Zooming into the water users: A multi-scale, interactive participatory approach to co-develop Water Management Plans in Bolivian River Basins

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In Bolivia, since 2006 the Ministry of Environment and Water (MMAyA), through the National Watershed Plan, has developed the conceptual framework and national policy for Watershed Management. At present, this national policy is still in the process of learning and construction from its application in various river basins, principally through the development of Watershed Master Plans.

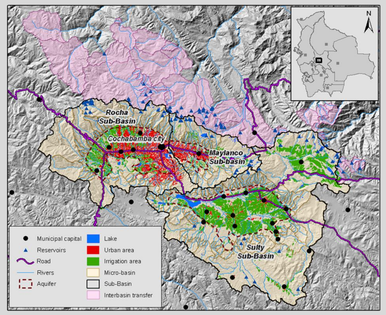
Three principles guide the development of this national planning effort:

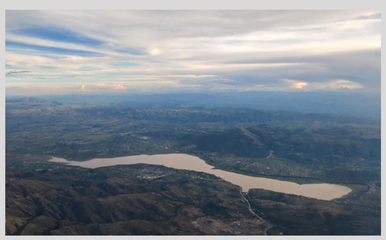
i. The recognition of the growing dependence on participatory processes as a forum to identify and enable legitimate water management and governance options,
ii. The need to plan for an uncertain future caused by climate change and other societal prerogatives
iii. The systemic analysis of the territory incorporating biophysical, sectoral and regional interactions

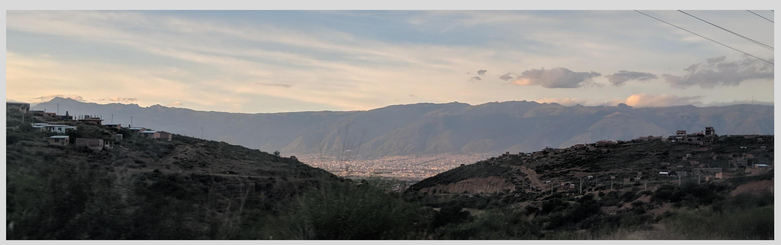
Here we present results and lessons learned of this process in the formulation of the Master Plan of the Río Rocha Basin (PDCR)

Study area and Problem formulation

With a population of ~ 1,500,000 people (13% of Bolivia's population), the basin has high levels of water scarcity that feed an intricate network of conflicts related to access, governance, and environmental degradation. The PDCR is a planning opportunity to enable the necessary conditions to resolve current conflicts and set the foundation of sustainable water management.



