

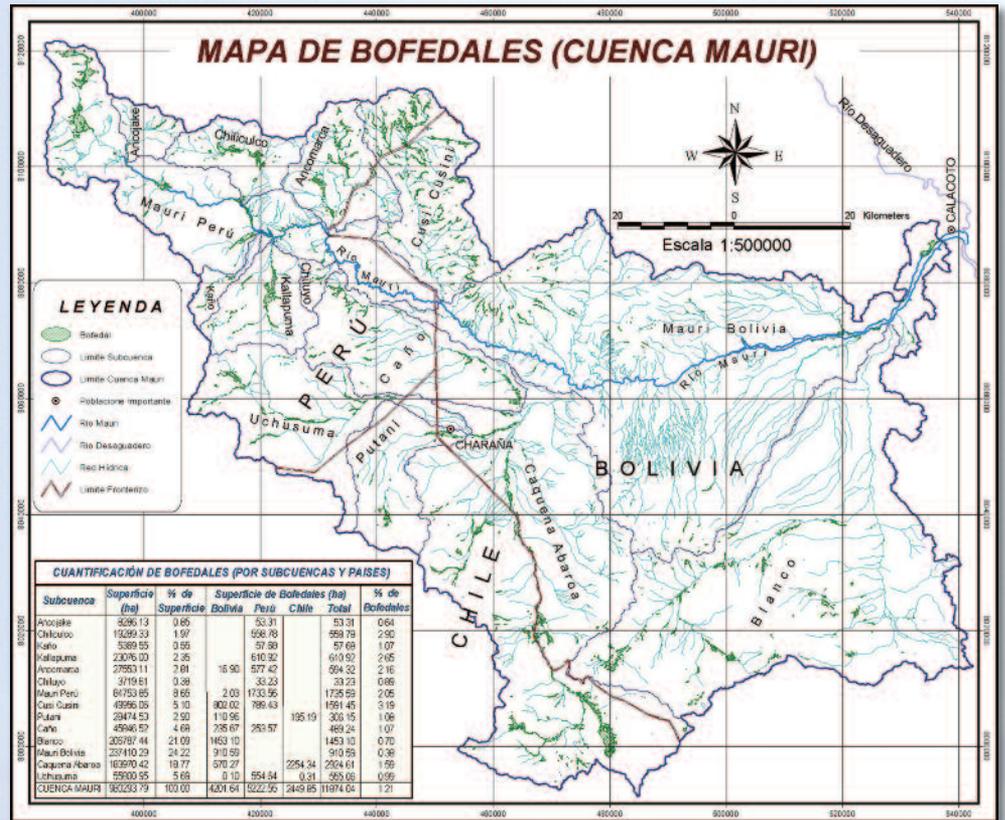
The impact of Andean Bofedales on Camelid Survival & Behavior

By Eric Hoffman

In 2003 Pat Long, DVM and I bumped along a dirt track on the Peruvian altiplano. We were at roughly 14,000', north of Lake Titicaca near Ayavari, the headquarters of Rural Alianza, the largest alpaca cooperative in the world. We were there to screen alpacas bound for a European registry.

An Animal Magnet

After passing through parched landscape, our well-used Toyota pickup paused as we came upon vast green pastures where perhaps two hundred alpacas grazed. The area was entirely different than the desert-like barren hillsides that surrounded us. Almost all of the alpacas were grazing voraciously — tearing off bunches of grass and other plants as fast as they could chew, with only momentary pauses to look up. The animal magnet that attracted these animals was a large bofadel, a unique high altitude ecosystem of grasses, densely clumped cushion plants, and a myriad of other plants. These rich feeding grounds have played an important role in the development of the domestication of llamas and alpacas and the evolution of the behaviors we see today in all four species of South American camelids.



Parque Nacional Lauca in northern Chile provides perhaps the easiest accessible example of the importance of bofedales. At Lauca snowcapped volcanoes tower over vast bofedales, which are usually saturated with snow melting from slopes of the volcanoes. Lauca is one of the few places in the Andes where you can see all four

Photo by: Roger Kasper



species of South American camelids in one place. In a matrix of interconnecting, the bofedales cover hundreds of square kilometers. In such a large area there is room for traditional pastoralists to shepherd alpaca and llama herds, while nearby vicuna males guard their family groups and patrol their territories. Guanacos are plentiful on drier areas along the park's boundary. The family groups on the dry slopes outside the lush pasture will feel the most hardship when a drought shrinks the available pasture to the point that only the strongest males can fend off challenges and assure his family group will have food and enough stability to raise young animals.

