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IARIA

Towards accurate traceability of water reaching the reservoirs

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Index

- The problem of chemicals arriving the reservoir
- The context
- Objectives
- Some previous attempts
- Solution overview
    - Input data
    - Phases 1 and 2
    - QGIS plugin
    - Data analysis

The problem of chemicals arriving the reservoir

- Rumblar reservoir in Jaén, Andalussia (Spain)
- The reservoir supplies water to 88.000 inhabitants
- Today is at 10% of capacity
- In the basin of the reservoir there are several villages, forests and crops, especially olive groves.

The context

The problem

- Chemical analysis determines high levels of nitrates and other substances in the reservoir
- Reservoirs supply drinking water to the population
- The reservoir is surrounded by crops (olive groves)
- It's not easy to know which plots contribute the most to these discharges

Proposed solution

- To establish correlation between chemical analysis points and origin
- Tracking the water through its path to the reservoir
- Considering:
  - orography
  - land use type (agricultural, etc.)
 - soil absorption
  - rainfall maps

Objectives

- Obtain information about water traceability arriving at a reservoir
- Which crop plots contribute with rainwater and in which percentage
- Make easy the process of analysis to the end-user
- Contribute to soil conservation and water quality
- Use a real use case: the Rumblar reservoir
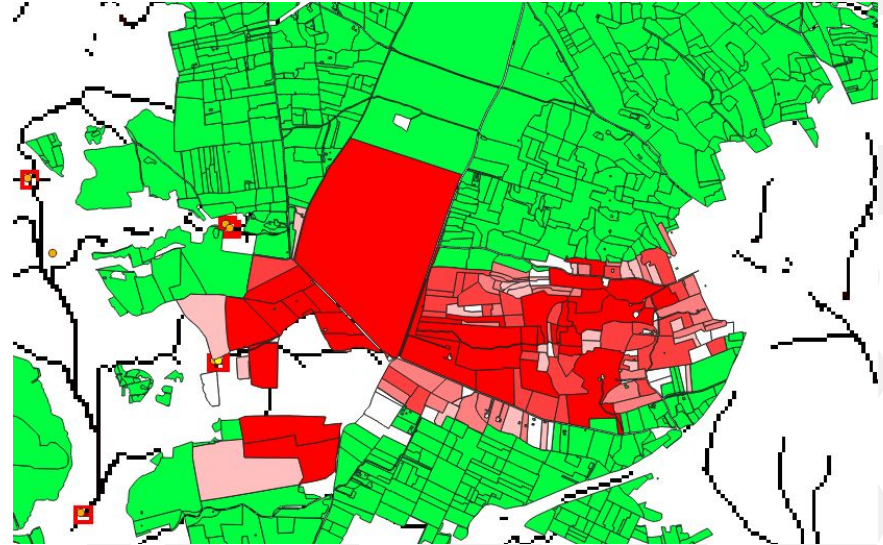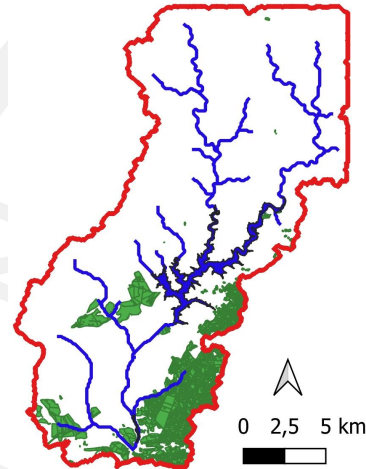
Some previous attempts

By simulation software (Maya)

- Good visual results
- No control on the process
- No empirical results
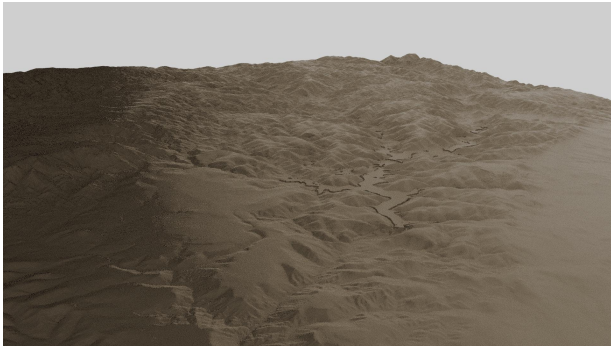
GIS tools (QGIS)

