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Political economy of energy subsidies for groundwater irrigation in semi-arid area in Argentina

World Water Congress – Cancún 2017

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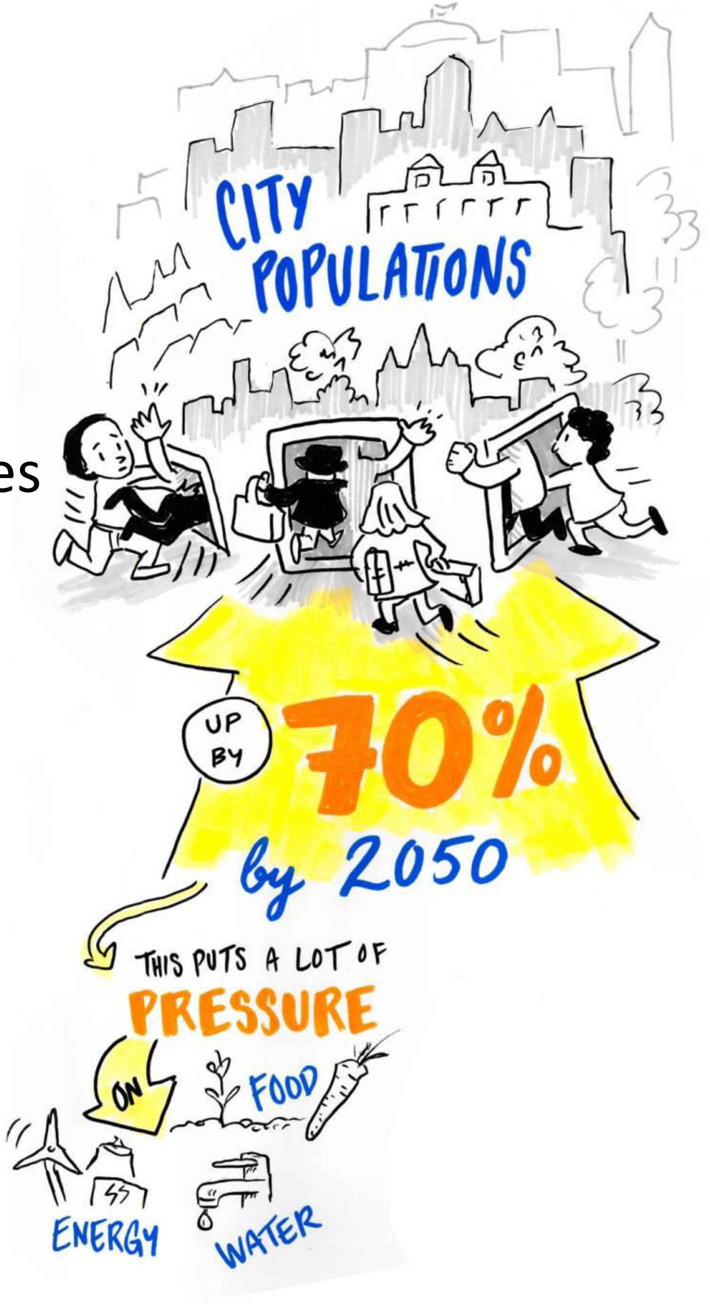
Introduction

- Water scarcity increases pressure to improve productivity and efficiency of water use
- Global concern on the availability of natural resources
- Water-food-energy nexus
- Agriculture demands 70% of water demand
- Groundwater is the main reserve of water
  - 25% of the natural surface water flux comes from groundwater
  - 90% of the natural groundwater recharge forms the stable part of the surface water flows

