

Evaluation of the rate and source of land degradation in a micro- catchment, Rabat region, Morocco

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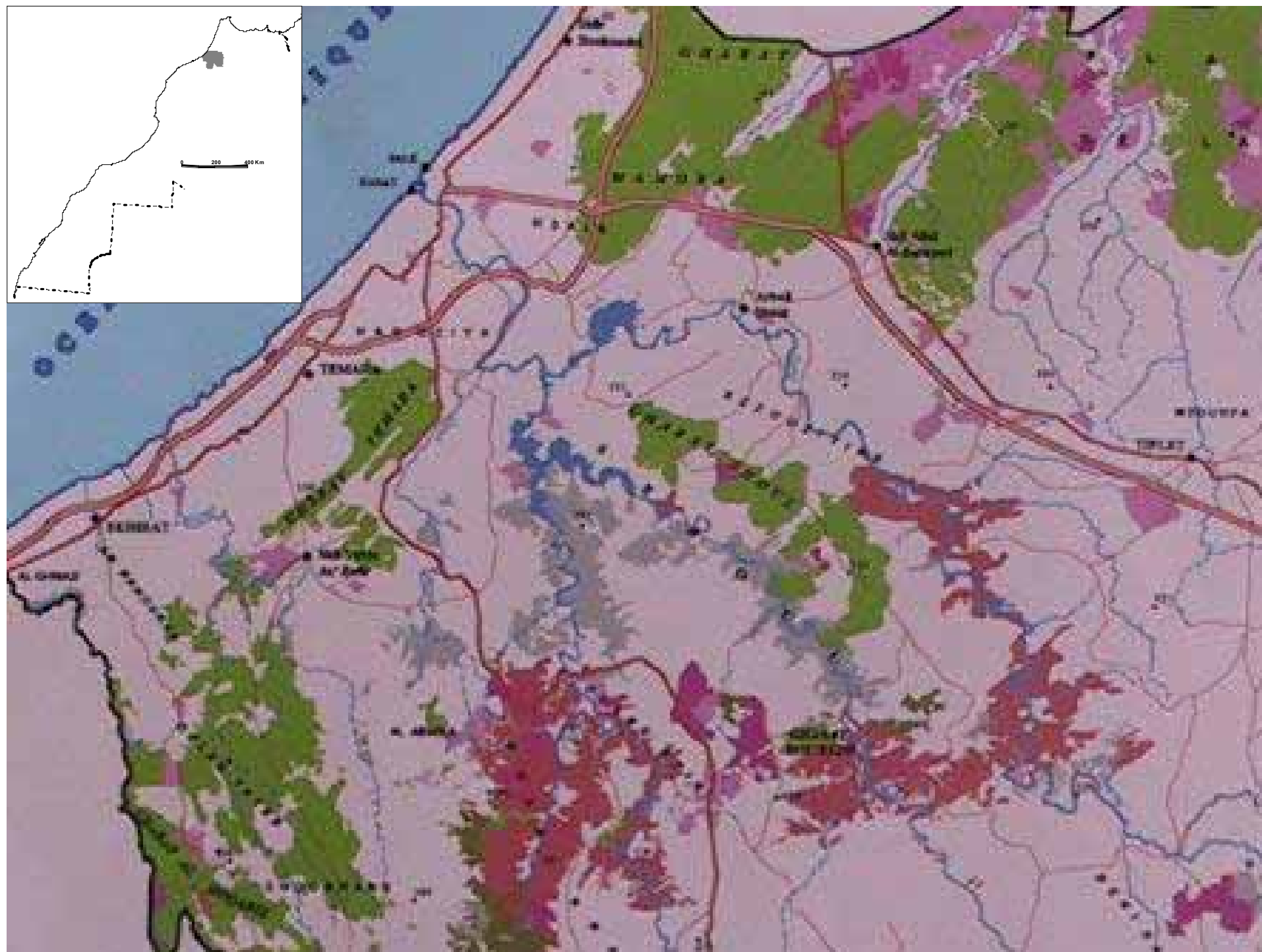
problematique

Under semi arid conditions, the erosion by superficial runoff, concerns more than 80% of the slopes, but contributes only for a weak part of the global soil loss.

The beginning of the streaming concentration, under the aspect of rills and gullies, constitutes a fundamental step in the slopes degradation.

Its main danger occurs when those concentrated streams start and carry the maximum of soil exportation. We pass from a discreet and continuous transport to a massive exportation that impregnates the landscape.