This unique high altitude ecosystem was dubbed a bofedal by the Spanish soon after they conquered the Incas in 1532. The Spanish generally opted to ignore words of the native Andeans, whose ancestors had raised llamas and alpacas for thousands of years. The native Andean pastoralists, who speak Quechua or Aymara, have hundreds of words in their languages that identify many aspects of pastures; seasonal pastures, especially high altitude pastures, stop over pastures where llamas can graze on their long journeys delivering trade goods, and pastures that offer specific types of forage, and much more. The words are subtle and their meanings show great knowledge of the Andean ecology. The Quechua and



Aymaras still know the bofedal as oqho or waylla, which roughly translates as “for feeding the animals.”

Andean Greenhouse

So what makes a bofedal tick? Recent studies in Peru's Huascarán National Park has shown that by comparing the species of plants in play, soil types and other factors that many bofedales are unique onto themselves. In one study 112 species of plants belonging to 29 families were catalogued in three bofedales in three separate valleys. Other studies have classed bofedales into four groups: Distichia dominated (a plant family that often thrives at high altitudes in mini-bush shapes), peat and moss based, peat meadow, and grass dominated fed by streams. Most of the plants are unique and have adapted to extremes of high altitude.

Botanical diversity aside what bofedales all have in common is exposure to the intense ultraviolet rays from the sun at 12,000 to 17,500 foot altitudes. They receive warmth during the day, due to the proximity to the equator, copious amounts of water, often from multiple sources (snow melt, streams, springs, rain, snow itself, and water via irrigation from nearby lakes), and a relatively flat surface where water collects. Rather than run off, the water tends to sit and be absorbed or just sits, allowing a bofedal to stay wet long after areas outside the bofedal have dried up due to seasonal changes or drought.



Photo by: Roger Kasper



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Many of the plants have evolved to withstand freezing nights and day temperatures of 80 degrees Fahrenheit in a span of 12 hours. A bofadel is a high altitude greenhouse on steroids.

On parts of the altiplano, bofedales may seem endless, but they aren't found everywhere in the Andes. The vast puna is actually two contrasting types of ecosystems: "dry puna" and the "wet puna." The "dry puna" is often seen as a high desert where annual rainfall fall is between 4 and 16 inches a year. Historically, the "wet puna" receives between 16 and 75 inches of precipitation annually, though recent years have been less predictable with droughts becoming more common. The "wet puna" encompasses the highlands in northern Chile, parts of northern Bolivia, northern Argentina and much of Peru. Most of the alpacas today, live on areas of "wet puna" where they were developed by breeding practices that commenced 6,500 years ago. Of the two domestic camelids, llamas are better adapted to the vegetation on dry puna than alpacas. The bofedales are under pressure by overgrazing in some areas, and by an increasingly dry climate due to global weather changes. The nourishing wet puna is currently in retreat, a trend that could bring about a much harsher environment.

Camelids Influence Incan Culture

The Inca culture was built on the backs of their domestic camelids, the fine-fleeced alpaca for clothing and trade, and pack llamas to carry goods from the Amazon to the Pacific coast and the length of the Andes. The animals were also a ready source of meat. Llamas and alpacas were used to pay tribute to

the victorious Spanish. In one year more than 500,000 alpacas and llamas were sent to the conquistador Francisco Pizarro, as a form of tribute. Depopulation of the native "sheep of the land" (both llamas and alpacas) was constant in the policies of the early Spanish. The animals survived primarily due to their hardiness at the high altitudes and the surviving Andean pastoralists who continued to raise them.

Brilliant Animal Management

When the Spanish first arrived they were astounded when they found that high ranking Incas living near lake Titicaca controlled vast herds numbering in tens-of-thousands. Within 50 years of the Conquest these herds had disappeared. The tragic history of what is often called Andean pastoralism has had its ups and down ever since.

The Andean pastoralists, in a series of civilizations that preceded the Incas, devised techniques of corralling animals and breeding them selectively. The process of creating domestic species resulted in llamas and alpacas. The behavior we see in these domestic forms was inherited from their wild progenitors (vicunas and guanacos).

There are two axioms to always remember when analyzing animal behavior in nature: 1) the behavior is for survival 2) the behavior is tailored to fit the environment. In their original setting the behavior makes sense. When the animal is moved to a foreign environment its behaviors come with it. To people owning alpacas and llamas on farms outside of their traditional South American haunts owners may find the behavior

amusing, inexplicable or even annoying. For example, why are some males prone to fight, or why do cria hum?

When you see a male driving other males out of its territory on the altiplano it makes sense. It's about maintaining a territory for a family group. Watching a llama simultaneously tilt its head up, and lay its ears back while striking a rigid body posture as another animal approaches may look unnecessarily hostile on your farm, but it is the "hard wiring" of a survival behavior signaling a warning to the approaching animal to keep its distance — and not encroach on the llama's eating space. Camelids have a language that signals one another about their intentions, fears, and dislikes.



