Conserving the last of the wild: pumas and wild camelids in the semiarid landscapes of the Argentinean Andes

3rd Preliminary report (Jan 2008-May 2010)

GRANTEE INFORMATION	
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SECTION 1: EXECUTIVE SUMMARY

Executive Summary:

In the semiarid landscapes of South America numbers of the only two native large herbivores, guanacos and vicuñas, dramatically declined, perhaps by more than 90%, during the last century. Historically, guanacos and vicuñas were the main prey of the puma. This predatory interaction has been lost through most of the original zone of distribution of these species following the widespread reduction of guanaco and vicuña populations. The consequences of such loss on the biological diversity of temperate South America remain unknown.

In the Argentinean Andes, at 3,000-6,000 m elevation, San Guillermo National Park harbors virtually intact plant and vertebrate communities that are seriously altered almost everywhere else in southern South America. The 150,000-ha park, established in 1998, is the core of the San Guillermo Biosphere Reserve, which encompasses almost 1,000,000 ha. Notably, San Guillermo National Park protects the largest coexisting populations of guanacos and vicuñas - and their only effective predator, the puma. Our preliminary work in San Guillermo National Park shows that camelids compose most of the diet of pumas, reflecting the high densities of camelids and the almost total absence of exotic herbivores in the park. Because of this, San Guillermo National Park appears as a unique conservation jewel, where key native wildlife species still interact as they used to do it before Spaniards colonized the continent.

This study attempts to understand, through experimental and observational research, whether predation by a top native predator, the puma, on native large herbivore prey species, guanacos and vicuñas, influences biodiversity and the structure and function of biological communities. Understanding how the interaction camelid-pumas affects biodiversity and biological communities will provide us with unique insights into the functioning of semiarid communities and ecosystems in which the effects of humans are minimal.

Results from this research will be used to (1) highlight the importance of conserving interactions among species as the best strategy to conserve biological communities and the landscapes they inhabit, (2) emphasize the role of San Guillermo National Park as an ecological reference system, stressing the importance of conserving the area as pristine as possible, and (3) strengthen efforts to restore semiarid systems where they have been altered; restoration attempts will be successful only if data revealing the main characteristics of these systems become available. San Guillermo NP stands as one of the last wild places where such information can be gathered.

SECTION 2: RESEARCH PROGRESS AND PRELIMINARY RESULTS

2-1: Research progress

To evaluate our working hypothesis, we set several research goals. These goals, as well as the progress achieved for each of them, are described below.

Goal 1: Analyze the spatial distribution of puma predation on SAC in the semiarid landscapes of the Argentinean Andes.

Activity 1A: Compare topographic and vegetation features associated with camelid carcasses (puma kills – non puma kills) that may define risky habitats for SAC

1) Carcass collection is currently underway and measurements of variables associated to sites of carcass collection are being taken. To date 23 juvenile (≤1 year old) and 46 adult (>1 year old) fresh vicuña carcasses have been collected. For 41 adult vicuña carcasses we were able to determine the exact site were the animal died (see Preliminary Results).

Goal 2: Investigate whether a behaviorally mediated trophic cascade triggered by pumas, and mediated by the risk of predation perceived by SAC, creates a mosaic of habitats that differ in the structure of vegetation, and abundance and diversity of plants, small vertebrates and invertebrates

Activity 2A: To assess behavioral responses of camelids to puma predation

1) Foraging behaviour in risky and safe habitats – preliminary work showed that camelids did not respond to the food we offered them. Trials utilizing a new substrate will be conducted in July-August 2010.

2) Vigilant behaviour in risky and safe habitats – Observations are underway in all types of habitats; no problems encountered regarding this activity. We included a third habitat type were we are also conducting surveys (i.e., canyons). Preliminary data showed that habitat structure (i.e. vegetation cover and height) and topographical features (i.e., canyons) have a strong effect on camelid vigilant budgets, while group size appears to have no influence (see see Preliminary Results).

