A Geobrowser to Enhance Stakeholders' Roles in Water Policy Development

Water productivity in the Andes of South America is limited and threatened by continued deforestation and land in protected areas and key water-producing zones, growth of the industrial sector (mining and hydropower) and the increasing demands of urban centers. These activities result in flooding, soil erosion, sediment yield, and water quality deterioration, all of which impact on the health, livelihood and well-being of both upstream and downstream populations. The unbalanced distribution of water and the lack of capacity to capture and maximize water resources aggravate poverty in the region. If water resources of the Andes are to be managed effectively and equitably, stakeholders, particularly the water users, must all work together in a coordinated fashion. A decision support tool such as the web-based AguAAndes Policy Support System (AguAAndes PSS), with the availability and use of high quality reliable data, could help ensure coordinated water management by various stakeholders across the Andes.

The challenge for coordinated action

The diverse physical and social contexts of Andean communities is a major reason for legislation on integrated water resource management (IWRM) to be adopted by different intermediary stakeholders, each with their own ideologies, rules and interests. This co-existence of formal and informal groups and institutions makes it necessary to develop a better understanding of their synergies as well as conflicting issues. The lack of coordination among them and their respective distinct objectives (i.e. energy, agriculture, health/social, conservation) can lead to inconsistencies, overlaps and even conflicts of policies, regulations and sectoral development plans. Where formal regulations are in place, enforcement has been limited by insufficient financial/human resources and by existing norms of the informal institutions.

Water management policies and legislations often:

- **Do not recognize the long tradition of rules/customs of peasant communities.**
- **Favor the private sector when providing technical assistance to communities to improve water supply, irrigation and small hydropower systems.**

Institutional trends in Andean countries on agricultural water management have leaned towards participation, decentralization and transfer of management to local governments. This, however, has to be accompanied by appropriate education, skills training and a common information base for dialogue that water user associations can access for making informed decisions. Hydrological analysis should be integrated into this information base and in water resource management assessments in support of policy making. It is in these contexts that a geobrowser-based Policy Support System (PSS) has been developed with local stakeholders for the management of water in the Andes. Called the AguAAndes PSS, its purpose is to provide a common baseline of high- quality information and tools for policy negotiations that are transparent and accessible to all.

The AguAAndes PSS: A knowledge integration tool

The web-based AguAAndes PSS is a tool for the management of the region's water resources, used to identify upstream-downstream interactions, especially, within the context of hydropower projects and payments for environmental services (PES) schemes. This PSS involves three key activities: understanding context, analyzing investment/ interventions, and examining likely consequences and impacts.

