

## **Rewilding with llamas? How domestic camelids sustain Andean ecosystems** **-Exposé-**

### **Background and motivation**

My motivation to choose this topic for my final project was my curiosity about the rewilding approach in nature conservation. I'm very interested in the ecological processes and the actors involved in conservation issues. Also, interdisciplinary and transdisciplinary work is key in this field. Trained as a biologist and social and cultural anthropologist, I enjoy to understand such socio-ecological process. Therefore diving in the Rewilding literature was not much a challenge than a pleasure. My second motivation was to know more about an important animal and an important ecosystem from my country. I was born and grew up in Peru which has guided my academic training. Llamas and the Andes have been well researched from the social sciences and humanities since these animals have played a significant role symbolically and economically for over centuries. However, the ecological interplay between llamas and Andean ecosystems are not well researched. Today, conservation projects have become crucial to preserve this fragile ecosystems from growing impact factors such as climate change and tourism. That is why I decided to focus on this region, to highlight and spread the word about the importance to preserve it and research further.

### **Research question / aim**

One of the conservation projects I found while researching, was the Llama Pack Project in the Urubamba mountain range, Cusco, Peru. Their goal is to reduce this impact of present human intervention, tourism, through the restoration of the use and breeding of carrier llamas. Working together with peasant-herder communities, the aim of this project is to preserve Andean mountain ecosystem (while bringing social and economic benefits to herders, too)<sup>1</sup>. I wanted to focus here on the ecological dimension of the project which is the ecological

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<sup>1</sup> [www.llamapackproject.com](http://www.llamapackproject.com)

functions carried and mediated by llamas. I formulated my concrete question as followed: how do llamas sustain Andean ecosystems?

### **Theoretical concept**

As mentioned before, I examine this topic within the framework of rewilding. What does “rewilding” mean? “Re” refers to the aim of restoring or, at least, maintaining an ecosystem in their “wild” state, i.e. prior to certain past or present human intervention<sup>2</sup>. What is new here? Rather than focusing on species populations per se, the aim here are the ecological processes<sup>3</sup> which sustain the functioning of an ecosystem and which are mediated by specific species, wild or domesticated, native or close-related to the native one.

### **Methods & presentation format**

I based most of my research on literature review mostly from ruminant or camelid sciences which comprises behavioral, ecological and archeozoological sciences of these kind of animals. I also took the chance to visit two times the Llama Pack Project in Urubamba and one of the partner herder community, Quishuarani, in Cusco, Peru. These visits took place by the end of the dry season in October 2016 and by the end of the rainy season in March/April 2017. Both dates were important to me, since Andean ecosystems are strongly influenced and differed a lot between these two seasons. The presented photographs were took in both visits.

I choose the photo-essay as a presentation format for different reasons. First, I want to speak to a broader audience rather. Visual methods such as photography are more “democratic” since most everybody can understand and relate to them. They also different impact on the public, evoking aesthetic values and beauty. The accompanying essay should still informed about my literature researched result in a complementary way and with concrete facts and explanation. I wrote it as short and simple as possible but still correct and informative.

### **Results**

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<sup>2</sup> Lorimer et al. 2015

<sup>3</sup> Root-Bernstein and Svenning 2016

In this part, I want to present the results I came up from my research. This essay is part of the written part of my photo-essay that I will here reproduce. The dark numbers refer to the pictures (see appendix).

South American camelids llamas (*Lama glama*) and alpacas (*Vicugna pacos*) were domesticated in the Andes from the wild (still living) camelids guanaco (*Lama guanicoe*) and vicuña (*Vicugna vicugna*), respectively. For llamas, this occurred 5000-3,800 years ago. Since then, they have been part of the socio-ecological Andean landscape [1] playing a key role both economically (mainly as pack animals, but also as fiber/meat/dung provider) and culturally (mythological bound to sacred entities). Their greatest expansion took place under Inca rule (1470-1532, light-coloured part on map)<sup>4</sup>. Within the first century of Spanish conquest, domestic camelid population was almost completely substituted by European livestock in coastal and highland valleys. By the end of 16<sup>th</sup> century, they had drastically decreased in number (only 10% left)<sup>5</sup> and valuable herding practices knowledge disappeared, too.