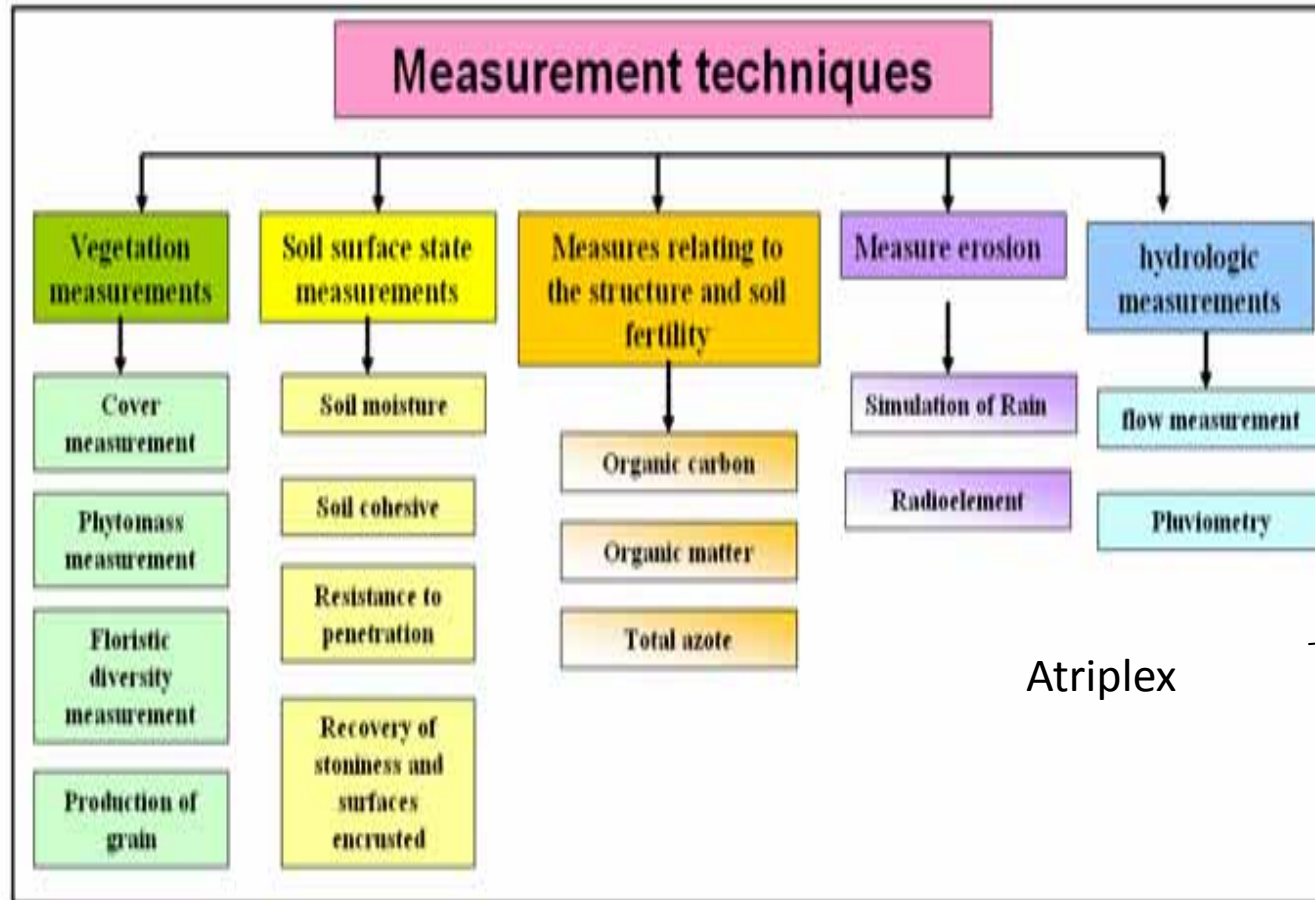
The danger is still looming ahead as long as the rill exists, because it canalizes water immediately downstream, and can transform itself, in case of excess of precipitation, into a deeper and more active gully.



