THE JOINT RISK PROGRAM AT CEMAGREF

Gérard Brugnot
CEMAGREF
Domaine Universitaire
BP 76, Saint Martin d'Hères
Voice: (33)76762711
Fax : (33)76513803
E-mail : brugnot@cmgr01.grenet.fr
France

Keywords : natural risks, natural hazards, social science, economics, natural hazards mapping.

ABSTRACT : CEMAGREF has been studying natural hazards for many years. Depending on its traditional links with the Department in charge of agriculture, forests and country management, the hazards mostly considered have been forest fires, hazards related to mountain environment (avalanche, torrents and mudflows) and to floods (including dam stability and floods related to dam failure).
In these fields CEMAGREF used to carry out technical studies so as to assist government bodies directly or by means of technical tools as standards and computer programs. Being transformed in 1985 into a research Institute, CEMAGREF gradually entered what was more an evolution than a sudden transformation, since its main center of interest were not changed and applied research was the global task it was assigned.
A significative instance of this evolution is the way CEMAGREF programs evolved in cooperation with different partners in the field of natural hazards, from the above described technical assistance to a comprehesive research program the circumstances of which will be described hereafter.

NATURAL RISKS : FRENCH TRADITIONS AND CURRENT CONTEXT

France has been a very centralized country for many centuries and it is no surprise that natural risks have been mainly dealt with by the central government for as many years. Nevertheless, no country can escape the widespread evolution reducing the role of central governments, handing over their responsabilities one hand to agencies or private sector, on the other hand to locally elected governments. An other aspect is the transfer of power to supranational institutions as European Union, but so far it has not had a significant direct influence in our feld of interest.

For instance, concerning natural risks in mountain areas, in many countries, forest services or agencies are in charge of mountain hazards, the Alpine countries are no exception and France has this tradition. But most of the Forest Administration being transformed into an agency as soon as 1965 (Office National des Forêts - ONF), a kind of hybrid was created to manage mountain related hazards. This entity, named "Service de Restauration des Terrains de Montagne - Mountain Conservation Agency" both depends on government (Departement of Agriculture and Forest) and on ONF. It has both technical tasks (construction works using civil enginering and biological techniques) and political tasks in the field of risk zoning and emergency assistance to the local representative of the central government.
As far as other natural hazards are concerned, the situation is quite similar. Other governmental bodies and agencies play some role in these fields, which have been more crowded than ever since 1982, the landmark date when the central government transferred many powers to locally elected councils heading municipalities, *départements* or *régions*. Natural hazards are theoretically still regulated by central government but for instance most municipalities are totally in control of land planning, deciding which kind of settlement must be promoted in which part of the city, which results in a document called Plan d'Occupation des Sols - POS. Natural hazards have to be taken into account of in the POS, so a negociation between central and local government is an absolute necessity. This negociation results in a an other document, called Plan d'Exposition aux Risques - PER. This procedure has just been modified, so its name was changed. All this proves how difficult this negociation process is.

CEMAGREF HISTORY AND NATURAL HAZARDS

CEMAGREF is a government agency doing resarch in the field of Environment and Agriculture. Concerning

natural hazards related to moutain and forest it can be considered as having inherited the tasks of this branch of the Forest Administration which was in charge of technical research in the field of moutain hazards in 1965 then was incorporated into CTGREF as a branch of the technical service of the Department of Agriculture. CTGREF was transformed into an agency in 1981, its name being changed to CEMAGREF. In 1985, CEMAGREF was given the status of "research agency", which implies special conditions for the manpower and subsidies from the Department of Research. In a similar way CEMAGREF inherited some technical and scientific tasks in flooding corresponding to administrative responsabilities of the Department of Agriculture, most of them being meanwhile transferred to the Ministry of Environment. Only through history can be explained that for similar reasons CEMAGREF has a research team working on dams stability and flooding resulting from dam failure.

CEMAGREF ACTIVITIES IN NATURAL HAZARD RESARCH

At least 5 laboratories are active in natural hazards, As a whole these laboratories are staffed by 51 researchers and engineers plus 10 phD. Their tasks, defined in accordance with the general tasks of CEMAGREF is applied research aiming at developing protection technologies and mapping phenomena. Research is carried out in cooperation with universities and other research agencies when fundamental knowledge improvement appears as necessary.
The detail of the activities depends stongly on which technologies and scientific tools are relevant in a given domain. For instance, fluid mechanics applied to newtonian flows is a prerequisite to avalanche and mudflow study. In the same way remote sensing and botanics are fundamental if one is to study forest fire mitigation.

THE JOINT RISK PROGRAM

A brief history ..

