

The role of quinoa in the diets and livelihoods of farmers in the Southern Bolivian Altiplano:

A case study in the municipalities of Salinas and ColchaK

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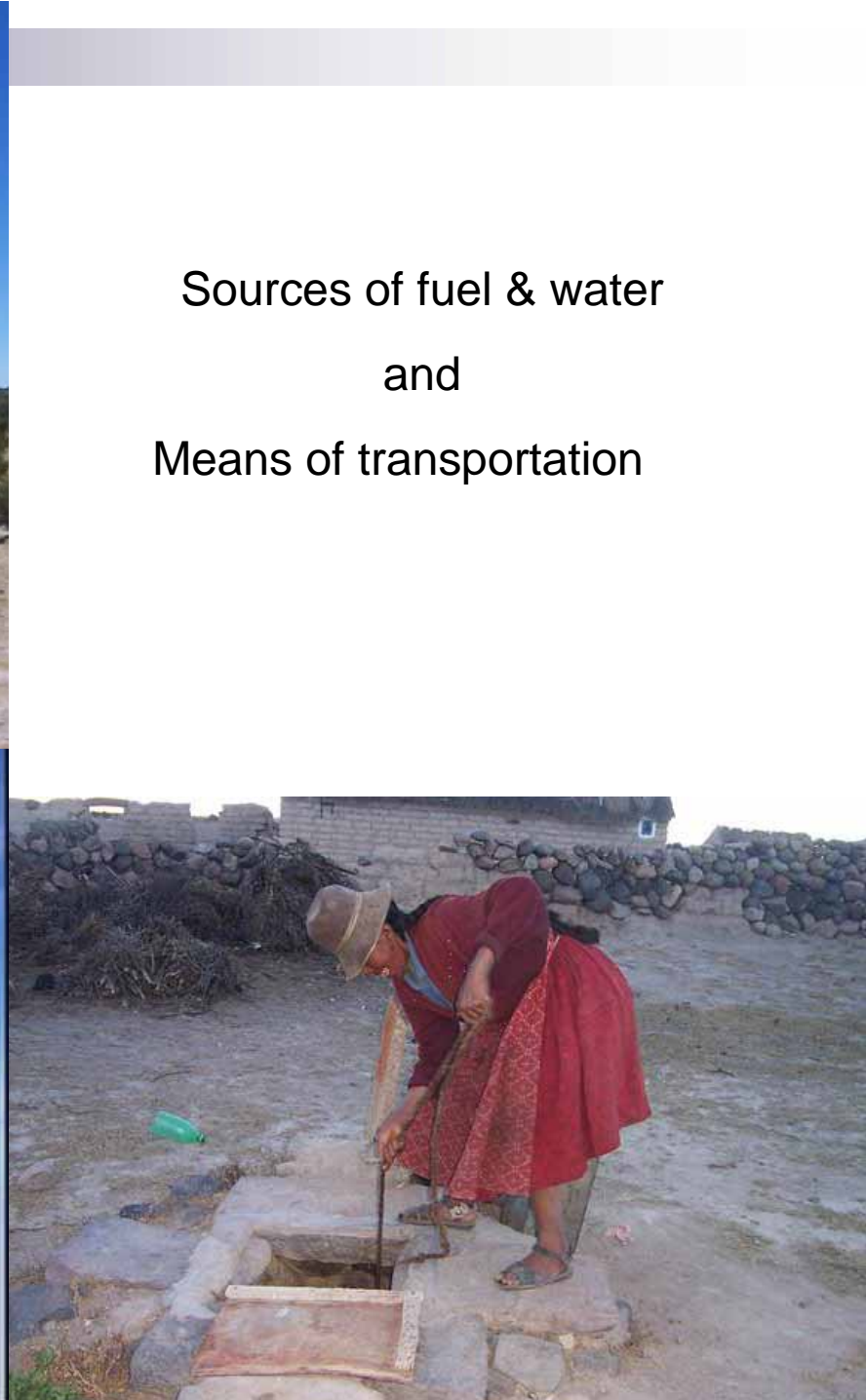
Geographic Information of the Area

Agricultural Production & Development Limited by:

- Area located at 4,000 meters above sea level
- Extreme temperatures that range from -18°C to 27°C
- Extremely low precipitation 250 mm a year
- Presence of frost 225 days of the year
- Alkaline, saline, sandy soils with organic matter ($< 1\%$)
- Geographically isolated (closest city at 9 hours by bus)
- Lack of basic infrastructure (roads, difficult access to markets)
- Limited or no basic services (running water, electricity, education)







