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# Protection against muddy floods: perception for local actors in Alsace (France) of a protection measure (fascines)

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**ABSTRACT:** For several years, an increase of muddy floods frequency (and associated damages) is noticed in the Alsatian region (NE of France). In 2008, the regional authority ("Conseil Général") with the collaboration of the Chamber of Agriculture decided to set up, directly on farmlands, micro-structures called "fascines" (faggots of brushwood). These little protection systems allow to decrease the muddy floods velocity and to capture the sediments that are transported decreasing by this way the vulnerability in risk prone areas located downstream the catchment. These protections present two advantages: they are very easy and cheap to set up. In the region, we can list 400 fascines, step up in 21 municipalities exposed to the muddy floods risk.

This study focuses on farmers' perception of these fascines in order to understand their potential acceptability of this kind of mitigation measure and to highly the main issues linked to the democratization of these protective measures in the whole risk prone areas. The methodology used is a questionnaires (N=37) held among farmers in 5 municipalities exposed to muddy floods risk. The main results show that the fascines are perceived as a restrictive tool: the most of the farmers mentioned that their maintenance is more important than for other mitigation measures such as hedges, non-inversion tillage, grass strips,... also proposed in the questionnaire. Moreover the "real" efficiency of the fascines against the muddy floods propagation is questioned by the farmers as well as their integration in the landscape. Among others, these results allow to highly the main restraints in the development of such mitigation measures and have been directly used by the Chamber of Agriculture in order to improve their information campaigns among the farmers to improve the use of the fascines in risk mitigation polices and risk prone areas planning.

*Keywords:* Risk mitigation, Perception, Surveys, Natural disasters.

## 1. INTRODUCTION

The Alsatian region is frequently concerned by runoff and soil erosion processes (Armand, 2009, Le Bissonnais et al., 2002a): between 1982 and 2005, 225 municipalities were concerned at least once (Auzet et al., 2005a, Heitz, 2005). Due to the high number of associated damages, their management becomes a priority for public authorities in charge of the environmental issues, the farmers, the scientists, ... For instance, in the Bas-Rhin department, the muddy floods risk management is conducted in partnership with public authorities and the Chamber of Agriculture. Among all the measures of protection, we can distinguish two kinds of measures, intervening at different levels of costs and scales:

1. the collective measures which are set up on the public area. Their setting up requires important investments. We can quote the setting up of dams, the road networks and urban areas plannings;
2. the individual measures, which concern the private domain and which require less investments. They include measures such as individual measures of protection, measures setting-up in the fields (fascines, grass straps, ...).

We focus your study on these second types of measures and more precisely on the fascines. These measures of protection are directly set up in the fields, the agreement of the farmers is then required. It is important to inform them about the consequences of soil erosion and runoff, and especially to inform them about the usefulness of protective measures to decrease the vulnerability of the municipalities located downstream the catchment. Our question is by now: What kinds of perceptions have the farmers of the fascines, a few years after their setting-up? Our study follows two main objectives:

1. To identify the farmers' needs and the limits in the setting-up of fascines
2. To supply knowledge favoring the future setting-up of such measures.

To answer to these objectives, we conduct questionnaires among the farmers located in five municipalities frequently concerned by muddy floods.

## 2. MUDDY FLOODS: PROCESSES AND EXISTING MEASURES OF PROTECTION

The risk of muddy floods results from the conjunction of diverse factors. Boardman (2006) consider this phenomenon as a "complex system" integrating a variety of physical and human aspects.

### 2.1 Physical processes and definition of the muddy floods

The muddy floods correspond to fluid flows with suspended loads (Auzet et al., 2005b). The superficial horizons of the soils are removed (under the effect of rains and/or of runoff) using gullies ploughed in the fields (Auzet, 1987, Le Bissonnais et al., 2002b). This definition shows that the muddy floods result from the conjunction of runoff and soil erosion processes. In Alsace, the presence of silty soils increases the risk of soil erosion (and muddy floods): silty material presents a very fine texture and confers it a weak structural stability. Moreover, in Alsace during springtime, soils are not covered by the crops

(maize) and heavy rainfalls are registered (90-100 mm for the periods of May-June were registered in the south of Alsace - Van Dijk et al., 2005). Soil sealing is also formed by the drops' impacts and it will stop the water infiltration and favour the runoff processes (Kinnell, 2005).

