Universidad de Concepción

CRHIAM
CENTRO DE RECURSOS HÍDRICOS PARA LA AGRICULTURA Y LA MINERÍA

Agriculture in Central Chile: Challenges and oportunities

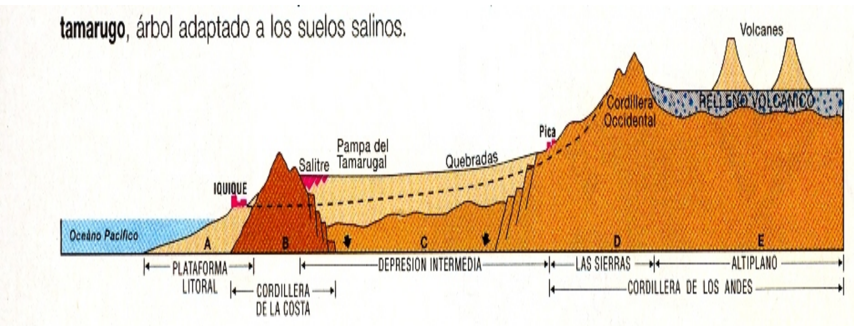
Dr Diego Rivera Salazar
Civil Engineer
Group leader
Comparative Policy in Water Resources Management

Key points

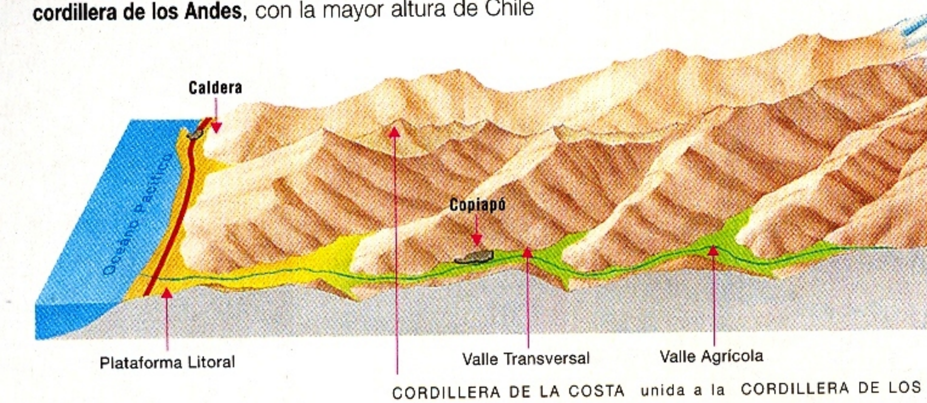
- Central Chile is subject to strong interannual, decadal variability, plus climate change.
- Mediterranean climate: wet winters (80 % of annual precipitation in 4 months) and dry-warm summers.
- Agriculture relies on storage – natural and artificial-, snowmelt and water distribution.
- Regulation relies on private sector: water rights are free and perpetual.

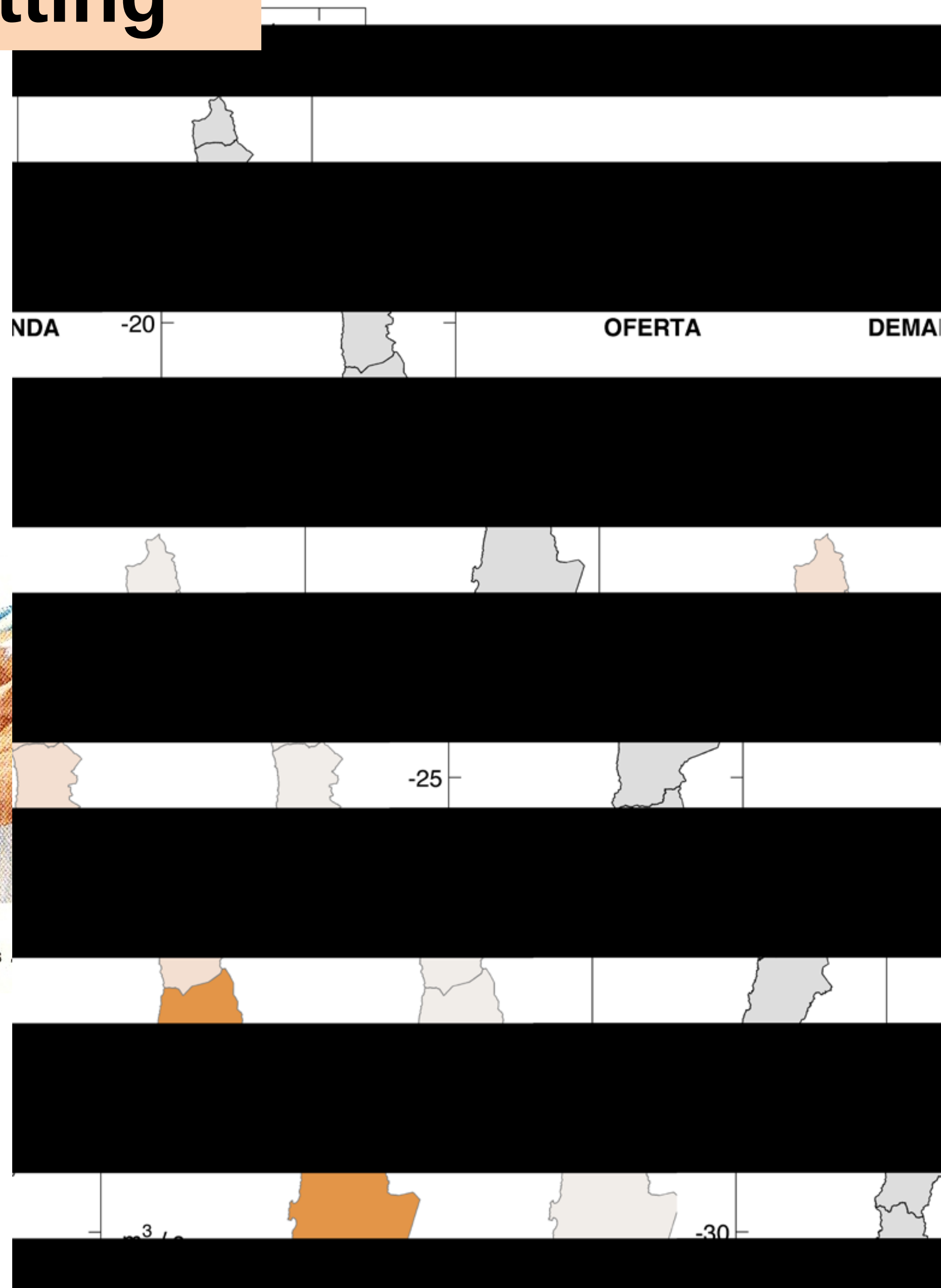
A. Hydrogeological setting

tamarugo, árbol adaptado a los suelos salinos.