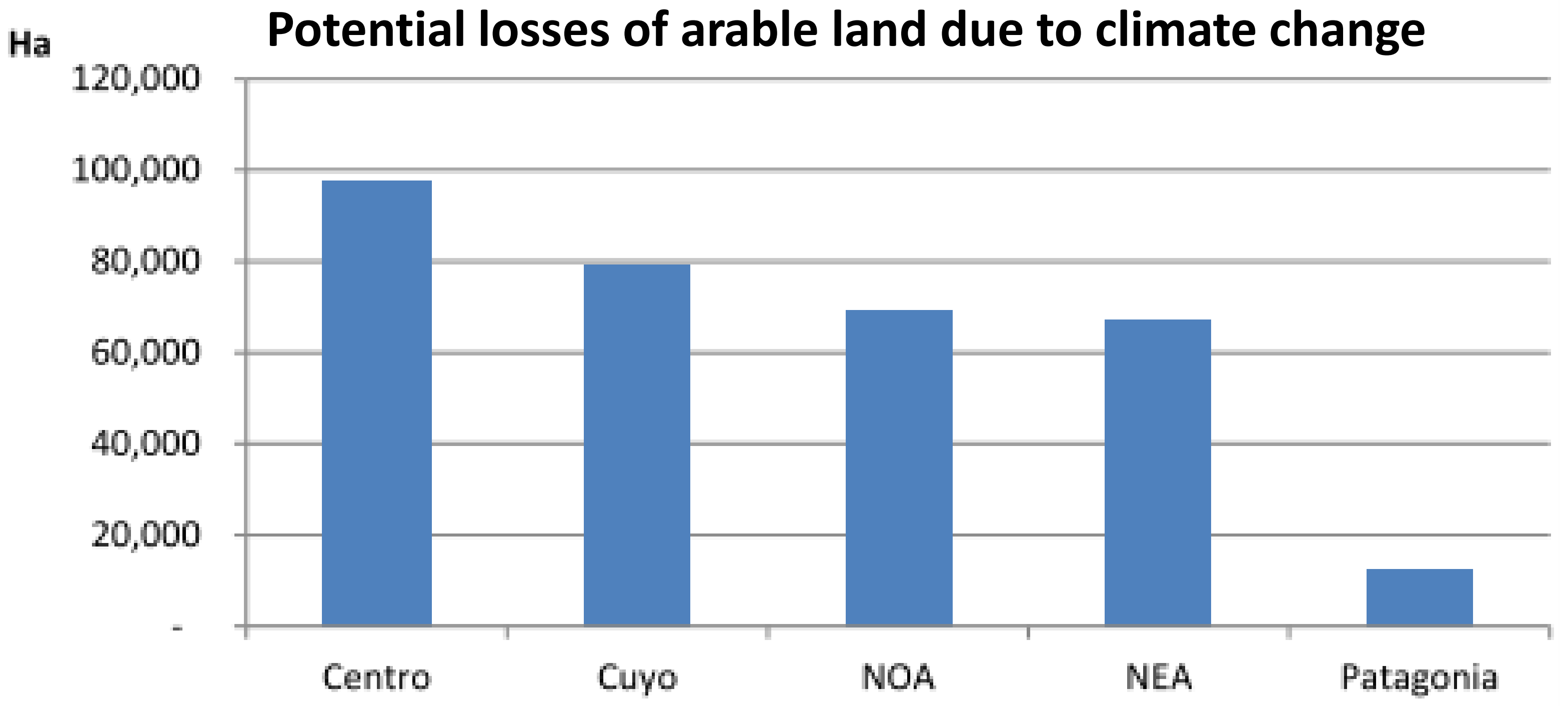


Sources: Bravo-Ureta, B. (2016*); FAO (2012); FAO-PROSAP (2015); WB (2013)

Introduction

Water scarcity in Argentina

Business As Usual scenario



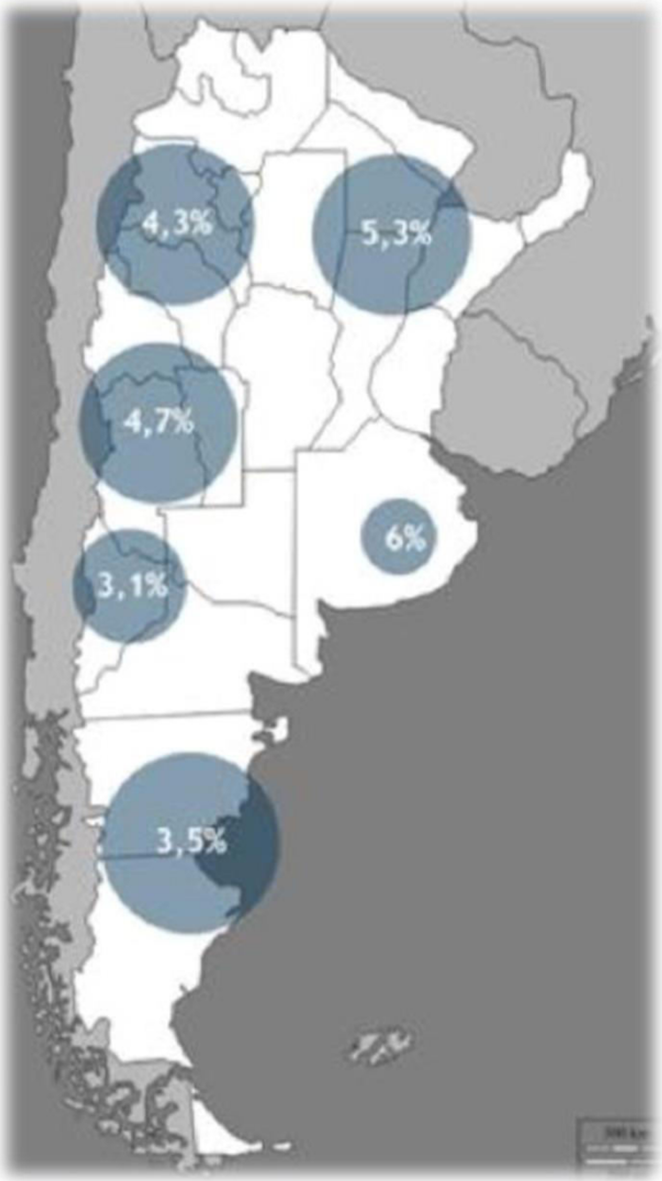
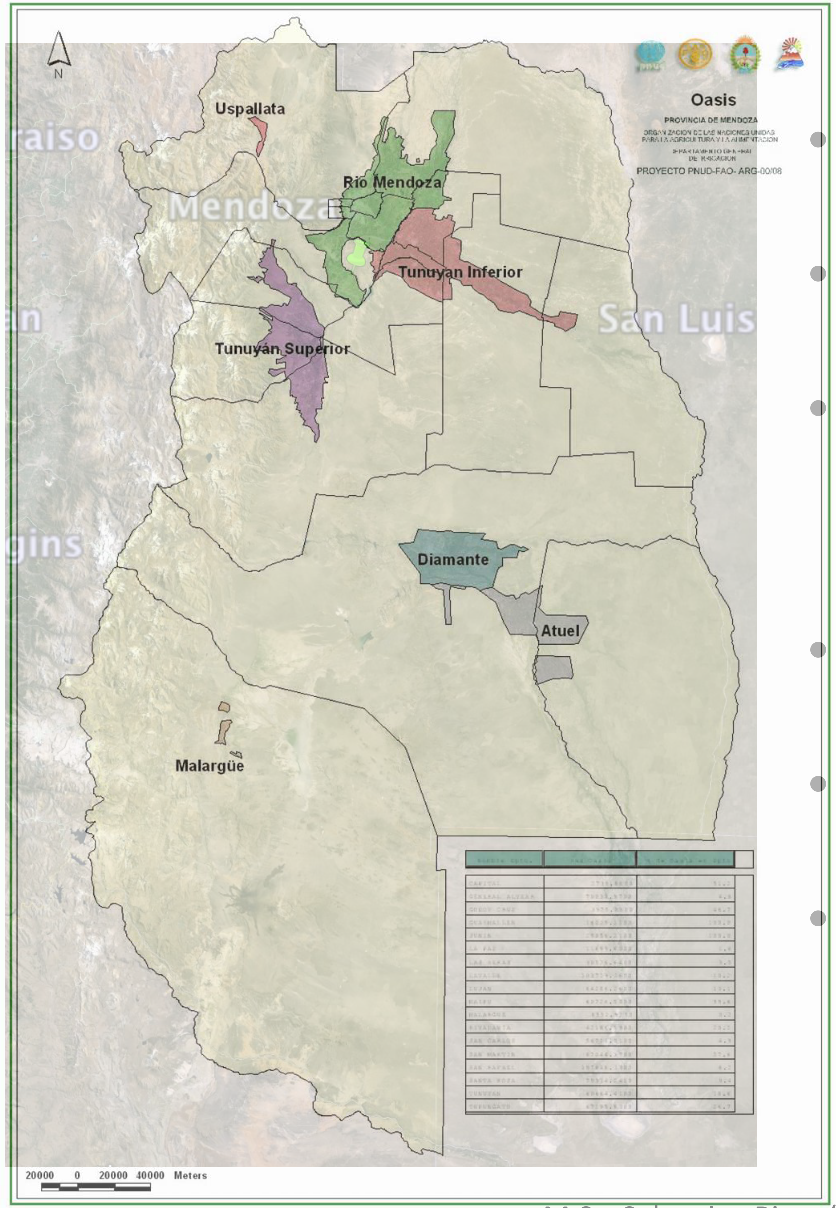


