

AAEA Annual Meetings, July 27 2009, Milwaukee
Wisconsin. Session:
"Risks, climate and vulnerability among poor smallholder
households in marginal areas"

Climate change, markets and livelihood strategies for adaptation in vulnerable Altiplano Ecosystems

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Illampu, Bolivia 2009

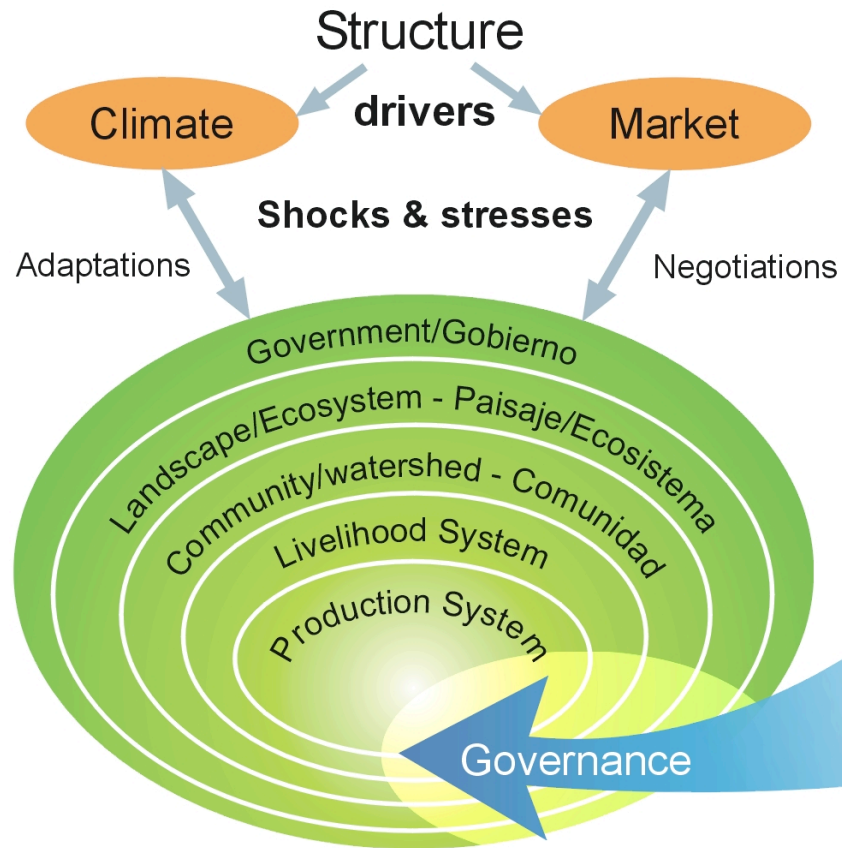
Climate change, agriculture and adaptation

- Climate change will increase food insecurity in Tropical regions (Lobell et al, 2008, Science)
- **Three groups of questions in the context of the Andes**
 - What do we know about Andean Climate Trends and Change? Are the impacts and issues the same? (Brown and Funk, 2008, Science)
 - How are livelihood strategies shaped in Altiplano ecosystems by markets and capitals & are the impacts of climate change the same?
 - What do we know about access and use of climate and forecast information in rural areas of the Tropics?
 - Participatory research and institutions in the development of community adaptation strategies.

Overview

- Framework of Scales and Interactions
- Altiplano Climate Trends and Change
- Markets, livelihood strategies and perceptions of risks across the Altiplano ecosystem
- Uncertainty - participatory research in adaptive capacities

ADAPTING TO CHANGE IN ANDEAN ECOSYSTEMS



Dynamics and interactions of the human and biophysical systems at multiple scales

Human Agency/ Negotiation



Transformative Hypotheses of capitals, capabilities and institutions for adaptive capacities

Key Scales and Interactions

(Ostrom 2007)

- Scales

- Global, national, regional and local markets
- Regional climate trends and projections
- Watersheds and rural communities
- Environmental trends: pests and diseases
- Household and community decision making
- Production of crops and livestock: farm and fields

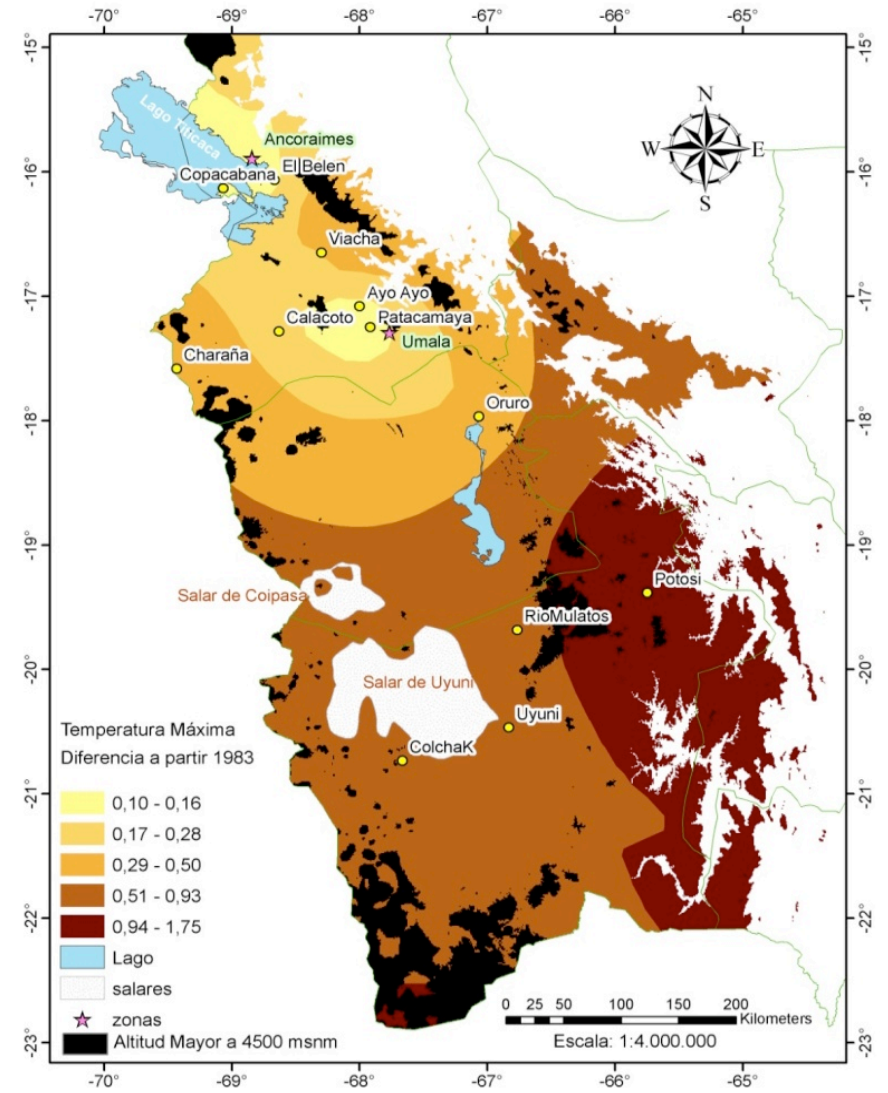
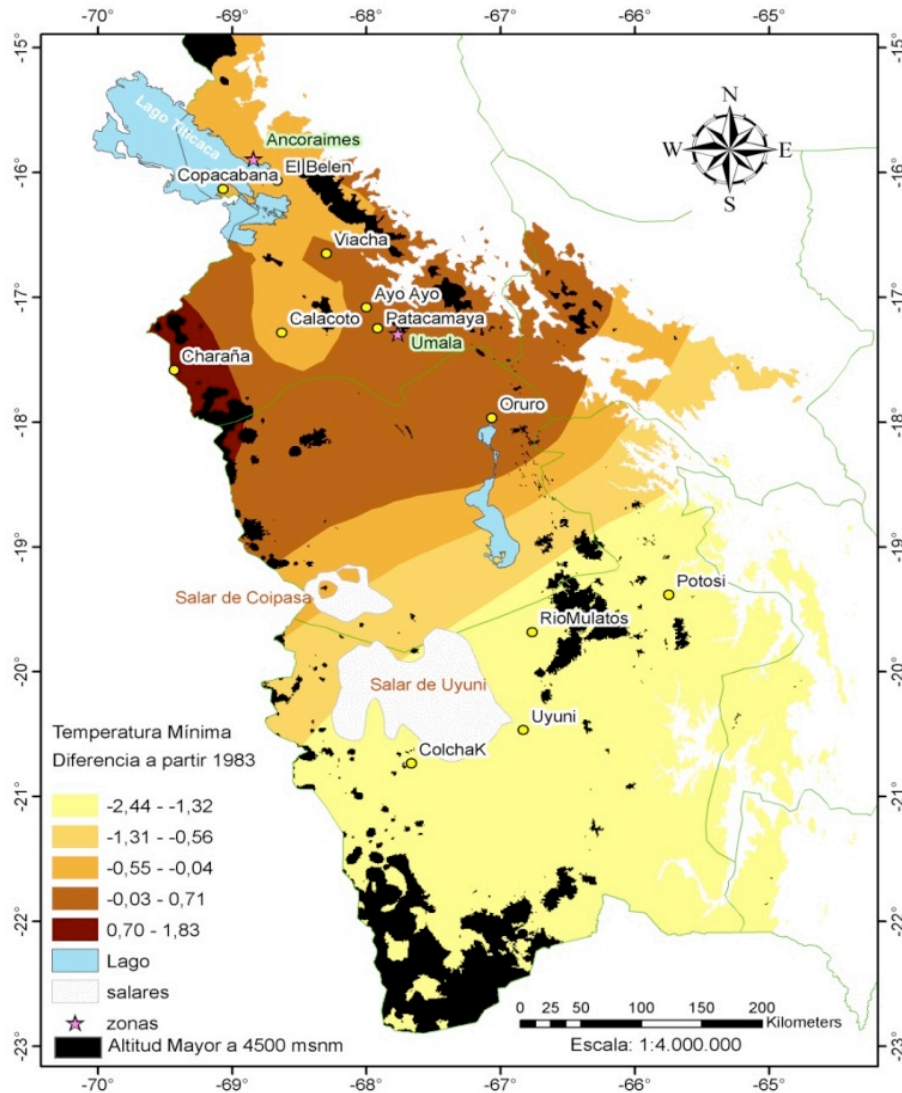
- Interactions

