I. Climate Change Variability and Andean Agriculture: The Context

SANREM CRSP LTR4: Adapting to Change in the Andes

Practices and Strategies to Address Market and Climate Risks in Vulnerable Ecosystems

Corinne Valdivia
Outline

• Livelihoods Diversity and Networks (NOAA HD)
• ENSO Climate Variability and Use of Information – CPAs (WB CIP)
• Adapting to change (SANREM CRSP)
• Purpose – focus on diversity, access and implications for adaptation (Loeb et al, 2008; Brown and Funk, 2008, Science)
Livelihoods Diversity and Networks (NOAA HD)
Rural Livelihood Strategies

Assets → Activities → Outputs → Outcomes

- Production and Consumption are interlinked
- Markets are unreliable
- Limited credit markets
- Smoothing of consumption may deplete productive assets
- Social dimensions to accessing resources are relevant
Coping and Adapting

**Ex-ante:**
- Income Smoothing
  - Diversifying:
  - within agriculture
  - selling labor
  - Value added
  - > less covariant activities
- Portfolio Diversity - number and share of income activities

**Ex-post:**
- Consumption Smoothing
  - Loans
  - Sale of assets
  - Migration

**Adapting:**
- Activities more resilient to climate variability

NOAA HUMAN DIMENSIONS: CLIMATE VARIABILITY AND HOUSEHOLD WELFARE IN THE ANDES AND USE OF CLIMATE FORECASTS
Findings on Diversity Indices of Economic Portfolios in San José 93-95-99

- Intensives/Rural/Dairy
- Extensives/Agriculture/Potato
- Elderly

Graph showing the diversity indices for different economic portfolios from 1993 to 1999.
Network for Local Knowledge
Main Network Structure San José Bolivia

Network 1
E/P

Network 2
EM
Incamaya

Network 3
ML

Network 4
E
Tholatia
Barrio

Network 5
ML

Network 6
P
Callunimaya

Network 7
MF

Espiritu Wilqui

Network for Local Knowledge:
- MF: Dairy Forages
- ML: Dairy Labor
- E: Elderly
- P: Potato
- N: not in cluster
Main constraints to the growth in production after el Niño in the Altiplano:
- Lack of seed in all groups
- Lack of cash in the agricultural and passive
- Lack of more land on the agricultural and passive

Sources of information about climate forecasts for decisions:
- Local knowledge systems
- Knowledge from grandparents
- Local networks
- Limited outside sources of information 4%

Concern with climate risk a function of ability to cope with shock – differences between rural and the other two groups
Transitioning to climate resilient development: Perspectives from communities in Peru

WB – CIP – MU

With CIRNMA and ITDG
Communities represent the diversity of environmental, population and productive agroecosystems.
Southern Peru – Participatory Rural Assessment

Communities represent ethnicities, agroecosystem and productive diversity of Peru’s Altiplano

- Dairy Cattle
- Lake, Crop Livestock Q
- Mainly Crops, Some Livestock
- SM. Crop Livestock
- An. Livestock Crop PS
- Lake, A. Crops and Informal Trade
Participatory Workshop Methods

Large Groups

Focus Groups

Time Line Development

Participatory Mapping

Community Participatory Assessments
Participatory Assessments

KEY FINDINGS
Climate Events: Impacts in the North

- Floods during El Niño
- Floods also during non Niño heavy rains
- Dry and Cold spells in consecutive years (two, three, or four years)
- Forest fires following Niño years
- Disease outbreaks during Niño years
- Concerns vary according to location, production activities, technological alternatives
FINDINGS

Multiple Shocks
Covariant risks

Southern Highlands
Rural Communities

Droughts
Frosts
Floods
Hail
Snow
Climate Events: Impacts in the South

- Spatial variability in the presentation of droughts, floods, frosts, and hail events
- Droughts during Niño years, in some but not all communities in same year
- Floods during wet years from the Lake
- Upper respiratory diseases during cold spells
- Concerns vary according to location, production activities, technological alternatives: loss of animals, loss of crops, raw materials
Coping Strategies

In the Northern Coast
- Selling of livestock
- Over-harvesting in dry forest - deforestation
- Collective strategies during floods
- Individual strategies during droughts
- Migration of adult males and youth to the jungle and the coast

