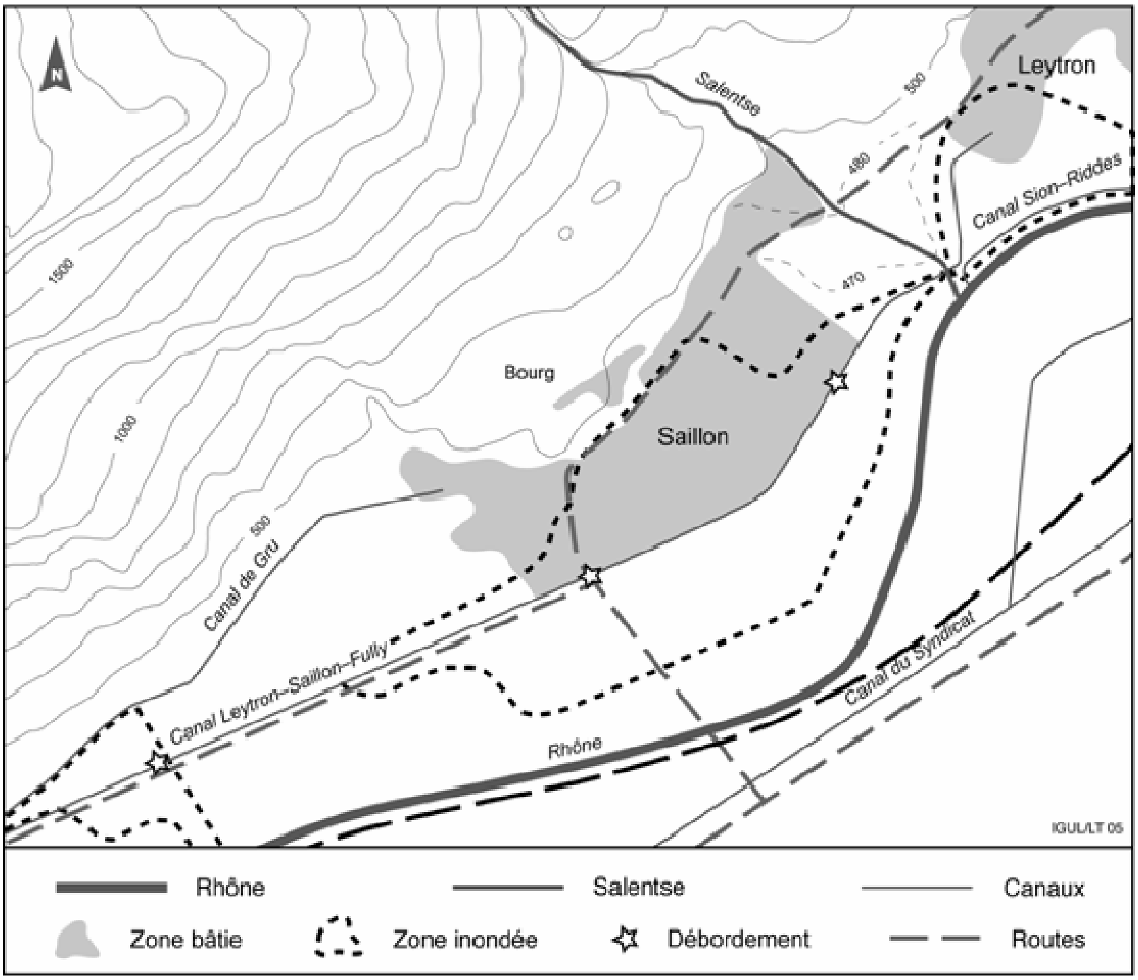

Figure 3-18 Geographical sketch of the Saillon flood in October 2000

The event was more tragic than in Saillon and large media coverage was given, especially because one year before, in autumn 2001, another flood had occurred and had affected houses that were under construction. Promoters and architects had assured at that time that the event was exceptional. After the 2002 event, some inhabitants, therefore, instituted an action in justice.

