



PONTIFICIA
UNIVERSIDAD
CATÓLICA
DE CHILE

Water for Mining and Agriculture - Socio-Economic Welfare and Environmental Costs

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Chile's Groundwater Regulation

- Historical evolution of groundwater development and management can be broken down into four major phases.
 - 1960-1990 period during which groundwater use significantly developed
 - 1990-2000 Increasing overexploitation
 - 2000- present development of an increasingly sophisticated groundwater regulation

Chile's Groundwater Regulation

- WC contains only few references to groundwater
 - Regulatory absence has been covered with groundwater guidelines established by the DGA
 - Groundwater development in institutional setting that put no or few limits on groundwater use
 - Precariousness of the treatment of groundwater remains
- 2018 reform established procedure to restrict groundwater
 - Limiting withdrawals
 - Restriction
 - Prohibition

Chile's Groundwater Regulation

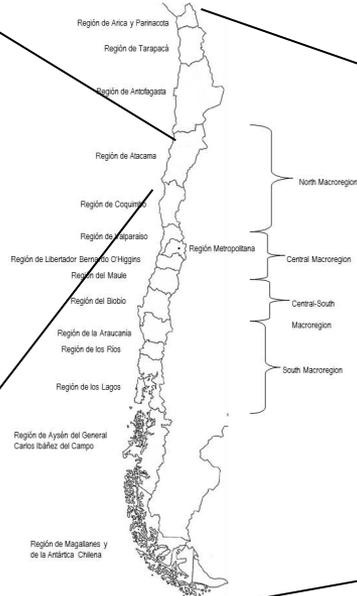
- Groundwater user associations (GWU)
 - Mandatory under restriction & prohibition

Macroregion	Restriction	Prohibition
North	47	5
Center	103	1
South	3	0
Extreme South	0	0
Total	153	6

