WETNESS IN THE ALTIPLANO: DROUGHT AS AN OPPORTUNITY TO REDEFINE EDGE CONDITIONS

A non-degree required thesis submitted to the
Master of Landscape Architecture Program
Department of Landscape Architecture

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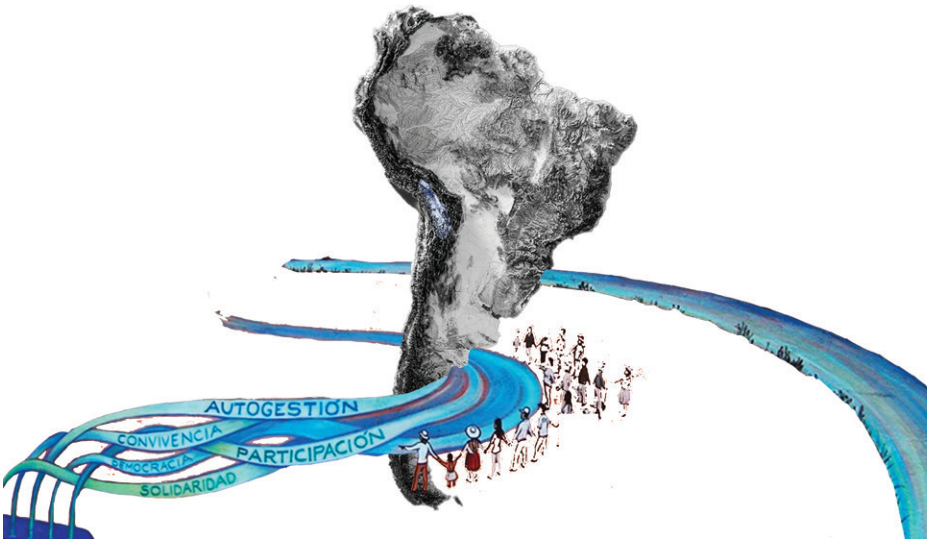
Finally, I would like to thank my family and MLA Cohort for their unwavering support during this journey. I could not have done this without you.



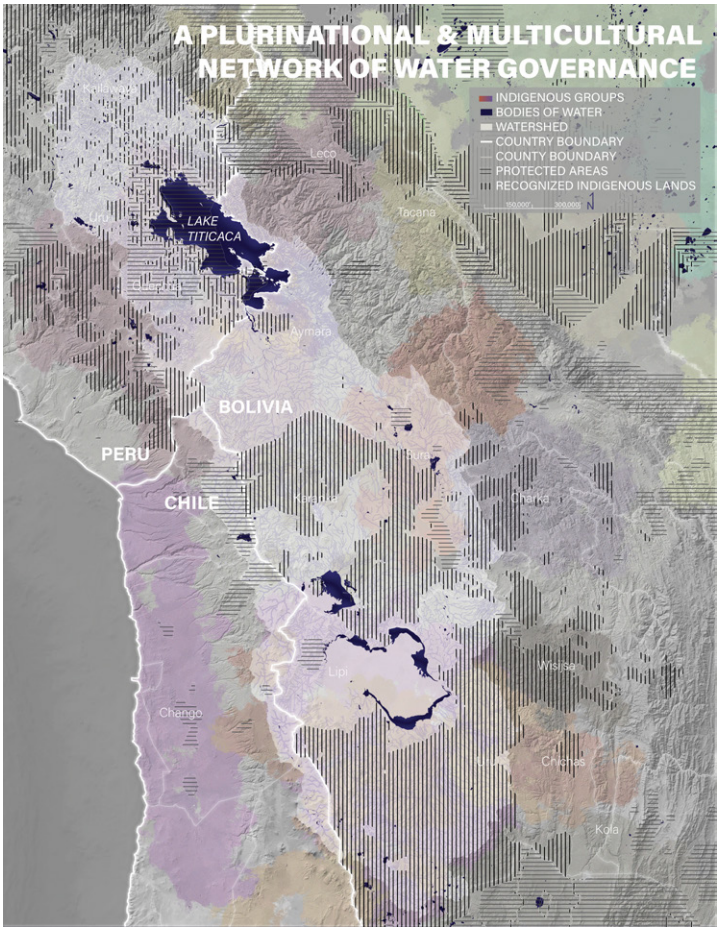
ABSTRACT

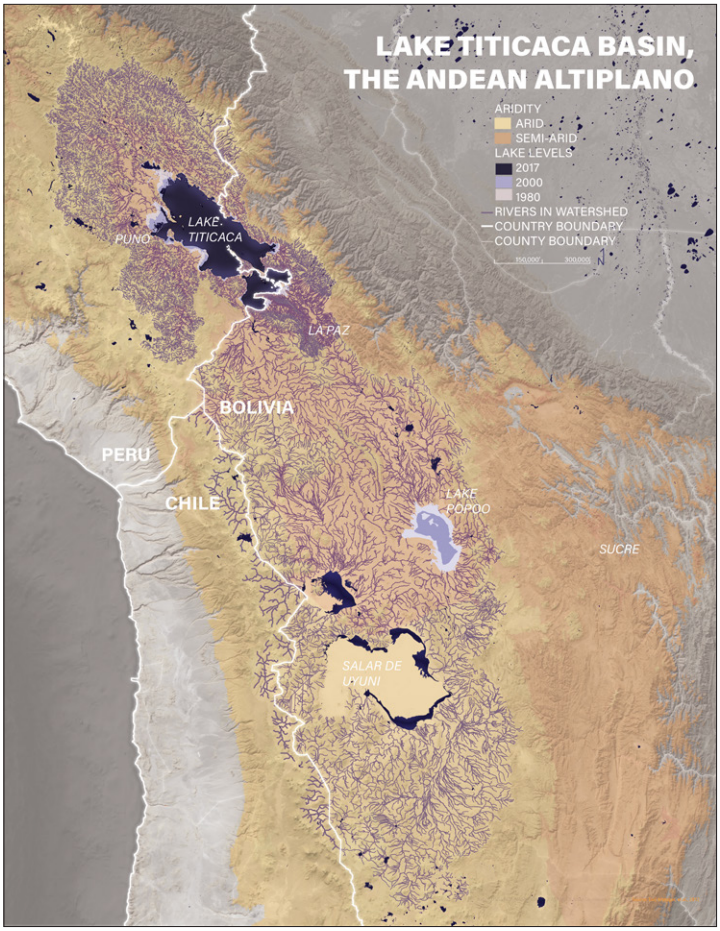
Wetness in the Altiplano uses the contingency of drought, and the emerging fertile lakebed, as an opportunity to rethink land tenure regimens and redefine property boundaries in Lake Titicaca. In Peru's Bay of Puno, State delineated borders sever the wetland into uncrossable parcels and disregard the existing social and material ecologies that are intrinsically intertwined with the Bay's shifting gradient of wetness. Seasonal and epochal lake level fluctuations blur the boundary between land and water. As such, it is necessary to redefine borders as a constellation of ephemeral and living edges, rather than as a static linear projection.

I use Puno, Peru as a testing ground for how access could equitably be inscribed into the receding lakebed. Through the design of a hydrosocial imaginary, I question the role of ubiquitous wetness and test the implementation of Ayllu in the anthropocene.

Using micro-topographic and ecological interventions, this project proposes the thickening of existing property boundaries to create communal corridors that interweave and reconnect fractured communities. The thickened edge expands into the lakebed, preemptively claiming the water column as a shared commons and promoting equitable access across a gradient of wetness. *Wetness in the Altiplano* utilizes seasonally shifting Totora reed (Schoenoplectus californicus subsp. tatora) as a figure of the commons, redefining access as an archipelago, in which the natural features that mark ownership are not fixed in space. Instead, they require the renegotiation of border conditions annually between local land-holders and the broader lacustrine community.

Note: This project was developed over the course of two semesters, presented verbally in May, 2024. The PDF below is a translation of my narrative.

