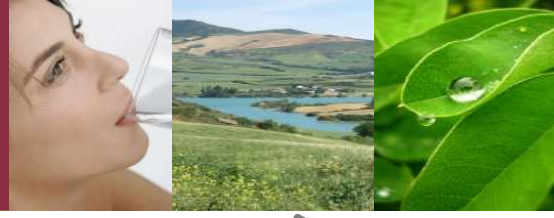
Simulated mitigation measurements to reduce nitrate in surface water using SWAT hydrological modelling in an agricultural watershed, Southwest France

José Miguel Sánchez-Pérez*, Sabine Sauvage, Jean-Luc Probst, Anais Abraham, Marion Cattaneo, Jean-Marie Lescot, Odile Leccia, Paul Bordenave

* sanchez@cict.fr

2011 SWAT

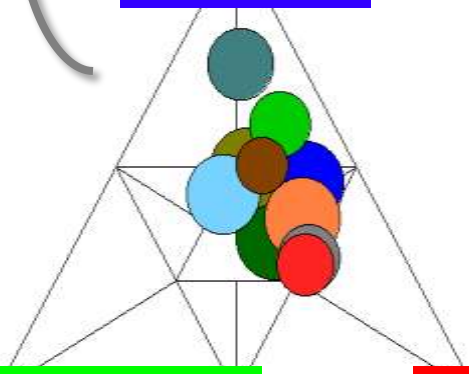
CONCERT'EAU : the process



STEP 1 – COLLABORATIVE diagnosis, construction of scenarios, and preparation of scenario assessment

Decision

Economy



Environment

Social

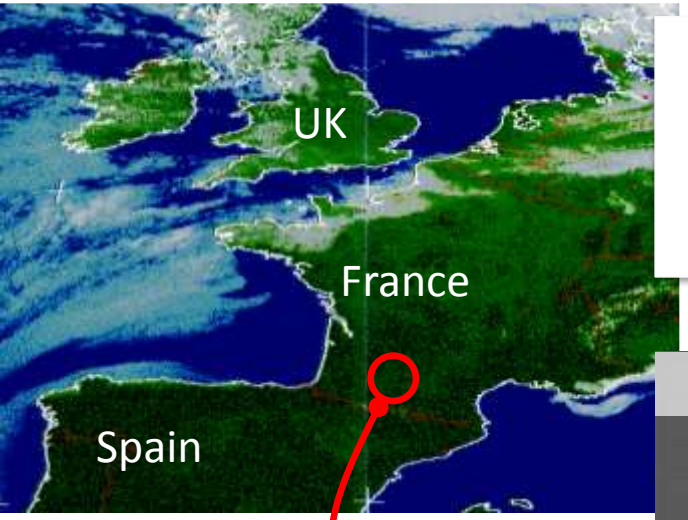
STEP 2 - EVALUATION

1- Choice of tools for the scenario assessment

2 – Assessment of environmental and economic consequences of the scenarios, and of their acceptability