Sources of fuel & water
and
Means of transportation

Socio-Economic Information of Area

- 87% of sample population depends exclusively in quinoa for their livelihoods
- Average income *only* from quinoa \$1,304 US
- 52% of homes can be considered medium high to high economic situation (within context)
- 62% of quinoa producing families work also outside their home 3-4 months in a year.
- 65% of quinoa producing households supplement incomes with livestock raising (mainly llamas, sheep)
- **Land Tenure**
 - Share Croppers 2%
 - Between 1-3 Hectares 16%
 - Between 4-10 Hectares 37%
 - Between 11-40 Hectares 24%
 - Between 21-40 Hectares 16%
 - More than 40 Hectares 5%





Other population dynamics

- Quechua and Aymara populations, although 72% of population speaks Spanish as a first language.
- Average years of formal education of parents 4.71 (women) 6.74 (men)
- Older population 72% of population over 45.
- High rate migration among population 18-25 (work and education)

Health & Nutrition of Municipalities

Municipal Health Index (PAHO, Bolivian Ministry of Health—10 Indicators)

Salinas 0.33/1

ColchaK 0.45/1

Malnutrition*

Salinas Municipality 27% Prevalence of global malnutrition (children under 5)

ColchaK Municipality 29% Prevalence of global malnutrition (children under 5)

National Prevalence: 24%

*Data provided by the Municipality Hospitals (for year 2005).

Problem of malnutrition not necessarily an issue of low income

Quinoa (*chenopodium quinoa willd*)

- A native grain cultivated in the region for 5,000 years
- Marginalized crop in relation with other crops (within Bolivia & globally)
- Excellent adaptation to the harsh environmental conditions
 - Drought Resistant
 - Adaptation to poor soils.
 - Resistance to low temperatures
 - Large intra-crop diversity



Quinoa Nutritional Information

- Good content of protein (10%-18%)
- High Quality Protein: Contains all 8 Essential Amino Acids
- Rich in Vitamins (Thiamin₁, Riboflavin₂, Niacin₃)
- Rich in Minerals (Iron, Magnesium, Phosphorus and Potassium)
- Zero Cholesterol
- Qualified by the US Academy of Sciences as “the most nutritious grain in the world”





Quinoa in Bolivia

- Two Systems
 - **Quinoa Real** (Southern Bolivian Altiplano), larger grains, higher concentrate of saponin, more commercial production, main outlet production export markets.
 - **Quinoa Dulce** (Northern and Central Bolivian Altiplano). Smaller grains, less commercial, main markets Bolivia and Peru.
- Market also segmented by organic & conventional production.
- Prices of quinoa range from \$700 US/ton of dulce Conventional to \$1,600US/ton Real Organic.

Market Development Quinoa

Evolution of the production of Quinoa per Region 1980-2001

	1980		1985		1990		1995		1999		2000		2001	
	hectares	tons	hectares	tons	hectares	tons	hectares	tons	hectares	tons	hectares	tons	hectares	tons
Northern Altiplano	2,225	1,446	13,938	5,645	7,839	3,135	7,129	3,336	6,717	3,842	7129	4078	6717	4030
Central Altiplano	2,835	1,843	17,764	7,838	9,990	3,996	9,086	4,725	8,561	5,325	9086	5651	8561	5325
Southern Altiplano	10,580	5,639	16,237	7,680	20,786	8,938	20,575	10,740	20,685	13,342	20575	13271	20685	13549
Total	15,640	8,928	47,939	21,163	38,615	16,069	36,790	18,801	35,963	22,509	36790	23000	35963	22904

Source: Prospeccion de demandas de la cadena productiva de quinoa en Bolivia. Fundacion para el Desarrollo Tecnologico del Altiplano. L.



Objectives of Study

- Evaluate the dietary patterns of quinoa producing households and understand the role of quinoa and other foods in their nutrition
- Assess the knowledge and use of quinoa's diversity by farmers
- Analyze dynamics of production and commercialization of quinoa and the effects of these dynamics on quinoa consumption and diversity conservation
- Develop appropriate policy and program recommendations on the areas of nutrition and quinoa diversity conservation



Methodology

1. Focus Groups

- Held in 4 communities (2 municipalities)
- Incentive: Nutrition talks and workshops on alternative uses of quinoa

2. Household Surveys

- **Sample size:** 275 Households
- **Sampling complicated by**
 - very low population density
 - Extremely difficult access to communities (distance and lack of roads)
 - migration (temporary and permanent)
 - Fields (plots) being away from the center of communities and by size of communities (as small as 13 families)
- **Sampling facilitated by collaboration of municipal offices and local leaders**
- **Data Collected**
 - Socio economic data
 - Production & Marketing Data
 - Access to Markets
 - 24 Hour Recall (Food Consumption)
 - Frequency Questionnaire