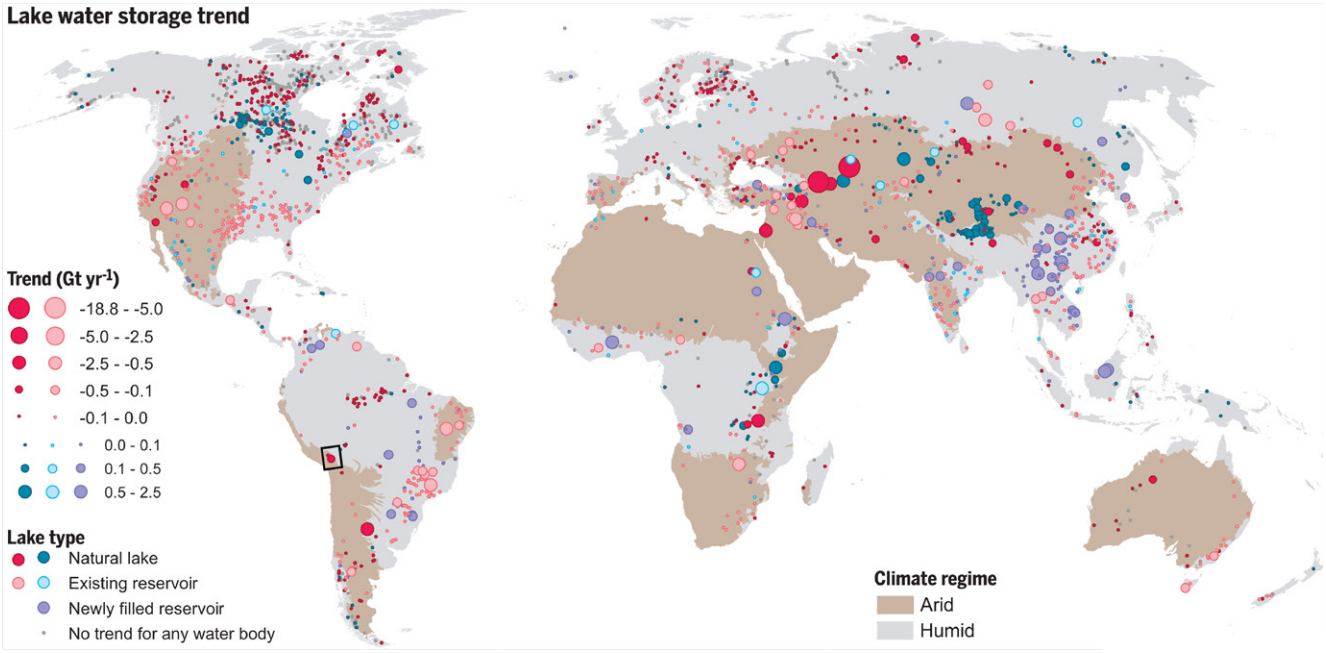




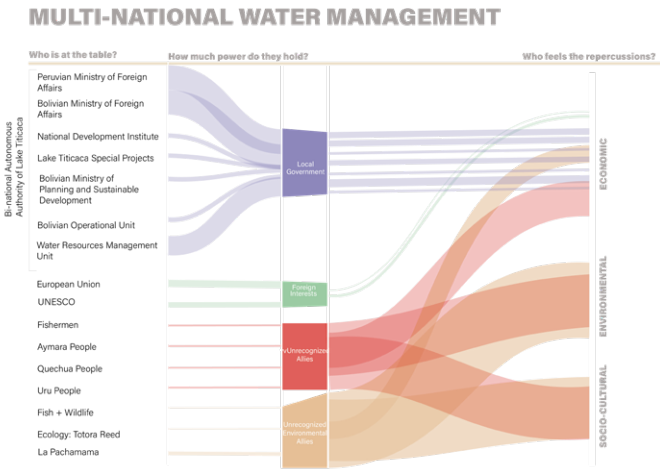
INTRODUCTION

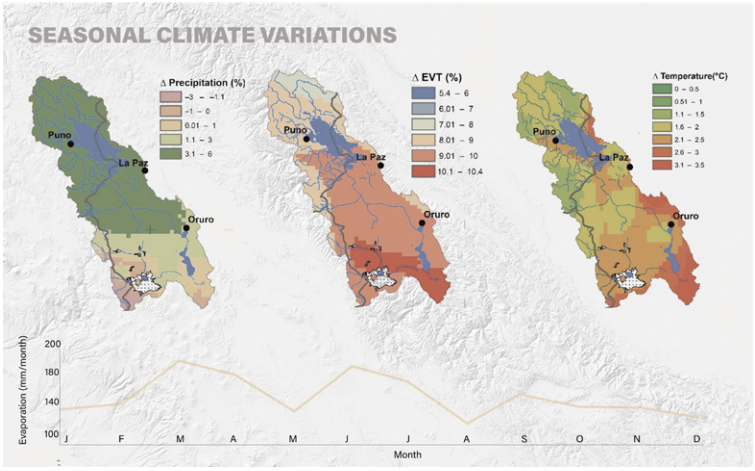
While sea level rise continues to encroach and cover land, my project highlights the emergence of newly occupiable terrain that materializes as a result of drought. Through this, I question who is able to occupy and access newly emerged land? How can we design with existing topography and ecotones as a method of property delineation? How can the space between property move beyond delineation and instead become a vibrant margin?

Titled *Wetness in the Altiplano*, my project uses alternative Andean ontologies as a method to redefine property lines as a thickened, living, and ephemeral constellation of edges. This project proposes a thickening of existing property boundaries using ecological interventions to create communal threads that interweave and reconnect fractured communities, promoting equitable access across a gradient of wetness and preserving land-based care practice.



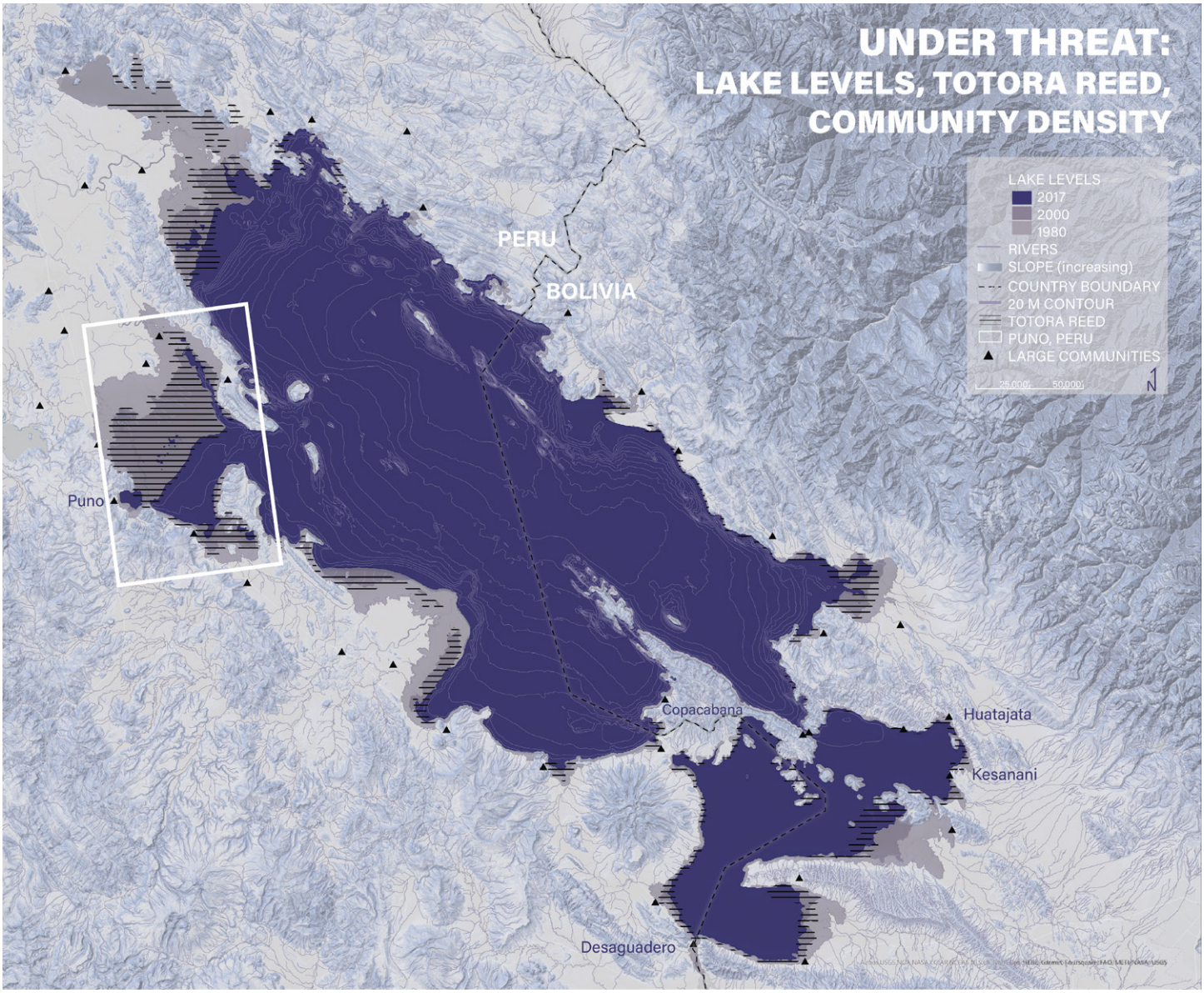
Source: Yao, 2023





Lake Titicaca, nestled in the Andean Altiplano, is a high elevation arid environment. Situated at an altitude of approximately 12,507 feet above sea level, it is the highest navigable lake in the world and spans the border between Peru and Bolivia. This region is characterized by its dry, harsh climate, with limited rainfall and extreme temperature fluctuations.

In recent years, Lake Titicaca has been experiencing heightened risks of drought, exacerbated by the broader impacts of climate change. Rising global temperatures have led to altered weather patterns, reducing the frequency and intensity of precipitation in the region. This has resulted in a decline in water levels, threatening the lake's delicate ecological balance and the livelihoods of the indigenous communities that co-exist with it.