- Effects of markets on livelihood strategies
- Effect of climate on the ecosystem and production systems
- Effect of climate and market on perceptions at household and community levels
- Interaction effects of climate and markets on livelihoods (through capitals) and diversity

A landscape photograph showing a wide valley with a town in the distance, surrounded by mountains. The sky is blue with scattered white clouds. The text is overlaid in the center-left of the image.

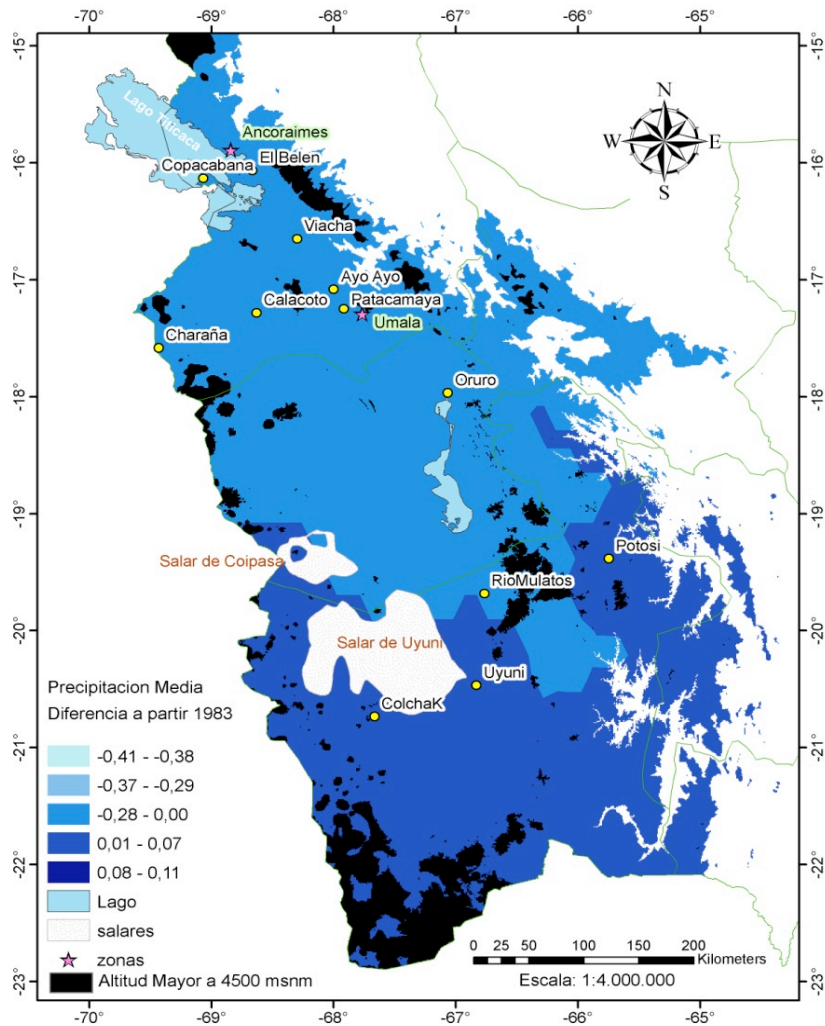
What do we know about
Andean Climate Trends
and Change and
What are the Implications

Altiplano Temperature Trends Differences (1950/60-2004) (Valdivia et al submitted)