Figure: Increments on irrigation needs

Sources: FAO-PROSAP (2015)

Introduction



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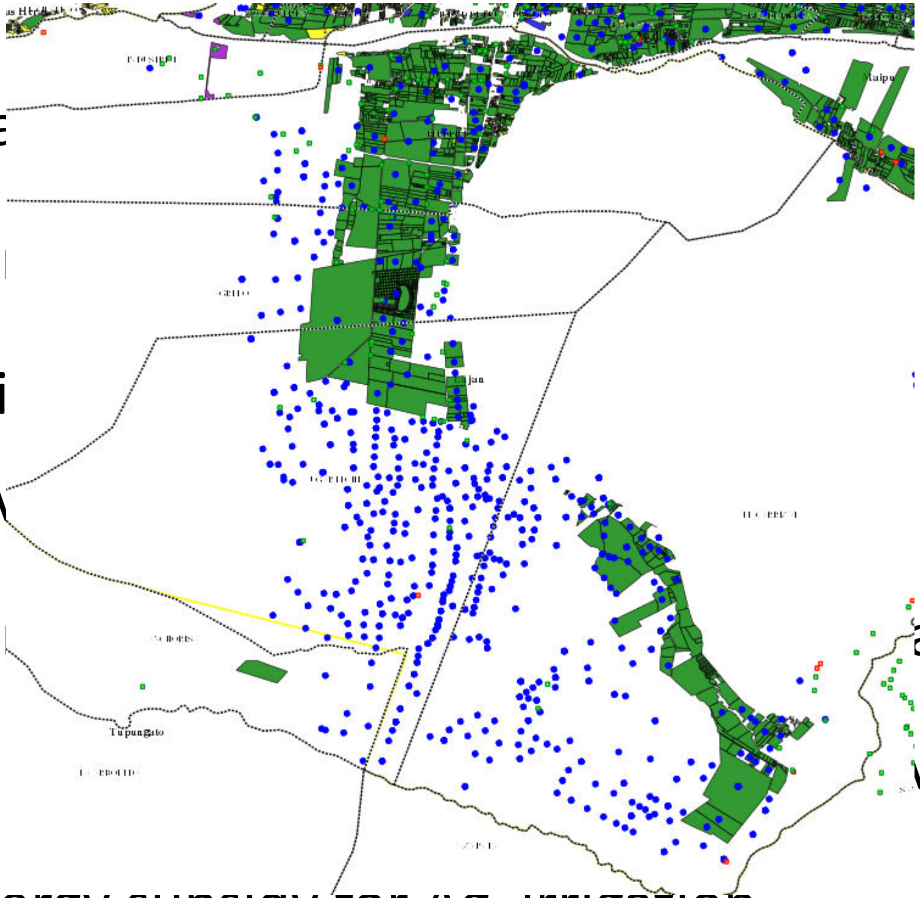
- Ag ... ater use
- Co ... ve use
- Energy subsidy for Ag. irrigation