Photo by: Roger Kasper

Behavior Offers Order in a Land With No Fences

There is no doubt the language, that includes vocalizations and body postures, is a necessity when living on bofedales and similarly desirable in crowded environments. The language allows order for family groups rubbing up against like groups and aggressive enforcement of territoriality keeps order allowing family groups a protective environment for newborns with enough to eat for their lactating mothers.

The territorial nature of males, the full body language of a broadside display (to advertise a territory is occupied from afar, allowing intruders to head in another direction without fighting, and more subtle ear and tail positioning to express tensions within a herd, are all needed to keep order and signal intent. Vocalizations such as an alarm call to "out" a predator or orcling to attract open females all came from the evolutionary process in the wide open setting over tens of thousands of years in the wild progenitors of alpacas and llamas. The language is essential to survival.

During wet years, family groups flourish and spread into marginal nutritional areas that would not provide enough nourishment in times of drought. The bofedales favor the social structure we see today in a family group with a dominant territorial male who earns his role to breed a group of females by maintaining a territory. At the same time the territorial males are usually transitory figures, whose genetic input may



be brief — only be a year or two. His job is high risk. The replacement male brings new genes that usually increases the population's diversity. Alertness, strength, stamina and aggression are the male's tools.

Choosing a desirable area to defend is a prerequisite for success. Setting up a territory is a balancing act. If the territory he marks is too large, the male will be hard pressed to protect his family group's stability and pastures. If the territory is too small, the family group might exhaust the food source by overgrazing. His vigilance to patrol his boundaries

often results in finding a predator, the encroachment of another herd into their feeding area and challenges from males wanting to be a territorial male. If all goes well his efforts and favorable weather will provide good forage that will sustain his females and their offspring. Not all behavior of the wild species is the same in the domesticated camelids. For example, for the most part the domestic camelids are cooperative with people.

This may come as a surprise to llama and alpaca owners outside of South America, but it's true. Release a herd of alpacas onto a bofedales from the rock corral (canchones) and chances are they'll graze for the day and come home at dusk to be shut into their canchones for the night. It's not uncommon for two children to shadow a herd of 500 animals and prod them gently when they want them to turn around and head for home.

For thousands of years llamas have been utilized to move products to far away villages. In South America the animals usually know the route and keep to it even if it takes several days to reach a destination. The most experienced animals lead the way and teach new animals the route. Usually someone with a sling shot in-hand brings up the rear and will launch a pebble to remind any independent minded animal to stay with the herd. This ability to remember a route and stick to it is hardwired.

As a person who spent my middle years trekking with llamas in the High Sierra it always astounded me how the animals reacted if



we changed the route on our return to the trailhead. I remember incidences when a cooperative string of llamas that was moving well would come to a halt when we digressed onto a trail we hadn't used on the way into an area a couple days earlier. At the very place we diverged the string of animals would stop and seem to say, "The trail you've chosen is wrong. It isn't way to the trailhead, don't you remember?!" Some animals would even challenge their lead ropes and lean in the direction of the "right" trail. After some prodding order would be restored. Camelids like familiar routines.

Pachamama is a revered goddess of the indigenous people of the Andes. She is alleged to look over the crops and fertility of the herds, plus she has the power to cause earthquakes. She also has the power to take the llamas and alpacas away from the people if they don't treat them properly. Who knows, maybe she created the bofadel to allow the South American camelids a safe haven in the best and worst of times. And, in her infinite wisdom, Pachamama may have provided camelid language so they could communicate with one another and share a bofadel in an orderly way so ensuing generations would be nurtured and grow to their potential.

About the Author

Eric Hoffman is the primary author of the second revised edition The Complete Alpaca Book, (Bonny Doon Press, 2006). He created the first scientifically based alpaca registry (known as ARI for many years, but most recently merged with AOA) in the world and is author of hundreds of articles on all four species of camelids. His articles have appeared in International Wildlife, Animals, Pacific Discovery, California Living, Wildlife Conservation and many other publications. His speaking engagements on camelids have taken him to many places including Australia, New Zealand, Sweden, Finland, Switzerland, Canada, Peru, Chile, Germany and England in recent times. Most recently he has been involved in cancer research project involving camelids at Kyoto University in Japan. Eric and co-authors Sherry Edensmith and Pat Long DVM published "The Alpaca Evaluation: A Guide for Owners and Breeders", a three DVD set and 120 page fully illustrated handbook.

A large herd of vicuñas in a territory depleted of its nutrition. Vicuñas are often reluctant to leave territory even when there is almost nothing to eat. Guanacos on the other hand are more flexible. If it snows to much and covers the food or a drought is on they set out for better digs. They'll even swim to islands to get better feed. Both llamas and guanacos are better suited for sparse conditions. These vicuña, wandering into a high desert, illustrate a quirk in the vicuña's survival strategy.

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