RESULTS OF WATER-ENERGY-CLIMATE NEXUS IN MEXICO'S

The results of scenario A1B-AGW (carbon emissions medium to high) in Table 2 indicate a significant shift in the number of aquifers with negative balances (from 92 to 114 in 2060, and 108 in 2100) and a parallel change in the corresponding volumes. Most of these aquifers are located at the center and north of Mexico. A2-AGW (high carbon emissions) scenario shows an even greater proportion of aquifers with negative balances, which is critical given that A2 is more likely to occur than A1B. Carbon emissions are part of the water-energy-climate nexus as climate changes imply adaptive strategies that will depend on water and electricity availability (for example cooling systems), that finally translates into more challenges for managing the already depleted water resources.

With the addition of population's MV projections in A2-AGW-MV the result is an increase of the negative volume by 638 MCM by 2100. While results are worst off considering a constant rate of population growth (a negative balance of -22,401 Million Cubic Meters [MCM] in relation to 2010), this trend is less probable as Mexico has been experiencing lower population rates than earlier projected (UN, 2011).

It should be noted that indirect population's effect on agricultural water demand by means of food demand has not been considered in this analysis, but it is expected to generate more pressure towards urban-agricultural competition for groundwater.

Finally, the pricing policies related to annual increases of 1% and 2% in the agricultural water tariff 09 over the 2010-2100 period show important decreasing effects on the number of aquifers with negative balances and the difference in negative volumes, especially the annual increase of 2% over the period 2010-2100. These results indicate the valuable policy tools available for promoting sustainable yields of groundwater. On the other hand the institutional and policy history of Mexican agricultural water administration has been characterized by failures in regulatory actions and by pressure of stakeholders to obtain more benefits and cheaper energy prices for agricultural pumping, which indicates that these institutional changes could be politically difficult to implement. Another observation that adds to the importance of institutional change is the fact that even if implementing a 2% increase in tariffs, the balance of groundwater remains largely negative (-17,515 MCM in 2100 with respect to 2010).

Table 2. Results of scenarios for groundwater balances in Mexico

	Scenarios	Number of aquifers with negative balances			Volume (sum) aquifer balances in MCM		Change (volume) annual aquifer balances in MCM
		2010	2060	2100	2010	2100	(2010 to 2100)
Climate drivers	1) A1B-AGW	92	114	108	48,044	47,439	-606
	2) A2-AGW		116	130		26,722	-21,323
Climate + Human drivers	3) A2-AGW-MV		124	132		26,083	-21,961
	4) A2-AGW-CF		127	133		25,643	-22,401
Climate+Human+ Pricing drivers	5) A2-AGW-MV-E1		121	134		29,174	-18,870
	6) A2-AGW-MV-E2		105	111		30,530	-17,515

Conclusions

The results obtained from the modeling of six scenarios merging climatic variables into inclusive models with human and pricing policy drivers forgroundwater in Mexico hold important lessons for other countries facing similar challenges (e.g., especially India). The most A2 emissions scenario with medium-variant population change would result in negative balances in 132 aquifers by 2100, 40 more than in 2010, while the volume difference at the national level is estimated to be -21,961 MCM. With the application of a 2% annual increase in agricultural energy tariffs, however, the number of negative-balance aquifers drops to 111, and the depleted (negative) volume decreases.

This is indicative of the importance of pricing policies as tools for managing the agricultural pumping of groundwater; however this is not enough for reaching a sustainable yield of aquifers as change in volumes are still largely negative even for the sixth scenario. This implies that although this measure can produce important improvements in management, it is not enough and an integral strategy that takes into account the relationships between regulatory and participatory approaches as well as pricing policies that really reflect the marginal cost of energy and water within the water-energy-climate nexus needs further attention.

Source: http://www.iwawaterwiki.org/xwiki/bin/view/Articles/Thewater-energy-climatenexusinMexicosuseofagriculturaluseofgroundwater