- 2D image and additional layers
- No control on the process
- No control on new variables

0   2,5   5 km

Solution overview

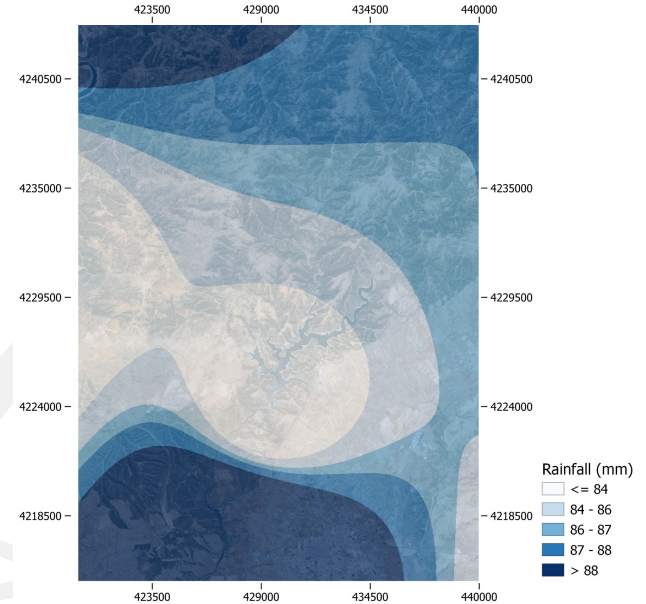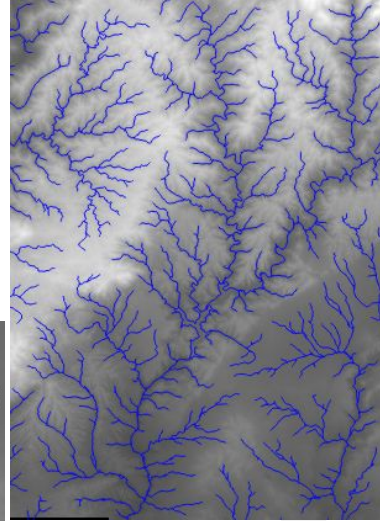**Extend D8 algorithm for drainage network**

- Two executions of the D8 algorithm
- *Algorithm 1:* obtains **R**epresentative **P**oints
- *Algorithm 2:* stores all the information about traceability in these RPs
- Implement QGIS plugin for the end-user
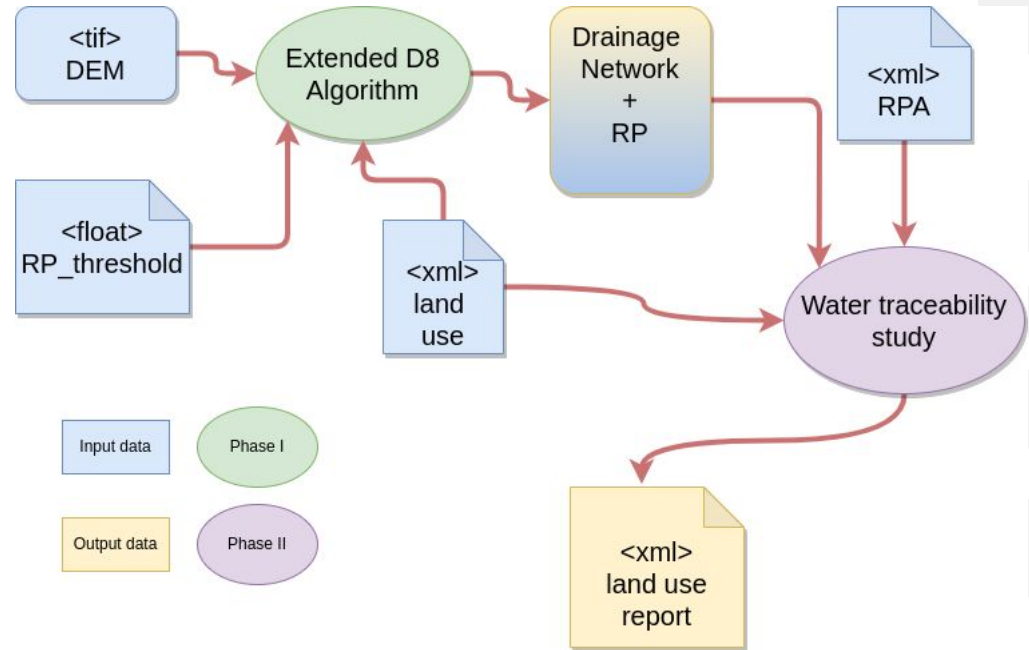
Input data