The preparation of the joint risk program started in 1993. Its central goal was to improve the internal cooperation between researchers who had few mutual contacts because, resulting from their history as was explained before, most of their contacts they had with their "clients" of the Department of Agriculture and Forest.
To find a common ground for all these research units was not that simple but a consensus was attained about the interest of social science as a common concern and an opportunity to shed new light on researches strictly confined in the field of physical science.
A great help in building this program was provided by the French Department of Environment, not only because it brought funding but also because acting as an outside operator it helped and forced the different research units to work out unified research proposals.
The result was a program divided in two main chapters, called "Social science and economics" and "Hazard Mapping". As can be seen in these title, the first part implies much cooperation with non CEMAGREF social scientists whereas the second encompasses themes which are more traditional and familiar to CEMAGREF engineers and reseachers.

The content of the program

The content of the program appears in this table :

Part 1 : Social sciences and economics
- 1-a Negociation as the central process of risk mitigation
- 1-b Total quality as a tool for risk mitigation
- 1-c Tools for negociating flooding mitigation

Part 2 : Mapping
- 2-a Methodology
- 2-b Time and space related mapping for forest fires
- 2-c Vulnerability mapping in the case of avalanche protection by forest
- 2-d Typology of maps
- 2-e Multi-hazards maps

To fully account for the program negociated with the Department of Environment it is necessary to mention that other topics, of immediate interest, were included which concerned dam stability and avalanche knowledge transfer to Turkey (a joint program with Switzerland in the frame of IDNDR).

Preliminary results

The program starting officialy early 1995, it is not possible to display significative results. Nevertheless, some parts of the program have been at least partially explored in other programs. Combining the results of these programs and the preliminary discussions which have led to the CEMAGREF joint risk program some elements can be exposed as a basis for further research. Considering the preliminary state of the program, one will not be surprised by the unequal stage of development of the different parts of the program. Some of them which are barely started will not be commented .

Social science and economics : Negociation as the central process of risk mitigation. The program is continuation of a joint program started about three years ago by CEMAGREF and CRISES, a research entity depending on the National Center for Scientific Research - CNRS, known for its research in the field of crisis management but mainly for industrial risks (Lagadec 1993). So it is no surprise that the first encounter led to a program dealing with crisis in the field of natural hazards. The first step was to analyze the similarities between the management of crises caused by natural and technological hazards, using two crises due to snowfalls.

The first case was a case of a heavy snowfall creating a week-end trafic congestion on a main highway in December 1990, the second a case of avalanche hazard in a valley leading to the most important ski resorts of France, amonst the largest in the world (February 1991). One central point of interest of CRISES in all cases of crisis was the role played by the different actors and especially by experts (Decrop and Charlier 1992).

The next step was to investigate the role of experts not only in the crisis process but also in "normal time" process, i.e. in every day activity and processes of natural hazards management. This made it necessary to build an other instance of what sociologists call "the risk stage", meaning this stage where all actors meet and interact.

From this situation the research evolved into the examination of the relevant technical tools the actors can use when playing and interacting on the stage of the risk mitigation theater. Mapping, especially hazard mapping appearing both as a very useful and controversial tool it was deemed necessary to construe how maps are actually used in the negociation process. This is the current stage of the research.

Total quality as a tool for risk mitigation : Considering the typology of natural hazards, one possible criterion oppose those hazards caused by physical phenomenon which only produce harmful effects to these caused by physical phenomena which also have beneficial effects and can even been considered as economic goods. The former category is exemplified by earthquakes, the latter by snow avalanches, in which case it clearly appears snow is both the case of major life and property losses but also of great social benefits through the ski industry. Hence the idea to investigate if natural risk mitigation could be a part of quality management in ski resorts having at least considered the possibility of drawing up a quality management procedure. This study has been conducted for approximately four months and the result is inconclusive. It appears that natural risks are to be dealt with in the general context of safety level in a ski resort, which entails also considering problems related to law, insurance...In the same context this study made it clear how even in the largest ski resorts which appear as being managed as big industrial company, local politics exerts a great influence on all decisions.

Tools for negociating flooding mitigation : An other important criterion to natural hazard typology is whether a natural hazard only cause damage to property or both cause damage to life and property. Slow and large floods widespread in the plains of northern Europe being a good example of the first class, a CEMAGREF resarch team has investigated with economists at CNRS the possibility of working out a compromise between the partners acting on the risk stage. The basic idea is to bring out criteria linked with direct economic impacts, which allow for using classical economic tools like preference or indifference curves for given goods, in which case the theory predicts that if the number of actors is large enough one gets the Pareto optimum (Schotter 1994). The resarch was carried out in an experimental way. A preliminary stage consisted in improvement of available tools or creating new ones to represent physical effects of floods, along such parameters like frequency, water depth and velocity, flooding duration. Then using these tools some tests were performed with real problem, i.e. with real rivers, real inhabitants, real elected council. The first results seem promising, as not only a consensus was worked out but it seemed that the tools provided and tested by the researchers greatly helped attain this consensus. .