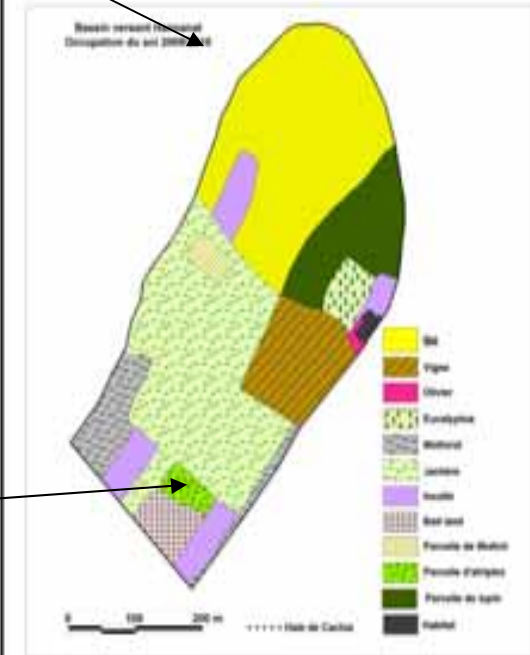




I- METHODOLOGY



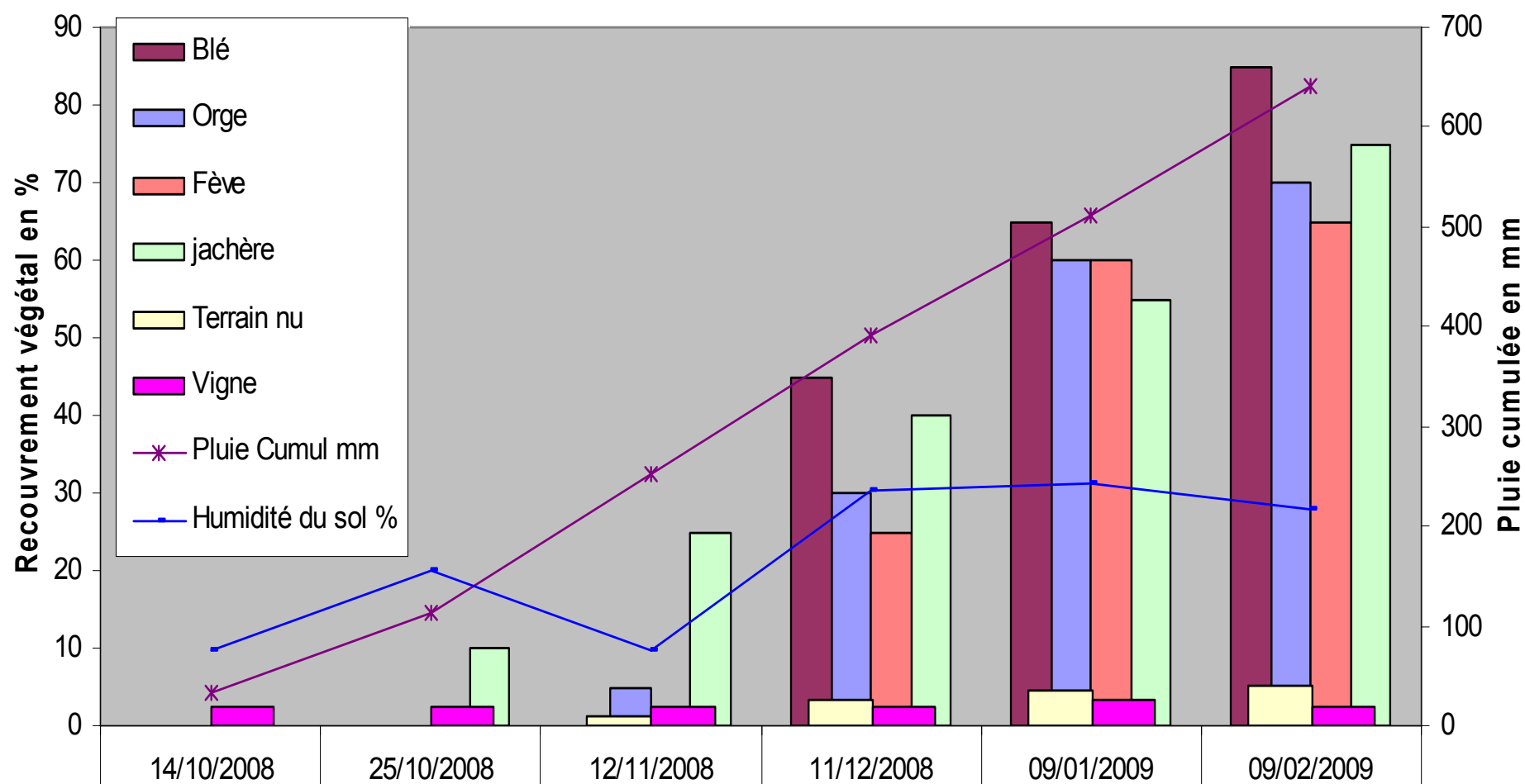
F + MT



Atriplex

The monitoring of soil, vegetation and dynamics of water, was made in various plots in the catchment and was cumulated with the hydrologic follow-up at the outlet.

Recouvrement végétal du sol

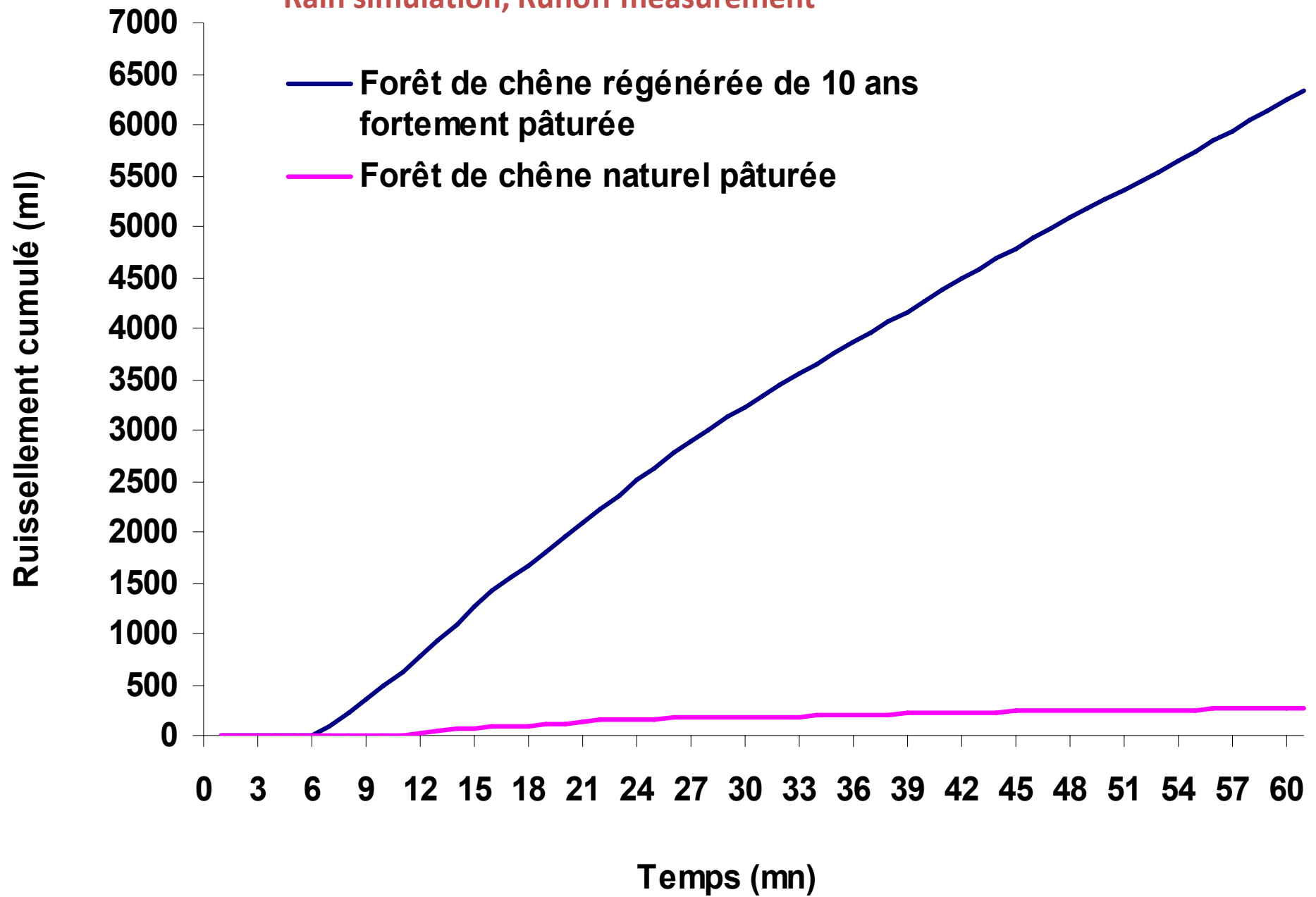


With the progress of the rainy season, the vegetation cover improves in cereal fields and remains weak in grape field and in the bare and degraded one

