

## Final Evaluation Report

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Your Details	
<b>Full Name</b>	Francisco Joaquin Molina
<b>Project Title</b>	Puma predation on guanacos in Patagonia: understanding a key ecological interaction to change negative public perception and enhance conservation action.
<b>Application ID</b>	30059-1
<b>Date of this Report</b>	6 Oct 2022

**1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.**

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Fitting GPS collars				Up to February 2022, 16 pumas and 25 guanacos were fitted with GPS collars.
Quantifying predation of guanacos				Up to February 2022, we visited 2,209 GPS-clusters from collared pumas. 73% of those that belonged to a predation event were guanaco kills.
Building herbivory enclosures				We built 80 1x1 m enclosures, which were representatively distributed in areas of low and high predation risk within Patagonia Park.
Estimating guanaco abundance				We estimated guanaco abundance during winter when guanacos gather in large groups inside the park. Our estimations suggest a density of about 16 individuals per square km. Additionally, we are planning on estimating abundance this summer to know the extent to which the population decreases due to migratory individuals that leave the park seeking higher elevations.
Food supplementation experiment				GPS data showed that guanacos were not avoiding high predation risk areas, and thus we did not carry out this experiment since its purpose was lost.

**2. Describe the three most important outcomes of your project.**

**a).** Our field investigations on GPS-clusters from collared pumas indicate that guanacos are the main component of their diet (73% of predation events were guanaco kills). This is a promising result as it shows that the puma-guanaco interaction remains strong in this remote area despite a recent history of intensive sheep ranching.

**b).** Our measurements comparing vegetation parameters (height, cover, and biomass) inside and outside herbivory enclosures suggest that guanacos do not currently suppress vegetation, neither at high nor low predation risk areas. This suggests that the population size of guanacos in the park might be too low, such

that vegetation is undergrazed. Low guanaco numbers are presumably a consequence of decades-long culling practices by previous sheep herding owners.

**c).** We found a guanaco density of 16 individuals/km<sup>2</sup> during winter, which presumably decreases to less than half in summer since about 70% of individuals are migrants who leave the park in summer for higher elevation vegetation (Candino et al. 2022, Movement Ecology). This density is intermediate between low guanaco densities in ranches with sheep herding and ranches without sheep (Baldi et al. 2001, Oecologia). As indicated above, Patagonia Park seems to be undergrazed and thus we would expect a positive population trend for guanacos over subsequent years.

**3. Explain any unforeseen difficulties that arose during the project and how these were tackled.**

We did not find any major difficulties other than time delays caused by the Covid-19 pandemic.

**4. Describe the involvement of local communities and how they have benefited from the project.**

My project was research-focused and did not aim to explicitly involve local communities. However, GPS data from collared pumas shows that they avoid neighbouring ranches with cattle raising, suggesting that the establishment of the park might help mitigate conflict between pumas and cattle ranchers. This is highly valuable information for Patagonia Park rangers, who have established good relationships with neighbours and seek to collaborate on mitigation measures. In addition, Patagonia Park's administration is making continuous efforts to involve local communities by promoting the development of eco-tourism. I also hired a local person as my field technician, who was then hired by the park for long term service.

**5. Are there any plans to continue this work?**

Yes, as mentioned above, our results suggest that Patagonia Park might be undergrazed after sudden removal of sheep and because of remaining low guanaco density. While this means that there should be room for a much higher guanaco population, the current low levels of herbivory might thwart population growth by limiting forage quantity and quality. This is because plants adapted to a long evolutionary history of grazing, such as those in the Patagonian steppe, typically respond to herbivory by showing compensatory regrowth, in which plants increase productivity and quality. Conversely, ungrazed plants become senescent, decreasing productivity and quality. In fact, there should be an optimal level of grazing intensity that maximises consumable forage (McNaughton 1979, American Naturalist). Thus, we suspect that current low herbivory pressure might delay population growth of guanacos by allowing plants to mature and become senescent. We are currently designing a project to measure the potential for plant compensatory regrowth in the park and how this would affect population growth of guanacos by limiting forage availability. This would have management implications aimed at reaching optimum grazing intensity to help accelerate guanaco population recovery.

**6. How do you plan to share the results of your work with others?**

I am preparing a manuscript to submit my results to a peer-reviewed scientific journal. Once this is published, notes to the news will be provided. In the meantime, I will share my results on professional meetings and give talks to the more general public.

**7. Looking ahead, what do you feel are the important next steps?**

It will be important to implement annual surveys to track the population trend of guanacos. This will allow to determine which factors are affecting their recovery, including grazing intensity, predation, and human impact.

**8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?**

I have not produced any publications yet, but The Rufford Foundation will be properly acknowledged when I publish my results or share them at talks or conferences.

**9. Provide a full list of all the members of your team and their role in the project.**

**Dr. Jacob Goheen (University of Wyoming)**, my academic advisor, provided scientific guidance on my research.

**Dr. Emiliano Donadio (Foundation Rewilding Argentina)** provided scientific guidance, logistic support, and coordinated the acquisition of GPS-collars and a truck for field work with Patagonia Park' administration.

**Drs. Arthur Middleton (UC-Berkeley)** and **Jonathan Pauli (UW-Madison)** collaborated with **Dr. Donadio** in the acquisition of GPS-collars and field truck.

**Drs. Justine Smith (UC-Davis)** and **Pablo Alarcón (CONICET)** provided assistance on management and analysis of GPS-collar data.

**Matías Chambon** Field technician, lead field investigations of GPS-clusters from collared pumas.

**10. Any other comments?**