Methods

The study was divided in three parts. After the reconstruction of the event, by using scientific and technical reports, maps and some interviews with key-actors, we established a "cartography of the actors". This first step allowed us to conclude that the number of actors involved in the event was quite large and concerned two main groups: the institutional actors – flood managers, planners, crisis managers, politics, etc. – and the non-institutional actors – NGOs, inhabitants, associations, fishermen, etc. We developed a comprehensive view of the collaboration networks – and also the gaps of collaboration – existing between actors. The scale of intervention (local, regional, federal) of each actor could also been established.

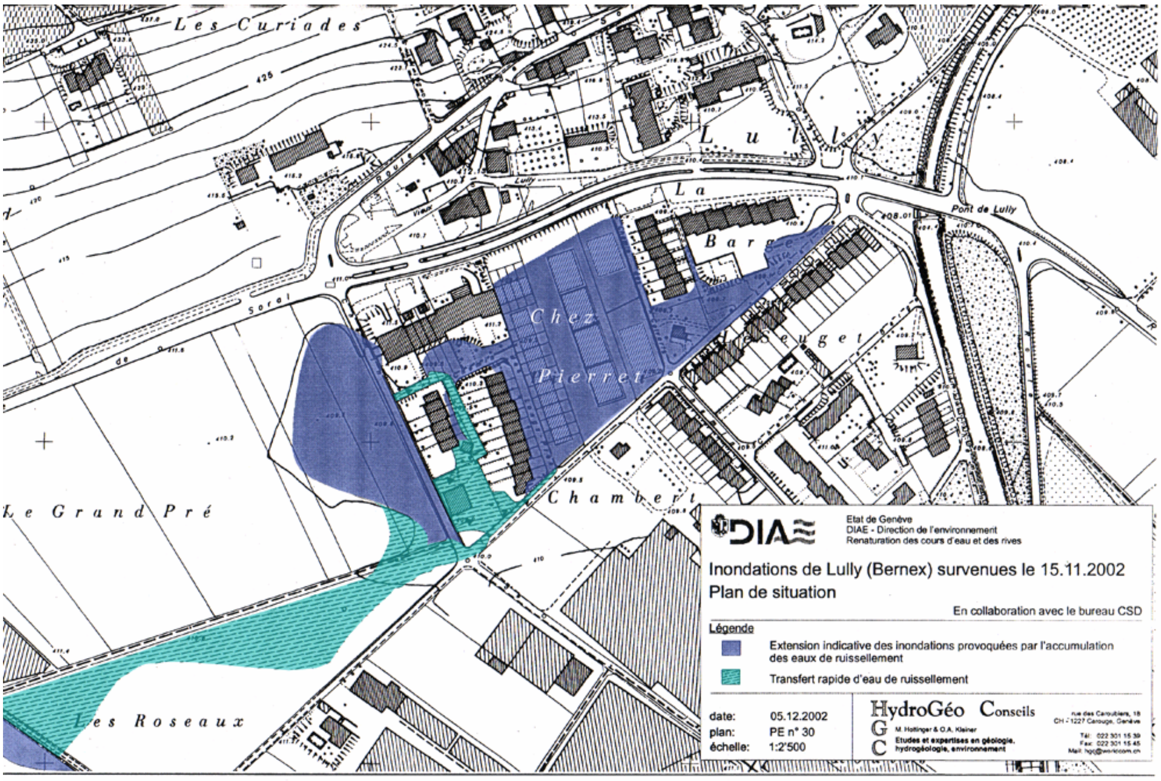

Figure 3-19 Map of the flooding event in Lully (15 November 2002)

The second step was the undertaking of interviews with a selection of actors. 41 persons were interviewed. Each actor received guidelines, with a panel of questions, before the interview. The questions were organised according to 9 themes, covering two main areas: risk knowledge and territorial dynamics (Table 3-5). Each interview was recorded and the transcript noted.

Table 3-5 The nine themes of interviews grouped in two categories, A = risk knowledge; B = territorial dynamics

A 1	Role and knowledge of the interviewed person relating to the risk before and after the event?
A 2	How does the interviewed actor define the risk?
A 3	How was his/her risk knowledge gained?
A 4	What are his/her collaboration networks in the domain of risk?
A 5	Does the interviewed person have a global comprehension of the phenomenon?
B 1	What are the various territorial dynamics at different scales?
B 2	How do different heterogeneous territorial dynamics co-exist?
B 3	What is the temporality of the territorial risk management?
B 4	What is the spatiality of the territorial risk management?