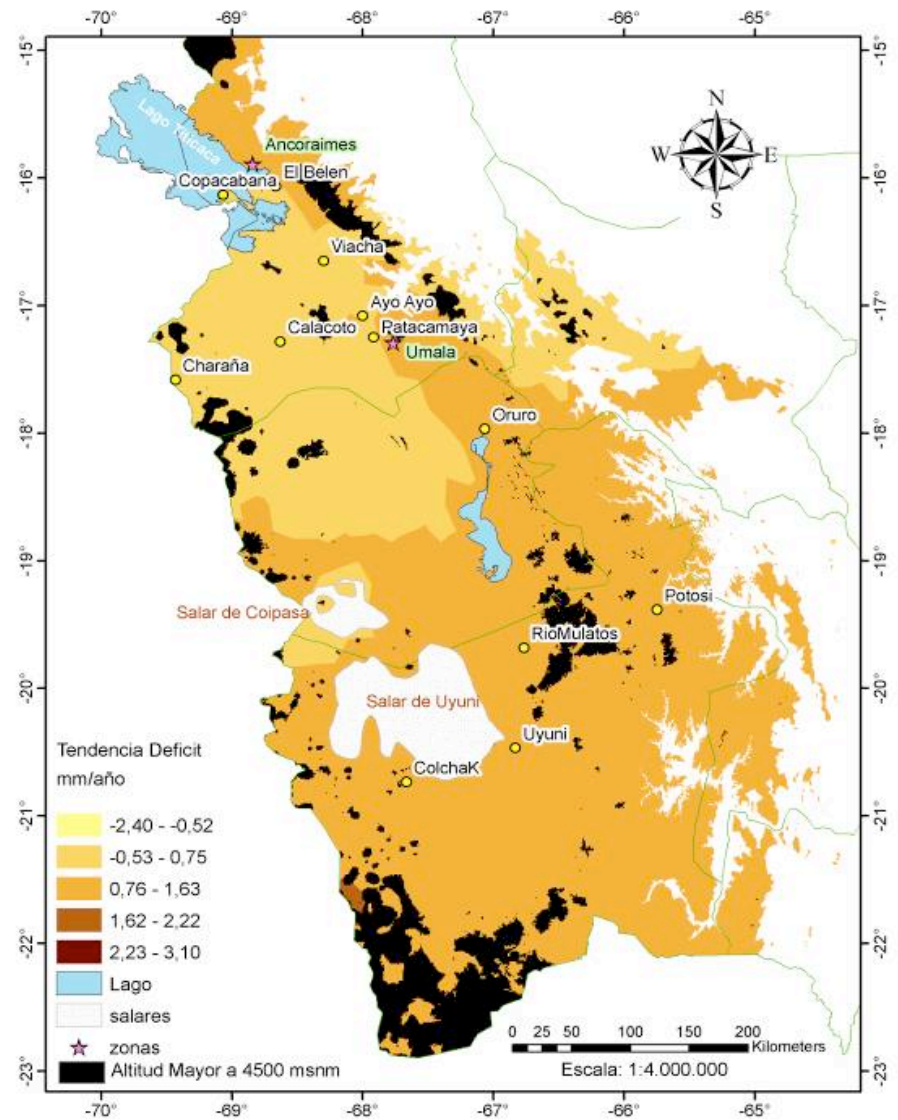


Significant warming trends in Central and Northern Altiplano, larger in Minimum Temperatures

Trends in Rainfall & Evapotranspiration (Valdivia et al submitted)



Small to no changes in precipitation in the last forty years in North and Central Altiplano



Significant increase in evapotranspiration in the North and the Central Altiplano

Altiplano Climate Change Projections (Seth et al)

CMIP3 Data Archive

Data Availability Summary (as of 27 February 2008)



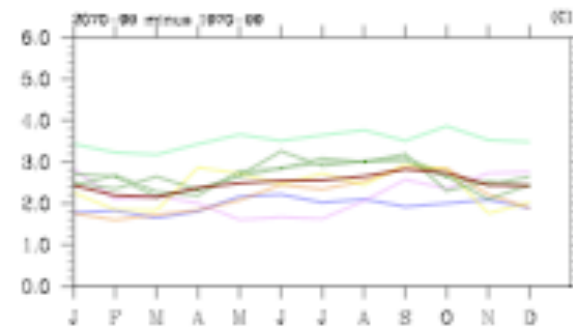
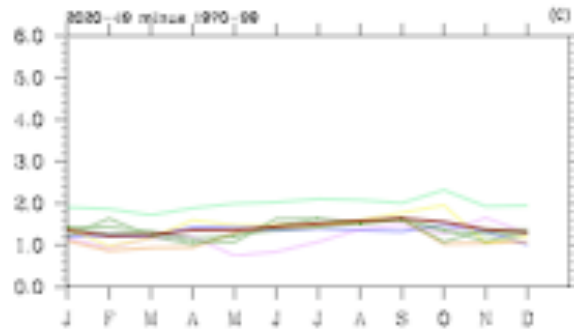
Altiplano Climate Projections were developed using ten models that project monthly mean temperature and precipitation and extreme indices. Caveat – problems in representing Altiplano altitude allowed for more moisture.

Projected Temperatures

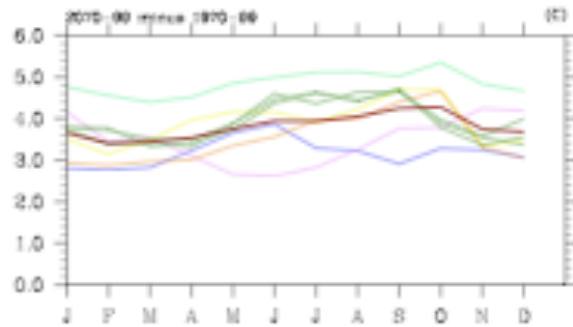
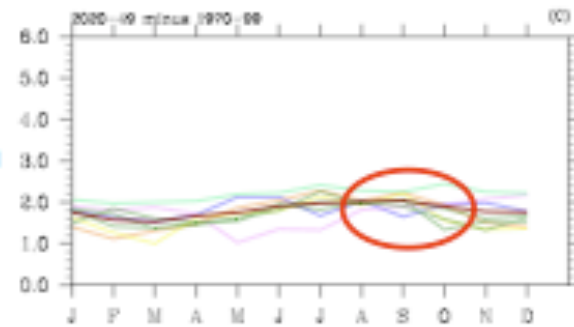
2020-49

2070-99

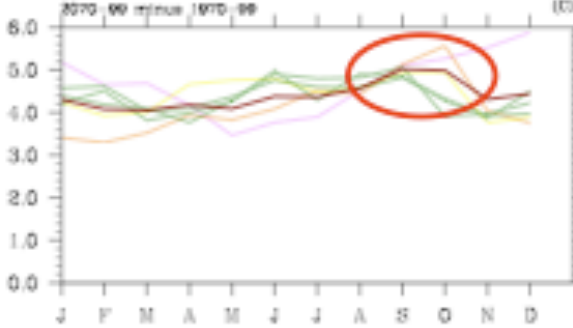
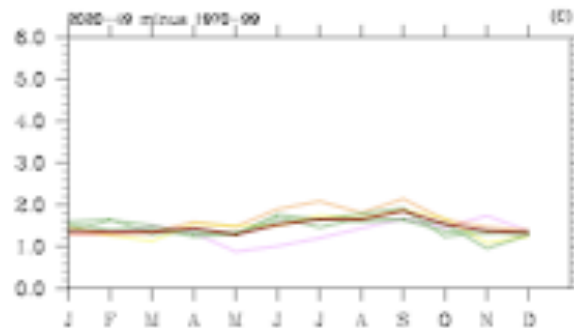
BI: low



