


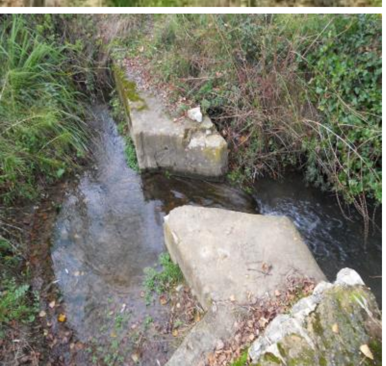

Application of a SWAT model to assess the impacts of diffuse pollution from vineyards in north-central Portugal

SWAT 2013
Toulouse France

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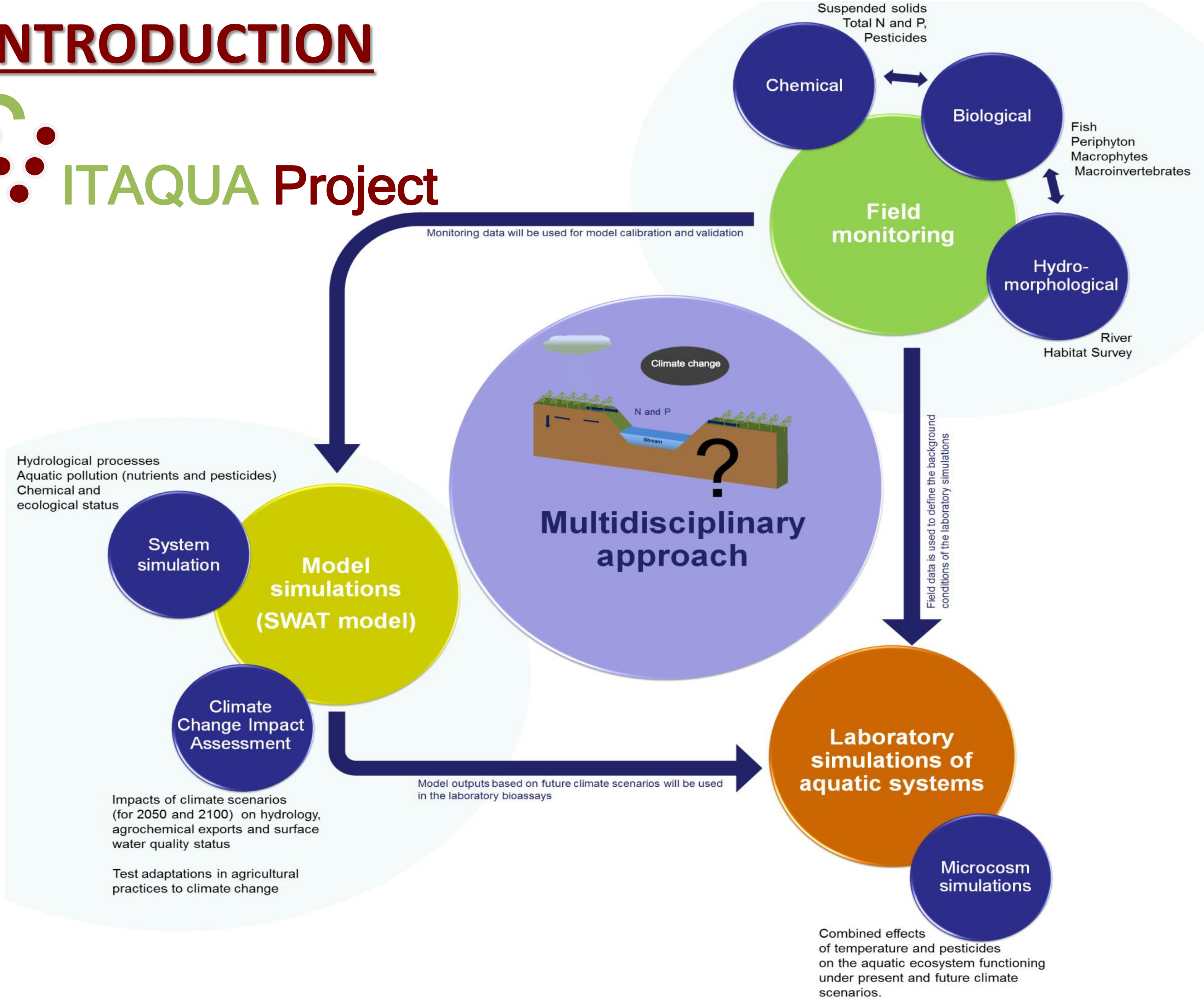
1. INTRODUCTION

