

Long term management of water in the Beauce aquifer - France



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Laurène PINEAU

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- **aquifer presentation**

- Geographic situation
- aquifer physical characteristics
- Agricultural and natural conditions
- Chronology of the awareness

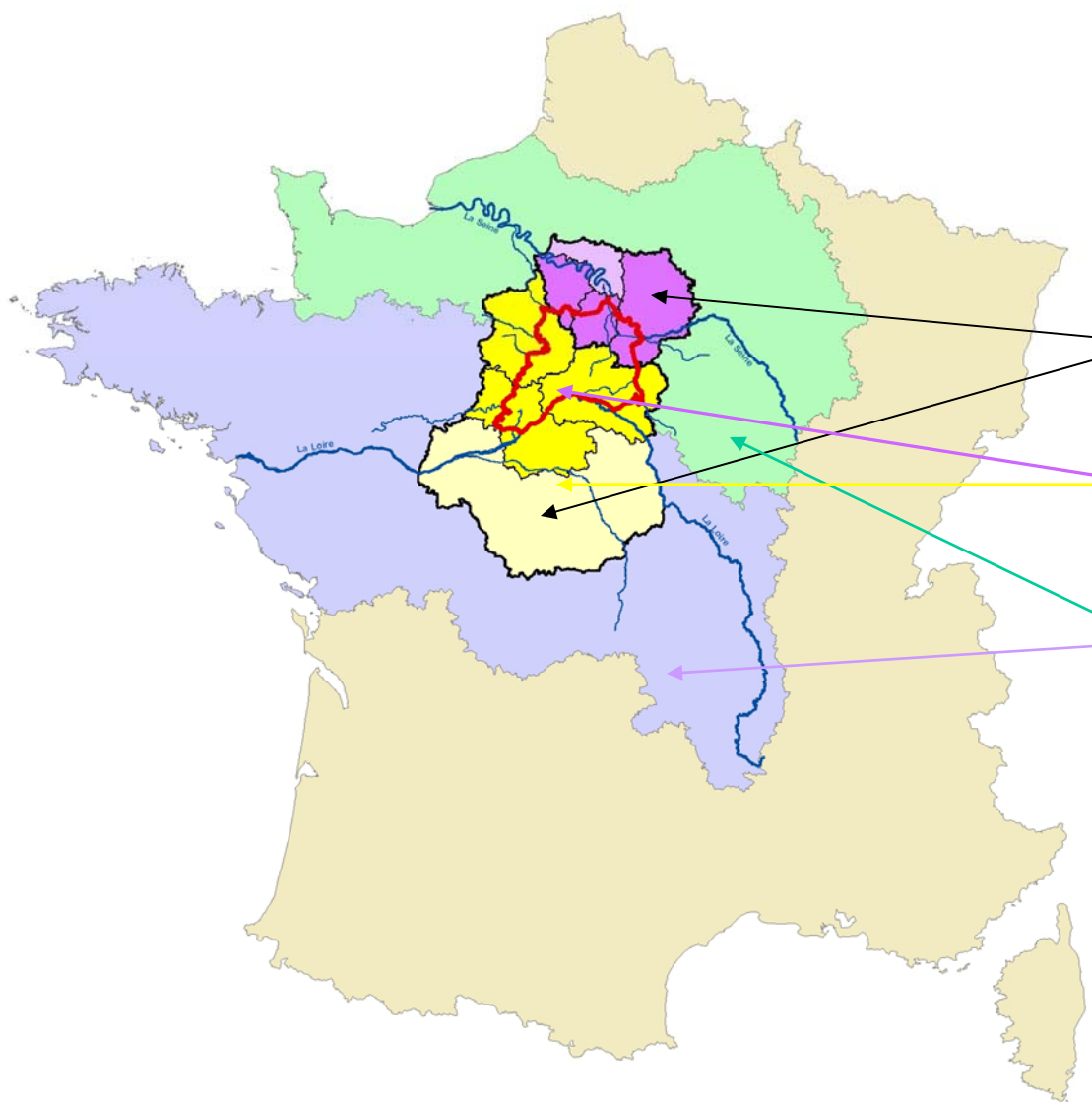
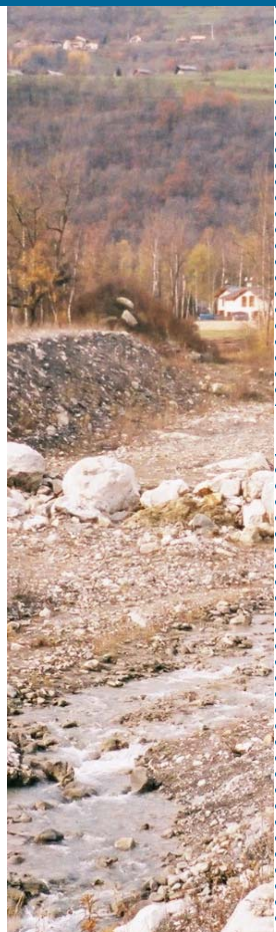
- **Actions engaged**

- Management measures
 - Volumetric management measures
 - SAGE (River Basin management Plan for sub basin)
- Knowledge improvement of the aquifer functioning
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 - Mathematic modelling