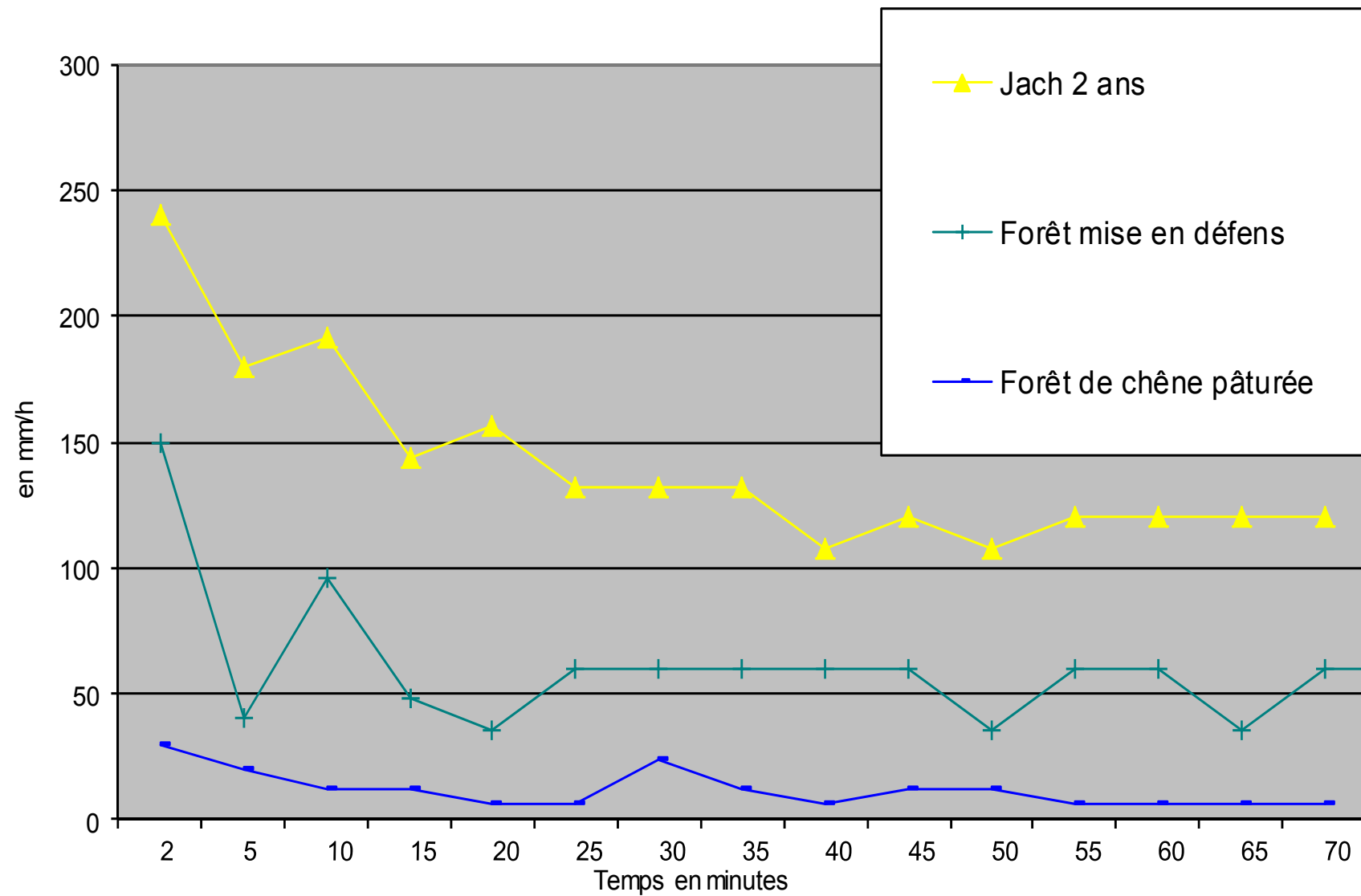
Rain simulation

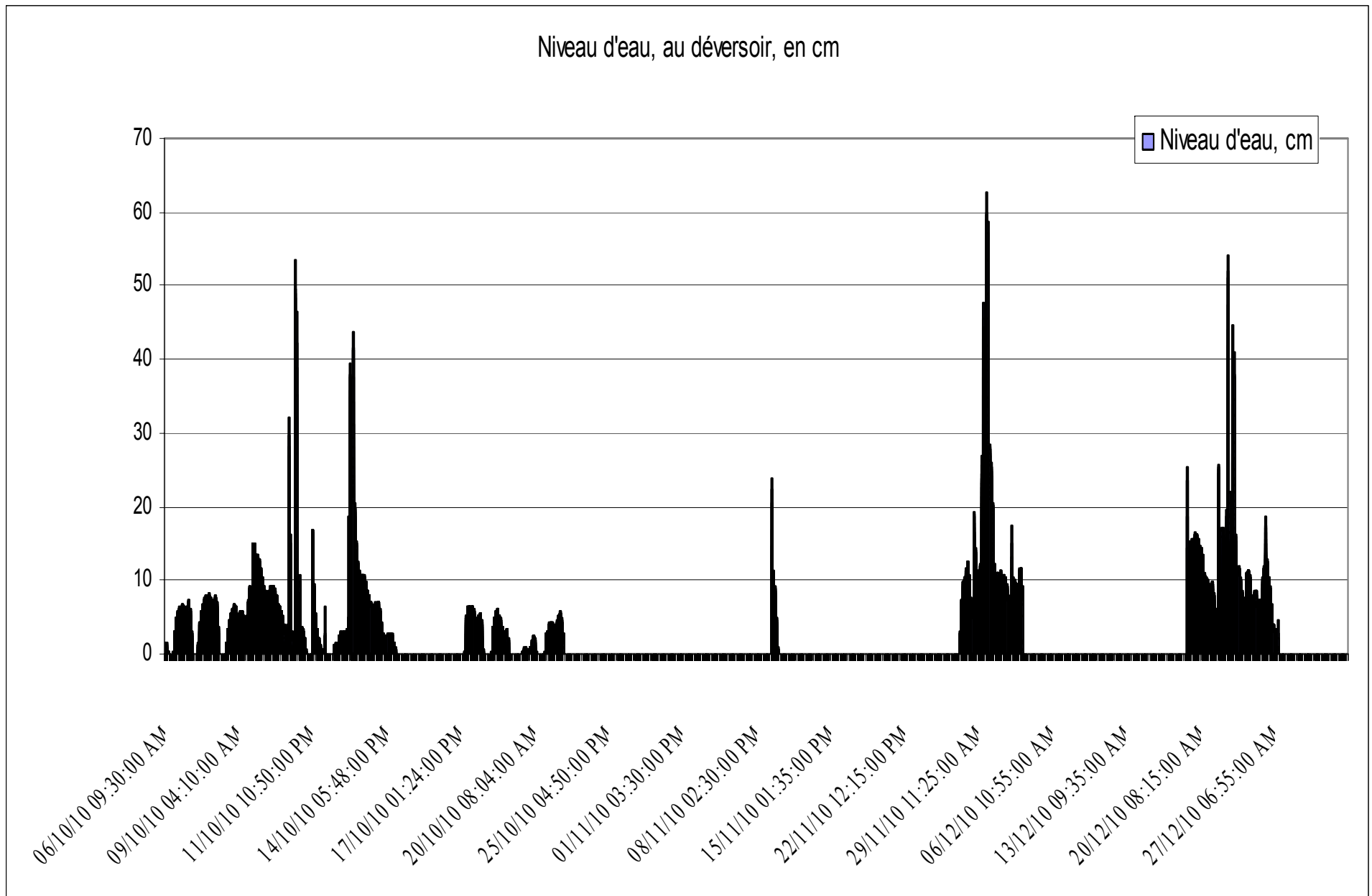