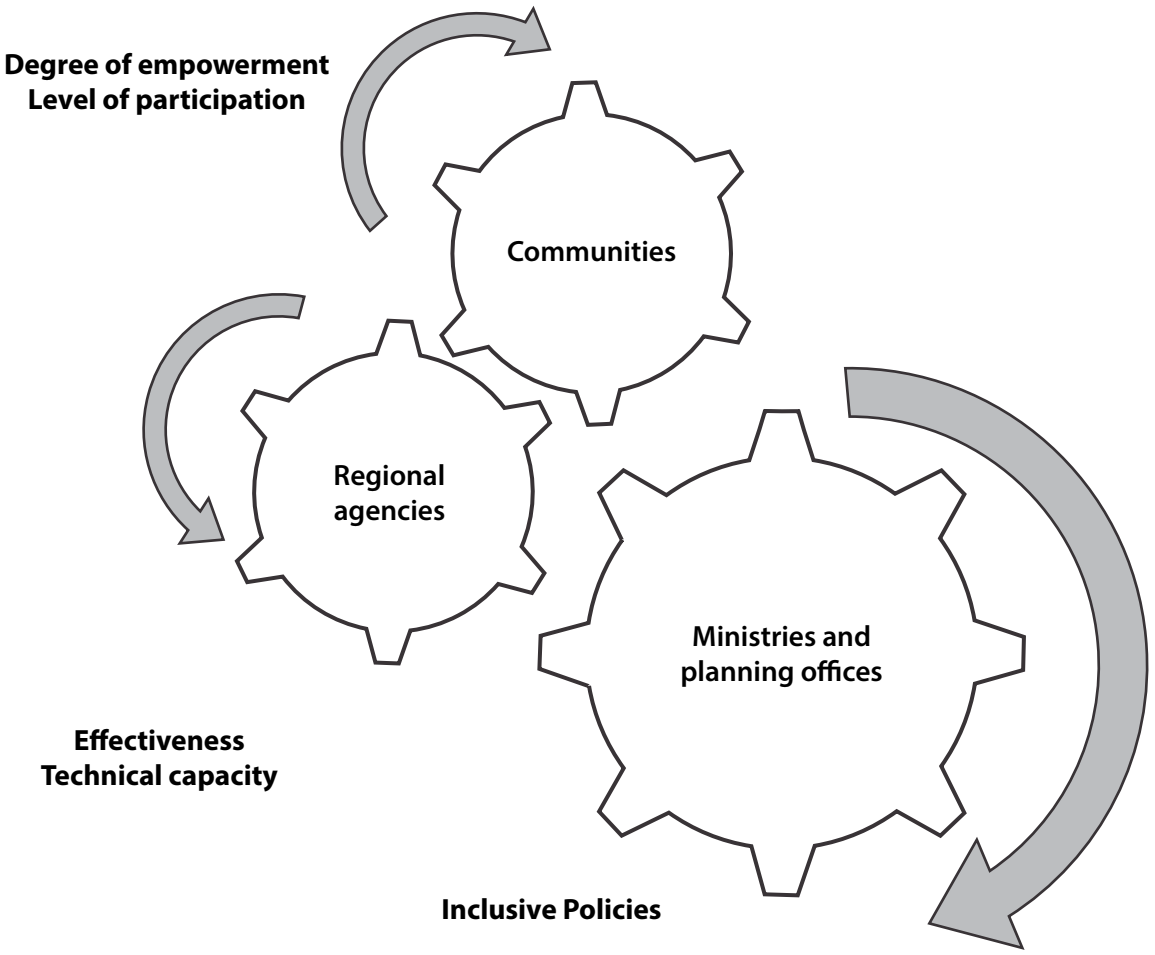
Two premises in the development of the PSS:

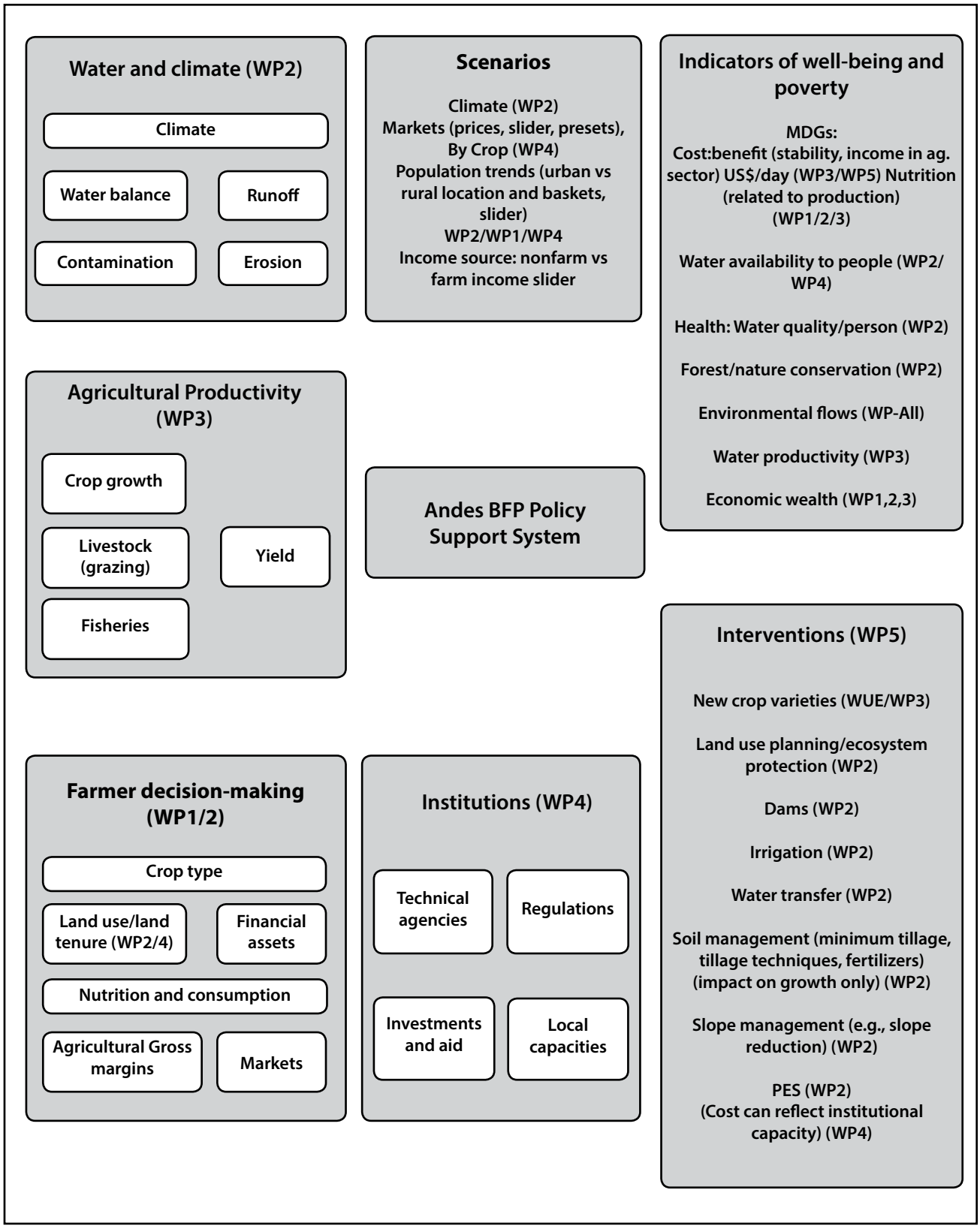
- **Policies are more effective and equitable when based on both the natural and social sciences.**
- **Key stakeholders involved from the initial steps in developing the PSS will be its main users.**