We have then segmented each interview by using the 9 themes and merged all the paragraphs concerning each theme that was analysed separately. That allowed us to show the general lessons concerning each research question, and not only the information given by one specific actor on the event and the flood risk in general. The main findings are presented in the following paragraphs.

The actors and their knowledge of risk

The different actors (institutional and non institutional) have very different knowledge of hydrological risks. Their perception of phenomena is very heterogeneous. This conducts to a large panel of risk definitions. The "**specialists**" of territorial planning and hydraulic engineering refer generally to the definition adopted by the Swiss Federal Agency of Environment: risk = hazard x vulnerability. Most of them have good knowledge of the various processes that can cause a flood and of specific concepts used for defining the intensity of an event (e.g. recurrence time). During the interviews, they frequently illustrated their comments by examples from different parts of Switzerland in order to compare them with the specific studied cases (Lully, Saillon). Moreover, their definition generally refers to the notion of probability that may be used for quantifying the danger. The "**non-specialists**" – that is persons working in other administrative sectors, the local authorities (e.g. mayor) and the inhabitants – generally define the risk on the basis of the specific event or on their experience.

We analysed the knowledge of hydrological risk in their area before the event. The result is that, as for the definition of risk, the knowledge was very different from one person to another. The actors could be divided in six specific groups (Table 3 6).

In the Valais, the specialists knew more about hydrological risks than those in Geneva. The farmers and old people generally had good knowledge of floods and their developments, based on their long experience of the area. All the other actors initially had very little knowledge of the risk. Moreover, most of the information that the actors had before the event concerned the hazard. Apart from the specialists of water management in Valais, the actors did not have a precise perception of the vulnerability. Their knowledge of risk – viewed as the combination of hazards and vulnerability – was, therefore, largely incomplete.
On what do the actors base their knowledge? Two types of actors may be highlighted. The specialists of flood management have knowledge based on a large panel of sources and documents (models, simulations, historical information – former events –, administrative documents, experience), whereas farmers, old people and some actors at the local level (e.g. firemen) base their knowledge principally on their experience and field observation.

Table 3-6 Forms of knowledge before the events

Group of actors	Knowledge	
	Lully / Geneva	Saillon / Valais
Canton administration (actors working in the domain of water management)	Few and fragmented knowledge	Precise knowledge concerning hazards due to the Rhone River
Canton administration (other sectors)	No or incomplete knowledge	Basic knowledge
Local administration	Very few knowledge	Very few knowledge concerning the Rhone River hazards
Firemen	Reduced knowledge	Knowledge concerning the potential break of a dyke
Inhabitants	Few and fragmented knowledge. Exception: old people	Few and fragmented knowledge. Exception: old people
Farmers	Precise knowledge concerning runoff hazards and the initial state of the plain	Precise knowledge concerning the Rhone River floods and the initial state of the plain

Finally, as for knowledge in general, the memory of risk – that is the knowledge of former events and geographical indications that record the hazard – varies dramatically according to the actors. There is, therefore, cohabitation between very different levels of risk knowledge and memory in a small space. We can conclude that neither Saillon nor Lully has a collective risk memory as other vulnerable regions have.

In the two cases the event has provoked a profound change of the knowledge of risk. We have identified four types of changes:

- Radical change of knowledge (e.g. people who initially thought that their region could not be flooded);
- Creation of new knowledge (e.g. discovery that flood could be provoked by runoff and not only by the Aire river in the Lully area):
- Adaptation of existing knowledge (e.g. level of flood that was underestimated);
- Confirmation of existing knowledge (e.g. bad state of the Rhone river dykes).

These four types of changes concern the various groups of actors differently. Some of them (inhabitants, local administrations, non-specialised administration in Geneva) change their knowledge radically. For other actors (e.g. specialists of river management), the event confirms existing knowledge and allows the adaptation and perfection of previous practices.

Concerning the basis of knowledge, after the event, all the actors are confronted with a diversification of their sources of knowledge. Because of their responsibility in case of disasters, the local political authorities form the group that changes its sources of knowledge the most radically. The event has shown a profound gap in the knowledge, and in the two cases, the local administration has launched scientific studies (e.g. hazard maps) in order to define the knowledge on the hazards.

