

Objectives, Hypotheses, Methods, Outcomes

Objective 1: Develop a shared (by decision makers and researchers) understanding of the ecosystem, and the social, economic and environmental drivers of change in vulnerable communities of highland agro-ecosystems: Disciplinary and holistic approaches used to address production systems perceived or actual problems will be integrated through participatory research methods and common indicators will be developed.

Hypotheses Objective 1:

H1a Changes in climate have a negative impact on on-going cropping systems. Traditional cropping systems are changing in the face of increased climate risks.

Methods: Community participatory assessments of hazards and risks; Focus groups, group interviews, interaction with panels of local experts.

H1b Changes in cropping systems and soil management practices from traditional agricultural management systems due to climate and markets will cause a reduction in the perceived importance of organic soil amendments and soil organic matter maintenance.

Methods: Baseline on organic use, land use patterns, production and market activities (baseline survey instrument); focus groups, interaction with panels of local experts.

H1c On-going land use cropping systems practices that deviate from traditional practices (changes in rotations and fallow uses in addition to manure use and plowing) have resulted in lower soil organic C and N.

Methods: Direct analysis of C and N levels in farms with different types of management regimes from current to most traditional. Farms will be identified from baseline surveys. The baseline survey includes questions on land use, soil fertility, and production activities

H1d Local perceptions of climatic conditions reflect the trends identified in climatology analysis of the locality (confirmed by empirical analysis).

Methods: Baseline surveys and focus groups with local experts will provide us with perceptions. Our meteorologists will use available data to document actual weather trends and then will work with panels of local experts to reconcile the two if necessary. Daily weather data will be gathered from sites in the Altiplano having data for 35 years or more to look at trends in rainfall, onset of rains, frosts, frequency and intensity of rains. These trends will be compared with farmer perceptions obtained from focus groups and group interviews. Data will be used to evaluate the Intergovernmental Panel on Climate Assessments AR4 coupled model to evaluate the utility of this tool. The participatory assessments will also include changes in production systems patterns, to tease out (separate) climate effects, from changing technologies/practices effects.

H1e Cropping system diversity has decreased in recent years -in response to market incentives and out migration.

Methods: Existing data on local cropping systems will be compared with actual patterns detected in the baseline study. There has been previous research in some parts of our study areas. Conduct baseline survey of typical crop varieties, crop rotation, intercropping practices, changes in rotations and fallow of land, in addition to manure use and plowing for analysis, to assess soil quality impact, to predict risks of in situ conservation of traditional crop varieties and evaluate the economic benefits of conserving them. Where we do not have access to such data we will use focus groups and panels of elders and local experts to recall crops and other activities, and these will be included in the baseline survey to assess what activities and in which significance they were pursued in the past five, and ten years.

H1f Best disease and pest management practices are changing in the farm systems of our study region (potentially due to climate change)

Methods: Use focus groups and local expert panels to describe local practices, the strengths and drawbacks of them and whether they are becoming more or less effective. Use on farm trials to compare traditional practices with ones proposed by project scientists.

H1g Disease and insect herbivore loads of wild crop relatives in Apolobamba Integrated Management Area are changing (potentially due to climate change)

Methods: Survey disease and herbivore damage to wild crop relatives to provide baseline for long term study and to determine whether there are short term trends that can be explained by short-term weather patterns.

Outcome measures:

Since we are doing participatory research that includes scientists and producers, the rejection or validation of the above hypotheses is a measure of a common understanding. A simple check list listing results of research can document this.

Objective 2: Measure the role of market and climate risk (objective and perceived) on livelihood strategies, and the role of assets on risk perceptions and strategies. Understand how livelihood strategies are being developed in response to perceptions of the relative risks associated with these changes; and how these perceptions are linked to the assets they possess (livelihoods);

Hypotheses Objective 2:

H2a Perceived Climate Hazards are the most significant risk facing households in the communities of the High Altiplano Region.

Methods: Survey data, hazard risk mapping, and focus groups to understand risk rankings, will be used as the basis of risk assessment that looks at the relative level of risk posed by climate, markets, pests, and family health/well being. In household surveys we will elicit questions to measure impact of climate shocks, measure impact of prices and

transactions costs in accessing markets. Contrast impact, and frequency of shocks with perceptions of risk, and determine which perceived risks influence strategies.

H2b Farm households having more biological diversity will have more stable levels of income and well-being than less diverse ones.

Methods: Assess farm productivity and net income as a function of crop system, crop species, and crop variety diversity using farm surveys and actual field measurements. A panel of farms will be followed for 3 cropping seasons. This will require annual assessment of selected crops.

H2c Perceptions of risks will differ between local experts and other producers.

Methods: Network analysis using baseline survey (see H2a) supplemented by group interviews and ethnographic data will identify local experts in the areas of climate prediction, marketing and production. Their perceptions of risk factors will be compared to other members of the communities.

H2d Less diversified economic portfolios in crops are more vulnerable to economic and climate shocks.

Methods: Survey data will be used to test this. Cross sectional regression analysis.

H2e Biodiversity/Growth in the natural capital (investments in soil fertility, water, landscape improvements, biodiversity) is negatively affected by degree of livelihood vulnerability.

Methods: Surveys will be the instrument to identify degree of vulnerability, and combined with direct measurement the bio-diversity. The natural capital indicators will be developed by the soil, crops biodiversity, and production systems researchers and producers (Objective 1).