- **Conclusion: Perspectives of improvement**



Geographical Situation



- 2 regions
- 6 districts
- 2 water agencies










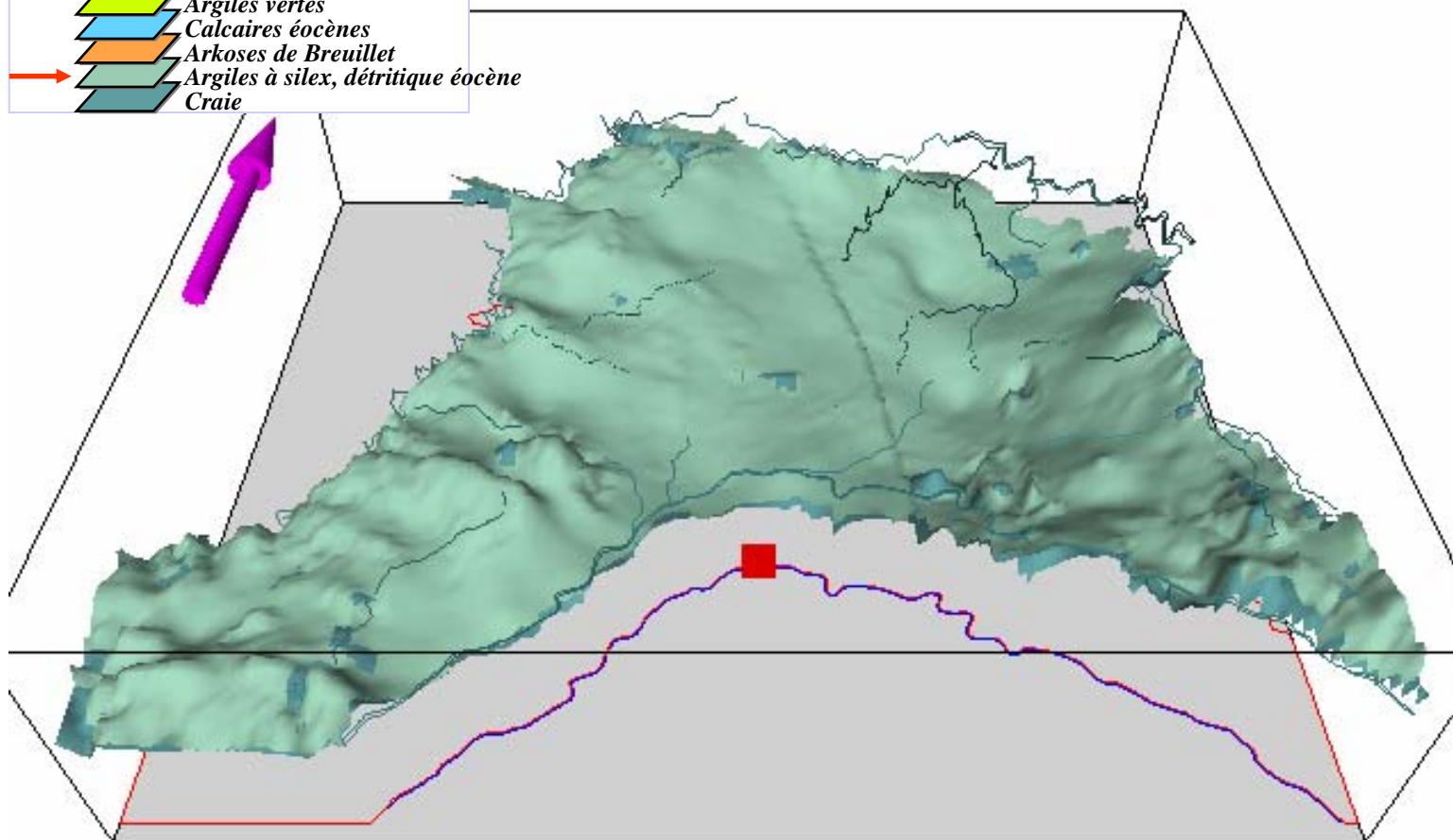
- Maximum of 200 m of thickness
- Area: 9 000 Km²
- Assessed storage capacity: 20 billions of m³
- Surrounded by different geographical formations:
Permeable: calcareous, sand, ...
Semi-permeable to impermeable: marl, clay, ...

One of the most important resource at the national level. Dependance of numerous aquatic environments and human activities on this resource.















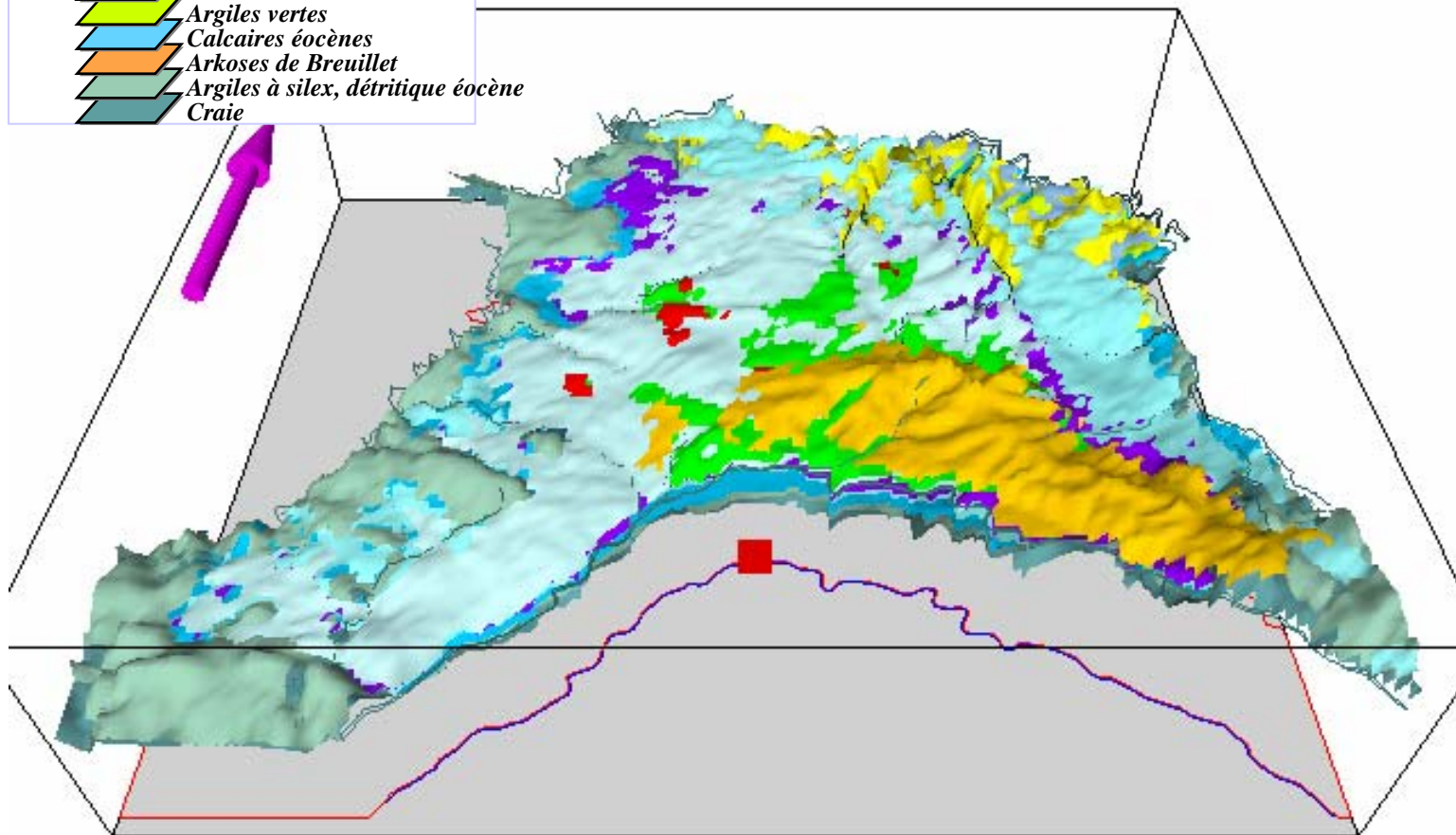


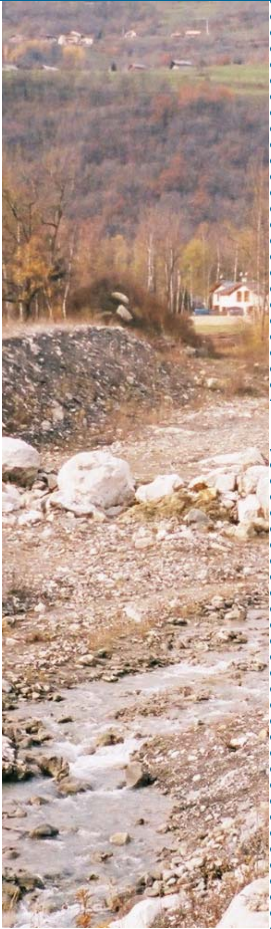
-  Marnes, sables Orléanais-Sologne
-  Calcaires de l'Orléanais
-  Marnes de Blamont
-  Calcaire de Beauce-Pithiviers
-  Molasse du Gâtinais
-  Calcaire d'Etampes
-  Sables de Fontainebleau
-  Marnes à Huitres
-  Calcaire de Brie
-  Argiles vertes
-  Calcaires éocènes
-  Arkoses de Breuillet
-   Argiles à silex, détritique éocène
-  Craie





