Opportunities and Challenges to Linking Science and Policy in the Luquillo LTER: Preliminary Findings on Stakeholder Perspectives of Water Governance and Sustainability.

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Introduction

• While the Luquillo Mountains (LM) in eastern Puerto Rico (Figure 1) receive high amounts of rainfall (about 3500mm/year in low elevations and 5000 mm/year in high elevations), the region has historically faced **water conflicts** due to increasing demands for surface water, management inefficiencies and a lack of planning.

• At the same time, the **existing institutional framework is undergoing modifications**, such as decentralization of water management operations, a new state Water Plan and municipal land use zoning regulation (see Figure 2 for a visual representation).

• To help inform the integrated management of water resources, scientists of the Luquillo Long-Term Ecological Research (LTER) project have initiated a program that engages traditionally conflicting stakeholders in **collaborative forums to discuss policy and science priorities** for water management and sustainability in the region.

• This poster presents a **preliminary analysis of stakeholders' perspectives** on 1) the most critical water and sustainability issues in the region, and 2) the role of science in the Luquillo water governance context.

• In the summer of 2007, we conducted **semi-structured interviews with 14 stakeholders** actively involved in land and water management in the area, including government representatives (federal, state, municipal), civil society groups, and scientists. Figures 1 through 3 and the text below summarize preliminary findings.

Preliminary Interview Findings

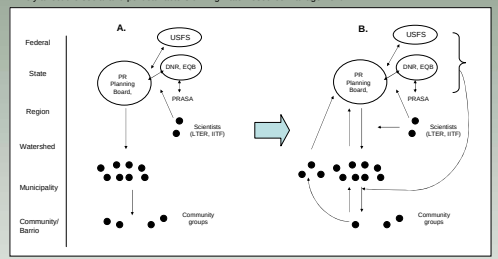
• Interview informants identified vulnerability to water scarcity, primarily caused by land development and stream dewatering, as the main water resource issue facing the region (Figure 3). State and local authorities perceive limited reservoir and infrastructure capacity as a major problem, while civil society groups and local authorities are concerned with unequal water allocation among social sectors.

• Informants' perceptions about **the role and expectations of science** are consistent with the objectives of the collaborative effort (Figure 4). Science is also viewed as a way to validate different positions and citizen knowledge, which could hinder conflict resolution. Collaborative forums should have a role in integrating multiple sources of information, including local knowledge.

• There is an **overall satisfaction with the collaborative forums** in terms of sharing information among sectors, involving the community, and serving as a platform for future discussions on water management in the region (Figure 5). However, stakeholders exhibit different views about program objectives, with some state and federal officials viewing the forums as a way to educate the community, rather than mutual learning. Also, while civil society groups view them as neutral forums for dialogue, some state officials view them as a venue to gain status.

Figure 1. Map of the Luquillo LTER. The gray areas show urban regions, and the green area outlines the Luquillo Experimental Forest, site of the LTER. Source of map and photos: ITES and IITF, 2006.

Figure 2. Illustration of the institutional changes in land and water management in the LM region. The planning and management of resources has traditionally been top-down (A). The state planning board has had centralized control in developing land use plans in the region, with input from other federal and state agencies, including the PR Aqueduct and Water Authority (PRASA), Department of Natural Resources (DNR), and scientists. Today, planning efforts are becoming decentralized with the municipalities having greater input in developing land use plans (B). Water management by PRASA is also becoming more localized, and bottom-up civic participation from community groups and NGO's is increasing. This changing institutional context will likely affect the social and political factors driving water resource management.



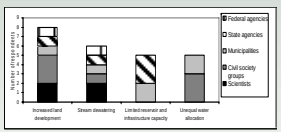


Figure 3. Most important water resource issues in the LM region. Interview question, "What do you see as the most important issue facing the region?"

• All the informants identified land development as a key issue affecting water resources, but local municipalities and civil society groups also mentioned unequal water allocation among users.

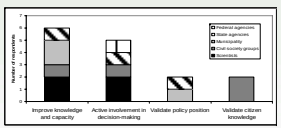


Figure 4. Perceived role of science in decision-making. Interview question, "What do you think should be the role of scientific information in water management and decision-making?

• Most of the informants felt that science was important to improve knowledge and capacity and decision-making, but state and municipalities felt it was necessary to validate policy positions, while civil society groups use it to validate citizen knowledge.

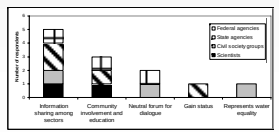
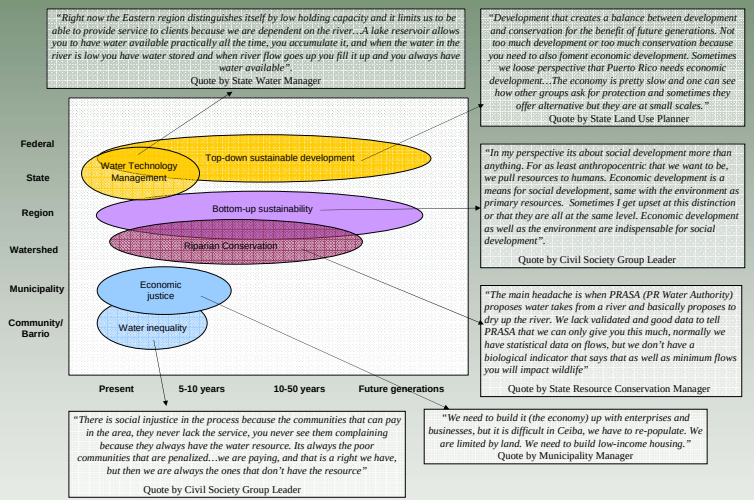


Figure 5. Perceived value of collaborative science-policy forums. Interview question, "What do you think of the HELP program[1]? What aspects did you find valuable?

[1] The HELP Program is an international collaborative effort that provides support to the Luquillo LTER scientists in conducting these workshops in the LM region. Part of the UNESCO, the Hydrology, Environment, Life and Policy Program helps facilitate science-policy integration and collaborative learning for water resource management in multiple basins around the world.

Mapping Discourses: Framing at Multiple Scales

• **Perspectives on the problem of growth and development goals** for the LM area are different on multiple scales. However, stakeholders' frames of the problem may also overlap, such as civil society groups addressing both regional and local issues, and state officials and scientists addressing watershed conservation issues. Characterizing how problems and solutions are framed is informative to develop mutually agreeable scenarios for sustainable water management. The figure below presents an assessment of these discourses and quotes derived from the interviews that best describes them, and the spatial and temporal scales they address.



Implications and Future Directions…

• This study shows that efforts to link science and policy have been well received in the LM area, and the dynamic water governance context may provide opportunities for greater interactions among the multiple stakeholders in the region. However, different expectations of science and divergent development goals may pose a barrier to effective integration of science and policy.

• These preliminary interview findings highlight the importance of assessing perspectives of different knowledge groups and how their framing of water management problems overlap or conflict in order to develop scientific information and policy scenarios that are relevant to the socio-political context.

• The approach and results from this study are relevant to the water-related efforts of CAP and other LTERs, not just in providing a cross-cultural perspective on water issues, but also in terms of the barriers and opportunities to make LTER science relevant to water policy and management.

• Future research will expand interviews to include a broader set of stakeholders, including the broad public. Research will also address the implications of the science-policy efforts on water governance, specifically how conducive they are to social learning and adaptive governance.

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