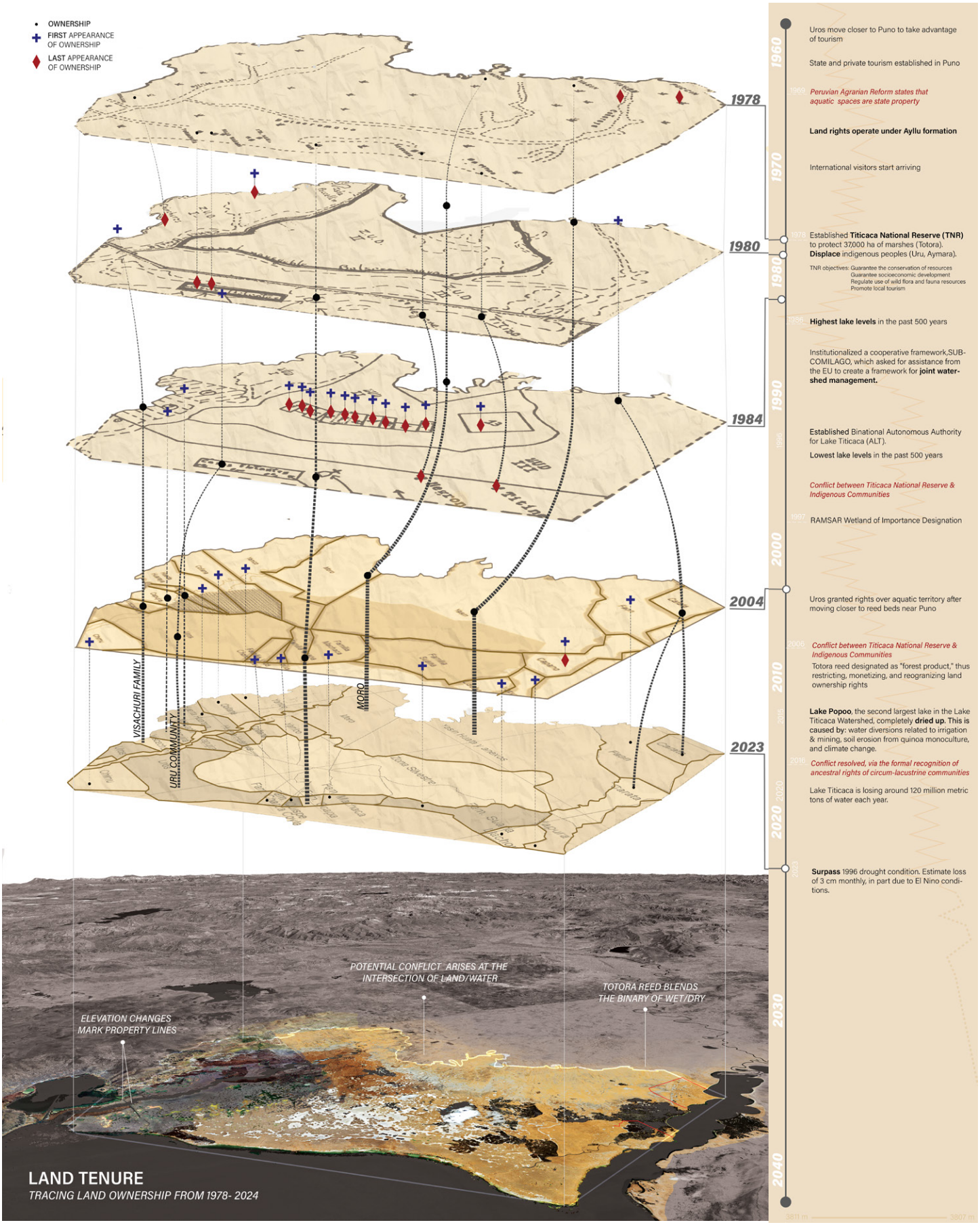


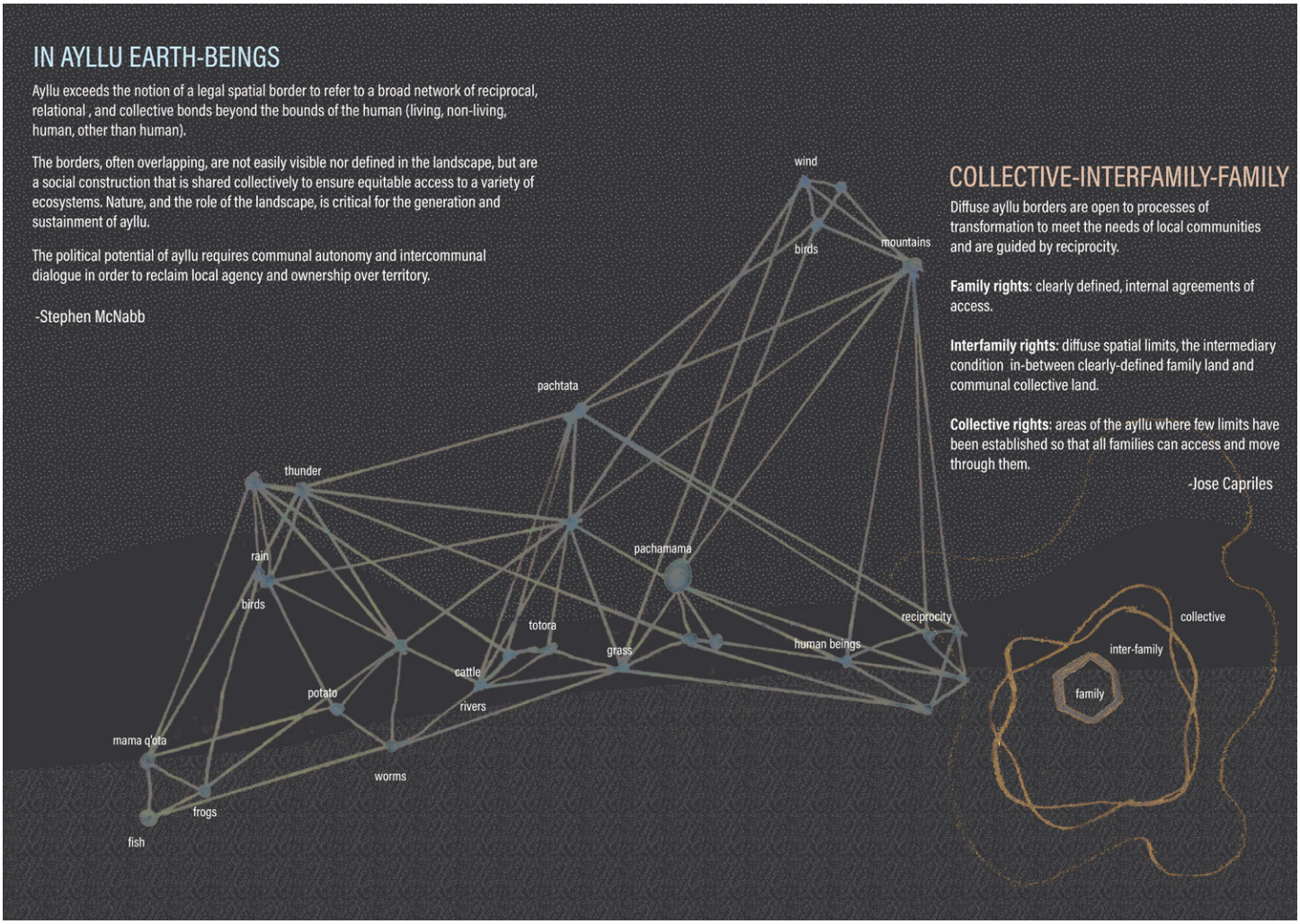
I use Puno, Peru (in the Northwestern corner of Lake Titicaca) as a testing ground for how access could equitably be inscribed into the receding lakebed. Through the design of a hydrosocial imaginary, I question the role of ubiquitous wetness and test the implementation of Ayllu in the anthropocene.

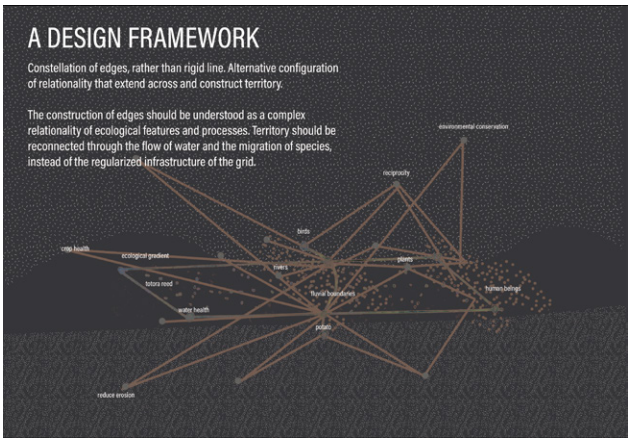
THE DILEMMA

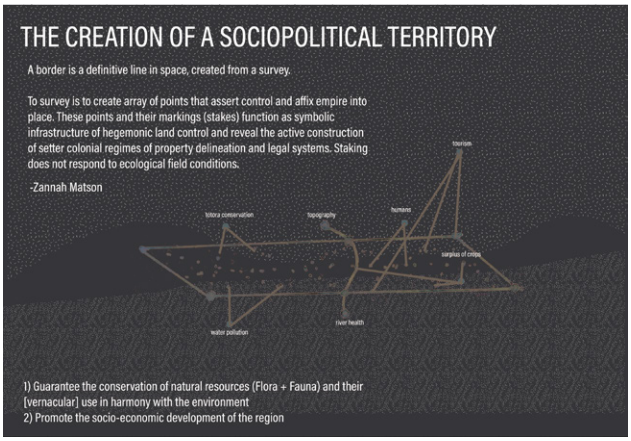
In the Bay of Puno, State delineated borders sever the wetland into uncrossable and arbitrary parcels, disregarding the social and material ecologies that are intrinsically intertwined with the Bay's shifting gradient of wetness.

The static property borders that exist today were reconfigured under dictatorship rule in 1979, rupturing self-defined boundaries and indigenous territorial autonomy. Several lines of ancestral ownership were eliminated and community access to a gradient of wetness was severed.


OWNERSHIP
FIRST APPEARANCE OF OWNERSHIP
LAST APPEARANCE OF OWNERSHIP
1978
1980
1984
2004
2023
VISACHURI FAMILY
URU COMMUNITY
MORO
1960
1970
1980
1990
2000
2010
2020
2030
2040
Uros move closer to Puno to take advantage of tourism
State and private tourism established in Puno
1969 Peruvian Agrarian Reform states that aquatic spaces are state property
Land rights operate under Ayllu formation
International visitors start arriving
1978 Established Titicaca National Reserve (TNR) to protect 37,000 ha of marshes (Totora). Displace indigenous peoples (Uru, Aymara).
TNR objectives: Guarantee the conservation of resources
Guarantee socioeconomic development
Regulate use of wild flora and fauna resources
Promote local tourism
1986 Highest lake levels in the past 500 years
Institutionalized a cooperative framework,SUB-COMILAGO, which asked for assistance from the EU to create a framework for joint watershed management.
1996 Established Binational Autonomous Authority for Lake Titicaca (ALT).
Lowest lake levels in the past 500 years
Conflict between Titicaca National Reserve & Indigenous Communities
1997 RAMSAR Wetland of Importance Designation
Uros granted rights over aquatic territory after moving closer to reed beds near Puno
2006 Conflict between Titicaca National Reserve & Indigenous Communities
Totora reed designated as "forest product," thus restricting, monetizing, and reogranizing land ownership rights
Lake Popoo, the second largest lake in the Lake Titicaca Watershed, completely dried up. This is caused by: water diversions related to irrigation & mining, soil erosion from quinoa monoculture, and climate change.
2018 Conflict resolved, via the formal recognition of ancestral rights of circum-lacustrine communities
Lake Titicaca is losing around 120 million metric tons of water each year.
Surpass 1996 drought condition. Estimate loss of 3 cm monthly, in part due to El Nino conditions.
POTENTIAL CONFLICT ARISES AT THE INTERSECTION OF LAND/WATER
ELEVATION CHANGES MARK PROPERTY LINES
TOTORA REED BLENDS THE BINARY OF WET/DRY
3811 m
3807 m
LAND TENURE
TRACING LAND OWNERSHIP FROM 1978- 2024

