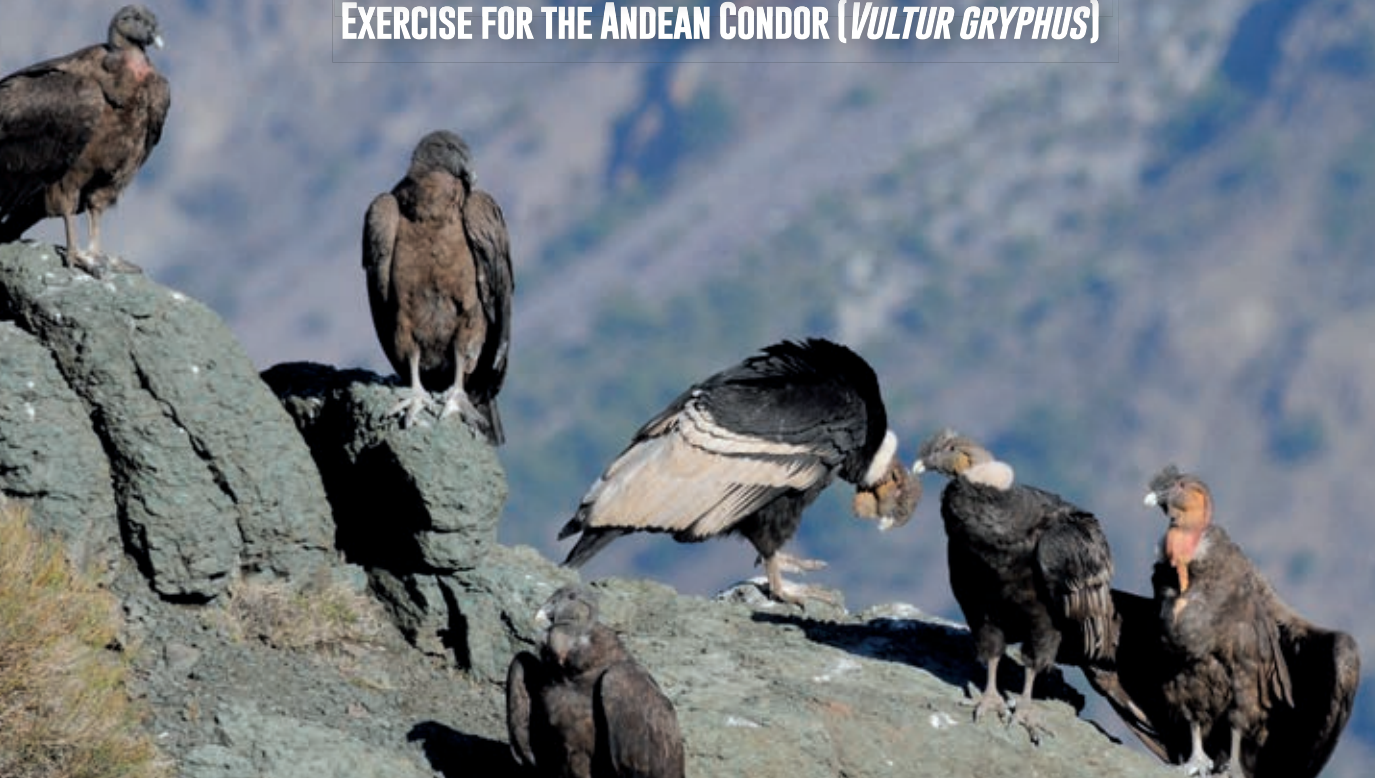


SAVING THE SYMBOL OF THE ANDES:

A RANGE WIDE CONSERVATION PRIORITY SETTING EXERCISE FOR THE ANDEAN CONDOR (*VULTUR GRYPHUS*)



Robert Wallace, Ariel Reinaga, Natalia Piland, Renzo Piana, F. Hernán Vargas, Rosa Elena Zegarra, Pablo Alarcón, Sergio Alvarado, José Álvarez, Fernando Angulo, Vanesa Astore, Francisco Ciri, Jannet Cisneros, Celeste Cóndor, Víctor Escobar, Martín Funes, Jessica Gálvez-Durand, Carolina Gargiulo, Sandra Gordillo, Javier Heredia, Sebastián Kohn, Alejandro Kusch, Sergio Lambertucci, Diego Méndez, Rubén Morales, Alexander More, Adrián Naveda-Rodríguez, David Oehler, Oscar Ospina-Herrera, Andrés Ortega, José Antonio Otero, Fausto Sáenz-Jiménez, Carlos Silva, Claudia Silva, Rosa Vento, Guillermo Wiemeier, Galo Zapata-Ríos & Lorena Zurita

May 2020

Results of Andean Condor Range Wide Priority Setting Workshop, May 6th-9th 2015, held in Lima, Peru.

Author order is based on the following criteria. The first author led the design of the workshop and research, raised funding for the meeting, provided data and supervised the systematization of Andean condor data across the range, facilitated the RWPS portion of the workshop, and led write-up efforts. The second author systematized Andean condor data and produced maps and spatial analyses for the workshop and the publication. The third author produced a note record of the workshop and then wrote up significant portions of the document. The next three authors were fundamental in the organization and design of the workshop, provided data and reviewed and contributed to this document. The next 31 authors participated in the workshop, generously provided data, and reviewed and edited the report.

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Introduction

The iconic Andean condor (*Vultur gryphus*) is an emblem of the Andean region. The image of one soaring over the mountains with huge, motionless wings has inspired local folklore across its range. The Andean condor links the seven Andean nations of Argentina, Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela, and its cultural significance goes so far as to serve as the national bird of four different countries known for their avian diversity: Bolivia, Chile, Colombia, and Ecuador. Andean mythology places the condor as the ruler of the sky, or Kai Paccha (upper world), and associates it with the sun deity. The indigenous communities of South America have transmitted knowledge about the Andean condor from generation to generation by word of mouth and direct experience, preserving the view that the species occupies a central role in their cultures (Astore *et al.* 2017).

Its role as scavenger make the Andean condor an essential part of the ecosystem, eating carrion to speed up the decomposition process, while decreasing the risks of disease associated with slow-rotting carrion. It is evolutionarily important: it is one of seven species of American Vulture (Family: *Cathartidae*), which are known for their superior sense of smell (uncommon in birds), although this is not the case for the Andean condors which cannot smell. The Andean condor is monotypic in its genus *Vultur*; and the only one of the seven species to show sexual dimorphism, with males possessing a large, fleshy lump on the front of their heads, called a caruncle, as well as neck wattles that are absent in females.

Given its broad geographic range and extremely wide-ranging behavior, the first step in creating an effective conservation strategy is to spatially assess where Andean condors are and have been, what threatens condors, and what actions are likely to abate these threats, setting priorities throughout the entire distribution.

Today the Andean condor is found on both sides of the Andean mountain range, from Venezuela to Patagonia (Birdlife International 2017), but we know little of its historic range. While only considered Near Threatened at the global level (Birdlife International 2020), the Andean

condor has disappeared from much of the northern portion of the Andes and in national red list classifications is considered *Critically Endangered* in Colombia (Renjifo *et al.* 2002, 2016; Rodríguez-Mahecha & Hernando Orozco 2002, and Endangered in Ecuador (Freile *et al.* 2019) and Venezuela (Rodríguez *et al.* 2015; Sharpe *et al.* 2015). In the central Andes, its status has been unclear for decades, but it is classified as Endangered in Peru (Decreto Supremo 004-2014-MINAGRI) and Vulnerable in Bolivia (Balderrama *et al.* 2009; MMAyA 2009). Although populations are larger in the southern portion of the range, condors are considered Vulnerable in Chile (CONAF 1993), whilst in Argentina it is not classified due to insufficient data (Lambertucci 2007). Nevertheless, a recent report from the Ministry of Environment and Sustainable Development in partnership with Aves Argentina classified the Andean condor as Endangered in Argentina (Resolución #795/2017, MAyDS & AA 2017), whilst previously it was considered Vulnerable (Resolución #348/2010, espacios SA y DS 2010).

Assessment of population and distribution of the Andean condor is inconsistent across its range. Andean condor specialists have estimated that only 6,700 mature Andean condors remain across the entire range (Chebez *et al.* 2012). This overall global population estimate is 300 below the estimate of 7,000 adult animals required to guarantee survival of a population of large vertebrates for forty generations (Reed *et al.* 2003). Moreover, the lack of sustainable populations across their entire geographic range may have serious consequences when we consider the implications of climate change.

Andean condors have been virtually extirpated from the northern portion of their range with less than 100 adults estimated across Ecuador, Colombia and Venezuela (Chebez *et al.* 2012), where, in the latter two countries reintroductions have been underway for more than a decade. A more recent national census suggested the presence of 94 to 102 individuals in Ecuador (Naveda-Rodríguez *et al.* 2016). Efforts in Bolivia and Peru have estimated minimum population sizes of 253 individuals for Bolivia (Méndez *et al.* 2015, 2019) and between 155 and 249 individuals for Peru (Piana & Angulo 2015), although for Peru an overall population of less than 2,500 animals is indicated in the National Action Plan. Population estimates of around 2,000 animals have been proposed in both Argentina and Chile (WWF and Fundación Bioandina 2000), although there are no field studies to support these estimates, and given the geography of these neighboring elongated countries, it seems probable that there is significant overlap between these estimates. Therefore, urgent action is needed to conserve remaining Andean condors across their range.

The Andean condor is particularly vulnerable to threats due to its naturally low abundance, wide-ranging behavior and low reproductive rates, that collectively make population viability issues a real concern. Threats such as direct hunting, collisions with power line infrastructure, illegal involuntary (and sometimes voluntary) carcass poisoning for predator control, lead poisoning from the hunting of prey species, and competition for food from feral and domestic dogs can directly impact its population. Sporadic Andean condor attacks on domestic livestock have contributed to an image problem and can lead to human-wildlife conflict issues including direct persecution. The unregulated use of Andean condor feathers (and other parts) in handicrafts and traditional medicine may also threaten populations. Finally, a very specific threat in central Peru is the Yawar Fiesta, where condors are strapped to bulls' backs and are often killed or damaged. In addition, it is important to understand how these threats interact and how new threats, like human-forced climate change, which is thought to have stronger effects on ecosystems with high altitudinal range such as the Andes, will affect condors in the future.

Recently, conservation planning for the Andean condor has resurged with more awareness about these threats, and with a series of events bringing together relevant stakeholders to discuss the conservation of the Andean condor in South America. For example, in Colombia an Action Plan for the Conservation of the Andean Condor was developed for the 2006-2016 period, followed by a similar initiative in Ecuador in 2009 and 2018. Three workshops in 2013 in Peru produced a National Plan for Andean Condor Conservation, which was formally approved during this workshop (see Conclusions) in 2015. Meanwhile, Andean condor reintroduction efforts in Argentina, Chile, Colombia, and Venezuela have been increasingly coordinated.

Since 2010, a South American initiative across the species range has developed with a regional meeting for the Andean condor held at the I World Congress for Raptors, in Bariloche, Argentina, in October 2013. This meeting resulted in the Bariloche Agreement that delineated joint commitments to orient conservation actions in South America and assigned country representatives and their respective responsibilities. In November 2014, in Córdoba, Argentina, the First International Symposium on the Andean Condor was held where researchers and conservationists updated the status of planned actions.

In response to this dynamic and the conservation information needs of the species, in May 2015 a partnership of National Forestry and Wildlife Service of Peru (SERFOR), the Peruvian Ministry of Environment (MINAM), The Peregrine Fund, and the Wildlife Conservation Society (WCS) held the II International Symposium on the Andean Condor, which included an Andean Condor Range Wide Priority Setting Exercise at the Hotel Colón, Miraflores, Lima, Peru (6th - 9th May, 2015). The main objectives were to systematize existing distributional knowledge and identify priority conservation areas for the Andean condor throughout its distribution using the Range-Wide Priority Setting Exercise developed by WCS for landscape and globally threatened species (Sanderson *et al.* 2002), and to create a space for exchanging lessons learned regarding the Andean condor.

The Range-Wide Priority Setting Exercise aimed to assess the distribution and conservation status of the Andean condor, and consolidate all available information on the species, currently dispersed and scattered from all different sources, to be translated into a conservation strategy, including the participative definition of Andean Condor Conservation Units (ACCUs). The exercise anticipated that these ACCUs consider threats, distribution, and relative

abundance, potentially important factors for selecting specific sites for long-term conservation investment, as well as studies and population monitoring on behavior, reproduction, and distribution. The exercise also hoped to produce an action plan and distribution map for dissemination across the bird's range, as well as crucial conversation among the important actors in the conservation of the Andean condor.

Andean Condor Symposium Results

The event was well attended by over thirty recognized Andean condor experts from across the range, as well as around 70 participants from interested decision makers in Peru (see Annexes I and II for agenda and participant list).

Brief Summaries of Expert Presentations

The first part of the event, between May 6th and 7th, followed the style of an academic conference, with experts from each country presenting summaries of knowledge on Andean condors. These presentations can be grouped in two large umbrella themes: **what we know regarding the species in each country and experiences in research and rehabilitation.** These presentations were authorized by presenters for sharing purposes and can be found in an annexed digital archive.





State of Knowledge on Andean Condors in each Country

As host country, Peru updated the Andean Condor's status in the country. David Velarde, representing the National Protected Areas Service (SERNANP), showed that the Andean condor is found in 20 of the 76 protected areas of Peru, representing 25% of the national protected areas system (SINANPE). However, for some areas, such as the National Reserve Lomas de Lachay, Andean condors have not been registered for several years. SERNANP uses two methods to register information on condors. The first is through park ranger patrols – information that is currently systematized using the Spatial Monitoring and Reporting Tool (SMART). The second method is through periodic counts, but these are only employed by the National Reserve San Fernando.



Javier Heredia

Renzo Piana ((Asociación de Conservación de la Cuenca Amazónica, sister organization to the Amazon Conservation Association in Peru) reviewed literature found in five different international academic search engines, and consulted with Manuel Plenge, a researcher responsible for the Peruvian ornithological bibliography. The review emphasized that few published articles in indexed journals exist for Andean condors (but see Williams *et al.* 2011; Piana 2014; Piana & Angulo 2015) and there are many knowledge gaps with resulting implications for adequate management and policy. For example, the national categorization of threatened species (D.S. N° 004-2014 MINAGRI) lists the Andean condor as *Threatened*, due to a national population estimate of 1,500 individuals in 2004, an estimate that has not been validated or updated since.