STEP 3 – Collective comparison and individual choice

Gers Amont
a Concert'Eau demonstration territory



Territory

47 000 hectares
55 urban zones
40 000 habitants

Agriculture

700 farmers
37 000 hectares
cultivated

Rivers

The **Gers** river
and 3 tributaries

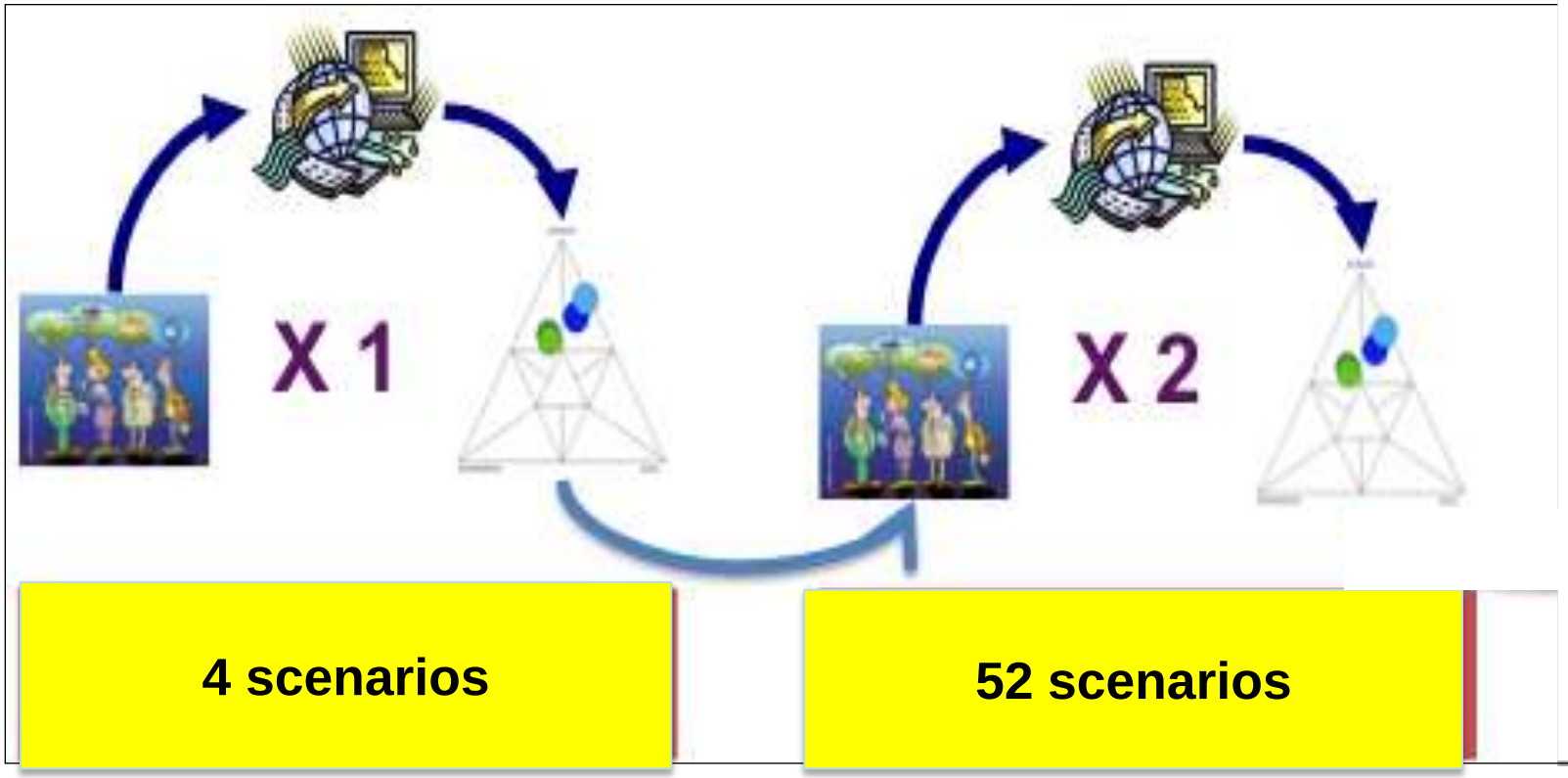
Drinking Water

five drinking water intakes serving 30,000 consumers.

- Pesticide and nitrate contamination of surface waters.

Sanchez-Pérez et al., Int. SWAT conference, Toledo 2011

CONCERT'EAU : scenarios selected



85 participants at the meeting
(**40 % farmers**)

Sanchez-Pérez et al., Int. SWAT conference, Toledo 2011

What is a scenario?