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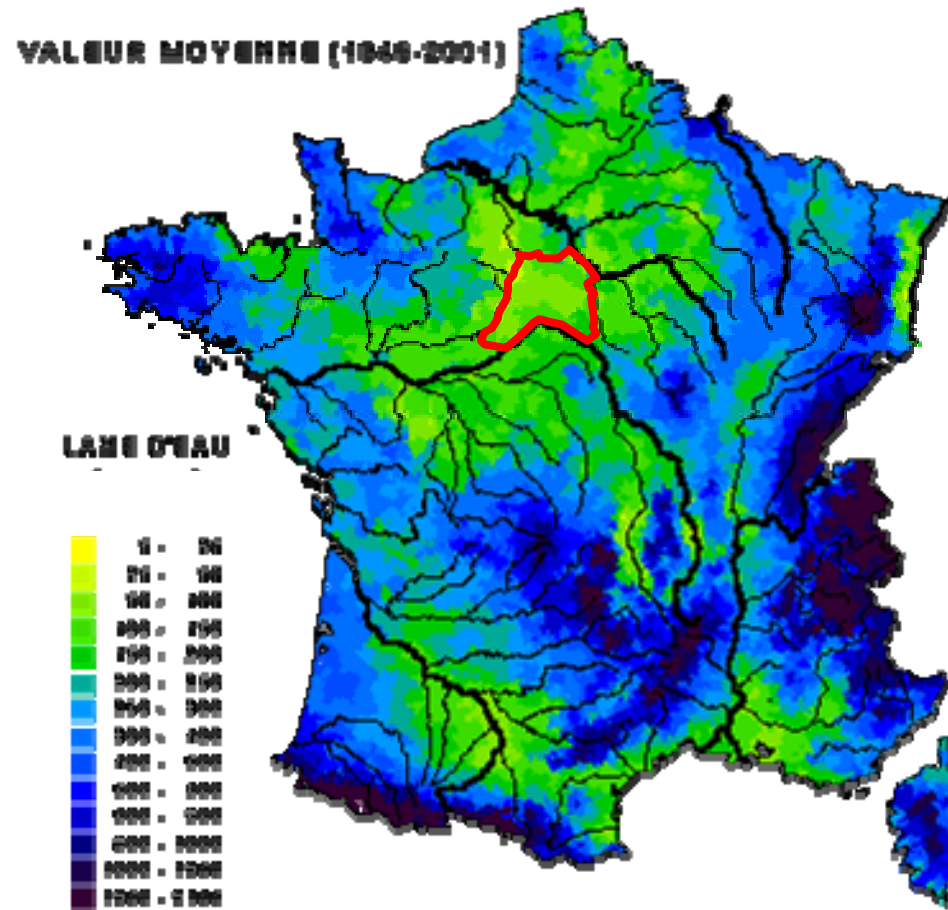
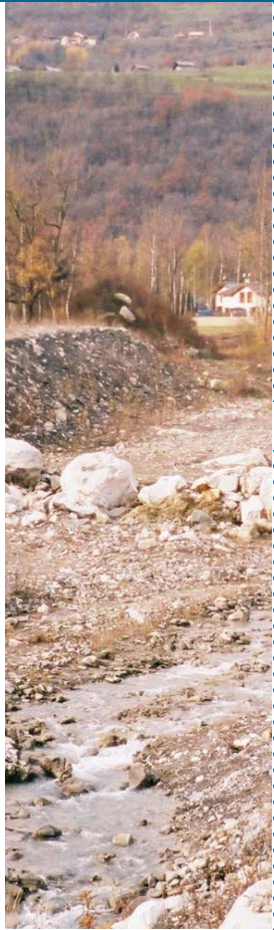
- One of the driest region of France (average rainfall : 600 mm/year)



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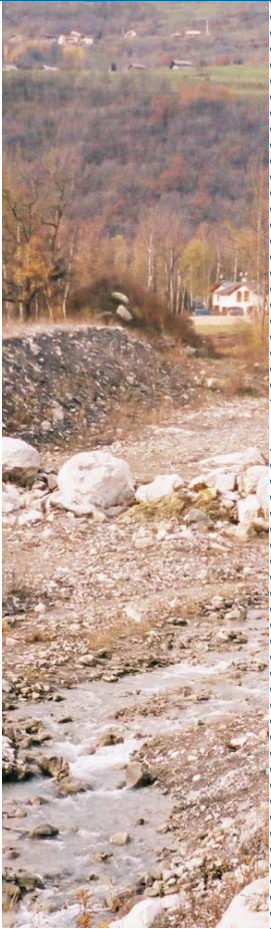
Efficient average rainfall : 100 to 160 mm/year
Very weak efficient rainfall



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- One of the driest region of France (average rainfall : 600 mm/year)
- Region of cereals, oleagines, sugar beets ...

Agricultural Surfaces = 70 % of the area (more than 6 000 km²)

Irrigated area = 50 % of Agricultural Surfaces
(3 000 km²)