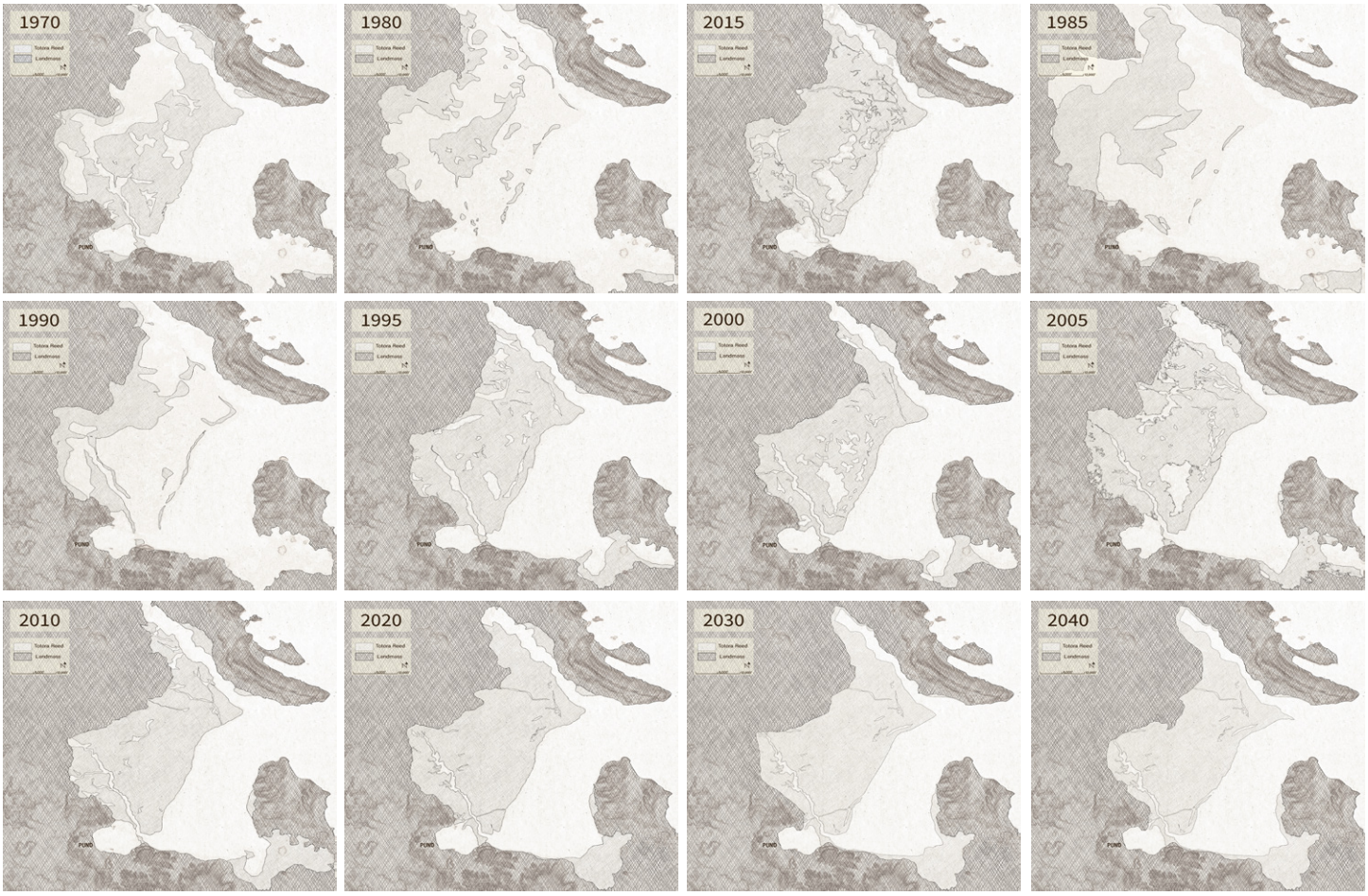






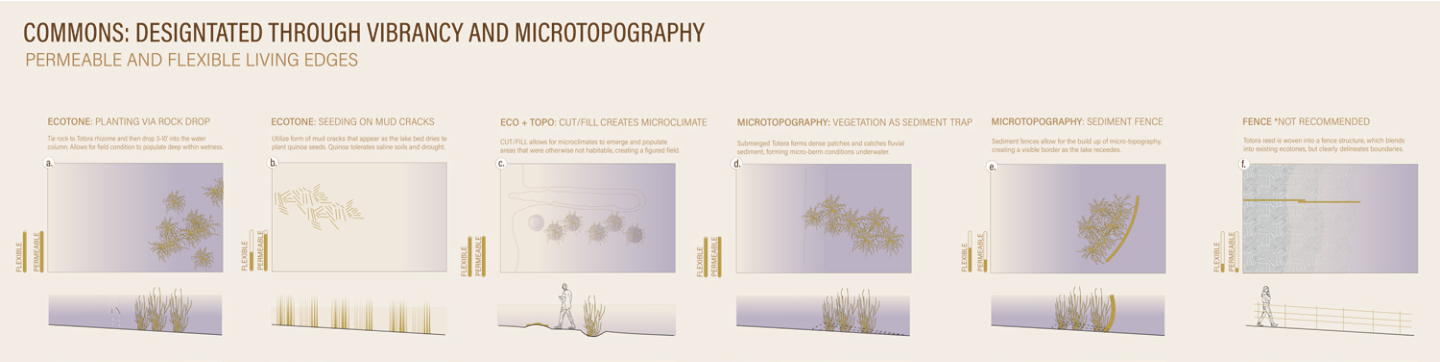
This disruption has had a dramatic impact on the social and material ecologies present. For centuries, the andean concept of Ayllu governed decisions on regional land use. Ayllu allows for the fluidity of spatial borders and emphasizes the importance of reciprocal and relational bonds between the human, non-human, and non-living (McNabb, 2023). The borders, often overlapping, are not easily visible nor defined in the landscape, but are a social construction that is shared collectively to ensure equitable access (Da la Cadena, 2015) (Allen, 2012). Nature, and the role of the landscape, is critical for the generation and sustainment of ayllu. Note that Ayllu is not something of the past, but is a living belief. Bolivia has legally recognized Ayllu as a governing body in both its constitution and the National Council of Ayllus and Markas of Qullasuyu.

Yet, during the 1980s, the state used the definition of a border as a definitive line in space created from an array of points, often asserting control and spatializing the ideology of the state into individually owned plots. This definition does not respond to ecological field conditions, nor the fluidity of wetness.



The boundary between land and water is blurry and indeterminable. The Bay of Puno experiences dynamic shifts between land and water due to seasonal and climate-induced fluctuations in lake levels. These variations, driven by rainfall and exacerbated by climate change, have caused the lake to encroach 11 miles lakeward since 1980. Thus, the fixed property boundaries drawn by the Peruvian State inherently contradict the ephemerality of the landscape.

Thus, I believe that it is necessary to redefine these borders as a constellation of ephemeral and living edges, rather than as a static linear projection onto a planar landscape (Matson, 2017). The construction of edges should be understood as a complex relationality of ecological features and processes, in which territory is reconnected through the gradient of water and the migration of in-ayllu beings. Thinking through ayllu, I consider how Andean notions of place-making challenge Western socio-political ideologies that regard borders as an uninhabitable legal space to instead propose edge conditions where Nature is an active and embodied social agent.

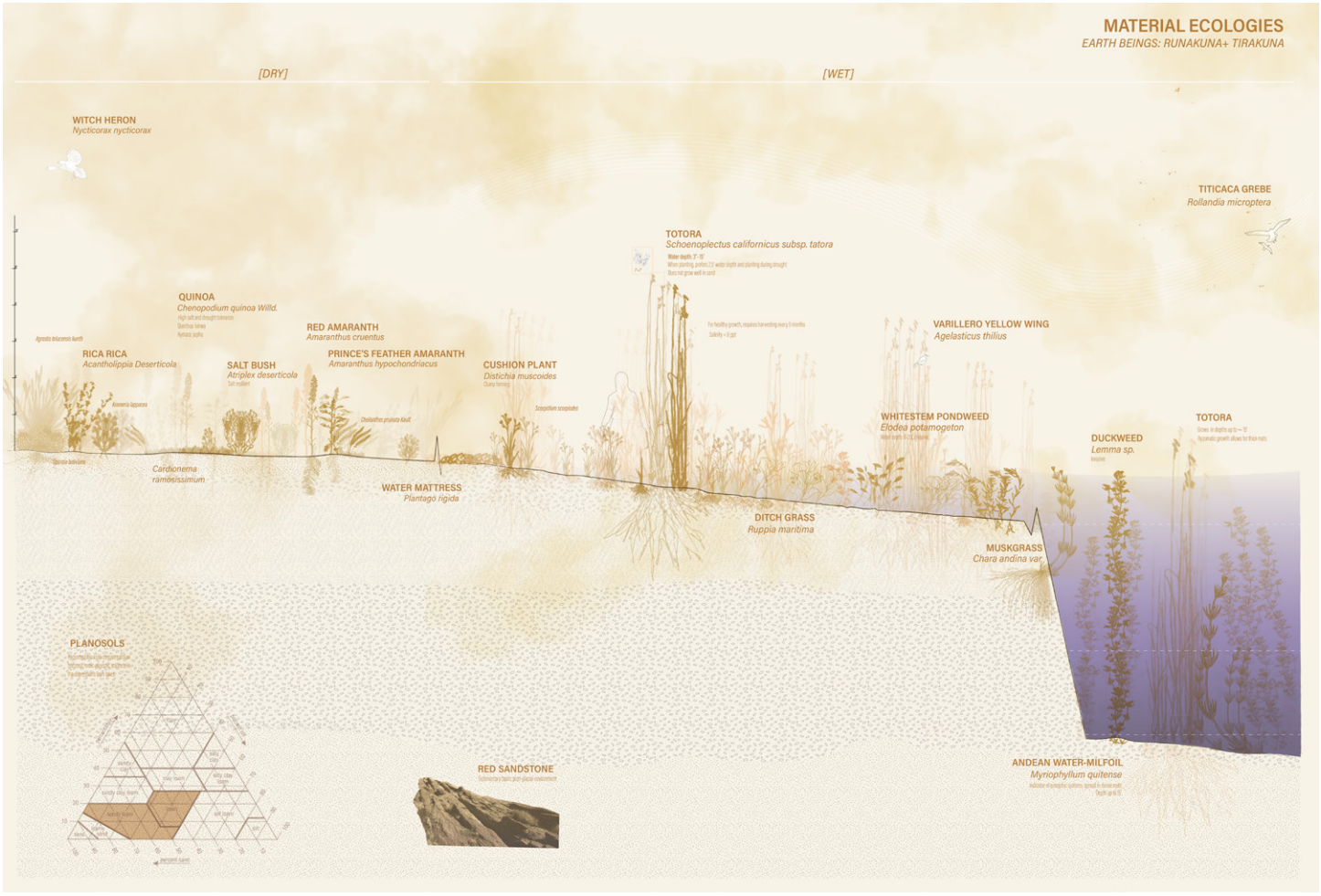


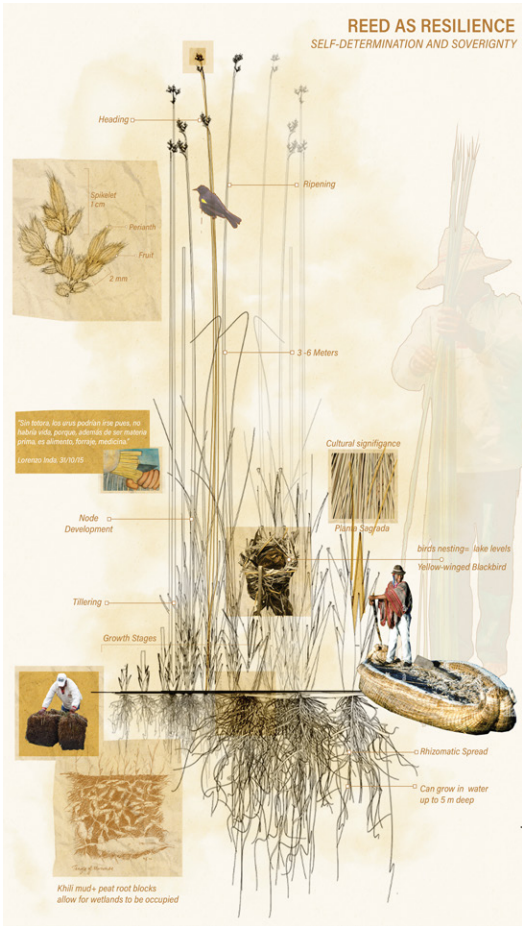
THE INTERVENTION

I propose using topography and ecotone as two primary methods to thicken edge conditions. Central to this endeavor is to translate borders into an occupiable volume, in which circulation and productivity is encouraged.