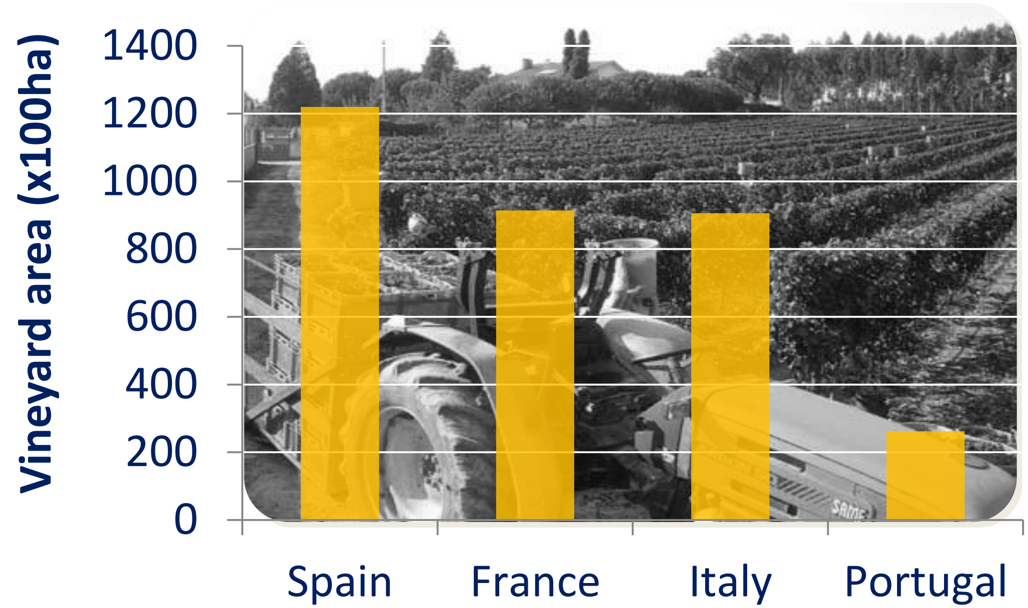
ITAQUA Project



1. INTRODUCTION

Why focusing on vineyards?

i) ***The importance of the wine sector for the national context*** (vineyards represent more than 250 000 ha)



ii) ***Viticulture is highly dependent on the use of pesticides and fertilizers*** (mainly applied from February to September)

2. OBJECTIVES

- Evaluate the **reliability of the model to simulate the input of agrochemicals (nutrients and pesticides) to aquatic systems** in intensive vineyard areas and to reproduce the water chemical status.

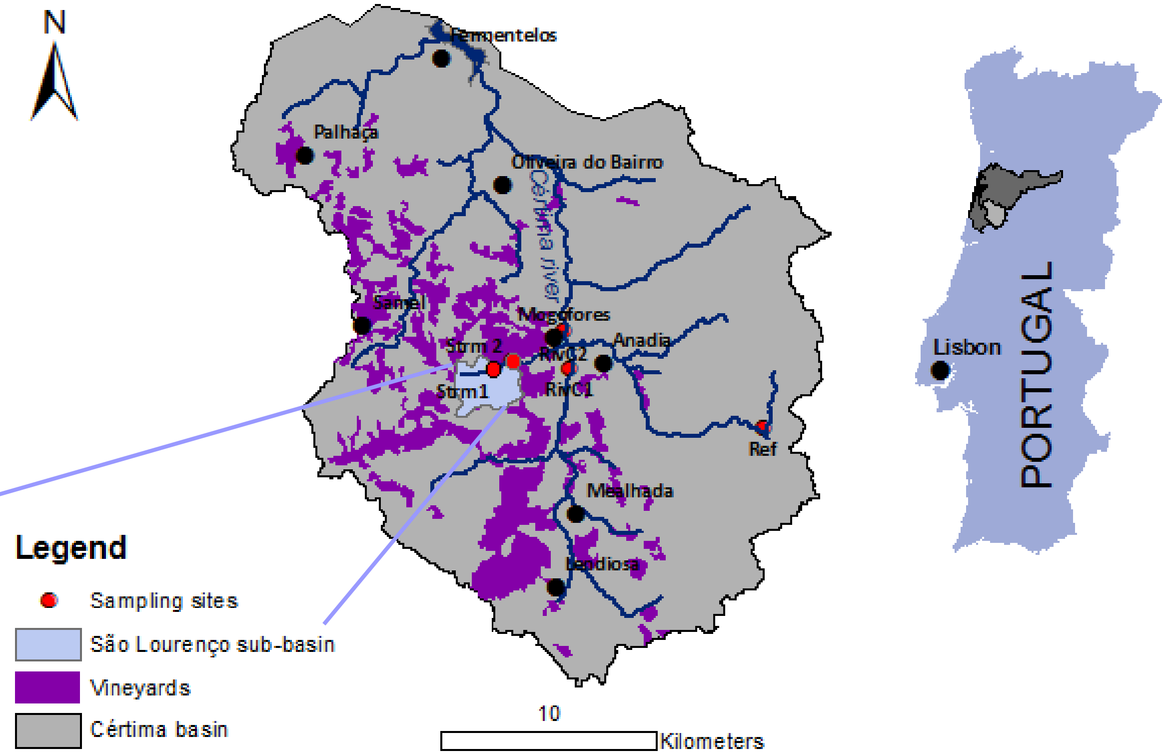
Sub-basin scale

- Evaluate the **impacts of climate changes** on vineyard productivity, hydrology, agrochemical exports and surface water quality status.