Copiapó Valley



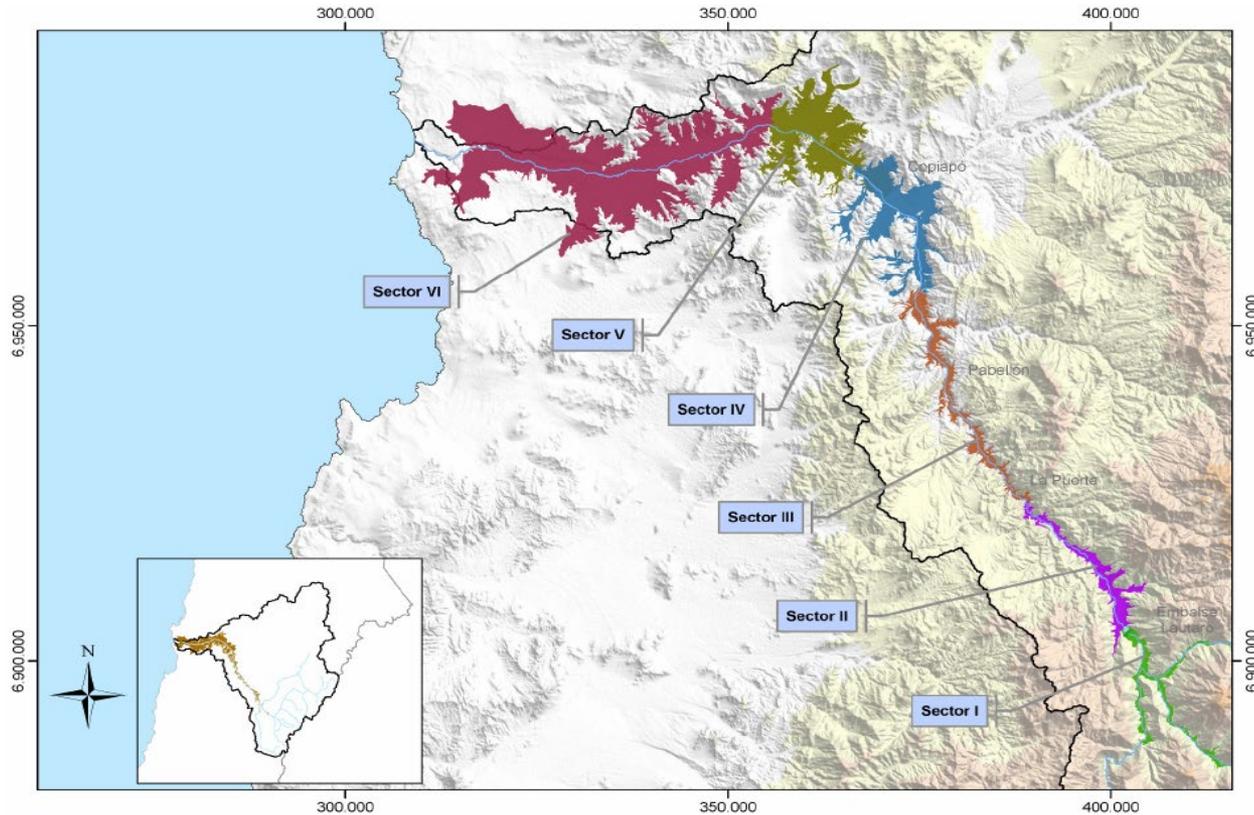
Chile



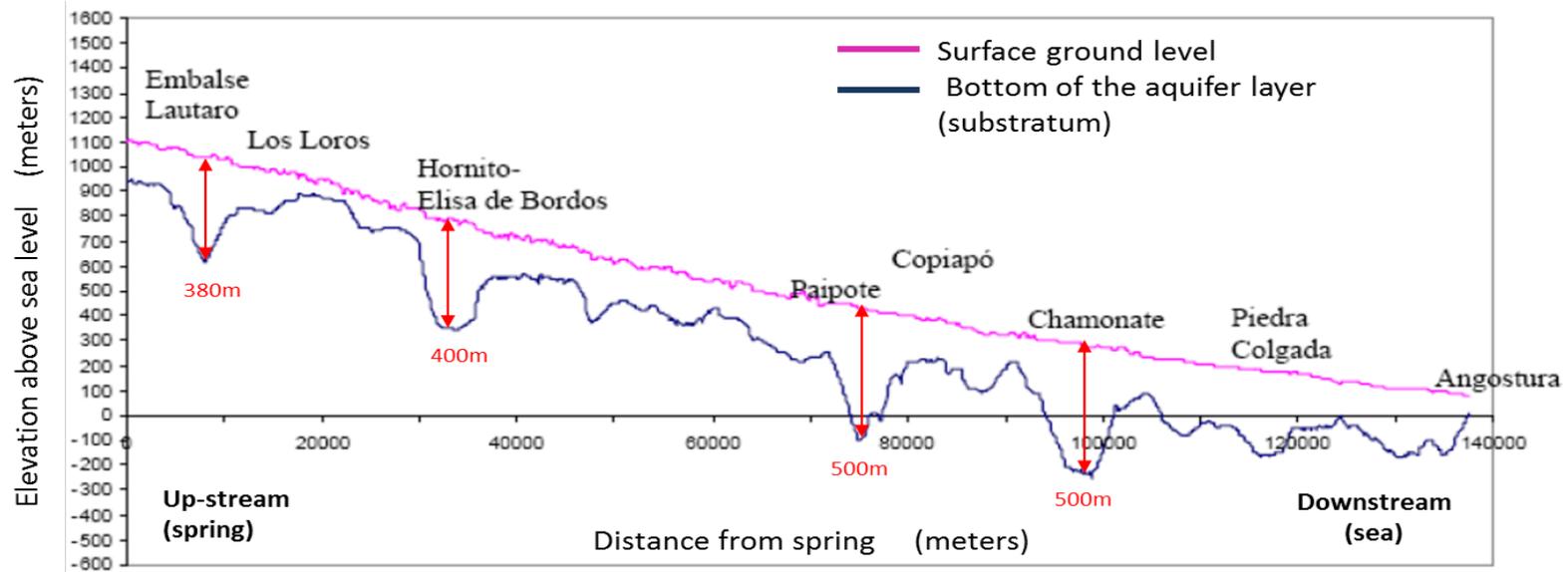
Copiapó Valley



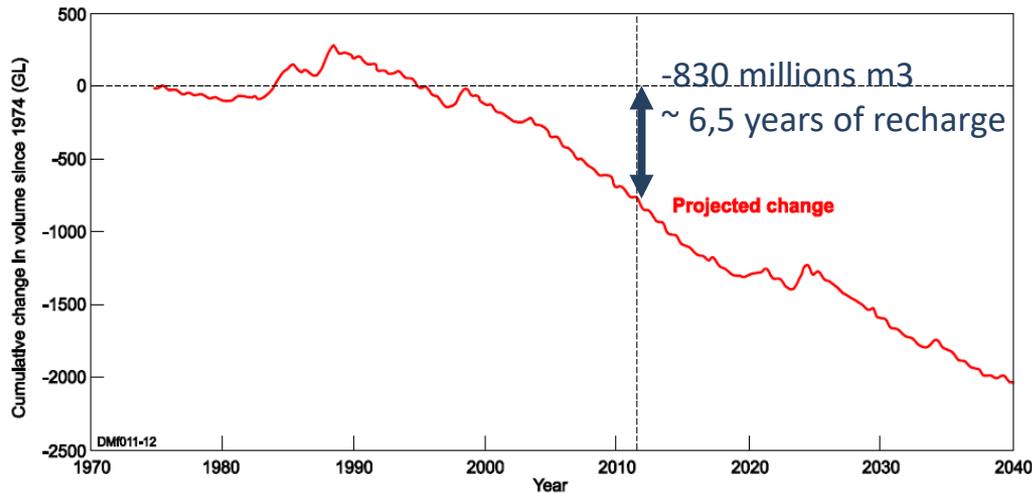
Copiapó Valley Aquifer



Longitudinal section of the aquifer, showing the various sectors