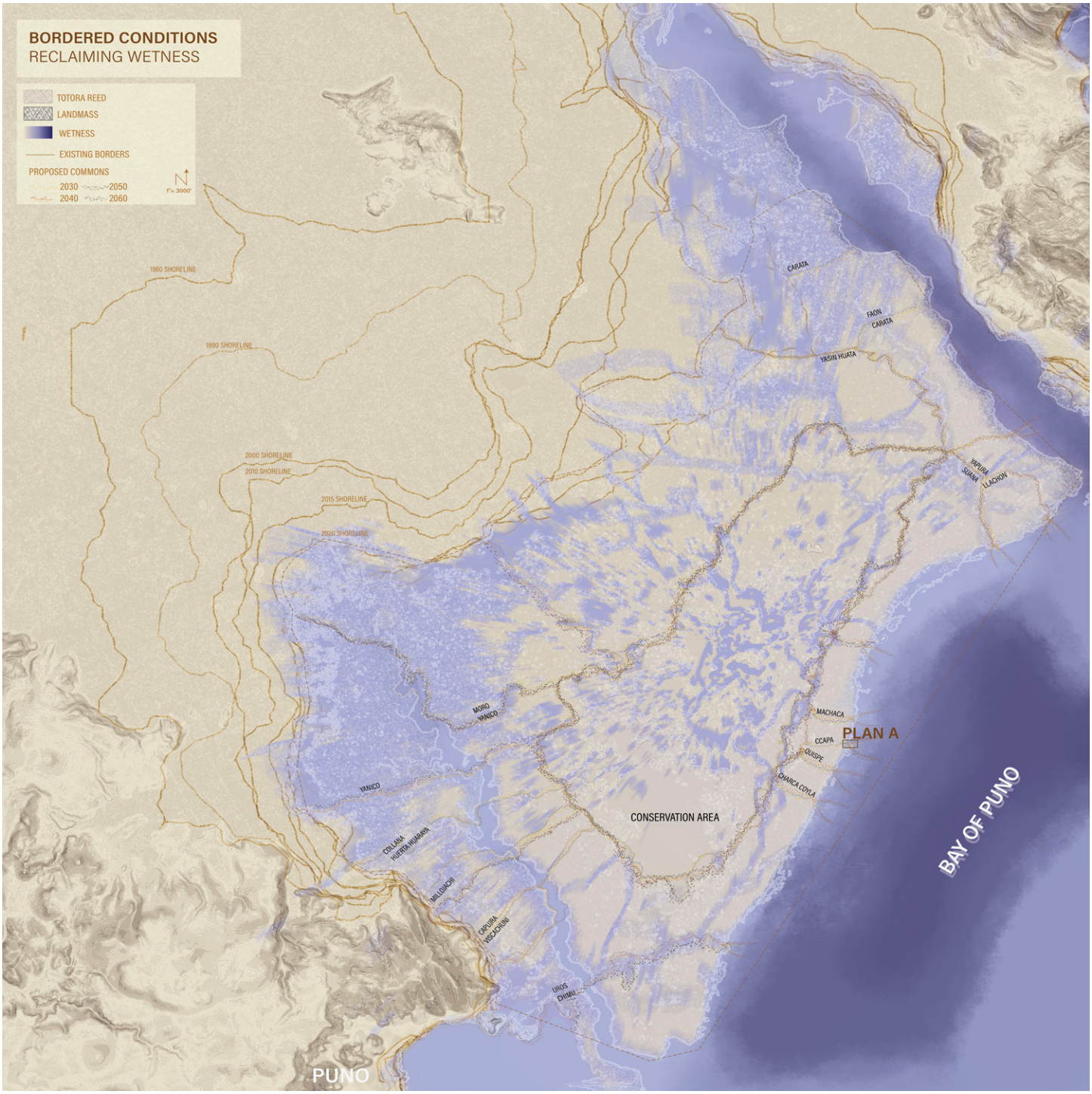
One intervention, for instance, proposes the dense patchwork of vegetation to create permeable and flexible living margins, in which communities can occupy, harvest, and alter space through maintenance and care practices. Microtopographic interventions are complementary and involve cut/fill to create new microclimatic conditions for distinct ecological communities to thrive. All interventions have the distinct ability to shift seasonally or decadally, disrupting the rigid lines that the state enacted.

The material ecologies present in the Bay of Puno support this proposal. Totora (Schoenoplectus californicus subsp. tatora) emerges as a cultural keystone species due to its unique ability to populate in the water column up to 15', or as little as 1". Yet, this material itself is contingent: after heavy rains, totora becomes detached from lakebed, creating a constellation of dynamic ecological patches.


MATERIAL ECOLOGIES
EARTH BEINGS: RUNAKUNA+ TIRAKUNA
[DRY]
[WET]
WITCH HERON
Nycticorax nycticorax
TITICACA GREBE
Rollandia microptera
TOTORA
Schoenoplectus californicus subsp. tatora
QUINOA
Chenopodium quinoa Willd.
RED AMARANTH
Amaranthus cruentus
RICA RICA
Acantholippia Deserticola
SALT BUSH
Atriplex deserticola
PRINCE'S FEATHER AMARANTH
Amaranthus hypochondriacus
CUSHION PLANT
Distichia muscoides
VARILLERO YELLOW WING
Agelasticus thilius
WHITESTEM PONDWEED
Elodea potamogeton
DUCKWEED
Lemma sp.
TOTORA
Cardionema ramosissimum
WATER MATTRESS
Plantago rigida
DITCH GRASS
Ruppia maritima
MUSKGRASS
Chara andina var.
PLANOSOLS
RED SANDSTONE
ANDEAN WATER-MILFOIL
Myriophyllum quitense


REED AS RESILIENCE
SELF-DETERMINATION AND SOVERIGNTY
Heading
Ripening
Spikelet 1 cm
Perianth
Fruit
2 mm
3 -6 Meters
"Sin totora, los uros podrían irse pues, no habría vida, porque, además de ser materia prima, es alimento, forraje, medicina."
Lorenzo Inda. 30/10/15
Cultural significance
Node Development
Plano Sagrada
bird's nesting= lake levels
Yellow-winged Blackbird
Tillering
Growth Stages
Rhizomatic Spread
Can grow in water up to 5 m deep
Khili mud+ peat root blocks allow for wetlands to be occupied

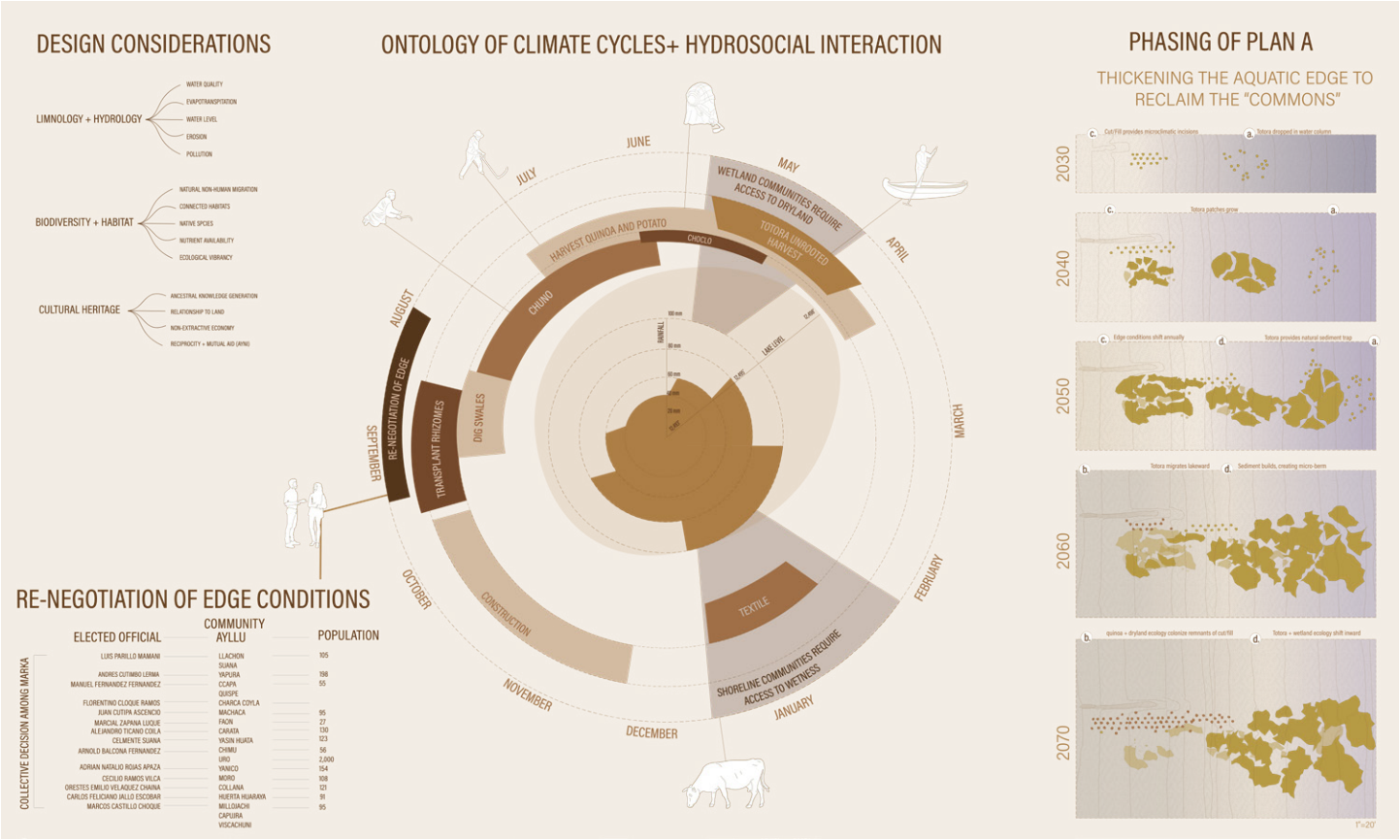

REED AS SHIFTING BOUNDARY
A CONSTELLATION OF CLIMATE-DEPENDENT BOUNDARY MARKERS
AFTER HEAVY RAINS, TOTORA BECOMES DETACHED FROM LAKEBED, CREATING A CONSTELLATION OF DYNAMIC ECOLOGICAL BOUNDARIES
SHIFTING ECOLOGIES
CLIMATE EVENT



At a territorial scale, these interventions thicken existing legal property lines, create communal threads that reconnect fractured communities, and allow for equitable access across a gradient of wetness.