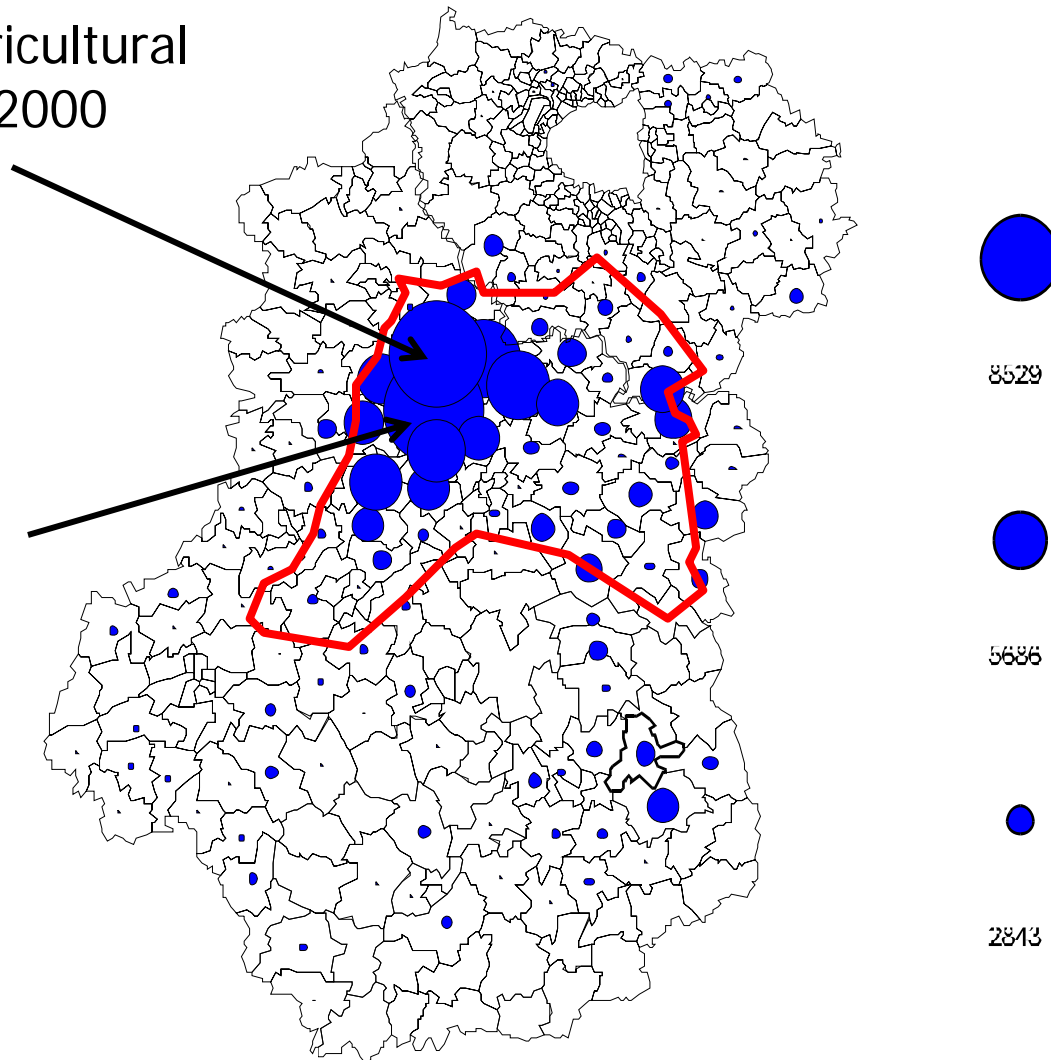




Effective irrigation

32 % of Agricultural Surfaces in 2000

40 % of Agricultural Surfaces in 2000

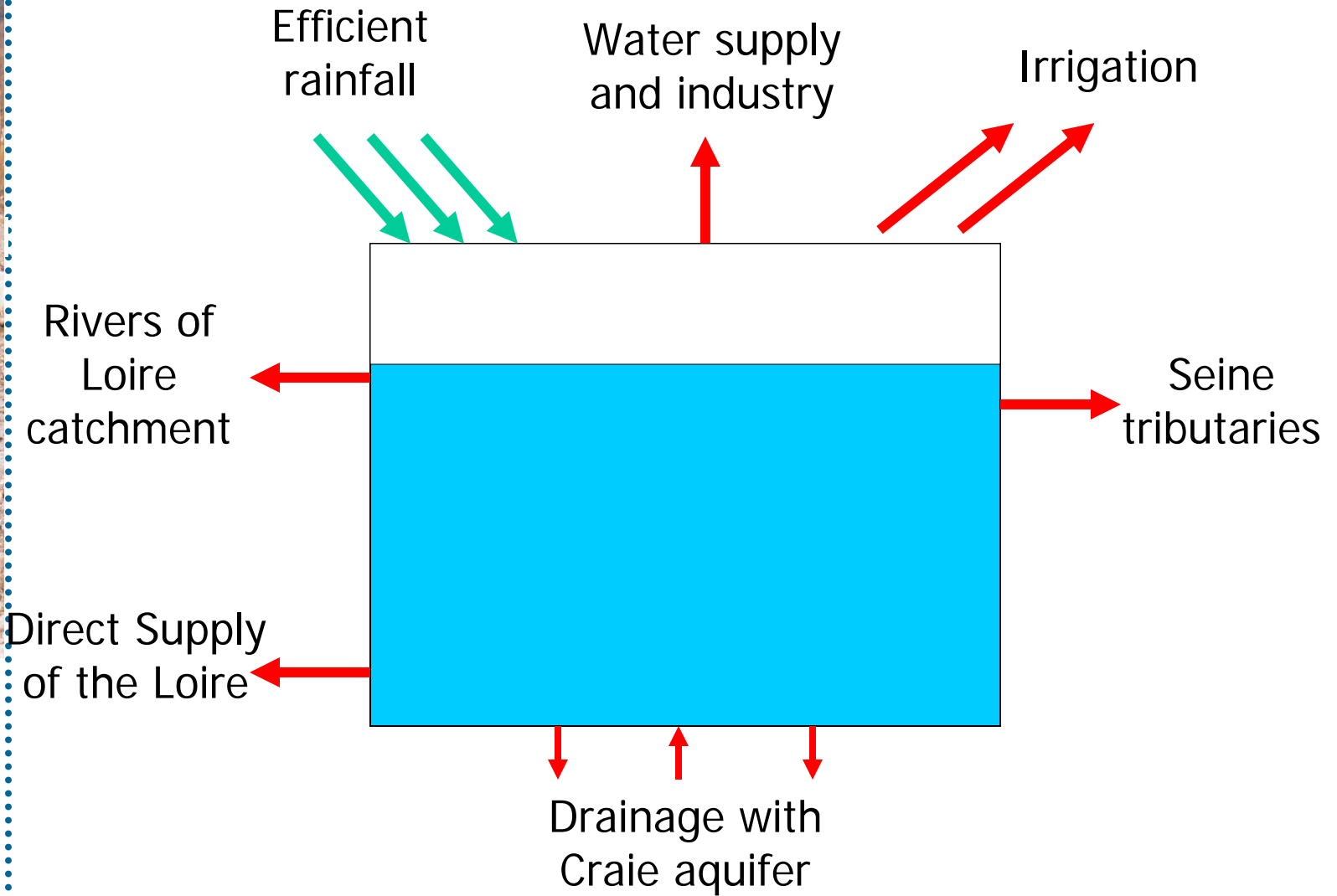
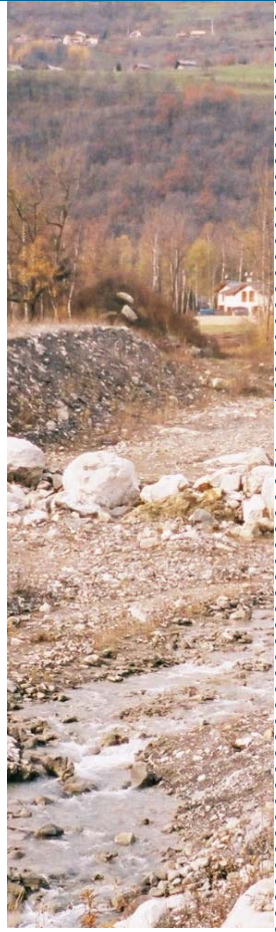


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Flows'scheme





- Efficient rainfall recharging

Average of 140 mm/year => 1.15 Billions of m³

- Abstracts :