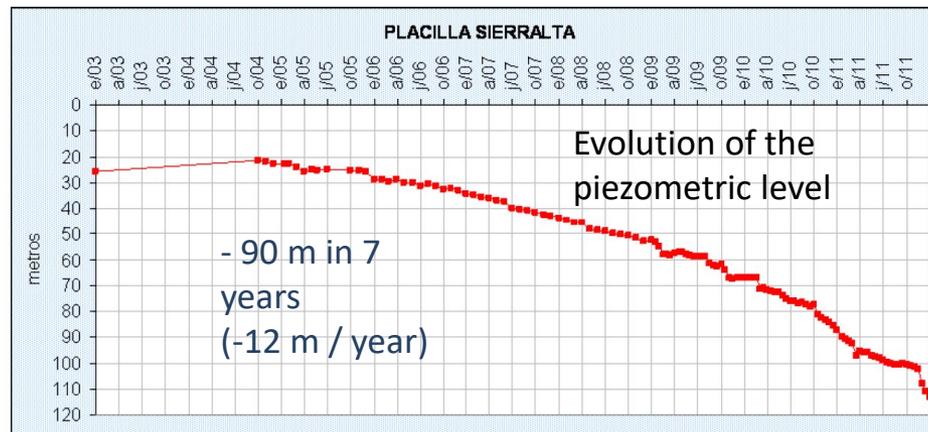


Evidence of Overextraction



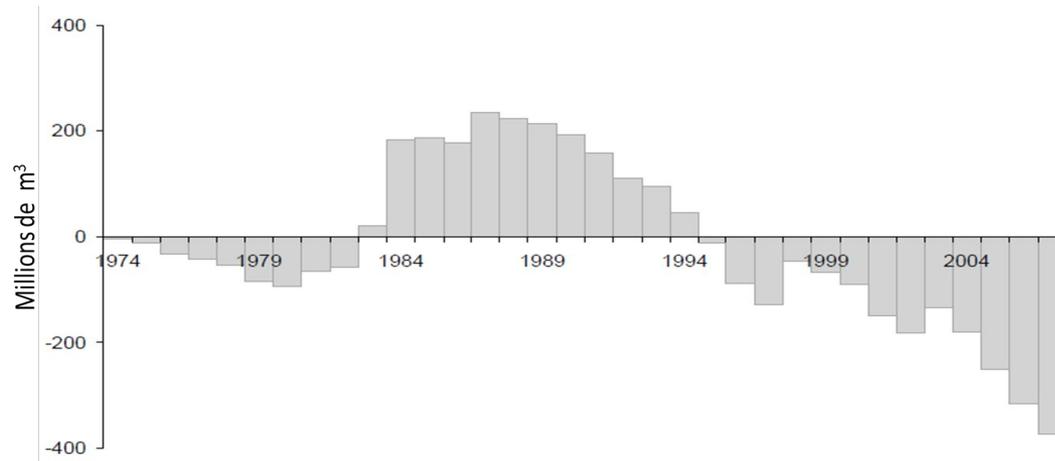
Recharge :
4000 L/s

Granted Water
Rights:
20 000 L/s



Collapse of the water table

Withdrawals exceed recharge of 4 m³ / s



Source DGA (2020)