Southern Altiplano
- Selling of livestock
- Selling of wool and handcrafts
- Stinting on food in the family
- Informal trade
- Migration of male adults and youth
- Non market institutions: access to land, seed, labor (social reciprocity relations)
Role of Climate Information

Information About El Niño

- Awareness and trust in the North;
- Radio is a trusted source; official forecasting sources “not trusted”;
- Scale is a constraint in the forecasts for the Altiplano region;
- **El Niño forecasts listened to in radio in the Altiplano perceived as “belonging” to the coast**;
- While a connection between El Niño and drought occurrence appears to exist in the Altiplano … multiple shocks

Local Knowledge Indicators

- Local scale biological and physical indicators in the North and the Altiplano
- Perceptions that climate is changing, difficulties “reading” the indicators
- Local knowledge exists for agriculture and fisheries
- Loss of knowledge among the youth
- Use knowledge differs between the North and the Altiplano
Barriers to Adaptation

In All Communities
- Limited understanding and access to local and regional governance structures
- Progressive loss of assets leading to poverty trap
- Lack of access to credit
- Lack of insurance mechanisms
- Lack of technological alternatives
- Lack of trust in information of forecasts
- Erosion of social structures due to migration (local knowledge)

In the Altiplano
- Multiple and consecutive shock events- uncertainty
- Lack of understanding of presentation of the hail, frost, and flood events: landscape

In the North Coast
- Isolation during periods of drought
- Flood relocation conflicts
- Long periods of stress during dry years
Resilience or Trap: Assets and Ability to Recover from Shock and Stress

About depletion of assets and traps:
Ellis; Zimmerman and Carter; Valdivia et al; de Waal and Tumushabe; Sheik; Sacks et al
SANREM CRSP LTRA4

Adapting to Change
Adapting to Change

Five Objectives -

– Shared understanding of drivers of change in Andean Ecosystems
– Local knowledge and response to perceptions of relative risks associated with drivers and other risks
– Practices and information that explicitly link local and new knowledge to adapt to change
– Market integration opportunities and institutions that contribute to adaptation
– Build capacities and capabilities to adapt to change – pathways to enable agency

Multiple Disciplines –
Hypotheses on the current state and its drivers
- Pests
- Soils
- Biodiversity
- Local Climate
- Local Markets
- Livelihoods

Transformative Hypotheses
- Bridging knowledge systems for change
- Building coalitions to implement change
- Risk and dread and ability to act

Secondary research is used to fill in the gaps in primary research as needed for each site.
10 communities
Altitude
Vulnerability
Diverse systems
Access to Markets

Ancoraimes
Umala
Ilave
Integrating knowledge systems
An Integrated Plan for Participatory Research and Evaluation of Impacts

Participatory Approaches: a. To identify concerns, demands, perceptions, risks, and vulnerabilities; b. To conduct research; c. To share findings (socialización)
Participatory Maps – Chinchaya: Land Cover, Land Use Change, and Vulnerabilities

**Erosion, Drought, Frost**

**BEFORE**

**VULNERABILITY**

**AFTER**
Studying Livelihoods Strategies, Market Integration, Climate and Perceptions of Risks
Income Level & Diversification: differences in regions and communities

Household income levels in Umala are twice the income of Ancoraimes.
Human Capital: gender matters

In both contexts, women have lower schooling than men

![Bar chart showing years of schooling for males and females in Ancoraimes and Umala.](chart.png)
Natural Capital: Land fragmentation
Ancoraimes and Umala

Hectareas de terreno (2005-006)

Uso de la tierra

- Sembradas
- Descanso
- Pastizales
- Alfares

Has

0 1 2 3 4 5

Ancoraimes

Umala
Livestock Assets: A coping strategy for shocks in Ancoraimes

Tenencia de ganado

Promedio

Oveja criolla
Oveja mejorada
Vacuno criollo
Vacuno mejorado
Porcino
Auquénido

Ancoraimes
Umala
Natural Capital: crop diversification

Greater diversity of potato varieties in Umala

Dread of pests in disease high
Dread of frosts, floods, drought differentiated by region
Social Capital: individual’s participation within producer and community organizations

Participation in community organizations is basically the same in both sites

Differences in the nature of social capital and articulation to markets
Access to credit is limited