Sergio Lambertucci brought a historic perspective to the knowledge of the bird in Argentina. The Andean condor came in second place—after the rufous hornero—in a vote for national bird of Argentina in 1928. Since the 1980s, groundbreaking and regionally significant research regarding the species has been conducted thanks to the establishment of the Condor Group in 1985, and subsequent guiding meetings with specialists in 1991. Condor research in Argentina has included species distribution in the country (Pérez-García *et al.* 2017); population estimates in Patagonia and the Central Andes (Alcaide *et al.* 2010; Lambertucci 2010; Cailly-Arnulphi *et al.* 2013); the importance of roosts, roosting behavior, population dynamics and hierarchy of social structure (Donázar & Feijóo 2002; Lambertucci *et al.* 2008, 2012; Lambertucci & Ruggiero 2013, 2017); genetic variability (Hendrickson *et al.* 2003; Padró *et al.* 2018,

2019); breeding (Lambertucci & Mastrantuoni 2008); diet (Lambertucci *et al.* 2009, 2018); competition with other scavengers (Carrete *et al.* 2010); competitive asymmetry in function to sex, age and coloration (Donázar *et al.* 1999; Marinero *et al.* 2018); reproduction (Cailly-Arnulphi *et al.* 2014); movement ecology including adult foraging ecology and juvenile dispersal (Shepard *et al.* 2011; Lambertucci *et al.* 2014, 2018; Williams *et al.* 2015; Alarcón *et al.* 2016, 2017; Guido *et al.* 2019); lead analyses (Lambertucci *et al.* 2011; Wiemeyer *et al.* 2017; Plaza *et al.* 2020); genetic and hormone analyses (Gangoso *et al.* 2016); carotene concentration analyses (Blanco *et al.* 2013); general and specific threats to the species (Speziale *et al.* 2008; Lambertucci & Speziale 2009; Péron *et al.* 2017); health evaluations (Plaza *et al.* 2019a, 2019b); and the importance of environmental education (Cailly-Arnulphi *et al.* 2017).

Víctor Escobar presented the state of knowledge of the Andean condor in Chile, where it is considered *Vulnerable* in the central-north zone, *Rare* in the south, and *Not Threatened* in the extreme south (Tierra del Fuego), according to the Hunting Law (DS 5/1998 MINAGRI). Andean condors are found from Arica to Cabo de Hornos and from the Andes mountain range to the coast. Although there are not many scientific publications in Chile, there has been much research. In the 1990's, for example, 30 condors were tagged in a landfill in the highlands, allowing research on the use of landfills by the species. It was found that condors used the landfill between 07:00 AM and 13:00 PM, with an increase of individuals in the autumn and winter seasons, when there is less prey to scavenge on. Other notable research projects include: habitat use and choice, biochemistry and immunology, monitoring of reintroduced condors (2001), nesting and parental choice, demography, ecotourism potential, population modeling, and census (Escobar-Gimpel *et al.* 2015; Kusch 2004, 2006; Sarno *et al.* 2000).

Diego Méndez presented a summary of Andean condor knowledge in Bolivia. Research in Apolobamba suggests that there are at least 80 condors in the area (Rios-Uzeda & Wallace 2007). A study carried

out by ARMONIA estimated a population of at least 253 individuals for the whole country (Méndez *et al.* 2015). These data are a first population estimate, but a census for the entire country is still lacking and the population estimate is therefore incomplete and as such a minimum estimate.

Hernán Vargas provided a population estimate for Andean condors in Ecuador of about 150 wild individuals and 19 captive individuals. Andean condors are *Critically Endangered* in Ecuador (Granizo *et al.* 2002; Koester 2002). A comparison between telemetry data and eBird data, showed that the latter concentrates records on those sites frequented by tourists, which does not necessarily reflect Andean condor movements. In Ecuador, the National Strategy for Andean Condor Conservation was updated in 2015, and research led by The Peregrine Fund has increased knowledge through satellite telemetry, population monitoring, reproductive biology, and health and genetics.

Francisco Ciri from Colombia recounted the history of Andean condor research from the first report in 1664 – where the priest Antonio Olivares realized a very complete descriptive study of the species – until 2015. Andean condors have almost never been recorded on either coast, except for two records, one in Tumaco, Nariño, and another in Palomino, Guajira. The reintroduction process supported by the San Diego Zoological Society, the Cali zoo, regional corporations and NGO's between 1989-2013, amounted to 69 individuals released and monitored, specifically focusing on reproductive biology in the National Natural Park Los Nevados. It is thought that some individuals liberated in southern Colombia may have emigrated to Ecuador. There has been no monitoring for individuals outside of Los Nevados, and there are no published studies about wild populations (but see Sáenz-Jiménez *et al.* 2015).

Adrián Naveda-Rodríguez showed that in Venezuela, the Andean condor has always been considered a transient species, not a resident. Starting in the 1990s, 14 individuals were reintroduced from the

United States. However, this effort failed primarily because there was no preliminary work done with local communities, and many individuals fell victim to bullets. There are 12 Andean condors in Venezuelan zoos, and there has been talk of starting another reintroduction program, although the current political situation is not affording much opportunity Andean condor conservation work.

Finally, **Adrián Naveda-Rodríguez** reviewed information for Brazil and Paraguay, showing that there is very little information and almost no records, proving the assumption that there are no permanent populations of Andean condors in either country.

Experiences in Rehabilitation and Research

Raising and liberating Andean condors: What have we learned?

Vanessa Astore from Argentina, presented the Andean Condor Conservation Program (PCCA), a program based on five pillars: 1) Latin American Studbook for the captive population, 2) incubation and rearing in isolation from humans, 3) rescue and rehabilitation centers, 4) release and monitoring of individuals, and 5) education and traditional culture. Through agreements with different institutions, PCCA put together a rescue and rehabilitation center where injured condors from any place in the country can be kept and rehabilitated by specialized professionals. From 51 chicks born in captivity in the Ecoparque Interactivo Buenos Aires Zoo, 100% have been released. The PCCA has released Andean condors across South America, including 173 rehabilitated condors equipped with monitoring systems based on radio-telemetry and satellite transmission. Monitoring efforts underline that an individual can have a home range of up to 80,000 km² if it's a juvenile, and 150,000 km² if it's an adult, and therefore cooperation is needed between neighboring countries to protect the condor across its entire distribution.

Víctor Escobar described the work of rearing and rehabilitating condors in the Raptor Rehabilitation Center (CRAR), founded in Chile in 1991, and the

National Zoo, as well as the collaboration with Argentina for the Binational Program for Andean Condor Conservation, through which captive individuals were released in both countries. The two most essential aspects of rehabilitation were: minimal contact between humans and chicks, and keeping the chicks with their parents until they finished developing their plumage (about 6 months). In the zoo, chicks are not exhibited until they are five months old, and are only considered for release at one-year-old. Prior to release, they are tagged with ankle bands and subcutaneous chips and are socialized with wild condors at scavenging stations. Since 2005, 11 condors have been released and intensively monitored, providing key data on the different threats that Andean condors face: two released condors died, one due to poisoning, and the other was killed.

Carolina Falla presented the Rehab and Liberation Program for Andean condor in Colombia. *Ex situ* work in ACOPAZOA (Colombian Association of Zoological Parks and Aquariums) is complimented by the collaboration of NGOs and Condor-Keepers doing in situ conservation work. The program also has the international support from the Condor Cooperative Group, a group of South American experts, the US group Species Survival Plan, donors from Houston Zoo, and capacity building programs from San Diego Zoo, and Colombia has conducted capacity building workshops in incubation, and obtained specialized equipment (incubators, oviscopes, hatcheries). The importance of using the Andean Condor Studbook, a registry of kinship relationships for captive individuals, in all *ex situ* installation and rearing programs in South America was highlighted, as well as exploring ways to use it in in situ programs.

Andrés Ortega presented learned lessons in rearing and release of Andean condors in Ecuador, going back to the 1970s, when First Sergeant Washington Cabo Castro successfully initiated captive breeding multiple times with a pair of condors in the Military School Eloy Alfaro Zoo, producing 35 eggs between 1978 and 1994. Ecuador now has a properly monitored captive reproduction program, with a first chick (male)

in 1992, and a second chick (female) in 1994. In the Quito Zoo, a pair of condors, Awki and Kawsai, have become a symbol for the country through a study of fertility conditions and associated communication. Thanks to their fame, it is well known in Ecuador that killing a condor is a crime punishable with up to five years in jail, underlining the enormous importance of this type of outreach and environmental education campaigns to promote species conservation.

To conclude this section, it is important to highlight that future reintroduction work should consider both the sex ratio in the receiving population, as well as the individuals that will be released to avoid worsening the demographic situation of the receiving population (Lambertucci *et al.* 2012).



Victor Escobar

Health

Yovana Murillo (Peru) represented **Luz Dary Acevedo** (Colombia) in presenting a small literature review of scientific articles on the health of the Andean condor. The revision was organized by country and highlighted differences in subject matters, including: physiology, ecotoxicology, infectious agents, and trauma. Given the abundance of grey literature on these subject matters, an important conclusion was the importance of sharing the database such that all researchers could add their information for a more complete repository.

Guillermo Wiemeyer, from the Rehabilitation Center of the Buenos Aires Zoo, presented results regarding health studies, highlighting that the tolerance level threshold for lead in Andean condors is not well known. Levels of more than 25 mg of lead/dL of blood can cause pathogenic effects, but sampled Andean condors had levels up to 300 mg/dL. Condors are intoxicated by eating prey that has been killed by lead bullets, or by being shot directly. By sampling some wild individuals in San Juan and in Bariloche, researchers compared condors received in the Rehabilitation Center with those in the wild. The condors in San Juan had lead levels much lower than those in Bariloche, which underscores the importance of studying these issues at a regional scale. Another priority health topic identified for Andean condors is the need for intense monitoring of the West Nile Virus, given its potential to be transmitted to humans and its fatal consequences in the United States.

Population monitoring methods

Diego Méndez applied a photographic monitoring method used with the Californian condor in the 1980s to identify Andean condor individuals in Bolivia. One of the study's objectives was to study plumage characteristics for their potential to identify at an individual level. On the eastern Andean slopes in Bolivia, 28 scavenging stations were placed on flat surfaces for optimal camera trapping in 2012 with a minimum of 150 km between them. When condors arrived, they were classified by age and sex, and photos taken of individuals in flight and from both sides of the scavenging station. This method resulted

in hundreds of photographs of condors, and is a good tool for identifying and monitoring individuals and populations. The results provided a minimum abundance estimate for Bolivia of 400 condors. Competition between Andean condors and feral dogs was the most surprising and worrying result of the study.

Sebastián Kohn presented results from the Research and Ecological Monitoring Project of the Andean Condor in Ecuador, led by The Peregrine Fund, which monitored roosting and nesting sites, and also collected data on historic nesting sites. Andean condors were tagged with wing bands and satellite trackers, allowing the collection of valuable hereto unknown data on the species. Camera traps at scavenging sites revealed population size and demography. Feathers were also collected for genetic analysis. Monitored populations suggested more adult males than females—and a similar pattern was found in sub-adults and juveniles. Ten documented wild condor nests showed that condors reproduce all year round. One pair of condors had three chicks in three years, in different nests at the same site, and fledglings left the zone as soon as the parents laid a new egg. Three cases of attacks by condors on cow calves were recorded, proving that Andean condors can attack and kill young animals, although the frequency of these attacks remains unclear and specific research on this human-wildlife conflict is needed. In the meantime, environmental education programs need to be changed, such that the problem is acknowledged, but stressing that livestock is only at risk if poorly managed.

Carolina Gargiulo presented research on the distribution, abundance, and nesting patterns of the Andean condor in the central Andes of Argentina. Potential changes from the historical to the actual distribution of the Andean condor in Córdoba, San Luis, and La Rioja, was analyzed by comparing historical data such as toponyms, indigenous illustrations of condors, and observations before the twentieth century, with current data including observations from the beginning of the twentieth century onwards, as well know roosting and nesting sites. Results revealed that current distribution has not changed in relation to historic distribution.

The age structure and abundance of populations in three communal roosting sites in the Quebrada del Condorito, Sierra de las Quijadas, and Talampaya national parks, were assessed with a seasonal census through direct observation. The maximum number of adults and immature individuals in Condorito was 113, in Quijadas it was 36 birds, and in Talampaya just 11 condors. Maximum abundances were stable throughout the study, and did not show a seasonal pattern. There were more adult condors than immature condors at all sites.

Seasonal monitoring of Andean condors between 2008-2012 at a nest in the Reserva Cerro Blanco, Córdoba revealed that one pair nested for four consecutive years with 75% success, the highest reproductive success for the species in the wild. The dependency period of juveniles was 8-9 months, and the pair did not incubate a new egg until the chick fledged. Both parents participated in incubation, and the male gave more time to parental care. This study inspired similar monitoring in the National Reserve San Fernando in Peru.

Finally, **Letty Salinas** presented an exercise in modeling population, historic range, and the future of the Andean condor. A Maximum Entropy algorithm (MaxENT) used 3,600 Andean condor observations and climate data to perform an ecological niche model. The two most important factors in the model were the median temperature in the hottest quarter and the seasonality of temperature, factors that together explained 30% of the temporal variation in the distribution of Andean condor in the study area. These results were used with different climate change models (Hadley GEM 2) to visualize the species distribution range and how these could modify due to climate change.

Satellite telemetry and movement ecology

Sergio Lambertucci highlighted that the major problem in studying the Andean condor is the risk of counting an individual more than once in observation records. Satellite telemetry studies in Argentina have mapped habitat use and documented movement patterns from dozens of Andean condors that has greatly improved our understanding of basic Andean condor movement

ecology (Lambertucci *et al.* 2014). Additionally, flight cost maps for the condor around Bariloche revealed that the airport is located in a place where condors don't frequent, thus avoiding accidents. Flight cost maps can be used when planning infrastructure development such as airports, electric infrastructure, or others, in order to avoid collisions. Andean condor conservation efforts should not be solely focused on terrestrial space, such as nesting, roosting sites, and feeding sites, but also on aerial space.

Hernán Vargas emphasized the difficulty in catching wild condors in Ecuador, as compared to Argentina. In Ecuador adult condors are caught using several methods including carcasses in the field, holes and lassoes in roofs of cages with captive condors, and walk-in traps. Felipe, the first condor rescued and released in Ecuador with a satellite tag moved through the Antisana, Cotopaxi, Llanganates, and Sangay national parks, but spent most time outside protected areas before being shot dead after eight months of providing heretofore unknown information for the species. Between 2014 and 2015, one individual was rescued and eight individuals were captured. Of these nine condors, six have satellite trackers, and three have wing bands. Preliminary data from these condors show that they also spend most of their time outside protected areas. Satellite tracking has revealed more than 200 roosting sites, when previously only 30 were known, allowing a then-planned national census using known roosting sites (Naveda-Rodríguez *et al.* 2016).

Fausto Sáenz highlighted that while telemetry is mainly used to learn about habitat use and how species moves, it can also provide other valuable information. For example, telemetry identified the first active Andean condor nest in Colombia involving wild animals since 1968. Ecological niche modeling, more clearly established the geographic distribution of condors and predicted the possible effects of climate change.

Finally, Pablo Alarcón introduced the different tools available to analyze telemetry data and detailed two types of transmitter programming for documenting the home range of the species: one taking data once an hour, and the other taking data every 15 minutes.

Home ranges can be characterized using three different methods: 1) Minimum Convex Polygon, which treats each point in the same way; 2) Kernel Density Method, which still treats each point as independent, but based on the intensity of use; and 3) Brownian Bridge Movement Model, which uses points and their correlations in time to generate probability distributions based on the observed use by the animal. Other methods like the random walk statistical model and the behavior reference model were discussed and a recommendation to the Noelia Volpe website: <https://sites.google.com/site/gisanimalspaceuse/home>.

Environmental education

Sandra Gordillo presented environmental education as a strategy for Andean condor conservation at a regional scale and in a multicultural space. The *Cóndor como Patrimonio Natural y Cultural* project (COPANACU) began in 1998, aiming to promote condor conservation by recognizing the species as a component of cultural identity in the local communities of Córdoba, Argentina. The project's logic comes from the affirmation that *"the root of many of the problems that society faces are related to the loss of a fundamental connection between human and its cultural-natural environment"*, and involves elaboration of curriculum material, published books, and workshops with children and teachers, lectures, and communication campaigns.