**Several files are required:**
- DEM (orography)
- plot polygons and land use
- rainfall maps

Phase 1: find Representative Points

**An RP is a point in which flowing water overcomes a threshold**

- These are points belonging to the drainage network
- The user can add new points, ARP (Additional Representative Point) (e. g. for specific chemical analysis)
- Interesting points are those close to the reservoir
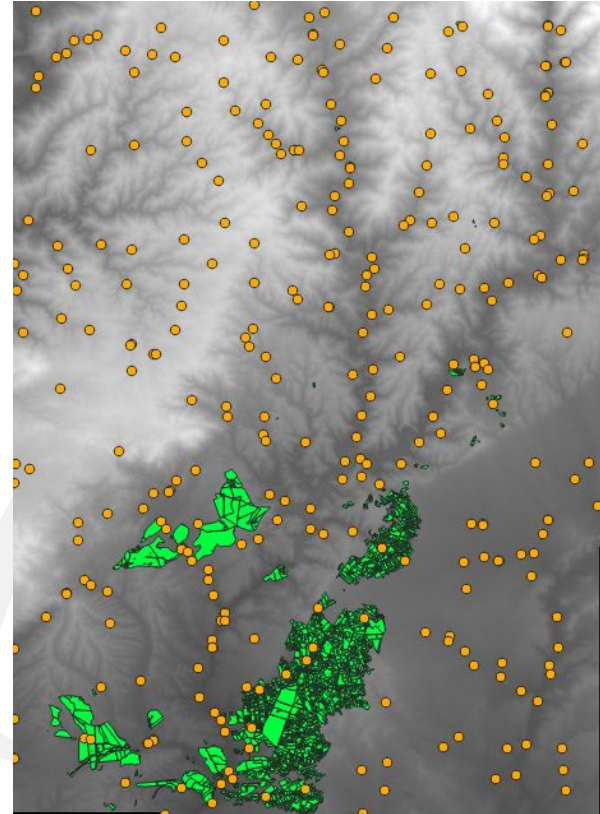
Phase 2: study water traceability in RPs