Availability of contingency markets to buffer shocks varies by region communities and households
### Perception of risks and assets

Riesgos climáticos (o=no riesgo; 5=alto riesgo)

<table>
<thead>
<tr>
<th>Familias con capitales:</th>
<th>Granizo</th>
<th>Heladas</th>
<th>Sequía</th>
<th>Inundaciones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mayores</td>
<td>3.91</td>
<td>4.24</td>
<td>4.61</td>
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<tr>
<td>Medianos</td>
<td>3.97</td>
<td>4.28</td>
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<tr>
<td>Menores</td>
<td>4.13</td>
<td>4.52</td>
<td>4.79</td>
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Riesgos de mercado

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<td>3.64</td>
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<td>Medianos</td>
<td>3.57</td>
<td>3.70</td>
<td>2.97</td>
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<td>3.67</td>
<td>3.72</td>
<td>3.50</td>
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Valdivia Jimenez and Romero 2007

Rees Valdivia and Marks – assets and off farm income matter in perceptions of risk
Synthesis – Lessons to Date

• Climate impacts on livelihood assets, and therefore on ability to recover – locality and variation

• Land fragmentation and shocks – off farm and migration at region and local levels – variation

• Markets have multiple effects:
  – Secure prices, an incentive mediated by the type of natural capitals accessed (forages an example of dairy development) – long term
  – Incentives may lead to increases in vulnerability to climate if specialization – evaluation of portfolios & TC
  – Coping with shocks – asset depletion – lack of contingency markets – high degree of covariant shocks - further research
  – Niches that value biodiversity – further research
Synthesis – Lessons to Date

• Role of climate information in decisions – networks, local knowledge to date – disconnect to outside sources - local

• Approaches to integrate new knowledge – climate and participatory approaches – climate trends and scenarios

• Social and political capitals as elements of agency for adaptation – climate scenarios and trends
Appendix
### 2nd Canonical Variable: Strategy (Xs) and Response (Ys) and Correlations

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<tr>
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<tr>
<td>X Age</td>
<td>0.65</td>
<td>-0.08</td>
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<tr>
<td>X Labor</td>
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<td>0.03</td>
<td>0.2</td>
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<td>X Forages</td>
<td>-0.39</td>
<td>0.49</td>
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<td>X Cattle Improved</td>
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<tr>
<td>X Off farm Y</td>
<td>0.37</td>
<td>-0.52</td>
<td>0.11</td>
</tr>
<tr>
<td>X Food crops</td>
<td>0.86</td>
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<td>-0.31</td>
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<tr>
<td>Y Income</td>
<td>0.57</td>
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<tr>
<td>Y Diversity Index</td>
<td>-1.12</td>
<td>1.04</td>
<td>0.98</td>
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<td>Canonical Correlat.</td>
<td>0.61</td>
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Valdivia and Quiroz 2003
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Medios de Vida, Capitales y Estrategias

Capital Político

Medios de Vida, Capitales y Estrategias

Capital Natural

Instituciones Acción Colectiva

Políticas

Capital Creado

New Knowledge & Information

Climate Markets

Valdivia, 2001, 2004

“lo que las personas pueden lograr o ser con sus derechos”
Knowledge

- 450 households interviewed
- 180 farmers participating in research groups
- 350 farmers and researchers participated in CPAs
- Field Days
Capacities:
Degree and Non Degree Training

**Non degree:**
- Training of researchers: surveys, CPA, participatory methods, GIS (13 events)
- Training of farmers: pests and diseases, management, repellents, management of forages (22 events)
- Participatory assessments with farmer groups (27 activities)

**Degree training:** 27 students
- 11 Licenciatura
- 12 MS
- 4 PhD
- CIDES UNALM
Y por lo tanto cada grupo tiene diferentes *percepciones de control* sobre el riesgo:

### Control sobre riesgo climático (0=no control, 5=total control)

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### Control sobre riesgo de mercado

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<td>2.00</td>
<td>1.85</td>
<td>1.87</td>
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En Bolivia: ANCORAIMES

4 comunidades
3850 - 4300
Y Umala

4 comunidades
3,770 - 4,070
Peru

Intervention sites

APOPATA

SANTA MARIA

4,400m 13,000Has 80 Fam

3,900m 340 Has 60 Fam 400-600mm

Puno