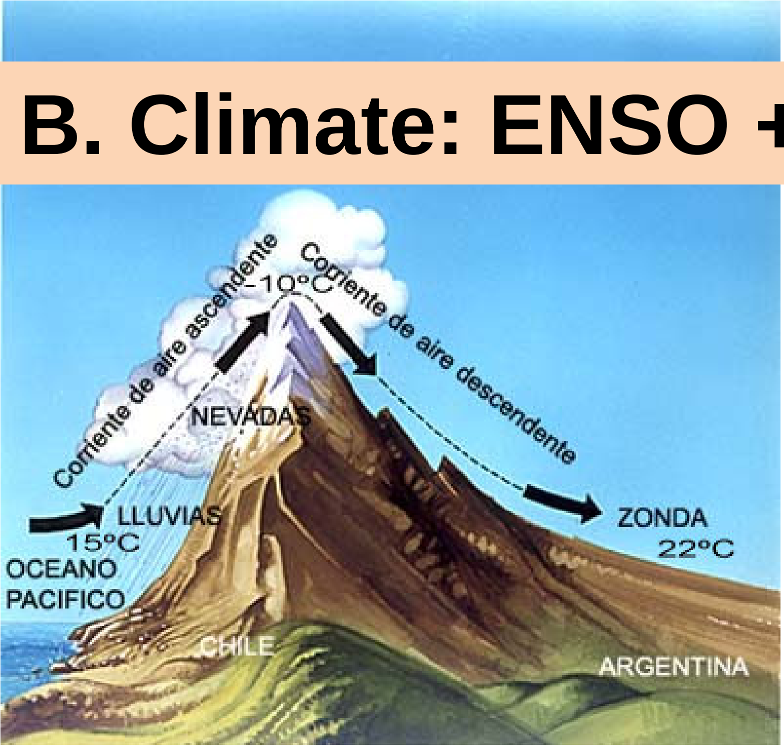


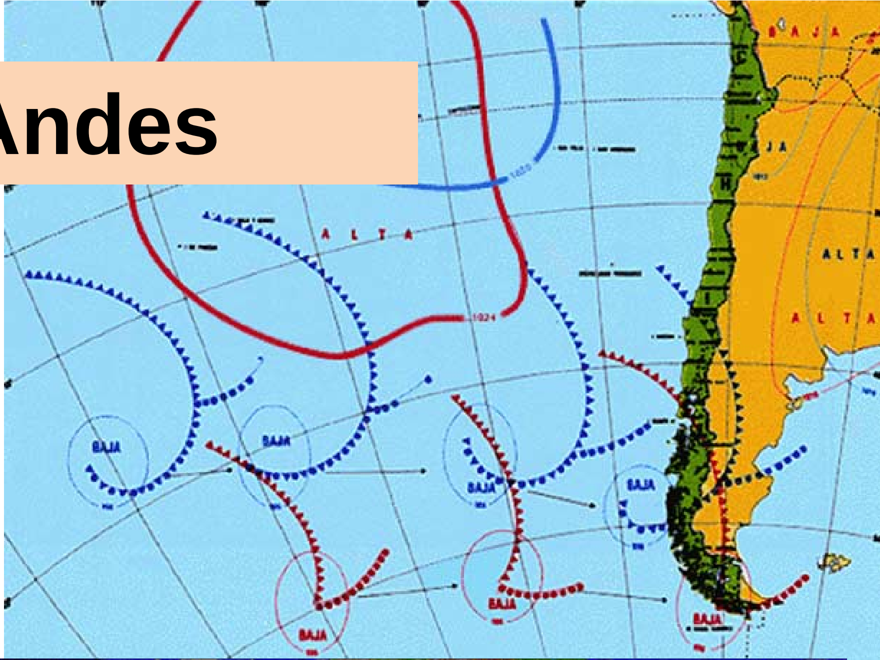
tiene algunas interrupciones en el valle de Copiapó. al océano.
cordillera de los Andes, con la mayor altura de Chile