The event has also had an impact on the perception of risk. In general, the sensibility to the hydrological risk has been reinforced in the two cases. The transformation of perception is mainly visible within the inhabitants. In Lully, several of them have been shocked by the event and some suffer from anxious states, especially in the case of bad weather. Several have taken individual measures in order to mitigate the vulnerability (e.g changes in the surroundings of their house, like small dams, in order to stop or change the course of the flood). The population in general seems to feel more concerned with flood risk issues.

Actor networks and information

Several interviews have shown that some problems during the event, concerning crisis management, were due to a bad circulation of information and collaboration between some groups of actors. We have, therefore, tried to understand how the information circulates between the different groups of actors.

A first conclusion concerns the diffusion of information within the administration. The different services are at the same time producers of information (e.g. danger maps) and receivers. Within the administration the circulation of information tends to follow hierarchical channels, instead of transversal (from one service to another one) directions, and bridges to facilitate the circulation of information between specialised services and offices are sometimes lacking. The fact that the hazard map of Lully existed since 2000, but was not integrated by the territorial planning and urbanism services, is an example of this type of gap.

A similar comment may be made concerning the relationships between the local administrations (communes) and the higher level (canton). The local authorities may be considered as generalists. Because of the small size of their administration, they generally do not have the possibility of specialising themselves on some sectors of territorial management and planning. Due to the large amount of tasks and to their incomplete knowledge of risk, this group of actors has a tendency to reduce the potential of risk. They, therefore, need impulsions coming from “above” in order to adapt their knowledge and preparedness. At the local level, we have observed that the event has launched an important re-organisation of the actor network.

In Saillon, the flood showed that the commune was not sufficiently prepared to the crisis management. Several actors had more than one important task (e.g. the commune technician was also the firemen chief at the same time) and the crisis roadmap was imprecise. A new crisis management task force was, therefore, created. In Lully, some inhabitants had the impression of being too weak actors and decided to create an association of inhabitants that is now an important actor involved in all the decisions concerning the territory and aspects of living in Lully (for more details see November et al., 2007).

Finally, the two events have shown the importance of the rapid diffusion of information before and during the event. The alert needs, nevertheless, a complex chain of information between specialised sectors (meteorology, hydrology, dam management), and that is the reason for the creation or reinforcement of specific alert systems that facilitate the decisions when an alert should be launched.

Territorial dynamics

A first conclusion concerning the spatiality of hydrological risks is the absence (or reduction) of a territorial memory. Some actors (old people, farmers) still have good knowledge of the territory, but they generally are not key actors in the territorial planning and risk mitigation projects. The majority of actors (administrations, inhabitants) do not have a sufficiently precise knowledge and memory of their territory. Nevertheless, several types of indices (toponymy, micro-topography, archives, historical maps) of risks exist – the so-called “grips”, see November et al. 2005 –, and could be activated for managing the risk.

A second conclusion concerns the development of passive protection measures. The measures proposed by the specialists (e.g. hazard maps, creation of surfaces for natural processes) oppose themselves to the interests of the economy, the urbanisation and the land and house owners themselves. There is, therefore, a trend to reduce the memory of the events and to mitigate the importance of measures aimed at reducing the vulnerability (e.g. definition of zones with building restrictions or no building allowed). This trend is reinforced by two tendencies: the first one concerns the probability that a new catastrophic event might occur; the second concerns the scale of the event (local versus global). Concerning the temporal aspect, there is a general view that if a catastrophic event has occurred, there is a low probability that a similar event may occur in the next years. The spatial considerations relate to the Global Change: we observe a type of fatality related to Global Change, on which it is difficult to act individually. The two tendencies have the effect of reducing the perception of a high potential of risk.