80 Mm³ for water supply

20 Mm³ for industry

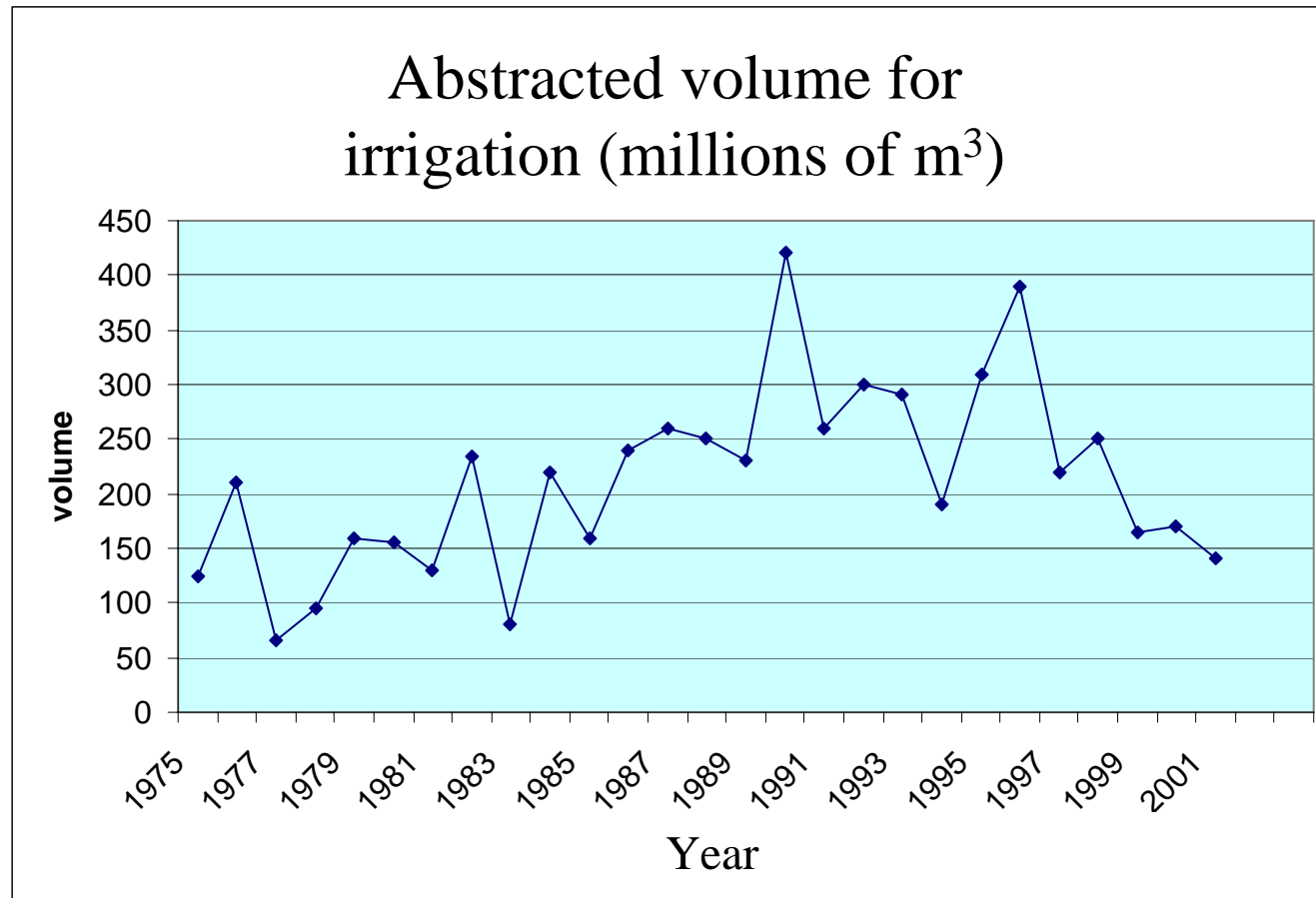
150 à 450 Mm³ for agriculture for 3 300 irrigant

- River catchment (Loire & Seine) :

Average of 1 Billion of m³



1. Management measures



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Water scarcity in 90's and overexploitation



Decrease of boreholes' productivity

Decrease of river flows



Water conflicts



Awareness of the necessity of managing water
resource

and new regulation tools (law of 1992)



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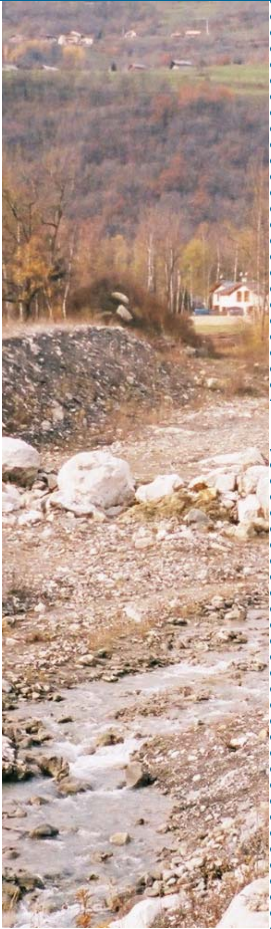
- **Actions engaged**

- Management measures
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 - SAGE (River Basin management Plan for sub basin)
- Knowledge improvement of the aquifer functioning
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- **Conclusion: Perspectives of improvement**



1. Management measures



- First measures in 1992: abstraction restriction by prefects
- Volumetric management network
- SAGE (River Basin Management Plan for Sub-basin)
- Registration in ZRE (protection area classification)



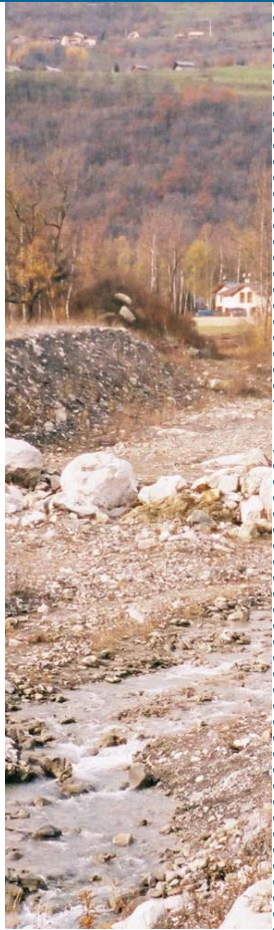
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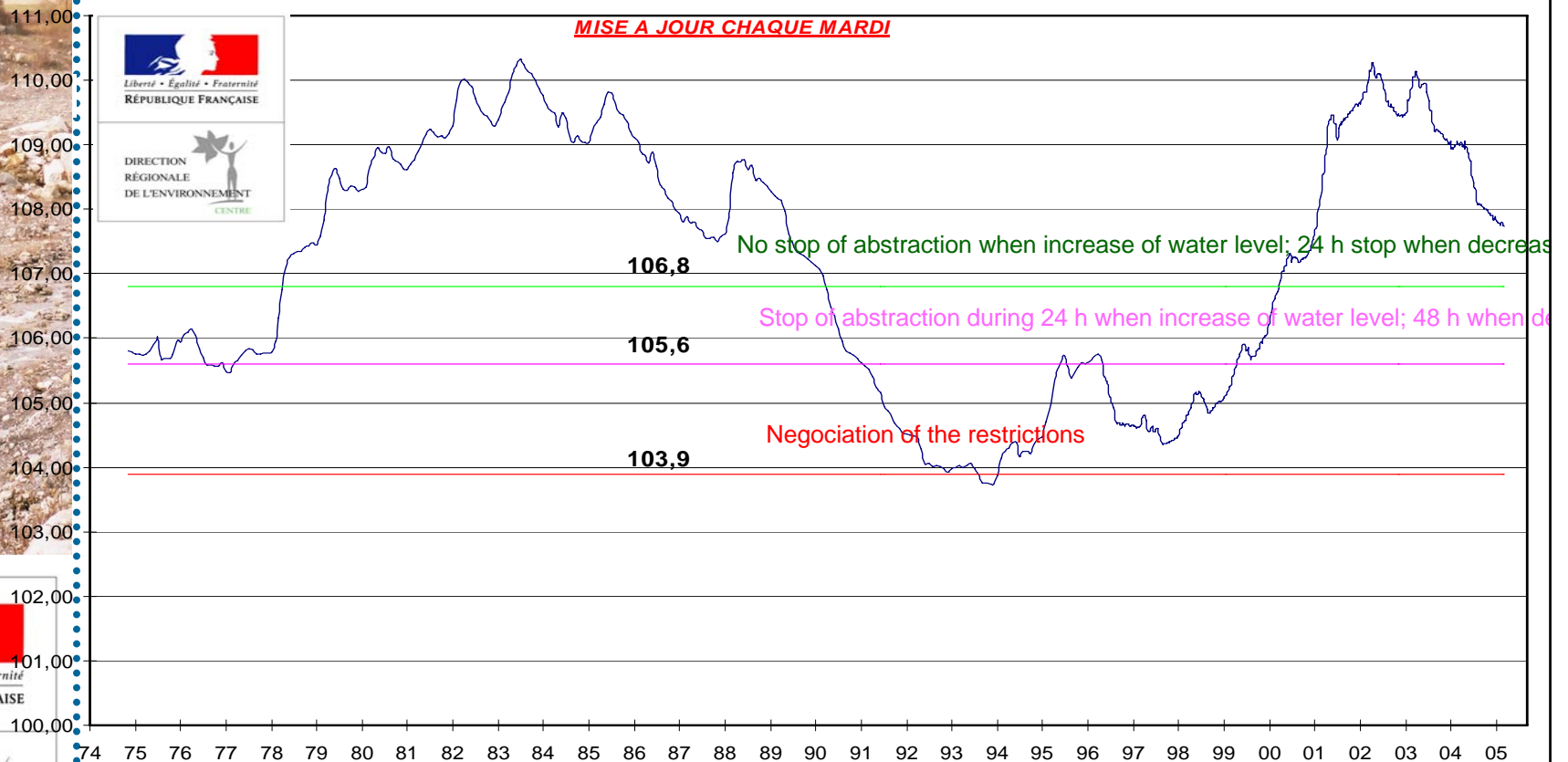
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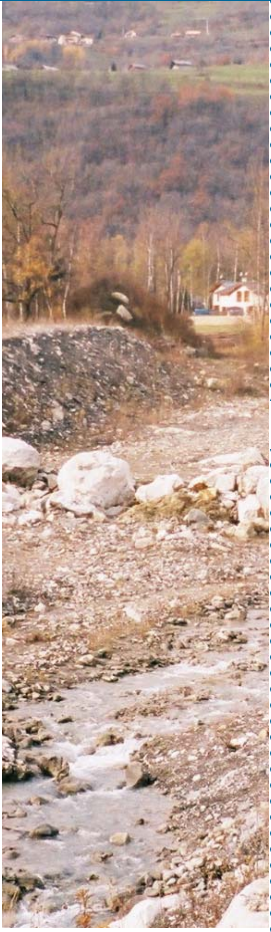
Principles