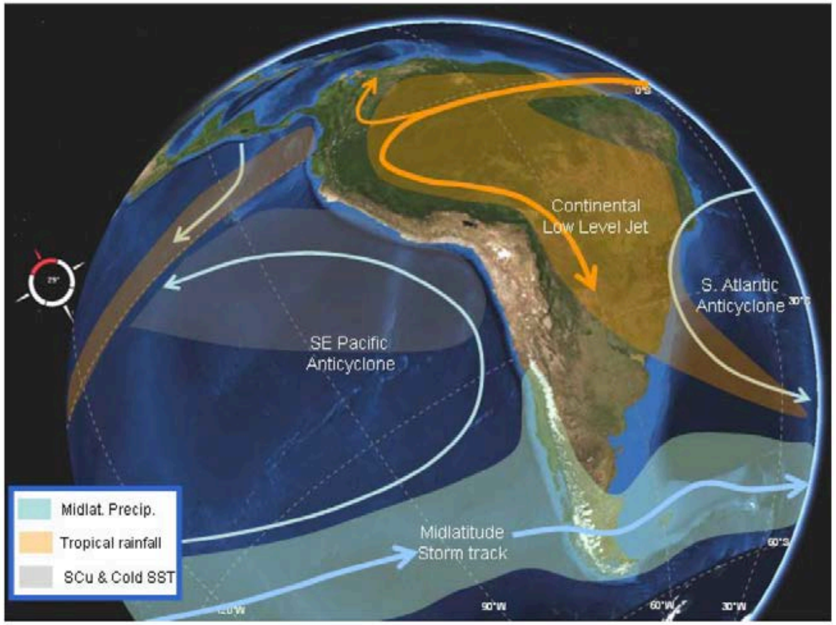


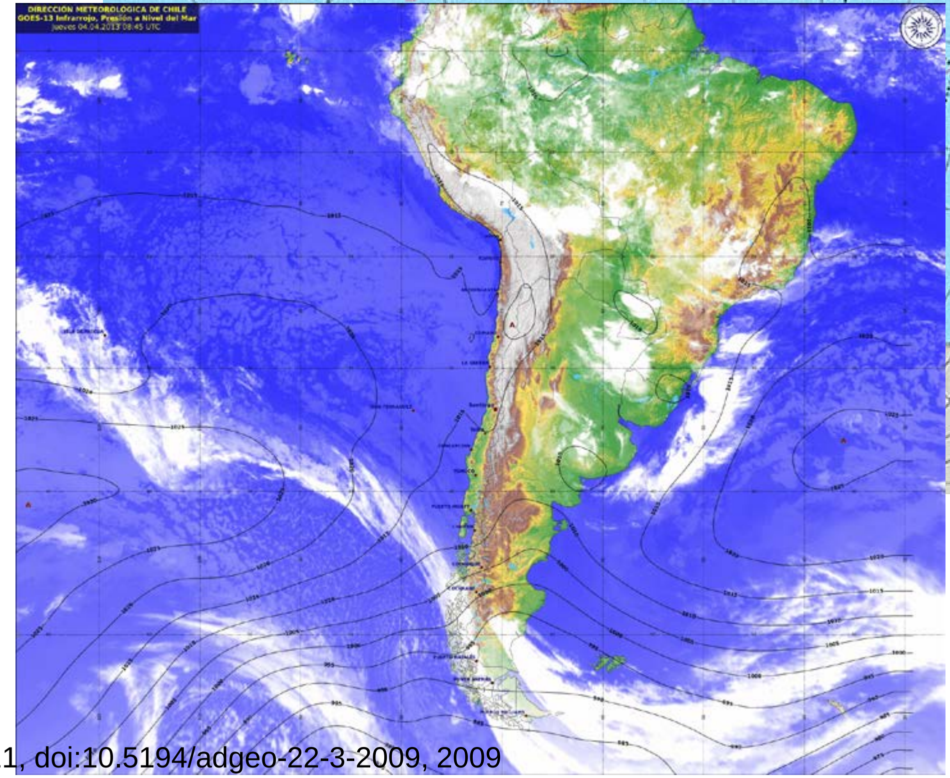


B. Climate: ENSO + The Andes



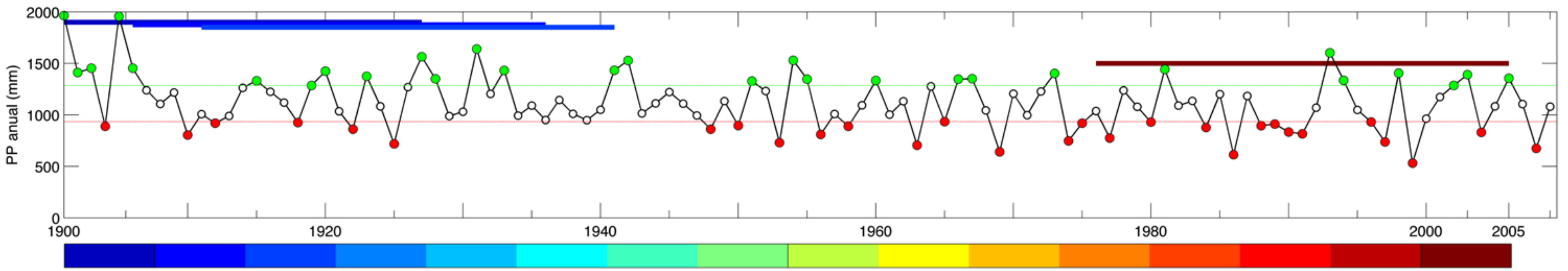


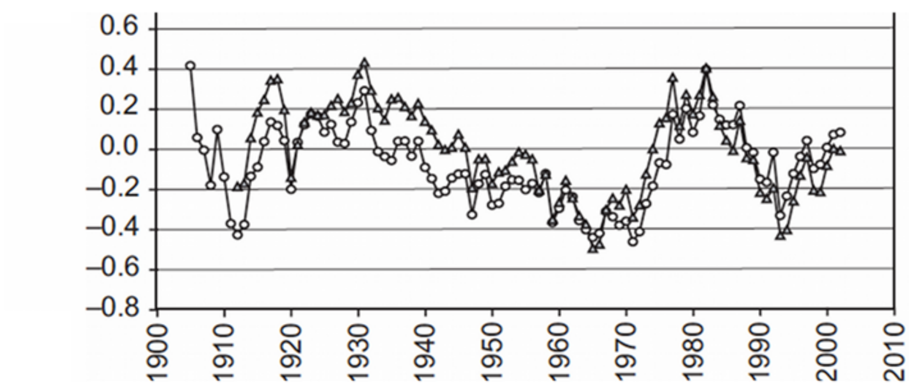




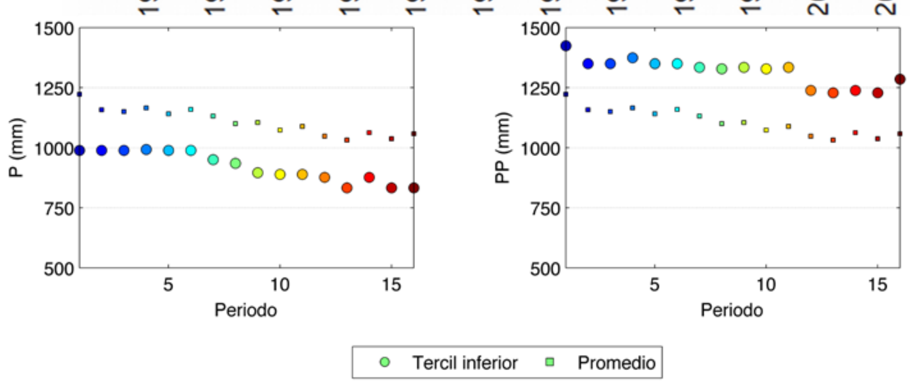
Garreaud, R. D.: The Andes climate and weather, Adv. Geosci., 22, 3-11, doi:10.5194/adgeo-22-3-2009, 2009

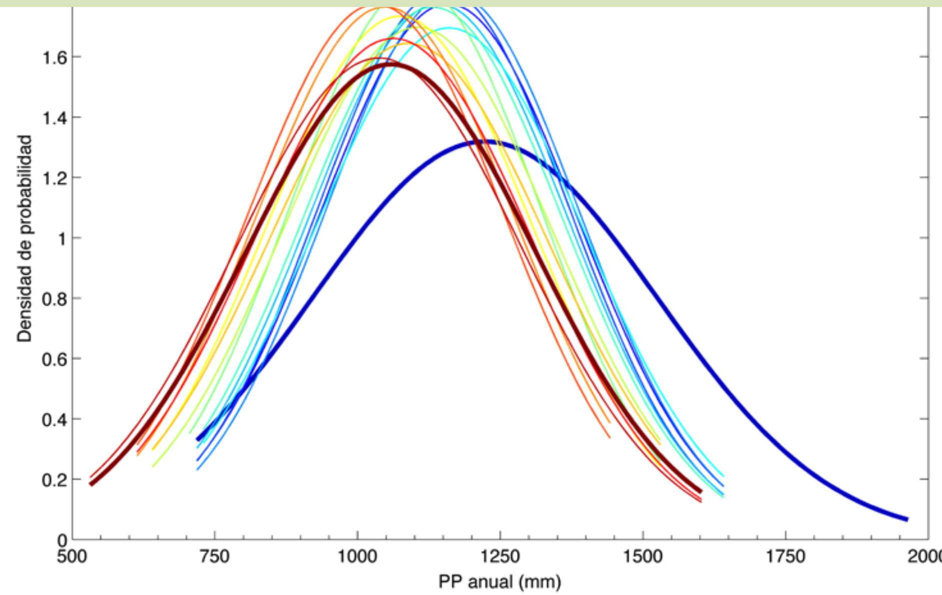
C. Climate variability: Uncertainty for planning



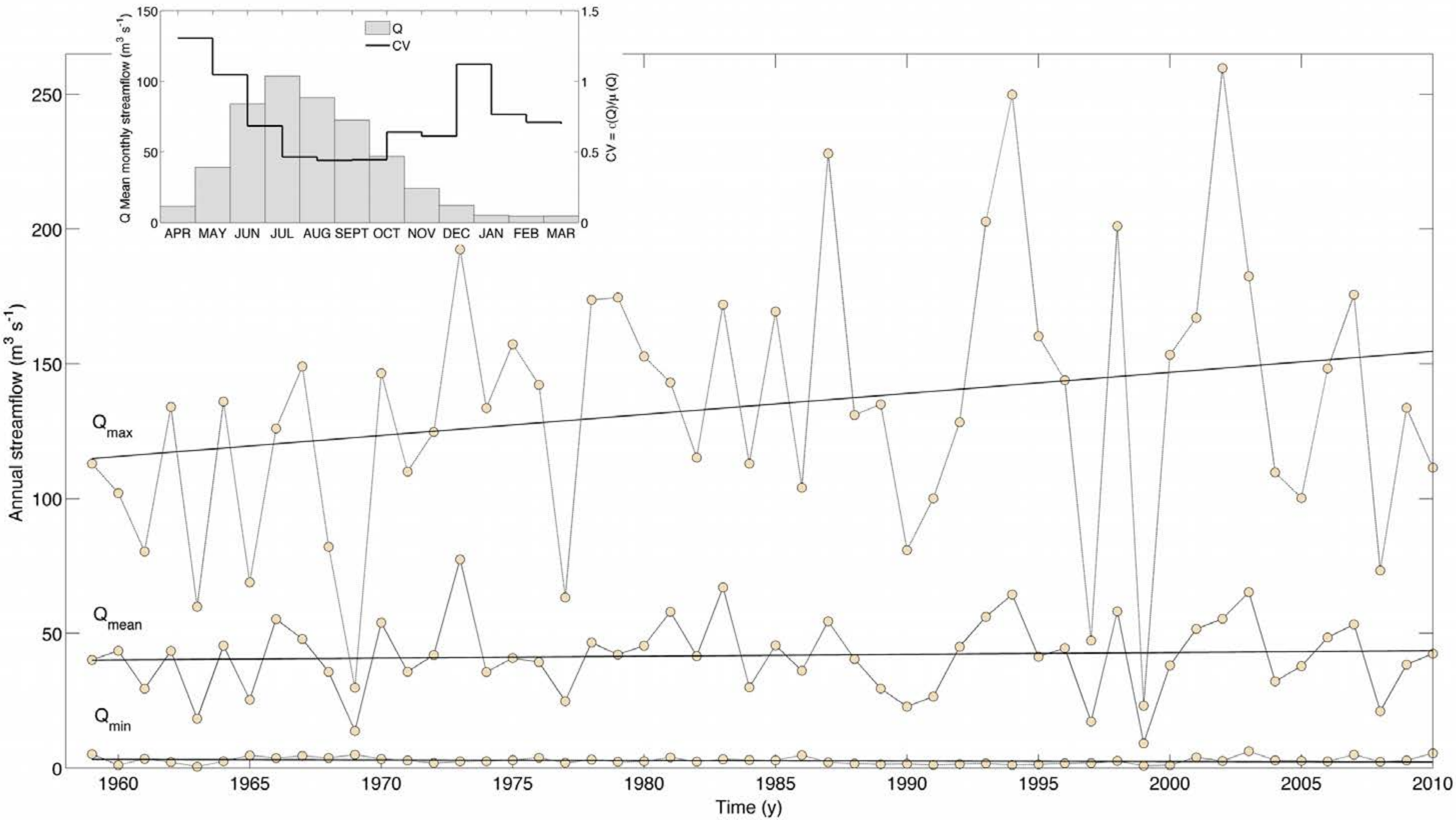


Quintana & Aceituno (2012) Changes in the rainfall regime along the extratropical west coast of South America (Chile): 30-43º S