Rain simulation, Runoff measurement

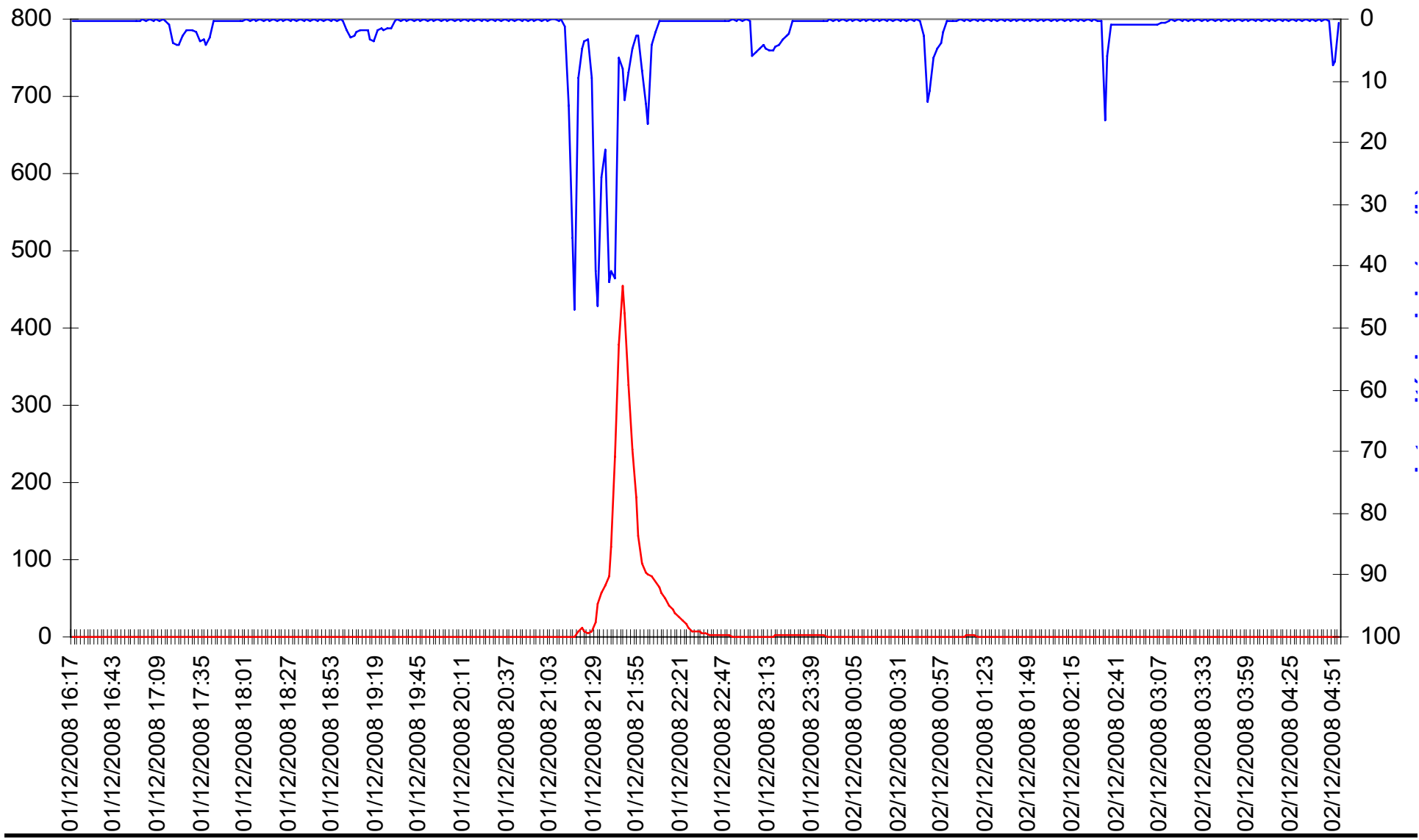


Infiltration





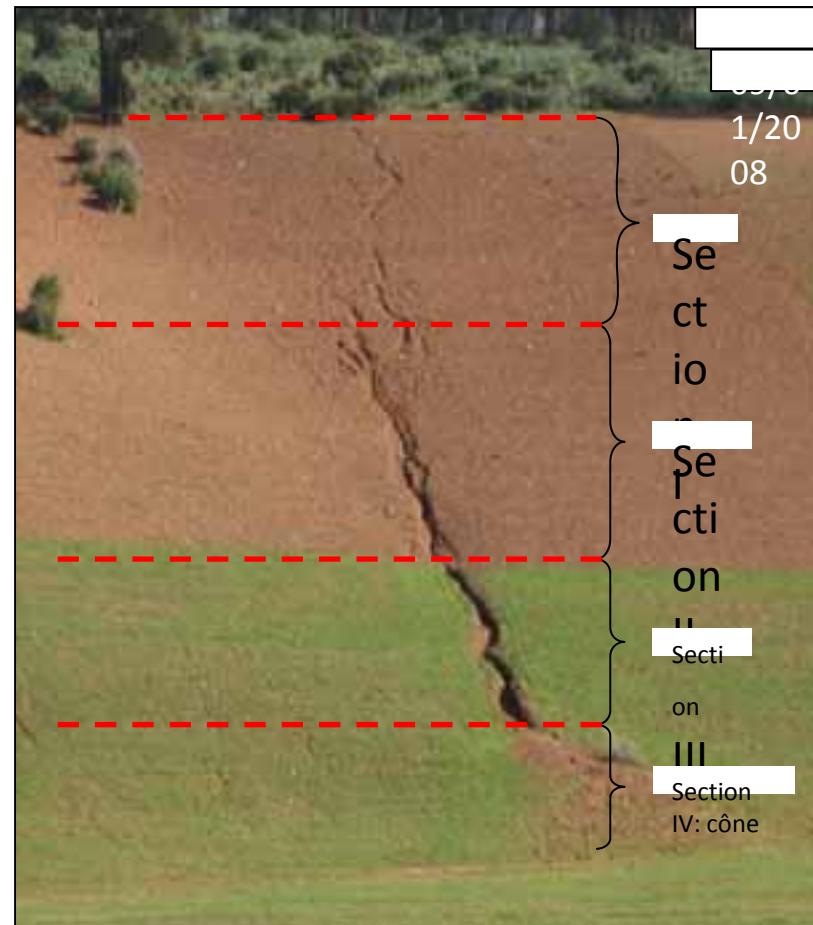