Figure 1. Past and present distribution of llama (*Lama glama*). Based on Dransart 2002:24

Today (dark-coloured part on map), llama herders own mixed herds of llamas, alpacas and sheep and live on the high elevations of the puna<sup>6</sup>. Lacking of pure breed characteristics, these llamas are not strong as they used to be. The latter reason is worrisome in areas where the tourism industry is expanding and increasing use of horses and mules [2] as carrier animals which impacts negatively the fragile Andean ecosystems.

Andean puna ecosystem is found between 3,500 and 5,500 m a.s.l. within the 8<sup>th</sup> and 27<sup>th</sup> parallel south, i.e. Northern Peru and Northern Chile/Argentina. It presents intense environmental conditions such as low atmospheric pressure, widely shifting temperatures during the day, variable precipitation and an extended dry season (from October to March) [4] [5]. Puna ecosystems have a long history of human activity (12,000 years) but little is known about the concrete ecological impact of traditional camelid pastoralism or of the

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<sup>4</sup> Wheeler 2012

<sup>5</sup> Flores Ochoa 1982

<sup>6</sup> Baied and Wheeler 2012

introduction of European livestock (and decrease of camelids). However, studies have shown many positive environmental impacts of present-day llama herding in the puna ecosystem<sup>7</sup>.

One of the main ecosystem functions carried out by llamas occurs because of their feeding behaviour and dietary selection. Llamas are both browsers and grazers, i.e. they eat all kind of vegetation found in the punas [6]: from tall to low-growing grasses to coarse bunchgrasses (being the later their preferred vegetation type). Llamas are highly adapted to the lower quality forage (bunchgrasses) which is abundant during the dry season in the punas<sup>8</sup> [7]. This is possible because of morphological and physiological traits which allow them to have low forage intake, slow rates of particulate passage and long retention in the rumen therefore they digest almost completely this low-protein-content vegetation. Their prehensile split upper lip [8] makes possible to grasp the plant or part plant to be eaten and neatly clipping it; sheep in comparison dig up vegetation with their feet and eat plants down to the roots. This means, not only do llamas make an “efficient” use of the typical vegetation of puna but also contribute to their regeneration<sup>9</sup>.

Another camelid morphological trait which benefits puna vegetation is their soft, nail-covered digital pads [9]. This structure is very different to hooves, the kind of feet that sheep or horses have, which cut into the ground. Llamas’ pad-feet minimize impact on the groundcover<sup>10</sup>.

Dung piles scattered throughout their herding zone are reused almost always by camelids [10]. These might have long-term-effects in the vegetation [11], inducing changes (plant succession) because of the nutrients containing it. Eventually this would induce the growth of preferred types of forage in dry and poor soil areas<sup>11</sup>. It is also probably that dung piling has other ecological engineering effects, e.g. inducing vegetation change or growth through seed dispersion, but this is still not researched<sup>12</sup>.

Other unexamined ecological functions by camelids are the interactions with other species, for instance other foragers or predators. Llamas do not compete with alpacas nor with sheep

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<sup>7</sup> Baied and Wheeler 2012

<sup>8</sup> San Martin and Bryant 1989

<sup>9</sup> Pfister et al. 1989

<sup>10</sup> Baied and Wheeler 1993

<sup>11</sup> Franklin 1982: 482 quoted by Dransart 2012

<sup>12</sup> Root-Bernstein and Svenning 2016

in their dietary selection<sup>13</sup>, but it is unknown which plant species evenness they help to increase or decrease. Predatory interactions with large carnivores (pumas) are also not yet well researched.

