



Description of the 5 Axes of RIISQ

AXIS 1

Flood and disaster risk factors: hazards, vulnerability and exposure

AXIS 2

Management and development of territories at risk of exposure, governance issues and legislation

AXIS 3

Biopsychosocial, health and economic impacts, and sharing of associated costs

AXIS 4

Transformation and reduction of the vulnerabilities of individuals, organizations and communities

AXIS 5

Management and communication of risk factors, and tools for decision-making, adaptation and resilience

AXIS 1

Risk factors for floods and disasters: hazards, vulnerability and exposure

Flood and disaster risks are the result of a combination of meteorological or climatic hazards, vulnerability and exposure levels of individuals and their communities, as well as environmental factors, whether natural or altered by human activity. In order to identify and anticipate a flood risk, it is necessary to understand and take into account the processes and conditions in which floods occur, and to evaluate how this combination of factors influences the occurrence, duration and severity of different floods.

Risk factors depend on several elements, some of which are rapidly evolving (e.g.: hydro-meteorological hazards in the context of climate change), more long-term (e.g.: exposure due to development in a watershed; urbanization), or involving issues of economic and human development (e.g.: aging population, social and health inequality). The magnitude and speed of current and future changes at regional or local scales are all elements to be considered, requiring hydro-meteorological and psycho-socio-environmental observations and models (e.g.: meteorological, climatic, hydrological) of increasing sophistication.

This requires the regular updating of data and the continuous development of models (for example, simultaneous forecasting at daily, seasonal, or even multi-year scales) and regular monitoring of the level of exposure of communities and infrastructure throughout Québec. By improving our knowledge of the various risk factors and their combination in time and space, including domino effects and breakpoints, the work of this axis will enable a more accurate and timely assessment of flood risks. This will enable policymakers to better understand how risk distribution evolves, promoting better flood prevention and preparedness. It will also contribute to improved development planning (AXIS 2); more precise assessments of potential consequences of a flood in exposed areas according to the level of vulnerability of affected populations (AXIS 3); help change our ways of doing things in concordance with principles of sustainable development, adaptivity and resilience (AXES 4 & 5); and more proactive and better-informed risk management (AXIS 5).

GENERAL OBJECTIVES

- ① Gain a better understanding of flood dynamics in the context of climate change, in light of past events.
- ② Increase the predictability of floods, including those related to ice jams and coastal submersions.
- ③ Identify vulnerable populations and those most susceptible to the effects of flooding.
- ④ Assess how the combination of natural and human factors and their probable changes influence the flood risk at the level of the community.

AIMS

- ① Develop new post-processing tools for hydro-meteorological forecasting.
- ② Develop new and more comprehensive criteria for defining alert thresholds (rate of flow, water levels, etc.) by hydrological and meteorological services.
- ③ Continuous evaluation of tools and co-authoring of user guides.
- ④ Contribute to the training of professionals (e.g.: emergency management, alert systems).
- ⑤ Develop comprehensive scenarios of floods at appropriate territorial (fine) scales.
- ⑥ Improve prevention and preparedness.

AXIS 2

Management and development of territories at risk of exposure, governance issues, and legislation

In Quebec, the *Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains Environment Quality Act* calls on three broad categories of parties as provided for in the Act Respecting Land Use Planning and Development: governmental bodies involved in cartography and the steering of the provincial agenda; metropolitan communities and regional county municipalities (RCMs), who are equally involved in cartography and are responsible for integrating the provincial agenda into their metropolitan plans and development strategies; and finally, cities and municipalities, via the adoption of urban planning regulations to manage land-use). This multi-level and multi-stakeholder governance system (including OBVs) is complex and should be examined for its effectiveness and shortcomings, including the land-use control system which requires evaluation and modernization. Research is required to update the territorial planning framework to take into account the specific nature of each territory (integrated and adapted management). The various stakeholders need support from researchers in order to conduct post-mortem analyses which can be used to improve preparative measures.

The challenges facing governing bodies on the ground can be divided into two categories: on the one hand, the preventive approach, and on the other, predictive approach, which includes preparatory measures. Parties in various positions and administrations must work together towards a shared, strategic plan which will allow them to act upstream and thus reduce the suffering, damage and costs resulting from a flood. Thereafter, there is the issue of the governance of emergency and recovery operations. The focus of this axis must be above all these preventive and preparative measures which occur before a flood, although it is possible that it may lead to work in the during and after phases. Preventive governance means drawing on the power and responsibilities of a number of individuals, and when responsibilities overlap this can sometimes lead to conflict, which can lead to significant delays. The diversity of parties at play has as a corollary the bursting and dispersion of available knowledge, which can lead to mutual misunderstandings. It is therefore key to understand that various stakes and to foster communication, collabora-

tion, and aiding in decision-making. Land development and strategies associated to the planning of uncertainties equally constitute a major hurdle. Innovative ideas incorporating methods of sustainable development, such as multi-functional watercourse spaces, have the potential to promote population resilience. Such spaces can be developed by integrating our knowledge about landscape function and biodiversity. It will be equally necessary to develop legislative tools for prevention and adaptation strategies that will ensure their feasibility on the ground. It must be well-understand that given the highly variable character of the climate and the great number of lakes and rivers in Quebec, it is very likely that certain deviations from the norm (greater low-water flow, torrential rain, winter floods, etc.) will be more prevalent if we stick to a more traditional urban planning framework. The challenges of interdisciplinary are here combined with inter-professional challenges which affect decision-making.