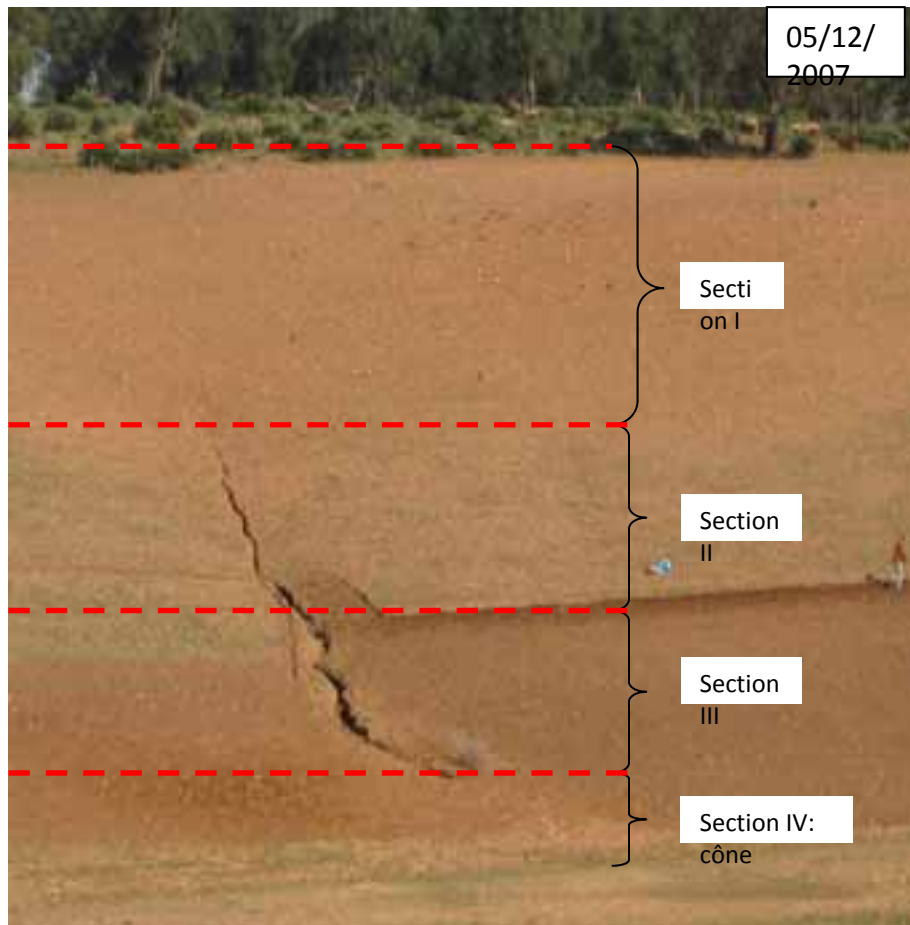
- The hydrologic measurements at the catchment scale







