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Climate Change in the Andes: agreements and disagreements between science and local knowledge

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BACKGROUND

Local knowledge is the group of ideas, experience and information that has been transformed by local people and integrated into their own ways of life. It is referred to technology development, own experiences, as well as to cultural, social and economic aspects (Tapia, 2002) as it does not belong to anybody, being collective and reflecting a cosmovision. The Andean population considers this knowledge in *local planning* and *decision-making* regarding *productive activities that are related to climate*. Based on biologic, astronomic and meteorological indicators, climate variability is interpreted and climate trends identified, which are important for local management to cope with climate variability.

1 Climate Change Adaptation Programme (PACC Peru)

Key elements:

- Agreements and disagreements exist between the identification of historic climate trends, scientific reports and local peoples' perceptions.
- Coincidences include increase in daytime temperature variations and changes in overall rainfall regime.
- Among the differences, rainfall trends are included. More efforts from the scientific arena are needed to measure and generate records at local level.
- The integration of science and local knowledge enrich and strengthen the identification of historical climate trends and the understanding of the current local climate.

Local people from the southern Andean region state that "*the weather is changing*". Some local observations, recorded by Romero et al. (2010a y 2010b) and Bueno et al. (2010:69-71) indicate that "there is *a clear and consistent manifestation of the population about climate change* produced and perceived during the lifetime of the informants, which has been accelerated in recent years[2]" (Bueno et al., 2010:69). Also, there is a great possibility that climate change *is modifying the effectivity of the indicators utilized* (Gutiérrez, 2008:41), causing loss of efficacy to predict weather.

In Andean countries, such as Peru, there is *limited climatic quantitative information at the local level* that can be actually used for climate change management. However, there is a great amount of local *own qualitative information*, especially, from tropical Andean mountain ecosystems cultures. (Torres and Valdivia, 2012). Information provided by the Meteorology and Hydrology National Service (SENAMHI) is still weak in reporting and predicting due to, among other reasons, limited availability of solid historic data, insufficient meteorological and hydrological stations, data reliability and incomprehensive language for disseminating the information. Furthermore, access to this information is particularly difficult, even more so for rural communities. It is almost impossible to obtain consistent and timely meteorological and hydrological information.

In relation to current local knowledge, we find that some theorists argue that modernity has privileged epistemic scientific knowledge as the only valid way to produce truths about human life and about the processes of nature, considering others as "pre science", as forms of "popular wisdom" as it is "anchored in a 'mythical' world view 'or that such knowledge is only

2 However, Flores and Valdivia (2010:49,55,153-154) are more cautious and note that when farmers state that climate is changing, they state on the one hand that these changes are specific to the climate variability they know, and on the other hand, in certain circumstances, they are an expression of its increase. This last precaution is very important and worth keeping as a central perspective, even though it does not change the significance of the impacts on their livelihoods.

the' prehistory of 'science"[3] (PNUD, 2012). Torres, 2012, notes that this is the meeting of two different *epistemes*, referring to scientific knowledge and local knowledge, as *two different knowledge theories*[4], where the role of scientific knowledge is to decode the gnosis and methodologies of traditional knowledge (local knowledge).

Currently, despite the efforts and attempts to recognize local knowledge, there is still a *hegemonic relationship* between them. Local and ancestral knowledge are not yet fully considered in policy decision-making, which is key to promote knowledge exchange between them. The latter is vital, considering that in Peru there is a process of significant *cultural erosion* due to the devaluation of ancestral knowledge, retraction of local languages, exclusion and discrimination, subjecting, discouraging and denying ancient local wisdom (Torres et al., 2008:85).