## **2.2. Protective measures to decrease runoff and soil erosion**

In the upstream catchment, the damages concern mainly the farmers. In the downstream catchment, they concern the inhabitants and the infrastructures (with damages on public equipment, roads, etc.). The measures of protection are various (Le Bissonnais et al., 2002a, Auzet, 1990, Evrard, 2008) and can concern:

- the agronomic practices (reduced tillage practices, different cover crops, banks, grass strips, hedges, fascines, etc)
- the hydraulics measures (dams, ponds)
- financial support to change farmers' behaviors and agricultural practices.

## **3. METHODOLOGY OF THE QUESTIONNAIRES**

The creation of a questionnaire requires following a precise methodology allowing us to answer to the questions: "What? Who? Where? When? How?" (Cauvin, 1999, De Singly, 1992). The precise methodology of this survey is available in Flinois (2011).

### **3.1 Definition of the main issues related to protective measures to create the questionnaire**

The questionnaire was created after interviews with farmers and risk managers, allowing us to identify the main issues linked to muddy floods risk and their management. These issues concern mainly:

- the setting up of fascines;
- their cost;
- their integration in the landscape;
- their care and maintenance;
- their efficiency against muddy floods;
- their place among other protective measures.

### **3.2 The studied areas**

We sample our population of farmers in five municipalities (Bas-Rhin department): Hohatzenheim, Brumath, Ettendorf, Eckwersheim and Lampertheim. All of the farmers have in common to have been damaged by muddy floods and to have set up fascines to protect the inhabitants and infrastructures located downstream the catchment. These five municipalities were also chosen because physical data, economic analyses and modelisations are available: comparisons and cross analyses can then be done.

### **3.3 The methodology used for the sampling plan and for the questionnaire administration**

As the fascines are set up directly in the fields, we decide to sample all the farmers of the five municipalities (if they have set up fascines or not). By this way, we can identify the main issues taken into account by the farmers, when they accept to implement fascines, or when they refuse. We decide to be exhaustive: that means that we seek all the farmers of our municipalities (41 farmers).

We first contact them by phone: this phone-call allows us to explain our study and if they agree to participate to it, to decide an appointment for the questionnaire administration (face to face questionnaire). This method allows us to reduce the unwillingness to participate (5 refusals on 41 farmers). We met the farmers between April and May 2011 and 32 farmers have accepted to answer to our questionnaire.

## **4. RESULTS**

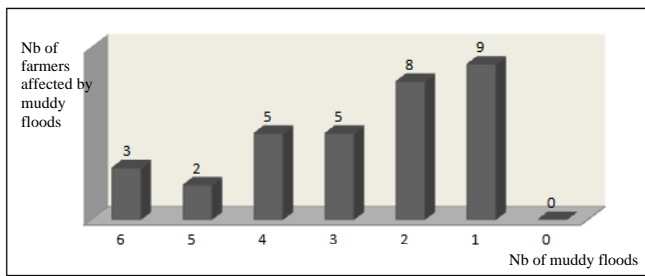
All the farmers use conventional agricultural practices (ploughing):

- 75 % use conventional practices,
- 21,9 % associate ploughing and reduce tillage,
- 3,1 % are involved in organic farming.

72% of the farmers are cereals farmers and 28 % have a breeding farm. Furthermore, on our five municipalities, the farms are relatively small with an average size lower than 40 ha.

### **4.1 How farmers assess them their level of threat?**

All the farmers feel exposed to muddy floods risk. For cause, they were damaged at least once by muddy floods (fig 1). The main consequences were the loss of plants (quoted by 75 % of the farmers), additional work after the muddy flood and the loss of fertile soil (quoted by 34 % of the farmers) as well as the formation of gullies (for 31 % of them).