- Reference volume : abstracted volume allowed: **450 millions m³/year**
- Distribution of the volume between the 6 districts related to possibly irrigated area by farm
- Individual reference volumes by district
- Application of a **reductive coefficient** each year related to the level of the aquifer
- Possibility to carry forward to the next year the economies realized in a limit of 20% of the volume assigned. Carried forward of the over consumption.
- **Generalization of water meters** and records



3 reference indicators





SAGE Characteristics

River Basin Management Plan for Sub-basin

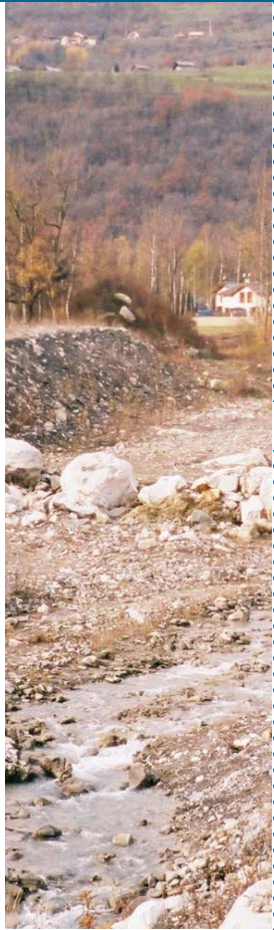
- Starting in 1999
- 680 town areas – 1,4 million of inhabitants
- Local water commission – 72 persons
- Base structure: regional syndicate
- 1st step (inventory of the fixtures) 2nd step (diagnosis) realized



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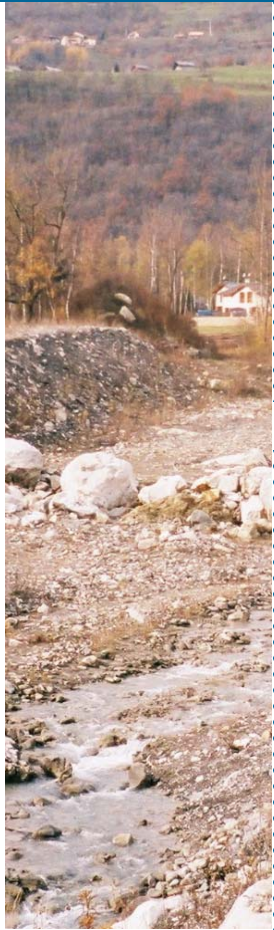
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Purposes and actions

- to officialize volumetric management engaged
- Quantitative management of water resource to preserve nature and to share equally water between users
- to ensure sustainably water quality
- to prevent from risks by wrestling in priority against inondations
- to preserve natural milieus





2. Knowledge improvement of the aquifer functioning

- Piezometric network: 86 stations
- Piezometric campaign in 2002 (high water level) by the Regional Environmental Directions (DIREN)
- Important programme of studies with mathematic modelling (€ 0,8 millions)