Activity 2B: To analyze the impact of camelids on vegetation and fauna

1) Exclosures construction – Exclosures construction was finished in February 2009. Thirty six (36) 400 m^2 exclosures are in place and operating. A first survey to evaluate the effects of exclosures was conducted in January and February 2010 (see Preliminary Results).

Activity 2C: To analyze camelid use of risky and safe habitats

1) By conducting 50 500 m-long sample lines which will extend perpendicularly from rocky cliffs into the open areas; a first set of transects has been conducted. Analysis of this 25

transects showed that camelids are less likely to use areas regarded as risky (see Preliminary Results).

2-2: Preliminary Results

Our data suggest that pumas and camelids interact strongly. Preliminary analyses of adult vicuña carcasses and newborn survival show that pumas are the main mortality factor for vicuñas. A high percentage of adult vicuña carcasses (84.8%, *n* = 46) showed signs of puma predation suggesting that pumas account for most of vicuña mortality. Results from radio-marked vicuña newborns, monitored from birth to death or 12 months of age, show that pumas also kill a large number of juvenile individuals (at least 50% in 2008, n^1 = 4, total individuals marked = 7; at least 42% in 2009, n^1 = 12, total individuals marked = 42, and; 75% in 2010, n^1 = 4, total individuals marked = 41 [this cohort is still under study]). Overall, adult vicuñas killed by pumas were in good nutritional condition. Preliminary analysis of topographic features associated with puma kills show that pumas kill adult vicuñas more than expected in habitats *a priori* defined as risky, canyons and meadows, while they kill adult vicuñas less than expected in habitats *a priori* defined as safe, open plains (fig. 1).

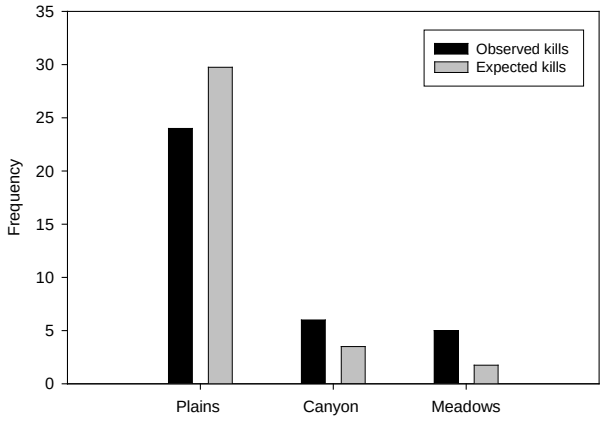

Fig. 1: Frequency of occurrence of observed and expected vicuña carcasses with signs of puma predation in three different habitats at San Guillermo National Park. Expected frequencies resulted from multiplying the estimated area occupied by each habitat times the total sample (n = 35).

Vicuñas seemed to respond to this predation pressure using two different strategies. First, they tended to avoid areas close to canyons with rocky outcrops where puma activity (fig. 2) and likely puma hunting success appear to be higher (fig. 1). Second, they increased vigilant and decreased foraging times in areas with tall vegetation and high plant cover (i.e., meadows) or complex topographical structures (i.e., canyons with rocky outcrops where pumas could hide). For instance, our preliminary analysis showed that in meadows and canyons individual and group vigilant budgets where higher than in open plains. In fact, individual vicuñas in meadows tripled the amount of time spent vigilant when compared to vicuñas in the open plains. Likewise, in meadows and canyons the percentage of vicuñas vigilant within groups at any given time was 3.5 to 4 times higher than that of vicuñas groups grazing in the open plains (fig. 3a and b).