Finally, Vanesa Astore highlighted the importance of implementing transversal environmental education programs to promote the participation of local populations Andean condor rearing and release programs. Local schoolchildren become guardians of the condors by incorporating natural history into their curriculum and participation in liberation ceremonies.

Research Priorities Identified in Resulting Symposium Discussions

During discussions following the presentations, experts at the workshop identified the following research priorities for Andean condor conservation efforts:

- Censuses and demographic studies to validate on the ground the important areas for condor conservation and determine Andean condor population status
- Identification and characterization of the principal causes of condor deaths in each country, particularly in the northern portion of the range
- Determination of survival rates and reproductive success across the region
- Additional studies regarding Andean condor use of space, seasonal movement and foraging ecology in areas that are geographically complimentary to the handful of existing studies, would massively enhance our understanding of Andean condor ecology and also help further document and identify movement between countries
- Mapping roosting and nesting sites and characterizing their use
- Further documentation of the ecological importance and role of Andean condors as scavengers
- Impact of habitat loss for Andean condor populations with an emphasis on urban and agricultural expansion
- Social diagnostic studies regarding community perceptions of Andean condors, prioritizing areas where Andean condor human-wildlife conflict is relevant, as well as Peruvian communities that practice *Yawar* Fiesta
- Implementation of the Studbook in *ex situ* projects and exploration of how to apply them in *in situ* projects
- Apply a one health approach in order to understand better the animal, diseases risks, and monitor potential zoonosis.

Inputs for a Regional Action Plan for Andean Condor Conservation

Two work sessions were put together to generate inputs for a regional action plan for Andean condor conservation. The first focused on guidelines for the plan—the results of which were written up by Renzo Piana, from the Asociación para la Conservación de la Cuenca Amazónica (ACCA) (Annex III). The second important input was the identification of key messages and audiences for the development of environmental education programs for the species. Celeste Condor was in charge of putting together this input (Annex IV).

Standardized Methodology for a Regional Census

At the first International Andean Condor Congress (Argentina, November 2014), one of the identified priorities was the development of a standardized methodology for a regional census. To achieve this objective in Lima, Sergio Alvarado (Chile) led a discussion regarding statistics and methodology that highlighted the differences in the ecology, capacity and available resources of each country. The discussion points were as follows:

- Theoretical framework: Complete censuses are virtually impossible, and as such the objective is to achieve a trustworthy estimate for the condor population in its entire distribution.
- Data collection: Study area will be divided up into cells, which will then be filled in with presence, absence, or unknown regarding the condor's status in that cell. The last condition, "Unknown," could refer to places where the condor has historically been known to occur, but with no recent sightings. These cells will be established based upon the information and maps resulting from the RWPS exercise.
- Census temporality: A full week should be allowed for simultaneous census efforts

throughout the range, considering climatic and logistical factors and impediments.

- Sample duration: Each country has the responsibility to decide how long to stay in each sampling point. For example, in Argentina the field team can stay at a point for 30 minutes and then move on to the next point, 20 km from the original point. This approach can work in places where condor populations are healthy, but in other places, sufficient sampling could take days.
- Population data analysis: Other forms of data collection on populations (for example, through the monitoring of roost sites) are important, but the ways in which these data are analyzed are dissimilar to that of census data.
- Standardization: It is important to have continuity in the basic study design so that it can be implemented through time, and thus detect population trends.
- Field optimization: It is important to predetermine cautiously what additional data could be recorded in order to take advantage of the fieldwork.
- Technological support: The support of innovative technology is fundamental.
- Other sources of information: eBird platforms are a good departure point to collect presence data from a variety of sites, but the information gathered through these tools can be very biased since there is not a prevalent bird watching culture in the condor distribution. This only highlights the necessity for a simultaneous, systematic census.
- Photographic registry: If possible, photographic records before and during the census could refine the methodology for identification of condors and population estimates.

- Other matters: As a long-term plan, it is recommended to build capacities of park rangers and other allies so that census efforts in the future are more complete.

Sergio Alvarado and Víctor Escobar agreed to design a methodology based around an escape radius of 1 km and stratified sampling, keeping in mind what is known regarding condor movement. The methodology will be applied in a case study in Chile and results will be shared with representatives in each country for potential replication.



Víctor Escobar





Alejandro Kusch/WCS

National Plan for Andean Condor Conservation in Peru

The Forestry and Wildlife Service (SERFOR) and the Ministry of the Environment (MINAM) carried out three workshops held in Cusco and Lima in 2013 to develop the National Plan for Andean Condor Conservation in Peru. The plan was elaborated with the participation of academic institutions, non-governmental organizations, and representation from national and regional governments. The national goals considered in this plan by 2025 are:

- The realization of a national census of the Andean condor in Peru, and design and implementation of a population monitoring plan and related research,
- 100% of rehabilitation and captive centers have an adequate management and care of Andean condors in their facilities.

The action strategies in the plan respond to specific objectives that aim to diminish hunting and illegal capture of Andean condors, reduce the number of deaths due to direct and indirect threats, carry out research on identified priorities such as threats to species survival, and guarantee that the Andean condors in captivity receive appropriate care and management. These specific actions are:

- Reduce hunt, capture, commercialization, and trafficking of Andean condors,
- Raise awareness regarding the cultural and ecological importance,
- Develop communication materials promoting the conservation of Andean condors,

- Conserve and maintain Andean condor habitat and populations,
- Carry out prevention outreach campaigns with local authorities regarding the negative consequences of the use of poison,
- Raise awareness regarding Andean condor behavior as a scavenger,
- Identify intoxication sources, including lead and other heavy metals, and document their effect on Andean condors,
- Identify threats to Andean condor habitat,
- Carry out research regarding food sources and availability for the Andean condor,
- Generate information regarding captive management with the objective of establishing protocols and rearing programs.

On May 9th 2015, the last day of the II International Symposium on the Andean Condor, this plan was approved, when the Executive Director of SERFOR, Fabiola Muñoz Doderó, signed the Executive Directive Resolution N° 063 - 2015 -SERFOR/DE. The approved ten-year plan will be implemented to achieve the general objective of mitigating threats and promoting the conservation of the Andean condor and its key habitat in Peru. The implementation of this plan at a national level will be coordinated by SERFOR, with the participation of the National Protected Areas Service (SERNANP), MINAM, the Ministry of Culture, the National Service for Agricultural Health (SENASA) from the Ministry of Agriculture, the Ministry of Health (MINSA), the Technical Administrative Forestry and Wildlife Offices (ATFFS), Ministry of Education, Ministry of External Commerce and Tourism (MINCETUR), universities and research centers. The ATFFS will coordinate the implementation of the plan at a regional level with the participation of regional governments, local

governments, NGOs, captive rearing and rehabilitation centers, and the Peruvian National Police (PNP). The Ayacucho and La Libertad regional governments and Forestry and Wildlife Regional Authorities (ARFFS) will directly coordinate the implementation of Andean condor conservation actions where functions are transferred as part of the decentralization process.

Andean Condor Range Wide Priority Setting Exercise

Methodology

General Approach

The Range-Wide Priority Setting Methodology was developed by the Wildlife Conservation Society in response to the need to systematize scarce and usually dispersed data regarding the global distribution of threatened wildlife species in order to make informed management decisions regarding their conservation (Sanderson *et al.* 2002). Conceptually the methodology is essentially an expert driven opinion on where the most important conservation sites are for a given species, but based on a current spatially explicit analysis of systematized distributional data for the species. To date the methodology has been successfully used to systematize data for the following species: jaguar (Sanderson *et al.* 2002; Marieb 2007), American crocodile (Thorbjarnarson *et al.* 2006), white-lipped peccary and lowland tapir (Taber *et al.* 2009) and Andean bear (Wallace *et al.* 2014) in Latin America, and bison in North America (Sanderson *et al.* 2008), and eastern chimpanzees in Africa (Plumptre *et al.* 2010).

The basic conceptual steps to this methodology are as follows:

1. Systematize existing public information on the distribution of the species,
2. Request a community of experts to provide updated and/or unpublished information on the distribution of the species in a spatially explicit manner,
3. 3) Consult a community of experts on the threats facing the species across its range,
4. Request experts to identify the most important Conservation Units or conservation strongholds for the species across its range as a function of population sizes,
5. Gather information and provide first spatially explicit drafts of distribution (historical range & current range), threats and conservation units for the species,
6. Bring together contributing experts to review and improve drafts of distribution (historical range & current range), threats and conservation units for the species, and make decisions regarding priority conservation actions,
7. Complete write-up and analysis of results for publication and decision-making use in the future.

The following are some of the key definitions of the Range-Wide Priority Setting Methodology:

Area of Knowledge: Areas where experts are able to express opinion about the presence or absence Andean condor.

Locality Records: Localities where Andean condor surveys have been conducted in the last 20 years including dates, results, type of land use, and type of records.

Potential Range or Historical Range: Areas where Andean condors may have existed in the last 100 years.

Proposed Actual Distribution: Areas (polygons) where experts believe the Andean condor has occurred in the last 20 years.

Andean Condor Conservation Units (ACCU): Areas important for the long-term conservation of the Andean condor divided into two types with details on current threats:

- Type I: population resident and stable,
- Tipo II: población residente, pero bajo amenaza.

The areas with and without knowledge of the condor, and the historical distribution of the condor will allow us to focus our exploratory research and future reintroduction, thereby, minimizing the areas where we don't know anything about condors to better inform decision-making. The actual distribution map and the ACCUs will help us optimize financial resources and capacities to conserve the most important places for the species.

Pre-Workshop Methodology

In the case of the Andean condor, data collected and systematized prior to the workshop came from four main sources: i) a thorough literature review conducted by WCS between 2014 and 2015; ii) interviews carried out in 2009 and 2010 by WCS and the Cayetano Heredia Peruvian University in Bolivia and Peru (Wallace *et al.* 2015); iii) data downloaded from eBird up to March 2015; and iv) the information solicited from the experts from different countries (see participant list). For the latter, using models previously designed for jaguars (*Panthera onca*; Sanderson *et al.* 2002), white-lipped peccaries (*Tayassu pecari*; Taber *et al.* 2009), lowland tapirs (*Tapirus terrestris*; Taber *et al.* 2009), and Andean bears (Wallace *et al.* 2014) we developed three specific questionnaires for the Andean condor (see Appendices V-VII):

- Questionnaire A: Andean condor localities in the last 10 years,
- Questionnaire B: Threats to the conservation of the Andean condor across its distribution,
- Questionnaire C: Andean Condor Conservation Units (ACCU).

Once these questionnaire forms, along with an explanation document, had been revised by a small committee of Andean condor experts we sent the forms to recognized Andean condor experts. Identified people also received the explanation document, as well as maps of their country in GoogleEarth™ format as an additional tool with which to draw polygons and/or place distribution points.

Over a period of three months we awaited reception of responses to the questionnaires. As data came in from different respondents we then processed this information into one overall GIS and associated databases for Andean condor.

Once the reception period closed in March 2015, we then assessed which of the respondents we could invite to the workshop to be held in May 2015 in Lima, Peru. The selection of workshop participants was based on a) budget constrictions, b) geographic coverage of Andean condor across their range, c) participant availability, d) the amount of data provided by each respondent, and e) the particular interest of the Peruvian government through the SERFOR and MINAM offices.

Andean Condor Range Wide Priority Setting Exercise Workshop Objectives

The 2-day RWPS workshop in Lima had the following objectives:

- Update distributional knowledge of the Andean condor across the range and analyze the connectivity of identified populations,
- Evaluate the conservation status of the Andean condor across the range through identifying ACCU (Andean Condor Conservation Units) and analysis of habitat integrity,
- Determine priority conservation areas for the Andean condor across the range,

- Develop a working group for the Andean condor across the range,
- Identify and prioritize concrete and local investigation and conservation actions that will also contribute to the conservation of the Andean condor.

Workshop Methodology

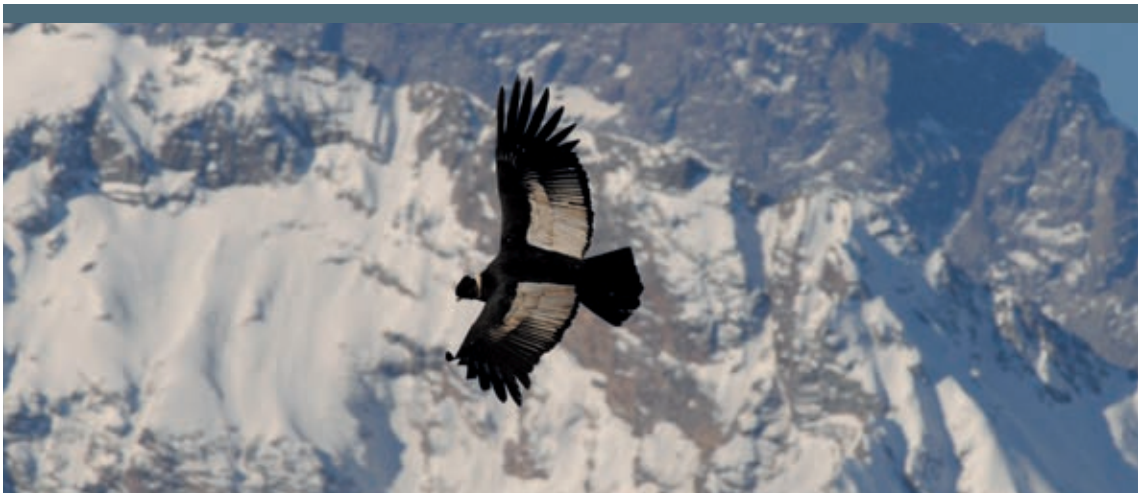
In Lima, workshop participants were placed into seven geographical groups to identify different aspects of the state of the condor: i) historic distribution; ii) actual distribution; iii) places where experts had knowledge of the condor; iv) places where experts did not have knowledge of the condor; v) most important threats; and vi) Andean Condor Conservation Units. There were many Peruvian participants at the workshop, and so the group was divided into a northern and a southern geographic group, and as such the working groups were: (1) Colombia and Venezuela; (2) Ecuador; (3) Northern Peru; (4) Southern Peru; (5) Bolivia; (6) Argentina; and (7) Chile. Using printed map material, digital versions in portable computers and the definitions detailed above, each group was asked to review the historical range draft maps, then the current distribution and knowledge maps, and finally the

proposed Andean Condor Conservation Units. Groups were asked to work in the order requested and clearly mark changes on the printed satellite image maps with populations and thoroughfares included, and/or digital versions in kmz format (Google Earth™).

The groups were also asked to revise and fill in the corresponding digital questionnaire forms (Appendices IV, V, VI), so that detailed data for each record and/or polygon could be included in the Table of Attributes of the Geographic Information System. Each group elected a secretary to record the decisions and progress of the working groups. Upon conclusion the geographic working groups reported back to each other, which was particularly important from the perspective of a number of transboundary areas.

Post-Workshop Methodology

After the workshop the maps were digitized and modified according to the corrections and proposals of the workshop participants and decisions. Subsequently, we sent the modified historical range map to the participating Andean condor experts. Finally, we sent the draft version of this document to all authors for comment and analysis and revised this document according to responses from 33 of 38 contributing authors.