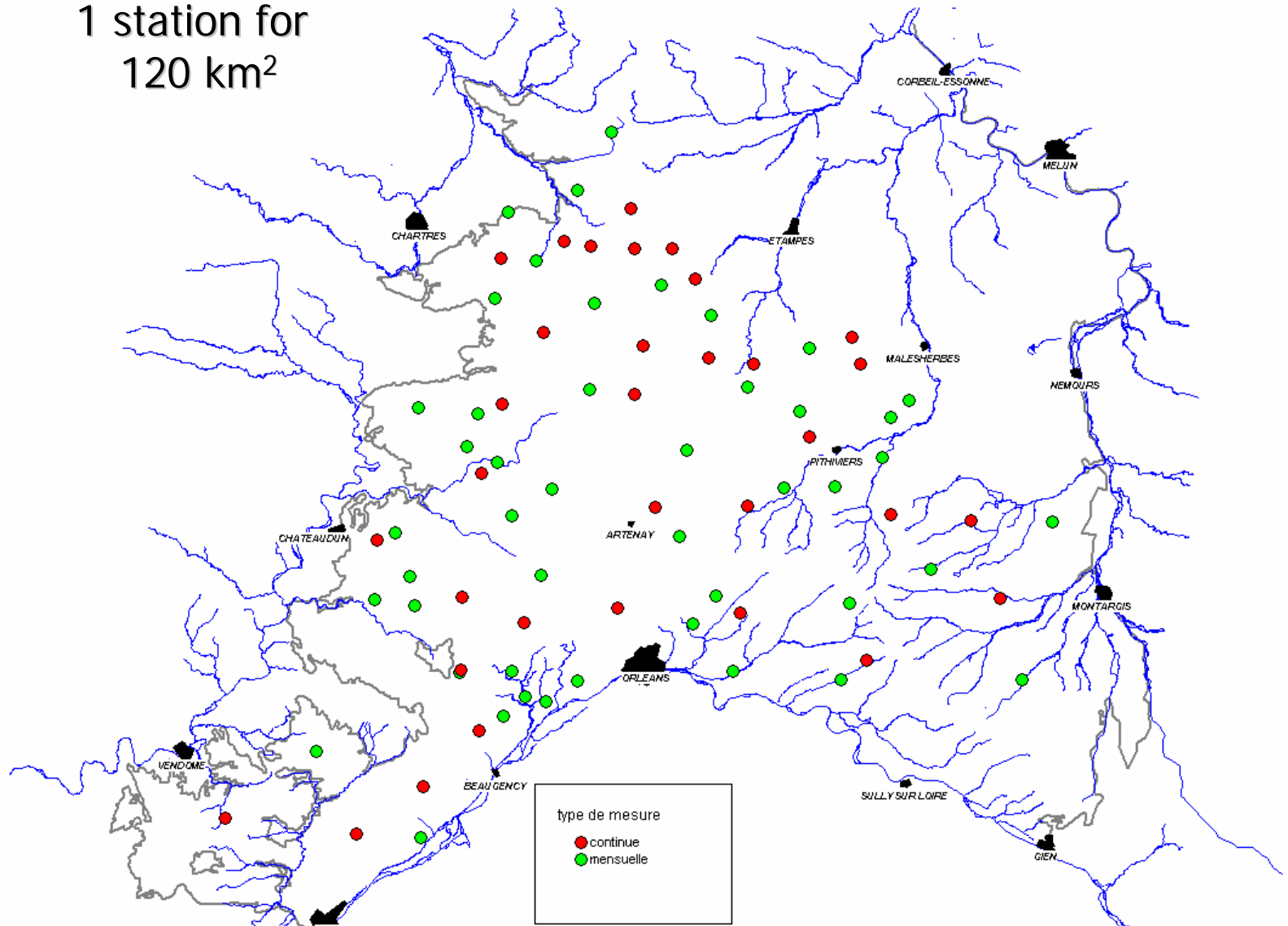
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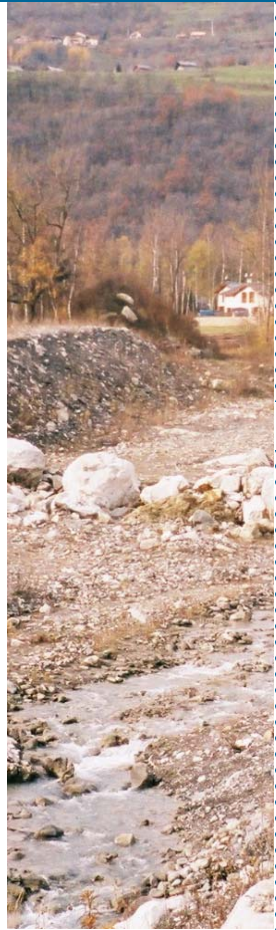
1 station for
120 km²



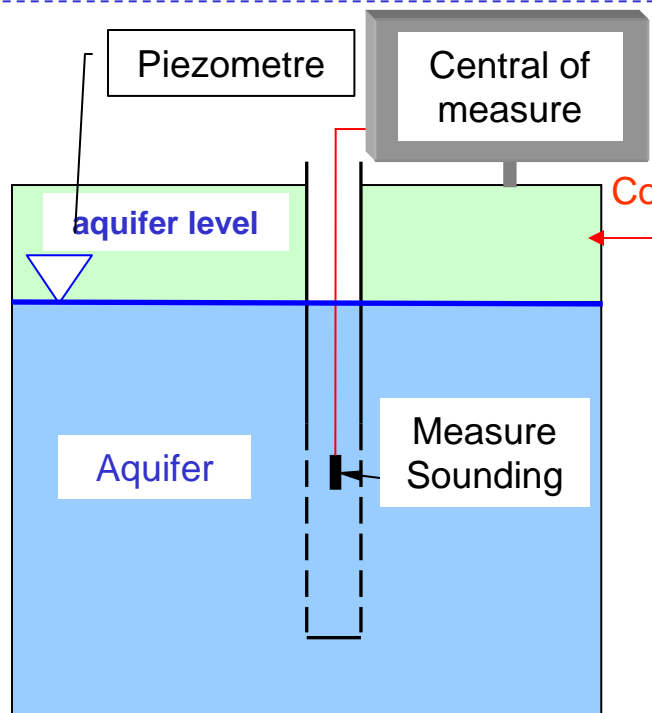
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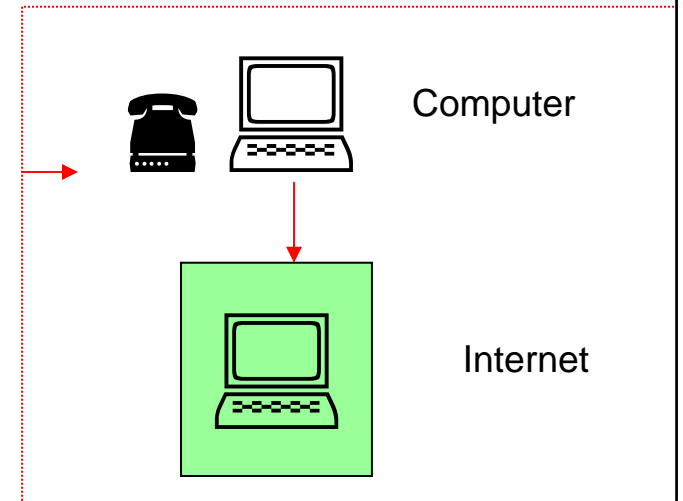
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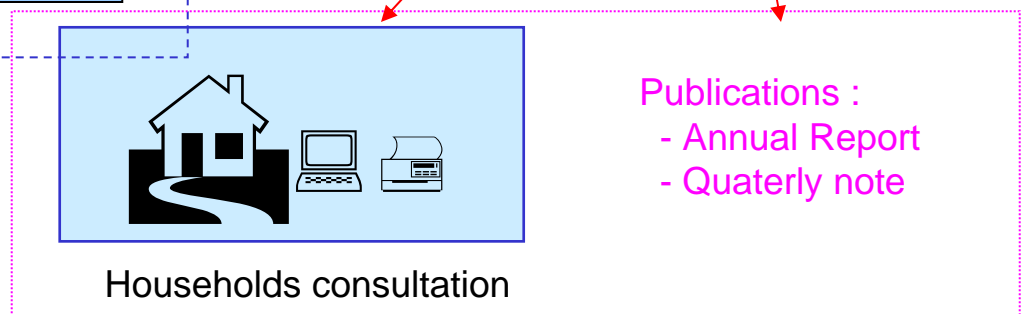
1. Measure



