WATER-ENERGY-CLIMATE NEXUS IN MEXICO'S AGRICULTURAL USE OF GROUNDWATER - METHODS AND PROCEDURES

Six scenarios for groundwater balances were simulated for 280 of Mexico's main aquifers starting in 2010 as the base year. However 25 of the aquifers listed as "overexploited" did not have publicly available data, so they were not included in this analysis. The scenarios include several human, climatic and policy drivers (see shaded cells in Table 1). The first scenario uses the A1B scenario of medium to high carbon emissions (column A) while the other five use the A2 scenario (high emissions). All scenarios include calculations of groundwater recharge based on precipitation projections (B) and temperature-based evapotranspirative demand for agricultural groundwater, abbreviated as AGW (C). The climatic projections were extracted from 15 models of the World Climate Research Programme's Coupled Model Intercomparison Project Phase 3 (CMIP3).

In addition to A2 carbon emissions, scenarios 3), 5) and 6) use population based on Medium-Variant Projections of the United Nations (D) as a proxy for non-agricultural water demand (human driver), while scenario 4) uses the UN Constant Fertility Rate (E).

The input for these scenarios was the population census' data of year 2005 corrected by preliminary data of census in 2010 for Mexico's 2,429 municipalities (INEGI 2005). Finally, the last two scenarios include changes in energy tariffs for groundwater pumping: scenario 5 corresponds to an annual increase of 1% over 2010-2100 (F), and scenario 6 corresponds to 2% of annual increase over 2010-2100 (G). Data on 1999-2009 electrical power sales to agriculture under tariff 09 (agricultural water pumping tariff) were accessed from the web site of CFE (the Federal Electricity Commission in Mexico) and the elasticity price-demand was estimated by regression analysis on data previous to the changes in the 09 tariff occurring in 2003 (Nighttime tariffs, 09N). The natural log regression results were used to estimate water demand in the last two scenarios.

Table 1. Groundwater balances scenarios

Scenarios	Climatic drivers			Human drivers		Pricing policy drivers	
	CE (A)	PBR (B)	TB-AGW (C)	Non-agricultural water demand		1% AIT (F)	2% AIT (G)
				PC- MV (D)	PC-CF (E)		
1) A1B-AGW	A1B	■	■				
2) A2-AGW	A2B	■	■				
3) A2-AGW-MV	A2B	■	■	■			
4) A2-AGW-CF	A2B	■	■		■		
5) A2-AGW-MV-E1	A2B	■	■	■		■	
6) A2-AGW-MV-E2	A2B	■	■	■			■

Full details of the water balance model and estimate of depletion can be found in Scott (2011).

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