DESIGNING AT THE WATER'S EDGE

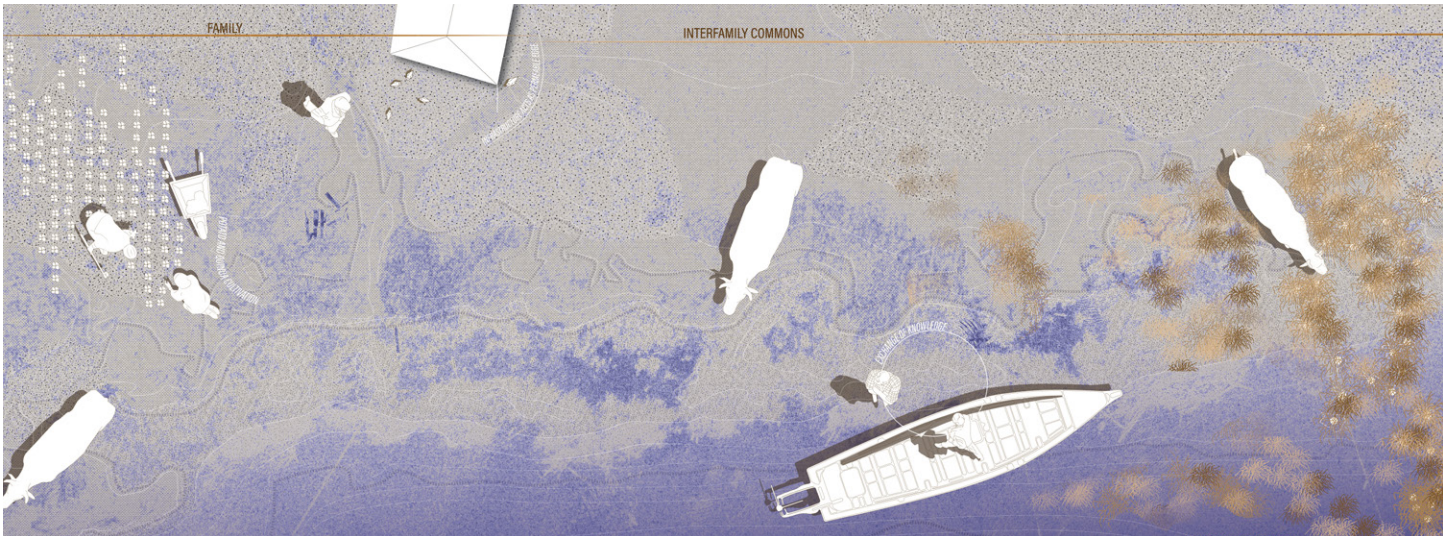
In this rapidly changing terrain, I utilize drought as an opportunity to rethink edge conditions as they extend into the lake, and use dense planting strategies to define and construct an ephemeral and productive commons. The sections and plans below all outline this one edge condition, in part because it is an

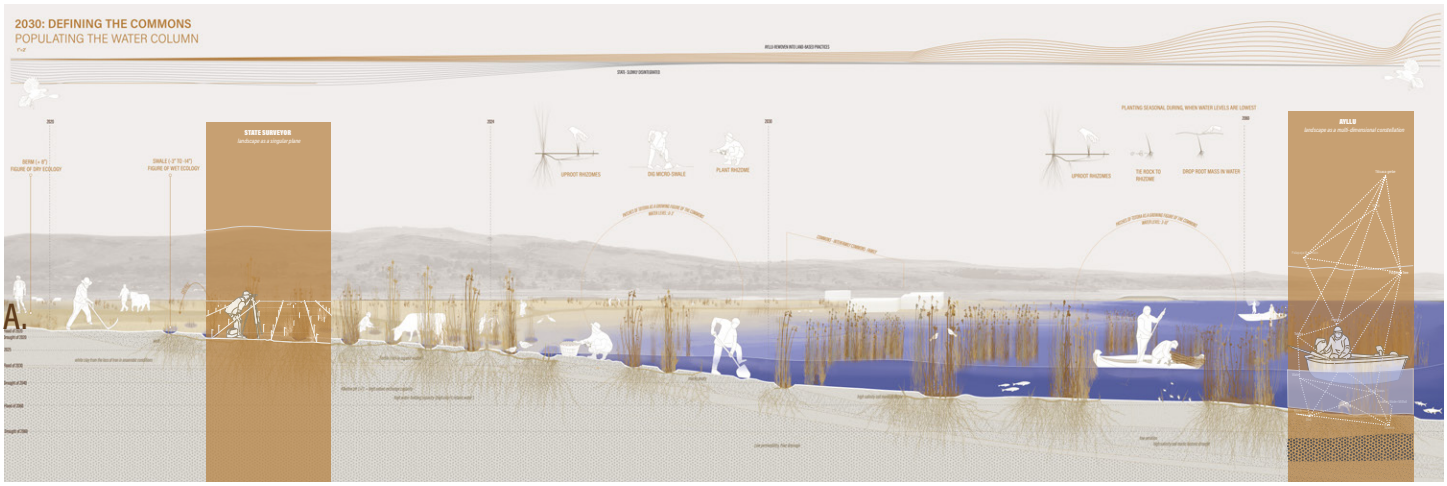


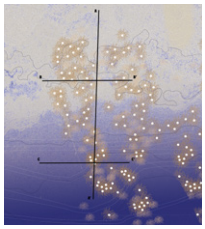
especially precarious space. Rather than displacing land to create a commons, using the retreat of water opportunistically to designate a commons will allow land-locked communities to have access to a gradient of wetness.

At the water's edge, microtopographic interventions have a profound effect on the ecological communities that are able to thrive. I leverage cut/fill to create a figure of communal land. On dry land, I propose a constellation of 6-12" microswales that allow wet ecologies to mark the ground. The corresponding fill creates a longitudinal berm that extends into the dry land, connecting with the thickened edge condition. Deep within the water column, Totora rhizomes are tied to sandstone and then intentionally dropped into the lakebed. Dense patches of totora form, designating space as communal before it dries up and conflict occurs. By designing with these existing practices, I hope to amplify and preserve cultural care practices (Chacon, 2014).

Totora acts as an embodied social agent, re-inserting sovereignty into water column and promoting ayllu autonomy. This design proposal elevates Nature, specifically Totora reed, to a position of socio-political agency that weaves together individual and communal identities around the sharing of critical resources. As seasonal water fluctuates up to 3' due to seasonal drought and flood conditions, the commons and edge conditions must be renegotiated and redefined. Community members meet seasonally, when lake levels are lowest to designate how maintenance and planting practices may shift spatially after the flood.





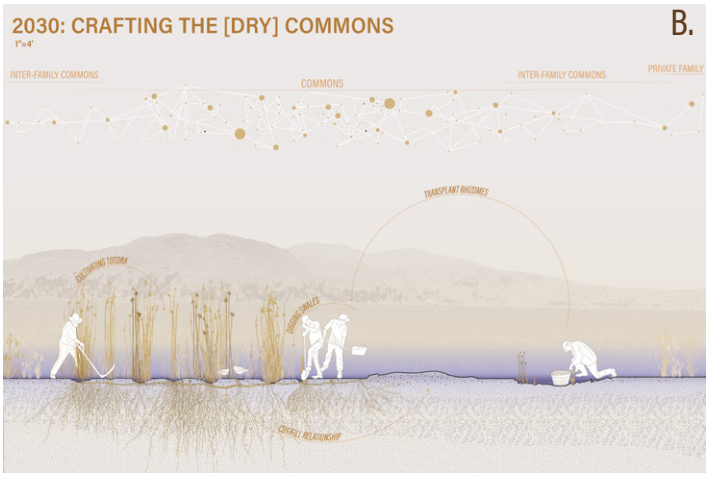


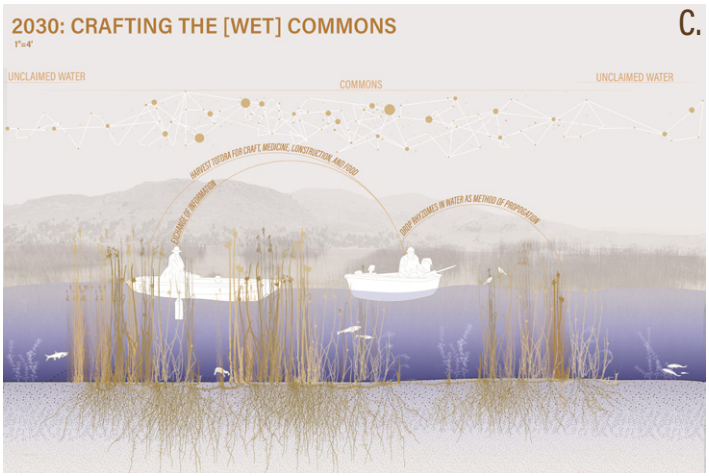
Totora is the physical manifestation of a social collective.