Catchment scale

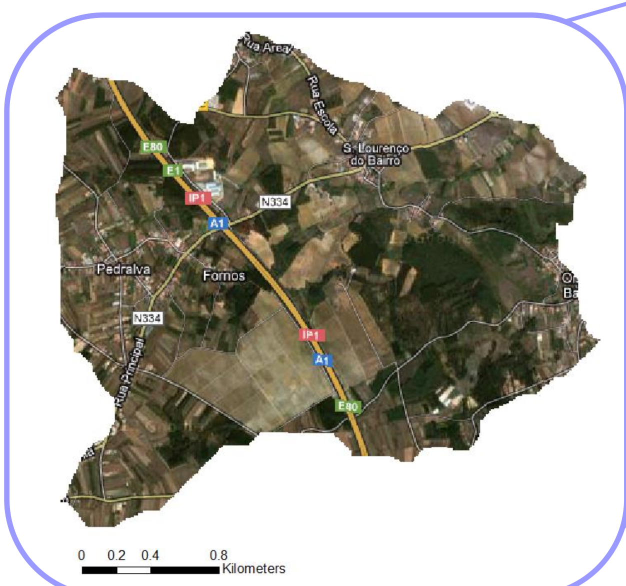
3. METHODOLOGY

Study area



São Lourenço sub-basin

- Area: 620 ha
- Vineyard area: 198 ha



Cértima basin

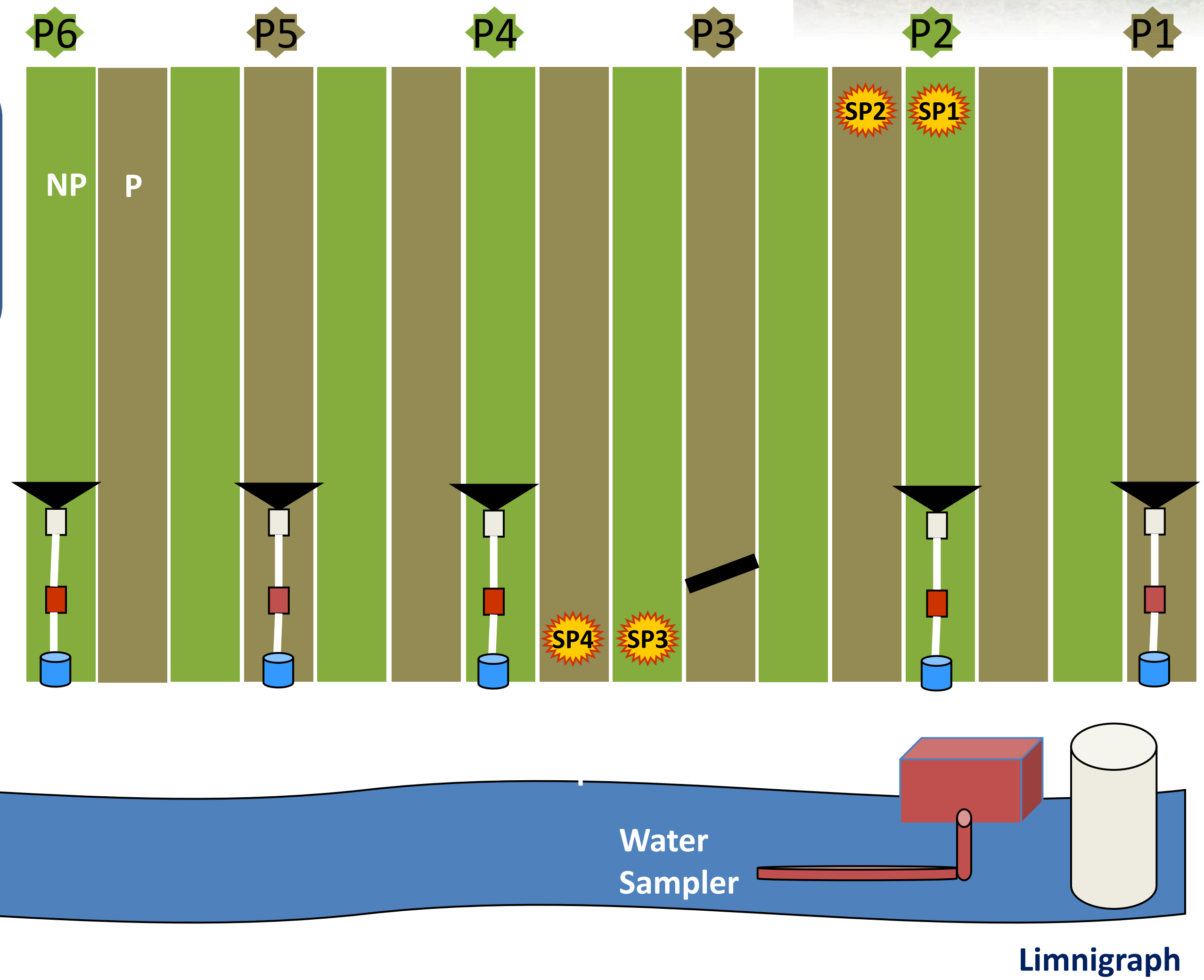
- Wine origin denomination: ***Bairrada***
- Total area: ***53 800 ha***
- Vineyard area: ***12 000 ha***

3. METHODOLOGY

Data collection – *experimental design*


Totalizer rainfall gauge


Automatic rainfall gauge



3. METHODOLOGY

Data collection *(weekly or bi-weekly)*

Runoff

Superficial waters

Groundwaters

Soil moisture

Hydrometric station

Automatic sampler

3. METHODOLOGY

Water quality parameters

- ***Basic physicochemical parameters*** – Temperature, pH, Conductivity, Dissolved oxygen, Total Suspended Solids;
- ***Nutrients*** – Nitrates, Total Nitrogen and Total Phosphorus
- ***Pesticides*** (16)