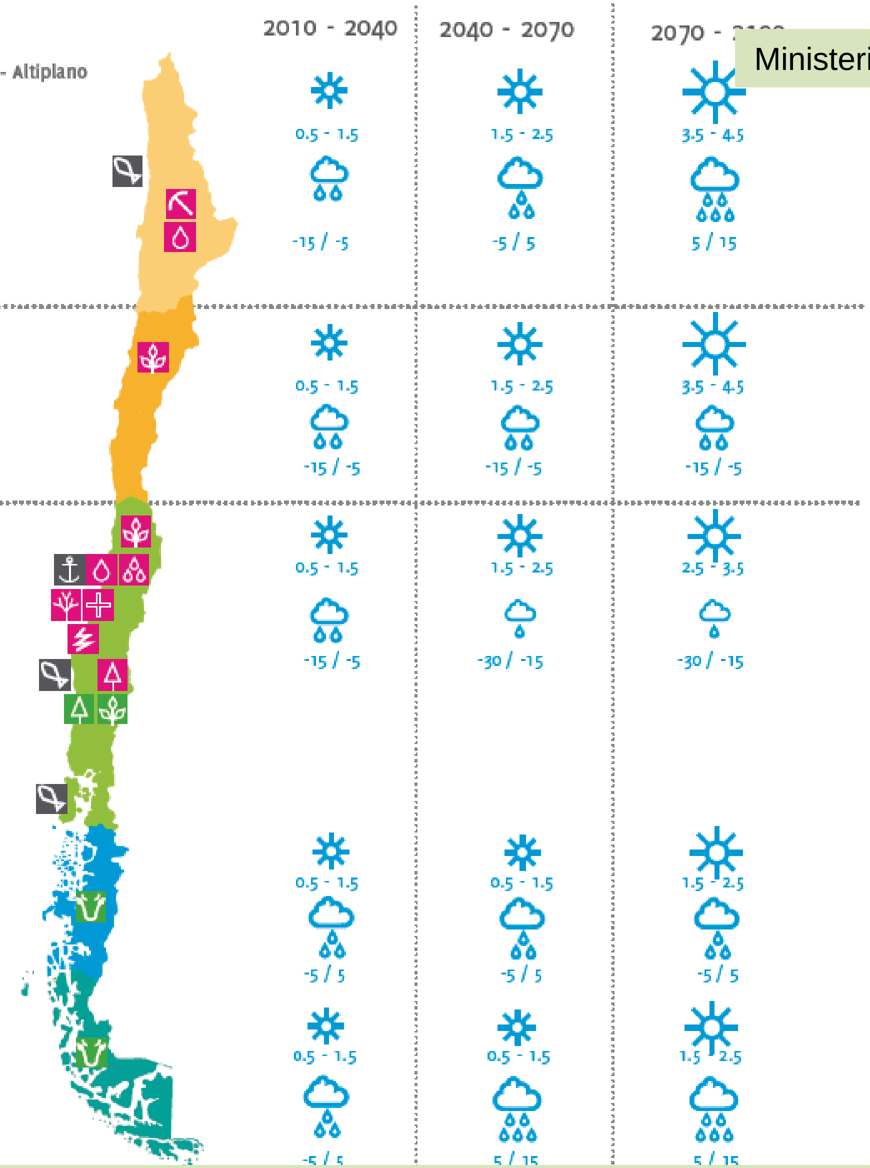




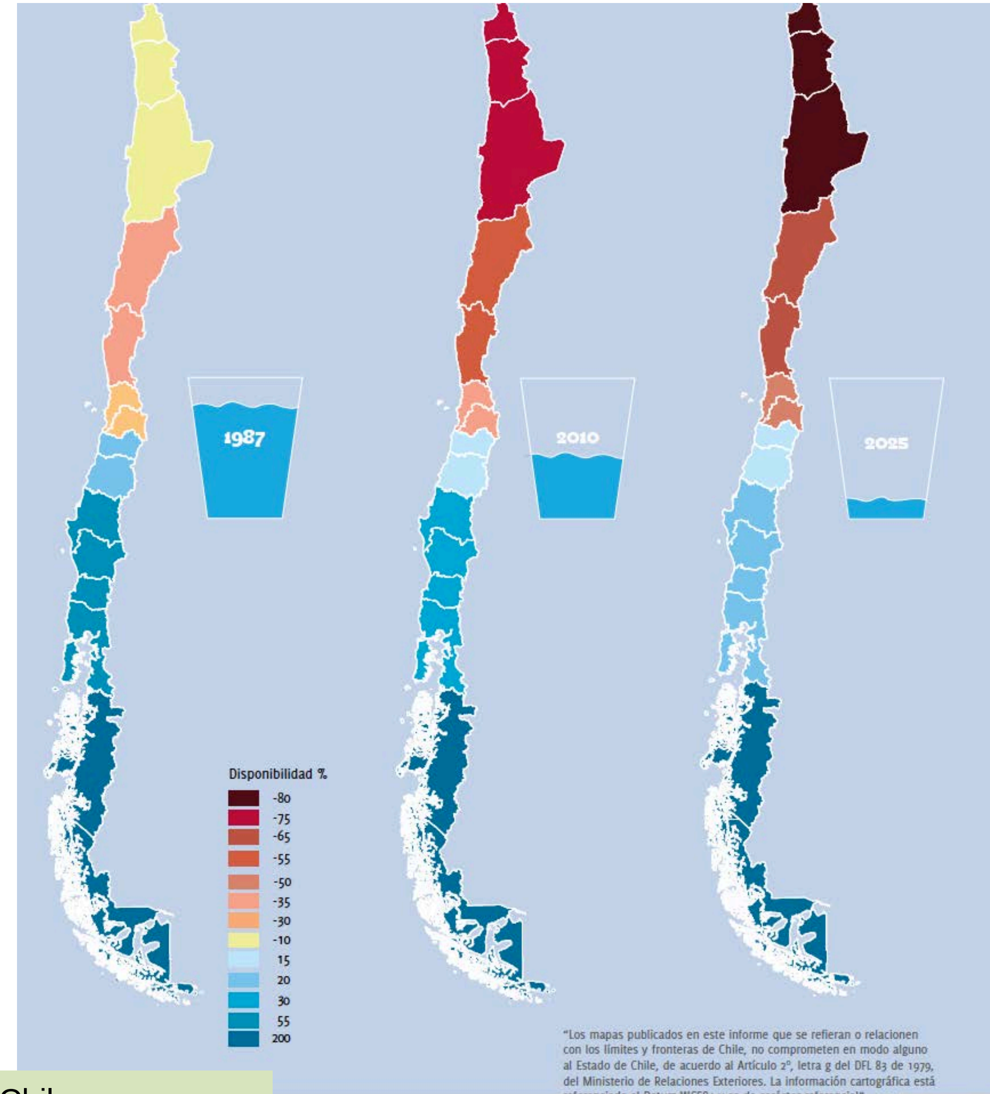
D. Climate change: <u>observed</u> changes