It should also be noted that UNESCO has evidenced the way different countries have given high political priority to the incorporation of local knowledge in Science, Technology and Innovation (CTI) policies, while others put up various specific instruments despite the low level of political priority assigned. Ancestral knowledge has proven its worth over time, its specificity and particularity for *decision-making* at local level. It has been recreated with scientific knowledge, maintaining its validity; and although it is not the only one, decisions regarding it are taken for multiple activities. The need for *systematic research* to reassess, complement and compare the efficiency of local knowledge with scientific knowledge becomes imperative in seeking complementarity in the application of scientific methods, regarding knowledge, practices and local knowledge[5].

In Peru, one of the *first studies* related to climate change considering local knowledge was carried out in the Piura[6] region, facilitating access to climate and ethno climate information from the Yapatera sub-watershed to the population. Likewise, the use of biotic and abiotic indicators for *climate predictions agreed with SENAMHI* Piura, integrating the use of biotic and astronomical indicators in weather forecasting ensures sustainability and recognizes the importance and role

3 Walsh, Schiwy, and Castro-Gómez, Indisciplinar las ciencias sociales.

4 The development of scientific theories involves reconciliation and integration of dissimilar views. Each actor, group, place or laboratory boasts a local point of view, a partial truth shaped by local practices, local beliefs, local resources, local constants, local results that cannot be fully verified in all locations. The aggregation of all these views lays the strength and power of science (Turnbull, 1993/1994). Thus the mystery of great totalizing theories, universal heritage of Western science is unveiled (Obregón, 2000).

5 It is pertinent to recognize that climate predictions allow decisions -in short periods, an agricultural season. It is necessary to recognize the limited capacity to predict extreme weather using indicators or phenomena such as "ENSO"/"La Niña" events.

6 Gestión de cuencas para enfrentar el cambio climático y el Fenómeno El Niño, 2008.

Farmer showing the water cycle in his community (Mollebamba micro-watershed, Apurimac).

of local predictions in decision-making. Approximately 200 publications and/or bibliographic records related to local knowledge and climate at country level (Torres and Valdivia, 2012) have also been recorded. However, the need to link the scientific knowledge research with local knowledge is required for tackling local challenges of climate change management.

Determination of climate changes from local knowledge and science

Several research studies conducted in the southern Peruvian Andes during 2009 and 2010, in the framework of the Climate Change Adaptation Programme (PACC Peru), sought not only to find *scientific evidence* on manifestations of changes in climate variability and climate change in the Huacrahuacho micro-watershed in Cusco and the Mollebamba micro-watershed in the Apurimac region, but also to reassess and redeem ancestral knowledge regarding local climate from rural populations that inhabit these mountain ecosystems; to compare, validate, complement and provide greater consistency to their conclusions.

THIS ANALYSIS

Comparing and contrasting the "scientific knowledge" and the "local knowledge" allowed for the identification of agreements and disagreements between scientific evidence and observations of the population, regarding local analysis of climate variables; in order to compare, validate, complement and provide greater consistency to the findings. It also allowed for reassessing and redeeming ancestral knowledge from rural populations about local climate in the Andean mountain ecosystems in southern Peru. Highlighting the need to recognize the existence of two different knowledge types that need to be integrated and to complement each other in identifying trends and understanding the current climate, for optimal local planning.

Farmer in the community of Pumathalla registering the temperature in the meteorological station of the Huacrahuacho micro-watershed, Cusco region.

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RESULTS

This contrast determined that ***people*** whose livelihoods depend mainly on rainfed agriculture and livestock, develop and manage information from a ***larger number of climate parameters*** with ***finer observations*** and ***temporal*** and ***spatial details***, which are not analyzed by science because of limited historical data and models that can project them, *such as solar radiation, humidity, and strong winds, thunderstorms, hail*, among others.

Among the *similarities* identified in the Huacrahuacho micro-watershed are: *increased daytime variation in temperature*, consistent with the decline of -0.022 ° C / year in average of minimum temperatures and the barely significant increase of + 0.011 ° C /year in the average of maximum temperatures (both trends identified in the period 1970-2009), expressed by local people through testimonials such as "The sun is burning, it heats too much and the cold is too strong now" (Guillermo Imata), "Definitely the climate is changing, the day comes too warm and at night it is very cold" (Eufrasio Chara), "The sun is burning too much" (Nazario Cárdenas). There are testimonials from the Huacrahuacho micro-watershed farmers, in Cusco.