Victor Escobar



Thomas Kramer

Andean Condor Range Wide Priority Setting Exercise Results

Historical Range of the Andean Condor

Participants at the workshop redefined the historical range of the Andean condor using a base map for the historical range (Fjeldsa & Krabbe 1999: Figure 1). Geographic working groups worked independently to redefine the map for each country and then met to discuss results, which was especially important for a number of border areas across the range (Figure 2). Overall, the expert driven revision of the Andean condor historical range resulted in a polygon of 3,230,061 km².

Andean Condor Distribution Points

In Bolivia and Peru, a previous questionnaire-based study developed by WCS and the Cayetano Heredia University systematized Andean condor data from published sources (n=633 localities) and knowledge from experts and some park guards or specific protected areas in both countries (n=157 localities; Wallace *et al.* 2015). A geographic extension of the literature reviews to include the entire historical distribution resulted in a total of 928 data points as a baseline prior to the workshop. Andean condor experts attending the Range Wide Priority Setting Exercise provided an additional 793 data points for inclusion in the overall database.

A major source of information resulted from eBird, and by May 2017 after filtering duplicate points from the existing database, amounted to 8,277 additional data points on Andean condor distribution. Table 1 summarizes the number of data points per country in the overall database of 9,998 data points for Andean condors, as well as overall distribution point density considering the size of the Andean condor's historical distribution in each country (Figure 3).

Figure 1. Baseline Andean Condor Historical Range (Fjeldsa & Krabbe 1999)



Figure 2. Revised Andean Condor Historical Range



Table 1. Andean Condor Distribution Points by Country

| Country | Historical Andean Condor Distribution Size (km ²) | % Historical Range | # Distribution Points used in RWPS | Distribution Point Density (Points per 1000 km ²) |
|--------------|---|--------------------|------------------------------------|---|
| Venezuela | 17.656 | 0,55 | 12 | 0,7 |
| Colombia | 129.867 | 4,02 | 222 | 1,7 |
| Ecuador | 53.831 | 1,67 | 1.163 | 21,6 |
| Perú | 529.097 | 16,38 | 939 | 1,8 |
| Bolivia | 366.092 | 11,33 | 1.181 | 3,2 |
| Chile | 751.481 | 23,27 | 3.863 | 5,1 |
| Argentina | 1.382.037 | 42,78 | 2.639 | 1,9 |
| Total | 3.230.061 | 100 | 9.998 | 3,1 |

The number of distribution points for each country ranges from just 12 points in Venezuela, the northern distributional extreme, to 3,863 distribution points in Chile in the southern extreme of the Andean condor distribution (Table 1).

However, there is notable variation in the portion of the historical distribution range in each country which ranged from 0.55% in Venezuela to 42.78% in Argentina, with the southern portion of the historical range in Argentina and Chile accounting for over 66.05% of the overall revised historical range, the central portion in Peru and Bolivia representing almost 28%, and the northern portion of the range in Colombia, Ecuador, and Venezuela accounting for just 6.24% of the revised historical range (Table 1).

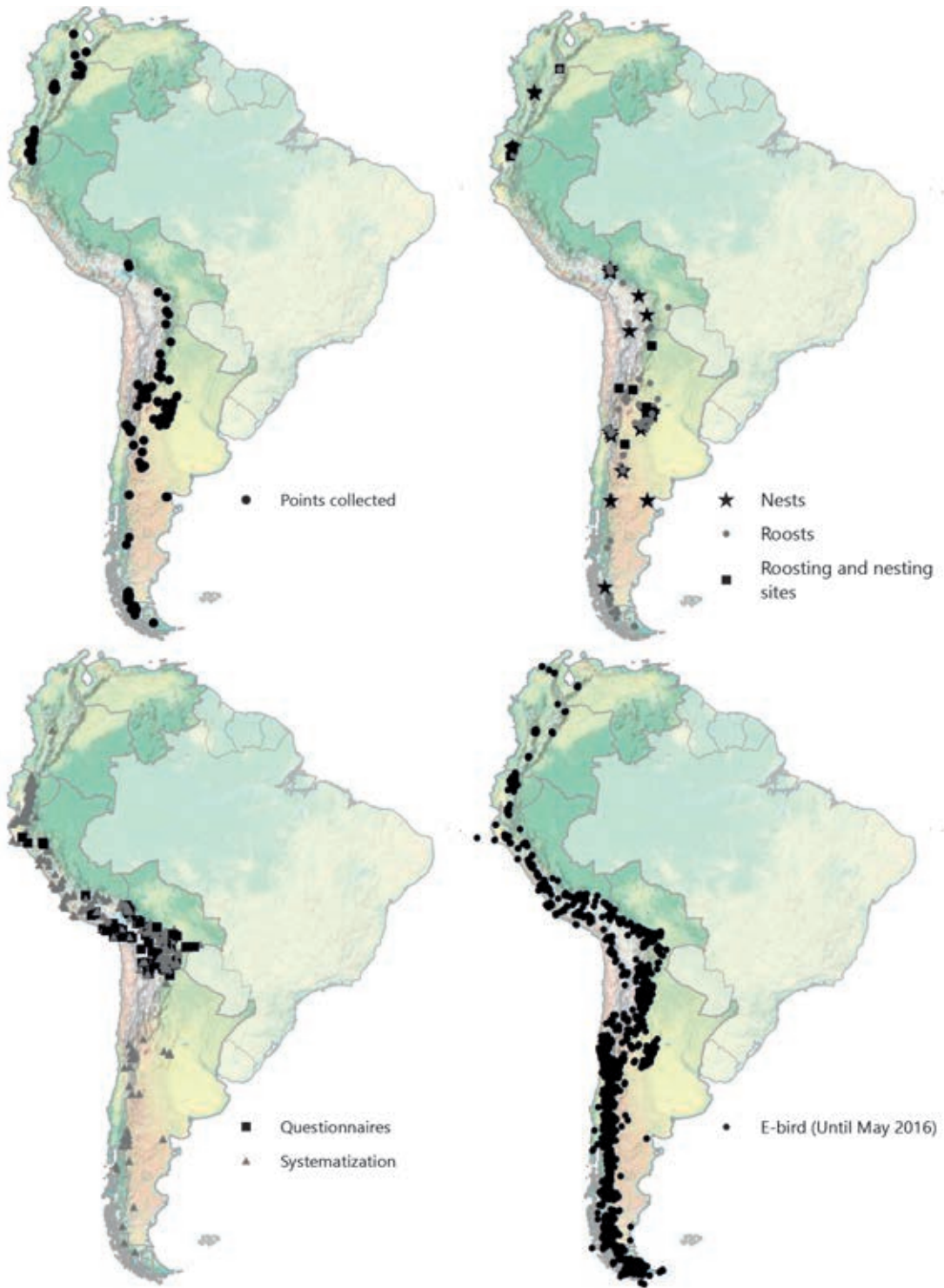
We therefore calculated a standardized distribution point density expressed as the number of distribution points per 1,000 km² (Table 1), revealing a remarkably

low density for Venezuela (0.7 distribution points per 1,000 km²), and a conversely remarkably high distribution point density for Ecuador (21.6 distribution points per 1,000 km²). Otherwise distribution point density was fairly consistent across the countries in the rest of the range (1.7 – 5.1 distribution points per 1,000 km²).

Given the huge influence of eBird data for the Andean condor distribution points (82.8% of systematized points), the high distribution point density in Ecuador may reflect high tourism visitations from natural world enthusiasts related to the Galapagos Islands destination.

The map of distribution points (Figure 3) reveals a virtually continuous distribution for the Andean condor in Argentina, Chile, Bolivia, Peru and Ecuador, with the distribution points then breaking up in Colombia and Venezuela.

Figure 3. Distribution of Confirmed Andean Condor Localities



Areas Identified With and Without Andean Condor Expert Knowledge

The Range-Wide Priority Setting methodology identifies areas where knowledge exists for a species across its distribution, and also recognizes areas where knowledge is lacking or absent, thereby ensuring that the expert community and the resulting dataset distinguishes between a lack of knowledge versus at least some knowledge for a given area (Wallace *et al.* 2014). This distinction allows the identification of large and potentially important conservation areas for basic surveys for the target species.

Andean condor experts detailed areas with (Figure 4) or without (Figure 5) expert knowledge. Unsurprisingly, the polygon areas with knowledge across the Andean condor distribution largely reflect

the known localities detailed in Figure 3. Overall, experts expressed knowledge about 65.79% of the Andean condor revised historical knowledge when including areas where Andean condors are now considered absent (Table 2). Experts considered 34.21% of the historical range as areas without expert knowledge (Table 2).

Andean Condor Extirpated Areas

Nevertheless, in a fascinating demonstration of the relevance of citizen science, the dominant eBird dataset also provided presence data for large portions of the range without expert knowledge or expert derived distribution points.

Table 2. Andean Condor Expert Knowledge Across the Revised Historical Range

| Polygon | Total Area (km ²) | % Historical Range |
|---|-------------------------------|--------------------|
| Historical Andean Condor Range | 3.230.060,77 | 100 |
| Area with Expert Knowledge | 1.888.923,66 | 58,48 |
| Area without Expert Knowledge | 1.105.124,94 | 34,21 |
| Area Where Andean Condors No Longer Exist | 236.012,55 | 7,31 |

Figure 4. Areas With Expert Knowledge for Andean Condor



Figure 5. Areas Without Expert Knowledge for Andean Condor



Figure 6. Areas where Andean Condors no longer occur





Threats to the Andean Condor in the 21st Century

During the Range Wide Priority Setting Exercise for the Andean condor, participants worked together to identify the most important threats along the distribution range. Current threats to the Andean condor are diverse, and it is important to note that not all have been documented properly. Seven threats were prioritized as the most important and analyzed: Habitat Conversion, Hunting, Lead Contamination, Carcass Poisoning, Competition with Free-ranging Dogs (domestic and feral), Lack of Carcasses, and Use in Folkloric Rituals and Crafts.

Habitat Conversion

The loss and degradation of Andean ecosystems, in particular, deforestation and *paramo* burning in the high-altitude cloud forests of the Eastern Andes associated with the expansion of the agricultural frontier, but also mining and urbanization, can have an impact on Andean condor populations. As a wide ranging, soaring bird, habitat destruction may not be as devastating as for more terrestrial wildlife species, however, degradation of nesting and roosting sites, and significant reductions in the food availability (see Lack of Carcasses section below), probably seriously affect habitat suitability for condors.

A very specific example of how Andean condor habitat can be affected by development, is this threat posed by electrical and telecommunications infrastructure, especially the power and telephone cables and towers spreading across the landscape. Until recently there had only been anecdotal reports of Andean condor collisions in flight with cables. However, in November 2017 a juvenile was filmed colliding with an electrical cable in Sondondo valley, Ayacucho, and in March 2018 another juvenile crashed with a steel cable in the Colca Canyon in Arequipa. Both areas are considered of high conservation priority for the species in Peru (Piana & Angulo 2015).

Hunting

Historically, from the 1920's to the 1940's, the Autonomous Guano Company implemented a policy to exterminate species that were perceived to negatively impact guano production on the coastal islands of Peru, including the Andean condor (Cushman 2005). Hunting has also been reported in the Sierra de las Quijadas National Park, San Luis, Argentina.

The expansion of livestock – particularly bovine – in the eastern Andean slopes is also a source of conflict with local communities, which see the Andean condor as responsible for a percentage of their livestock's mortality (Nallar *et al.* 2008; Zapata *et al.* 2012). For years many experts rejected the condor's responsibility in the death of these domestic animals, however there are now unpublished observations where condors have killed calves in Bolivia (Ninón Ríos pers. comm. 2005) and Ecuador (Hernán Vargas pers. comm. 2012) by pecking them in the anus, eyes, and tongue. This behavior has led to the persecution hunting of condors, for example, in June 2014 an adult male died from gunshot wounds in Nazca, Peru, and later the same year an adult female head was on sale at the market of Chiclayo, Peru.

Lead Contamination

Another important threat to Andean condors is lead poisoning (Jácome & Astore 2016). In the Córdoba Province in central Argentina pigeon hunting is an increasingly important activity. It is estimated that approximately 1,600 tons of lead are fired annually and that thousands of lead contaminated pigeons remain in the field, and are available to be eaten by other species (Gordillo 2008). Coria (2007) conducted an evaluation of bird hunting in the Bañado del Río Dulce in northeastern Córdoba, where the annual activity is widespread and practiced by local people and foreign hunters brought by companies. Although Córdoba has legal instruments to promote the sustainability of waterfowl hunting in these wetlands, the main deficiencies are a lack of regulations for international hunting tourism, and population monitoring that evaluates the effects of hunting on wild bird populations. The magnitude of illegal hunting is unknown, and furthermore there is no restriction on the use of lead ammunition by hunters. Therefore, lead poisoning could affect Andean condor conservation in Córdoba and its relevance should be investigated in greater detail.

Another problem is the illegal hunting of guanaco with lead shells, representing a deadly threat to animals that ingest carcasses with lead debris. Gargiulo (2014) registered four dead condors in the Quebrada del Condorito National Park, Córdoba, and two of the specimens contained high concentrations of lead (19 and 32 ppm) in the bones, indicating that they were exposed to lead for prolonged periods. Lead contamination has also been registered in wild Andean condors in Northern and Southern Patagonia (Lambertucci *et al.* 2011; De Martino *et al.* 2011), and in birds under rehabilitation from Argentina in general (Wiemeyer *et al.* 2017).

Carcass Poisoning

At the time of the workshop there were already some reports of poisoning of Andean condors as an apparently unintended consequence of efforts to illegally control wildlife predators associated with more frequent livestock losses, specifically Andean foxes (*Pseudalopex culpaeus*) and puma (*Puma concolor*). Livestock carcasses were baited with poison and consumed by predators and scavengers, including Andean condors. In July 2013 four Andean condor adults (two males and two females) with intoxication symptoms were found in upper Santa Eulalia River, near Lima, and successfully treated. Of these, two adult males were released with satellite transmitters and provided information on spatial movements and habitat use in Peru (Piana & Vargas 2018).

On the 16th May, 2017 the Ayacucho regional government reported the death of six condors in the Sumbilca sector, Querobamba district, Sucre Province, that were presumed poisoned together with a mountain caracara (*Phalcoboenus megalopterus*). Necropsies were performed on the five adults and toxicology results were negative for organophosphates, carbamates and pyrethroids, however, the decomposed state of the cadavers may have compromised the tests. Subsequently, the Ayacucho regional government stated that the condors were collateral damage in the poisoning of a carcass by local communities in order to eliminate a problem puma (*Puma concolor*).

Worryingly, since the workshop this threat is becoming increasingly evident with recent prominent cases in Argentina and Ecuador. As Andean condors are social animals, a single poisoned carcass can kill dozens of individuals, and therefore, have a significant impact on local populations. Illegal poisoning of livestock cadavers with toxic pesticides caused significant Andean condor deaths in Jujuy, Argentina, where 19 dead specimens were found in 2017, and in Mendoza,

Argentina, where 34 condors were killed in 2018, greatly affecting the conservation status of the species (Alarcón & Lambertucci 2018). Toxicological studies by the Bioandina Argentina Foundation through the PCCA demonstrated the illegal use of carbofuran, a powerful pesticide that endangers all life forms, including human health (Estrada *et al.* 2020). It is likely that many isolated deaths of fewer individuals go unnoticed.

In La Rioja, the creation of the Talampaya National Park decreased the use of strychnine baits to kill foxes, and thus the chances of scavenger poisoning deaths.

