Towards common groundwater management - the case of Copiapo in Northern Chile

Jean-Daniel Rinaudo,

Direction de l'Eau, de l'Environnement et des Ecotechnologies, BRGM

Guillermo Donoso

Water Law and Management Center
Pontificia Universidad Católica de Chile

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Chile's Water Regulation (1981 WC)

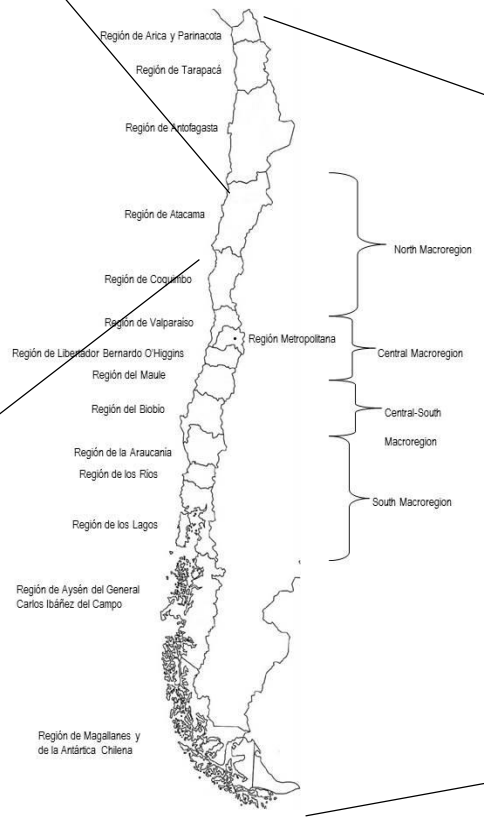
- Sophisticated water legislation
  - Creation and application of individual groundwater use rights
    - Strong property right protection
    - Transferable
  - Bipartite governance

  - Assumes
    - State has capacity to
      - Calculate and impose Sustainable Abstraction Limit (SAL)
      - Sharing SAL among the various users – Individual WR
      - Establish realocation mechanisms – WR markets
      - Define rules to adjust WR volume – Water sharing (WUAs, State has little power)
      - Establish efficient enforcement strategy (WUAs, State has little power)