GENERAL OBJECTIVES

- ① Reduce the barriers to effective preventive governance that slow down, or even prevent decision-making or actions which would protect communities and their territory and reduce risks and damage.
- ② Develop spatial planning tools that promote adaptation to climate change.
- ③ Promote the development of necessary legislation, in collaboration with local parties, which integrate relations and social capital.

AIMS

- ① Implement adaptation tools at different levels of governance.
- ② Foster interdisciplinarity and the means of collaboration with the milieu.
- ③ Develop the legislative tools needed to reduce risk.

AXIS 3

Biopsychosocial, health and economic impacts, and sharing of associated costs

Floods have a number of negative repercussions on the physical health (such as respiratory and cardiovascular problems), psychological health (such as stress, PTSD, anxiety and depression) and on family, social and professional lives of victims, as well as on the dynamics and the development of organizations and communities (such as the incursion of debts by households and the municipality). Moreover, the longer and the greater the flood, the greater are its effects on mental health. The consequences of a flood may outlast the flood, and the extent of the hazard, the management of the flood as well as the satisfaction of those affected with the social support they receive are all factors that affect the distress levels of victims. Emergency responders are them, too, susceptible to the negative effects of such an event. This having been said, there is insufficient up-to-date empirical data on the consequences of floods in Quebec, and there continues to be a lack of tools being developed to allow local authorities to quickly and cheaply identify the consequences of flooding on their communities.

Very few studies have evaluated community and public interventions and initiatives which could reduce the risks of developing post-disaster problems. One of the main roadblocks is that researchers in the natural sciences (e.g. those involved in disaster forecasting), engineering (e.g. infrastructural integrity), actuarial science, economics and policy development (e.g. insurance premiums) do not link their work to the health and social consequences of flooding. Conversely, specialists in social work, psychology and communications often neglect to consider in their research, models, interventions and analyses the knowledge developed by their colleagues in other disciplines.

Governments assume most of the financial burden of floods. With the avowed goal of reducing the costs of DFAA (Disaster Financial Assistance Arrangements), the federal government foresees reducing its role in the financial compensation of those affected by natural disasters. It is therefore important that the sharing of the financial risks and burdens of floods by governments, insurers, municipalities and citizen be studied from a number of angles: (1) the financial responsibility of rising costs linked to natural disasters and damage to properties located in non-insurable flood zones; (2) how the financial burden

should be shared between municipalities and citizens; (3) investments in infrastructure. The work of Axis 3 oversees in an integrated manner the wide array of consequences of flooding, using innovative methods to measure and describe their effects.

GENERAL OBJECTIVES

- ① Document the effects of flooding in the short, medium and long term on the global health of individuals and their community.
- ② Document the interdependence of (a) the physical, mental and social health of individuals; (b) the social characteristics of flood-affected areas; (c) the economic situation of communities; (d) the features of rising water levels.
- ③ Determine the factors of individual, collective and organizational adaptation and resilience with regards to floods.
- ④ Develop sharing schemas for the financial risk among citizens, private insurers, various levels of government and private and public partners.

AIMS

- ① Develop tools to model the relationship between different flood-related effects on the health of the population.
- ② Review the scientific literature and available data collection tools to quickly document the fallout of floods on the health of the population.
- ③ Compose a guide of recommendations about effective interventions that can be put in place in order to diminish the impact of floods.

AXIS 4

Transformation and reduction of the vulnerabilities of individuals, organizations and communities

Floods disrupt the lives of the inhabitants, organizations, and the provision of municipal health services, both physical and psychosocial. Some individuals, because of their age or social, economic and/or health condition are more at risk of incurring material losses or physical harm, of dying, or of suffering other post-disaster repercussions. Organizations and municipalities which are poorly prepared to handle such a disaster due to either a lack of emergency plans, resources and/or of experienced personnel trained to intervene during a flood, are equally vulnerable. When we say the transformation and reduction of vulnerabilities we mean promoting the resilience of individuals, organizations and communities (IOC) to allow them to prepare for, resist and reconstruct after a flood. Vulnerable IOCs are more likely not to receive the services they require during the period of deployment of emergency service, not to use effective adaptation strategies and to develop more post-flood problems than those that have been less weakened by disturbing organizational or social factors.