Agreements between local knowledge and science

Also, *changes in the overall rainfall patterns*, such as *delay* in the onset, *heavy rains concentrated* in only a few days and out-of-season *rains*, consistent with *evidence of increase in annual and seasonal rainfall variability, measured by the coefficient of variability* (Cv) with values from 0.15 to 0.20 between 1990-1999 and 2000-2009 decades and higher *rainfall aggressiveness* measured by the modified Fournier index, with moderate to high values between 1990-1999 and 2000-2009 decades, all increasing the potential erosion of the soils. These trends are expressed by the population through some evidence, such as: "*Nowadays it does not rain, or it does not rain as it did before, I do not know if it will rain in December*" (Fortunata Cucho), "*In past times, rain fell slowly, softly, not like nowadays: now it pours*" (Guillermo Imata). There are testimonials from the Huacrahuacho micro-watershed farmers, in Cusco.

For the Mollebamba micro-watershed, *coincidences* were also identified in *the increase in the daytime variation of temperature*, consistent with the decrease between -0.1 and -0.2 °C per decade from March to August and September to November and the increase in +0.06 °C per decade from December to February; both trends analyzed for the 1964-2009 period, with reference data from Chalhuanca station (SENAMHI, 2011). "*Now the climate is harsher; it is certainly a disorder, because before it was not so hot or so cold, now it is worse than previous years" (Jorge Dávila, farmer from the Mollebamba micro-watershed, Apurimac region)*. However, opposite tendencies have also been identified in the temperatures differentiated in quarters.

Likewise, there are also *similarities* in the *changes in the overall rainfall patterns*, as the delay in the onset, heavy rains concentrated in only a few days and out-of- season rains, consistent with the monthly and yearly increase of the variation coefficient (Cv) from 0.15 to 0.20 in the period 1970-2009, indicating greater irregularity in rainfall patterns; and the increase in their aggressiveness in the 1990-1999 and 2000-2007 decades with values of 146-156 respectively, and increase since the early 2000, which could pose increased soil erosion potential caused by rainfall.

These findings coincide with the testimonials from local population: "*In the past, rainfall was very soft; but now, it pours and in five minutes, rivers are formed. It was not like that before*" (Francisco Zela, farmer from the Mollebamba micro-watershed, Apurimac region).

Disagreements between local knowledge and science

Differences regarding trends of decreasing rainfall and local water sources, crucial to local observations, but less clear for science, as results differ across temporal units of analysis.

On a scientific level, there is less clarity on the trend in the volume of precipitation, as findings differ according to the temporal unit of analysis. For a 38-year series in the Huacrahuacho micro-watershed, a non-significant trend of +4.4 mm/yr was found, while for the last 14 years of the same series, a strongly negative trend of -12 mm/yr was found. Science interprets these results with caution, as a *14-year period is too short to determine climate trends*, which may not necessarily occur due to climate change, and also *do not reflect future projections*. *Among the population, there is a clear conviction of a decreasing trend in precipitation*, mediated by its nearest memory, and evidence of declining flows and disappearing water sources.

For both science and local population, it *is not certain if these signs are related to climate change or if changes are expressions of high climate variability of such ecosystems.*

Farmer showing a representation of the agro-biodiversity of his field in relation to climate (Mollebamba micro-watershed, Apurimac region).

