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Jazmin Arguello Velazquez, Herve Parmentier, Luc Merchez, Ioan Negrutiu,  
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# Preliminary water and river accounts for the Rhône river watershed

## Premiers comptes écosystémiques de l'eau et des rivières sur le bassin versant du Rhône

Jazmin Arguello Velazquez<sup>2</sup>, Hervé Parmentier<sup>1</sup>, Luc Merchez<sup>1</sup>, Ioan Negrutiu<sup>2</sup>, Jean-Louis Weber<sup>2</sup>

<sup>1</sup>Laboratoire EVS, UMR 5600, <sup>2</sup>Laboratoire IXXI, Institut M. Serres, ENS de Lyon, 15 Parvis René Descartes, 69007 Lyon

### Context and Introduction

Ecosystem degradation is absent from accounting standards, creating systemic ecological debts. Internalizing the consumption of natural capital has been the focus of INSEE "comptes du patrimoine naturel" in France, of several programs launched by the United Nations, Eurostat, European Environmental Agency, and lately the Aichi objectives on biodiversity.

On that frame, we are developing Ecosystem Natural Capital Accounts (ENCA) to evaluate the state of ecosystems, services and resources they provide with the purpose of completing accounting standards from which ecosystem degradation is absent.

ENCA integrate balances of bio-carbon, land, water and river systems infrastructure and biodiversity. In this poster, we present the river water accounts and land cover changes of the French Rhône River watershed.

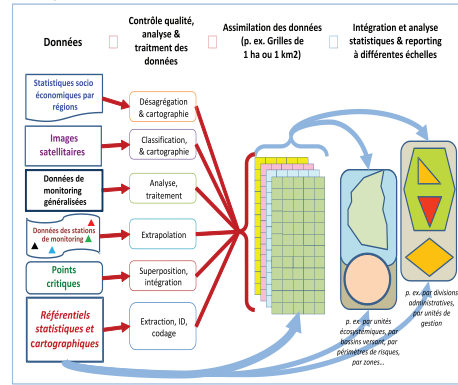


Fig 1 - The sub-basins of the Rhône hierarchical and aggregated in ENCA basins

### Objective and challenges

Measure the impact of economic activities on ecosystems structures and functions and the sustainability of the resource/services that they provide with the purpose of completing accounting standards from which ecosystem degradation is absent.

Establish balance sheets to record ecological debts and credits of countries, enterprises...



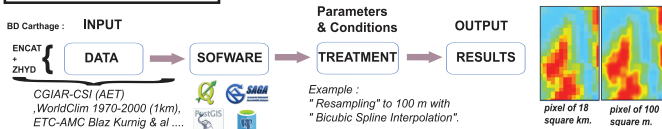
- Ecosystems' complexity
- Heterogeneity of data quality, quantity and spatial and temporal distribution
- Proof of concept
- Scale

### Methods: data infrastructure

Accounting framework

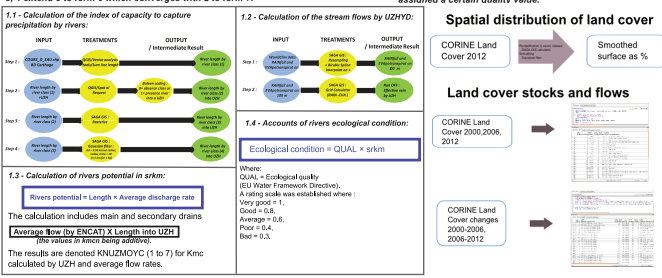
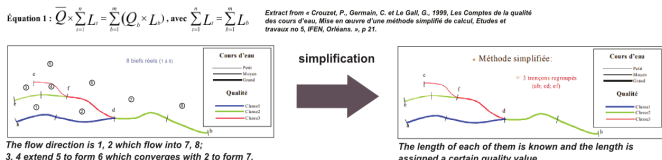
- Basic quantitative balances of stocks, flows and resource use of land/biodiversity, biocarbon and water, combined with a diagnostic of ecosystem health.
- Sustainable capacity of all delivering services and measurements of degradation or enhancement with a composite unit of ecological value (Ecosystem Capability Unit, ECU).

#### Geomatic treatments and results :



#### Mathematical calculation :

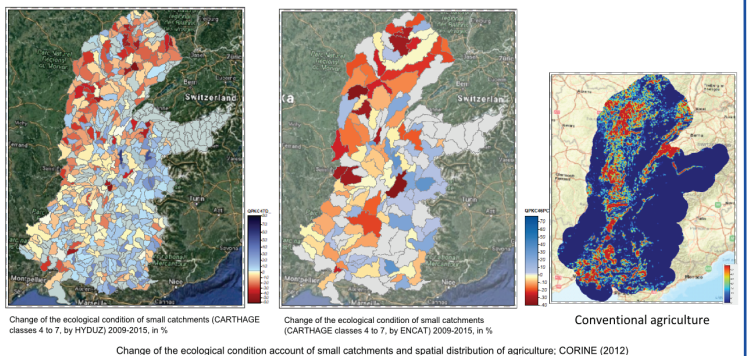
The sum of the kmcn calculated per reach (index b) is equal to the calculated total kmcn as an average rate applied to all the calculation sections, indexed by L.



### Results, chosen examples

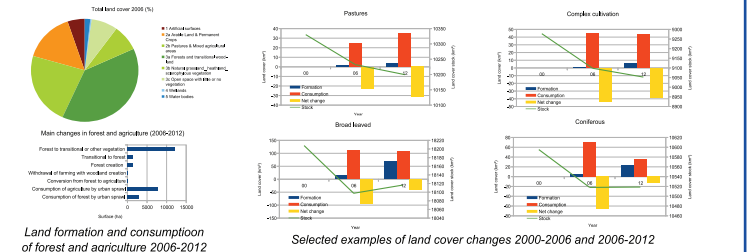
#### • Ecological condition of small rivers, state and change 2009-2015

The maps of changes in the ecological condition of small French rivers (order classes 4 to 7) show an improvement in mountain areas and a strong degradation in the plain. The pollution of small rivers is local and can be related to land use (compare figures). For river classes 1-3, pollution accumulation upstream is the rule ; the analysis indicates a strong correlation with density of obstacles to flow and a prevalence of low water quality on right banks (not shown).



#### • Land cover stocks and flows 2000-2012

47% of Rhone basin's land cover consists of forest and natural areas, while 38% is agricultural land. The data also show decline in vegetated area.



### Discussion and future perspectives

The presented proof-of-concept for water and land accounts at 1ha resolution is an application globally reproducible at regional scale.

#### Forthcoming improvements include :

- extension to the entire Rhône watershed (cooperation with EPFL and OFEV).
- evaluation of accessible versus available water resource.
- calculating the ecological value of the watershed area (see scheme) to inform on degradation, stability or improvement trends over time.
- optimization and automatization of the ENCA tool (data accuracy, annotation, etc..)