Competition with Free-ranging Dogs

An emerging threat for the Andean condor is the loss of potential carrion due to food competition with free-ranging dogs, both domestic and feral, first documented in the Apolobamba region of Bolivia (Aliaga-Rossel *et al.* 2012), and later confirmed during as more widespread censuses across the country and in Ecuador (Mendez unpublished, Vargas *et al.* unpublished). When dogs arrive at carcasses they drive Andean condors and other wildlife away, and feral dogs are a widespread phenomenon in the Andes.

Feral dogs have been found throughout the condors' range in Ecuador. Camera trap data, field expeditions and talks with local park guards demonstrate that dogs are present everywhere in the Andean condor habitat. Data from Zapata-Ríos & Branch (2016, 2018) reveal that dogs negatively influence the presence of all native mammal species in the country. Vargas *et al.* (unpublished data) found feral and domestic dogs present in every *paramo* where they have used camera traps.

Dogs have become a conservation, animal welfare, and public health problem in vast areas of the Ecuadorian highlands, as a result of human

population growth, poor waste management practices, absence of responsible dog ownership, and low awareness of zoonotic disease issues. In the Ecuadorian Andes, occupancy rates of dogs were the most important predictors of occupancy of four Andean carnivores (puma, Andean fox, Andean bear, and striped hog-nosed skunk) across a study area that spanned 2,000 km² (Zapata-Ríos & Branch 2018). In addition, in areas of the Ecuadorian Andes, where human impacts are very low, four native mammal species (mountain coati, mountain paca, long-tailed weasel, and northern pudu) have been extirpated in areas where feral dogs are abundant, and six others showed significantly reduced relative abundance compared to areas without dogs (puma, Andean fox, Andean bear, striped hog-nosed skunk, mountain tapir, and little red brocket deer). Furthermore, the presence of dogs altered significantly the activity patterns of three species (Andean bear, mountain tapir, and little red brocket deer). The increasing number of dogs in wilderness areas have varied and complex ecological effects, influencing community dynamics in innumerable ways, including direct and indirect effects that could cascade down several trophic levels (Zapata-Ríos & Branch 2016).

Lack of Carcasses

Depletion of food availability is a threat and was mentioned as particularly relevant in the southern portion of the range. In Ecuador, where the main food for Andean condors is cattle, the government is eradicating this exotic species from the highland ecosystems in order to protect water sources (Vargas *et al.* unpublished data). Condors have not been recorded feeding on native mammals, and are completely dependent on cattle as food source since their introduction over 500 years ago. This situation poses conservation challenges for condors in Ecuador.

Other potential threats include poisoning with lead as result of scavenging on carcasses of wildlife shot by sports hunters. In recent years, the PCCA have received cases and this is now the second most

frequent cause of incoming rescued condors to the Rescue and Rehabilitation Center.

Use in Folkloric Rituals and Crafts

Three folkloric rituals in Peru were identified as threats to the species: Yawar Fiesta (Apurímac and Ayacucho), Danza de Huaylilas (Huancavelica and Ayacucho), and the Carnaval Dance (San Antonio de Putina, Valle de Sandia, Puno). Historically, the Cónдор Rachi is a traditional fiesta from the Peruvian central Andes until the 1970's. A condor was placed on a wooden arch and then repeatedly hit until dead by people on horseback (M. Stucchi com. pers.).

Piana (2014) indicated that "At multiple locations in the Cuzco, and especially Apurímac, regions in southern Peru, a number of Andean condors are captured alive by locals for the bull runs in a celebration called "Yawar Fiesta" or Toro Pukllay (Affentranger 2005). Andean condors are captured by placing bait at locations which prevent rapid escape after eating, and then taken to the bull run locations where they are held in poor conditions for a few days. At the events the Andean condors are tied to the back of feral bulls which are then released into the town plaza. After about 20 minutes of the bull running and jumping around the plaza, the Andean condors are released by the local people. Many condors probably die in the ceremony, and even survivors may die later in the wild. Currently, no information is published about the number or age of Andean condors captured, nor subsequent survival rates. Thus, the impact of this practice on the population is unknown, although suspected mortalities are high".

Piana (2019) estimated the number of Andean condors used in Yawar Fiesta between 2000 to 2015, after reviewing 31 different videos available on Youtube. Celebrations were held at 12 different localities in the southern Peruvian Andes: ten in Apurímac, one in Ayacucho (Querobamba District, Sucre Province) and one in Huancavelica (Lircay District, Angaraes Province). A total of 40 different Andean condor individuals were used in 27 Yawar

Fiesta celebrations. In Apurimac, 28 Andean condors were used in celebrations in Cotabambas Province, seven in Aymaraes Province and two in Antabamba Province. Of all identified Andean condors, 14 were males (5 adults, 9 juveniles) and 20 were females (9 adults, 11 juveniles). Four individuals were either killed or seriously injured. Three individuals received minor injuries after hitting the bullring walls while strapped onto the bull.

Finally, even though the Andean condor is a sacred symbol for Andean cultures, there are records of condors being killed for use as adornments for traditional clothing in folkloric dances in Bolivia, such as Tobas, Tinkus, and Suris Sicuris (Balderrama *et al.* 2009), and more recently in Peru in Sondondo in Ayacucho. Meanwhile, in Peru the trade in feathers and other Andean condor parts was documented in Cuzco (Williams *et al.* 2011), apparently as elements in spiritual ceremonies, although the scale of the problem is unknown.

Other Threats to the Andean Condor

Other known causes of death include road kills in the Talampaya National Park, La Rioja, Argentina. For example, mammalian road kills on National Route 76, which links the city of La Rioja with Pagancillo and Villa Unión, represent a source of food for scavengers such as condors, but also constitutes a threat as condors are exposed to road kill while feeding (Gargiulo 2014).

In central Argentina, there are no formal records on captive condors as pets, but it is known to occur. A photographic record from Cuchi Corral, La Cumbre, where an adult male condor has a rope around his right leg cannot be verified as it is possible that it has been accidentally entangled.

In Northern and Southern Patagonia, the possible threat of tourism approaches to Andean condor nests has been registered (Lambertucci & Speziale 2009). In addition, condors killed by collision with power lines have been registered (Alarcón & Lambertucci 2018, unpubl. data).



Hernán Vargas





Description of Priority Andean Condor Conservation Units (ACCU) and Country Summaries

For each of the seven range countries, here follows a section that describes the state of knowledge for each country and a more detailed description of areas with and without knowledge, and especially the expert identified Priority Conservation Units for the Andean condor.



Diego Méndez



Robert Wallace/WCS

Distribution and Ecology

The natural history of the Andean condor in Venezuela is unknown. The status of the Andean condor as a resident species in Venezuela has been questioned by the ornithology community. Aguilar (2000) considers this species as an occasional visitor since there are no biological, archeological or anthropological records breeding for the Andean condor in the Venezuelan Andes.

More recently, Naveda-Rodríguez (2015) estimated an extent of occurrence and area of occupancy for the Andean condor in Venezuela of 16,544 km² and 6,566 km², respectively, with distribution areas confined to the Cordillera de Mérida and the Sierra de Perijá.

Population Size

The population size of the Andean condor has been questioned in Venezuela, with no population estimates despite reintroduction efforts in the 1990's. Sharpe and colleagues (2015) estimated a minimum population size of 50 adults, however this estimate is not based on quantitative field data.

Implemented Conservation Actions

The Andean condor is classified as an endangered species in Venezuela and included on the list of species that are banned to be hunted in the country (República de Venezuela 1996a, 1996b). According to the national IUCN red list classification, the Andean condor is *Critically Endangered* based on criteria D (Sharpe *et al.* 2015) and was proposed as Vulnerable according to the IUCN criteria B (Naveda-Rodríguez 2015).

Between 1993 and 2001, 13 individuals born in the Argentinian and US zoos were liberated in the Mifafí Páramo of the Cordillera de Mérida as part of an unsuccessful reintroduction program. Venezuelan zoos have led *ex situ* reproduction efforts since 1992, with 12 individuals documented individuals currently within (eight males, four females) in four zoos.

In theory the natural protected areas are fulfilling their role of conserving Andean condor habitat in the Venezuelan Andes. Indeed, a large portion of the distribution area in the Cordillera de Mérida and the Sierra de Perijá are within the protected area system, specifically 39% and 61% of the Andean condor extent of occurrence and area of occupancy in Venezuela, respectively, are within the national protected areas (Naveda-Rodríguez 2015).

Andean Condor Historical Range in Venezuela

The historical distribution of Andean condor in Venezuela has been described based on eight anecdotal records in the country (Figure 7). Hilty (2003) summarizes the complete historical distribution in the country, which includes the Cordillera de Mérida (Lara, Trujillo, Mérida and Táchira States) and the Sierra de Perijá (Zulia State).

Areas Where Andean Condors No Longer Exist in Venezuela

Defining areas where Andean condors no longer occur in Venezuela is a major challenge due to the overall lack of records which are restricted to the Mérida and Zulia States with no contemporary records that permit verification of presence in other areas. North of the Cordillera de Mérida (Lara and Trujillo States) *páramo* areas exist, but do not offer ideal conditions for the Andean condor. Naveda-Rodríguez and colleagues (2016) modelled the distribution of the Andean condor in Venezuela and the northern *páramo* (Lara and Trujillo) had low levels of habitat suitability for the species.

Areas With and Without Expert Knowledge on Andean Condors in Venezuela

Areas with expert knowledge about Andean condors in Venezuela (Figure 8) are located in the Sierra de Perijá and the south and central Cordillera de Mérida. In addition to historical records, recent records in these areas stem from eBird. Areas without expert knowledge are restricted to the northern *páramo* of the Cordillera de Mérida in the Lara and Trujillo State (Figure 9), where no recent efforts have been made to register the species.

Priority Andean Condor Conservation Units in Venezuela

The priority Andean condor conservation units in Venezuela (Figure 10) are the same areas defined as areas with expert knowledge (Sierra de Perijá and southern and central Cordillera de Mérida). These areas are receiving more attention from ornithologists and conservationists due to recent sighting of Andean condors in these areas in 2016 and 2017.

Figure 7. Andean Condor Historical Range in Venezuela



Figure 8. Areas With Expert Knowledge on Andean Condors in Venezuela



Figure 9. Areas Without Expert Knowledge on Andean Condors in Venezuela



Figure 10. Priority Andean Condor Conservation Units in Venezuela





Thomas Kramer

Description of Priority Andean Condor Conservation Units in Venezuela

Name: *Sierra de Perijá Priority Andean Condor Conservation Unit (ACCU-VE-01: Type II).*

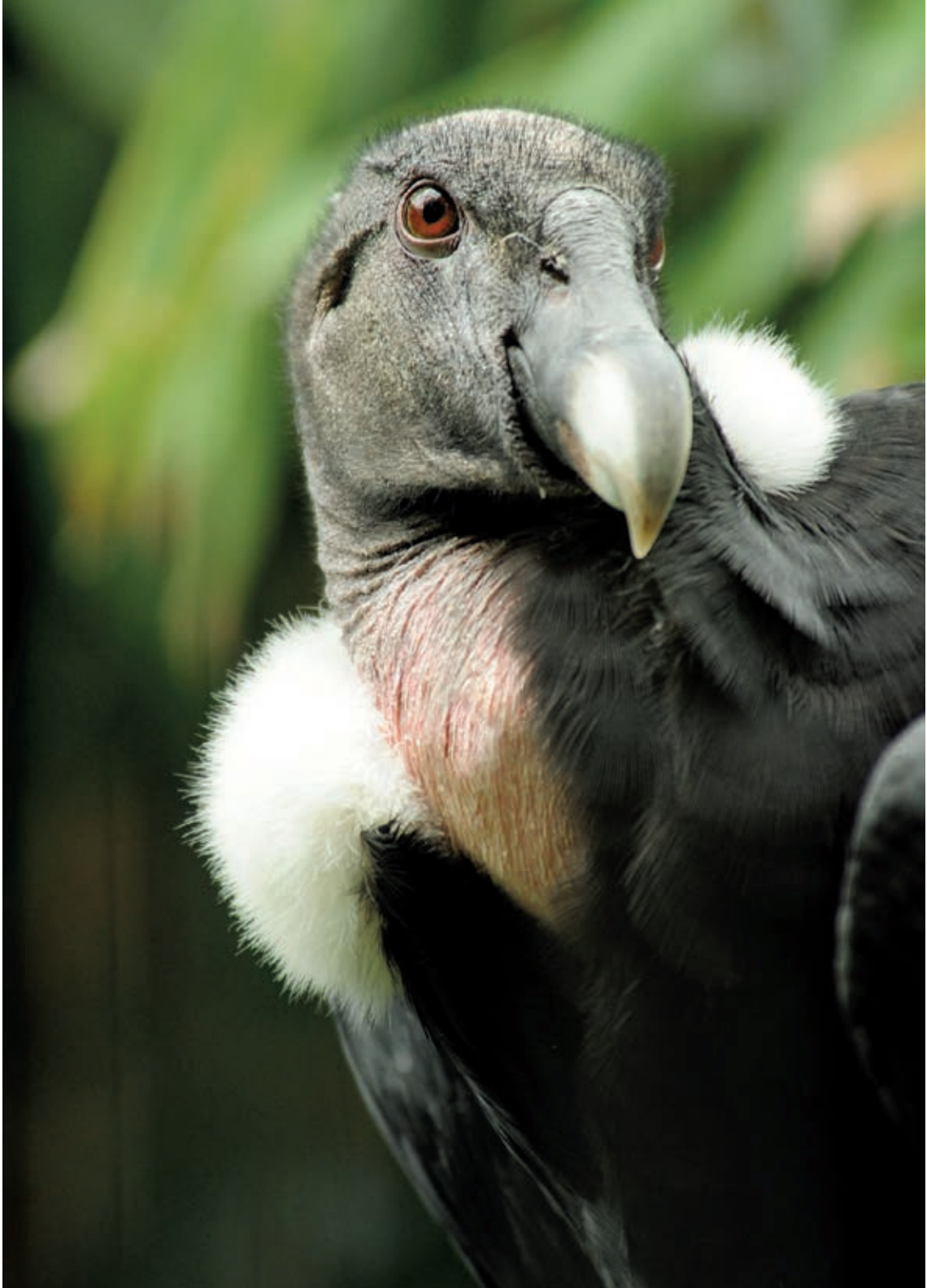
Description: The eastern slopes of the Sierra de Perijá reach elevations of more than 3,600 m a.s.l., including three major altitudinal levels: foothill forest, montane forest, High Andean vegetation, with the third dominated by grassland and shrub *páramo* ecosystems. A lack of research precludes precise altitudinal limits for each of these major ecosystems. The montane forests and *páramo* of the Sierra de Perijá occupy an area of 6,321 km², of which 38.7% (2,447 km²) is within Sierra de Perijá National Park which is suffering intense anthropogenic activities.

Name: *Cordillera de Mérida Priority Andean Condor Conservation Unit (ACCU-VE-02: Type II).*

Description: This area includes the northeastern branch of the Venezuelan Andes (40,625 km²), from the Colombian border in the Táchira State, to the Barquisimeto flatlands in Lara State. This area includes the highest altitudes in Venezuela (Pico Bolívar: 4,980 m a.s.l.) and therefore also includes the highest vegetation types in the country (up to 4,700 m a.s.l.). Climate varies according to altitude and aspect, but also according to local anomalies, such as xerophytic conditions in some inter-Andean valleys. Generally, rainfall is high, especially on the eastern slopes at medium and high altitudes.