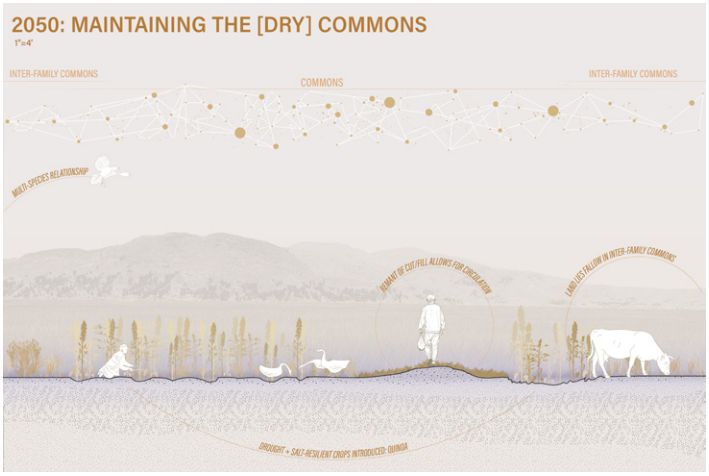
In plan, the flow of in-ayllu beings move across edge conditions, ensuring that they are fluid and permeable. Totora acts as a constellation of edges, rather than a rigid line. Alternative configuration of relationality that extend across and construct territory. The marginal landscape is bound together by kinship, reciprocity, and flexible land claims.

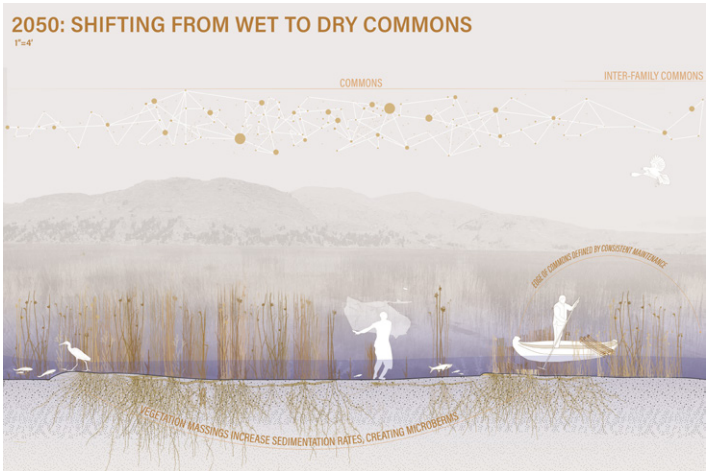
As conditions dry, totora no longer becomes a suitable species to designate the now occupiable and dry commons. Drought and salt resistant species migrate northward from Bolivia, and can be used to mark the dry commons. Specific agricultural cultivars (Red Amaranth, Prince's Feather Amaranth) will grow in the micro-swales and will feed the commons.

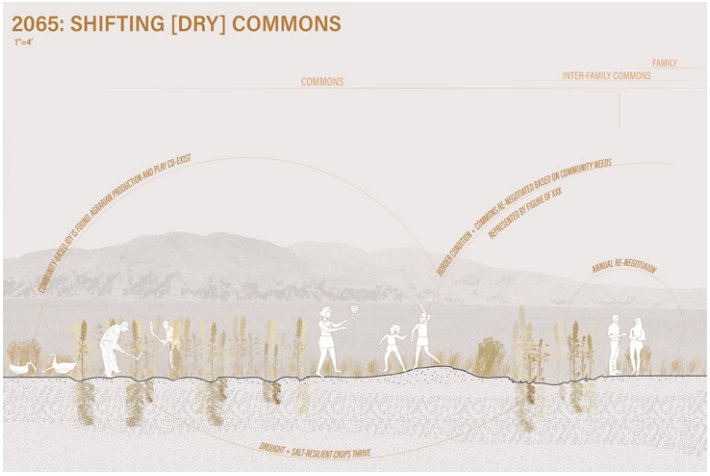
The initial topographic interventions of cut/fill allow diverse range in ecological communities to thrive. The remnant berm acts as a circulation network stretching from lake shore to land.

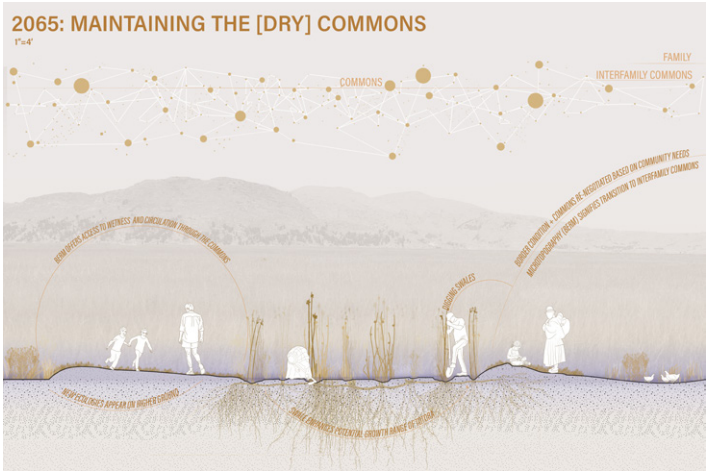


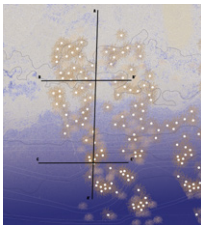






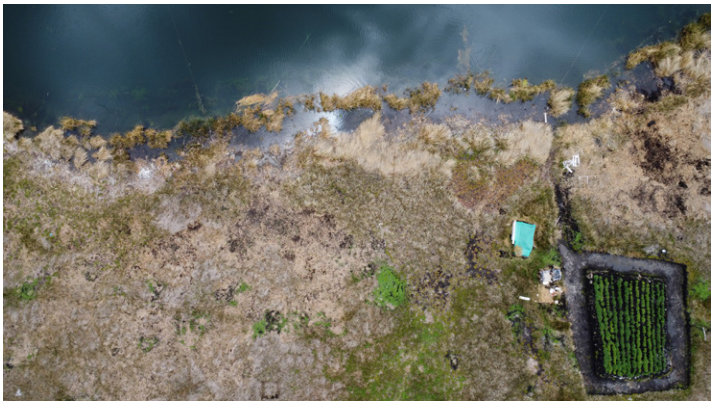






These smaller sections run perpendicular to the long section (page 15) and outline the dispersion of the communal space and how it grades into private family lands. Inter-family is the intermediary condition between clearly-defined family land and the less defined collective land (Villarroel, 2014).

Over time the network among in-ayllu beings grows and expands across the landscape. Yet, in-ayllu beings decrease once blending into the family private land, since fewer actors are in network. The commons and inter-family commons is a place for reciprocal interactions between land, resources, and inhabitants. The commons is always a productive space despite its wetness level through the harvesting of Totora, fishing practices, and the cultivation of amaranth/quinoa.



BIRDS EYE: The water's edge in the Bay of Puno

The water's edge in the Bay of Puno, Peru

The water's edge in the Tocoli, Bolivia

Map over Wiphala flag in Tiwanaku, Bolivia

Wiphala flag in Tocoli, Bolivia

Sharing of cocoa, chuno, plantains during a meeting with Ayllu representatives in Ancoraimes, Bolivia

BOLIVIAN LAND TENURE

Latifundio and indigenous customary systems

Ayllu (community-level regulation) disbands Western notions of tenure security which is viewed in terms of the secure right of an individual to a plot of land. Stakeholdership in ayllu is ultimate criterion for tenure security or security of access.

2006 Agrarian Reform Bill modifies the 1996 INRA law to speed up and **broaden redistribution of land** in favor of indigenous and peasant communities

2006 Evo Morales elected.

1999 Uru of Popoo Lake file first Native Community Lands (TCO) demand in the highlands

1997 Establish Council of Ayllus and Markas of Qullasuyu (CONAMAQ) to **restore the self-governance** of "original nations" including "**collective rights to land** and natural resources, re-definition of administrative units and self-determination exercised through indigenous autonomies and direct representation in state institutions."

1997 Ley No. 1715 recognizes the individual or collective right to private property and upholds the social function of land ownership. Continue redistributing land away from large estates and state land.

1996 Ley INRA guarantees the smallholder sector's rights to land and does not legally recognize large latifundios

1993 Government recognized multi-ethnic nature of population and mentions their rights to Tierras Comunitarias de Origen (TCO)
TCO are communal territories with no individual titles. Ayllu consist of both individually-titled lands and communally-titled land

1992 Audit National Agrarian Reform (SNRA), found 60% overlapping titles
It was often local ayllus that would grant security

1991 Ratified ILO Convention 169 on Indigenous and Tribal Peoples

1990 Protests about land rights and indigenous recognition in low-lands.

1982 End of dictatorship

Redistribute land to landless and land-poor latifundio tenants

1953 **Agrarian Reform** Decreed that 1) land should go to the tiller, 2) ownership of land should fulfill a social function, 3) the ownership of all natural resources was vested in the nation itself. Formally recognize and regularize diverse forms of tenure and made indigenous property inalienable.
Critique: Individualistic and failure to take indigenous forms of organization into account

1952 Movimiento Nacionalista Revolucionaria instigated Agriaian Reform with veil of assimilation
80% of existing farmland in the western highlands + Andean valleys redistributed to smallholder rural populations

1900 Mobilization of comunidades + sindicatos against Hacienda conditions
Only 27% indigenous population lived in freeholding communities

1879 Pacific War **expropriated community lands** in highlands and increase Haciendas communities

1866 Land tenure legislation decreed that indigenous communities must assert their land title + 1874 Ley de Exvinculacion de Tierras promoted **individual** titling of comuneros. Thus, **recognizing and guaranteeing the right to private property**

1800 *63% indigenous population lived in freeholding communities*

1825 Bolivian Independence.

1781 Tupac katari led rebellion against Spanish Government

1700

1600 Formation of large **haciendas** to cater towards **resource extraction** and concentrate indigenous populations in compact settlements.