Participating Communities

Department	Province	Municipality	Communities	Number of households	Percentage of Participating households from the Community
Oruro	Ladislao Cabrera	Salinas (# Surveys: 137)	Salinas de Garci Mendoza	86	60%
			Jirira	14	77%
			Irpani	6	40%
			Thunupa Vinto	6	40%
			Coota	9	60%
			Ancoyo	3	38%
			Pacocollo	3	42%
			Colcaya	4	40%
Churacari	6	67%			
Potosí	Nor Lípez	ColchaK (# Surveys:138)	ColchaK	90	75%
			Copacabana	48	80%

Quinoa production in Salinas and ColchaK

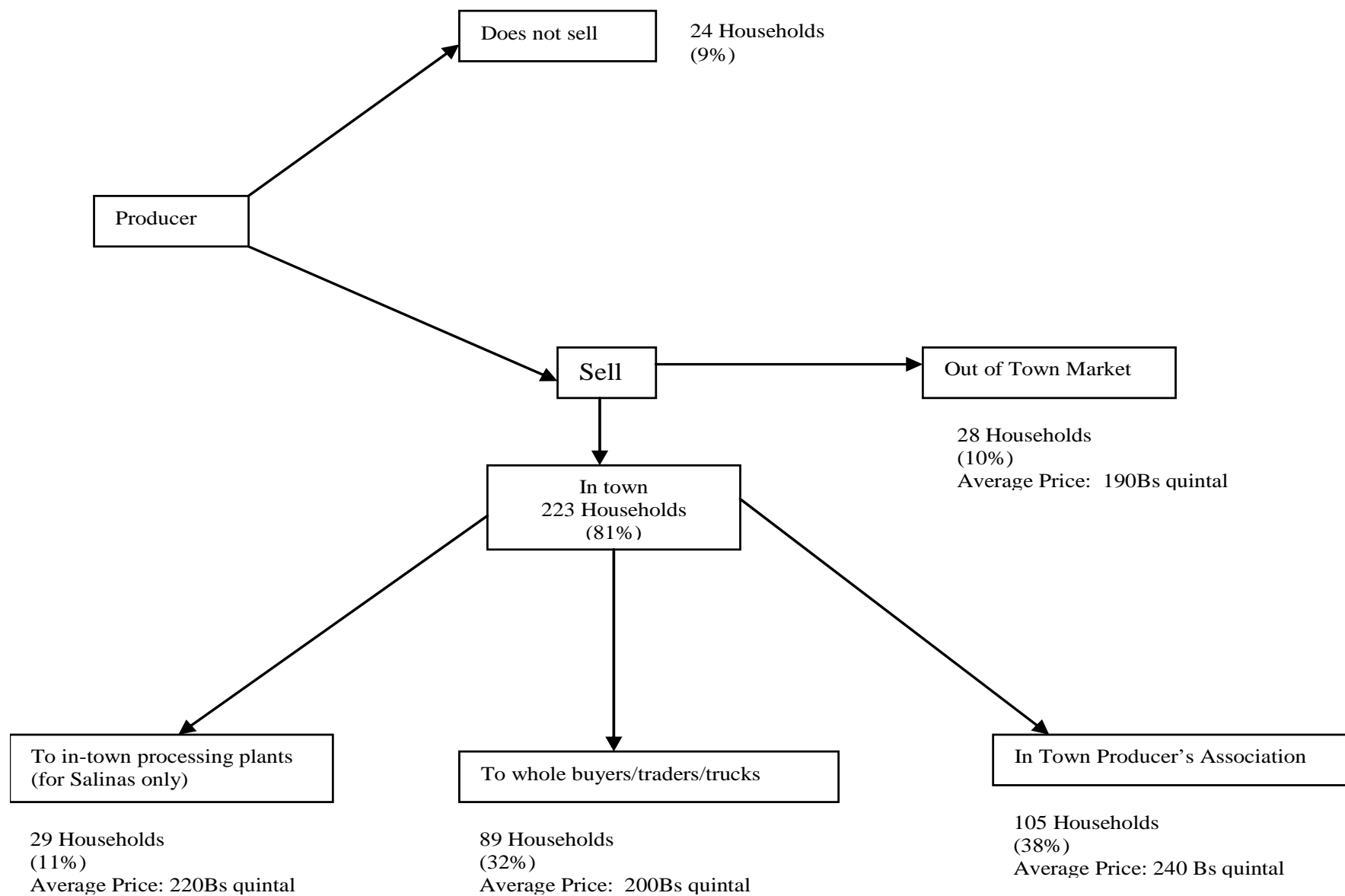
- Average size land under quinoa cultivation per family 6 hectares (range 1 to 60 hectares)
- Average yield 60 quintales (2,760kg) range from 6 *quintales* (276 kg) to 300 *quintales* (13,800 kg).
- The average yield per hectare was 12 *quintales* (552 kg) with a range of 4 *quintales* (230 kg) to 20 *quintales* (920kg).