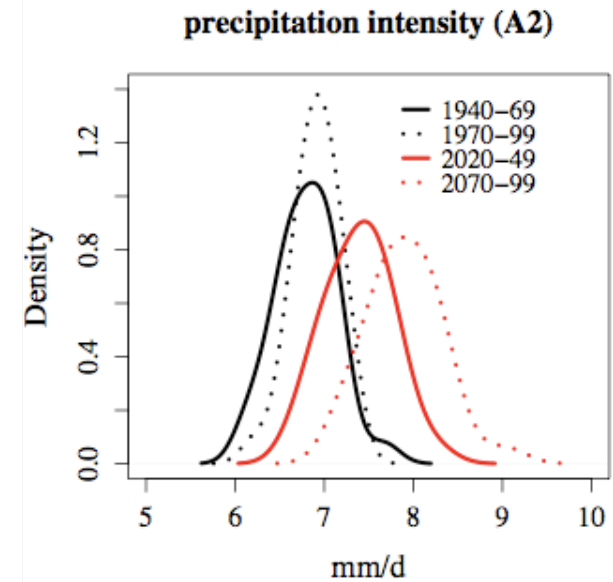
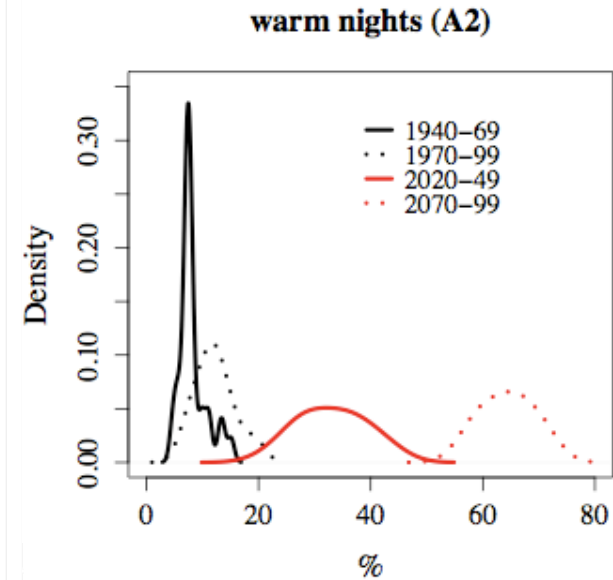
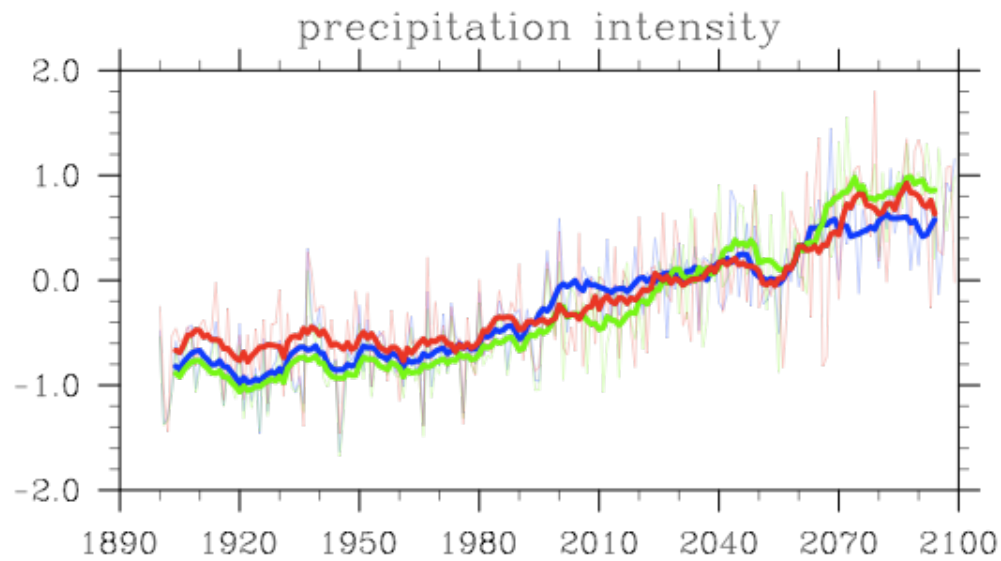
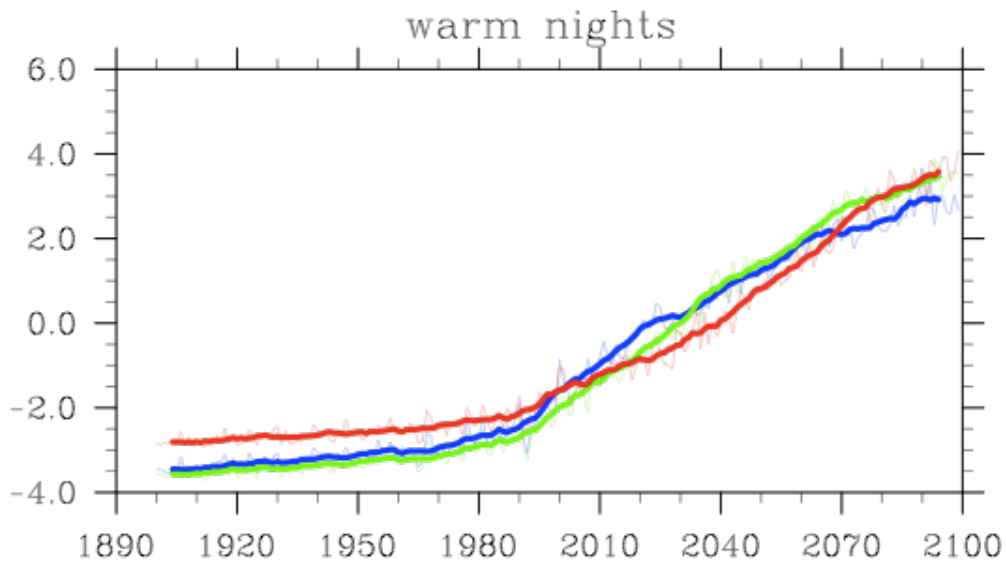
A1B: medium



A2: high



(Seth et al)



Standardized differences (left) for temperatures above the 90th percentile (T90) (top); precipitation intensity given the annual precipitation divided by the number of rain days (bottom). Shifts in probability distribution functions for the time periods given (right). Emission scenarios A2 (red), A1B (green) and B2 (blue), annual values in light colors with 10 year running averages superimposed. (Thibeault et al. JGR, submitted)