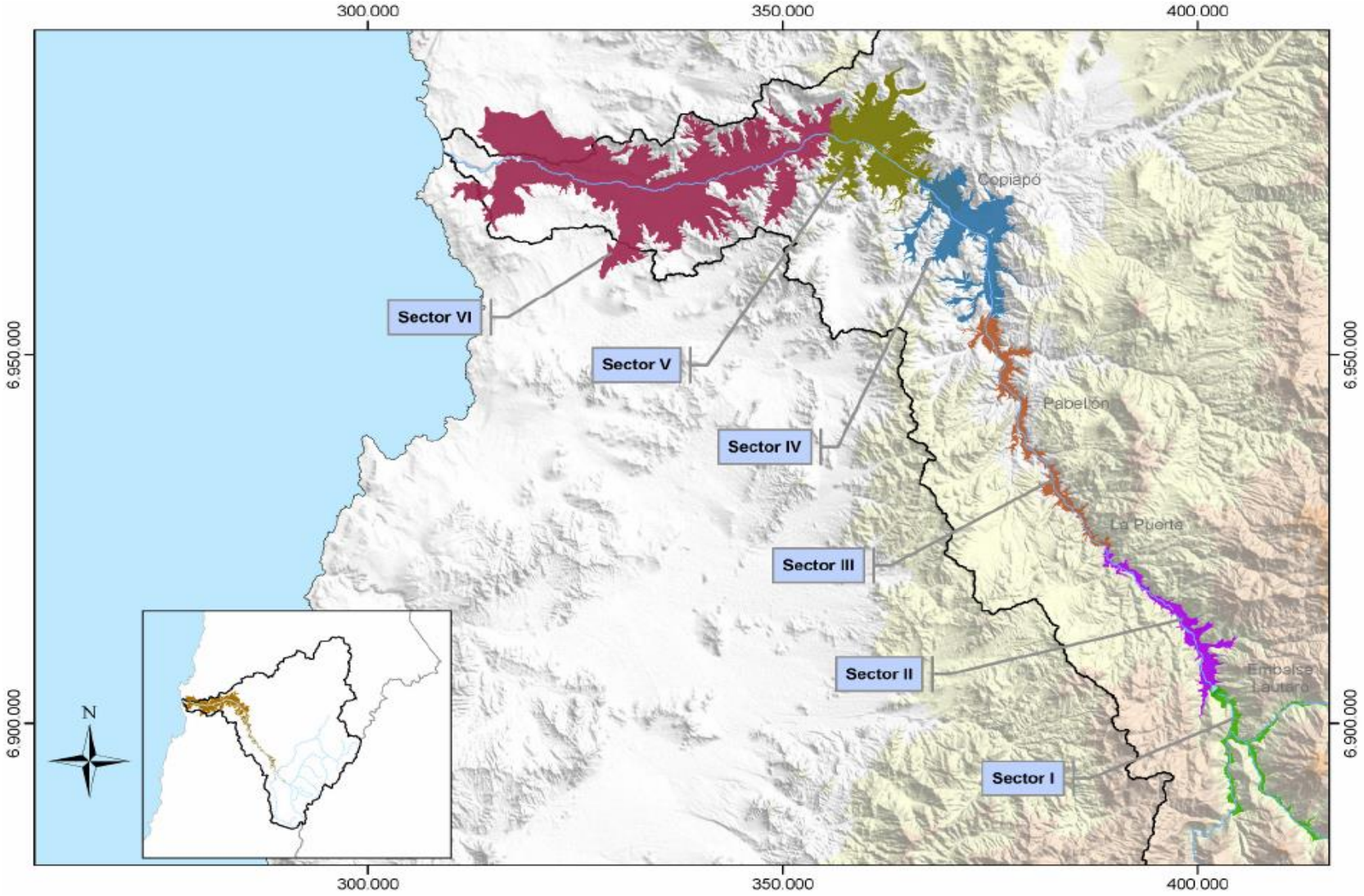
    - Effective collective water management by users