D. Climate change: projected changes



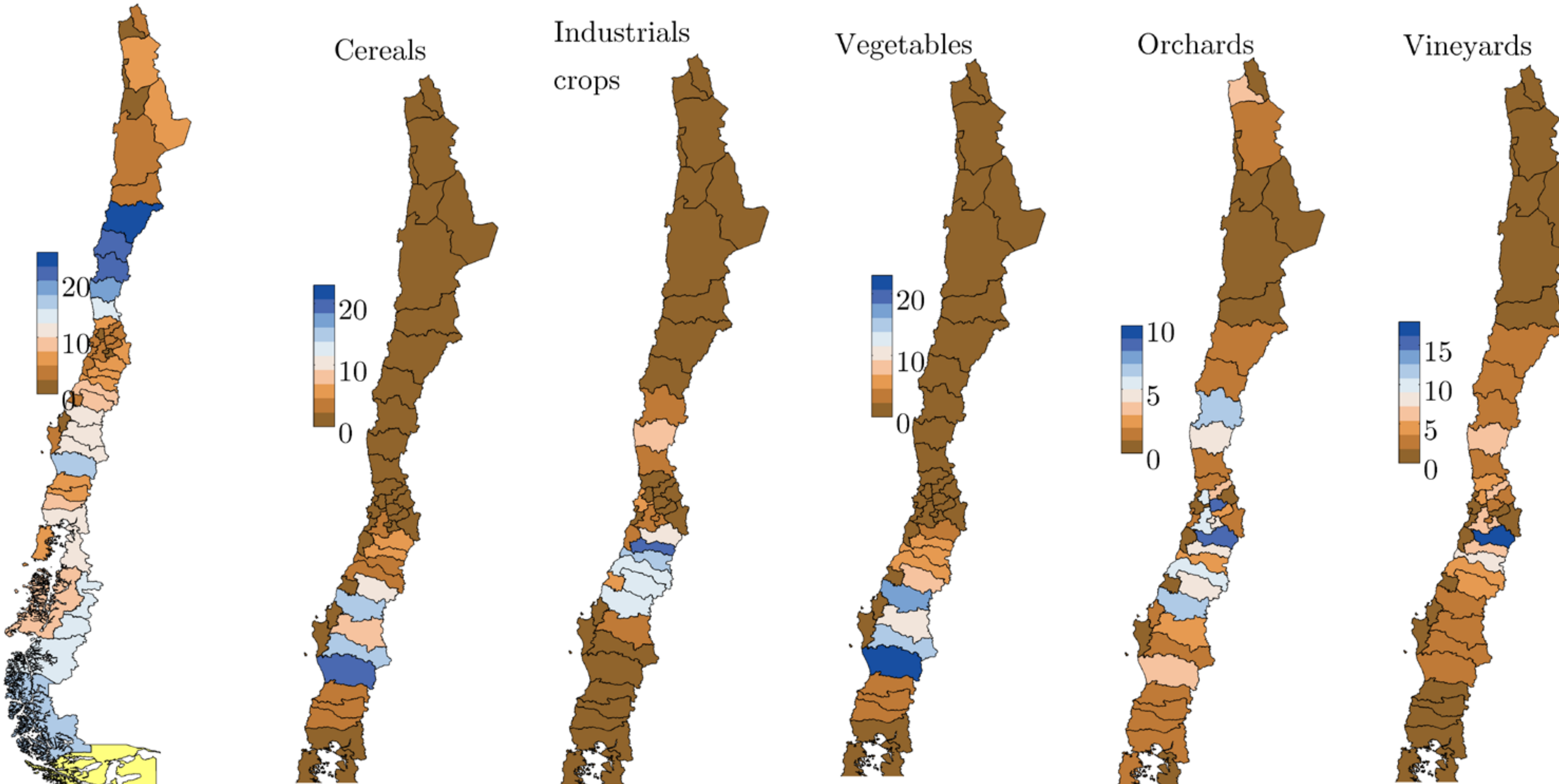
Ministerio de Medioambiente (2011) Informe del Estado del Medio Ambiente



Samaniego et al. (2012). La economía del cambio climático en Chile.

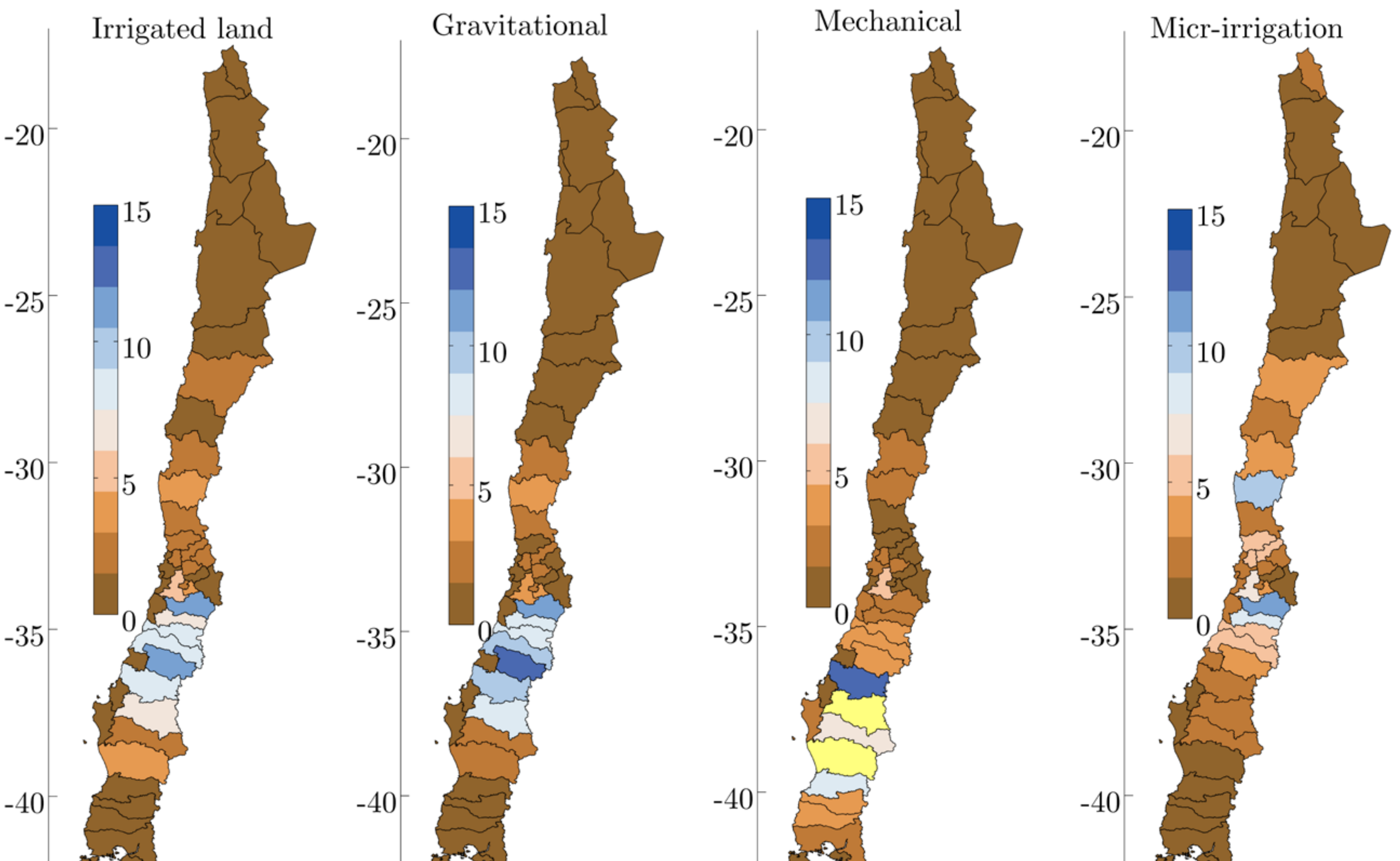
E. Chilean Agriculture: crops (80 % H_2O)