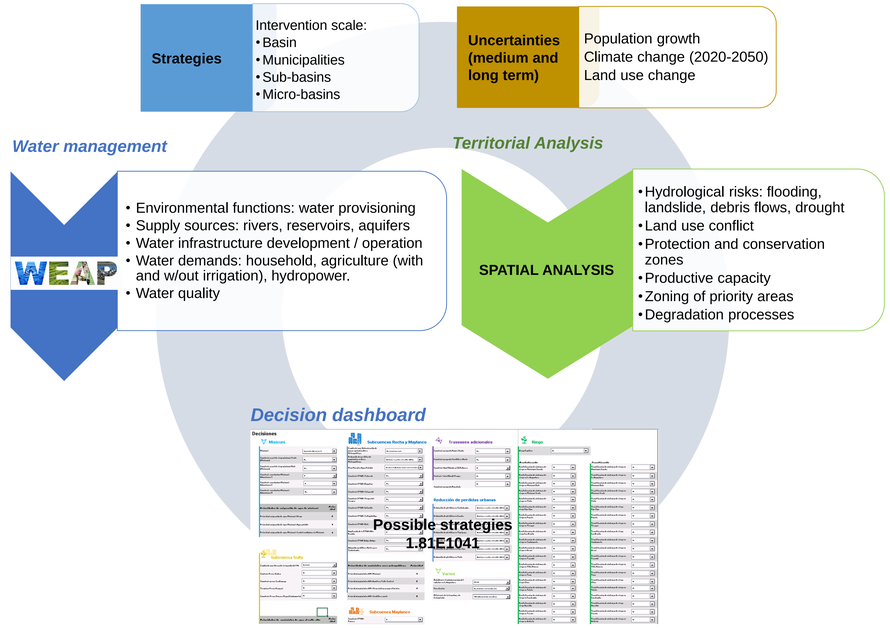




Watershed management problems

1. Low coverage for access to safe drinking water
2. Low coverage in sanitation
3. Unmet irrigation water demands
4. Unsustainable use of groundwater
5. Loss of environmental functions and productive systems
6. Surface and groundwater pollution
7. Hydroloclimatogical risks (flooding, landslides, drought)
8. Soil Salinization
9. Urban growth in agricultural and aquifer recharge areas
10. Institutional weakness to secure equitable access to water and sustainable river basin management
11. Lack of social awareness about the importance of water, hydrological cycle and its relationship with ecosystems and human activities

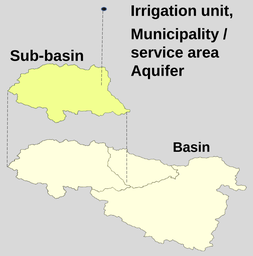
Analytical engine



PERFORMANCE METRICS: EFFICIENCY, EFFECTIVENESS, IMPACT AND SUSTAINABILITY

Multi-scale indicators

To accommodate the large disparities in water access across interests represented at different regions and scales of the Rio Rocha Basin, we implemented two innovations in the RDS process: first, a set of 24 quantitative indices that can operate at several nested scales of planning sub-units (i.e. from independent irrigation units or household water supply service areas, to the entire river basin), and second, the use of an interactive "hard-coupled" decision dashboard to the Water Evaluation and Planning System (WEAP).



In combination, this innovations enabled a diverse audience of actors to:

i) Explore the positive and negative interactions of water management, production systems, hazards and risks management, and ecosystem functions
ii) Identify disparities in the performance of a proposed plan between scales and
iii) Analyze and compare different management strategies interactively to improve outcomes and identify and mitigate emerging regional or sectorial conflicts.

Methods

The process considered public participation as an essential element to involve institutions and stakeholders from the river basin, working as a mechanism to promote environmental governance. Robust decision support (RDS) has been adopted as a guiding framework, constructing a participatory process that considers uncertainties and strategies within an array of management options for the system (Lempert et al., 2003; Purkey et al., 2018).

Problem identification: 15 workshops

Problem prioritization: 2 workshops

Sharing and agreeing upon action points: 2 workshops

Strategic lines

As a result, the PDCR established a set of regional and intersectoral actions for 2025 and 2040, which integrate infrastructure, efficiency, pollution control, and territorial and productive planning actions, accompanied by institutional strengthening and capacity development measures. The plan expects to increase access and coverage of the demand for safe water, improve irrigation access, enable long term sustainable exploitation of groundwater and establish synergies with the existing sanitation plan to achieve additional improvements in the environmental quality of the Rio Rocha.

PLAN DIRECTOR CUENCA RIO ROCHA

WATER MANAGEMENT	INTEGRAL AND SUSTAINABLE MANAGEMENT OF SUB-BASIN AND MICRO-BASIN	INSTITUTIONAL STRENGTHENING	INFORMATION AND KNOWLEDGE	WATER CULTURE
8 Action lines	**6 Action lines**	**8 Action lines**	**8 Actions**	**8 Actions**
37 Actions	**19 Actions**	**10 Actions**		

IMPLEMENTATION PLAN: General specifications, implementation, regional priorization, referential costs

RESULT INDICATORS: Medium term (2025) and long term (2040)

FINANCIAL PROPOSAL (2025)

References

Lempert, R. J., Popper, S. W., & Bankes, S. C. (2003). *Shaping the Next One Hundred Years: New methods for quantitative, long-term policy analysis*. RAND.

Purkey, D. R., Escobar Arias, M. I., Mehta, V. K., Forni, L., Depsky, N. J., Yates, D. N., & Stevenson, W. N. (2018). A Philosophical Justification for a Novel Analysis-Supported, Stakeholder-Driven Participatory Process for Water Resources Planning and Decision Making. *Water*, *10*(8), 1009. https://doi.org/10.3390/w10081009

Yates, D., Sieber, J., Purkey, D., & Huber-Lee, A. (2005). WEAP21—A demand-, priority-, and preference-driven water planning model: Part 1: Model characteristics. *Water International*, *30*(4), 487-500