Herbicides

- Terbuthylazine

Insecticides

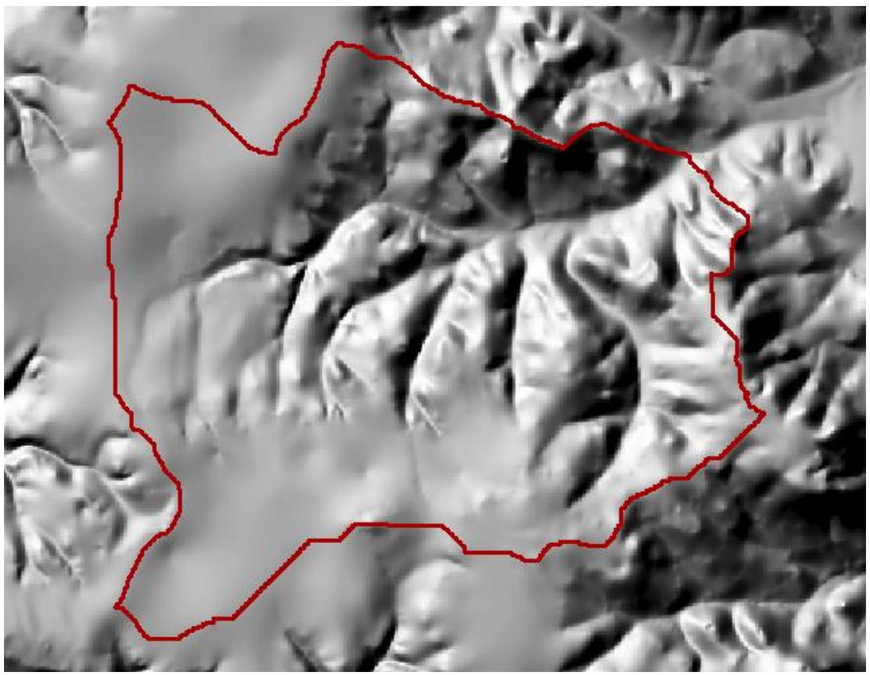
- Chlorpyrifos
- Flufenoxuron

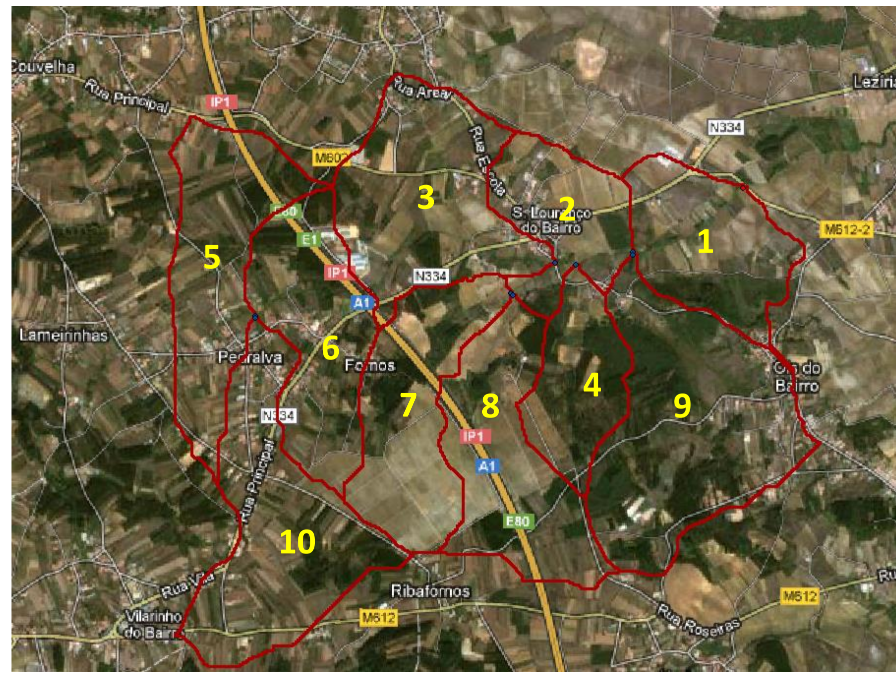
Fungicides

- Azoxystrobin
- Cymoxanil
- Dimethomorph
- Folpet
- Metalaxyl
- Myclobutanil
- Penconazole
- Pyraclostrobin
- Pyrimethanil
- Quinoxyfen
- Tebuconazole
- Trifloxystrobin
- Copper sulphate

4. MODELING

Model set-up





Digital Elevation Model (DEM)