Fresh products
High geographical concentration
Competing uses: energy, mining



E. Chilean Agriculture: irrigation

1.000.000 ha: 75 % gravitational, 25 % mechanical and micro



F. Challenges

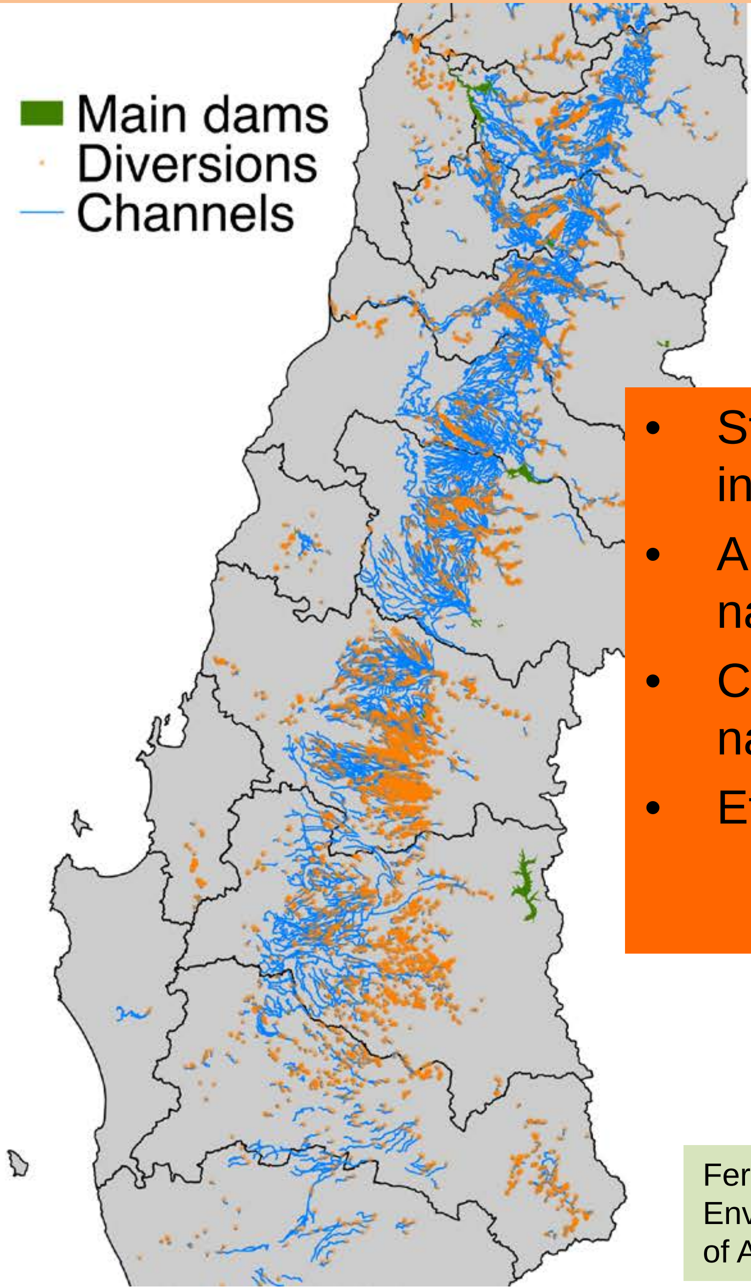
Climate variability and change:

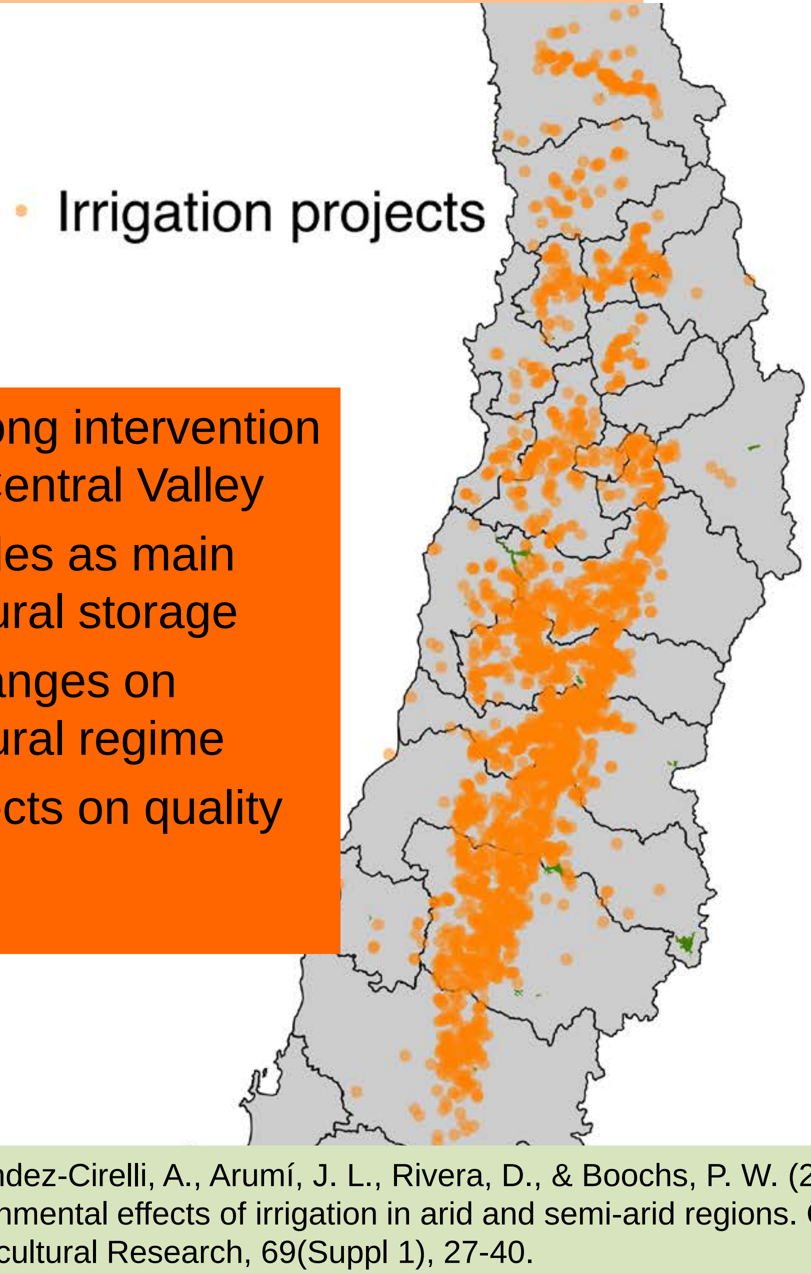
- Uncertainty for year-to-year planning
- Actions for long-term adaptation
- Insfraestructure