Outcome Measures:

Again if we answer the questions in these hypotheses we will understand how livelihood strategies are being developed, and measure the impacts of climate and markets, as well as propose alternatives to reduce these risks. (some of these are the technologies being assessed at the different research sites. See objective 3)

Objective 3 Explicitly link local and new knowledge to produce practices and information that provide alternatives for adapting to change;

Note: Here is where we begin taking the outcomes related to objectives one and two and have measurable outcomes. Here is where the pest and disease participatory research products, the soil management products, the forecast/climatology knowledge, and the potato (other native) and wild varieties findings come in. As the information is generated through participatory research groups the questions are: are the alternatives viable, and how are these communicated to others in the community, and to other communities.

Hypotheses Objective 3:

H3a Traditional forecast methods are unable to predict current climate behavior.

Methods: A baseline survey will provide perceptions of this phenomenon. Local forecasters/experts identified in surveys and focus groups will make forecasts using traditional methods, our meteorologists will make forecasts using their models, participatory (decision makers and researchers) groups will meet to synthesize results.

H3b Traditional soil classification systems and soil management systems emphasize organic content. Soil fertility will be defined in terms of organic content.

Methods: Focus groups and workshops with local experts will describe local soil classification system. Soils in different indigenous/local classifications will be chemically evaluated to ascertain the relationship between traditional classification teams and chemical composition. Changes in rotations and fallow uses in addition to manure use and plowing will be considered.

H3c The networks that producers use to access information to help in their decision making are not articulated to the networks through which experts, NGOs and government agencies try to disseminate information to producers.

Methods: Surveys and focus groups will use basic network analysis techniques to look at the flow of information used in production decisions by producers. Similarly focus groups with extension workers and scientists will identify the networks used in information dissemination strategies.

H3d Local experts who are the opinion leaders in their communities concerning agricultural decision making do not have contact with extensionists, NGOs and government agencies.

Methods: Approach described for H3c will identify experts and ascertain articulation with scientific based systems of production.

H3e The combination of local and scientific knowledge of climate can help farmers make production decisions that can increase resiliency.

Methods: Varieties and cropping systems that respond better to climate risks will be the object of on-farm trials and the results of these trials will be evaluated in terms of its economic and nutritional impacts.

H3f Local systems of soil classification and soil fertility will correspond to empirical measures of soil properties.

Methods: Same as for H3b.

Outcome Measures

1. Local opinion leaders will have linkages to scientific communities and other resources.

2. There will be an increased use of scientific based information in decision making.
3. Farmers will try out new varieties of crops that are less vulnerable to climate risks.
4. Farmers will include new, less vulnerable varieties in their production systems if economically viable.
5. Community members and scientists will agree on causes of changes in fertility.
6. Farmers will experiment with new soil management systems. If promising (cost effective?) ones are identified, they will adopt them.
7. Food security will be enhanced for families who adopt new technologies.
8. Families adopting new practices will handle shocks from extreme weather events (frost, drought, floods) better than those who do not.

Objective 4; To evaluate and identify market integration opportunities and institutions(mechanisms) that contribute to resilience. We define resilience as the ability of people and their environments to recover from shocks and stresses;

Hypotheses Objective 4:

H4a Vulnerable populations in rural communities lack reliable market access, as well as access to market information for their products.

Methods: Household survey information will compare market access by level of vulnerability measured in terms of access and control of labor and land, assets, and networks.

H4b Urban markets exist for traditional (native) varieties and cultivars of tubers and grains that are currently only used and valued for home consumption.

Methods: Focus groups will examine the uses and desirable traits of native cultivars. Marketers and urban consumers will be surveyed to identify potential demand. Data from MAPA will be analyzed for the regions of study to identify existing links.

H4c Best Management practices in the Altiplano will change under predicted climate change scenarios

Methods: GIS applications will be used to estimate management needs for the Altiplano under both simple and more complex climate change predictions. Baseline and monitoring surveys will be used to input as data to identify current land use patterns and climatic hazards.

Outcome Measures

1. Market linkages for selected traditional cultivars.
2. Market linkages for on-going production activities, and linkages between producers by linking to associations lead to increased income from agricultural sales.

3. Increase in assets that could be used to cushion shocks.

Objective 5: Develop methods that integrate these knowledge systems. Our underlying approach is to share capacities across disciplines (bio-physical, social sciences), across countries (Bolivia, Peru, and the USA), rural communities, research and development communities (universities), and stakeholders (NGOs, UNDP, USAID, WFP, CIP).

This objective refers to the development of approaches and capacities that are interdisciplinary and collaborative. This is the pathway that enables the research to have impact, but it is a community building process and not one that is appropriate for research hypotheses.

Hypotheses Objective 5:

H5a The linking social capital of producers will be increased during the life of the project.

H5b Interaction between university researchers and stakeholders (NGO's, USAID, international organizations will increase as a result of this project.

H5c Producers from different communities will be linked to others- Networks of rural producers can be strengthened

Methods: As part of the baseline activities the linking social capital of community members, project researches and stakeholders will be assessed using informal interviews. =

Outcome measures

1. Community linkages with outside agencies will increase over the life of the project.
2. Families participating in the project will have increased linking social capital.
3. Capacity building: Researchers, farmers and students trained in participatory, interdisciplinary research for development.