Due to high human population densities, the natural vegetation has been eliminated across large proportions of the area. Given the biodiversity importance of this area, the preservation of the ecosystems of this region requires special attention, and to date 27% (11,009 km²) of the area is under protection from seven natural monuments and 11 national parks.





Distribution and Ecology

After a reintroduction process of more than 20 years, six nucleus Andean condor populations have successfully been established along the central and eastern cordilleras (Rodríguez *et al.* 2006). The Andean condor has recovered in part of the historical distribution and the range is currently almost continuous in northern Colombia in the Sierra Nevada de Santa Marta and the Serranía del Perijá, in the central and northern portions of the Eastern Cordillera including the páramo in the Departments of Norte de Santander, Santander and Boyacá, and around the Chingaza National Park. In the Central Cordillera and southern Colombia, condors persist in the areas where they have been successfully reintroduced in the Los Nevados and Puracé National Parks and the Chiles Indigenous Reserve in the Nariño Department (Rodríguez *et al.* 2006; Sáenz *et al.* 2014, 2016; Arango-Caro *et al.* 2016).

To date there are few studies on the ecology and natural history of Andean condors in Colombia, with the first studies published by McGahan (1972) who observed two nests in the Río Pasto canyon, describing behavioral characteristics of the species including reproductive biology and feeding habits. Unfortunately, these nests were later abandoned, probably due to the construction of the Panamericana highway, and there are no new records for this locality. The reproductive biology of the species has been more recently described through nest observations in the buffer zone of the Los Nevados National Park (Restrepo-Cardona & Betancur 2013; Restrepo-Cardona *et al.* 2018) and the Almorzadero páramo in Santander (Sáenz *et al.* 2016). Together these observations suggest that egg laying and incubation for the Andean condor in Colombia probably occurs between September and October and/or February to March.

Undergraduate and postgraduate theses have generated important information on Andean condors in Colombia. For example, Parrado (2015), studied the choice of nesting and roosting sites in the Almorzadero páramo in the northern portion of the Eastern Cordillera, suggesting that low temperature variation, distance to communities and roads, and the altitude of crags determine the selection patterns for Andean condor nesting and roosting sites.

Studies by the Fundación Neotropical (2015, 2016) in the Eastern Cordillera have demonstrated a conflict between Andean condors and local people that reside in the páramo, due to apparent predation by condors on newborn sheep and lambs. Although this behavior has not been documented yet in Colombia, this perception is shared by local people across the mountains of this region. This situation may reflect the low carrion availability because of improved sanitation and the sale of older domestic animals to local sausage factories.

Population Size

To date there have been no systematic censuses for the Andean condors in Colombia, however, some estimates for specific areas exist, as well as data on the number of condors reintroduced. Based on this data the combined wild and reintroduced Andean condor population estimate for Colombia is 130 individuals (Arango-Caro *et al.* 2016).

The scarce data regarding the population status of the species suggests that the majority of individuals are concentrated along the Eastern Cordillera and the north between the Serranía del Perijá and the Sierra Nevada de Santa Marta. The most recent studies across the country have registered 16 individuals in the Boyacá Department (Fundación Biodiversa & Fundetropico 2015). For the Almorzadero páramo in the Santander Department the estimated population is between 13 and 20 individuals in studies realized between 2014 and 2016, with a slightly adult female biased sex ratio (0.75:1) and slightly biased immature and adult ratio (0.9:1) (Fundación Neotropical 2017), and for the Los Nevados National Park: 9 individuals with 6 males and 3 females (CORPOCALDAS & FUMSOL 2008).

Implemented Conservation Actions

In the 1980's the Andean condor was in severe danger of extinction in Colombia and in response in 1989 a reintroduction process began and ran until 2013, releasing 69 individuals at eight localities distributed along the Central and Eastern cordilleras: 1. Chiles Indigenous Reserve, 2. Puracé National Park, 3. Los Nevados National Park, 4. Chingaza National Park, 5. Páramo de San Cayetano, 6. Páramo de Siscunsi, 7. Buffer zone of the El Cocuy National Park, and 8. Páramo de Belmira (although this failed and the condors were recaptured) (Rodríguez *et al.* 2006; Arango-Caro *et al.* 2016). Some regional environmental entities (CORPOCALDAS, CORPOCHIVOR, CORPOBOYACA and CAS) also developed environmental education and species monitoring efforts.

In the face of significant human-animal conflicts in the northern páramo of the Eastern Cordillera, the Fundación Neotropical in alliance with the Jaime Duque Park and the National System of Learning (SENA) developed a project to implement systems to improve sheep production. The project also promoted 12 conservation agreements with local people to protect Andean condors and their habitat into the future (Fundación Neotropical 2018).

Andean Condor Historical Range in Colombia

Historically the Andean condor was distributed along the entire Colombian Andes, principally the Central and Eastern cordilleras (Olivares 1963; Rodríguez *et al.* 2006), where a total of 20 localities have been documented (Figure 11), including the only observation along the Pacific coast of Colombia in the Tumaco municipality (Tovar 1995). Nevertheless, in the 1980's Andean condor populations had become drastically reduced and restricted to two completely separated localities, the Sierra Nevada de Santa Marta in the north and Nariño in the south on the border with Ecuador (Rodríguez *et al.* 2006).

Areas Where Andean Condors No Longer Exist in Colombia

The southeastern páramos of the extreme north of Central Cordillera were identified as an area where Andean condors no longer exist (Figure 12), despite historical records from the 1930's (Tovar 1985) and a more recent unsuccessful attempt to reintroduce the species to the area (Arango-Caro *et al.* 2016).

Areas With and Without Expert Knowledge on Andean Condors in Colombia

Although there have been recent research efforts to describe the population status and ecology of the Andean condor in Colombia, there are still large areas without knowledge. For important localities for the conservation of the species such as the Sierra Nevada de Santa Marta and the Serranía del Perijá there is no recent information on the status of the species.

The most recent studies on the species were conducted in two regions, principally the northern portion of the Eastern Cordillera (Sáenz-Jiménez *et al.* 2014, 2016; Fundación Biodiversa & Fundetropico 2015; Parrado 2015), and the Los Nevados National Park in the Central Cordillera (Zuluaga 2010; Restrepo-Cardona & Betancur 2013; Restrepo-Cardona *et al.* 2018) with some recent published reports on the border with Ecuador (Martínez & Courtalon 2016).

Priority Andean Condor Conservation Units in Colombia

In Colombia eight Priority Andean Condor Conservation Units were identified (Figure 15) spanning the length of the country: Sierra Nevada de Santa Marta, Serranía del Perijá, Páramos of the Northeastern Andes (Santurbán, Almorzadero, Cocuy National Park), Páramo Corridor (Guantiva, La Rusia, Iguaque), Chingaza National Park, Los Nevados National Park, Puracé National Park, and Chiles Indigenous Reserve and the Páramos on the border with Ecuador.

Figure 11. Andean Condor Historical Range in Colombia



Figure 12. Areas Where Andean Condors No Longer Exist in Colombia



Figure 13. Areas With Expert Knowledge on Andean Condors in Colombia



Figure 14. Areas Without Expert Knowledge on Andean Condors in Colombia

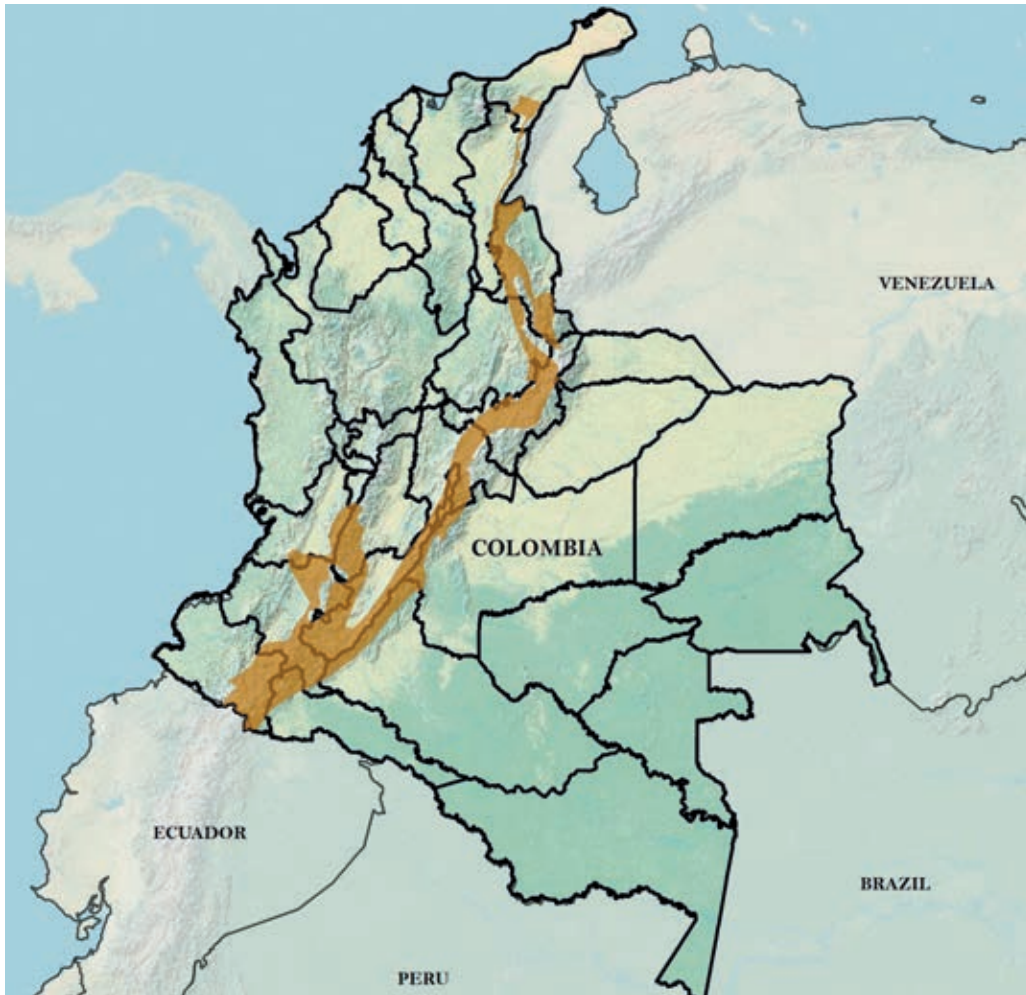


Figure 15. Priority Andean Condor Conservation Units in Colombia



Description of Priority Andean Condor Conservation Units in Colombia

Name: *Sierra Nevada de Santa Marta Priority Andean Condor Conservation Unit (ACCU-CO-01: Type II)*

Description: The Sierra Nevada de Santa Marta is the highest mountain system in Colombia. Situated in the north of the country close to the Atlantic coast it is isolated from the Colombian Andes. The majority of this area is protected by Sierra Nevada de Santa Marta National Park and Tayrona National Park and it is considered the region with the largest population of Andean condor in Colombia (Rodríguez *et al.* 2006), although there are no detailed population estimates for the area.

Name: *Serranía del Perijá Priority Andean Condor Conservation Unit (ACCU-CO-02: Type II)*

Description: The northernmost part of the Eastern Cordillera lying on the border with Venezuela. The Serranía del Perijá is important for the conservation of the Andean condor in Colombia as it also facilitates connectivity between the populations in the Sierra Nevada de Santa Marta and the páramos of the northern portion of the Eastern Cordillera.

Name: *Páramos of the Northeastern Andes (Santurbán, Almorzadero, Cocuy National Park) Priority Andean Condor Conservation Unit (ACCU-CO-03: Type II)*

Description: A mountain chain forming part of the Eastern Cordillera in Colombia and where Andean condor populations have recently been registered (Sáenz-Jiménez *et al.* 2014, 2016). In Cocuy National Park a population nucleus was established through reintroduction efforts.

Name: *Páramo Corridor (Guantiva, La Rusia, Iguaque) Priority Andean Condor Conservation Unit (ACCU-CO-04: Type II)*

Description: Representing a fork in the Eastern Cordillera in the Boyacá and Santander Departments, a few occasional Andean condor records exist for this area.

Name: *Los Nevados Priority Andean Condor Conservation Unit (ACCU-CO-05: Type II)*

Description: Los Nevados National Park is found on the Central Cordillera and is another of the nucleus populations from reintroduction efforts. It is the only reintroduction site in Colombia where reproduction of reintroduced individuals has been confirmed (Zuluaga 2010; Retrepo-Cardona & Betancur 2013).

Name: Chingaza Priority Andean Condor Conservation Unit (ACCU-CO-06: Type II)

Description: Found in the central portion of the Eastern Cordillera, near the city of Bogotá, in 1989 Chingaza National Park was the focus of the first population nucleus for Andean condor reintroduction efforts, and a small population is established in the area.

Name: Puracé Priority Andean Condor Conservation Unit (ACCU-CO-07: Type II)

Description: Puracé National Park is a volcanic area found in the southern portion of the Central Cordillera in the Cauca Department. Another of the nucleus populations from reintroduction efforts, one pair of Andean condors is known to reside here.

Name: Chiles Indigenous Reserve and Neighboring Páramos Priority Andean Condor Conservation Unit (ACCU-CO-08: Type II)

Description: Found in southern Colombia on the border with Ecuador and composed of a group of volcanic mountains (Azufra, Galeras, Cumbal), the area contains Chiles Indigenous Reserve where another reintroduced population of Andean condors exists. The majority of reintroduced condors have migrated to the páramos of northern Ecuador, although they frequently return to this area. Additionally, satellite tagged Andean condors from Ecuador have been registered in this area (Hernán Vargas pers. obs.).



Victor Escobar



Robert Wallace / WCS



Distribution and Ecology

Andean condors are distributed along the Andean mountain range, that traverse the country from north to south, splitting in two major branches, the Western and Eastern cordilleras. Andean condors are usually found at elevations ranging from 3,000 to over 5,000 m a.s.l., with two notable exceptions: the dry valleys of the Mira River (Carchi and Imbabura provinces) in the northern Andes, and the Leon River (Azuay and Loja provinces) in the southern Andes, where condors occur at lower elevations (1,200 m a.s.l.) accessing food sources further down the dry mountainsides. Throughout the country, condors feed mostly on domestic and feral cattle and horses. In the dry valleys they also feed on donkeys and goats.

Population Size

Historically, there have been several attempts to estimate Andean condor population size in Ecuador. However, these initiatives were limited in spatial scope and sampling effort. In 2015, after information from satellite telemetry became available, the first country-wide census was carried out (Naveda-Rodríguez *et al.* 2016). This census was implemented simultaneously in 70 roosting sites. A total of 93 individuals were recorded, and a minimum population of 94-102 individuals was estimated. In 2018, the census was repeated, this time increasing the effort to 180 roosting sites, and the resulting population estimate increased to 197 individuals (95% CL = 140-270: Vargas *et al.* 2018)

Implemented Conservation Actions

In 2009, the Ministry of the Environment created the National Andean Condor Working Group of Ecuador (GNTCA). The GNTCA supports and coordinates all the work of NGO's technicians, protected area staff, and national and local government officials working for the conservation of the Andean Condor in the country. The GNTCA is composed by a series of organizations: Aves y Conservación (Birdlife in Ecuador), Fundación Jocotoco, Wildlife Conservation Society – Ecuador, Fundación Cóndor Andino (FCA), The Peregrine Fund, Fundación Zoológica del Ecuador, Parque Cóndor, Bioparque Amaru, Fundación Galo Plaza Lasso, Centro de Rescate Iltitío, and Zoológico de Baños. The last six organizations hold 18 condors in captivity. The GNTCA is managing the captive population, with two successful breeding pairs already formed. There are four other pairs in the process of formation, and a couple of juveniles which will hopefully breed and produce offspring in the future.

