

Regional Integrations in Arid Central West Argentina: Trends and Expectations from a Human Paleocological framework

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Central west Argentina is a semiarid but highly heterogeneous landscape (Figure 1). This area is located between 30° and 37° S, and can be subdivided into three environments: the western mountain area and the south western volcanic plateau of La Payunia, characterised by a mean annual precipitation ranging between 200 and 400 mm, and piedmont, depressions and oriental with a mean annual precipitation below 250 mm. The area is located over the South American Arid Diagonal and within the inversion zone of precipitation regimes. It is affected by the action of the Atlantic anticyclone (piedmont, depressions and oriental plains) and the Pacific Ocean anticyclone (western mountains and volcanic plateau). From the morpho-climatic aspects, the subregions within Cuyo are highly contrasting due to their relief, the dominant masses of maritime air and the season of dominant precipitation. Due to the great distance travelled, the humid winds of the Atlantic produce little precipitation, mainly in summer, while the winds from the Pacific bring precipitation, principally in winter, at the mountain range of the Andes and volcanic plateau. As these winds cold adiabatically and lose moisture by rain shadow effect on western area, they gain heat and arrive at eastern lowlands generally dry and warm. In phytogeographic terms, there are four types of deserts vegetation: Altoandino, Puna and Patagonia distributed along mountains and plateau where grasses and cushion plants with *Adesmia* spp., *Mulinum* spp., among others as dominant that characterise the physiognomy; and Monte in lowlands characterised by shrub steppes with dominance of *Larrea* spp. (Zygophyllaceae) and species of *Prosopis* in open woodlands where groundwater is available (Figure 2, 3, 4, 5).

Today, the highest human density demography is localized in some "oasis" mostly in fluvial valleys. The human settlement is very heterogeneous with regular size urban centres and a high number of spread households. The economy is variable, farming and pastoral activity occupying the biggest area. However, mining and other industries are being developed today.



Figure 3. La Payunia volcanic field

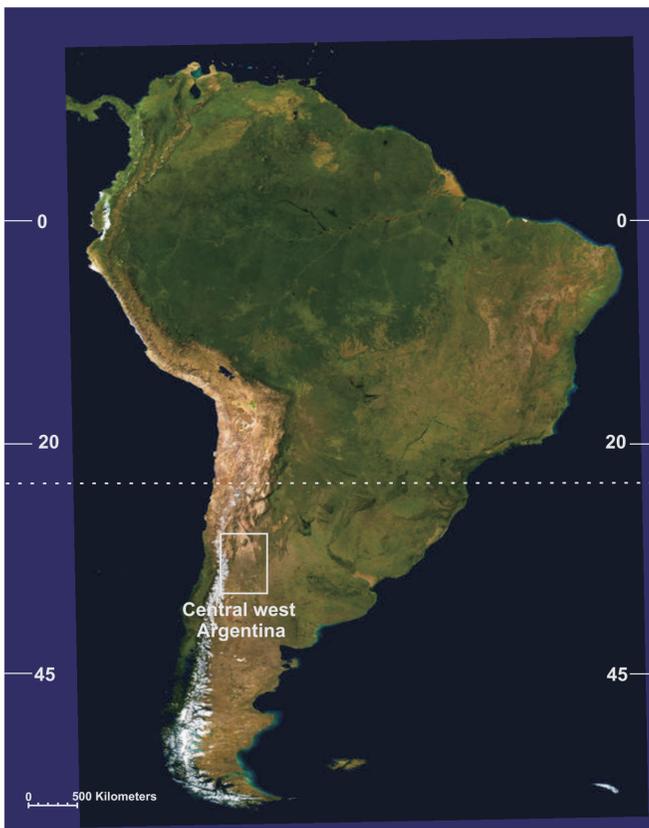


Figure 1. Central west Argentina

Focus

We will focus in Mendoza province and basically in its southern portion. Desertification could be mentioned as one among different environmental problems within Mendoza. Some researches mention an increase in the desertification process during the last centuries and a general change in landscape after the European arrival (C. XVI). It has been proposed, as hypothesis, that present environment is a consequence of the negative impact due to the introduction of Euroasiatic domestic animals, which could have generated the current desertification process. Climatic change in the last century -namely Little Age Ice, and the volcanic activity- could have made this process even more dramatic. If so, the present environmental structure is not a pristine relic of past environment now degraded.

Human Paleocology in central west Argentina

We assume human ecology as a theoretical perspective with emphasis in human behavioural ecology as a solid way to understand the human-environment relationship. In order to offer evidence about such relationship in a multidecadal scale, different lines of research are ongoing.