Rewilding with llamas represents thus a challenge but also a demand for further research on the ecological functions, biotic and abiotic interactions and side-effects of llama population restoration in the high-mountain Andean ecosystems<sup>14</sup>. The ecological dimension is however not the only domain to consider, since llamas are also integral part of the human social world in the Andes<sup>15</sup>. Although llama herding practices are considered to have got “lost” or drastically changed<sup>16</sup>, herders are still valuable key players. Because llamas are cared and owned by humans, herder-everyday-practices are a knowledge source to be considered, too. This is also important in order to avoid conflicts, e.g. between herders and pumas because of llama predation (if pumas population recovers)<sup>17</sup>. Little is known about the ecological history of the High Andes but fields such as paleoecology and archaeology can contribute to understand this ecosystem in order to manage and preserve them better in the today conditions<sup>18</sup>. Especially in the present context of increasing new human interventions, such as tourism, management informed by multiple disciplines is crucial in order to preserve such a historical, cultural, ecological, important habitat. Rewilding-like projects like “Llama Pack Project” offer the opportunity to do further research but, at the same time, need this research (along with transdisciplinary work) to carry on and achieve its aim to assist llamas by sustaining the puna [12].

## Literature

Baied, Carlos A. und Jane C. Wheeler. 1993. Evolution of high Andean puna ecosystems: environment, climate, and culture change over the last 12,000 years in the central Andes. *Mountain research and development* 13(2): 145-156.

Dransart, Penelope Z. 2002. *Earth, Water, Fleece and Fabric: An ethnography and archaeology of Andean camelid herding*. Oxon: Routledge.

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<sup>13</sup> Pfister et al. 1989

<sup>14</sup> Svenning et al. 2016

<sup>15</sup> Root-Bernstein and Svenning 2016

<sup>16</sup> Baied and Wheeler 1993

<sup>17</sup> Donadio et al. 2009

<sup>18</sup> Baied and Wheeler 1993

Flores Ochoa, J.A. 1982. Causas que originaron la actual distribución espacial de las alpacas y llamas. In: *El hombre y su ambiente en los Andes Centrales*. L. Millones and H. Tomoeda (Eds). Senri Ethnological Studies 10: 63-92. Osaka.

Lorimer, Jamie, Sandom, Chris, Jepson, Paul, Doughty, Chris, Barua, Maan und Keith J. Kirby. 2015. Rewilding: Science, Practice, and Politics. *Annual Review of Environment and Resources* 40: 39-62.

Pfister, J.A., San Martin, F., Rosales, L., Sisson, D.V. Flores, E. and F.C. Bryant. 1989. Grazing Behaviour of Llamas, Alpacas and Sheep in the Andes of Peru. *Applied Animal Behaviour Science* 23: 237-246.

Root-Bernstein, Meredith and Jens-Christian Svenning. 2016. Prospects for rewilding with camelids. *Journal of Arid Environments* 130: 54-61.

San Martin, F. and F.C. Bryant. 1989. Nutrition of domesticated South American llamas and alpacas. *Small Ruminant Research* 2: 191-216.

Svenning, Jens-Christian, Pedersen, Pil B.M., Donlan, C. Josh, Ejrnæs, Rasmus, Faurby, Søren, Galetti, Mauro, Hansen, Dennis M., Sandel, Brody, Sandom, Christopher J., Terborgh, John W. and Frans W.M. Vera. 2016. Science for a wilder Anthropocene: Synthesis and future directions for trophic rewilding research. *PNAS* 113(4): 898-906.

Wheeler, Jane C. 2012. South American camelids – past, present and future. *Journal of Camelid Science* 5: 1-24.

## **Figures**

Dransart, Penelope Z. 2002. *Earth, Water, Fleece and Fabric: An ethnography and archaeology of Andean camelid herding*. Oxon: Routledge.

## Appendix



Figure 2. [1] Llama herd in the peasant community of Quishuarani (3.800 m a.s.l.), partner of Llama pack project (April 2017).



Figure 3. [2] Horses (and mules) acquired by peasants to working in touristic treks, Quishuarani (April 2017).



Figure 4. [3] Pure breed llamas purchased and owned by the Llama Pack Project to improve breeding of llamas of the partner peasant communities (October 2016).



Figure 5. [4] Mountain landscape by the end of the dry season. Llamas of the Llama Pack Project grazing on the Pumahuanca Mountain (around 3.500 m a.s.l.) (October 2016).