Scenario = one or several combined management operations

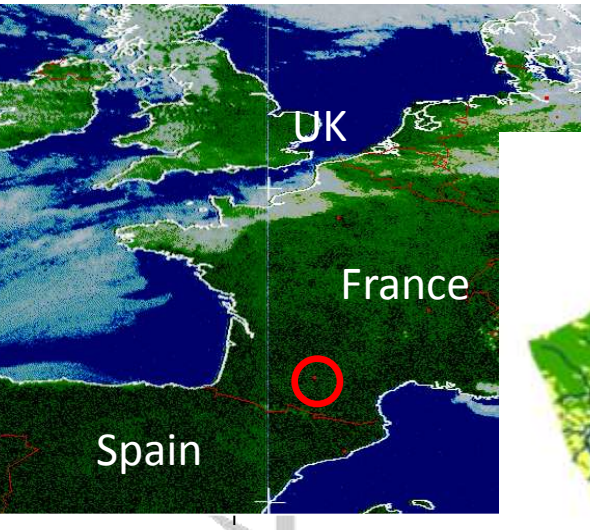
Examples of scenarios with one management operation :

Fertilization reduction; Lengthening rotations (5 years), Environmental bands etc.

Examples of scenarios in several combined management operations :

Environmental bands + organic fertilization + lengthening rotations +…

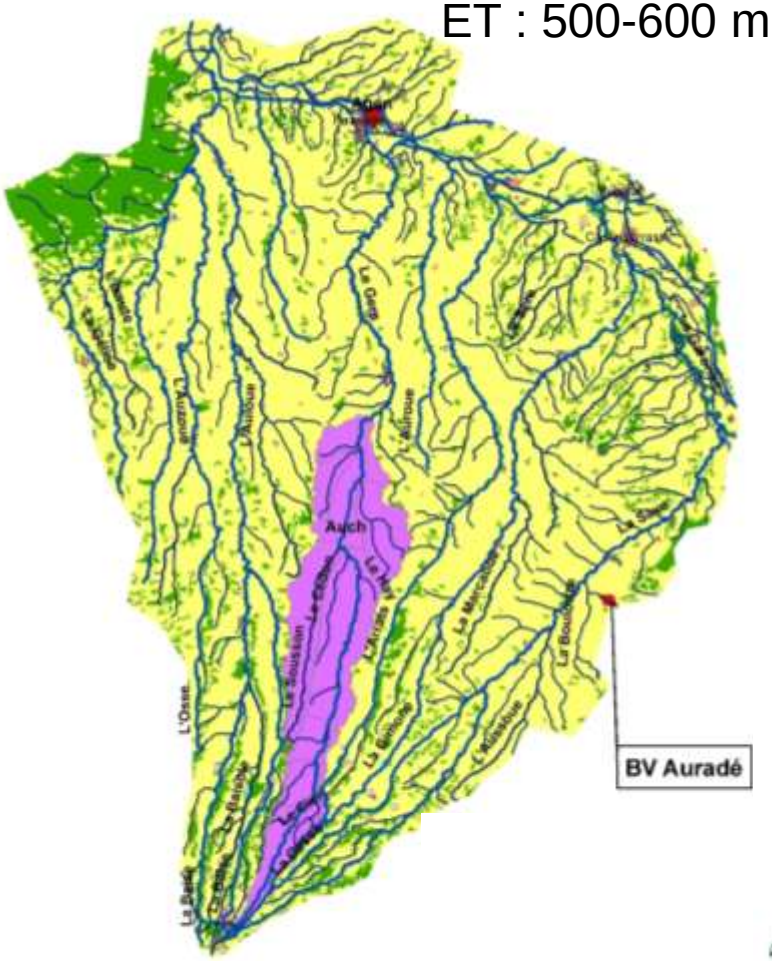
Swat projet : Gers amont



Catchment area : 660 km²

Rainfall : 600-800 mm