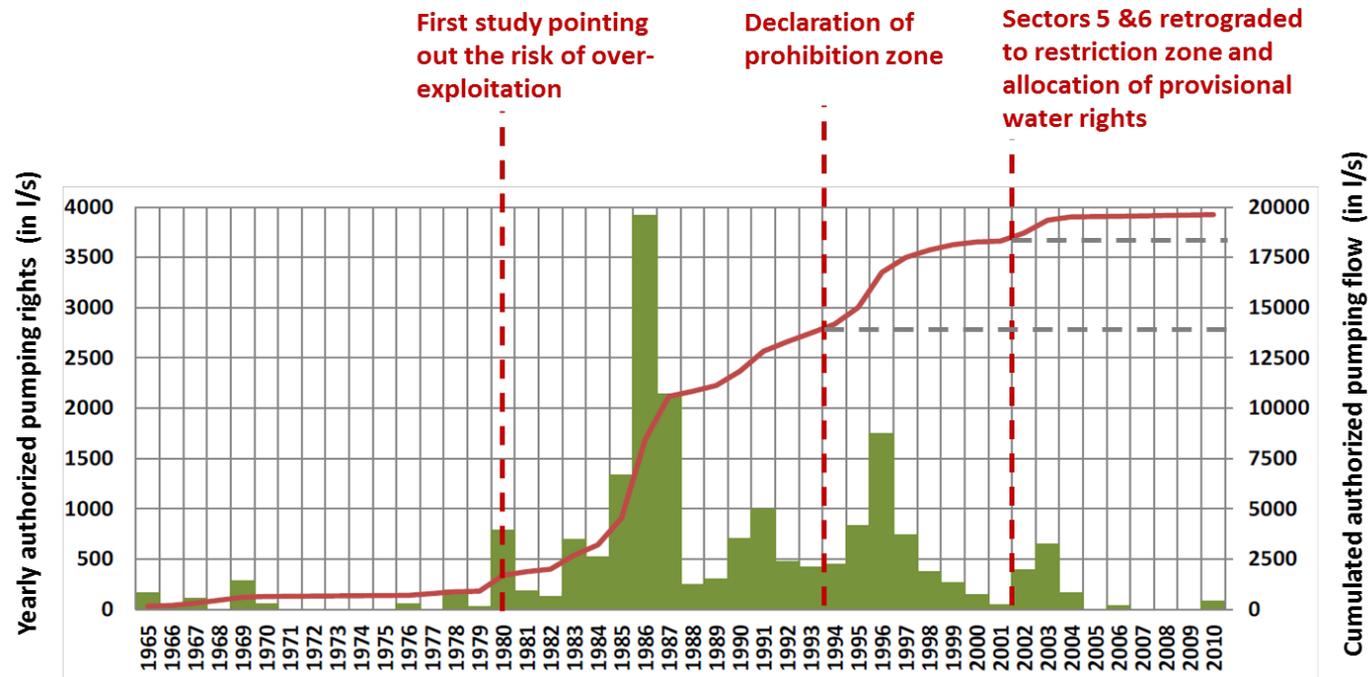
- Last 22 years reserve lost 830 million m³

The origins of the crisis

- Limited knowledge of the groundwater
 - Significant number of major studies alerted authorities danger overexploitation
 - Mixed conclusions of consequences
 - Arguments for
 - Users pressure State to grant WR
 - Government maintain investments mining

The origins of the crisis

- Difficulties of the State in ensuring the closure of the basin
 - Limited knowledge of the groundwater



The origins of the crisis

- Poorly-defined water permits
 - Use Factor
- Increased efficiency and WR trades

Activity	Use factor		Volume consumed per l/sec granted	
	Theoretical	Actual	Theoretical	Actual
Agriculture	20%	40%	7,900 m ³	12,600 m ³
Drinking water	75%	100%	23,650 m ³	31,500 m ³
Mines and Industry	75%	100%	23,650 m ³	31,500 m ³



The origins of the crisis

- Compliance and enforcement problems
 - Responsibility GWUs
 - Few users have installed measuring equipment
 - Weak social norm
 - DGA
 - Little power, Increased in reform 2018
 - Random monitoring \Rightarrow low detection probability
 - 7 last 12 years

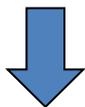
The origins of the crisis

- Inconsistency between the management of surface water and groundwater

Surface irrigation modernization policy



Reduction of artificial recharge of the water table (60% of total recharge) + extension of surfaces (Rebound Effect)



Increase deficit



Emergence of collective management

- Inherited from Surface Water User Associations
 - Effective collective management
- Ground Water User Association
 - Imposed by Water Code
 - First in 2000 – CASUB
 - 2012 – 2015 4 new GWUs
 - At present designing water extraction limits

Concluding Remarks

- Existence of water legislation
 - Does not ensure sustainable GW management
- WR management scheme
 - Inevitable over-allocation situation
 - State must prepare for this
 - Properly defined WR – Volumetric
- Need for crisis-management mechanism

Concluding Remarks

- Assumption State and GWU have capacity to implement policy
- Is not ensured even in countries with
 - Long water management tradition
 - Sophisticated water laws and
 - Well organized State agencies in charge of water management

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