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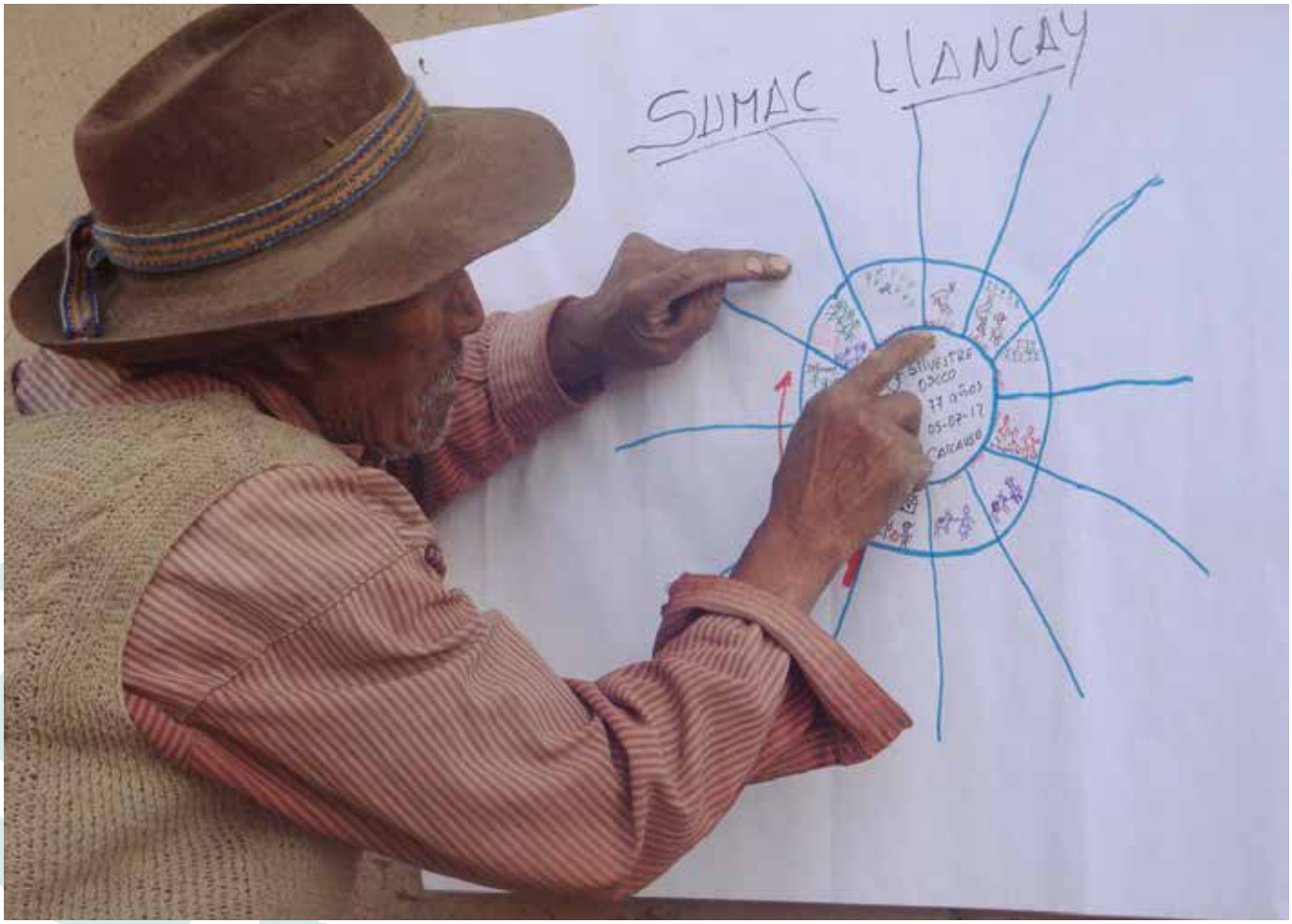
MAIN FINDINGS

There are ***similarities*** between historical climate trends identified through scientific knowledge records and perceptions observed by the people at local level, with greater solidity of ***temperature*** trends. However, there are disagreements in other trends, where more efforts from science are needed in order to precise local measurements and records. (i.e. rainfalls).