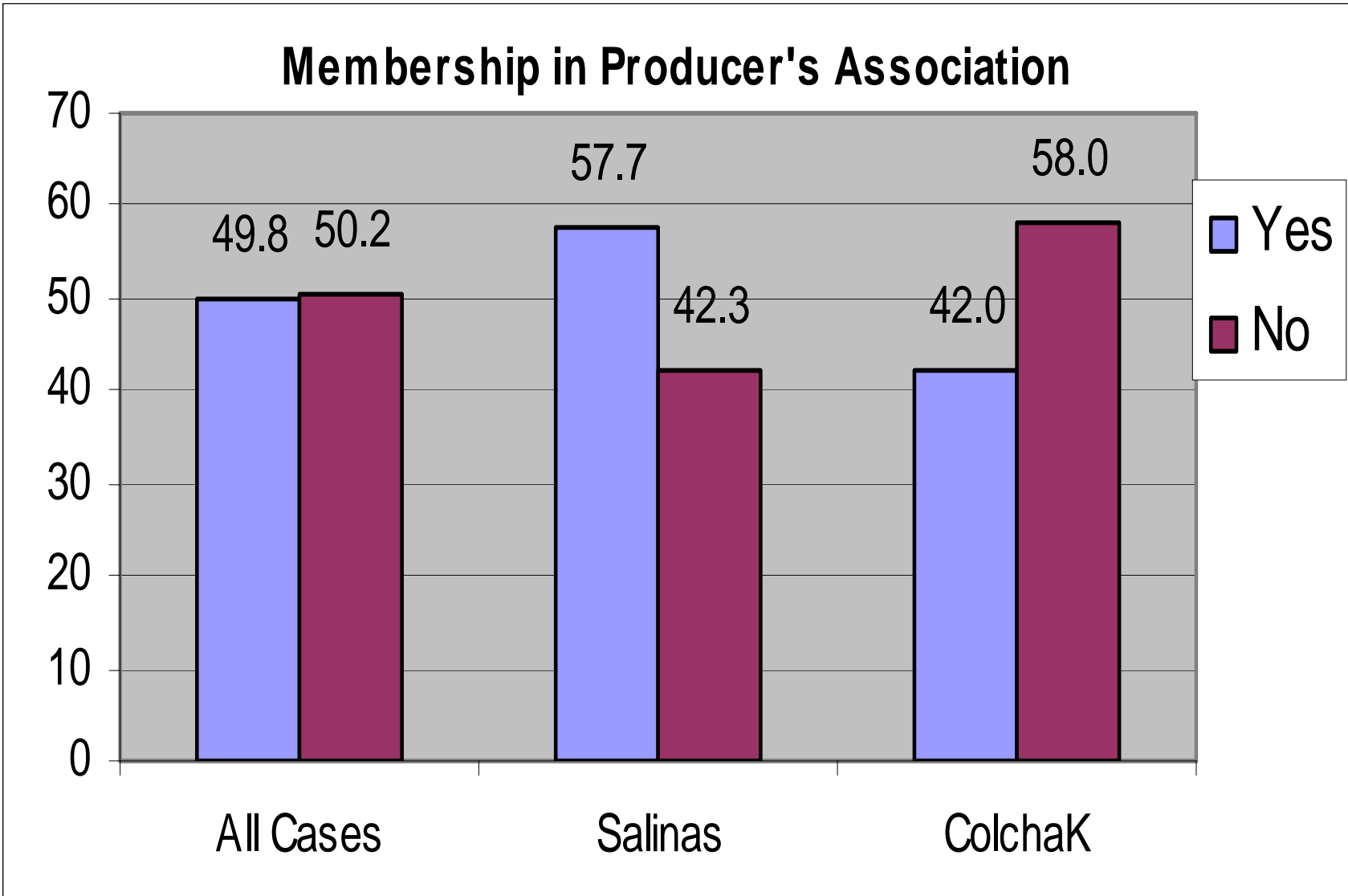


Transformation on the agricultural production and live systems in the Southern Altiplano as a result of market development

