



Cornhusker Economics

Community-Centered Climate Resilience Strategies for Agriculture in Chile's Los Lagos

Chile's Los Lagos Region presents a unique opportunity to address the complex challenges at the water-food nexus. Known for its rich biodiversity and significant agricultural output (including dairy, potatoes, grains, and beef), the region faces critical challenges associated with climate change. An ongoing mega-drought, coupled with rapid population growth, has intensified water demand and stressed traditional agricultural systems, underscoring the urgent need for sustainable water resource management strategies that can adapt to and mitigate the impacts of climate change. Traditionally

considered a "water-rich" environment, Los Lagos is now experiencing dramatic shifts in precipitation patterns that hinder its rain-dependent agriculture. Regional precipitation records show a drop in summer rainfall of nearly 50% over the past decade (Figure 1), leading to a reduction in crop yields and livestock capacity by up to 30%, according to local farmers. Scientific observations align with existing local knowledge, highlighting the importance of valuing local and generational knowledge and community-centered approaches to effectively develop climate mitigation strategies.

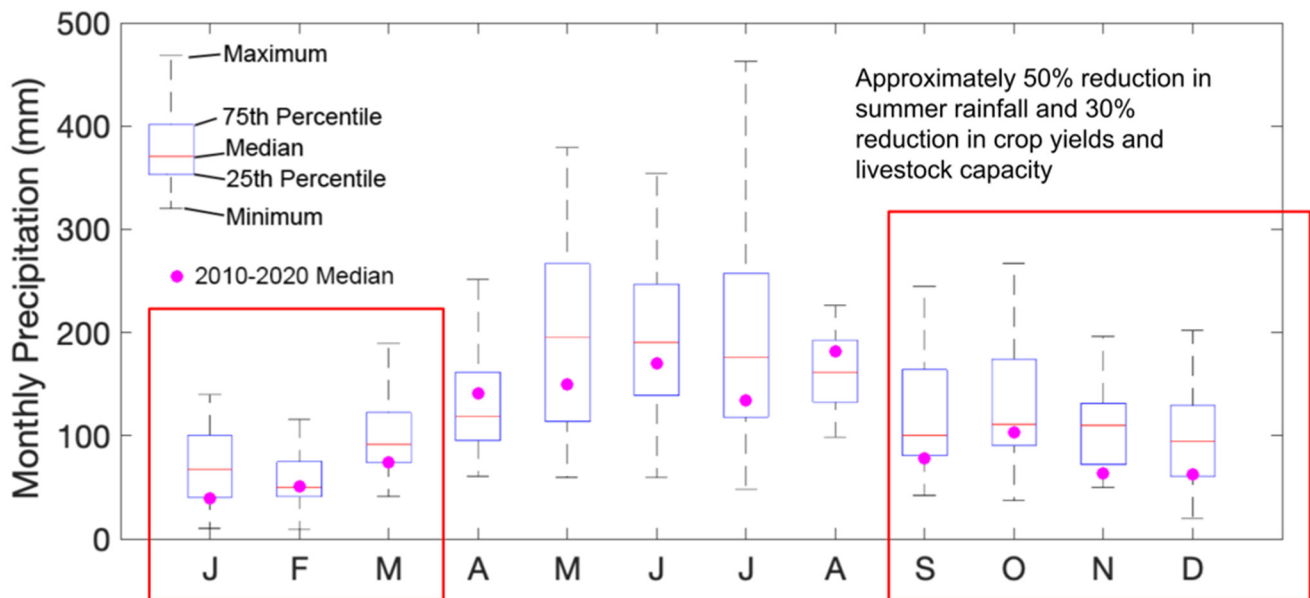


Figure 1: Precipitation patterns at the Puerto Montt airport (1980 to 2022)

Municipalities like Frutillar and Puerto Varas are also grappling with increased water demand due to population growth that accelerated during the COVID-19 pandemic (Figure 2). The challenges faced by Los Lagos at the water-food nexus are compounded by a shift

from traditional rainfed to water-intensive irrigated agriculture amidst changing water availability. This transition necessitates sustainable agricultural practices while addressing immediate water needs.



Figure 2: Urbanization of Puerto Varas, Chile

Proyecto Los Lagos (PLL) unites academic, agricultural, and municipal sectors to implement evidence-based water resource management. Dedicated to community-centered, climate-resilient strategies, PLL addresses the megadrought's socio-economic impacts, pursuing long-term sustainability and resilience of rural communities in Los Lagos. Recognizing the region's critical agricultural role, PLL partners with local communities through an

evidence-based knowledge co-generation. The Social-Ecological-Technical Systems (SETS) framework integrates social, ecological, and technical insights, fostering equitable community partnerships and honoring local knowledge in academic inquiries (Figure 3). This holistic approach ensures community voices are integral to scientific research and policy development.

