# Aconcagua Basin Agriculture Analyzing Hydrological Norms, Evapotranspiration, and Soil Moisture to Assess Crop Water Demand and Water Usage in Chile's Aconcagua Basin



## **Project Synopsis**

This project informs agriculture and water allocation decisions using Earth observation analysis in Chile's Aconcagua River Basin (ARB). The DEVELOP team focused on hydrological norm variables, soil moisture, evapotranspiration, and vegetation indices to comprehensively view water usage during the current drought.

#### **Study Area & Period**

- Agricultural regions of central Aconcagua River Basin
- Megadrought period 2010 present



## **Objectives**

- **Compare** hydrologic norms for pre- and intra-drought conditions in the ARB
- Analyze soil moisture and evapotranspiration trends in the region over agricultural lands
- **Discover** the presence of irrigation and excessive water usage by crop type per region (comuna)
- Inform our partners on agricultural water usage and potential water allocation risks in the basin by crop type during the megadrought period

## Results





Fig. 1. Map of study area in central Chile including comunas (subregion similar to a small county) boundaries and an agriculture mask showing crop area in 2021.







Fig. 2: Average soil moisture (mm) with agriculture area mask in central ARB for 2020-2021 season.



Fig. 4: Water allocation (m<sup>3</sup>/s, WA) and dominant crop type per comuna within central ARB in the 2020-2021 growing season. WA is normalized by agriculture area in each comuna.

Fig. 3: Accumulated evapotranspiration (mm) with agriculture area mask for 2020-2021 season.



Fig. 5: Average water table level (m) in central ARB

Comuna	Ratio of ET and SM to water allocation 2020-2021		
	WA	ET/WA	SM/WA
San Felipe	0.72	20.40	1.21
Panquehue	0.56	59.83	1.72
Llaillay	0.54	52.92	1.67
Rinconada	0.15	135.03	5.53
Santa Maria	0.13	120.01	7.15
Los Andes	0.12	85.19	6.86
Catemu	0.09	267.07	9.95
Calle Larga	0.08	264.64	11.14
San Esteban	0.03	486.12	26.66

#### **Team Members**



Javiera Canales Valenzuela (Project Lead)



**Carmen Martha** Petras

Daniela Quintero Garcia

Table 1: ET, SM, and water allocation (WA) ratios. Dark blue ratios (large numbers) indicate high use and low allocation.

#### Conclusions

- Avocados, grapes, and walnut trees are the most water-demanding crops in the study area.
- The decreasing water table, precipitation declines, and increasing water allocation represent a shrinking groundwater supply and indicate water stress may increase in the coming years.
- Compared to other comunas in the central ARB, San Esteban, Calle Larga, and Catemu appear to have an exaggerated pattern of water use for agriculture.
- Our CIREN partners can use SM and ET normalized by water allocation to indicate comunas with farmlands that are heavily irrigated.

## **Project Partners**

**CIREN** (Centro de Información de Recursos Naturales)

- Remote sensing and hydrology experts
- Felipe Antonio Arróspide Alarcón

Embassy of Chile, Agricultural Office

Fernando Vasquez

#### Acknowledgements

The team would like to thank everyone who made this project possible:

- Partners: CIREN and the Embassy of Chile, Agricultural Office
- Advisors: Dr. Venkat Lakshmi, University of Virginia & Dr. Kenton Ross, NASA Langley Research Center
- Fellows: Olivia Landry and Cecil Byles, NASA Langley Research Center







This material is based upon work supported by NASA through contract NNL16AA05C. Any mention of a commercial product, service, or activity in this material does not constitute NASA endorsement. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NASA endorsement. Any opinions, findings, and conclusions or recommendations expressed in this material does not constitute NASA endorsement.