Implications

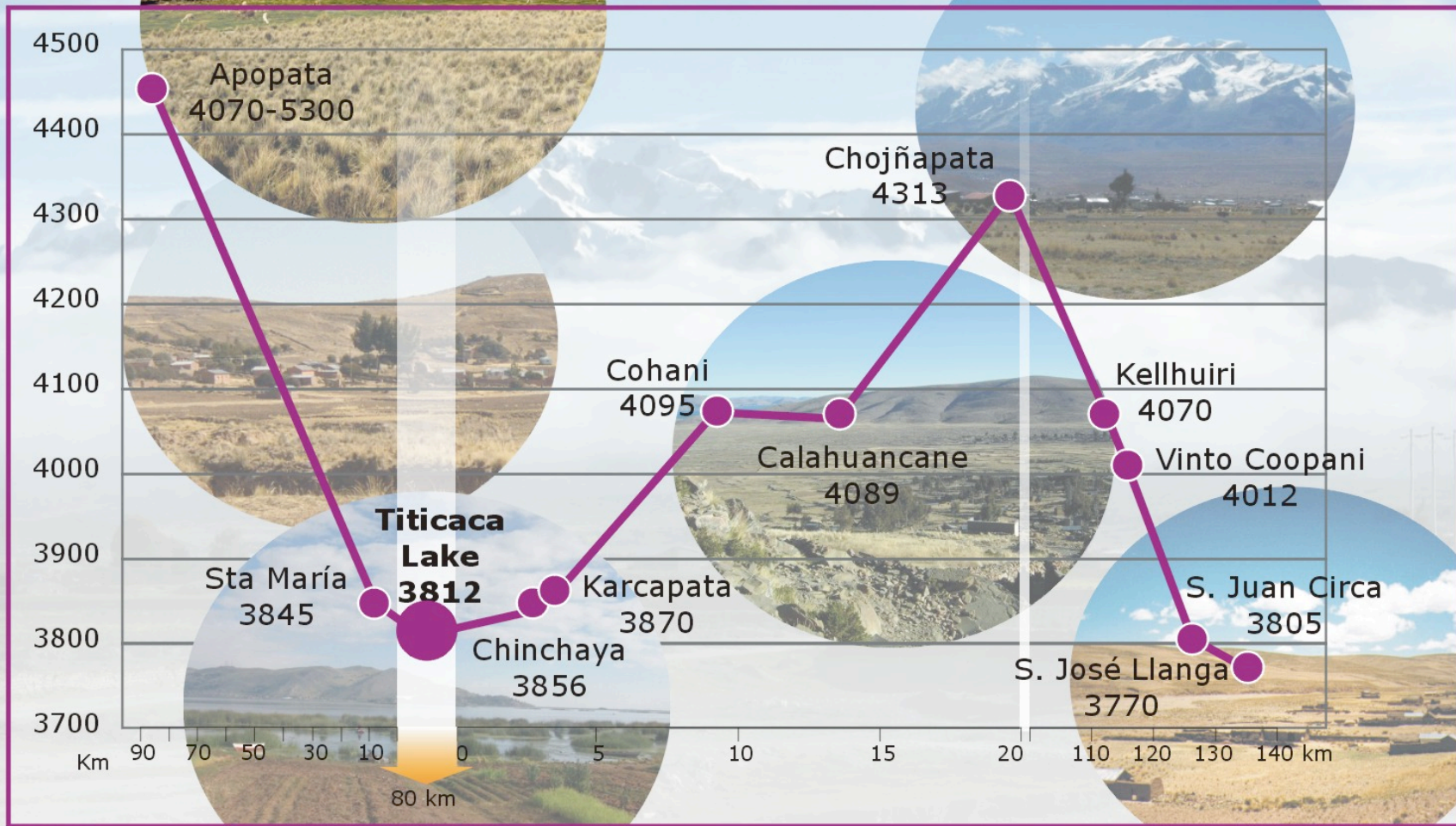
- Trends by geography have varying consequences – warming in Central, and warming and drying in the North, desertification in the South
- About climate projections – increases in temperature; no increases in precipitation (difficult to model); later onset of rains and intense precipitation during rainy season; increases in extremes; shifts in probability distributions; and loss of soil moisture (Thiebault et al)
- Warming trends and variability increase risks in agriculture, as well as new opportunities for crops.
- Implications in terms of the role of past experience in informing future decisions - Uncertainty



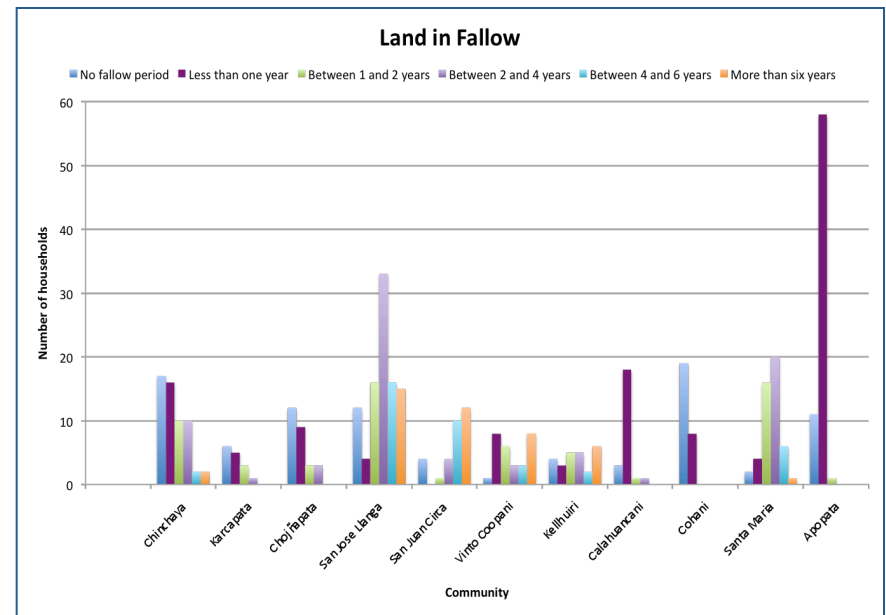
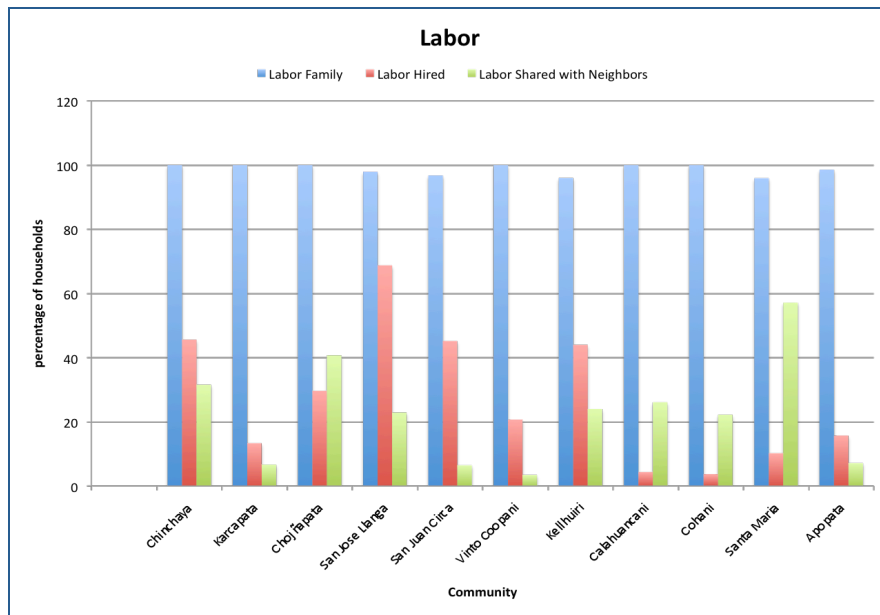
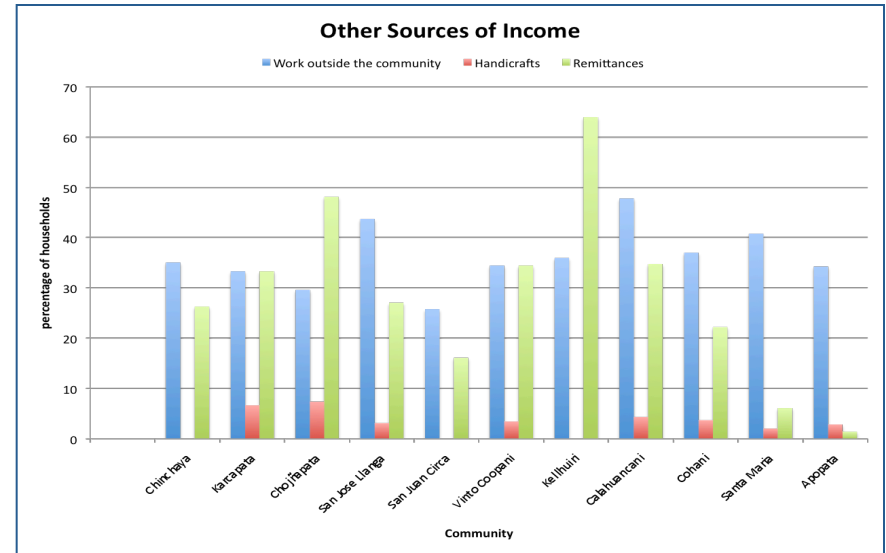
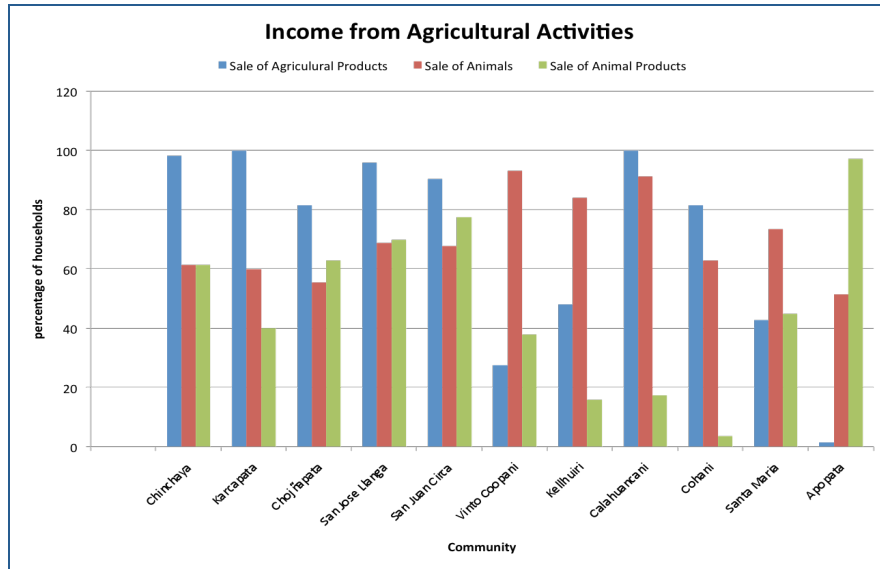
Markets, livelihood strategies and perceptions
of risks across the Altiplano Ecosystem