Micromorphology of the gullies and follow up of their extension and incision

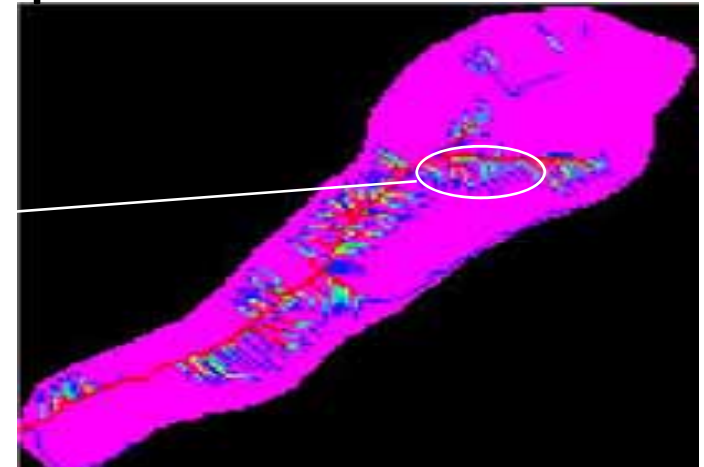


Comparison between slopes behaviour during an event





Modelling catchment plots behavior by local and repetitive measurements and location of the threatened slopes



Phenomena of soil erosion were observed in the field at the places where surface runoff was simulated (denudated soils, rills)