Copiapó Valley

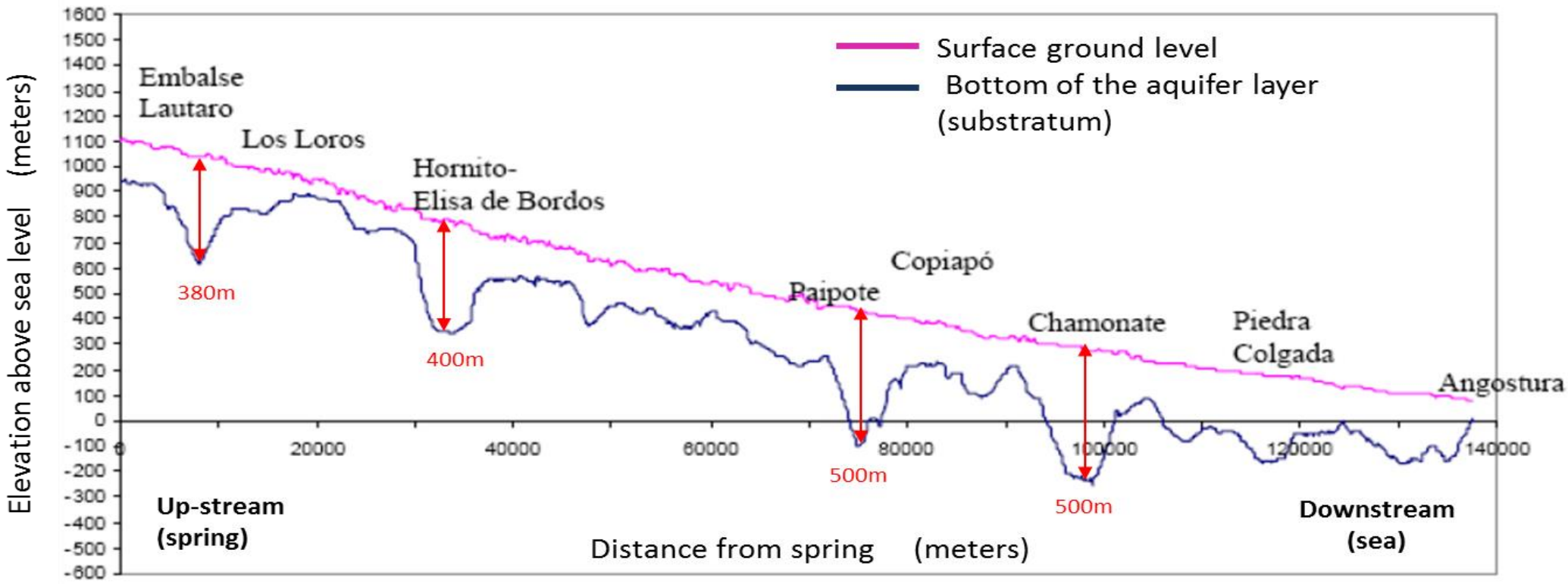
Chile



Copiapó Valley Aquifer

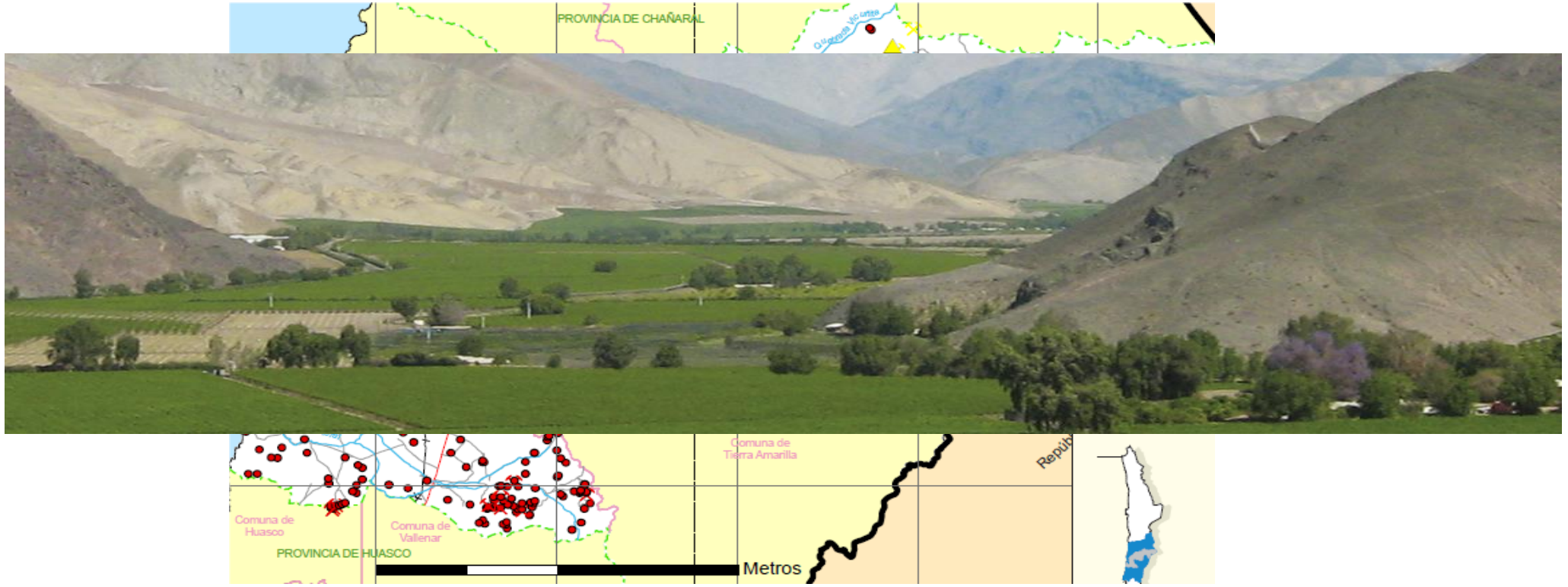


Longitudinal section of the aquifer, showing the various sectors



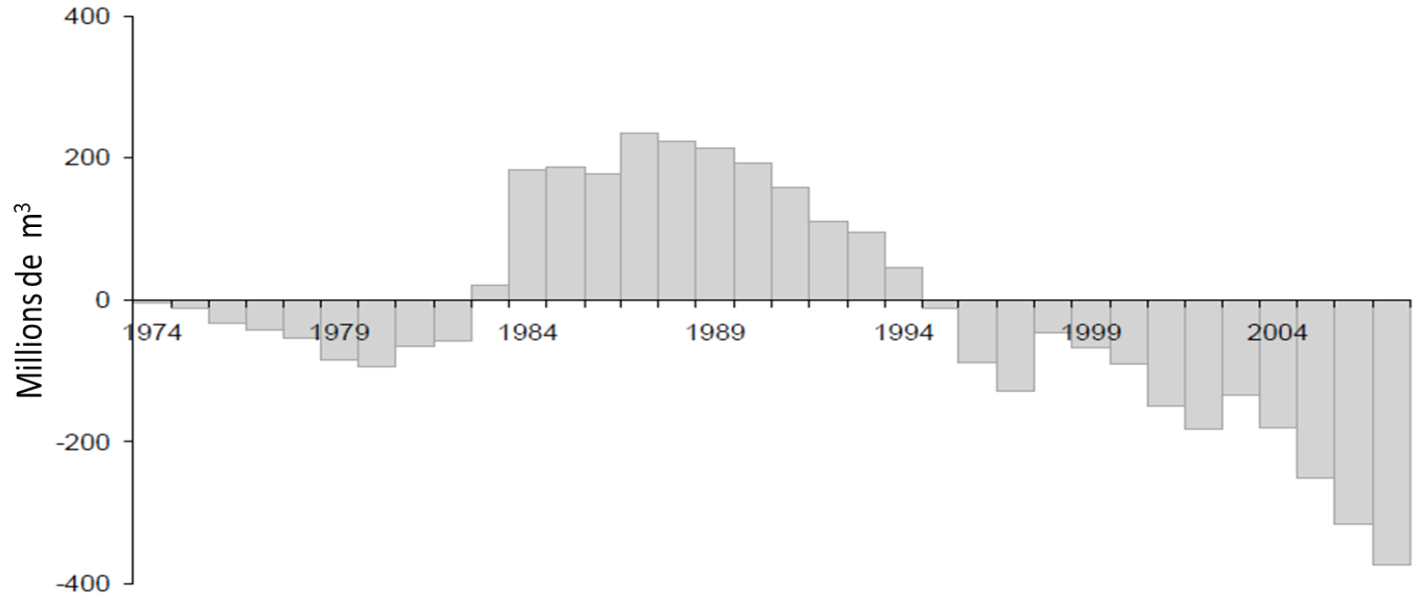
Groundwater crisis in Copiapo Valley

- Economic Growth



Collapse of the water table