Activity	Traditional	Modern
Crop rotation	Diversified agriculture with quinoa, potatoes and fava bean production. Effects/Impacts: Risk diversification and breaks the development cycle of pests.	No crop rotation only quinoa is only crop produced. Effects/Impacts: Promotes development of pests and increases risk of harvest losses.
Rotation of areas of cultivation (mantas system)	Utilization of multiple areas, microclimates and ecological zones (slopes, hills, flat areas). Effects/Impacts: Minimizes the risk to adverse weather. Land rests for long periods allowing soils to regain their nutrients.	No area rotation. Planting only in flat areas due to the need to use tractors. Effects/Impacts: Higher overall yield (but not necessarily per hectare). Higher risk due to weather adversities. No land in rest resulting in loss of soil fertility.
Plowing of land	Utilization of manual instruments (<i>taquisa, liukana, yunta</i>). Effects/Impacts: Conservation of soil texture. Minimizes pest propagation. Low costs of production. Use of rural labor force.	Mechanized plowing using tractors with disc plows. Effects/Impacts: Loss of vegetation and soil texture. Increased wind and water soil erosion. Propagation of pests.
Pest control	Crop rotation and use of natural pesticides (infusion of bitter <i>tholas</i> like <i>muña</i> mixed with saponin dust). Effects/Impacts: Minimum pest attack and absence of environmental conservation.	Use of chemical pesticides without control of the concentrations and number of applications (farmer has limited information) Effects/Impacts: Environmental contamination (underground water), residual effects of chemical pesticides, health risks for farmer.
Social Organization	Communal solidarity and communal participation in agricultural activities through <i>ayni</i> and <i>minka</i> .	Disappearance of communal work and institutions mostly due to mechanization. Inefficient use of rural labor force which can exacerbate migration.
Diet and Food Consumption	Based mostly in local production quinoa grains and leaves, bitter potatoes, fava beans, llama meat, lamb, local seasonal fruits,	Less quinoa and llama meat, white bleach flour products (bread, pasta), rice, sugar and processed foods (soda).

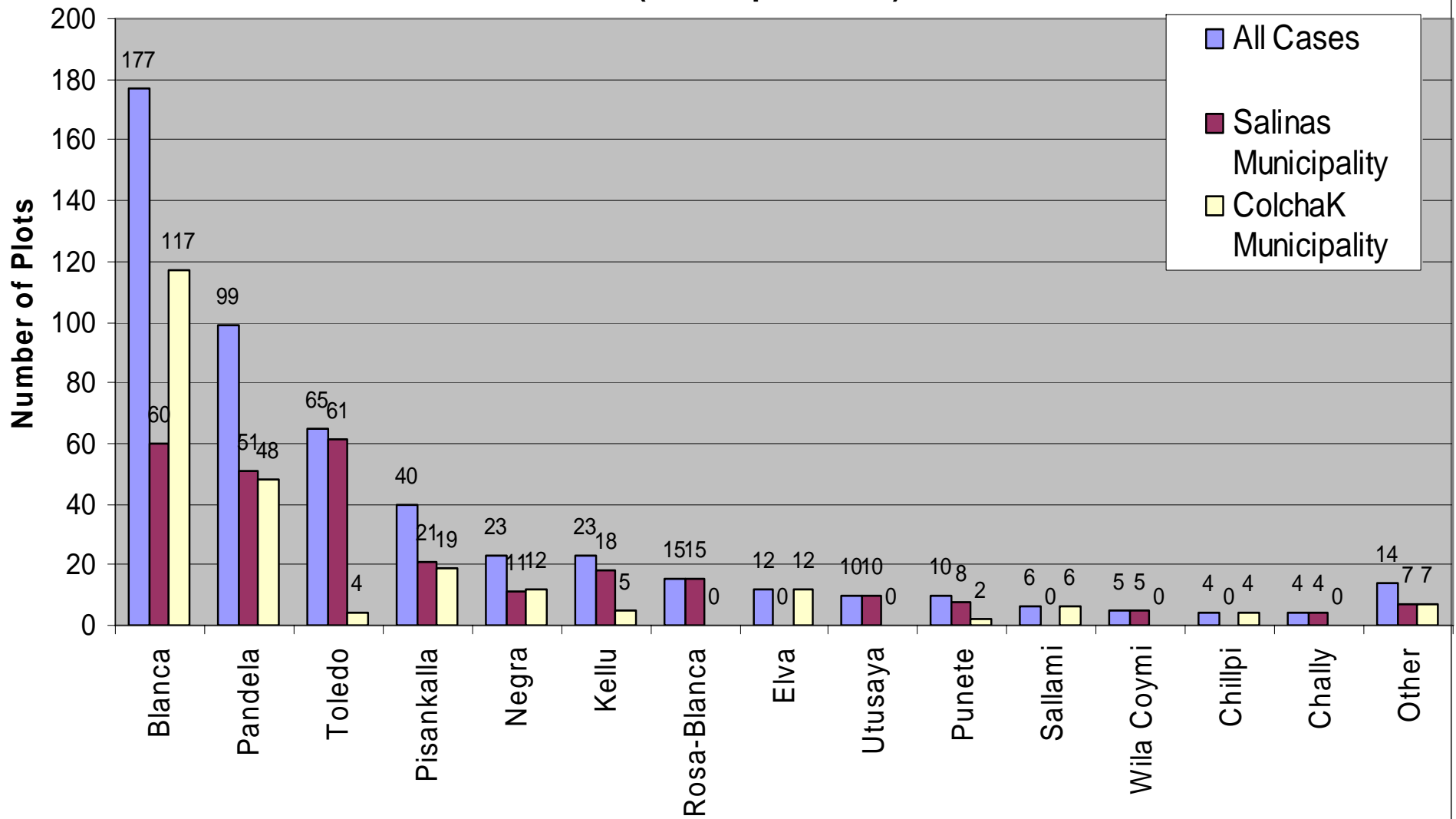
**Decision Making Tree:
Marketing on Quinoa
Producers on Southern Altiplano of Bolivia**