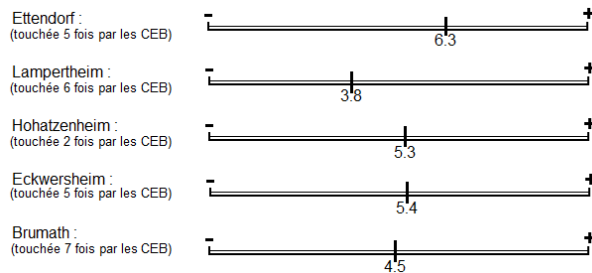


**Fig 1.** “How many times have you been affected by muddy floods?” (N=32)

To value the perceived level of exposure to muddy floods risks of the farmers, we asked them to mark a line on a scale limited by the signs “-” and “+”. This scale is a 10 centimetres axis and the signs “-” and “+” correspond to the “values” 0 and 10. By measuring the position of the line, it is possible to assess their perception of their exposure to muddy floods risks. The results highlight that the farmers located in Ettendorf feel to be highly exposed to muddy floods. They mark their level of exposure around 6.3/10 (Fig 2). It is not really surprising: the municipality was already concerned 5 times by this kind of disaster

It is interesting to compare this result with the other municipalities, in which the farmers feel less exposed while some of the municipalities are also frequently concerned (for instance, Eckwersheim – 5 times). Other municipalities are even more frequently affected: Lampertheim and Brumath damaged respectively 6 and 7 times by muddy floods. In these two municipalities the farmers assess their level of exposure at 3.8/10 and 4.5/10 (mean).

The farmers of Hohatzenheim (two muddy floods events) seem to highly estimate their level of exposure at the risk, compared with the results observed in the other municipalities (mean perceived exposure = 5.3/10).



**Fig 2.** Perceived level of exposure in the 5 municipalities (mean)

These various results on the farmers’ perceived level of exposure to muddy floods risk express the subjectivity of the perception of risk. The number of events seems not to be the single factor for explaining the level of perception.

#### 4.2 Main factors that improve the setting up of fascines

For farmers, fascines are considered as “solutions of emergency”. The inhabitants put the pressure on them: they are accused to be responsible of the formation of muddy floods. The farmers want to react quickly and setting up fascines seems to be an adequate solution. Fascines are visible and their efficiency is *quasi* immediate. According to the farmers, fascines seem to reassure the inhabitants. We ask the farmers to explain us what kind of feelings the inhabitants have towards the fascines. The results show that:

- 34,4 % of the farmers highlight the fact that fascines are visible: “...That shows that the farmers made something, that they get involved”, “... They see that the fascines will protect them”.
- 31.3 % of the farmers think that the inhabitants trust the efficiency of these protective measures and feel reassured by their installation: “... They are satisfied”, “They feel protected”.
- 31.3 % of them think that the inhabitants remain sceptical: “It is efficient but it is expensive”, “They wonder about the functioning and the maintenance of the fascines”.
- 3.1 % of the farmers think that the inhabitants have a negative feeling: “The Greens of the village said that it is not a good thing”, “It is just an illusion”.

These results show that the farmers identify positive aspects of the fascines: they are easy and fast to set up and the inhabitants see that the farmers undertake actions to protect them. It is possible that farmers agreed to settle fascines in their fields for these reasons.

## 5. CONCLUSIONS

The questionnaires allowed us to determine factors taken into account by the farmers in their willingness to set up fascines in their fields. Before anything else, the survey reveals that the great majority of them adopted this measure in an emergency context, following the catastrophic muddy floods of May, 2008. The fascines appeared as a fast solution to set up and whose effects were immediate.

The negative aspects mainly concern the cost, the integration in the landscape and the maintenance of the fascines. A part of the farmers think that the fascines are temporary measures and they seem to be more willing to adopt more sustainable actions such as reduced tillage practices.

Another point highlighted by the survey is the lack of information concerning the care and maintenance of the fascines. In the Bas-Rhin, nobody is in charge of the care and maintenance of the fascines. In other French department (for instance, Nord-Pas-de-Calais), public authorities and Chamber of agriculture establish a convention with the farmers. They define together the responsibility of each stakeholder in the setting up and the maintenance of the fascines. It could be useful to allow the sustainability of this protective measure to specify this issue in the Bas-Rhin department.

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