ET : 500-600 mm



Weather station

Gauging station

Sanchez-Pérez et al., Int. SWAT c

Soil map

Land use

Alluvial soils

Calcareous soils

Meadows
Urban
Forest
Corn
Pasture
Sunflower/Whinter weat

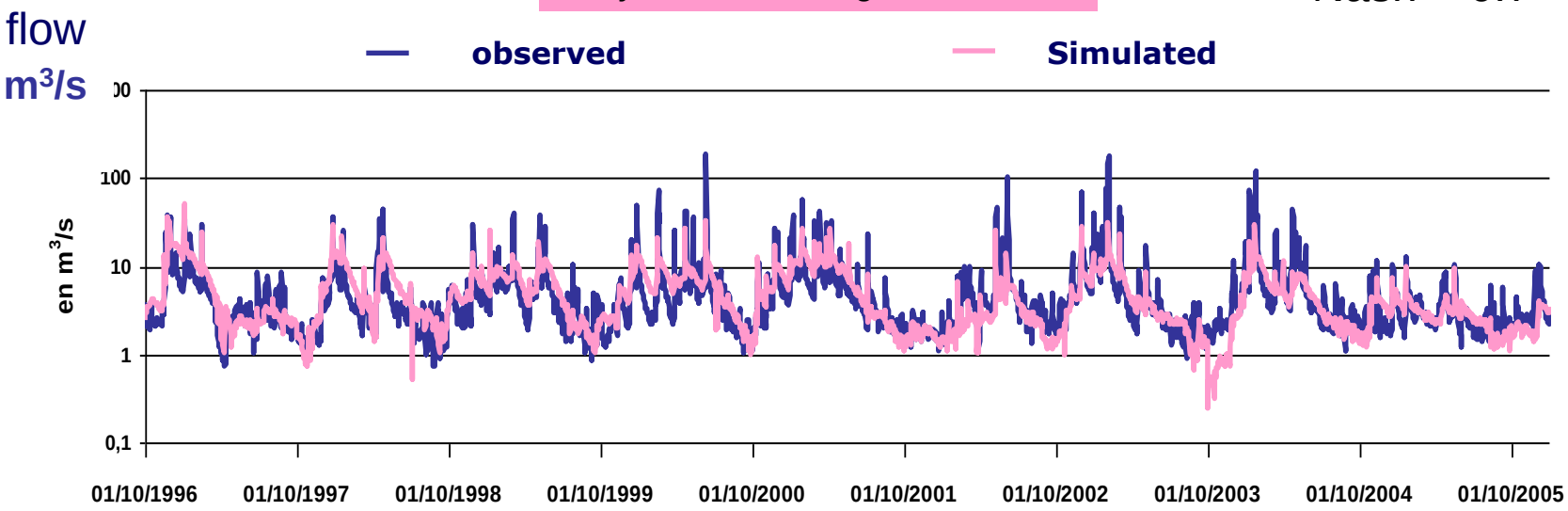
Model characteristiques

- 56 land uses, 14 soil types, 1 slope
- 46 sub-basins (500 to 3000 ha), 939 Hru
- Daily step
- Calibration : 10 years
- Validation : 10 years
- Flux simulation : mean for last 10 years
- Nitrates amounts : 200 kg/ha/year for actual scenario