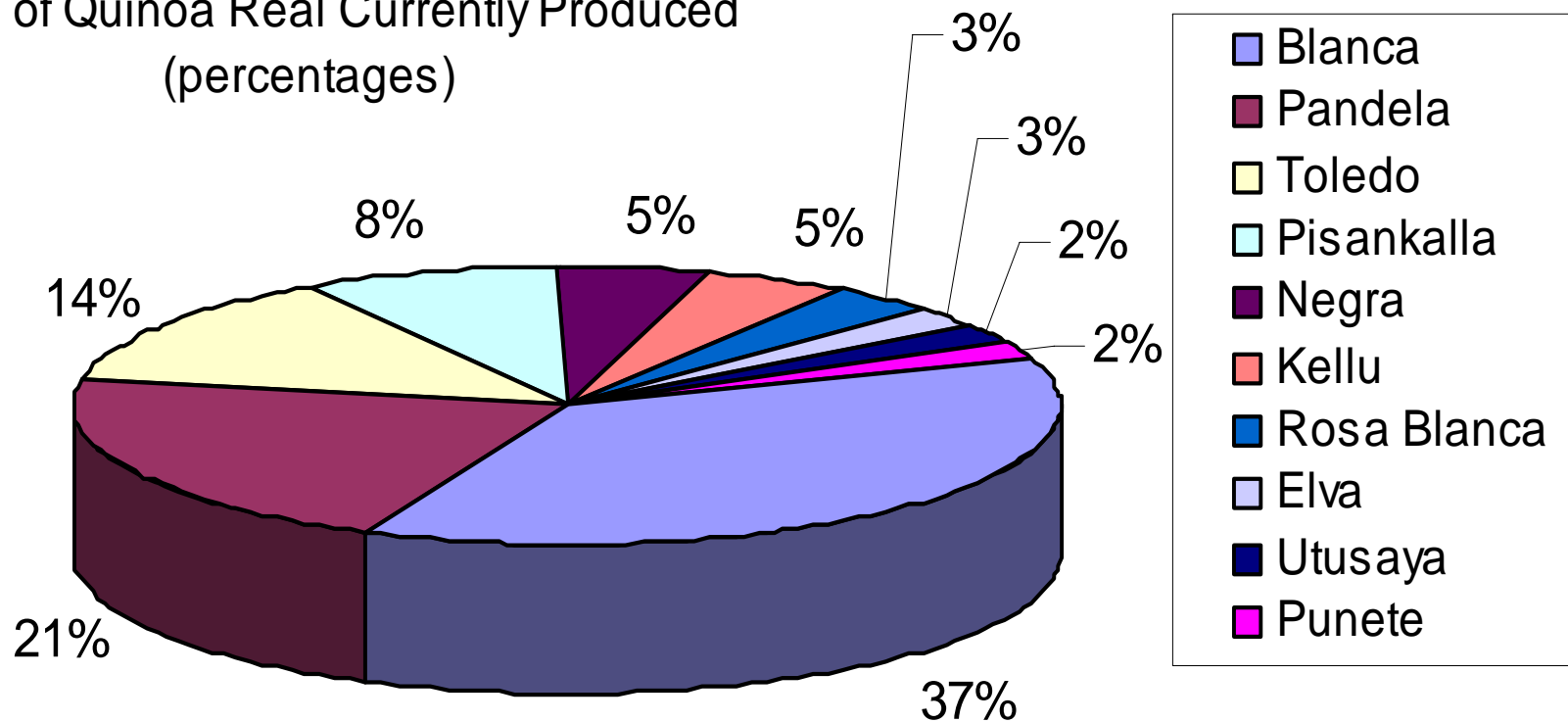
Diversity of quinoa in the area

Types Quinoa Produced
(total of plots=507)