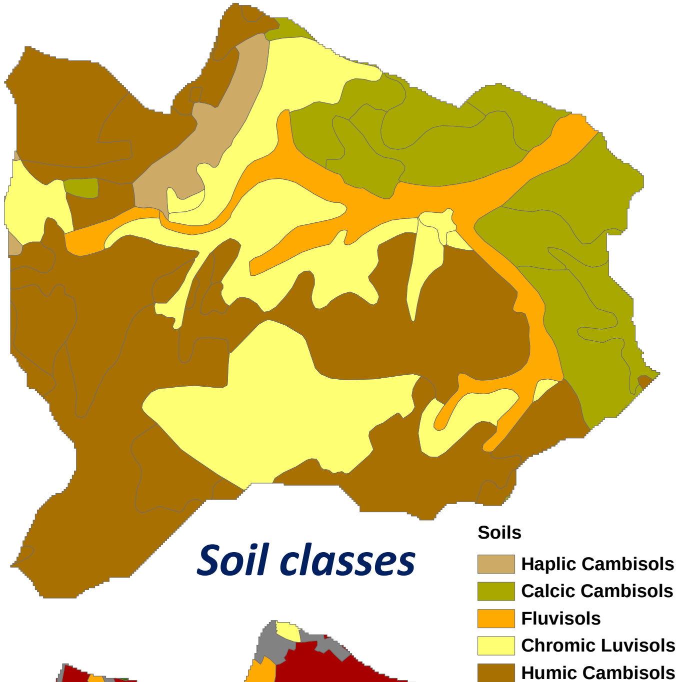
Watershed delineation

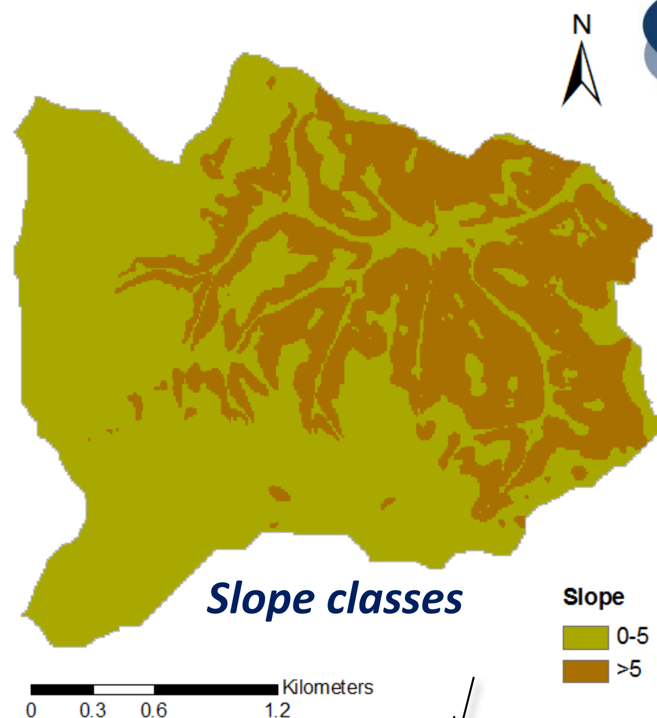
<u>Stream definition</u>: Area = 10 ha

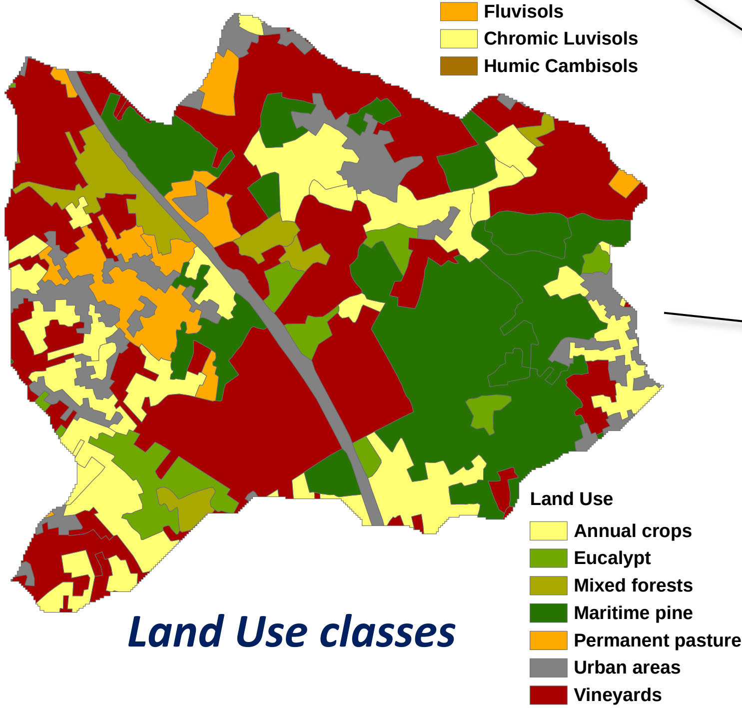
Nr. cells: 1000

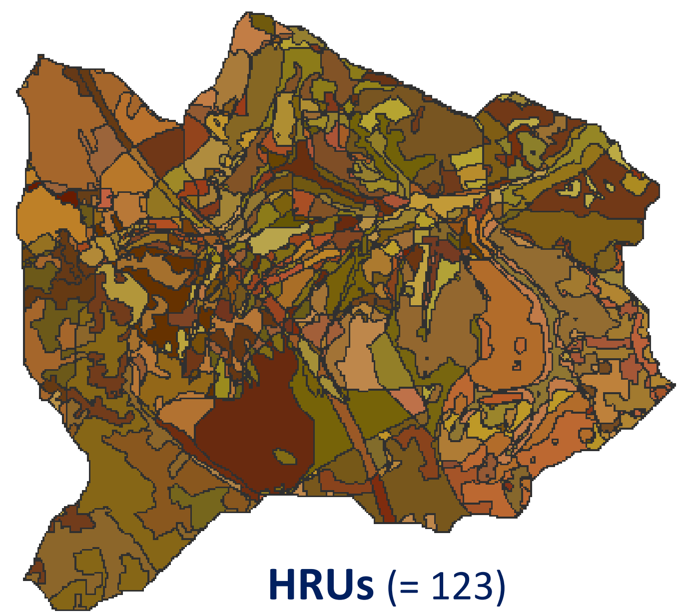
10 sub-basins

4. MODELING *(Set-up)*