Conclusions

In this study we have analysed how different groups of actors perceive and define the flood risk, which knowledge they have concerning hydrological hazards, vulnerability and risk, and how they act in a situation of risk, when an intense meteorological and hydrological event takes place. We can conclude that different forms of knowledge are used. Some, that we can call "vernacular", are based on personal experience and territorial observation and memory, and concern principally the inhabitants that have lived for a long time in the area and the farmers. Others are more technical and scientific and are activated by the professionals of risk (engineers, planners, firemen). These two forms of knowledge – vernacular and scientific – are created and/or activated during the various phases of the "risk cycle" (identification of risk, preparedness, recondition). Both constitute "grips" (November et al., 2005), that is indices, visible in the landscape or on various types of documents that the actors can draw upon to anticipate the disaster and prepare good methods of mitigating it. Also during the crisis management phase the knowledge of risk by the different actors may be crucial: a wrong interpretation of the situation may incur more damage.

The precise study of two cases has shown that several groups of actors – both institutional and non-institutional – do not know these "grips" and had very imprecise knowledge of hazard, vulnerability and risk before the event. The disaster has launched more or less deep changes in the perception and knowledge of risk by the various groups of actors. Comparatively to the situation before the event, the common knowledge is more precise and homogeneous after the disaster. This may be considered as the basis for a better integration between territorial planning, whose principal aim is the co-ordination of heterogeneous actions on a territory, and flood management strategies.

Another important finding of this study concerns the circulation of information. The analysis has shown that in the two cases several gaps and problems concerned the circulation of information between institutional actors, both between several administrative sectors (e.g. urbanism and flood management) and levels (e.g. between communes and cantons). These problems occurred both before (e.g. absence of integration of hazard map information in local land planning documents) and during (e.g. alert information circulation) the event. They show the importance of transversal bridges (e.g. co-ordination strategies) between the different sectors of the administration. These bridges must be formally defined. Bridges and strategies for the circulation of information have also to be developed between the various hierarchical level of the administration, especially between the communal and cantonal levels.

Concerning the territorial dynamics created by a flooding event, the modifications are less important than the ones concerning risk knowledge and crisis management. Moreover, they are not direct: two factors participate in the weakening of the risk memory and the mitigation of the actors' resolution to convert the risk reduction objectives into territorial planning measures. The first factor concerns the temporality of risk situation. The probability of a new event occurring is considered in the long term and a sort of weakening of the attention to the risk occurs.

Moreover, if a long time passes without an important event the perception that a potential risk exists weakens. Finally, the extreme events, whose extension is difficult to model, are more or less considered as virtual phenomena and their perception is very much reduced. The second factor is the spatiality of risk. Each risk is anchored differently within a territory (some are localised, others are diffuse). Moreover, the risk may be perceived as covering very large areas – e.g. the World concerning risks related to Global Change –, and in this case some actors have the idea that it is possible to escape the risk. All these temporal and spatial features act as filters in the risk perception. The result is a reduction of the capacity to act (and to pay) to take rational passive measures – that very often are contrary to individual objectives – in order to mitigate the risk.

Concerning the "risk cycle", this study allows us to complete the model in order to improve its use in concrete situations. First of all, the model should take the actors better into account. As they are numerous and generally very heterogeneous, every action aimed at considering the risk in a global and integrative way, should begin with a "cartography of actors". This initial step allows the listing of all the actors, institutional and non-institutional ones, and their respective relationships. It is also important to consider the actors' knowledge on risk issues, in particular, on which basis their perception of the risk is built, and if their knowledge is based on experience and vernacular knowledge of the territory or on more scientific bases. Another issue concerns the activation of different forms of knowledge. "Grips" exist both in the territory (toponymy, geomorphological landforms, etc.) and in documents (archives, historical maps, etc.). Some actors activate them and others do not. One aim of every integrative study of risk should be to show what these "grips" are and to give skills to the actors for activating them when a situation of risk occurs.

Moreover, the "risk cycle" model gives a view of the risk management that is too linear. The different actions (intervention, recondition, reconstruction, prevention and preparation) are presented as successive phases of a linear process. Our study shows, however, that the temporality of these actions is quite complex. Some are very short and localised in time (e.g. alert, rescue), whereas others are continuous tasks (e.g. preparation and prevention). There is no succession in time: the preparation may begin before technical prevention and planning measures have been taken. Moreover, in each of these phases, various temporalities may exist.

Our general conclusion is, therefore, that an "integrative actor analysis" is essential in every integrative and global study on risk mitigation. More in general, this study shows the pertinence and performance of social science studies in the domain of risk management.

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