Are the impacts
and issues the same?
(Brown and Funk, 2008)

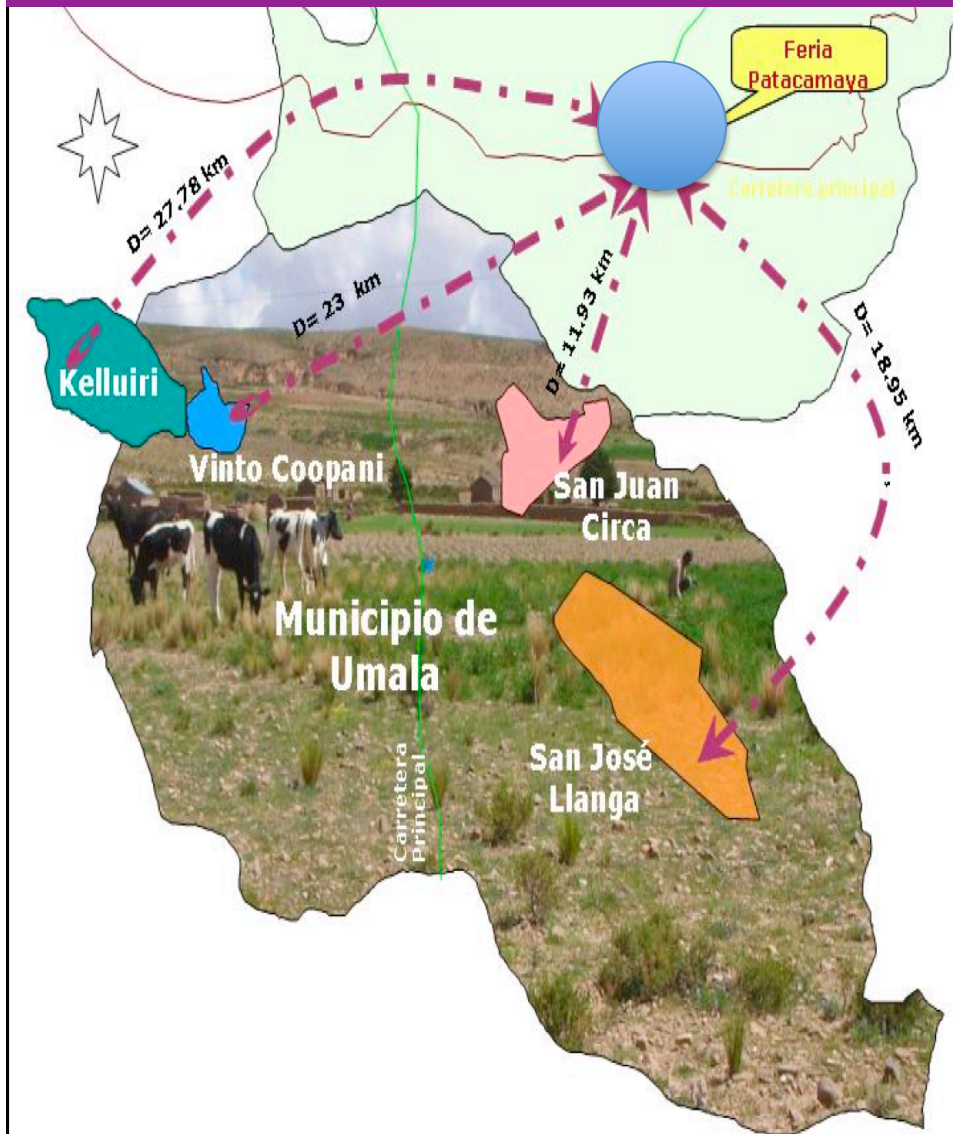
ALTIPLANO LANDSCAPES



Income, Activities and Community Capitals Across 11 Research Sites in the Altiplano 2006 (Turin and Thomas, 2008)