Since 2012, The Peregrine Fund and FCA have studied Andean condors, focusing on their habitat, breeding biology, and spatial movements (Vargas *et al.* 2016). As part of this study, nine Andean condors were tagged with satellite trackers, and three additional individuals with wing tags. These birds have provided unprecedented levels of spatial information throughout the Ecuadorian Andes (Vargas *et al.* 2016). The project has also documented 13 different nesting sites and systematically monitored nine nesting events (Vargas *et al.* unpublished data). Data from this project have been used as input for several education and awareness-increasing programs, carried out by the Ministry of

the Environment, National Fund for Water Conservation (FONAG), Empresa Publica de Cuenca (ETAPA), as well as several conservation-oriented zoos, FCA staff, and members of the Andean Condor Work Group.

The main roosting and nesting sites are located in Antisanilla (Pichincha Province). These sites have been purchased and turned into a private reserve by Fundación Jocotoco. It protects 5000 hectares of *paramo* and wetlands, including five roosting sites and four known nesting sites. Among these roosting sites is the *Peñón del Cóndor*, a large cliff where up to 31 condors have been counted at the same time.

In 2009, the Ministry of Environment of Ecuador and the GNTCA published the Andean Condor Conservation Strategy. Until 2017, this strategy has been guiding conservation action in Ecuador. A National Action Plan for the Conservation of the Andean Condor was published in 2018 (Ministerio del Ambiente & The Peregrine Fund 2018).

Andean Condor Historical Range in Ecuador

Historically Andean condors' range covered most of the Andean region of Ecuador, from the border with Colombia in the North, to the border with Peru in the south (Figure 16).

Areas Where Andean Condors No Longer Exist in Ecuador

Andean condors have been extirpated, or are very scarce, within a polygon that covers the eastern area of Bolivar Province, as well as the western sections of Chimborazo and Cañar provinces (Figure 17). Historical engravings, dating back to when the railroad tracks were built in the area in the early 20th century, show large numbers of condors present in this area. Neither satellite data from marked condors, nor fieldwork from biologists studying the species (Vargas *et al.* unpublished data) have recently recorded the species in the area.

Areas With and Without Expert Knowledge on Andean Condors in Ecuador

Most of the data from wild condors comes from the Andean Condor Research Project in Ecuador spearheaded by The Peregrine Fund and Fundación Condor Andino (FCA). Nine satellite trackers have been placed on wild condors, and their movements have revealed a lot of previously unknown information about behavior and home range size. These data cover almost the entire range of the Andean Condor in Ecuador (Figure 18). Thus, areas without expert knowledge are now fairly small, and restricted to southern Ecuador (Figure 19).

Priority Andean Condor Conservation Units in Ecuador

At the workshop, experts recognized three large priority conservation areas for Andean condors in Ecuador (Figure 20). One is located in the north and central Andes, the second one in the central Andes surrounding the Sangay National Park, and the third one in the south of the country.