The effects of such behavioral responses on vegetation are currently being evaluated. Our first experimental observations showed that in the open plains, grasses are 3.0 (1.4-4.6 [95%CI]) times higher inside than outside exclosures. Conversely, this grazing effect is less important in canyons

[1] *n* refers to number of marked newborn carcasses that showed clear signs of puma predation; in some cases cause of death could not be determined; therefore *at least* represents a conservative estimate

(1.2 [1.0-1.4]) and meadows (1.3 [1.0-1.6]) (fig. 4). These results suggest that the grazing effect of vicuñas is less intensive in risky areas. Whether this decrease in grazing intensity and concomitant change in vegetation height affects invertebrates and small vertebrates is still unknown. After one year of excluding vicuñas from exclosures neither the lizard nor invertebrate abundance have changed (figs. 5 and 6), while data on mice is still too scarce to be quantitatively analyzed.

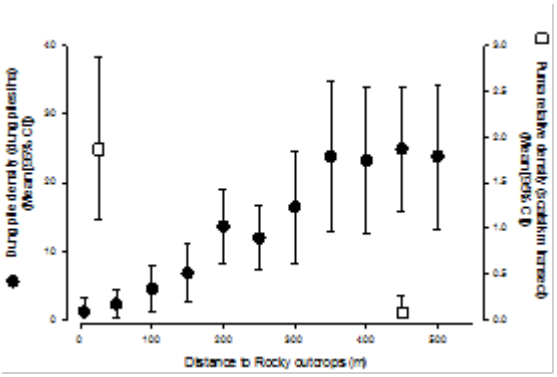

Fig. 2: Absolute dung pile density and relative puma density at different distances from rocky out crops. Puma relative density was estimated within a ratio of ± 50 m of the distances shown in the figure. Total sample size was 25 for each dung pile data point, 30 for puma relative density away from rocky crops and 10 for puma relative density nearby rocky crops.

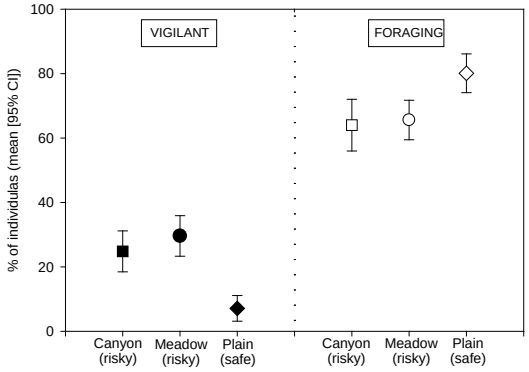

Fig. 3a: Number of adult vicuñas (%) that were observed foraging or vigilant in three habitats with different levels of predation risk.

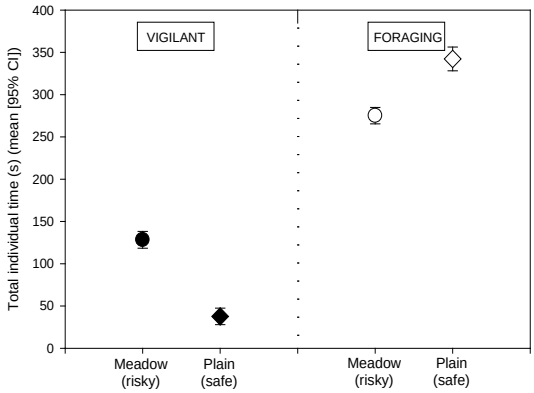

Fig. 3b: Total time in seconds that individual adult vicuñas spent foraging or vigilant in three habitats with different levels of predation risk. Note: data for canyons is being collected.