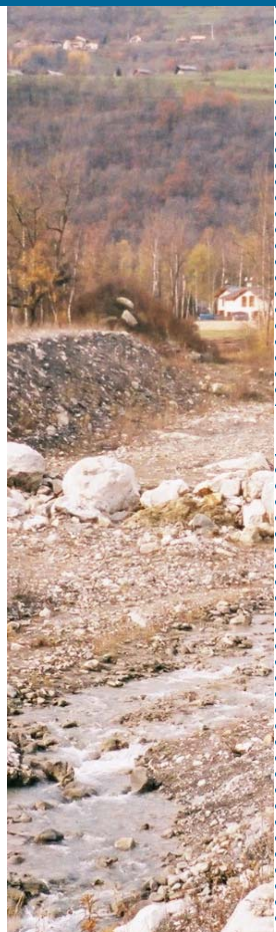
2. Data treatment



3. Diffusion



2. Knowledge improvement of the aquifer functioning



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2. Knowledge improvement of the aquifer functioning



- Nearly 1 000 measurements at the same time of the aquifer level (depth; bench mark)
- River Gauging
- Instantaneous altitude measurements and morphology of the aquifer surface



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2. Knowledge improvement of the aquifer functioning



- Preliminary studies: aquifer geometry, aquifer hydrological functioning ...
- Model development
- Adjustment of the parameters thanks to indicators, stations measurements, ...
- Simulations of scenarii defined before: variation of parameters: initiate water level, recharging, abstracts
 - Indicator test in a situation of low level of water
 - Indicator test in a situation of high level of water
 - Indicator test in wet situation
 - Consequences of a medium exploitation in a medium climatic situation



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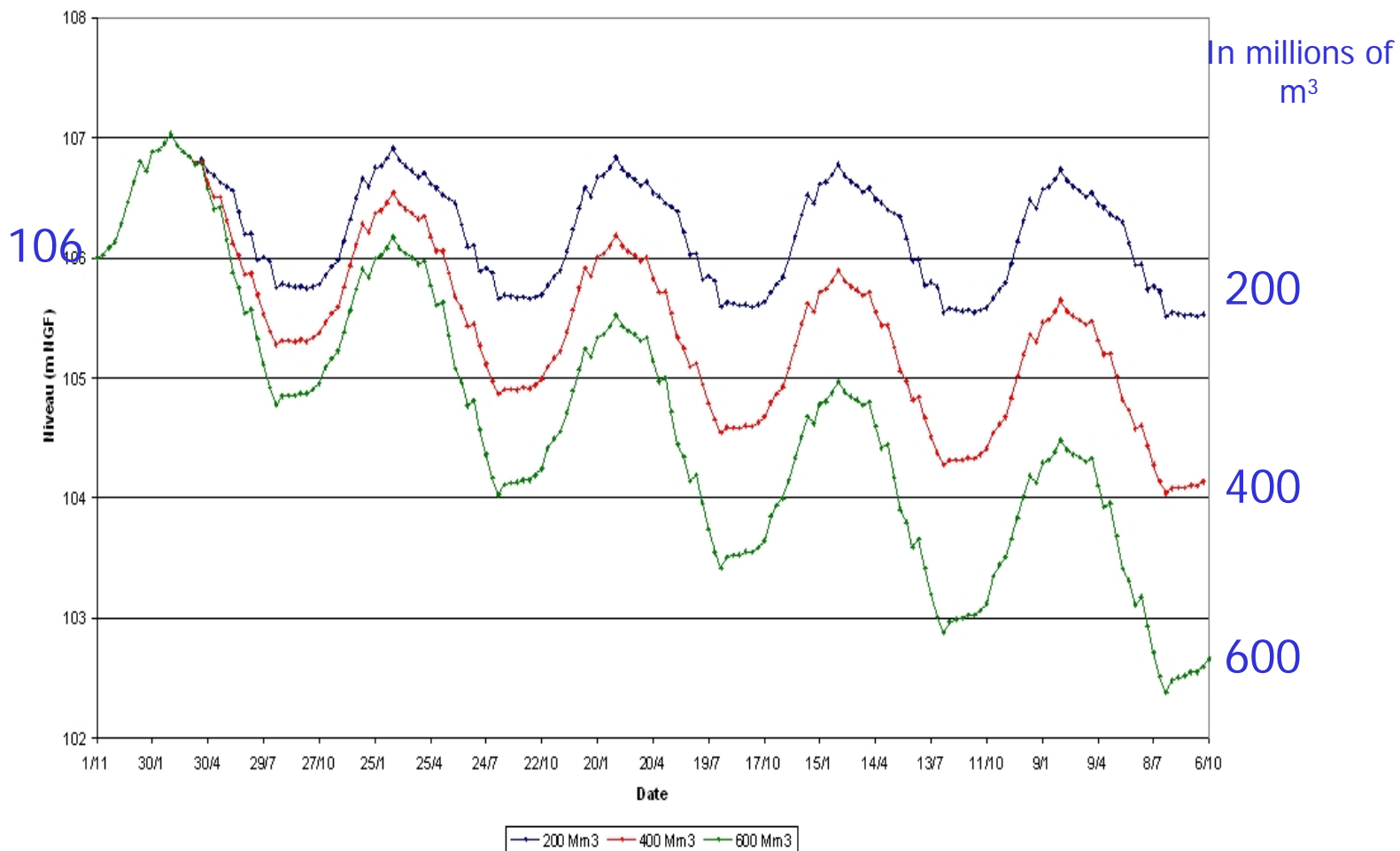


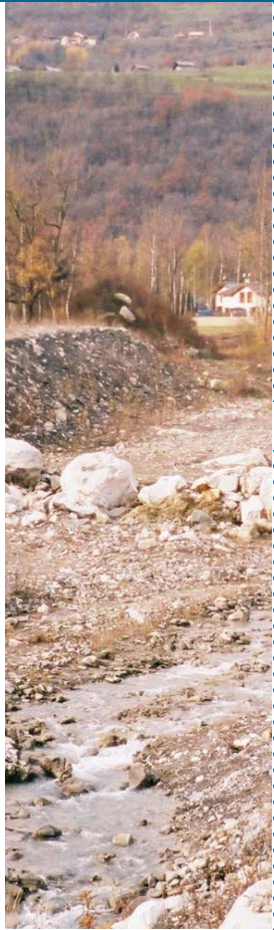
Initial level

Medium recharging (140 mm) during 5 years

Indicateur - Scénario 3

Abstracts





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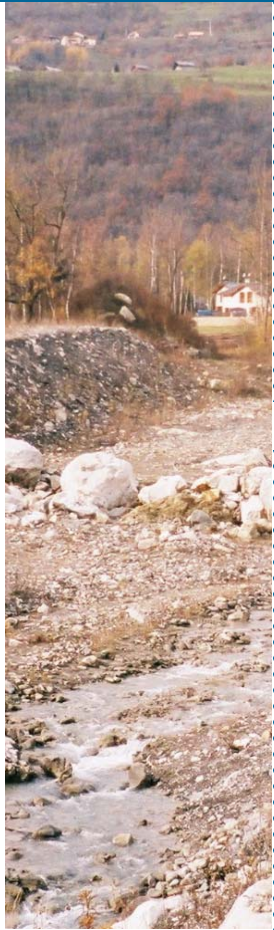
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- **SAGE must permit to strengthen the regulation system**

- Measures to apply if the third threshold is overpassed
- Adaptation to local particularities

- **Mathematical modelization has to be improved.**

- 4 complementary scenarii have to be defined.
- Utilization of « quantitative management » thematic group conclusions



Thank you
for
your attention



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