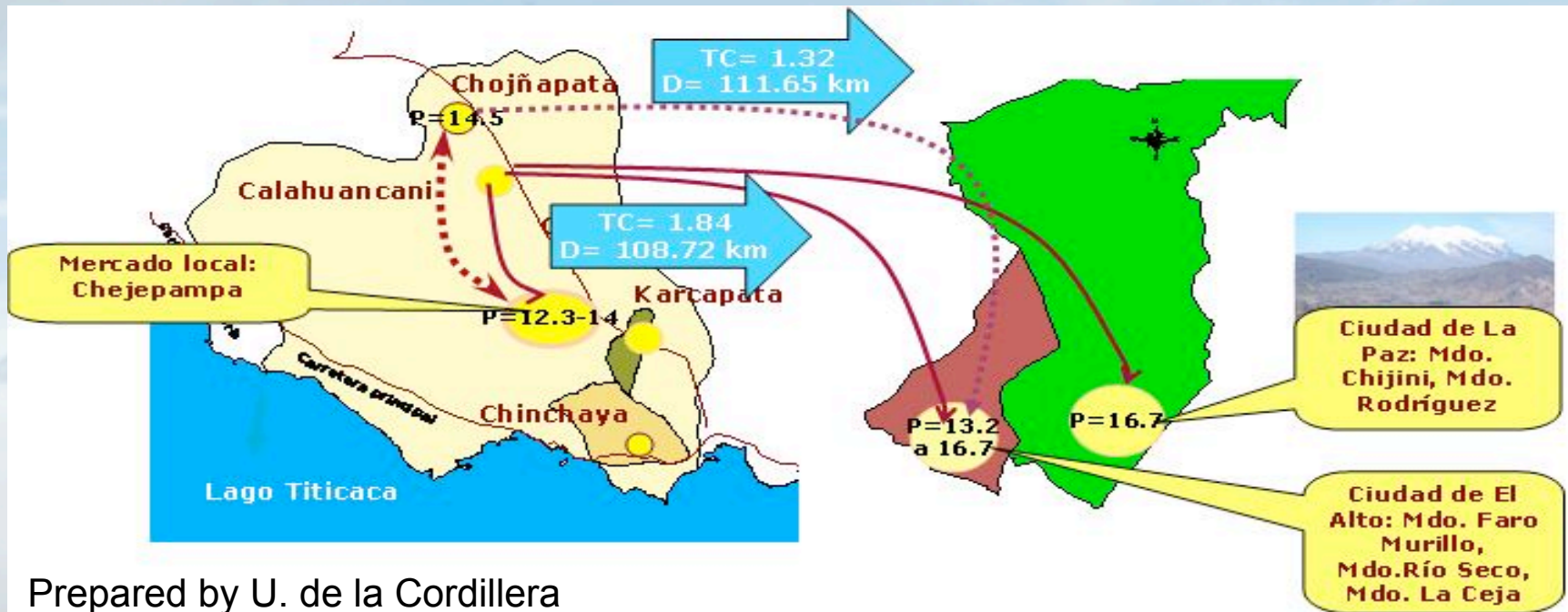


Markets in Umala –Central Altiplano



- A dairy policy that supported the development of milk markets.
- A development of potato markets in the last decade that resulted in a shift from consumption to market varieties.
- Transaction costs in access to markets and technologies vary within and between communities.

Markets in Ancoraimes – Northern Altiplano



Prepared by U. de la Cordillera

- Cash crops - onions, in the last 25 years, peas and marketable potato varieties in the last 10 years; spreading up the watershed.
- Local, regional, and El Alto markets depending, on product and gender.
- Labor, important commodity marketed outside the region.
- Livestock markets, especially to cope with shocks.

While livelihood strategies differ between and within regions by wealth, life cycle and education, dread of climate and pests risks are high, as well as the shocks experienced. Differences between regions lie on the nature of the change, hazard events a concern in Umala, and climate change a concerns in Ancoraimes. (Valdivia et al 2007)

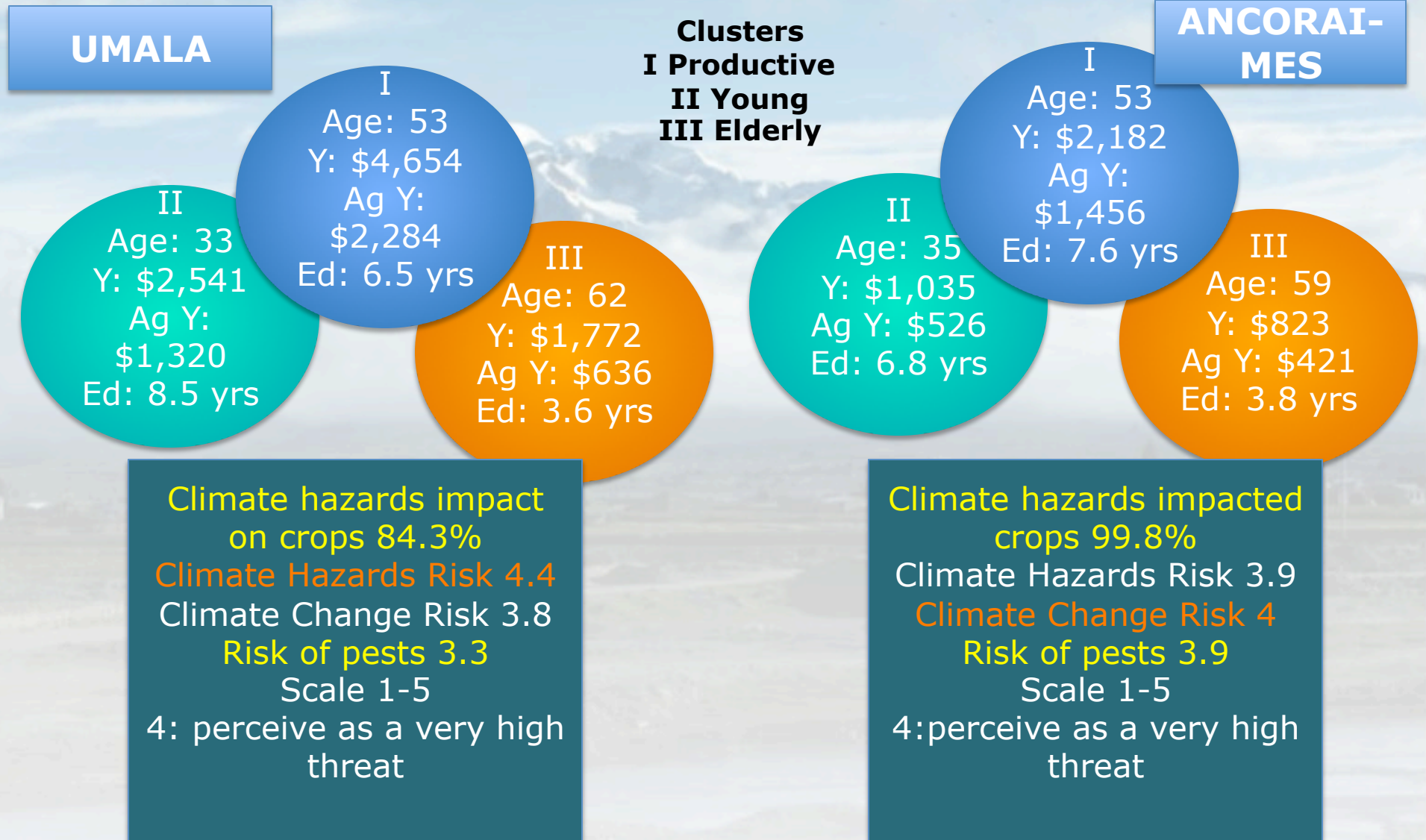


Table 1: Perceptions of Risks to Household Wellbeing of Various Climate and Market Hazards in Rural Communities of the Central and Northern Altiplano of Bolivia (2006)