In such a context, it is important to identify the various factors—personal (e.g. citizen engagement), contextual (e.g. the duration and extent of the damage), organizational (e.g. indemnity procedures), social (e.g. social capital, social networking), technological (e.g. infrastructure, alert systems), environmental (e.g. contamination), administrative, economic (e.g. debt, economic diversity), and political (e.g. the policies in place regarding the management and development of the territory)—likely to maintain, exacerbate, or diminish the vulnerability to, resilience against and coping with floods of Quebec society. Particular consideration must be given to the psychological and sociopolitical factors involved in the decision-making process leading to the adoption of coping behaviours and practices. More systematic studies must also take a look at factors which affect the capacity of organizations, communities and municipalities. There continues to be only limited information about these varied factors, which prohibits an efficient mobilization of knowledge in the service of public policy and the adaptation of public and community services. The research of this axis aims to develop knowledge which should aid in the

elaboration and application of measures designed to increase the ability of IOCs to cope during a natural disaster, and to prevent either the exacerbation of preexisting social, economic and political problems or the appearance of such problems in the aftermath of the disaster. In order to reduce the various vulnerability factors and to increase or promote the resilience of IOCs, it will be necessary to conduct intersectorial research projects as well as post-mortem analyses of the response to floods among a number of willing parties.

GENERAL OBJECTIVES

To identify:

- ① Identify the multidimensional factors and solutions in the pre- and post-flood which might encourage a reduction of the vulnerability of different groups (e.g. pregnant women, the elderly), organizations and communities, as well as promoting their vitality and resilience.
- ② Identify effective interventions which can be implemented, in collaboration with RISQ's partners, during any of the phases of a flood (prevention, preparation, intervention and recovery) in order to reduce risk factors and prevent adverse effects, including effects on the society.
- ③ Identify advances in technology and infrastructure, as well as development strategies which may help reduce vulnerability to floods (e.g. by replacing sandbags).

AIMS

- ① Review the scientific literature, among others, for effective ways to reduce risk factors before, during and after a flood, as well as ways to promote the resilience of IOCs.
- ② Draw lessons from post-mortem analyses and recommendations made by concerned parties.
- ③ Transfer recommendations made by experts to said parties.
- ④ Develop and evaluate pilot projects together with IOCs.

AXIS 5

Management and communication of risk factors, and tools for decision-making, adaptation and resilience

The goal of this axis will be to integrate the development and evaluation of awareness-raising and intervention programs (e.g. tools for communicating risks, training programs, decision-making tools) in order eventually to influence how we react and adapt to floods. Although it is very important to spread information about the risk of flooding, it is equally important to attend to the mechanisms whereby this information percolates into a behavioural change at the level of the affected population (i.e. adopting behaviours leading to preventive action), such as attitudes and beliefs. The perception of risk and attitude change are elements which must be included in an awareness-raising/intervention program aimed at changing behaviours. The authors of such programs can intervene on three elements: (1) developing a favourable attitude; (2) social pressure to adopt changes; and (3) a desire for greater control over one's behaviours in a time of crisis. In order to increase the likelihood of success, program authors must identify which of these three elements allows the best chances of anticipating the behaviours of an individual. The tools developed should target elements with the greatest predictive power. There are a number of strategies which promote a feeling of control over one's behaviour and an increase in social pressure to adopt a program, such a modelling, practice exercises in fictional situations, testimonials from influential individuals in a field, bonding between emergency responders and those whom the intervention is directed at, cognitive reframing of false beliefs, etc. It falls upon those who develop these programs to select those which are the most appropriate to each context. This axis will integrate the knowledge developed by other axes in order to co-construct and propose management, relief and adaptation strategies together with decision-makers and administrators. This axis will also work on risk communication strategies, which are a major component of risk and crisis management, as much operationally (during the event) as vis-à-vis a proper understanding of the issue (before, during and after the event).

GENERAL OBJECTIVES

- ① Improve prevention and preparation by communicating risk factors and improving access to and knowledge of hydro-meteorological information by decision-makers and the population.
- ② Improve our collective ability to effectively intervene among those at risk or in difficulty.
- ③ Develop tools in order to improve communication between various parties involved in disaster relief and the management of the consequences of floods.
- ④ Better understand the various factors which affect the perception of risk.

AIMS

- ① Review the key theoretical and practical knowledge to be included in tools to be used by decision-makers during disaster management.
- ② Propose solutions (e.g. in communication) to particular problems caused by premature warnings (forms of information, media, dynamics of transmission networks, reactive ability, etc.).
- ③ Contribute to the development of an intersectorial approach towards the creation of watchdogs tasked with identifying, preventing and evaluating the management of flood risks.
- ④ Development of protective and preventive measures, as well as awareness-raising initiatives in various domains.