Use of the AguAAndes PSS and its modeling capabilities was intended to answer questions about impacts of climate change in a particular area, the impacts of land-use change on downstream water supply to cities/dams and agricultural systems, and the current institutional constraints to particular interventions in specific zones. The research activities were integrated within a knowledge base and organized into modules or work packages (WP) as described in the following matrix. Then, in combination with mathematical and computer-based spatial models, the following outputs were generated:

- Diagnosis of the current status of water poverty, water productivity, environmental security and institutional context
- Maps of long-term average water availability and trends
- Maps of resource sensitivity to land use and climate change

Conceptual understanding of the way water institutions at three different levels should work and potential performance indicators. (Mulligan et al 2008)





General structure of the Andes Basic Focal Project (BFP) Policy Support System with accompanying lists of interventions and performance indicators

[1] *For details on the conduct of the WPs, the methods and the models to be used for generating the PSS outputs, see the Appendices section in Mulligan et al (2009).*

Matrix of PSS work packages (WP)	
MODULE	**Data sources, methods and modeling tools for generating PSS outputs and analysis**
WP1: Poverty analysis for determination of levels and distribution of poverty	**Census data; household survey; standard poverty mapping using the livelihoods framework (Bebbington, 2001); Bayesian network modeling; unsatisfied basic needs (UBN) approach (Schuschny and Gallopin, 2004); small area estimation (SME) method of Ghosh and Rao, (1994); human development index (HDI) by Sagara and Najam, (1998)**
WP2: Water availability analysis for regional GIS analysis of rainfall, fog and snow melt; climate change and land use change scenarios	**TRRM Rainfall Climatology (Mulligan 2006a); WorldClim (Hijmans *et al*, 2005); FIESTA model; Water Scarcity Model for the Andean Systems of Basins (computation of effect of factors contributing to water scarcity); household and agriculture spreadsheets (water accessibility costing)**
WP3: Water productivity Analysis	**Crop per drop agricultural water productivity; environmental flows from protected and non-protected areas using the FIESTA model; fisheries model to assess site suitability for aquaculture**
WP4: Institutional analysis on water rights and tenure	**Workshops to qualitatively assess organizational performance along these seven criteria: representativeness of interests, respect and credibility, confidence, mission clarity, confidence, information, compliance with laws and rules, and cohesion in group; Survey of institutional needs and perspectives; institutional environmental Index (IEI)[2]**
WP5: Intervention analysis	**Primary (interviews) and secondary data collection on significant interventions for water resource management qualitative data analysis using the Community Capitals Framework (Flora and Flora 2004). The seven capitals are human, social, political, cultural, financial, built and natural capital.**