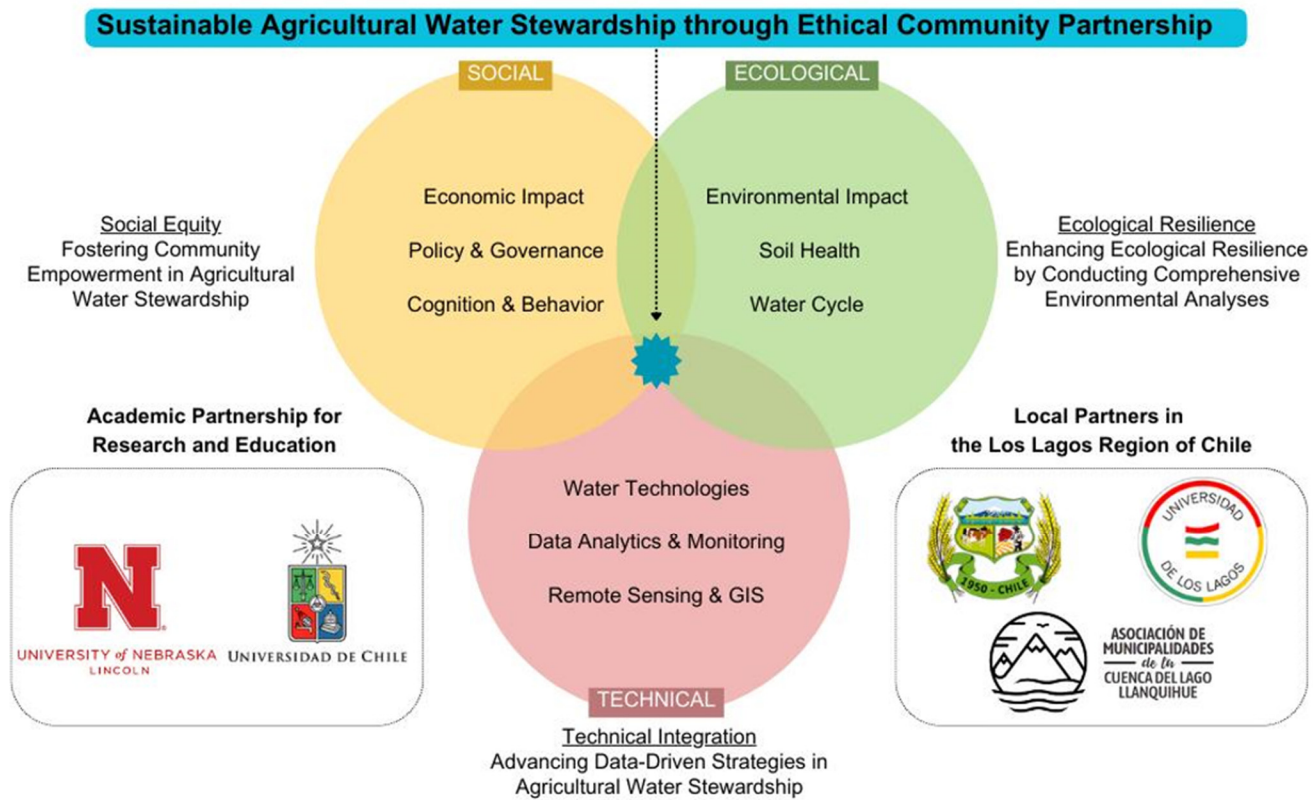


Figure 3: Proyecto Los Lagos’s Transdisciplinary Social-Ecological-Technical Framework

Since its inception, Proyecto Los Lagos (PLL) has fostered sustainable agricultural water stewardship through ethical community partnerships. By promoting social equity, PLL empowers communities in agricultural water stewardship, focusing on economic impact, policy and governance, and cognition and behavior. Centering community desires and involving them in project design from the start ensures culturally relevant and practically effective solutions. Ecological resilience is enhanced through comprehensive environmental analyses that improve understanding of hydrologic processes and predictions of environmental impacts. Technical integration is advanced by employing water technologies, data analytics, monitoring, remote sensing, and Geographic Information Systems. One successful

initiative involved a watershed monitoring project focusing on the region’s ecohydrology and developing hydrologic budgets. The region’s dominant soil type, Andisols, is known for high fertility, high nutrient content, and excellent water-holding capacity (Figure 4). These shallow soils with a hard pan from glaciation lead to high infiltration rates and minimal runoff. The project observed a rapid increase in streamflow following precipitation events, aligning with local and generational knowledge. This data was crucial in identifying areas most affected by drought and developing targeted water management strategies, underscoring the importance of integrating local knowledge with scientific data and demonstrating how equitable community partnerships can yield effective climate resilience strategies.



Figure 4: Family-Owned Small-Scale Dairy Cow Operation on Andisols in Los Lagos, Chile

In summary, community-centered approaches using the SETS framework facilitate equitable community-academia partnerships that co-create climate resilience strategies. By integrating local insights with academic research ethically and equitably, PLL aims to develop

evidence-based, culturally relevant, and technologically feasible strategies. This holistic approach not only enhances community resilience but also ensures the sustainable management of water resources in the Los Lagos Region.

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