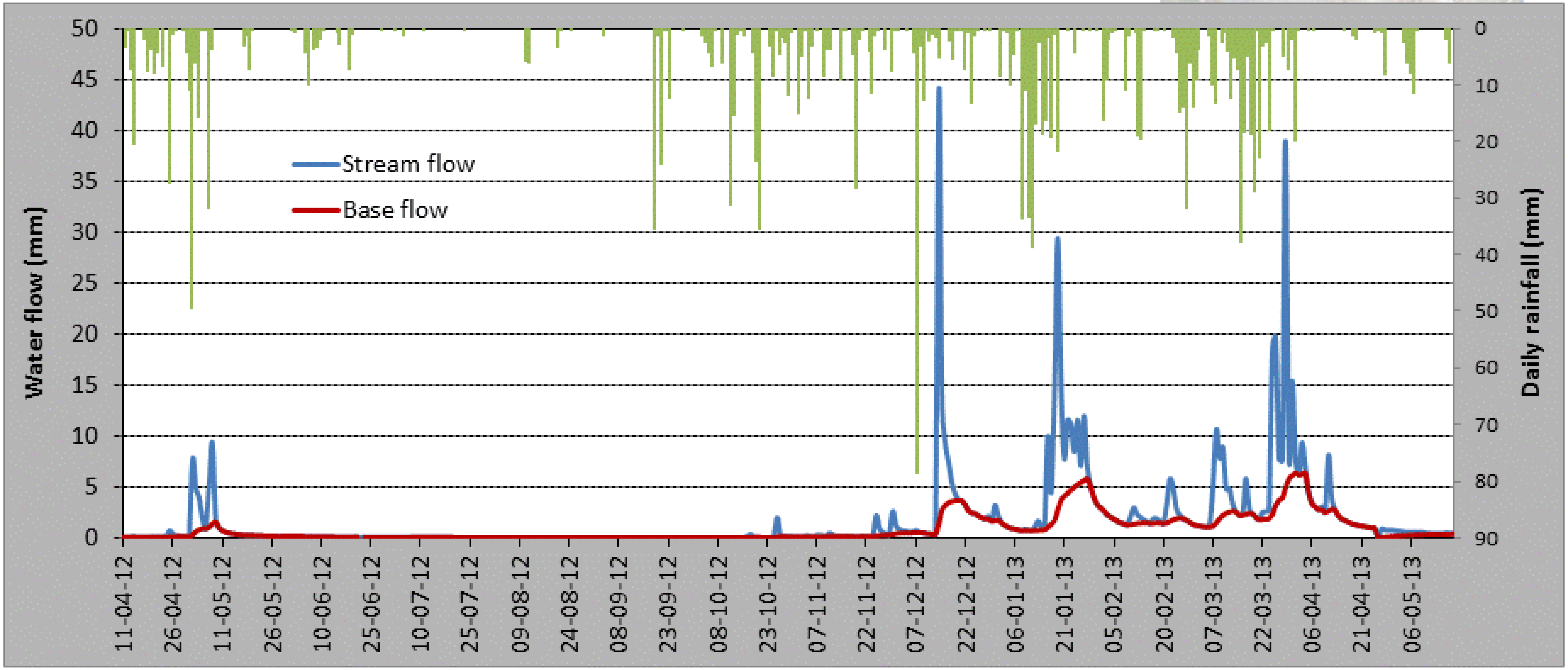






5. RESULTS AND DISCUSSION

Water flow rates



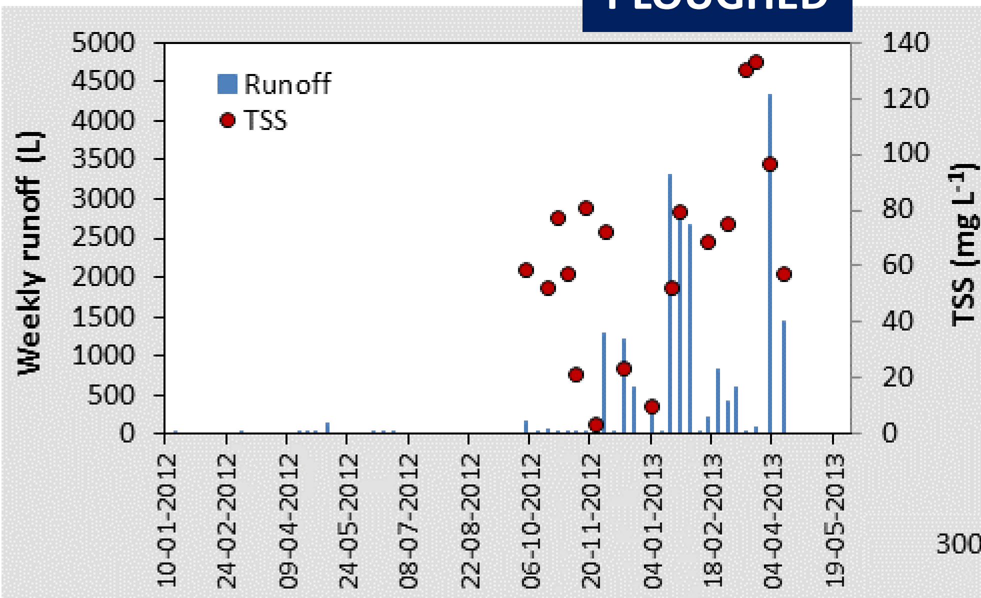
Arnold's et al. (1995) recursive filter

Baseflow recession constant (Alpha Bf) = 0.172

5. RESULTS AND DISCUSSION

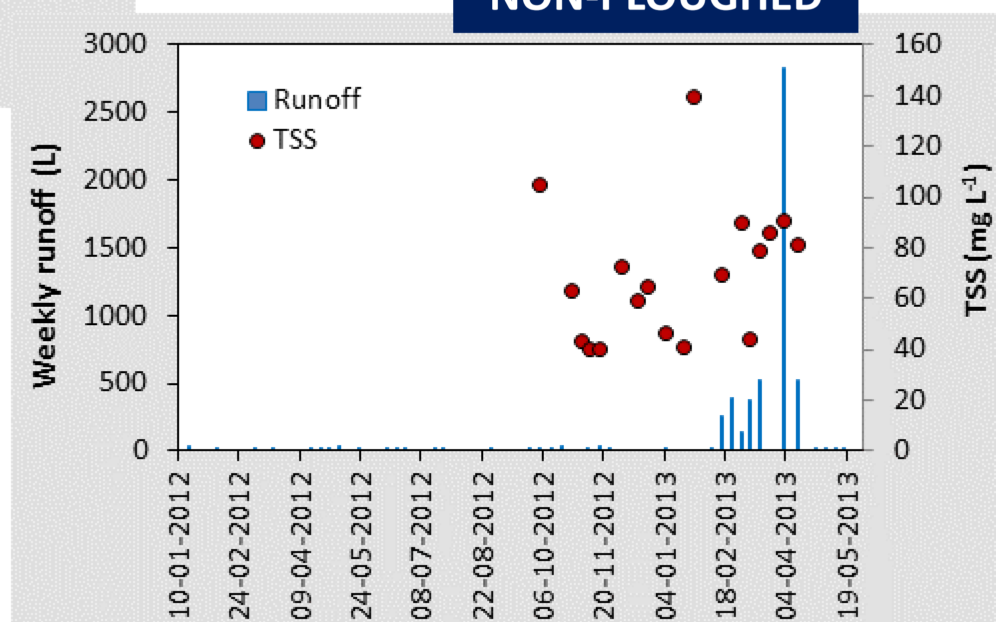