**For each RP a tree-based data structure maintains:**

- For each iteration of the process
  - the accumulated water and the agricultural parcel from which the water originates
- The data structure maintains O(n*k*p) entries
  - n = # RP points
  - k = # iterations of the algorithm
  - p = # plots pouring water in the RP
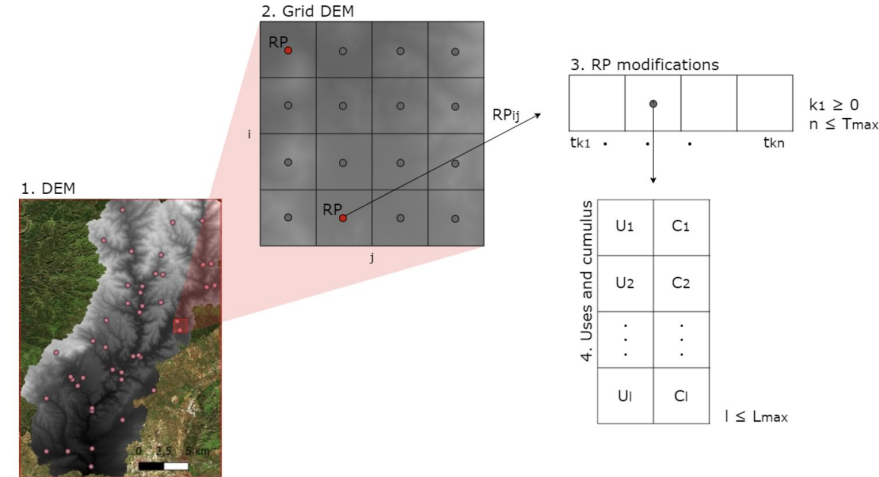
Phase 3: QGIS plugin
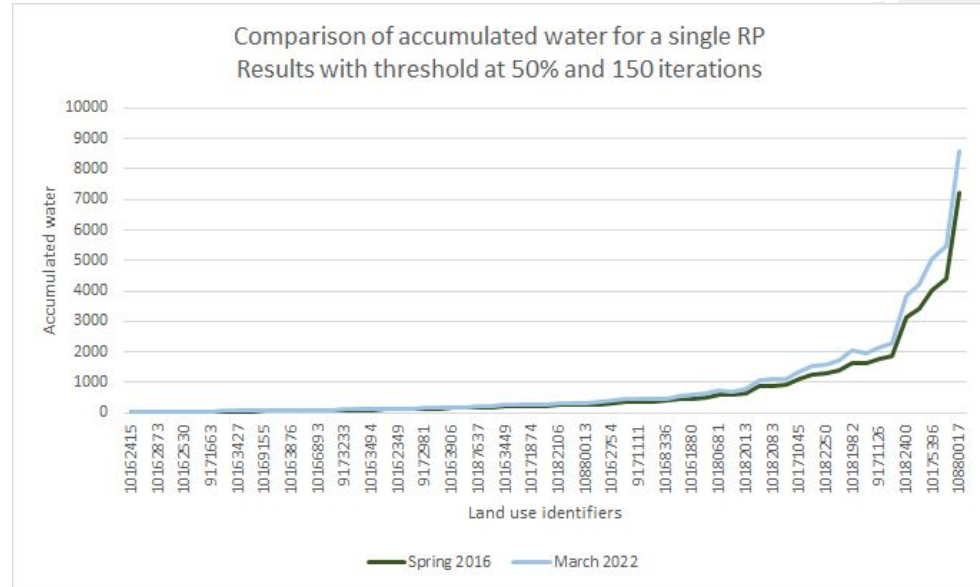
Python plugin with the functionality:
- Define color range
- Click on a RP point (interactive)
- Obtain visual and textual information
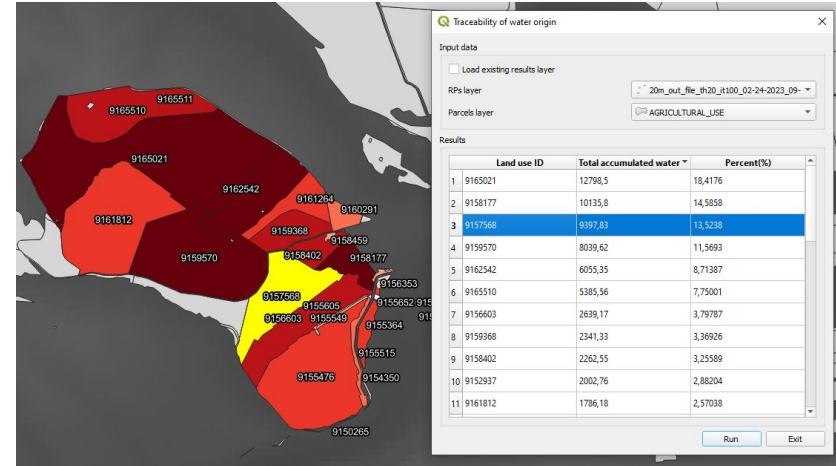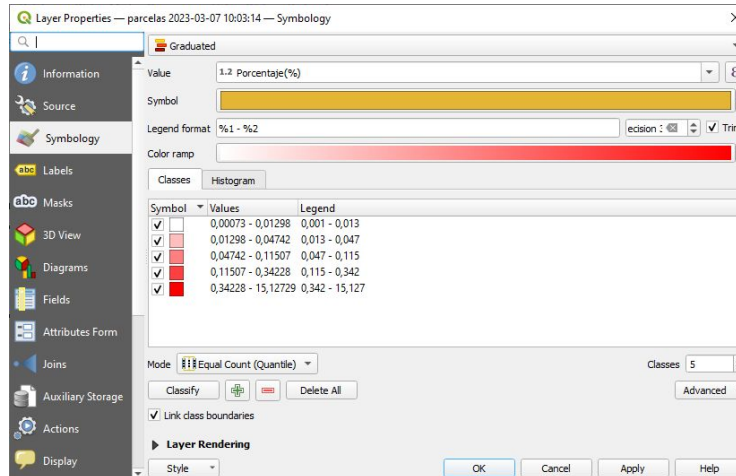
Phase 4: Data analysis

Information sorted by contribution:
- Choose different rainfall maps
- Observe the plots that most contribute
- Obtain information about the water accumulated (approximated)

The Rumblar reservoir

Thanks for your attention

Questions??

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