Validation : actual scenario

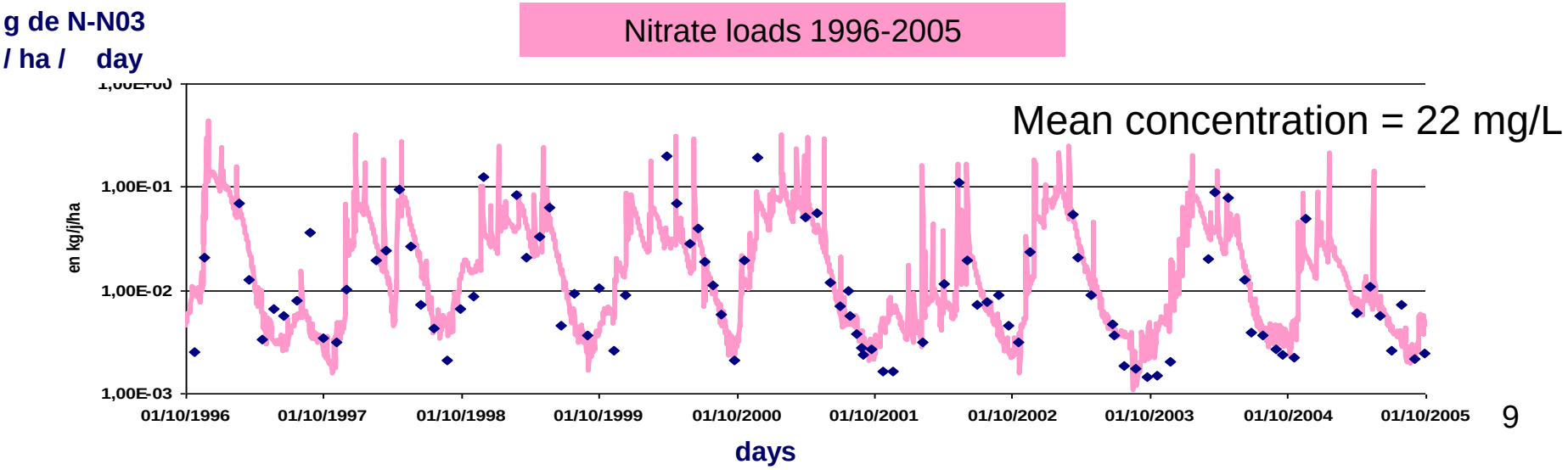
Daily water discharge 1996-2005

Nash = 0.7

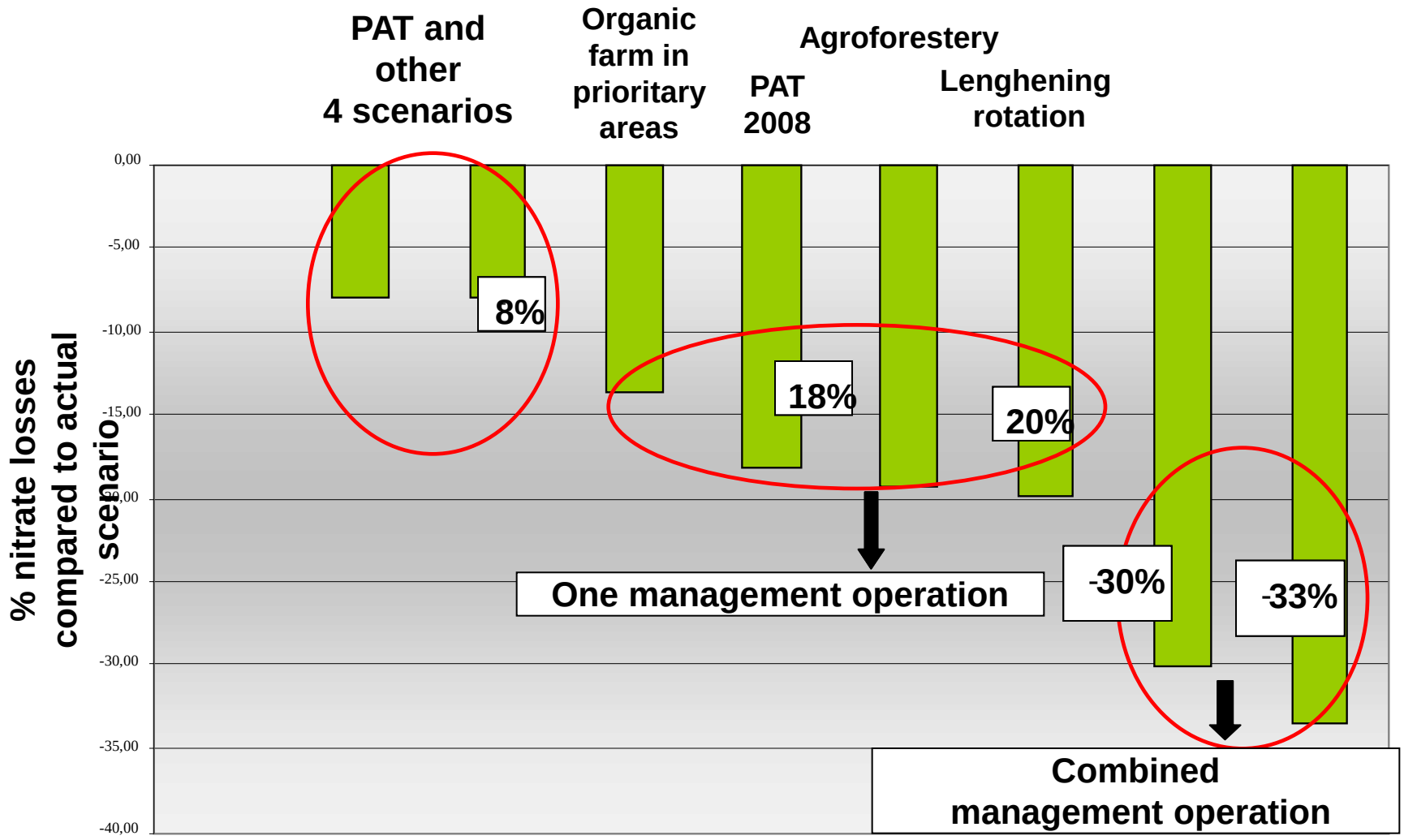