Runoff

PLOUGHED



No significant differences (ANOVA, p>0.1) in runoff between ploughed and unploughed plots

NON-PLOUGHED

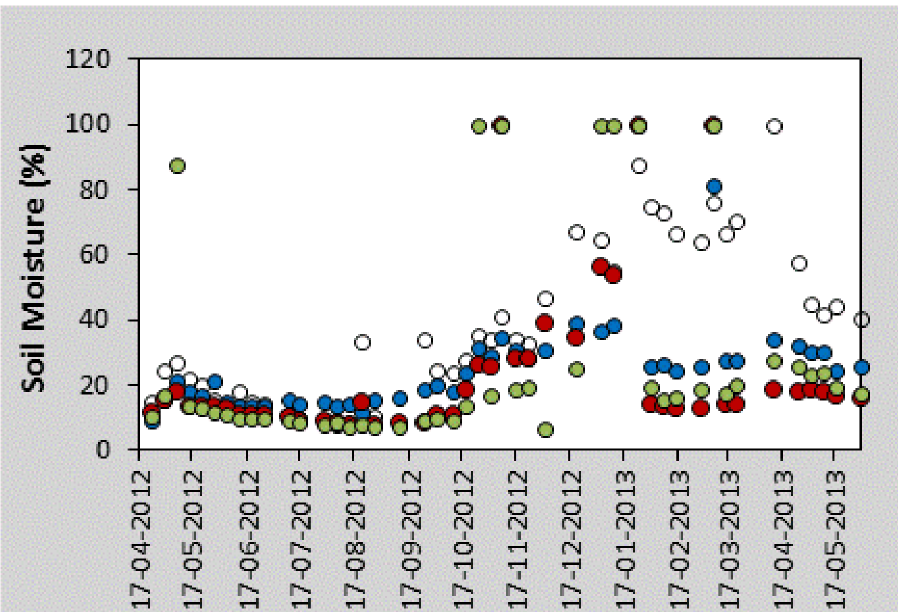


No significant differences (ANOVA, p>0.1) in Total Suspended Solids (TSS) between ploughed and unploughed plots