Use of quinoa's diversity

Types of Quinoa Real Currently Produced
(percentages)



Number Cultivars Used by farmers Present & Past (before market production)

# Types Quinoa	Most Recent Production		In the Past	
	Percent	# Farmers	Percent	# Farmers
0	1	2	1	2
1	44	121	24	67
2	36	98	30	83
3	11	30	17	46
4	6	16	14	39
5	1	4	5	15
6	1	3	6	16
7	0		1	2
9	0		1	3
10	0		1	2
Total	100	274	100	275



Most commonly given reasons for decreased use of diversity

- Farmers are willing to plant only what can sell in the market.
- Quinoa's adaptability to almost all culinary uses—does not provide incentive to farmers to keep more variety (processing is more important than type of quinoa).
- Higher costs of production of more landraces and opportunity costs.
- Small farmers say lack of land (to keep landraces separate) is a constraint
- Farmers do not know where to purchase or exchange seeds of different types or cultivars (no quinoa seed market in Bolivia).
- Concept of “luck” has played some role in this loss of diversity as farmers get rid of types that do not bring them “luck” in terms of yield.



Quantitative Analysis of Data (Poisson Regression)

The only variables that were statistically significant in this model predicting the number of types of quinoa a farmer produces are:

- the number of varieties a farmer held in the past
- membership in a producer's association
(membership effect 32% more diversity)
- the size of the farm (small farms 50% less diversity)
- father's education



Quinoa Consumption

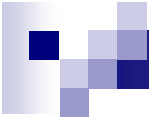
24 Hour Recall

- 275 households, 102 of them (37%) reported to have had some quinoa in any form or preparation the day before.

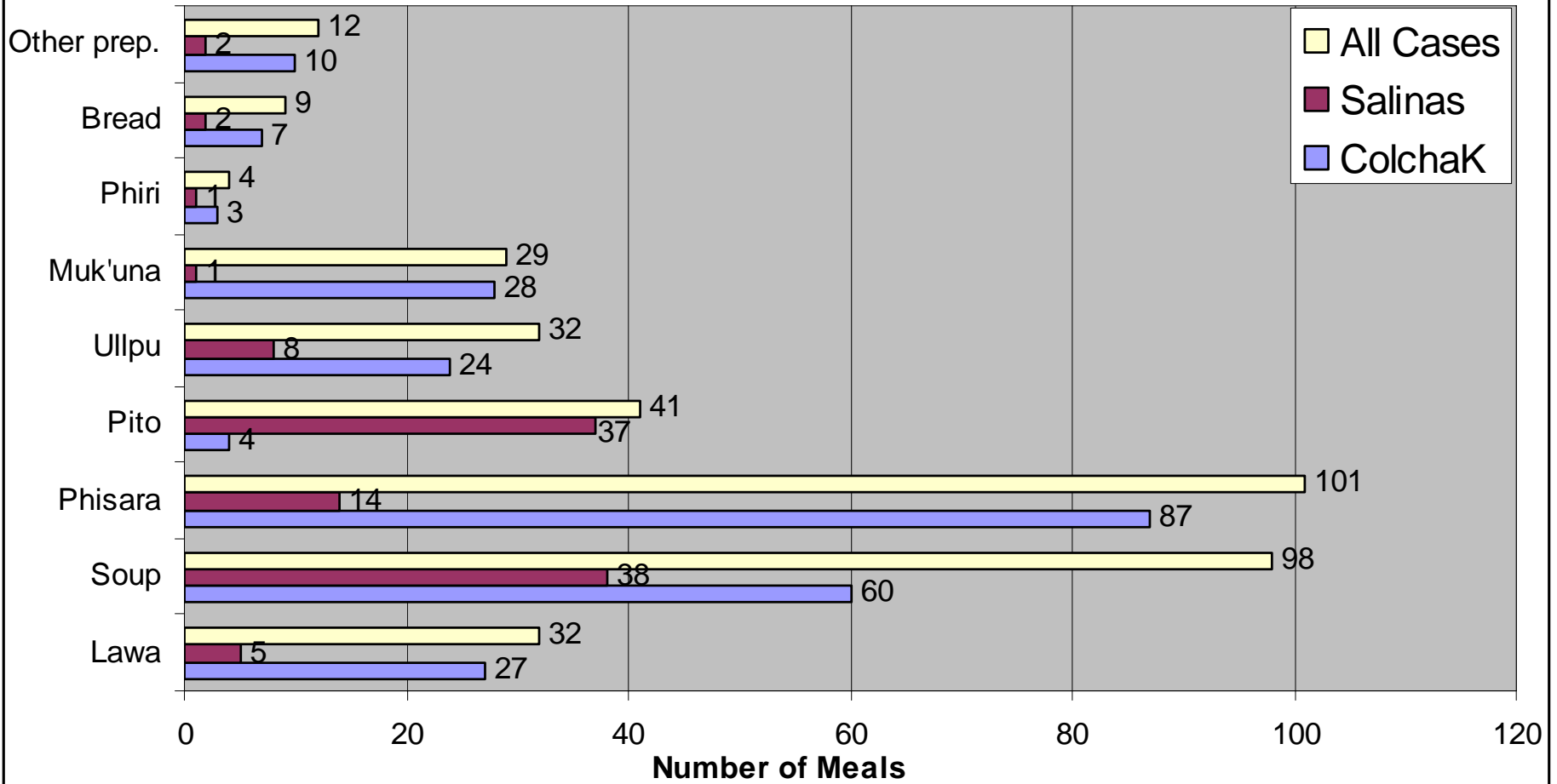
Number of total meals prepared with quinoa versus other foods			
	# Meals	# Meals with Quinoa	# Meals other food
Meals ColchaK	494	250 (51%)	244 (49%)
Meals Salinas	410	108 (26%)	302 (74%)
Meals Total	904	358 (40%)	546 (60%)