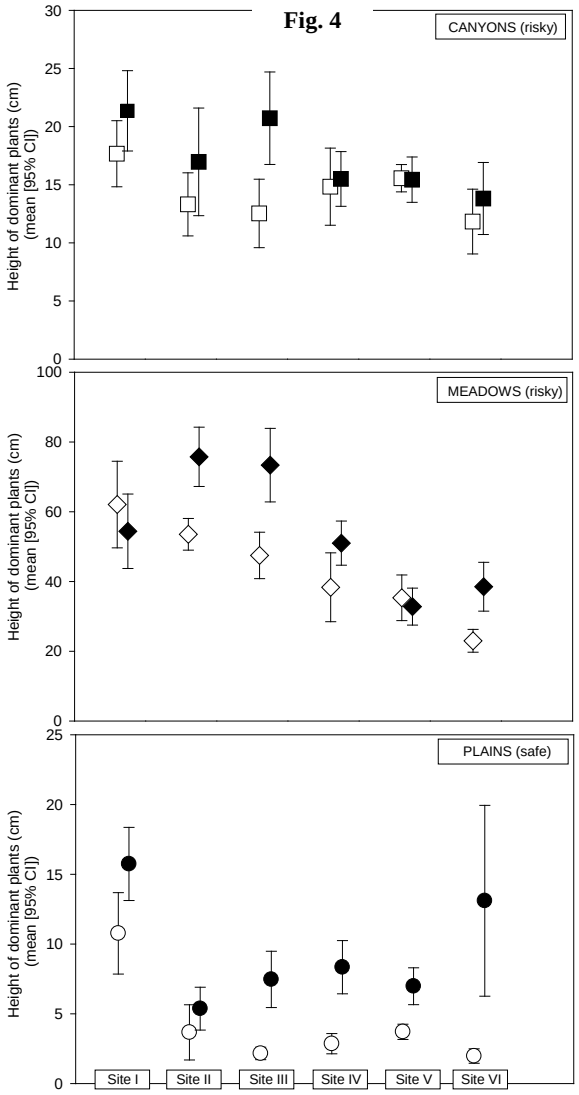

Fig. 4: Dominant plant species height inside (closed symbols) and outside (opened symbols) exclosures in three different habitats with different levels of predation risk for vicuñas. Sample sizes for each data point range from 15 to 25 observations.

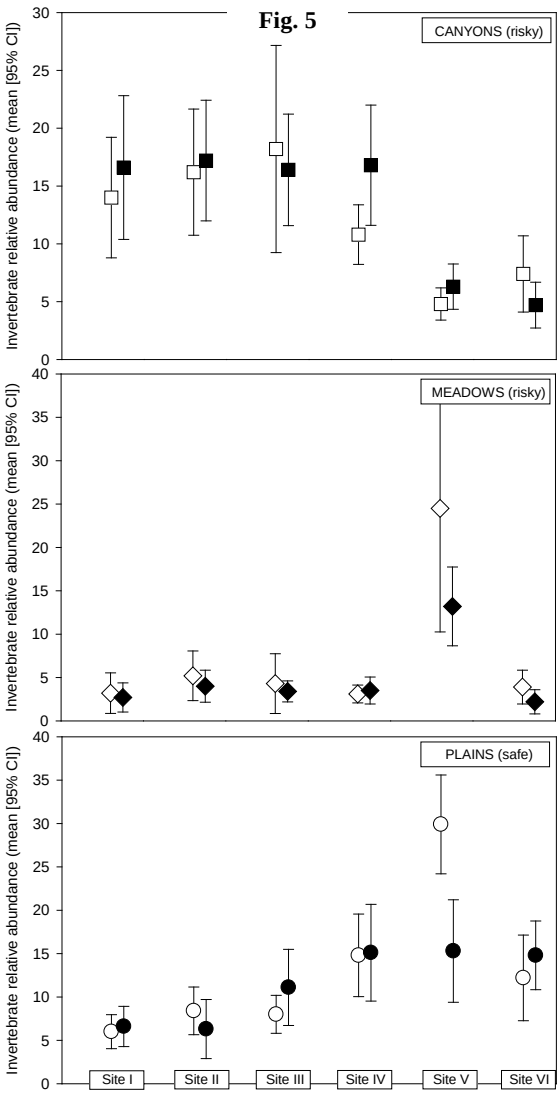

Fig. 5: Invertebrate relative abundances (individuals/pitfall trap) inside (closed symbols) and outside (open symbols) exclosures in three habitats with different levels of predation risk for vicuñas. Data for each data point resulted from the operation during 8 nights of 90 pitfall traps in each habitat type.

