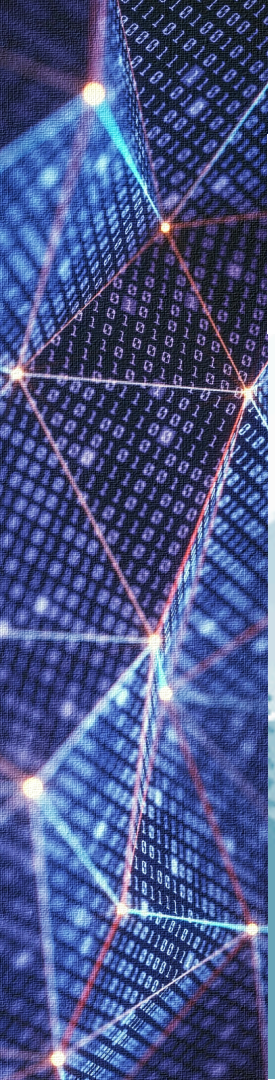

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DEPARTAMENTO DE RECURSOS HÍDRICOS Y CIENCIAS AMBIENTALES (iDRHiCA)

NH1.7 EDI

Hazard Risk Managment in Agriculture and Agroecosystems

Optimising agri-environmental measures at catchment scale through specific allocation with the SWAT model – A case study in southern Andes of Ecuador

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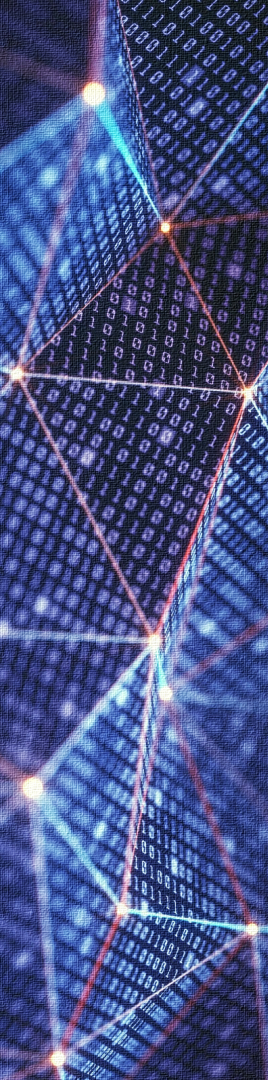


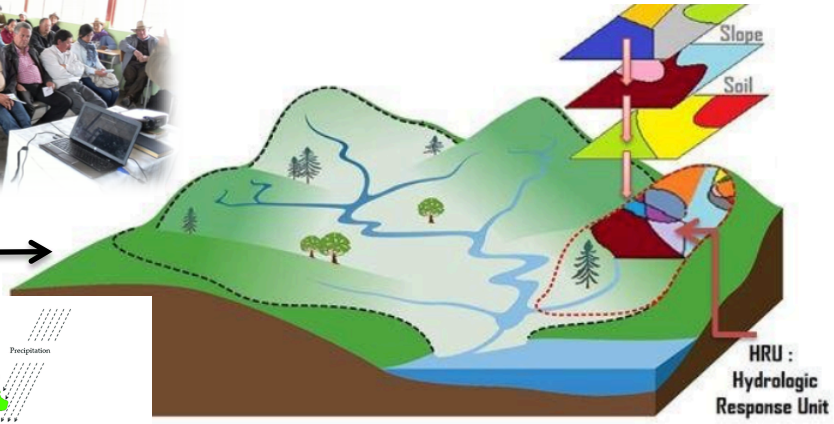
Introduction

- **Agro-enviromnetal measures** are key for sustainable agriculture
- There are places in the earth applying some sustainable practices with high potential to explore for **exporting measures to specific productive systems**.
- The **allocation of specific measures** are key in the territory to reach effectivity when asses environmental indicators.
- **Optimisation** is a common process to effectivelly allocate the measures. This involve several criterias of complex systems.
- **Scenarios and modeling** will be performed to increse reliability of the optimisation process.
- **Participatory process** is key for realistic scenarios in the near future

Methodology

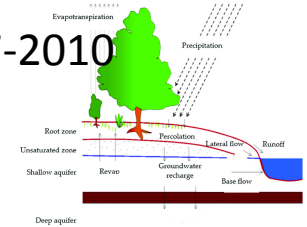
Collection of current measures

Optimisation units definition(HRUs)