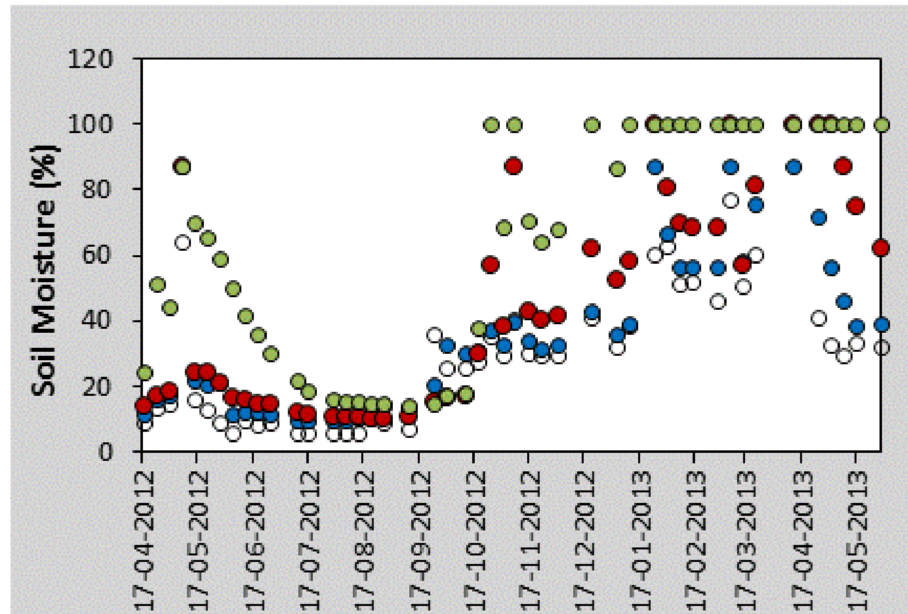
5. RESULTS AND DISCUSSION

Soil moisture

Top of the slope



Bottom of the slope



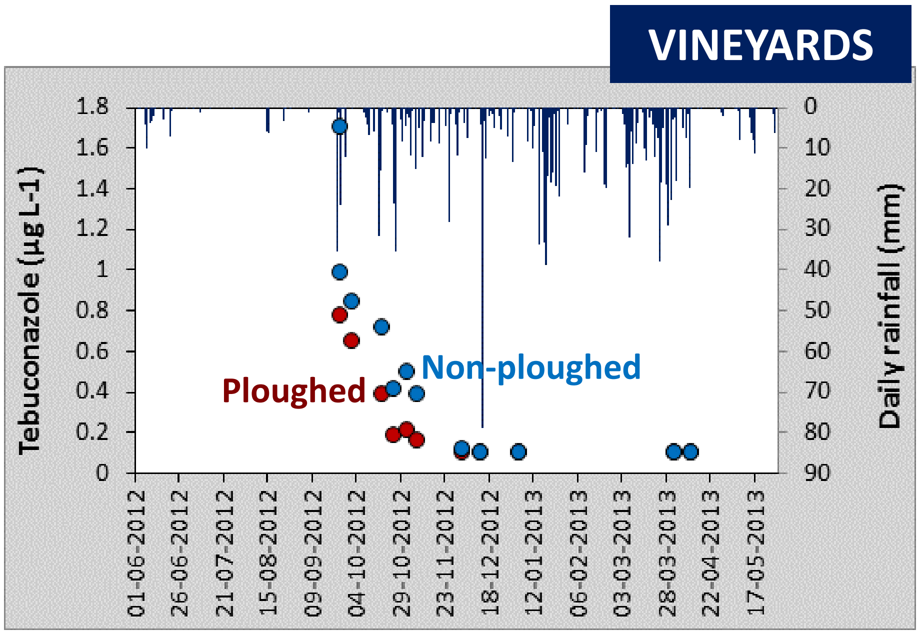
○ 10 cm ● 20 cm ● 30 cm ● 40 cm depth

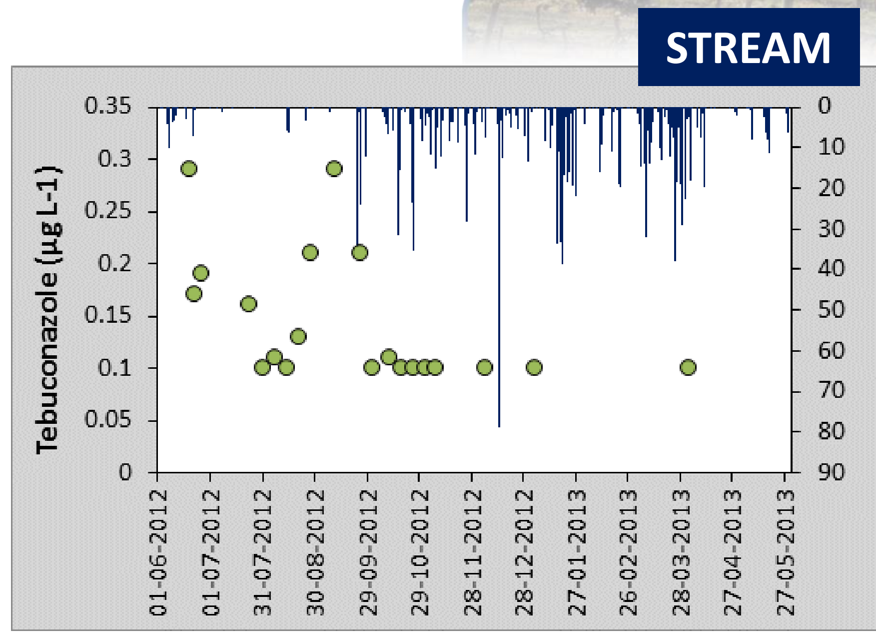
Moisture is higher on the upper soil layers

Moisture is higher on the deeper soil layers

5. RESULTS AND DISCUSSION

Pesticides





❖ **Tebuconazole** concentrations frequently > L.O.Q. in aquatic systems and vineyard's runoff

↳ WATER SOLUBILITY = 32 mg L^{-1}; DT_{50} hydro = 28 days; DT_{50} soil = 597 days; K_{OC} = 1.0

❖ **Metalaxyl** concentrations occasionally > L.O.Q in vineyard's runoff

↳ WATER SOLUBILITY = 8.41 mg L^{-1}; DT_{50} hydro = 1 day; DT_{50} soil = 62 days; K_{OC} = 163

5. RESULTS AND DISCUSSION

Microcosm experiments

EXPERIMENTAL DESIGN:

- **T = 15** and **25**ºC
- **Pesticides: Tebuconazole** and **$CuSO_4$**

- **Increase in temperature** → **higher metabolic /growth rates of primary producers** (*Microalgae and macrophyte)* **and higher ingestion rates of detritivores** (Trichoptera)

- **Increase in temperature** → **higher pesticide toxicity**

Combined effects of CLIMATE CHANGE AND DIFFUSE POLLUTION → **Negative impacts on aquatic ecosystems .**

6. CONCLUSIONS

- ✓ **First steps of SWAT are done**
  (Watershed delineation and HRU definition)
- ✓ **Compilation of meteorological data and of vine ecophysiology information** *(in progress)*

7. FUTURE WORK

- **Model Calibration**
- **Model Up-scaling**

ACKNOWLEDGEMENTS

FCT
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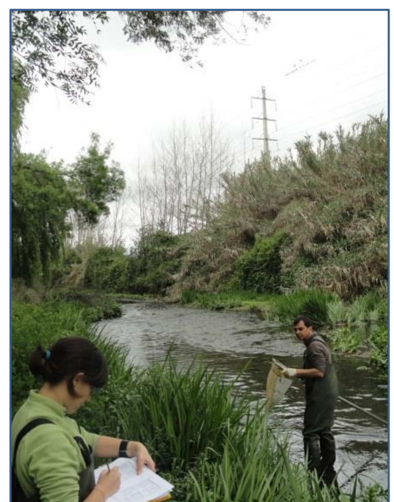
ITAQUA Project

Estação Vitivinícola da Bairrada
125 anos
1887 2012



Thanks for your attention!!!