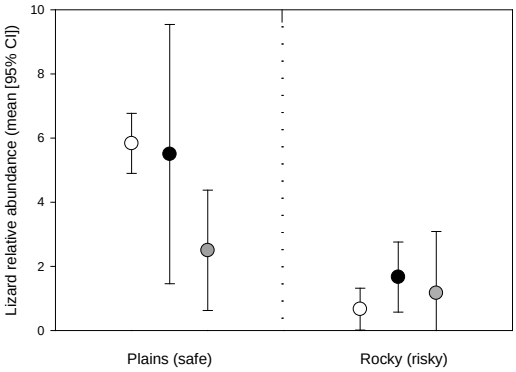

Fig. 6: Lizard relative abundance (individuals/pitfall trap) inside (closed circles) and outside (opened circles) exclosures in open plain and canyon (= rocky) habitats. The small number of lizards caught in meadows impeded a similar analysis. Data for each data point resulted from the operation during 8 nights of 90 pitfall traps in each habitat type. The grey circles represent abundances inside exclosures where vegetation was clipped.

SECTION 3: PROJECT PROGRESS & ACCOMPLISHMENTS

3-1: Training and educational accomplishments:

From January 2008 to present, thirteen undergraduate biology students from six different Argentinean universities, three graduate biology students (from Mexico and Argentina), two veterinaries (from Spain), seven park rangers, and three provincial conservation agents received, and some of them continue receiving, intense training in different field (transect sampling, behavioral observations, vegetation sampling, scat collection and identification, track identification, and field necropsies, small vertebrate and invertebrate trapping, marking and handling) and lab techniques (transect and behavior data analysis).

Presentations between January 2008 and June 2010: Together with two of my volunteers (undergrad students), I presented 2 papers at the XII Argentinean Mammalogy Meeting (early November 2008), 2 papers at the XIII Argentinean Meeting of Ecology (late November 2008), 3 papers at the 10th International Theriological Meeting and 1 paper at the 90th ASM annual meeting [see 3.3].

Public talks and seminars presented between January 2008 and May 2009: During 2008, based on previously gathered data and preliminary data collected during this project, I presented a public talk titled: *The ecological importance of the protected areas of northwestern Argentina*. I presented this talk before a diversity of audiences at the Argentinean Institute for Research in Arid Zones (Mendoza, May 2008), National University of Cuyo (Mendoza, June 2008), Argentinean National Park Service Northwestern Region (Salta, August 2008), Laguna Los Pozuelos National Monument (Jujuy, August 2008) and National University of San Luis (November 2008). This talk highlights the importance of conserving several protected areas of northwestern Argentina based on the persistence in those areas of ecologically important interactions. The presentation emphasizes the outstanding conservation status of San Guillermo National Park (my study site) and warns against the uncontrolled development of open-pit large-scale mining operations nearby the park.

Also, I developed the talk *An (im) perfect monitoring: thoughts on biologists, mining and conservation*. This talk deals with ethic challenges faced by biologists working for mining companies and also analyze and evaluate the Environmental Impact Assessments presented by mining companies working nearby San Guillermo National Park. This talked was presented at the Argentinean Meeting of Mammalogy (early November 2008, see 3.2), the National Park Administration Agency Central Branch, Cordoba (early November 2008), the Center for Applied Ecology, Neuquén province (early April 2009), National University of La Plata, Buenos Airesprovince (August 2009) and the Department of Zoology, University of Wyoming (October 2009).

Funding obtained between January 2008 and December 2008 (already described in previous reports): American Society of Mammalogists (Grant-in-Aid of Research), Program in Ecology (Program in Ecology Summer Fellowship), Wildlife Conservation Society, Cleveland Metropark Zoo (Scott Neotropical Fund Program), National Geographic

(Committee for Research and Exploration Grant) and CREO (Conservation, Research and Education Opportunities).