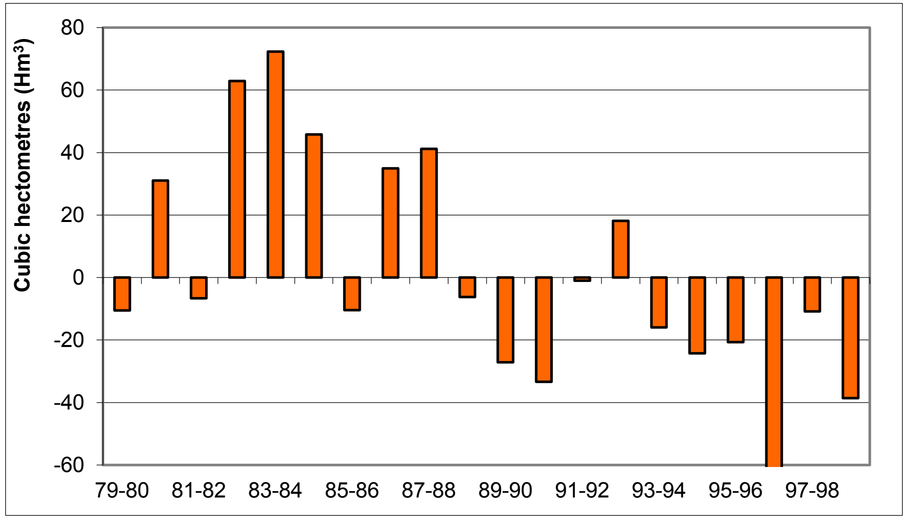


10.000 wells in the province

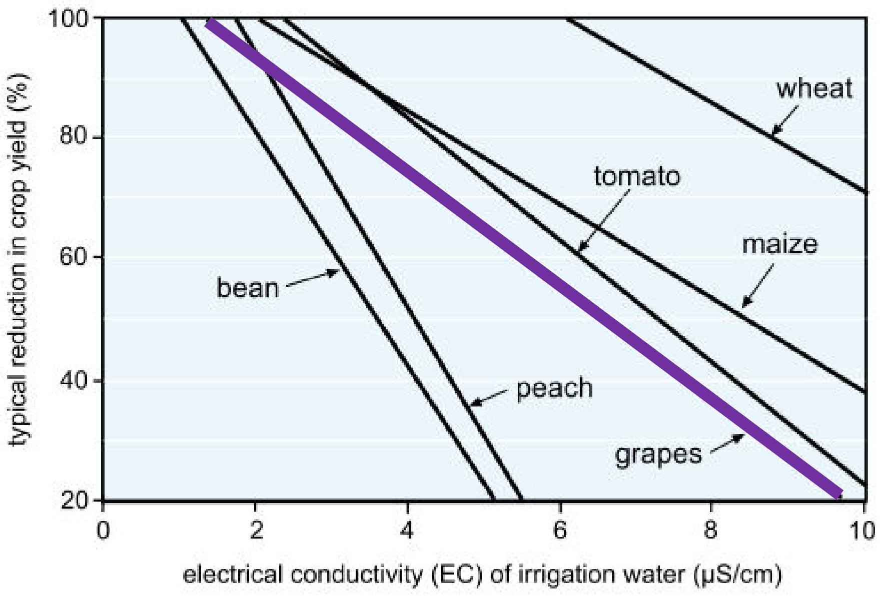
Source: DEIE (2013); DGI (2015); FAO-PROSAP (2015); Severino (2016).

Overuse of groundwater in agriculture

Net storage changes in the Carrizal aquifer



Crop sensibility to water salinization



- Quality degradation
- Soil & groundwater salinization
- Deeper water → +pumping cost
- Lower yields

Source: Foster & Garduño (2006); Hernández, et al. (2013).

Research questions

- What are the political and economic drivers of groundwater use at the northern basin in Mendoza?
- What are the stakeholders' incentives to consider the environmental trade-offs?

Theoretical Framework

- Policy assessment
- Dinar (2000); Garduño & Foster (2010); OECD (2011, 2015); Theesfeld (2010); Zilberman, et al. (2008).

- Legal & political review
- Erice (2013); Jofré (2010); Pinto (2015);

- Tripod analysis
  - Regulatory
  - Economic
  - Collective action
- OECD (2015); Puebla, et al. (2005); Theesfeld, et al. (2010);
  - Azpiazu, D.; et al. (2014); McCornick, P.; et al. (2008)
  - Badiani & Jessoe (2011); Barbazza (2005); Kemper et al. (2003); Pfeiffer & Lin (2014); Scheierling (2005);
  - Encarna & Dinar (2013); Rausser (2000)

