

Co-existence between pumas and people in the Patagonian steppe
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I hesitantly stepped into the cave, the weak light from my phone's flashlight no match for the inky darkness inside. A few old bones and some matted animal hair lay at the entrance, evidence that a carnivore had found things to its liking and made itself at home in the cave at some point in time.

'Puma!', I heard my colleague yell, conveniently from behind me. At almost any other time and place, that word would have made me excitedly look up and around. My current situation was, however, a reasonable exception to that otherwise solid rule. As I scrambled to extricate myself from what seemed like a decidedly unpleasant situation, I saw him point outside to a puma bounding away, having emerged from what was likely to have been another opening to the cave.

My colleague and I were in a canyon in Parque Nacional Laguna Blanca (PNLB), a small protected area in Neuquen province, Argentina, where P1 (Puma 1) had made a large number of clusters (clusters are groups of GPS location points within a certain area that indicate that the animal has spent time there and can offer important information regarding behavior, diet and other aspects) in the last few weeks. With a broader project aim of understanding puma space use, territoriality and interactions with herders in the region, we were investigating these clusters to obtain data on puma kills and bedding sites. Although most of the clusters were covered in snow due to a recent storm, we had been fortunate to see P1 taking off just a few minutes earlier, as we approached a cluster which seemed to be a favored spot for an afternoon siesta (and thus was being reused). It is unusual for adult pumas to hang around in proximity to each other, and although we had earlier seen evidence of the canyon being used by other adult pumas, discovering another animal so close to P1's siesta spot was completely unexpected.

PNLB is a unique system for understanding conflict due to the continued persistence of a large carnivore (pumas) despite the elimination of its only large-sized native prey (guanacos), resulting in elevated conflict levels with humans. Additionally, almost the entire park is grazed by livestock, including cattle, sheep, goats and horses. Understanding puma behavior and ecology in these intensive-use human-modified landscapes is critical for long-term persistence of these species and maintaining ecosystem health and functioning, especially in a world where land-use change continues to threaten some of our most pristine natural systems. How do pumas adapt to a near-absence of native prey and subsist on livestock? How and where do the resulting conflicts with livestock owners occur, and are there any discernable patterns to this conflict? Are there any non-lethal deterrents that can reduce this conflict? Are guanacos functionally replaced by sheep in this system?

My objectives for my pilot field season in summer 2019 were to test some of my hypotheses related to these questions and ideas, by investigating puma space use, territoriality and diet

choices and interacting with herders in and around PNLB. Unfortunately, our puma capture operations were a failure, resulting in only one active collared individual in the park, due to a combination of extreme weather conditions and strong human-avoidance behavior by pumas due to continued persecution in the area. Suspected puma kills (from GPS data from the one collared animal) were often blanketed by thick snow, with movement in and around the park already restricted due to accumulated snow.

Despite these setbacks, progress was made on some of the project objectives. An extensive survey of herders in the area was conducted before the field season to understand livestock ownership patterns, use of the landscape, seasonal migrations and perceptions towards wildlife. This data was instrumental in designing a methodology for implementing trials of non-lethal deterrents (NLDs) with 30 herder families, scheduled from March 2020 after herders return to the area from their summer grazing grounds. While a myriad variety of NLDs have been tried across the world with varying degrees of success, this will be one of the first studies that tests for methods to overcome two primary challenges with NLDs: wildlife habituation (animals getting used to the device) and deflection/leakage (animals getting deflected to nearby pens/corrals that do not have deterrents). Additionally, baseline data for herbivore (native and non-native) species in the region was also obtained through density sampling transects, which will offer valuable information about the available prey densities for pumas in the area.

Capture attempts will continue through our local collaborators till the end of 2019, with the objective of capturing at least 4 animals to ensure adequate sample size. Additionally, five pumas have already been collared in Patagonia Park, a new protected area south of Laguna Blanca. Collaring operations will also be completed by early 2020 in Parque Nacional Monte Leon, a park further south on the Atlantic coast. These two sites will serve as reference sites for the data emerging from PNLB.

Predator-prey interactions are a critical component of healthy ecosystems, but are globally threatened due to multiple factors including habitat loss and human-wildlife conflict. Such interactions between pumas (the apex predator) and camelids (the primary herbivore) are fundamental to the Patagonian steppe, a unique ecosystem in southern South America that is a key habitat for several charismatic faunal species. While most of the steppe has been converted into sheep ranching operations over the last 150 years, decreasing viability of ranching operations over the last few decades has contributed towards reduced tolerance of native faunal species that are seen as threats to ranch productivity. As a result, pumas and guanacos are actively persecuted in large parts of the steppe, resulting in local extinctions and range contractions across Patagonia. Understanding the ecological and human dimensions and drivers of these conflicts are essential if we are to move from a landscape of intense conflict to a landscape of co-existence, where indigenous communities like the *mapuche* live alongside the majestic creatures that inhabit the Patagonian steppe.