Figure 6. [5] Mountain landscape by the end of the rainy season. Llamas grazing moisture vegetation around a small lake, Quishuarani (April 2017).

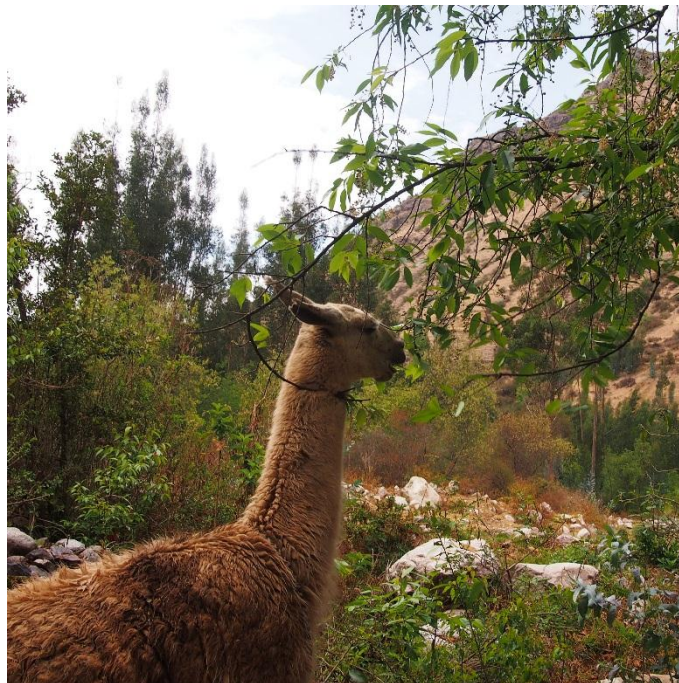


Figure 7. [6] Llama of the Llama Pack Project eating leaves of the mountain black cherry, Pumahuanca (October 2016).

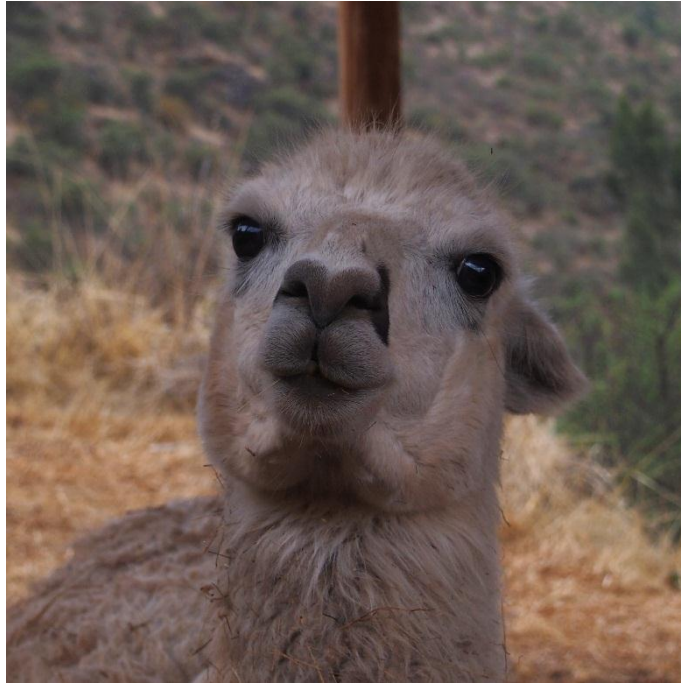


Figure 8. [7] *Llamas prehensile split upper lip which allows them to neatly cut of vegetation, Pumahuanca (October 2016).*



Figure 9. [8] *Puna typical coarse bunchgrasses vegetation, called ichu, Quishuarani (April 2017).*



Figure 10. **[9]** Dung piles made and reused by llamas in herding zone, Quishuarani (April 2017).



Figure 11. **[10]** Flowering plant growing among llama dung, Quishuarani (April 2017).



Figure 12. [11] Llamas are pad-footed which minimizes impact on the groundcover, Quishuarani (April 2017).



Figure 13. [12] Llamas staring into horizon, Quishuarani (April 2017).