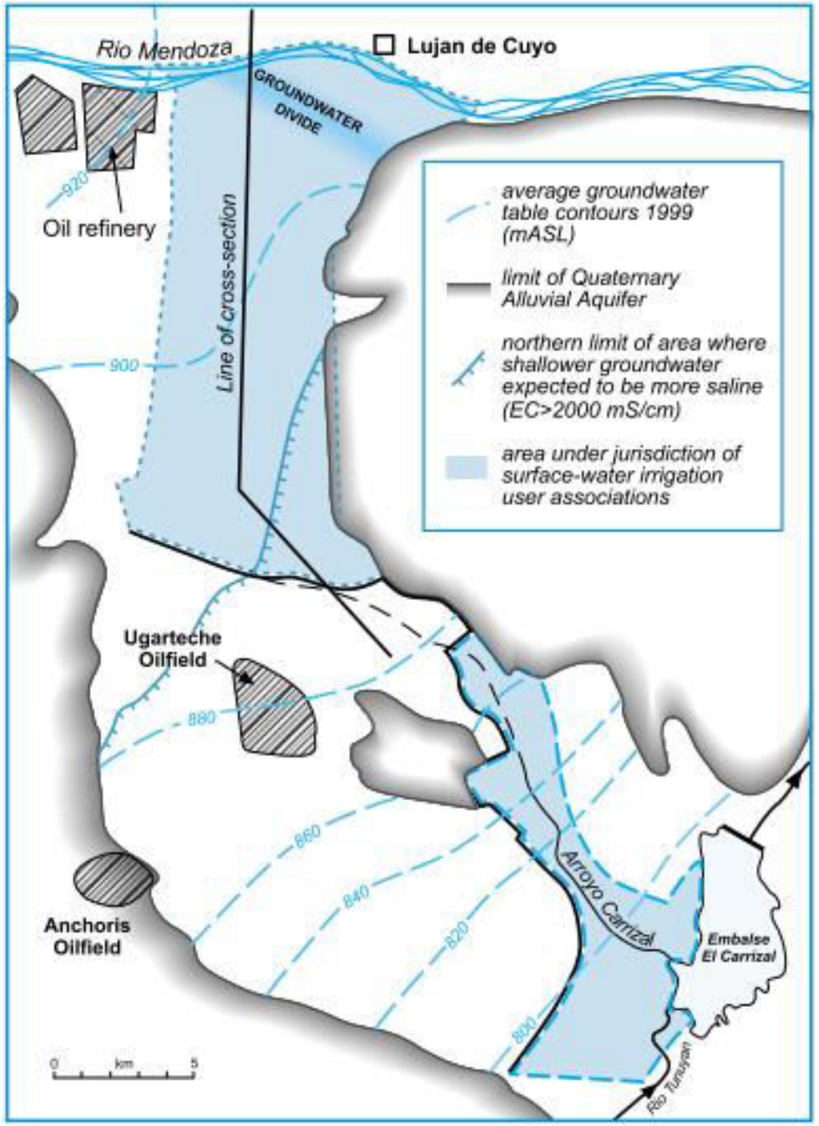
Irrigation system

Producers

Oil refineries & Lobbyists

Government

Water institutions

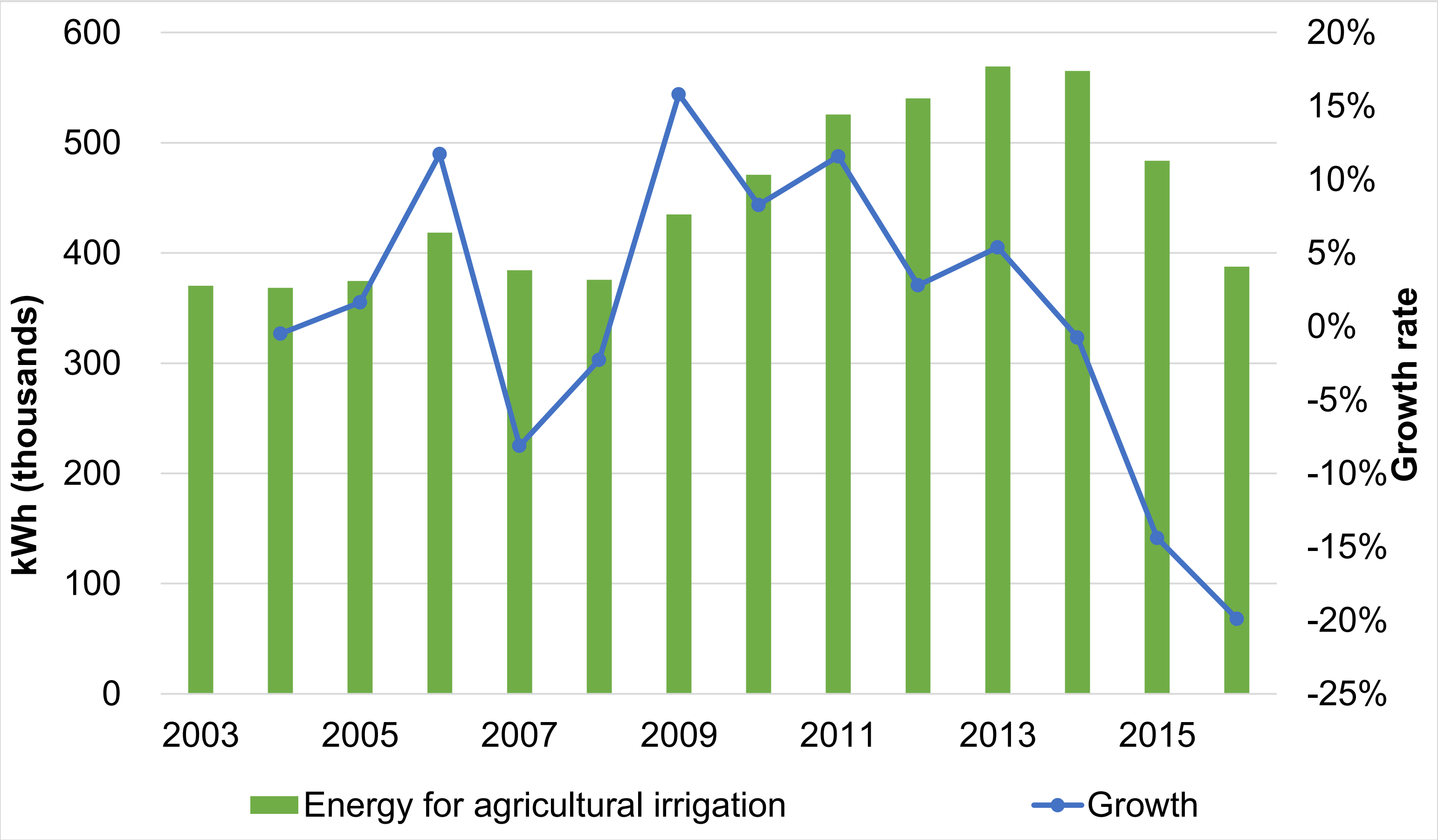


Source: Jofré (2010); Pinto (2015); Foster & Garduño, (2006).