Nitrate loads 1996-2005

Mean concentration = 22 mg/L



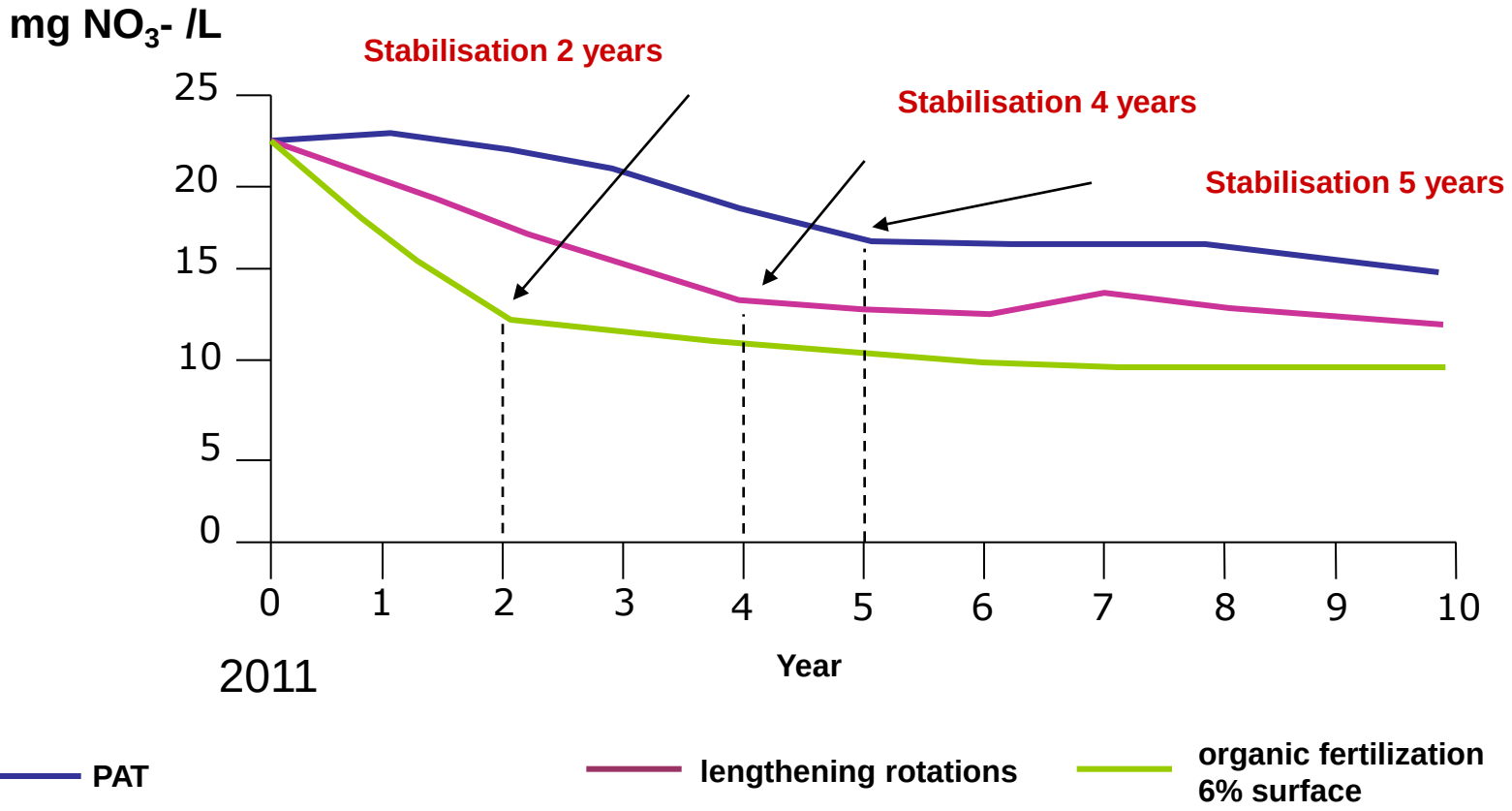
Results



Sanchez-Pérez et al., Int. SWAT conference, Toledo 2011