Conciliation between infraestructure and environment

Conflicts resolution

Infraestructure and environment



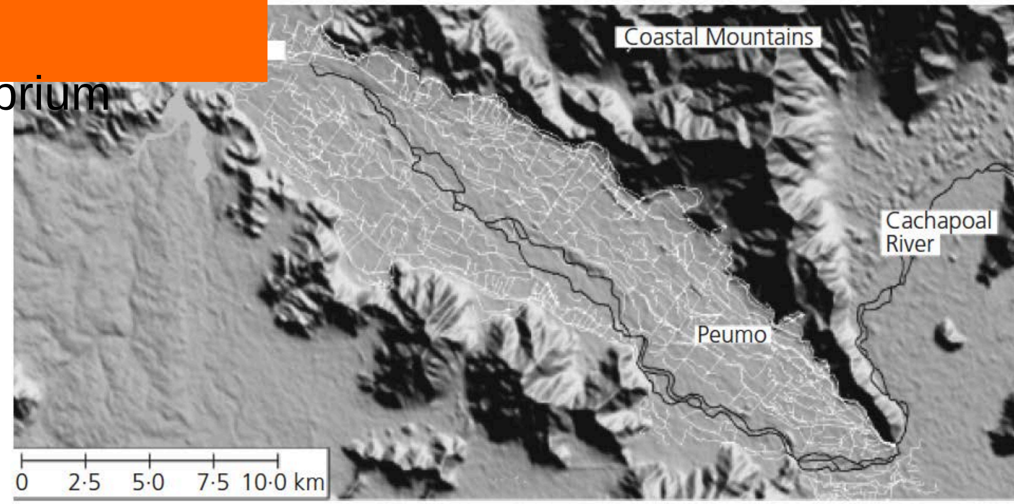


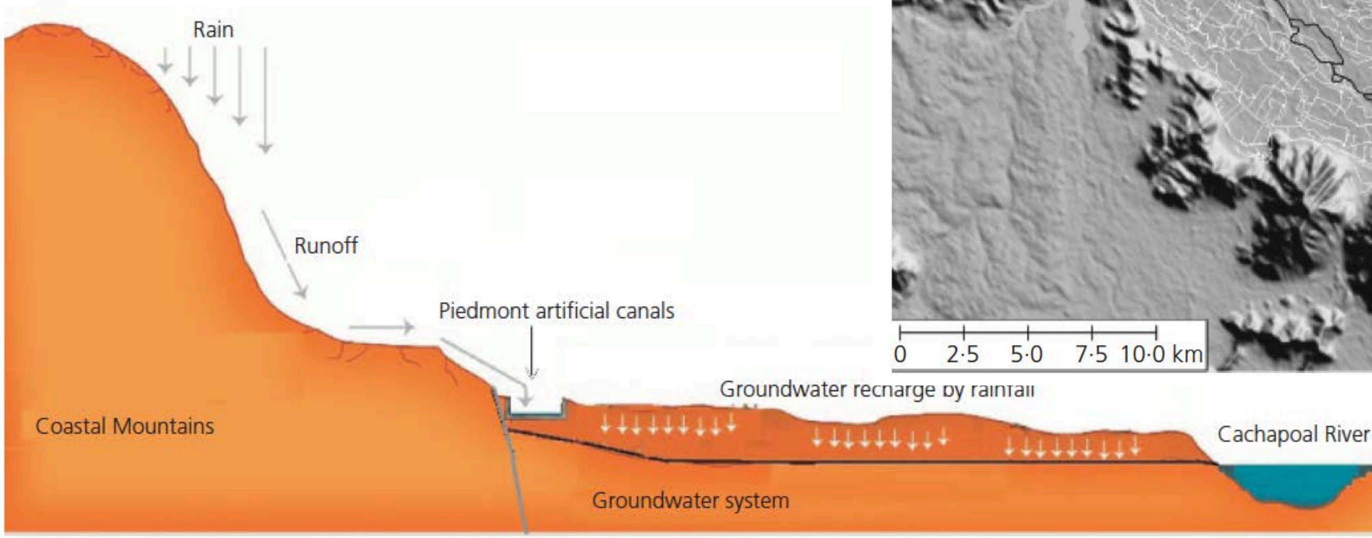
- Strong intervention in Central Valley
- Andes as main natural storage
- Changes on natural regime
- Effects on quality

Fernández-Cirelli, A., Arumí, J. L., Rivera, D., & Boochs, P. W. (2009). Environmental effects of irrigation in arid and semi-arid regions. Chilean Journal of Agricultural Research, 69(Suppl 1), 27-40.

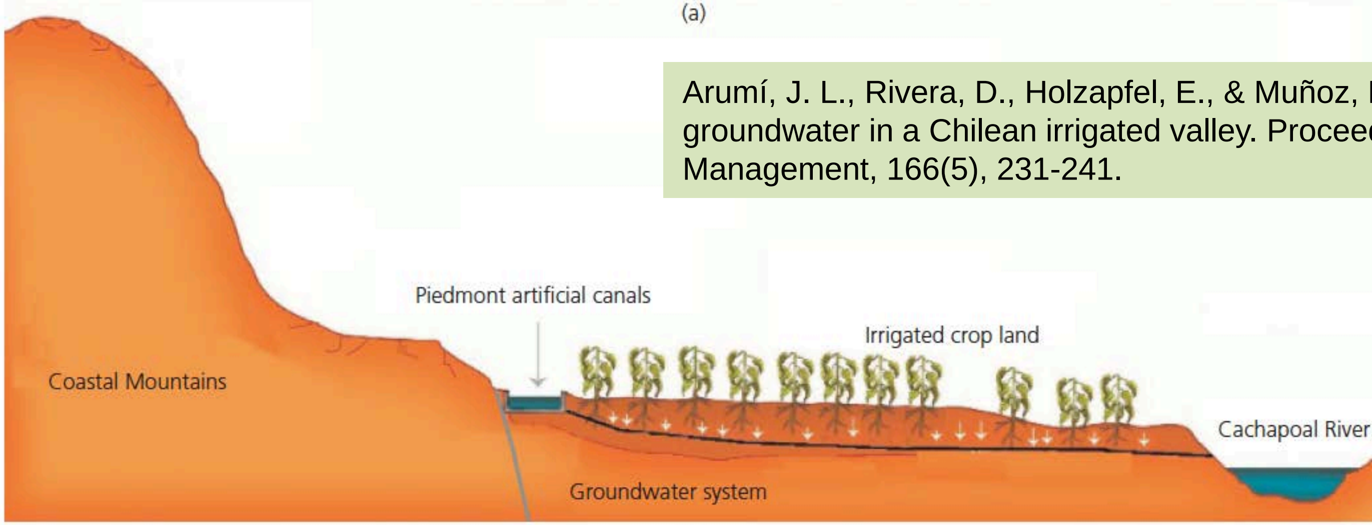
Changes on natural regime: The Peumo valley

- 50 % of grounwater recharge comes from channels
- Problems with irrigation management
- Is lining the solution? Long-term equilibrium





(a)

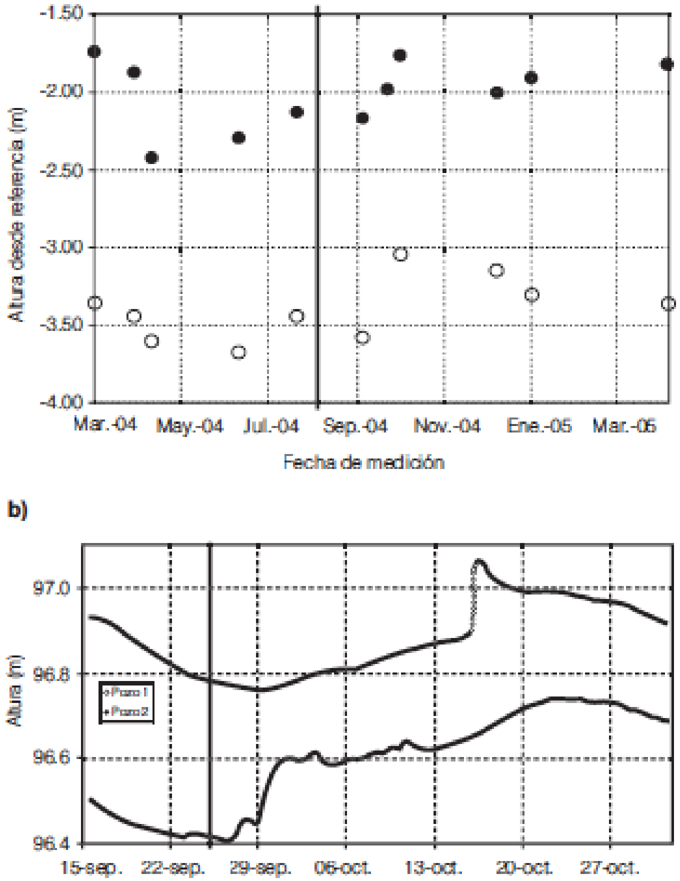


(b)

Arumí, J. L., Rivera, D., Holzapfel, E., & Muñoz, E. (2013). Effect of drought on groundwater in a Chilean irrigated valley. Proceedings of the ICE-Water Management, 166(5), 231-241.