[2] *The institutional environmental index (Hodgson 2006) reflects to a certain extent the quality of life in each municipality, in terms of service provision such as education, health, potable water, security, and investments in infrastructure, among others. When the quality and quantity of any of these services are is high, it is assumed that this indicates the presence and functioning of institutions and effective government or communal actions providing for local development. In contrast, when low values are scored, it is assumed that the conditions for these indicators are inadequate and hence, the desired institutional support is lacking.*

- Maps of the poverty outcomes of changing access to water
- Maps of the sensitivity of food production to climate (variability and change) and land-use change
- Database of organizations, institutions, and intervention projects and likely outcomes of a range of these in the basin
- Summary of points of contact and types of data/information required by institutions

Further notes on AguAAndes

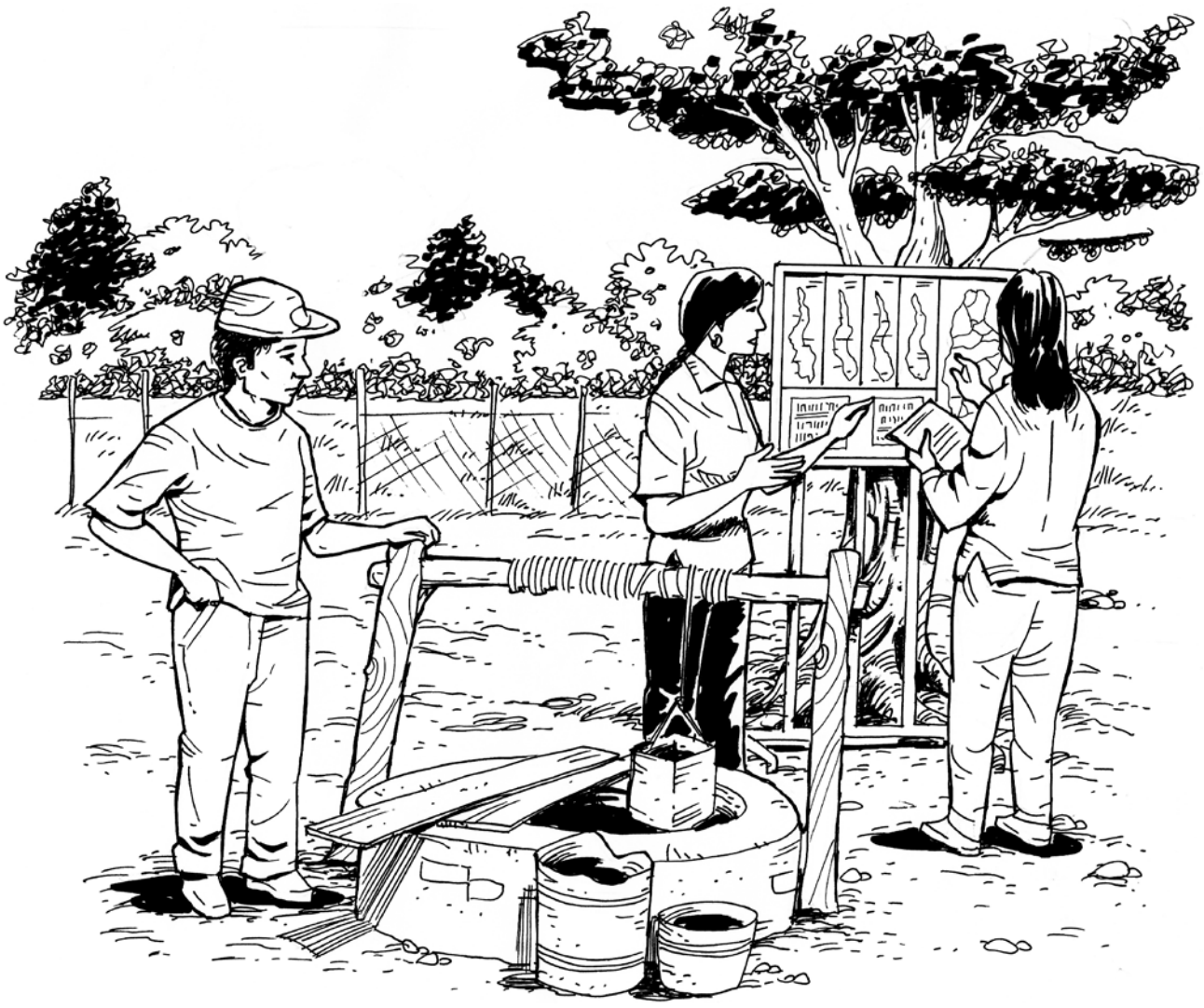
The AguAAndes is based on the simTerra policy support framework (www.ambiotek.com/simterra) that allows direct access to global and regional databases in usable form at no cost. Its technical, computing and GIS capacity requirements are minimal since users do not need to install or manage local software or databases because all applications are run on the online-server. Users need to only define an area for policy support. The system prepares the available datasets that can then be run for particular parameters, policy options and scenarios for climate and land use. Results are presented to the user in map form and as charts. The AguAAndes PSS also comes with a series of policy exercises to familiarize users with the tool. Two such exercises enable users to carry out a baseline simulation and a climate change simulation. The first allows users to define a baseline simulation of climate and hydrology for any part of the Andes at 1 km spatial resolution. The second defines the impact of climate change. The AguAAndes PSS can be accessed at www.policysupport.org/links/aguaandes.