Images: DGI (2015); http://www.taringa.net/posts/[...] html

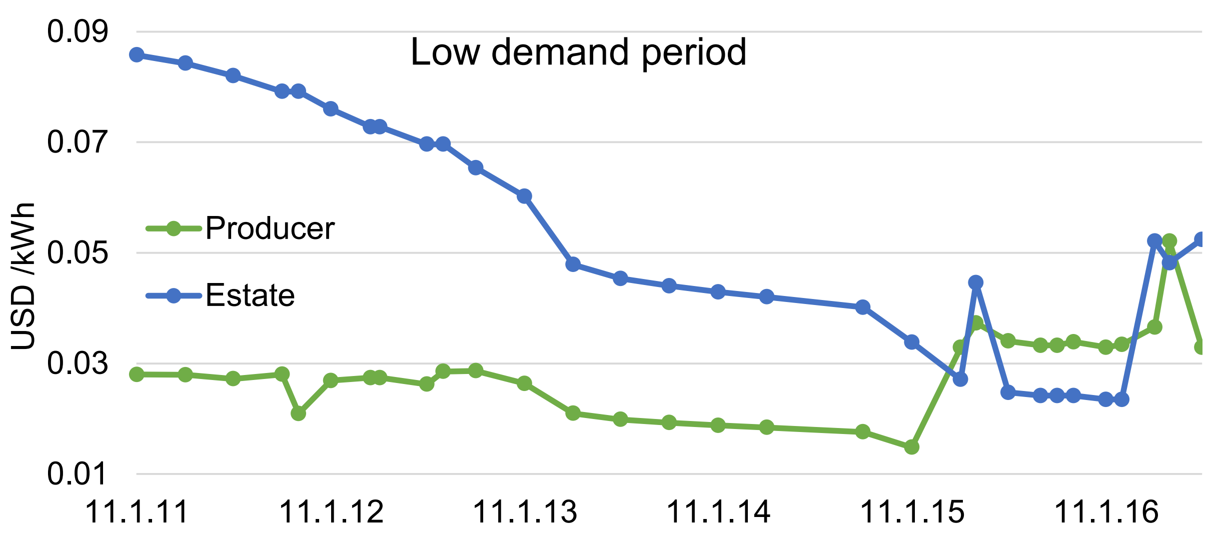
Energy subsidies & consumption

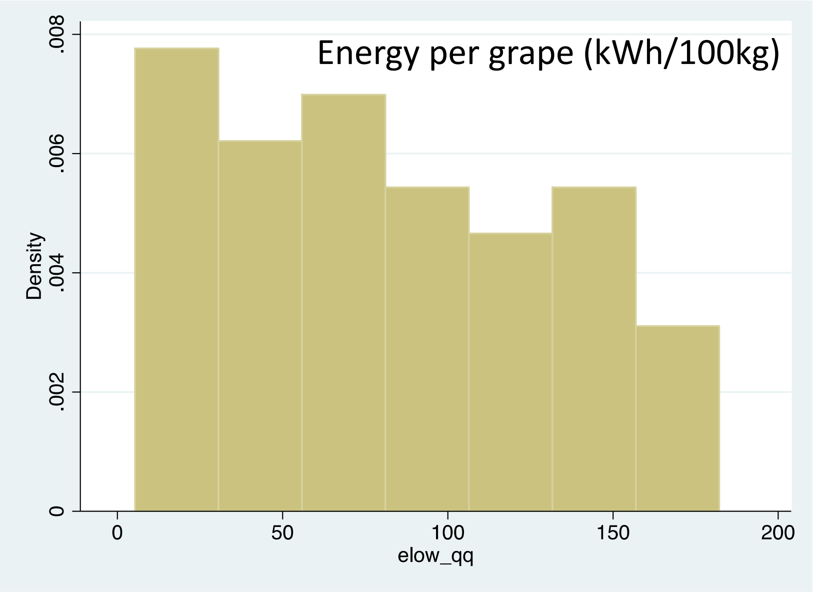
- Water scarcity since 2011
- Tariff doubled in 2016
- Wine producers: 7% demand