Forest fires: Heretofore a research team at CEMAGREF, working together with different partners (University of Marseille, National Institute for Country, Water and Forest Management - ENGREF, the Meteorological Service) has carried out technological research aimed at forest fire mitigation. Time related problems were addressed combining remote sensing data and meteorological data in order to define danger indexes which are directly useful to firefighters. Space related research takes advantage of remote sensing, and also of wind modeling at regional scale and vegetation mapping to determine hazard maps. Later these maps will be associated with vulnerability maps.

Vulnerability mapping in the case of avalanche protection by forest : Started about three years ago, this research makes an extensive use of G.I.S.. Taking advantage of the functionalities of these systems allowed for mapping forest extension and properties, physical

parameters as slope angle, and objectives endangered by avalanches and in some cases rockfalls. From this research a methodology was produced whose main interest is to provide Forest Service with a tool for forest management applicable to high elevation forests with a protective function. As these forests do not have a direct economical interest, it is indeed necessary to bring out relevant criteria to allot public money to their management.

THE FUTURE OF THE PROGRAM

It is quite impossible to know what the outcome of this program will be. Its success will strongly depend on the interactions which will develop in the next three years. These interactions will be made possible by the common use of some tools like GIS and also by the common interest for sciences which have not been developped in CEMAGREF yet, especially social science, economics and law. If some cooperations have been started in the two former domains, the latter is almost entirely to develop and it is a very important one, because courts are more and more severe in France for all the actors of the natural risks stage, experts, government or locally elected officials.

Towards a typology of natural hazards

The main stake is to know whether it is efficient to engage in this kind of joint program regarding natural hazards. In the field of social science, economics, law, insurance this will depend on the answer given to a fundamental question : are physical phenomena so different as landlides, snow avalanches, forest fires earthquakes and floods very similar if they are observed by a social scientist. The first impulse is to answer yes because social scientists first observe how society reacts and are interested in natural disaster as a litmus test of the basic fabric of society (Gilbert 1992). Industrialized societies are very sensitive to any kind of disaster, but their actual impact on society will depend on some intrinsic characteristics partially described. Two possible dimensions already mentioned are this opposing hazards causing fatalities to hazards causing no fatalities, and that opposing hazards related to a physical phenomenon which has no positive effect to hazards related to a physical phenomemon which on the other hand is an economic good. In the latter case avalanche has been taken as an example but other examples abund in the developing world of large crowds living on volcano slopes or along very large and dangerous rivers because there is the fertile soil.
The same analysis will probably help discover other dimensions. An axis of research is certainly the possibility for a phenomenon to happen at least twice in the same way opposed to phenomenon which have not this possibility. This criterion will oppose "meteorological" or "climatic" hazards, like avalanches, floods to "geological hazards", like large landslides and earthquakes. As a general matter of fact any kind of typology only presents some interest if it has practical effects. This criterion discriminates risks which can by dealt with by the insurance market from risks which justify national or local solidarity.
Other criteria are probably relevant to natural hazard typology and they certainly will appear in the exchanges taking place in the frame of the joint risk program now started in CEMAGREF. According to the context described by and large any typology and other kinds of research results anticipated in this program are expected to be directly useful to prepare decisions in several fields like mapping and insurance.

CONCLUSION

The joint risk program opens the door to many expectations, first of all because it sets the groundwork for a large scale cooperation between physical sciences and social sciences, and depending on the way this program was built establishes a relationship between scientists and lawmakers. This program involves research teams, inside and outside CEMAGREF. It is not a closed program. On the contrary, it is open to all kind of cooperation, especially with research laboratories working in the field of social sciences in contexts different from the French one.

REFERENCES

Decrop, G. and Charlier, C. 1992. "Crises, risques et expertises scientifiques". *Internal report.*
Gilbert, C. 1992. *Le pouvoir en situation extrêmes, catastrophes et politiques*. L'Harmattan, Paris.
Lagadec, P. 1993. *Preventing chaos in a crisis*. Mc Graw Hill, Maidenhead.
Schotter, A. 1994. *Micro Economics, a modern approach.* Harper Collins, Nex York

BIOGRAPHY

The author is currently head of a CEMAGREF laboratory dealing with snow and avalanche research. Educated in civil engineering and economics, he has before occupied positions in Water Management in Algeria and in the Census & Economics Service at the French Department of Agriculture.