- Withdrawals exceed recharge of 4 m^3 / s



Source Hydromas 2013

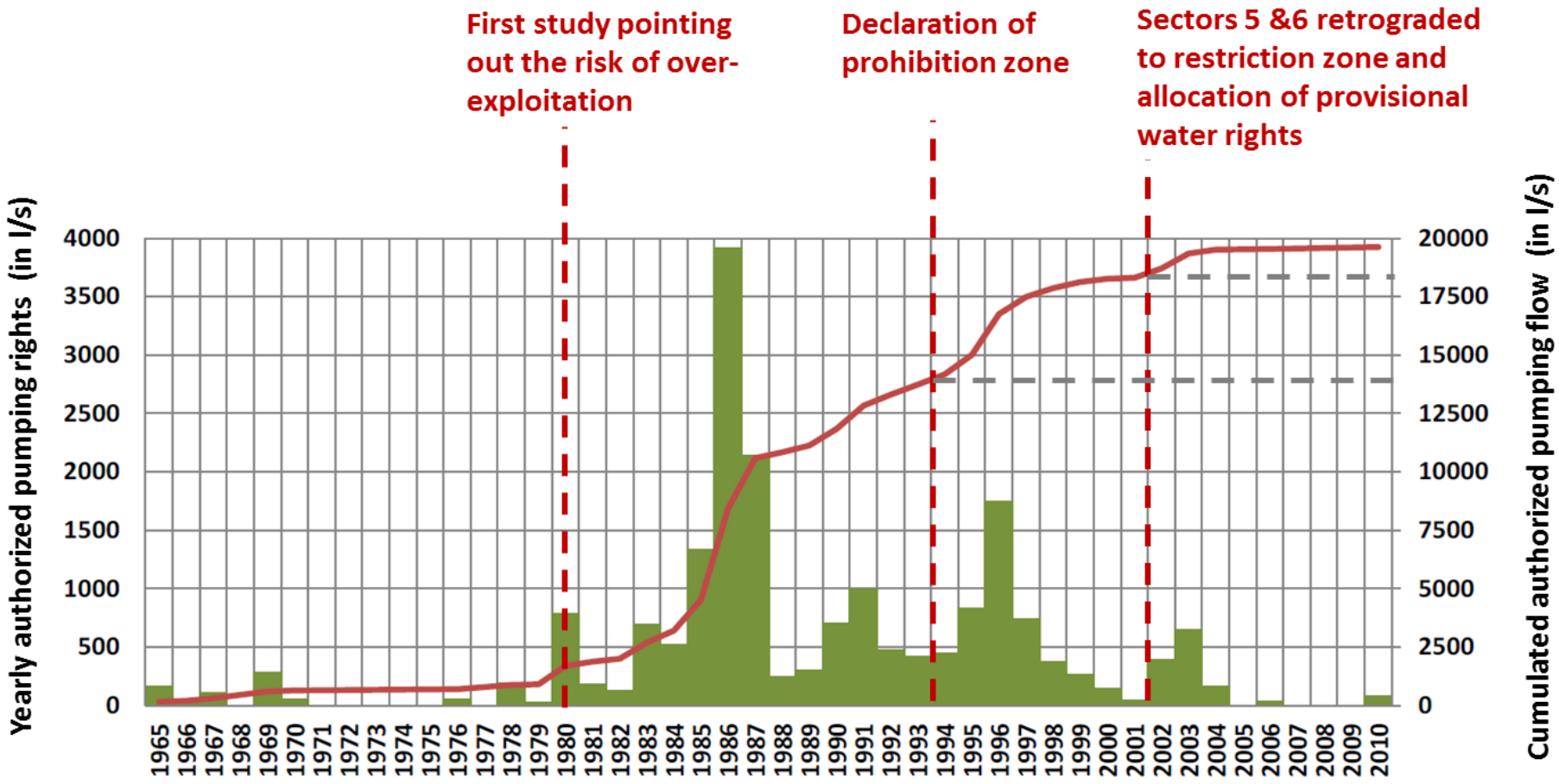
- Last 22 years reserve lost 830 million m^3

The origins of the crisis

- Limited knowledge of the groundwater
  - Significant number of major studies alerted authorities danger overexploitation
  - Mixed conclusions of consequences
    - 1980 study warned overdraft of 18%
    - 1987 study "*reservoir can be worked for next 50 years, including during droughts, without a significant fall in piezometric levels*".
  - Arguments for
    - Users pressure State to grant WR
    - Government maintain investments mining