Trends

Humans arrive to the region during the late Pleistocene, ca. 11 Ky BP. Evidence shows megafauna extinction at that moment and suggests human occupation in different environments -mostly in the intermountain valleys- during early Holocene. Those first populations exploited basically guanaco but other animals were used too. An aridization process for at least part of mid Holocene (ca. 8-4Ky BP) has been proposed for a great part of South America. In the region, the evidence shows a decline in the intensity of landscape's human use, probably as a consequence of the environmental change. Other researchers relate this decrease to volcanism -which is recorded in the region too or to both factors together.

Significant changes in human-strategies occurred during the last 4 Ky, among which we will only mention here change in technology (e.g. incorporation of ceramic technology) and subsistence (maize and domesticated introduction). At that time, the different environments were effectively occupied by humans, process that has been explained as part of an intensification process.

Learning from the Past to Reconsider the Present: Two Examples

Case 1: Archaeofaunal, geomorphological, and palaeontological data from Mendoza confirm the existence of a vast wetlands in the past, highlighting the existence of a large lagoon systems both in the north as in the south of the province: Guanacache and Llanquanelo respectively. However, current environmental conditions show a decrease in the availability of water: Guanacache Lagoon almost ceased to exist, and Llanquanelo Lagoon has been reduced substantially. Along with the changes in the landscape, human populations which occupied these spaces were changing their lifestyles and relationship with the environment, knowledge supported by different lines of archaeological and historical evidence. Until recent years, archaeological studies in southern Mendoza offered scarce information about exploitation of fish in human subsistence patterns. This factor contrasted with tendencies reported for northern regions of the province, and was consistent with the belief of current residents and biologists about the absence in Llanquanelo Lagoon of *Percichthys* (perch) in the past and its introduction in modern times. Nevertheless, recent identifications of this taxon in Llan 17, an archaeological site near the lagoon with a radiocarbon date of ca. 1 Ky BP, show not only the contribution of fish resources in human subsistence, but also the possible native nature of this resource. This archaeological evidence reconsiders the status of "introduced species" of the perch, and raises the need to amend certain aspects of the management plan of resources in the protected area of Llanquanelo.



Figure 2. Andes Cordillera



Figure 4. Llanquanelo lagoon

Case 2: The small mammals have been considered good indicators of environmental conditions. In Argentina some species of sigmodontine rodents were identified as dominant in areas highly modified by human activities. This is the case of *Calomys musculinus* in Monte desert (Puna and Pampas areas), and *Abrothrix olivaceus* in the Patagonian steppe. In this sense, the comparison of the archaeological record of late Holocene in southern Mendoza with a recent sample of raptor pellets from the same localities, shows that *C. musculinus* and *A. olivaceus* abundance has increased in recent times (Figure 6). Possibly, the dominance of these opportunistic species with further remarkable impoverishment of the small mammals diversity took place since the XIX century with the introduction of the domestic livestock and expansion of agriculture, which produced the most important change in the environments during the late Holocene, related with a diminution of the grass cover, increment of the bush cover, and the destruction of mesic areas (Figure 7).

Final Remarks

Labraga and Villalba (2009) show uneven temperature trends over the Monte showing global warming periods in the XX century. They propose, from an ensemble of climate experiments, that the most likely changes in temperature and rainfall occurred by the end of this century in relation to present climate. So, temperature increases, larger in summer than in winter, will be concurrent with more abundant precipitations in summer, but almost no changes or even small reductions in winter across the Monte. A similar situation will be possible to see a similar situation in the last 10 Ky paleoecological record, and to explore some trends in the paleoecological structure, as well as in the humans' relationship with their environments. We would like to highlight the potential of human paleoecology as a way to achieve information from the past to understand the present scenario and to generate expectations for the future.



Figure 5. Monte desert

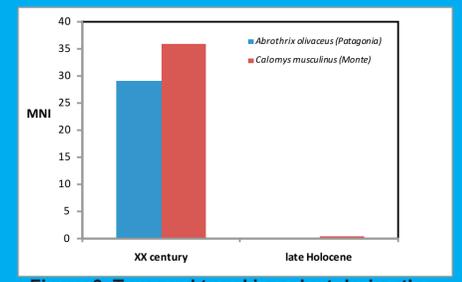


Figure 6. Temporal trend in rodent during the late Holocene

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- Acknowledgements:**
This research has been supported by the Agencia Nacional de Promoción Científica y Técnica and CONICET. Thanks to IGBP-PAGES, USRG LWEC University of Southampton for funds the first author travel to attend at the workshop "Regional integration of past records for management of modern resources and landscapes"



Figure 7. Pastoral activity