New funding was obtained, in October 2009, from the Posse Project, University of Wyoming and a private donor.

3-2: Other accomplishments:

My volunteers and I have attended several national and international meetings where we presented preliminary results obtained during this project ([1] undergraduate student).

Year 2010

- ✓ **Donadio E.**, M. Ruiz Blanco[1], R. Crego[1], S.W. Buskirk & A.J. Novaro. 2010. Birth weight and sex as factors affecting juvenile vicuña survival. Proceedings of the 90th Annual Meetings of the American Society of Mammalogists to be held in Laramie, WY, June 2010.

Year 2009

- ✓ Ruiz Blanco M. [1], **E. Donadio**, R. Crego[1], S. Buskirk & A. Novaro. 2009. Foraging and vigilant budgets in vicuñas *Vicugna vicugna*: habitat type overrides group size. 10th International Mammal Congress, Mendoza, Argentina.
- ✓ **Donadio E.**, D.B. McDonald, A.J. Novaro, J.N. Pauli & S.W. Buskirk. 2008. Effects of introduced prey species on native predator communities: a comparative study in semiarid habitats of Argentina (in Spanish). Proceedings of the XXIII Argentinean Meeting of Ecology, San Luis, Argentina.

Year 2008

- ✓ Crego R.D. [1], C.M. Ruiz Blanco[1], **E. Donadio**, S.W. Buskirk & A.J. Novaro. 2008. Vigilance and foraging budgets in vicuñas *Vicugna vicugna* and its relationship with habitat structure (in Spanish). Proceedings of the XXIII Argentinean Meeting of Ecology, San Luis, Argentina.
- ✓ **Donadio E. 2008.** An (im) perfect monitoring: thoughts on biologists, mining and conservation. Conference at the XXII Argentine Meeting of the Theriological Society, Villa Giardino, Argentina.
- ✓ **Donadio E.**, C.M. Ruiz Blanco[1], R.D. Crego[1], A.J. Novaro & S.W. Buskirk. 2008. Capturing and marking with ear-tag transmitters newborn vicuñas (*Vicugna vicugna*) at San Guillermo Nacional Park, Argentina (in Spanish). Proceedings of the XXII Argentine Meeting of the Theriological Society, Villa Giardino, Argentina.
- ✓ **Donadio E.**, M. Vitali[1], A. Wurstten[1], V. Salvador[1], J. Zanon[1], M.J. Veinticinco[1], M. Monteverde, A.J. Novaro & S.W. Buskirk. 2008. Wild South American camelids and their importance in the diet of pumas *Puma concolor*: a regional evaluation at seven protected areas of northwestern Argentina (in Spanish). Proceedings of the XXII Argentine Meeting of the Theriological Society, Villa Giardino, Argentina.

3-4: List of publications:

Past six months

- ✓ **Donadio E.**, A.J. Novaro, S.W. Buskirk, A. Wurstten[1], M. Vitali[1] & M. Monteverde. 2010. Evaluating a potentially strong trophic interaction: pumas and wild camelids in protected areas of Argentina. *Journal of Zoology* 280: 33-40.
- ✓ **Donadio E**. 2009. Ecólogos y mega-minería, reflexiones sobre por qué y cómo involucrarse en el conflicto minero-ambiental. *Ecología Austral* 19 (3):247-254.

Previous

- ✓ **Donadio E.**, M.L. Merino & M.J. Bolgeri[1]. 2009. Diets of two coexisting owls in the high Andes of northwestern Argentina. *Ornitología Neotropical* 20 (1):136-141.
- ✓ Di Martino S. & **Donadio E.** 2009. Biodiversity monitoring plan for San Guillermo National Park. Administration de Parques Nacionales, Argentina.