Nitrate concentration evolution

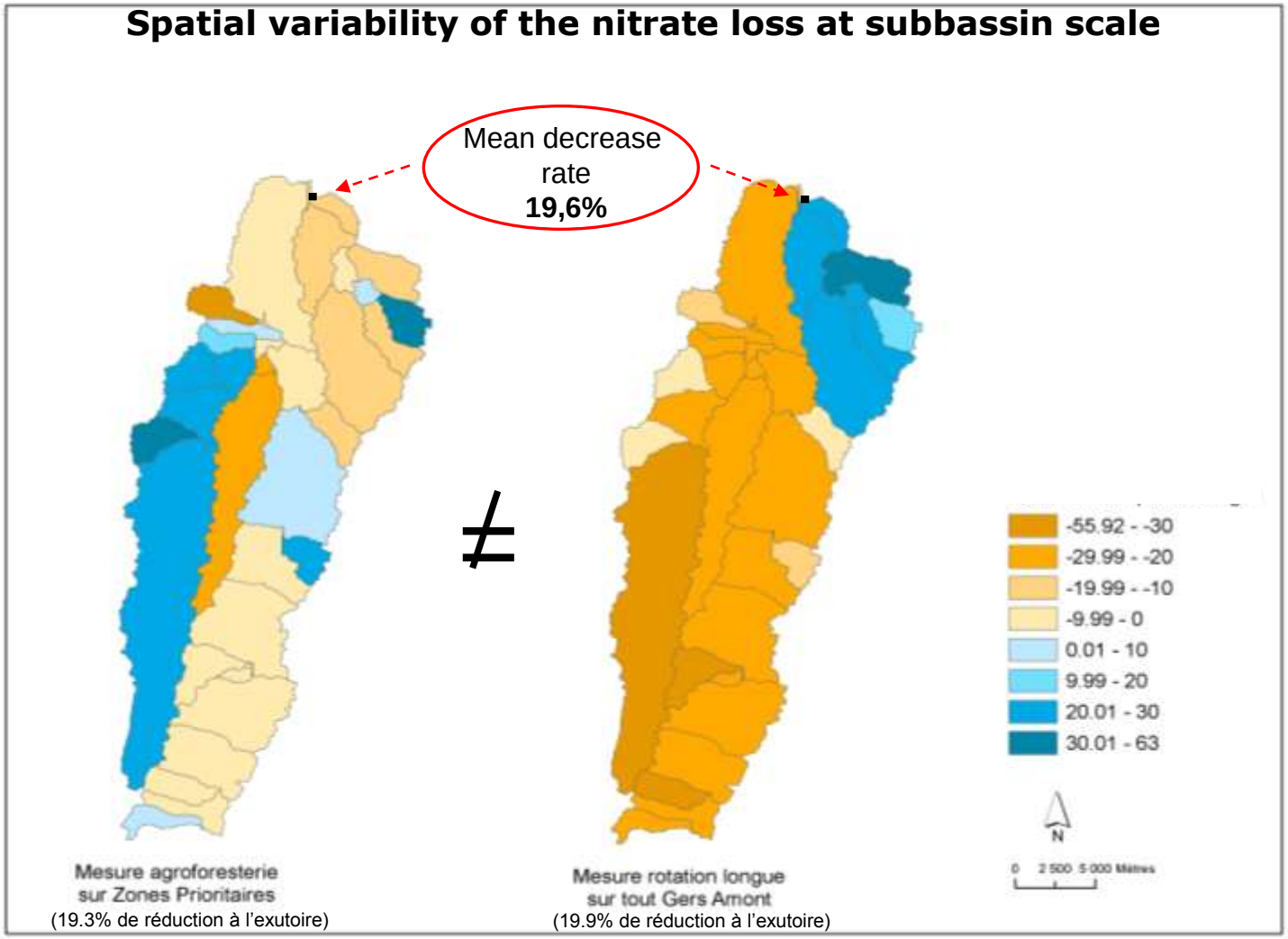
Evolution of the mean annual nitrate concentration for 3 scenarios