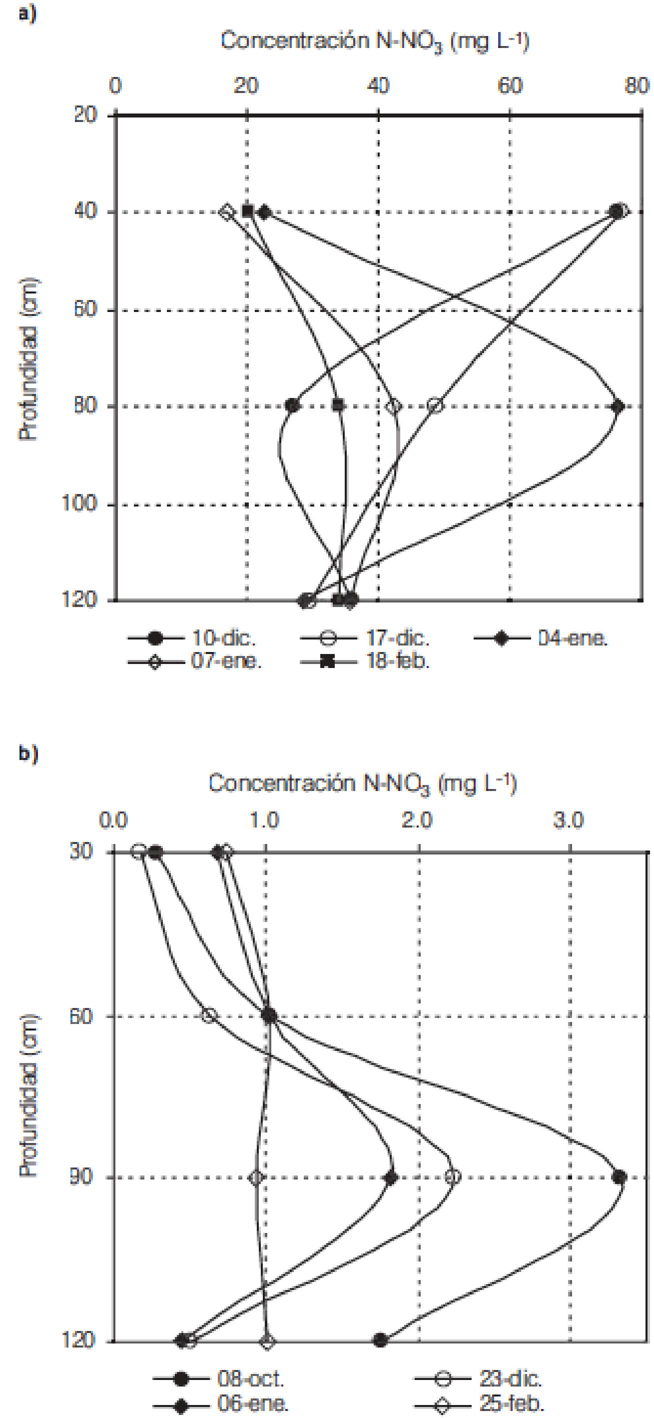
Changes on natural regime: The Peumo valley

- "Stable" groundwater levels
- Contamination



Flores, H., Arumí, J. L., Rivera, D., & Lagos, L. O. (2012). A simple method to identify areas of environmental risk due to manure application. Environmental monitoring and assessment, 184(6), 3915-3928.

Rivera, D., Arumi, J. L., & Holzapfel, E. (2007). Effect of irrigation channel network and irrigation systems on the hydrology of Peumo Valley, Chile. INGENIERIA HIDRAULICA EN MEXICO, 22(4), 115-119..



G. Opportunities

Move from field-efficiency to watershed effciency

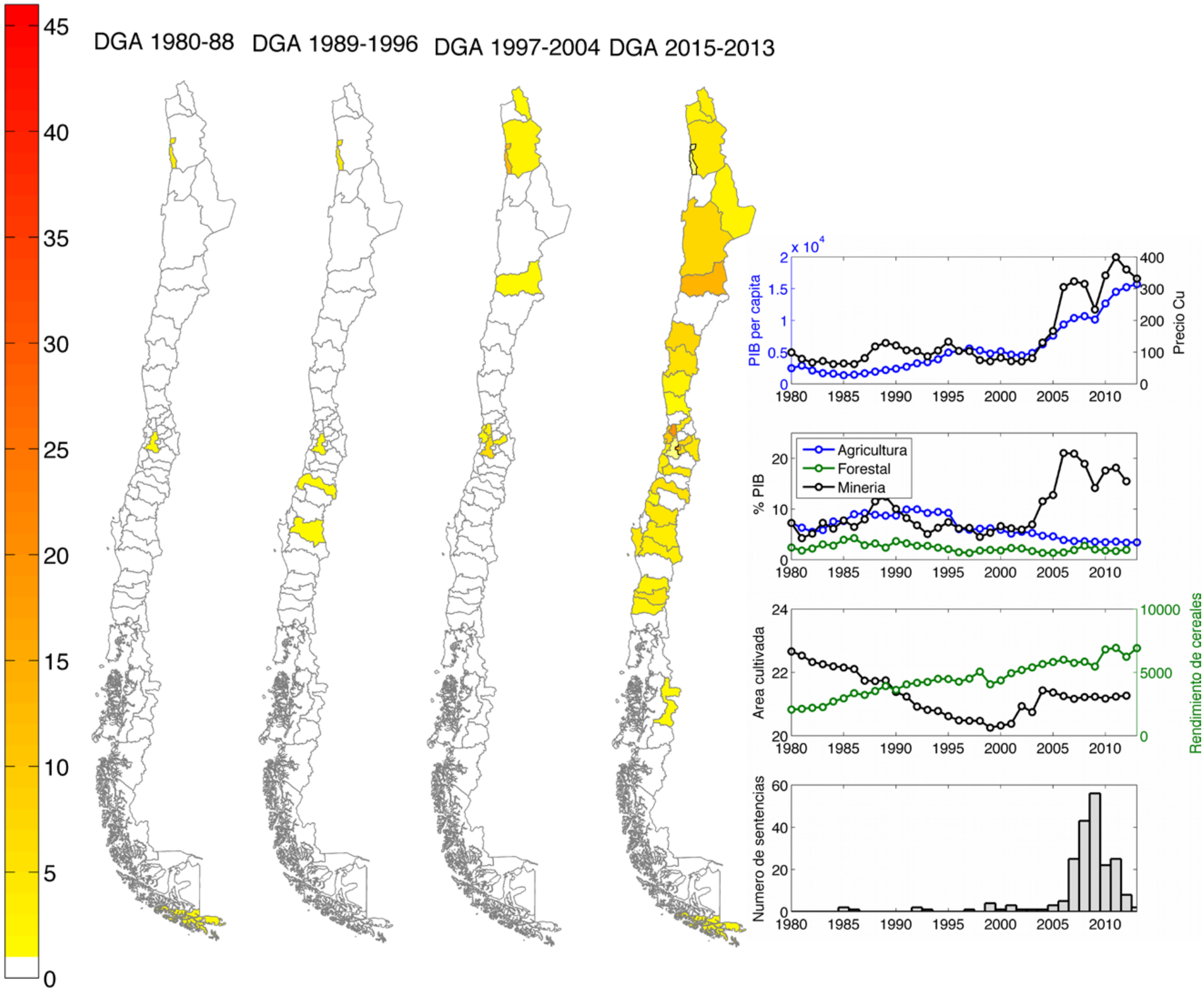
Uribe, H., Arnold, T., Arumí, J., Berger, T., & Rivera, D. (2009). Modificación del modelo hidrológico WaSiM-ETH para mejorar su aplicación en áreas regadas. Tecnología y Ciencias del Agua, 24(2), 23-36.

Diversification and non-conventional cropping systems

Adding value

Information and social aspects

Rivera, D., Lillo, M., Uvo, C. B., Billib, M., & Arumí, J. L. (2012). Forecasting monthly precipitation in Central Chile: a self-organizing map approach using filtered sea surface temperature. Theoretical and Applied Climatology, 107(1-2), 1-13.



DGA 1980-88
DGA 1989-1996
DGA 1997-2004
DGA 2015-2013
45
40
35
30
25
20
15
10
5
0
x 10^4
PIB per capita
Precio Cu
Agricultura
Forestal
Mineria
% PIB
Area cultivada
Rendimiento de cereales
Numero de sentencias
1980
1985
1990
1995
2000
2005
2010