Under these uncertainty conditions, it is prudent *to support population to adapt their livelihoods* to larger daily variations in temperature, increased frost incidence, increased incidence of temporal changes in rainfall and strong short rainy episodes with more erosive capacity.

It is also important to consider *future projections from a scientific standpoint*, which indicate a significant reduction in rainfall during the months known historically as the driest and a sharp reduction in the flows.

Integrating science and local knowledge *enrich* and *strengthen* the identification of historical climate trends and the understanding of the current climate at the local level in order to address climate change management.



Farmer drawing the seasonal cycle of climate associated with his productive activities (Mollebamba micro-watershed, Apurimac).

RECOMMENDATIONS

1 Considering that the Andean population have developed fine observations based on a combination of climate variables, as well as temporal and spatial details that current scientific studies cannot corroborate due to historic data limitations, there is a need to promote and carry out a stronger research effort, delving in both knowledge systems, while ensuring their integration. This integration will give more strength to the results, guiding the adaptation social responses.

2 It is important to complement the results of the historic climate trends identification with studies from a diversity of topics from social and economic science, which foster the integral analysis of the implications of these trends in the economic-productive activities and in the social behaviour of the Andean population.

3 It is key to involve the population in the analysis of climate change at local level, both in the analysis of the trends as well as in the projections. It promotes the rapid identification of adaptive practices, as well as their adjustment and implementation considering the climate analysis. This may constitute the basis for climate change local management while triggering a process for suitable policy formulation, from the local to the national level.

Mothers and daughters explain their interpretation of the past and present climate in their community (Mollebamba micro-watershed, Apurimac).

REFERENCES

- Bueno, M.; Alegría, J.; Canales; L. Ayala, C. 2010. Estudio de la gestión del agua y los conflictos por el agua en la región Cusco y análisis de la importancia de los factores asociados al cambio climático en su desencadenamiento – caso de la Microcuenca Huacrahuacho. Perú.
- Bueno, M. Alegría, J.; Canales, L.; Ayala, C. 2010. Estudio de la gestión del agua y los conflictos por el agua en la región Cusco y análisis de la importancia de los factores asociados al cambio climático en su desencadenamiento – caso de la Microcuenca Huacrahuacho. Perú.
- Flores, A.; Valdivia, G. 2010. Impactos de la variabilidad y cambio climático en los sistemas productivos rurales y en las condiciones de vida y desarrollo campesinos – una visión desde la población rural de Cusco y Apurímac, Perú. 72:165.
- Gutiérrez, R. 2008. Papas nativas desafiando al cambio climático, Propuesta de adaptación tecnológica del cultivo de papas nativas frente al cambio climático en Cusco y Ancash. Perú.
- Romero, G.; Kancha, K.; Gamarra, M.; Huamán, G. 2010. Estudio de impactos de la variabilidad y cambio climático en los sistemas productivos rurales y en las condiciones de vida y desarrollo campesino – una visión desde la población rural de Cusco y Apurímac.
- Tapia Ponce, Nelson. 2002. Agroecología y agricultura campesina sostenible en los Andes bolivianos. La Paz, AGRUCO. Bolivia.
- Torres, J.; Gómez, A. 2008. Adaptación al cambio climático: de los fríos y los calores en los Andes, experiencias de adaptación tecnológica en siete zonas rurales del Perú. Perú. 85:152.
- Torres y Valdivia 2012. El clima y los conocimientos tradicionales en la región andina. Climas encontrados. Recopilación y análisis de la bibliografía temática existente. Primera aproximación
- Walsh, C.; Schiwy, F.; Castro, S. 2002. Indisciplinar las ciencias sociales. Geopolíticas del conocimiento y colonialidad del poder: perspectivas desde lo andino. Quito: Universidad Andina Simón Bolívar. Ecuador.

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