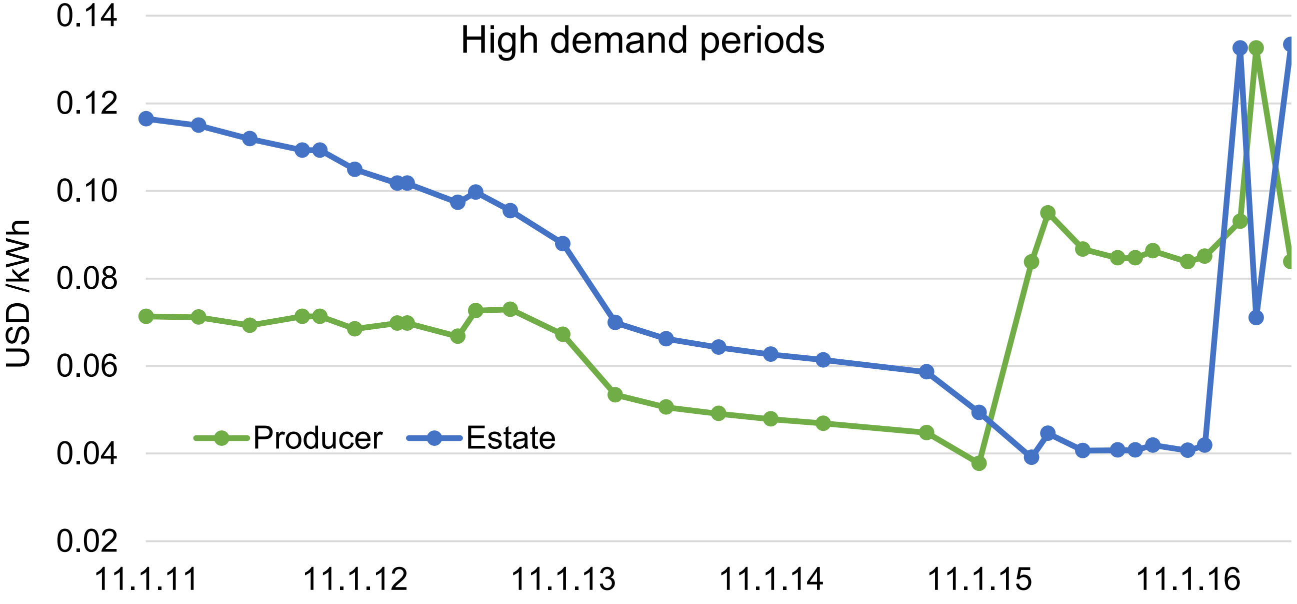


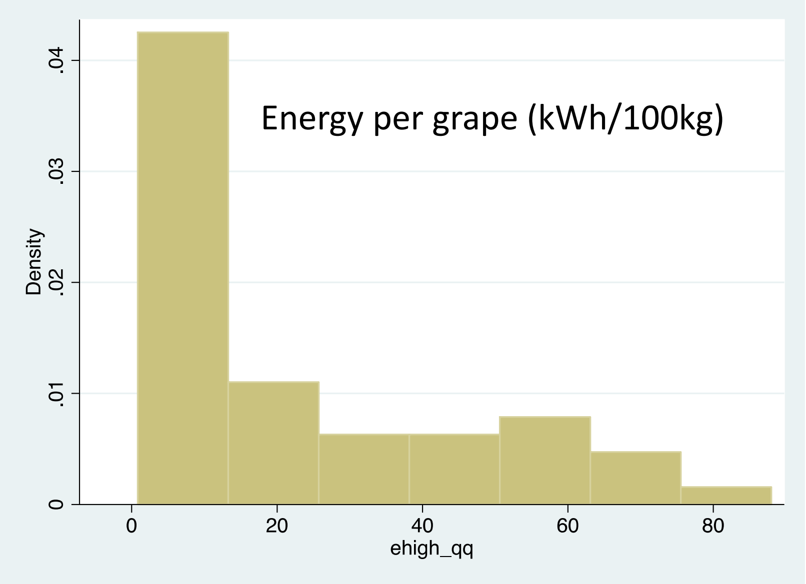
Source: Own based on DEIE (2014); EPRE (2011-16); Severino (2016).

Energy prices & yields









Source: Own based on DEIE (2014); EPRE (2011-16); Severino (2016).

Electricity subsidies & consumption

- Subsidies considering fix & distribution costs

Pumping equipment	Lower tension		Medium tension	
	High-demand	Low-demand	High-demand	Low-demand
10 < Kw < 300	57,3%	79,0%	63,1%	79,0%

- Installed capacity for Ag Irrigation: 300 Mw
- 15% inefficiently used (USD 14,7 million)

Subsidy elimination
Mexico: 15 – 19 % (OECD, 2015)

Effects of 10% subsidy reduction
India: 4.4 – 6.7 % (Badiani & Jessoe, 2011)
Meta-analysis: 4.8 % (Scheierling; et al. 2006)

Mendoza
Groundwater users (0.57)
Conjoint use of water (1.28)

Source: Own based on Barbazza (2005); DEIE (2014); EPRE (2016).

Policy timeline

Water	Energy	Economic
1884 General law 1916 Constitution rectifies DGI 1950s Oil refinery settlement 1974 Groundwater exploitation incentives 1997 Restriction for new wells 2000 Limited trade of rights 2004 Severe pollution detected	1996 Subsidy for agriculture irrigation 2004 Attempt to improve policy targeting 2011 Tariff hours optimization 2013 Subsidy: -10% beneficiaries 2013: Program to improve 25% efficiency in pumping equipment (not implemented)	1970s incentives for groundwater investments 2000 Financing infrastructure investments 2009 Failed attempt to target subsidies (50 ha limit) 2016 Withdraw national subsidy on energy (tariff +40%)

Source: Jofré (2010); EPRE (2016); Erice (2013).

Current policy tools on water management

Orientation \ Instrument		Regulatory approaches	Economic instruments	Collective management approaches
Demand side approaches	***Extensive margin (wells)***	Permit requirement		Association of groundwater users
	Intensive margin (use)	*Direct*: Flowmeter*	*Direct*: Higher annual fee Energy subsidies	
		Indirect: empowerment of water institutions	*Indirect*: assistance to improve infrastructure	*Indirect*: determination of turn scheme
Supply side approaches	***Additional supply for storing***			Construction of reservoirs
	Additional supply for use	Surface water supply: Turn scheme	Financing infrastructure	Collective management plans

Conclusions

- *General Irrigation Department (DGI) is a major player on water policy*
- *Water organizations are clear about resource administration but are lagging on quality programs for GW*
- *Improving GW management can leverage profits enhancing environmental trade-offs*
- *Energy policies may improve targeting beneficiaries and slowly update to full-electricity pricing*
    - *Subsidizing energy alters incentives for responsible water use*
    - *Improve water management*
    - *Potential savings USD 20 M*

Next steps?