The origins of the crisis

- Legal complexity and political pressures



The origins of the crisis

- Poorly-defined water permits
  - Use Factor

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

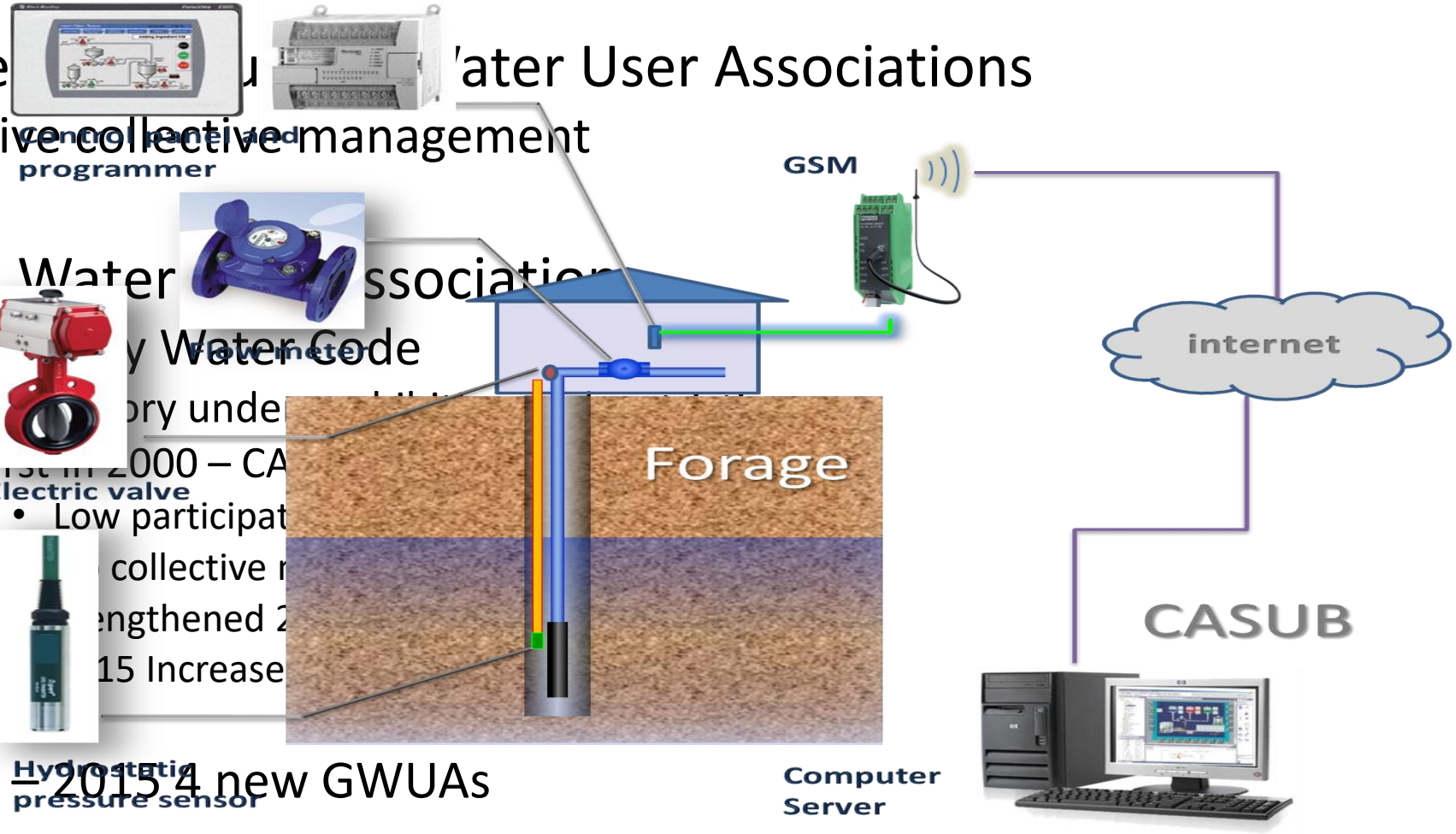
- Compliance and enforcement problems
  - Responsability WUAs
    - Few users have installed measuring equipment
    - Weak social norm
  - DGA
    - Little power
    - Random monitoring $\Rightarrow$ low detection probability
      - 7 last 12 years

The origins of the crisis

- Inconsistency between the management of surface water and groundwater

Emergence of collective management

- Inherite u 'ater User Associations
  - Efective collective management
- Ground Water A ssociation
  - Imp y Water Code
    - M ory unde
    - F st in 2000 – CA
      - Low participat
      - collective r
      - engthened 2
      - 15 Increase
  - 2012 – 2015 4 new GWUAs



Concluding Remarks

- Existence of highly sophisticated 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
  - Piezometric warning levels - trigger a restriction or a temporary prohibition (France) or automatic reduction authorized volumes following year (Australia)

Concluding Remarks

- Assumption State has capacity
  - Requirement is not ensured even in countries with
    - Long water management tradition
    - Sophisticated water laws and
    - Well organized State agencies in charge of water management

Thank You