Type of Threat	Ancoraimes Municipality Northern Altiplano			Umala Municipality Central Altiplano		
Communities	Low Lands	Mid Land	High Land	Low Lands	High Lands	
No Households	57	65	27	127	54	330
Hail impacts crops & livestock	3.51	3.97	3.56	3.85	4.28	***
Impact of floods	3.96	3.82	3.85	4.42	4.00	***
Impact of drought	2.41	2.97	2.67	2.96	3.00	***
Impact of frost	3.89	4.06	3.59	4.35	4.50	***
Impact of changing climate	3.79	4.17	4.11	3.87	3.53	***
Impact of pests	3.68	4.11	3.78	3.13	3.67	***
Soil fertility loss	3.91	4.23	4.00	3.44	3.68	***
Impact of low livestock prices	3.84	4.12	3.78	3.72	3.83	***
Impact of an adult becoming unemployed	3.70	4.23	4.04	2.33	2.98	***


Source: Household Survey of Capitals, Practices and Perceptions. *** P<0.001

- 1 = it is not a threat
- 2 = it is a minimal threat
- 3 = it is a moderate threat
- 4 = it is a very strong threat
- 5 = it is an extreme threat

Table 2: Experience with Shocks (% losses) and Wealth Distribution by Location in the Watershed, North and Central Altiplano in 2006

Sources of losses in 2006	N 330	Northern Altiplano			Central Altiplano	
		Low	Mid	High	Low	High
Drought	34	40	23	0	27	19
Floods	50	21	0	28	28	12
Frosts	107	19	19	25	22	0
Hail	48	17	22	20	21	21
Crop losses to pests	278	28	32	22	12	11
Livestock to frost	40	29	25	30	9	5
Livestock to diseases	164	14	17	18	18	15

Distribution of the Population by Life Cycle/Wealth Groups * N		Northern Altiplano			Central Altiplano	
	N	Low	Mid	High	Low	High
 Productive - 1	68	5	0	3	46	14
Young - 2	124	23	32	11	40	18
Elderly - 3	136	29	32	12	41	22
Total	328	57	64	26	127	54



Dread and risk of climate change, and threat of pests and disease are high.

Climate shocks and pests have a high impact on production, and differ by livelihoods and the capitals and diversification strategies.

There is a need to understand changes in dynamics, build new knowledge, and determine how this information can flow to strengthen decision making for adaptation.

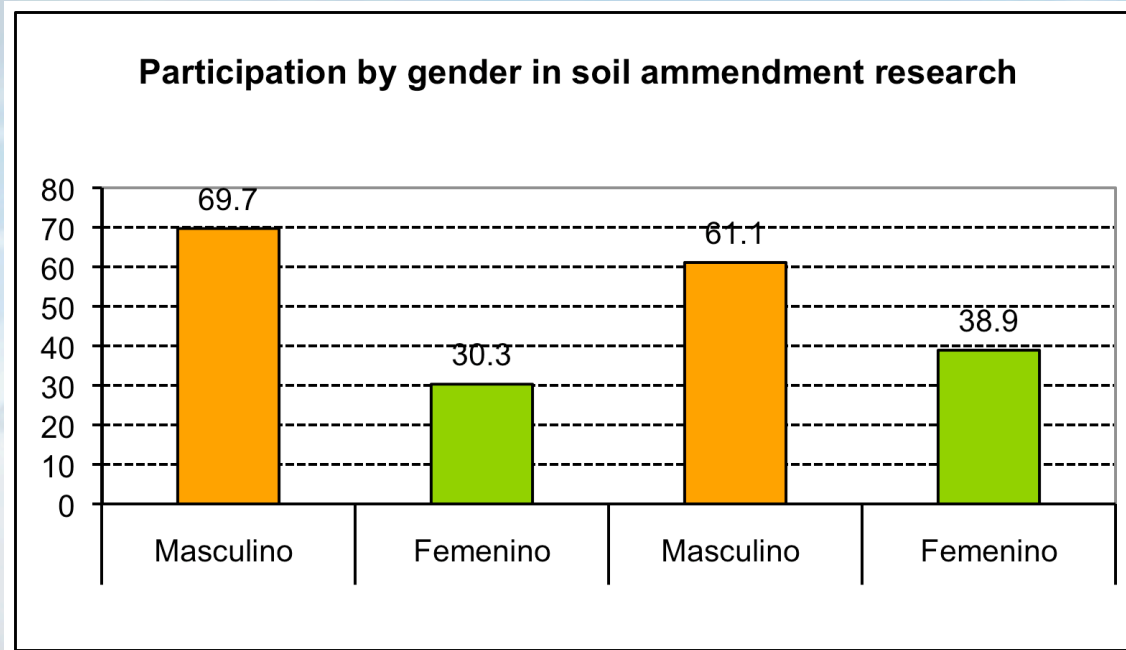
Uncertainty and participatory research ... building adaptive capacities

- People assess risks using rules based and association based systems (experiential) (Slovic and Weber, 2002).
- When the results of associational and rules based systems conflict, the decision maker reverts to his or her experience.
- In the Altiplano this probably means that when the results of traditional/local knowledge system and probabilistic forecasts conflict, farmers will rely on their traditional assessment (Slovic et al, 2002).
- Note that skepticism about new knowledge, in this case probabilistic forecasts, is a wanted trait when risk is high.

Participatory Research

- Given climate trends and projections, uncertainty will likely increase; participatory approaches may enhance local knowledge, in this case building trust through two-way participatory communication (Wilkins, 2001).
 - Participatory research allows farmers and producers to develop a common set of expectations and language to discuss alternative strategies.
 - By participating in research farmers can make own observations and can derive lessons from research beyond those conclusions presented by the researcher.

Research on Institutions: Participation & ability to act



Interest research groups formed by families with more resources;
Community groups include most vulnerable; women's participation is lower than men's. Wealth, labor constraints, factors in participation.

Findings to date

- Extreme event projections – uncertainty & variability, presentations unlike the present, potential stress in access to water and more extreme events.
- Change in climate, particularly later on-set of the rainy season and more extreme rainfall events, drought, and frosts have undermined production strategies tied to the use of local indicators.
- Later onset also reduces planting date options & threatens production of two important sources of plant protein in the Andean diets (quinoa and fava beans).

Findings to date

- Behavior of certain indicator species also changing due to climate and environmental changes -> the ability to respond to climate risks is declining.
- Opportunities in Ancoraimes in terms of introduction of new crops in respond to markets and climate, but are these sustainable? – specializing in onions, peas, few potato varieties as a main crop; water constraints, pest issues, soil depletion. Key – introducing the climate change dimension to assessment of options.
- Building social and political capitals through coalitions with organizations and stakeholders to identify actions is an on going process to build the capacities to plan for adaptation.

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Acknowledgments

- The 330 families from the rural communities who participate in the research on change and adaptation
- The SANREM CRSP
- Apolinar Contreras, Alejandro Romero, research assistants at U. C.
- Patricia Valdivia for the graphics