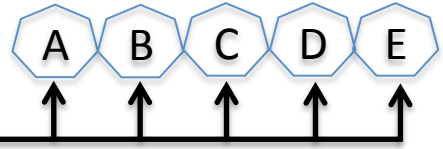


Basemodel defintion & assessment

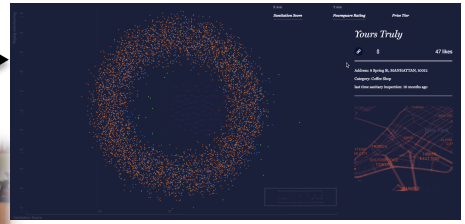
1997-2010



Scenario definition & assessment

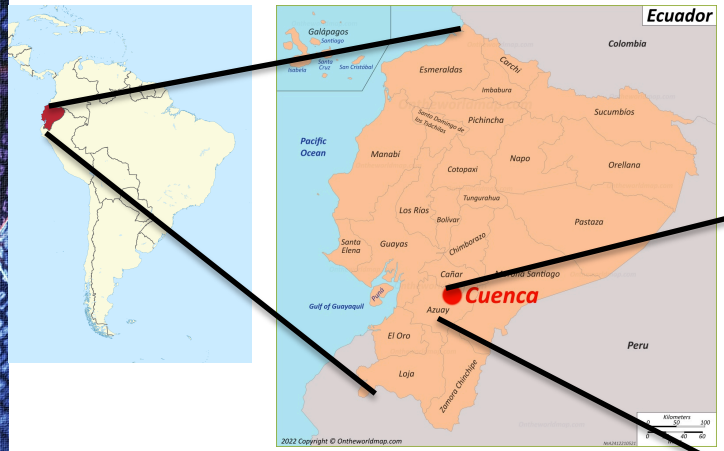


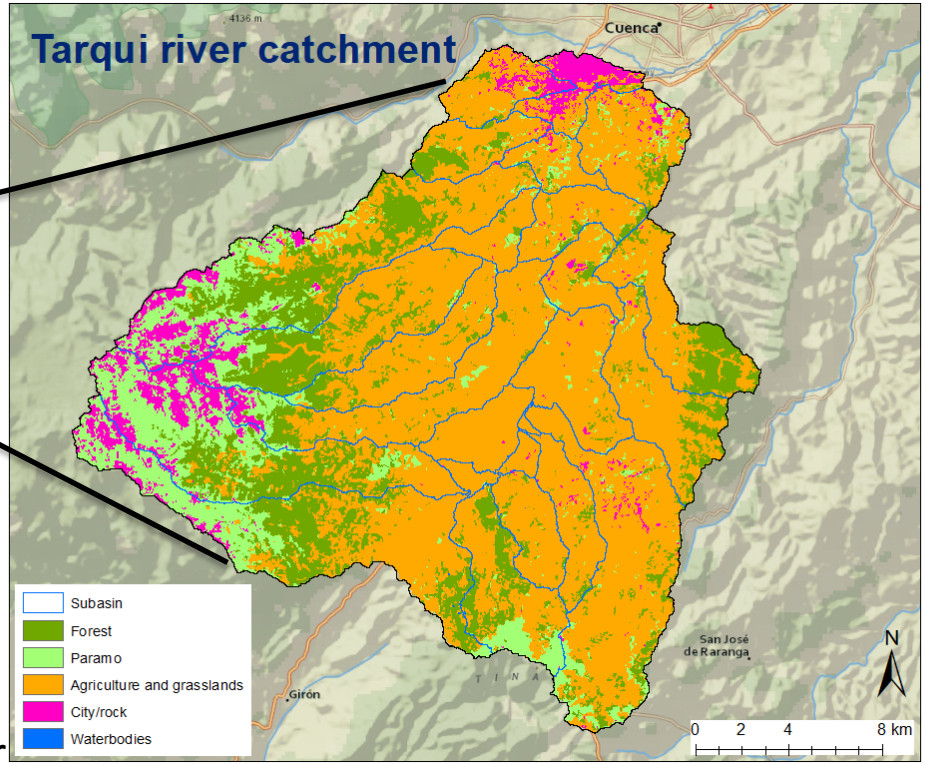
Optimisation process



Participatory Assessment of optimisation results

Case Study



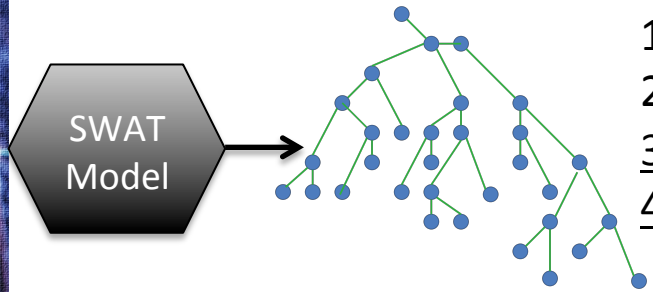


Importance:

- agricultural and livestock pantry of Cuenca City
- Water provision
- Water regulation of Paute river
- Rural development hotspot

Optimisation structure

- Allocation of resources
- Maximising temporal availability of resources
- Minimising demand of resources
- Shortest path
- Multi-level combinatorial problem
  - Duration of performing an agro-environmental measure
  - Number of performers within the group that performs this action
  - Total execution time of all action depending on the quantitative composition of groups of performers



1st level: subbasins (22)
2nd level: HRU (250)
3rd level: Static/dynamic HRUs
4th level: Limiting HRUs performance

Scenario definition

Scenario Name	Irrigation	Food Provision	Water Resources demand	Fertilization rates	Crop rotation and Sequences
A. CURRENT-MAX	+5%	+10%	+10%	+20%	
B. IRRI-MAX	+20%	+10%	+20%	0.0%	
C. FOOD-MAX	0.0%	+20%	-10%	-5%	
D. SUSTAINABILITY	-10%	+10%	-15%	+10%	
E. MIXTURE-A&C	0.0%	+15%	0.0%	+10%	

Results

Model	R2	NSE	PBIAS
Baseline (calibration) (1997-2005)	0.62	0.58	-9.22
Baseline (Validation) (2006-2010)	0.57	0.55	-11.01

- Reliability of flow gauge
- Pcp distribution (just 3 in ground stations)*

Variables assessed for each scenario with SWAT (used for optimisation)

Scenario/Variable	Irrigation Volume	Biomass	Crop yield	Base flow	Fert. Rate	ET
Irrigation	X	X	X	X		X
Food provision		X	X			X
Water resources demand				X		X
Fertilization rate					X	X
Crop Rotation		X	X			X

Results

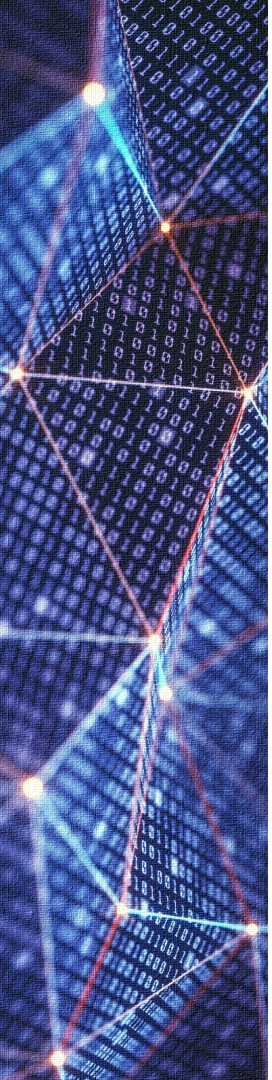
Scenario Name/ Water balance variation	OUT FLOW	ET	Base flow	Lateral flow	DA recharge
A. CURRENT-MAX	-5.7%	+8.3%	-11.9%	-3.4%	-4%
B. IRRI-MAX	-12%	+6.2%	-14.4%	-6.7%	-7%
C. FOOD-MAX	-10%	+7.5%	-7%	-8%	-6%
D. SUSTAINABILITY	**+0.5%**	**-4%**	**+0.3%**	**+4%**	**+3.8%**
E. MIXTURE-A&C	-7.8%	+5.6%			

1st level: subbasins (22) → Uplands sensitive to Crop rotation!

2nd level: HRU (250) → Grassland HRUs area key!

3rd level: Static/dynamic HRUs → Increase static HRUs!

4th level: Limiting HRUs performance → Avoid static HRUs in between routing!



Conclusions

- ✓ **Participatory processes and modeling** for future scenario assessment are crucial aspects for comprehensive assessment of catchments dynamics.
- ✓ **Catchments close to cities in Andean region are prone to natural hazards due to intensification of land use and land cover changes**.
- ✓ Climatic conditions are too sensitive and variable in small time windows in high altitudinal catchments as Andean-Amazon subbasins
- ✓ Participants are not aware of balance between natural resources demand and environmental implications.
- ✓ The majority of participants expect solutions from the authorities and not for their own and local responsibility for the use of resources.
- ✓ In Andean region, **the associated crops and rotation sequences with native seeds are key for optimise soil dynamics**. Include this into model increases the optimisation path.
- ✓ **Fragmented landscape offer more chance to optimise routing** but more computational resources are needed.

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Thanks!

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