Sanchez-Pérez et al., Int. SWAT conference, Toledo 2011

Cartography of the contributive zones

Spatial variability of the nitrate loss at subbassin scale



Sanchez-Pérez et al., Int. SWAT conference, Toledo 2011

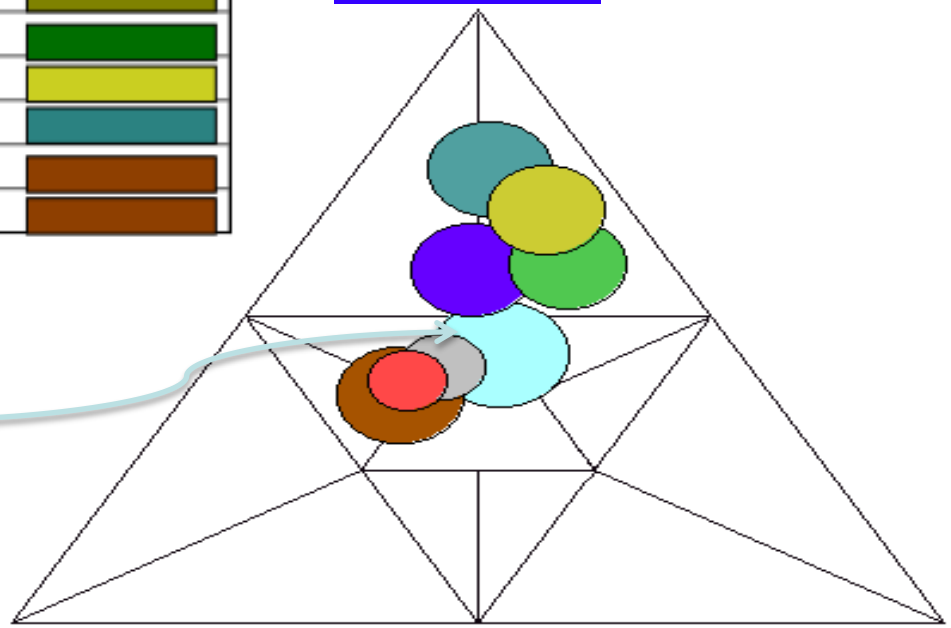
Results : integrative evaluation



Agricultural practic

	Tout Gers Amont
Arborisation Végétalisation	S17
Réduction des doses	S21
Diminution des désherbages chimique	S23
Augmentation des désherbages	S25
Allongement des rotations	S27
Bandes enherbées type luzerne	
Zéro pesticides	
Herbages + valorisation économique	
Ne pas désherber les prairies	S45
100% OGM	S49
12% de productions biologiques	
6% de productions biologiques	S51

Balanced Scenario



Sanchez-Pérez et al., Int. SWAT conference, Toledo 2011