1530s Spanish Conquest resulted in **Latifundio**, concentrated land distribution structure

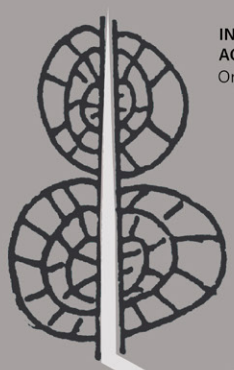
1500 Minor ayllus retain control over land in return for labor + tribute

1480s Incorporated Andean Altiplano into Quechua speaking **Inca Empire**, Aymara polities subdued

1400s Aymara and Quechua share **ayllu** social organization, an endogamous social unit consisting of various kinship groups organized according to dualist pattern of complementary halves in **collectively possessed, discontinuous territory.**

SPATIAL CONFIGURATION OF AYLLU

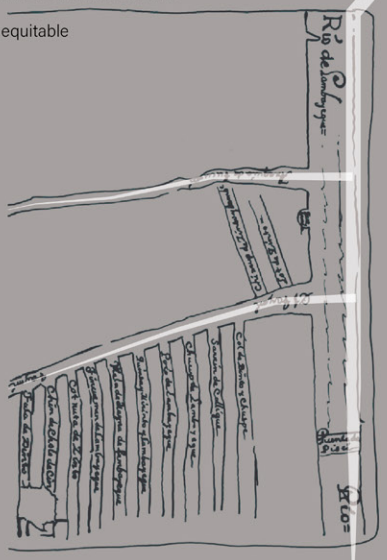
Ayllu disbands Western notions of tenure security which is viewed in terms of the secure right of an individual to a plot of land. Stakeholdership in ayllu is ultimate criterion for tenure security.



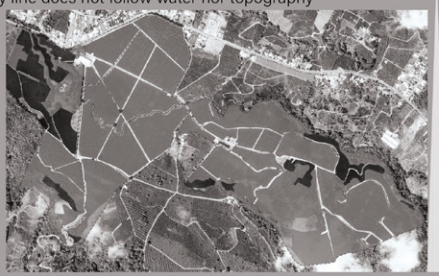
INTERPRETATION OF Q'ERO AGRICULTURAL LANDHOLDINGS
Organized around topography + water

THE RADIAL ORGANIZATION OF ANDEAN LANDSCAPES
Organized around water, topography, and road network

THE ORGANIZATION OF ANDEAN LANDHOLDINGS INTO PARALLEL STRIPS
Organized around equitable water access



LATIFUNDIUM INSPIRED HACIENDA
Territorial scale of individual ownership
Property line does not follow water nor topography



BIBLIOGRAPHY

Agassiz, Alexander. "Hydrographic sketch of lake Titicaca." In Proceedings of the American Academy of Arts and Sciences, vol. 11, pp. 283-292. American Academy of Arts & Sciences, 1875.

Allen, Catherine J. "The living ones: miniatures and animation in the Andes." Journal of Anthropological Research 72, no. 4 (2016): 416-441.

Al-Muqdadi, Sameh WH. "The spiral of escalating water conflict: The theory of hydro-politics." Water 14, no. 21 (2022): 3466.

Alonso, Wendy A., Waldo Lavado-Casimiro, Raúl Espinoza-Villar, and Eduardo Chávarri-Velarde. "Spatial Distribution of Droughts in the Titicaca Lake Basin." Revista Brasileira de Meteorologia 37 (2022): 289-304.

Arcoiris, País. "Un Mundo de Totora: 1. Cosechando Totora." Un Mundo de Totora (blog), miércoles, de abril de 2009. https://mundototora.blogspot.com/2009/10/cosechando-totra.html.

Arkush, Elizabeth. "Land use, settlement patterns, and collective defense in the Titicaca Basin: the constitution of defensive community." Andean Past 13, no. 1 (2020): 15.

Argumedo, Alejandro, and Bernard Yun Loong Wong. "The ayllu system of the Potato Park (Peru)." Sustainable use of biological di-versity in socio-ecological production landscapes 52 (2010): 84.

Banack, Sandra Anne, Xanic J. Rondón, and Wilfredo Diaz-Huamanchumo. "Indigenous cultivation and conservation of totora (Schoenoplectus californicus, Cyperaceae) in Peru." Economic botany 58, no. 1 (2004): 11-20.

Coca-Salazar, Alejandro, Huber Villca, Mauricio Torrico, and Fernando D. Alfaro. "Plant communities on the islands of two Altiplanic salt lakes in the Andean region of Bolivia." (2016).

Cottyn, Hanne. "Renegotiating communal autonomy: communal land rights and liberal land reform on the Bolivian altiplano: Carangas, 1860-1930." PhD diss., Ghent University, 2014.

Chacon Nina, Genaro. "Evaluación de la plantación de totora (Schoenoplectus tatora) en la península de Challapata, municipio de Escoma de la provincia Camacho del lago Titicaca." (2014).

Da Cunha, Dilip. The invention of rivers: Alexander's eye and Ganga's descent. Philadelphia: University of Pennsylvania Press, 2019.

De la Cadena, Marisol. "Earth beings: ecologies of practice across Andean worlds." Universitas Humanística 83 (2017): 403-412.

Dejoux, Claude, ed. Lake Titicaca: a synthesis of limnological knowledge. Vol. 68. Springer Science & Business Media, 2012.

"El Pueblo Uru Chipaya by FUNPROEIB Andes - Issuu." 2015. November 4, 2015. https://issuu.com/mayraivethponcevargas/docs/el_pueblo_uru_chipaya_un_pueblo_mil.

Elden, Stuart. "Legal terrain—the political materiality of territory." London Review of International Law 5, no. 2 (2017): 199-224.

Gartner, William G. "Mapmaking in the central Andes." Traditional Cartography in the Americas 169, no. 1 (1970): 647-654.

Heiser, Charles. "The totora (Scirpus californicus) in Ecuador and Peru." Economic Botany 32, no. 3 (1978): 222-236.

Hidalgo-Cordero, Juan Fernando, and Justo García-Navarro. "Totora (Schoenoplectus californicus (CA Mey.) Soják) and its potential as a construction material." Industrial Crops and Products 112 (2018): 467-480.

Hirt, Irène, and Louca Lerch. "Cartografiar las territorialidades indígenas en los Andes bolivianos: intereses políticos y desafíos metodológicos." Cybergeo: European Journal of Geography (2014).

Kent, Michael. "From reeds to tourism: The transformation of territorial conflicts in the Titicaca National Reserve." Current Issues in Tourism 9, no. 1 (2006): 86-103.

Kent, Michael. "The making of customary territories: social change at the intersection of state and indigenous territorial politics on Lake Titicaca, Peru." The Journal of Latin American and Caribbean Anthropology 13, no. 2 (2008): 283-310.

Latour, Bruno. Reassembling the social: An introduction to actor-network-theory. Oup Oxford, 2007.

Mamani, Julio Cesar Quispe, Cesar Elías Roque Guizada, Gladys Filonila Rivera Mamani, Freddy Abel Rivera Mamani, Alfonso Romaní Claros, and Nelly Jacqueline Ulloa Gallardo. "ECONOMIC VALUATION OF NATURAL HERITAGE: AN ANALYSIS FOR THE TITICACA NATIONAL RESERVE-PUNO SECTOR." Journal of Management Information and Decision Sciences 24 (2021): 1-33.

Matson, Zannah Mae. "A geometry of borders: The infrastructural points that construct the line." In Investigating Infrastructure: a forum. Society+ Space. 2017.

Marston, Andrea. "Strata of the state: Resource nationalism and vertical territory in Bolivia." Political Geography 74 (2019): 102040.

Thomson, Sinclair, Rossana Barragán, Xavier Albó, Seemin Qayum, and Mark Goodale, eds. The Bolivia reader: History, culture, politics. Duke University Press, 2018.

Murakawa, Atsushi. n.d. "¿Como Pueden Los Indigenas Eludir la intervencion estatal?: El Caseo de los Uros en la Reserva Nacional del Titicaca."

Paredes, Rossana, and Allison L. Hopkins. "Dynamism in Traditional Ecological Knowledge." Ethnobiology Letters 9, no. 2 (2018): 169-179.

Parker, Noel, and Nick Vaughan-Williams. "Lines in the sand? Towards an agenda for critical border studies." Geopolitics 14, no. 3 (2009): 582-587.

Perrier Bruslé, Laetitia. "The border as a marker of territoriality: Multi-scalar perspectives and multi-agent processes in a South American borderland region." Geopolitics 18, no. 3 (2013): 584-611.

Peters, Debra PC, James R. Gosz, William T. Pockman, Eric E. Small, Robert R. Parmenter, Scott L. Collins, and Esteban Muldavin. "Integrating patch and boundary dynamics to understand and predict biotic transitions at multiple scales." Landscape Ecology 21 (2006): 19-33.

Suaña Coila, Rita. Qot-qhas-soñinaka: Uros del Lago Titicaca, Qhapi Uros, Qhapi Cruz Grande Uro, Uros de Río Wily, Uros Chulluni (tierra). Primera edición. Cochabamba, Bolivia: FUNPROEIB Andes. (2022).

Sulca, Juan, James Apaéstegui, and José Tacza. "New insights into the biennial-to-multidecadal variability of the water level fluctuation in Lake Titicaca in the 20th century." Frontiers in Climate 5 (2024): 1325224.

McNabb, Stephen. "The Andean Ayllu and the Weaving of Borders." LACIS Review. Accessed February 22, 2024. https://www.lacisreview.org/blog-issue-02/the-andean-ayllu-and-the-weaving-of-borders. (2023).

van den Brink, Margo, Adri van den Brink, and Diedrich Bruns. "Boundary thinking in landscape architecture and boundary-spanning roles of landscape architects." Landscape Research 47, no. 8 (2022): 1087-1099.

Villar, D. A., Bastian Thomsen, Edwin R. Gutiérrez Tito, Anahi C. Paca Condori, Paola Velásquez-Noriega, Edilio Mamani, Mario Arivilca, Edmundo G. Moreno Terrazas, Jorgelina Marino, and Andrew G. Gosler. "Declining Use of Totora (Schoenoplectus californicus subsp tatora) in Lake Titicaca." Human Ecology (2024): 1-14.

Villarroel, Elena Katia, Paula Lady Pacheco Mollinedo, Alejandra I. Domic, José M. Capriles, and Carlos Espinoza. "Local management of Andean wetlands in Sajama national park, Bolivia." Mountain Research and development 34, no. 4 (2014): 356-368.

Wernke, Steven A. "Negotiating community and landscape in the Peruvian Andes: A transconquest view." American Anthropologist 109, no. 1 (2007): 130-152.

Yao, Fangfang, Ben Livneh, Balaji Rajagopalan, Jida Wang, Jean-François Crétaux, Yoshihide Wada, and Muriel Berge-Nguyen. "Satellites reveal widespread decline in global lake water storage." Science 380, no. 6646 (2023): 743-749.

Yumpu.com. n.d. "Plan de Uso Turístico de la Reserva Nacional del Titicaca - Sernanp." yumpu.com. Accessed January 12, 2024. https://www.yumpu.com/es/document/view/14296159/plan-de-uso-turistico-de-la-reserva-nacional-del-titicaca-sernanp.