- **Assess the price elasticity of groundwater demand for Ag Irrigation**
  - Analyse water management practices
  - Control for attenuation and amplification (Mieno & Brozovic, 2017)

- **Evaluate the environmental efficiency of agriculture farms associated with the exploitation of the aquifer**
  - No evidence of economic efficiency analysis on the region
  - Technical and environmental efficiency analysis (Wednesday 9:00 Cozumel 1)
  - Determine the intrinsic value of water for Ag Irrigation

References

- Abler, D. G., & Shortle, J. S. (1991). The political economy of water quality protection from agricultural chemicals. *Northeastern Journal of Agriculture and Resource Economics*, 53–60.
- Barbazza, C. V. (2005). Funciones de demanda de agua subterránea para el Este mendocino. In *CONAGUA*. Mendoza, Argentina.
- DGI. (2015). *Aqualibro* (2nd ed.). Mendoza: Irrigación Edita.
- Dinar, A. (2000). *The political economy of water pricing reforms*. (A. Dinar, Ed.) (1st ed.). New York: Oxford University Press. Retrieved from http://documents.worldbank.org/curated/en/2000/04/437127/political-economy-water-pricing-reforms
- Dinar, A., & Zilberman, D. (1991). The economics of resource-conservation, pollution-reduction technology selection. The case of irrigation water. *Resources and Energy*, *13*, 323–348 ST – The economics of resource–conservati.
- Esteban, E., & Dinar, A. (2013). Cooperative management of groundwater resources in the presence of environmental externalities. *Environmental and Resource Economics*, *54*(3), 443–469. http://doi.org/10.1007/s10640-012-9602-2
- FAO. (2015). AQUASTAT - Global Map of Irrigation Areas. Retrieved September 15, 2015, from http://www.fao.org/nr/water/aquastat/sets/index.stm
- Foster, S., & Garduño, H. (2005). *Gestión sustentable del agua subterránea. Argentina: Enfoque de gestión integrada para la conservación del agua subterránea en los acuíferos de Mendoza*. Washington, D.C. Retrieved from www.worldbank.org/gwmate
- Foster, S., & Garduño, H. (2006). *Integrated approaches to groundwater resource conservation in the Mendoza aquifers of Argentina*. *Sustainable Groundwater Management*. Washington, D.C.
- Hellegers, P., Zilberman, D., Steduto, P., & McCornick, P. (2008). Interactions between water, energy, food and environment: evolving perspectives and policy issues. *Water Policy*, *10*(S1), 1. http://doi.org/10.2166/wp.2008.048
- Jofré, J. L. (2010). *Efectos de las innovaciones productivas en la agricultura sobre la materialidad institucional del régimen hídrico. El caso mendocino entre 1976-2010*. Universidad Nacional de Cuyo.

References

- Maccari, L. C. (2004). *Proyecto de fortalecimiento institucional. Provincia de Mendoza*. Mendoza, Argentina. Retrieved from http://siteresources.worldbank.org/INTARGENTINAINSPANISH/Resources/Desarrollo_Institucional_Mendoza_Part_1.pd
- Margat, J., & van der Gun, J. (2013). *Groundwater around the world* (1st ed.). Boca Raton, FL: CRC Press. Retrieved from http://www.crcpress.com
- McCornick, P. G., Awulachew, S. B., & Abebe, M. (2008). Water-food-energy-environment synergies and tradeoffs: Major issues and case studies. *Water Policy*, *10*(SUPPL. 1), 23–36. http://doi.org/10.2166/wp.2008.050
- OECD. (2011). *Water governance in OECD countries: A multi-level approach*. OECD Publishing. http://doi.org/10.1787/9789264246744-en
- OECD. (2015). *Drying wells, rising stakes*. *OECD Studies on Water*. Paris: OECD Publishing. http://doi.org/10.1787/9789264238701-en
- OEI-DGI. (2006). *Integración de información, para el diagnóstico y gestión de la calidad del recurso hídrico en cuencas de la provincia de Mendoza, Argentina*. Mendoza, Argentina.
- Scheierling, S. M., Loomis, J. B., & Young, R. a. (2006). Irrigation water demand: A meta-analysis of price elasticities. *Water Resources Research*, *42*(1), 1–9. http://doi.org/10.1029/2005WR004009
- Theesfeld, I. (2010). Institutional challenges for national groundwater governance: policies and issues. *Groundwater*, *48*(1), 131–142. http://doi.org/10.1111/j.1745-6584.2009.00624.x
- Theesfeld, I., Schleyer, C., & Aznar, O. (2010). The procedure for institutional compatibility assessment: ex-ante policy assessment from an institutional perspective. *Journal of Institutional Economics*, *6*(03), 377–399. http://doi.org/10.1017/S1744137410000056
- Zilberman, D., Sproul, T., Rajagopal, D., Sexton, S., & Hellegers, P. (2008). Rising energy prices and the economics of water in agriculture. *Water Policy*, *10*(SUPPL. 1), 11–21. http://doi.org/10.2166/wp.2008.049

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Thanks for your attention – Muchas gracias por su atención

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