Findings

In a survey[3] conducted as part of the WP5 of the PSS in the Andes region, the following was discovered:

1. Thirty percent of the respondents had no experience in PSS while 90% attributed their lack of relevant knowledge of computer-based PSS as a factor in their low uptake of the web-based PSS tool.
2. Almost half of the respondents believed that the low level of usage of existing computer-based policy support is due to lack of reliable data. A third of the respondents agreed that spatial analysis and modeling tools are also being used to trigger the generation and use of reliable data.
3. Low levels of staff training/capacity (35%) and poor quality of computer equipment (24%) in governance institutions were reasons for the low uptake of computer-based policy support within the region.

[3] *Respondents to the survey were 46% development workers, 26% scientists, 21% students, and 9% public sector employees from seven countries in the Andean region.*



4. About half of the respondents considered the national public sector development agencies and local municipal planning offices as the sectors most likely to benefit from the PSS.
5. Water and water productivity were not on top of the agenda for many of the respondents who indicated that:

    a. The highest priority in Andean watersheds is soil erosion (71%).
    b. The effects of soil erosion on agricultural livelihoods should be considered more in the policy making process (44%).
    c. The institutional approach regarding the management of water resources is important (48%).
    d. The quality of access to water is important (66%).
    e. Implementation of PES be made a priority (58%).

Poverty levels are twice as high in the upstream parts of watersheds compared with those downstream, according to unmet basic need indicators. The less-poor lower basin benefits from water services supplied by the poorer upper basin. But residents of the upper basin receive no compensation for land use practices that support water resources.

Lessons learned

- Given the weak relationship between poverty and water in general, there is a need to analyze how poverty and its associated factors influence problems related to water management on a case-by-case basis. Interventions should consider not only the effect of water problems on poverty, but also how poverty exacerbates water problems.

- The lower living standards in the upstream portion of the Andean basins suggest that PES schemes can potentially improve water management in those areas.

- PES should be included in future PSS as it is an effective way to improve institutional water management and increase cooperation between different water users and institutions.

- With climate change being the big unknown, policies should not rely on projections of land use and landscape changes alone. Rather, more emphasis should be given to better understanding the sensitivity of water and production systems to change and paying particular attention to careful management in those areas where those sensitivities are high, irrespective of the highly uncertain projections for change.

- Legislation and norms designed to generate integrated water resource management are in practice adjusted by a variety of intermediary stakeholders, each with their own ideologies, rules and interests. Inclusion and active involvement of these stakeholder groups are therefore essential in developing appropriate water management policies.

Conclusion

AguAAndes is no silver bullet because its outputs are highly dependent on the quality of available data, on the social-scientific knowledge of the systems being simulated and on the availability of skilled staff and equipment. It does, however, provide a common information base for discussion of what is and what is not known in an area, democratizes knowledge and serves as a tool for knowledge integration and development for any area within the Andes.

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