II- The lessons of an experience of management



2 facing slopes with a completely different behaviour





Fans of pebbles accumulation

Main Channel incision

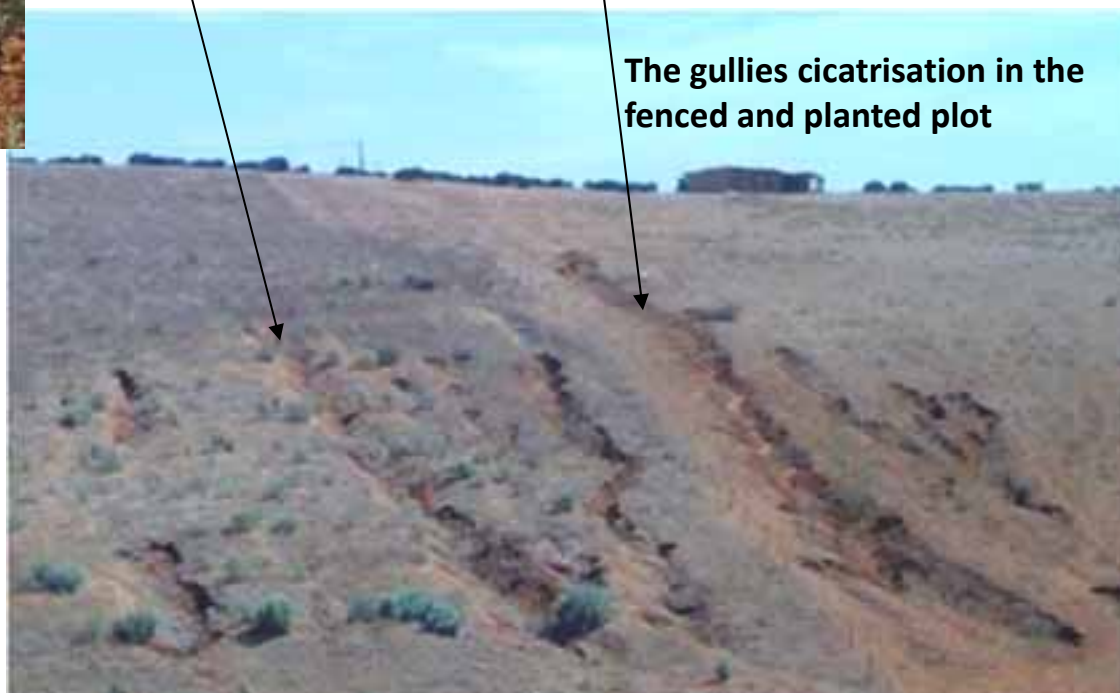


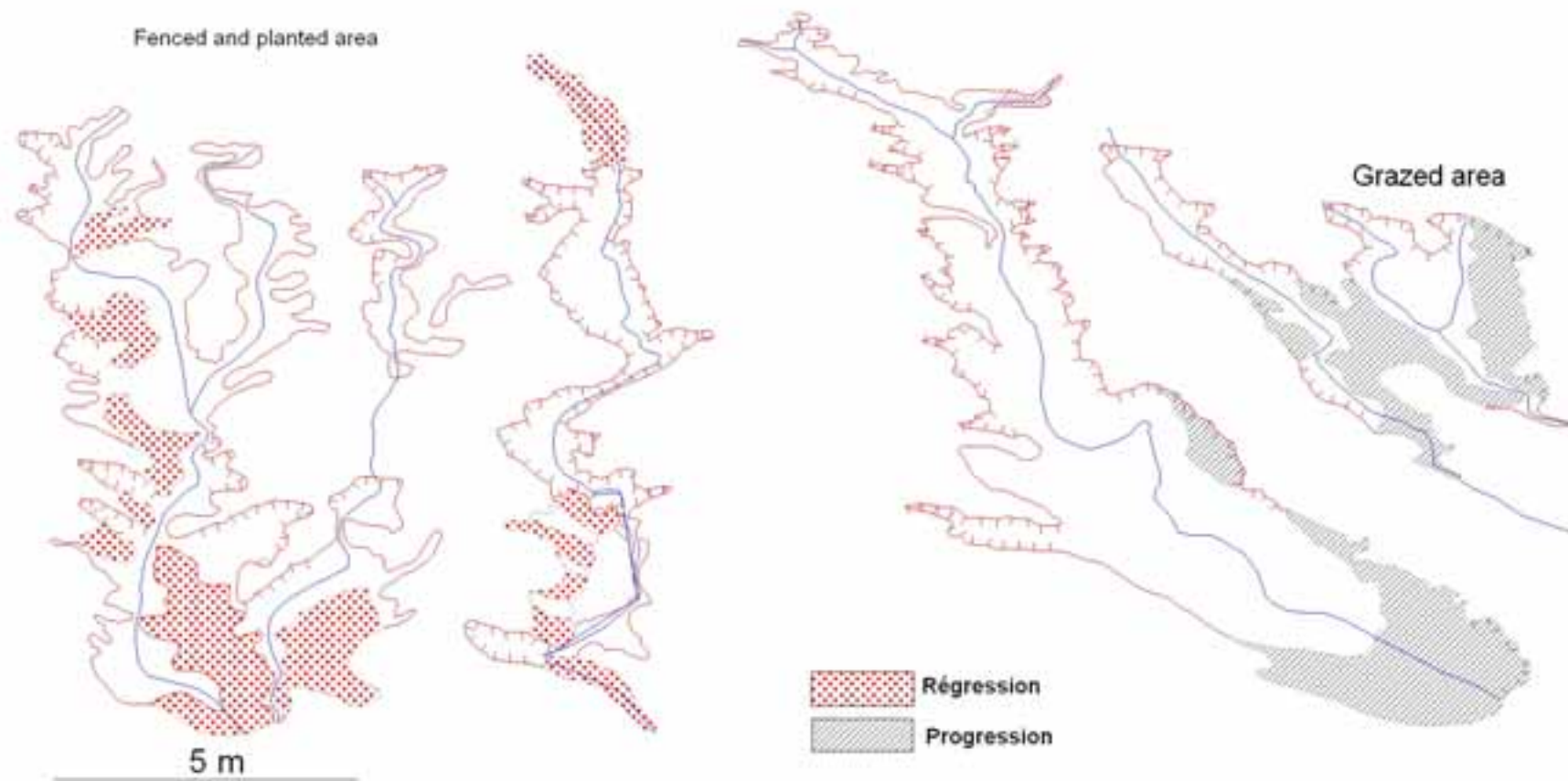
Technology scenario: Gullies control by fencing and plantation of fodder shrubs

The gullies extension and forms in 2009



The gullies cicatrisation in the fenced and planted plot





Map of the evolution of the gullies in the fenced plot (left) and the not managed plot (right)

Perspectives of extension

- The positive effects of the technology are evident:
 - Decrease of the erosion rate from $>50\text{t/ha/y}$ to $<10\text{t/ha/y}$
 - Increase of biomass: from 10 to 25 times after 10 years implementation
 - Economic profit on the long term:
 - Reduction of the need for stubble from the croplands and for forest grazing -> improve of the croplands and of the forests environment
 - Off site hydrological effect (decrease of reservoir siltation) , due to gullies cicatrisation
- The need for subsidies and coordination to ensure the adoption and the extension of the technology
 - Without reduction of the costs, the technology is condemned.
 - With 50% of costs reduction, the technology becomes profitable in most of the area.
 - This reduction should be assured by subsidies as a payment for Ecosystem service
 - The integration of the whole resources (forests, pastures and croplands) can make each resource profit from the management of the other resources

Reduced grazing scenario

- Less runoff is produced at the catchment outlet when the infiltration capacity in grazing fields is replaced by values typical of cultivated fields.
- The total discharge is reduced by 58-84% and the same for peak discharge. The runoff coefficient is reduced by 58-84%. The total infiltration increases, 5-7%.
- With tillage along the contour on the former grazing fields, the direction of the surface runoff is changed to the direction of tillage.
- Less surface runoff is expected to come from the concerned fields and at a slower rate. This is confirmed by the smaller peak discharge and total discharge at the catchment outlet compared to the hydrographs for the situation with tillage in the direction of the steepest slope.

Conclusion : The constraints

- -The cost: Investment of 2500 euros/ha; after 6 years, the balance remains negative; The technology needs a long time horizon to be profitable; it is then not acceptable for land users, without a state subsidy, in order to reduce the cost supported by them.
- -The fencing has an effect of eliminating the free displacement of flocks and then the free grazing; at the same time, it increases the pressure on the remnant fields not fenced, the forests and the fallow for example.
- -The fencing is a large part of the cost. In case of a concerted action, fencing larger fields than the individual plots could reduce the costs; but it needs coordination between land users.