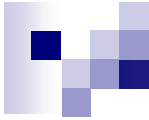
Quinoa Consumption (cont)

Food Consumed	Economic Level				
	Low	Medium Low	Medium High	High	Total
	Number of Households				
Quinoa	56	28	76	13	173
Other Food	31	14	46	11	102
					275
	Percentage of Households				
Quinoa	20%	10%	28%	5%	63%
Other Food	11%	5%	17%	4%	37%
Total	32%	15%	44%	9%	100%



Consumption of Different Quinoa Preparations in Salinas & ColchaK





Linear regression

Number of obs 244

F(8, 235) 25.37

Prob > F 0

R-squared 0.4317

Root MSE 0.63004

logpercapita	Coef.	Robust Std. Err.	t	P>t	[95% Conf.Interval]	
logyield	.8325136	0.2240888	3.72	0.000	0.3910341	1.273993
logyield2	-.0731511	0.0325078	-2.25	0.025	-0.1371951	-0.00911
mothage	.0094486	0.0035438	2.67	0.008	0.0024669	0.01643
mothered	.0343935	0.0124143	2.77	0.006	0.009936	0.058851
famsize	-.1733004	0.0197152	-8.79	0.000	-0.2121415	-0.13446
easymkt	.0606203	0.0941292	0.64	0.52	-0.1248247	0.246065
highecon	-.5383398	0.1717383	-3.13	0.002	-0.8766832	-0.2
nativelang	.2785285	0.0971589	2.87	0.005	0.0871147	0.469942
cons	2.093034	0.4532161	4.62	0.000	1.200149	2.98592

Main Reasons Given for Low Consumption

■ #1

- Difficulty to process it so it will be ready for consumption
 - Time
 - Negative impacts on women's health (to process grains)
 - Industrial Processing not acceptable

■ #2

- Economic: Families prefer to sell their quinoa, which depending on the ecotype and quality of the grain could sale \$35US(100lbs bag)
- Paradoxically higher consumption of quinoa at lower socio economic levels (correlation between vicinity/easiness of access to markets and less consumption)

■ #3

- The children and young people have lost the liking of the taste for quinoa.

#4

- Before household had no choice. No market for quinoa, no access to other products. Now people want more "diverse" diets.



Microbeneficiadora: Quinoa processing Machine



Function: Removes saponin from the grain.

Cost: \$560US (with Chinese engine)

\$800US (with Japanese engine)

Reduces Processing time:

Manual: 25lbs in 6 hours

Machine: 25 lbs in 7 minutes

Capacity: 200lbs per hour

Processing Costs: \$0.62 per 25lbs

Users willingness to Pay: \$0.75 per 25lbs

Tested in 5 communities. Based on survey done 98% of people were very satisfied with performance and will use it.





Conclusion (Biodiversity)

- Farmers not likely to continue to maintain/use diversity in the face of economic transition because costs to the family
- Promotion of niche markets for other types of quinoa (limited impact)
- Localized seed fairs may also have a limited impact
- What would be loss when non commercial types are gone from the area? What is the intrinsic value of each different type?

Consumption Opportunities

- Promotion (Study/Pilot Tests) Small Holder Technology
 - Machine to remove saponin (microbeneficiadora)
 - Machine to roll/flatten grains (máquina hojuelas)
 - Small mills (molinos para quinoa)
- Inclusion of quinoa in feeding programs (from government, ngo's and other development cooperation)
- Workshops in alternative ways of preparing quinoa especially to promote consumption among children and youth
- Family Education Programs on Nutrition (cooperation with schools, health centers, municipality)