Figure 16. Andean Condor Historical Range in Ecuador

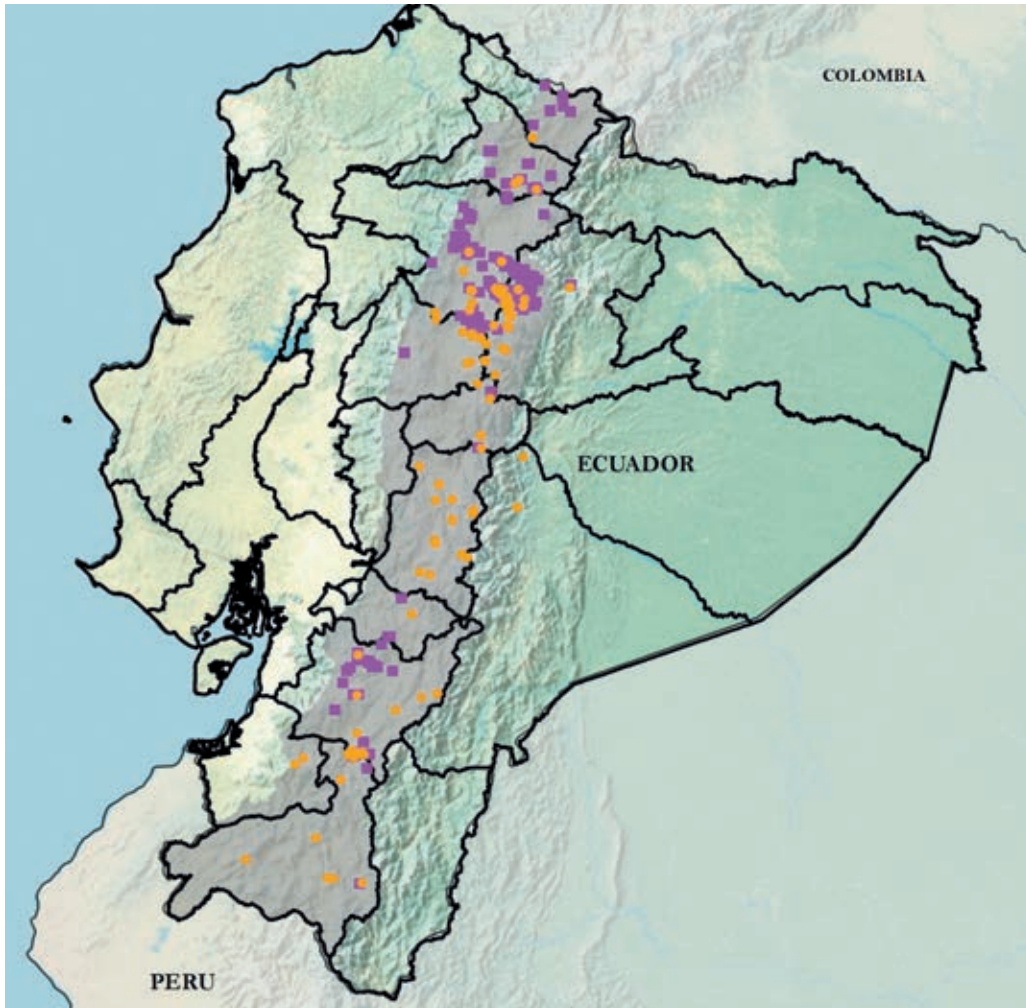


Figure 17. Areas Where Andean Condors No Longer Exist in Ecuador

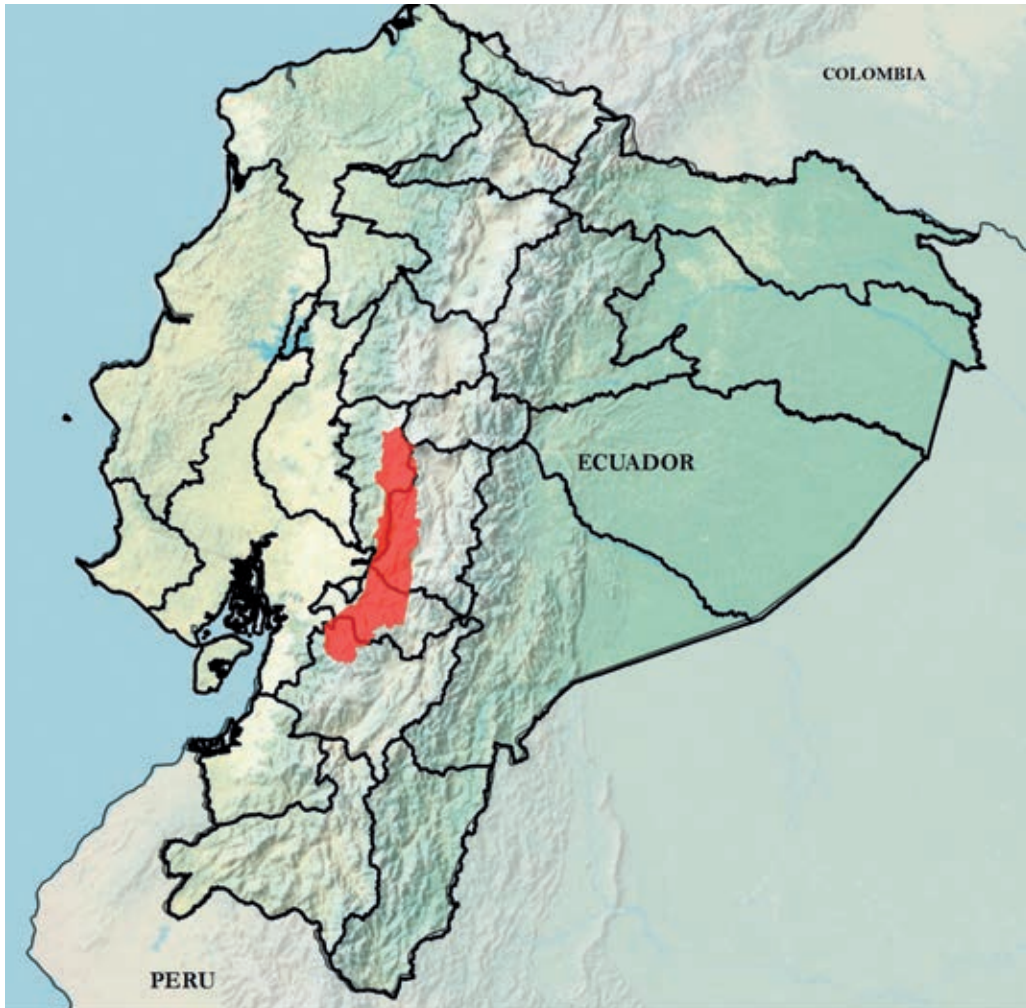


Figure 18. Areas With Expert Knowledge on Andean Condors in Ecuador

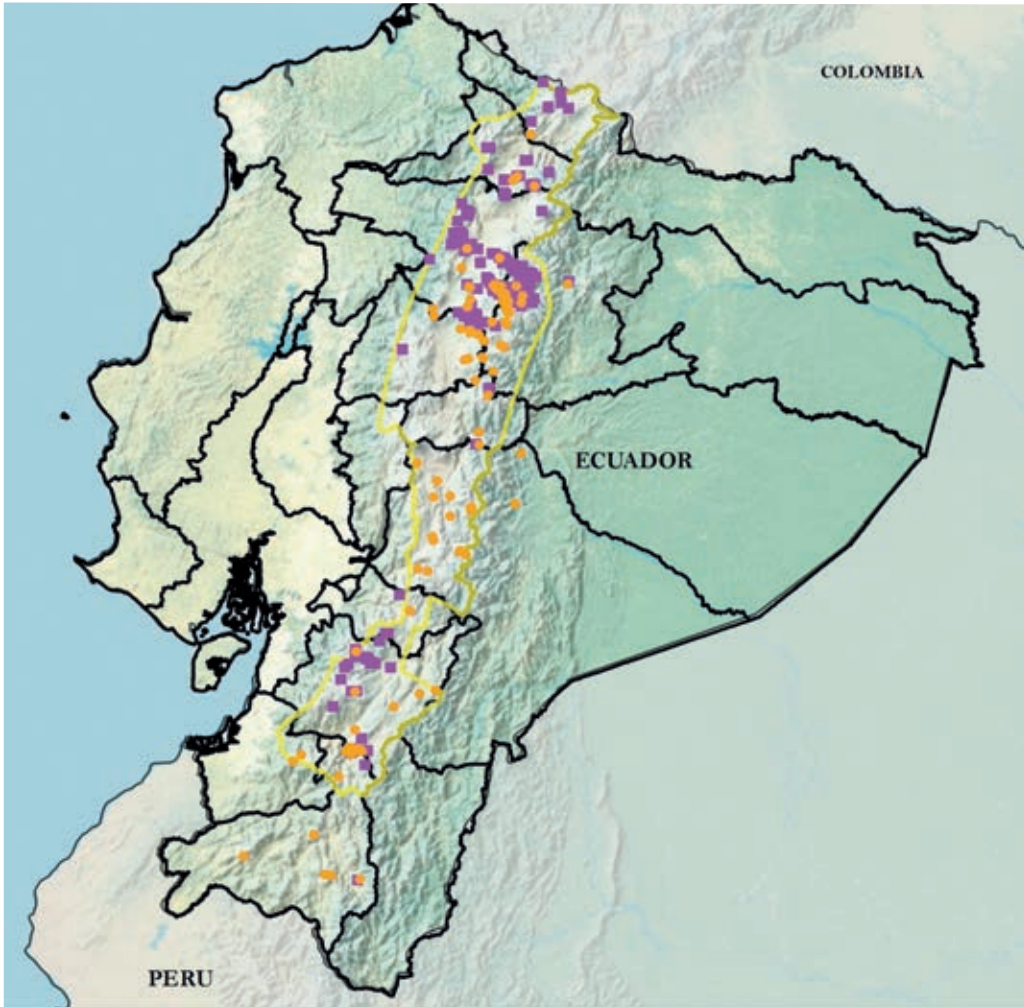


Figure 19. Areas Without Expert Knowledge on Andean Condors in Ecuador

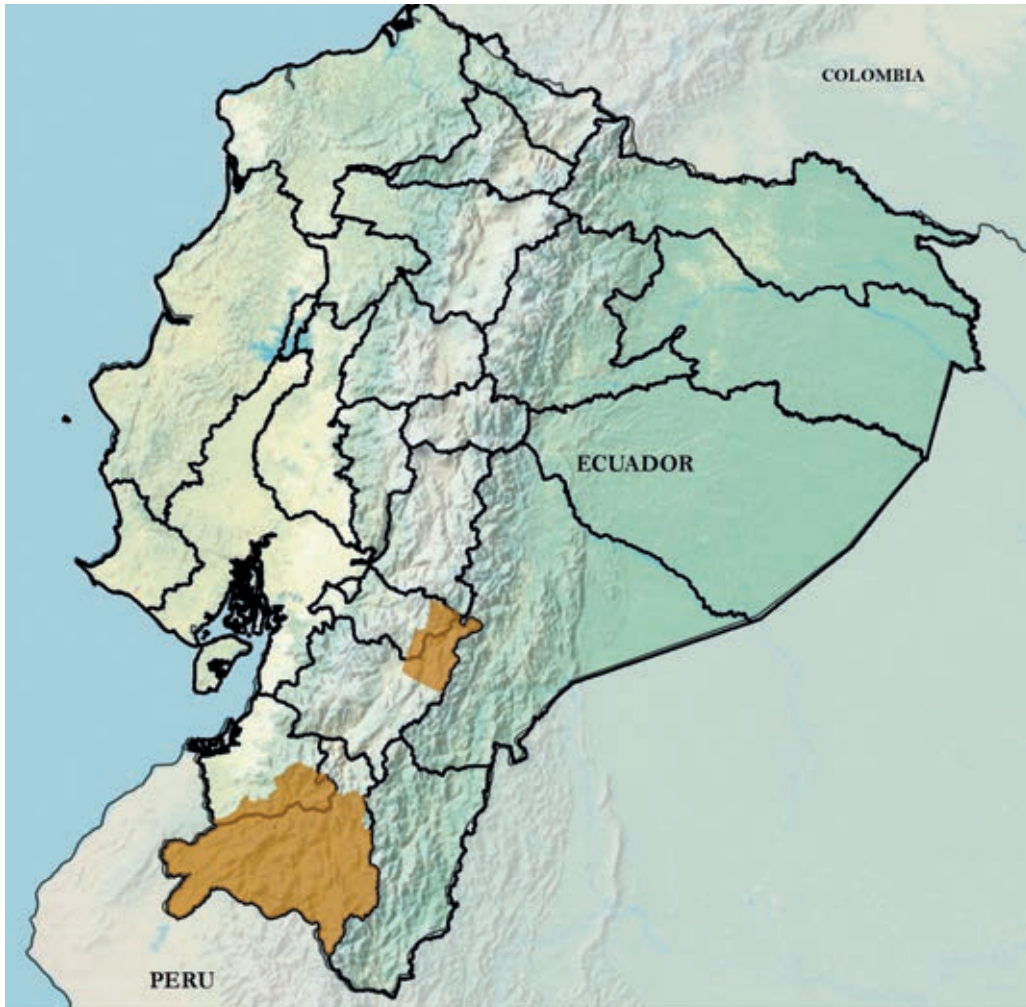
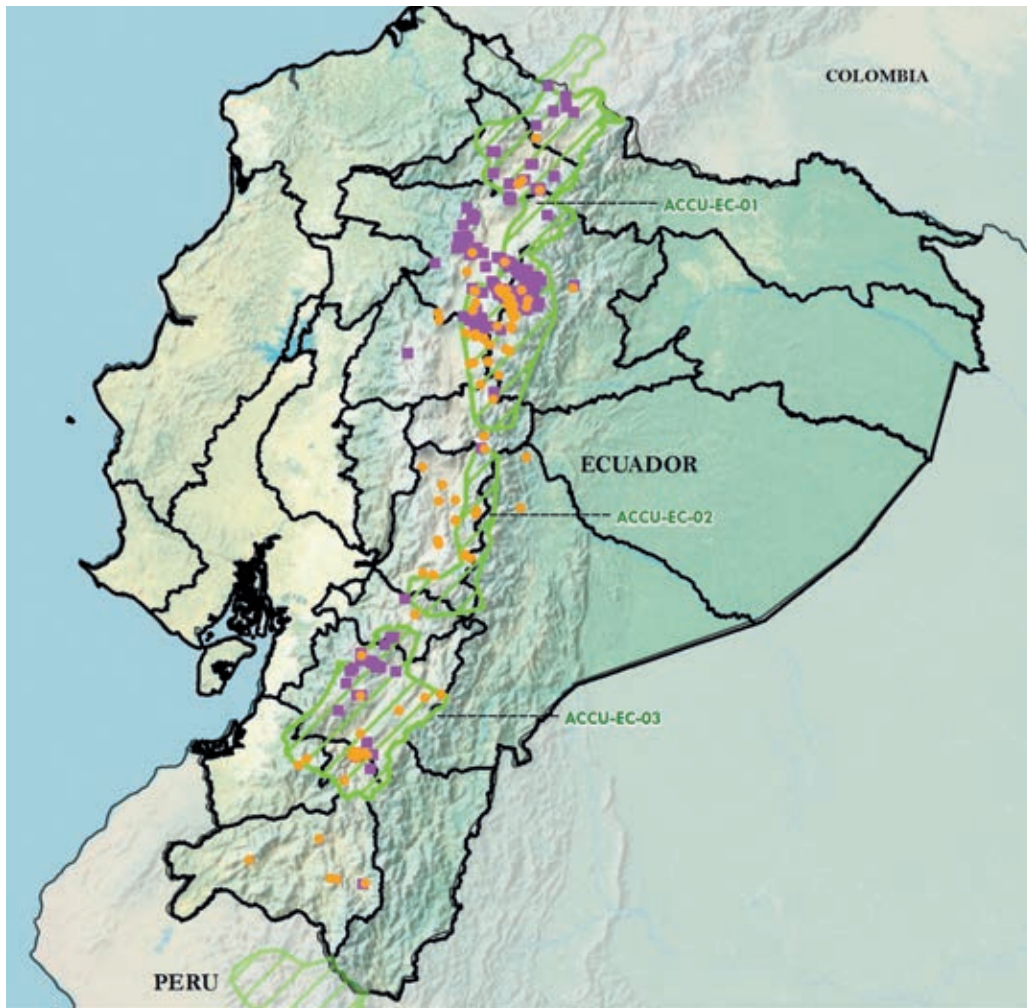


Figure 20. Priority Andean Condor Conservation Units in Ecuador



Description of Priority Andean Condor Conservation Units in Ecuador

Name: *The Northern Ecuador Priority Andean Condor Conservation Unit (ACCU-EC-01: Type II)*

Description: This area also covers a small section of southern Colombia, including the Cerro Negro and Chiles volcanoes. Once it reaches Ecuador it encompasses both the eastern and western Andes of Carchi and Imbabura Provinces. Further south in Pichincha and Napo provinces the Priority Conservation Area includes only the Eastern cordillera reaching down through Cotopaxi and Tungurahua Provinces. This area holds several protected areas: El Angel Ecological Reserve and Cotacachi-Cayapas Ecological Reserve in the Western Cordillera, and Cayambe-Coca Ecological Reserve, Antisana Ecological Reserve, Cotopaxi National Park, Colonso-Chalupas Biological Reserve, and Llanganates National Park. Even though there are many parks and protected areas within this Priority Conservation Area, a large part of it is located in private lands where Andean condors roost, forage and breed. High altitude grasslands or páramo, wetlands, dry forests and a small desert area are found in the area. It also encompasses human dominated agricultural landscapes, and the cities of Tulcán and Ibarra. The eastern side of Pichincha and Cotopaxi provinces, as well as the western side of Napo Province, contain the highest population of Andean condors in the country, with a high percentage of known roosting and nesting sites.

Nombre: *Unidad de Conservación Prioritaria del Cóndor Andino Parque Nacional Sangay (UCCA-EC-02: Tipo II)*

Description: Located mostly in the Chimborazo and Morona Santiago provinces, this conservation unit encompasses the Sangay National Park and its area of influence. It is an important area for genetic flow between condor populations in the north and south of the Andes. Within this ACCU there are important feeding and roosting areas.

Name: *The Southern Ecuador Priority Andean Condor Conservation Unit (ACCU-EC-03: Type II)*

Description: This area runs from Cañar Province, through Azuay and El Oro provinces down to Loja Province. The northern section of this area is located in the western cordillera and is comprised of mostly *paramo* and wetlands. The southern section encompasses both the western and eastern cordilleras, and is comprised of paramo, wetlands, dry forests and desert. The southern part of this priority area surrounds the dry forests and deserts of the Leon River watershed. Within this area lies the 34,000 ha Andean Condor Conservation Area, set aside by local communities to protect the dwindling population of condors in southern Ecuador.



Diego Mendez



Robert Wallace / WCS

Distribution and Ecology

The Andean condor is widely distributed in Peru along the Andes above 3,000 m a.s.l., on both the eastern and western side of the Andes (Schulenberg *et al.* 2010), though it is also patchily present along the coast from Ica to Tacna in the south and Piura and Lambayeque in the north (Stucchi 2013), with three stable coastal populations: Zona Reservada de Illescas (Piura), Reserva Nacional de Paracas (Ica), Reserva Nacional San Fernando (Ica). Andean condors have a low tolerance for hunting and direct persecution which is probably the reason for its patchy presence along the Peruvian coast (Wallace & Temple 1988; McGahan 2011). It is suspected that human encroachment along beaches in Peru is reducing feeding habitat for Andean condors, as urban development is targeting these areas (Piana & Vargas 2018).

In northern Peru, Andean condors have been observed feeding on mules (*Equus asinus*), dogs (*Canis lupus familiaris*), sealions (*Otaria byronia*), goats (*Capra hircus*), horses (*Equus caballus*), pigs (*Sus scrofa*), and marine turtles (*Chelonia mydas*) (Wallace & Temple 1987). McGahan (2011) reports the consumption of infant sealions on the Zarate island and adult sea lions on the de Paracas and Chala beaches. McGahan (2011) also reports feeding on various species of sea birds like the Peruvian pelican (*Pelecanus thagus*), Peruvian booby (*Sula variegata*), Humboldt penguin (*Spheniscus humboldti*), Peruvian diving-petrel (*Pelecanoides garnotii*), and fish, including sharks.

In 2015, immediately following the Andean Condor workshop, The Peregrine Fund in collaboration with Peruvian organizations deployed the first satellite transmitters on two adult Andean condors in Peru. Spatial data were used to develop preliminary models on foraging and roosting sites (Piana & Vargas 2018), indicating that: (1) the best habitat for Andean condors in Peru is located west of the Andes, from the border with Ecuador, south to Bolivia and Chile, (2) foraging areas of both individuals were located at higher elevations than roosting sites (means: 3,934 m and 3,356 m a.s.l., respectively), and (3) roosting sites were located in areas dominated by grasslands and agriculture, whereas foraging areas were dominated by puna grassland and brush.

Stucchi (2013), indicates that in 1919, Robert McMurphy documented the massive consumption of Peruvian booby by a group of 18 Andean condors frequenting the Asia island 120 km south of Lima, and that this predation eliminated the booby population from the island. The park guards of the Reserva Paisajística Nor Yauyos Cochabamba reported a group of Andean condors eating a vicuña corpse (*Vicugna vicugna*).

A rare report involved a juvenile Andean condor photographed eating leaf buds of a *Eucaliptus* sp. tree in the upper Santa Eulalia River (van Els & Tello 2013). In the Colca canyon in Arequipa, a juvenile was reported eating *Puya cylindrica* bromeliad flowers (Bermejo 2015).

Vasquez (2015) studied an Andean condor colony in the Reserva Nacional San Fernando, in the coast of Ica department. Number of individuals (except March that

was not surveyed), varied from 4 in June and 21 in January. No breeding attempts were observed during surveys.

Despite the reports of juveniles present along the country, the only nest reported in Peru was in the Zona Reservada Illescas, west of Piura department (Martinez 2016). The nest was located in a crack along a rock wall 250 m above ground. The chick fledged successfully but the incubation period could not be determined.

Distribution of Andean condors was modelled via a Maximum Entropy model using ebird data and determined that potential distribution of the species was mainly concentrated along the Andes, from Piura and Cajamarca departments adjacent to Ecuador, to Puno and Tacna departments adjacent to Bolivia and Chile (Maxent values = 61-100). Habitat suitability Maxent values were also high in the coastal plains west of the Andes, particularly south of Ica to Tacna departments. Variables included in the model were ecoregions, elevation, annual diurnal temperature range from 1961 to 1990, annual ground-frost frequency from 1961 to 1990, and annual minimum temperature from 1961 to 1990. The Area Under the Curve (AUC) of the receiver operating characteristic (ROC) plot, obtained from Maxent and used to measure the accuracy of the distribution model was 0.97 (Piana & Vargas 2018).

Species distribution models for foraging and roosting areas used by to rehabilitated adult male individuals were obtained via logistic regression from presence (obtained from satellite transmitters) and pseudo-absence data (obtained from Maxent; see above). The best models for roosting sites included grassland and agricultural areas, while those for foraging areas included grassland and areas dominated by brush. These models highlight the importance of native vegetation above 3000 m a.s.l. for Andean condors (Piana & Vargas 2018).

Population Size

A reliable estimate of the total population of Andean condors in Peru is not yet available. Historically, population estimates only existed for specific regions of the country, for example, 115 and 120 individuals at Península de Illescas and Olmos-Ñaupe in Piura respectively, between 1980 and 1982 (Wallace & Temple 1988; Temple & Wallace 1989).

Piana and Angulo (2015), systematized information about the abundance of Andean Condors in 17 places from the Andes and the coast where populations were estimated as greater than six individuals. These data were obtained from direct observations, personal communications with photographic evidence, and the revision of data from eBird. Many of the locations were roosts or obvious and repeated flight locations, perhaps associated with roosts. The number of individuals detected using this systematization was between 155 and 249 individuals.

The number of individuals maybe over estimated if double counting was an issue, given the huge daily movements of the Andean condor. However, we believe this is unlikely as the distances between the sites was greater than 300 km. It is also possible that the number of individuals is under estimated for Peru, as there many large holes in the overall range of the Andean condor where no information exists on populations. It seems probable that the Peruvian population of Andean condors is greater than this minimum estimate.

Implemented Conservation Actions

In Peru the Andean condor is classified as Endangered (EN) according to the Supreme Decree 004-2014-MINAGRI. This category was assigned due to overall population size, considered to be less than 1,500 individuals, and the pressures they suffer from direct persecution, trafficking and other threats, including habitat loss. The Peruvian government also approved Law 20303 that declared as a national interest and public necessity “the protection and conservation of the Andean condor”. At the workshop herein, the Peruvian government also announced the approval of the National Plan for the Conservation of the Andean Condor (2015), guided by the Forestry Service (SERFOR) of the Ministry of Agriculture and Irrigation (MINAGRI) and the Ministry of the Environment (MINAM). At the same time, the Vice Ministry Resolution No. 065-2014-VMPCIC-MC (Ministry of Culture), declares as National Heritage the Señor de Animas de Challhuanca fiesta -within which local communities perform the Yawar Fiesta-, however this recognition is not extended to the Yawar Fiesta celebration that involves bulls and Andean condors, and is therefore a precedent that the Yawar Fiesta is not recognized as a national patrimony of Peru.

Finally, at the national level it is important to stress the creation of Natural Protected Areas that protect habitat and probably nesting and roosting sites for the Andean condor, for example, the Zona Reservada Illescas, Parque Nacional Río Abiseo, Parque Nacional Huascarán, Reserva Paisajística Nor Yauyos – Cochas, Reserva Nacional de Paracas, Reserva Nacional Barbara D’Achille-Pampa Galeras, Reserva Nacional San Fernando, Reserva Paisajística Sub Cuenca de Cotahuasi y Reserva Nacional Salinas and Aguada Blanca. Although protected areas play an important role in preserving Andean condor habitat in Peru, Piana (2018a) found that the potential distribution area (PDA) for Andean condors, a surrogate of the species extent of occurrence (EOO) in Peru, was 481,760 km², and only 2% of this area was within strictly protected areas. Conservation actions for the species should be implemented with local communities and should protect habitats inside communal lands via conservation agreements with communal authorities, as well as in regional and private conservation areas.

The Regional Government of Ayacucho, emitted a Regional Ordinance No. 011-014-GRA/CR declaring the Andean condor as a regional interest and promoting the implementation of mechanisms towards the conservation of the species, such as environmental education in the Andamarca, Chipao, Cabana Sur and Aucará districts. Similarly, the Regional Government of Cuzco, through the Supreme Decree No. 022-2010-MINAM, created the Área de Conservación Regional Choquequirao (103,814 ha).

Andean Condor Historical Distribution in Peru

Historically, the Andean condor was found in a broad swathe up and down the country, from the Pacific Ocean to the west to the cloud forests and páramo mountain meadows on the eastern side of the Andes (Figure 21). The distribution of systematized Andean condor records in Peru broadly supports this expert opinion, with a fairly even distribution of known locations.

Areas Where Andean Condors No Longer Exist in Peru

There are only two areas where the Andean condor no longer exists in Peru (Figure 22)..

- Area 1. South and west of Tumbes to central and west Piura. This area includes most of the Sechura desert, from sea level to 500 m a.s.l. to the east. Andean condor absence here is due to the lack of food resources in the center of Piura and human encroachment in the coastal areas of Piura and Tumbes. However, these areas change considerably during El Niño events and might support herbaceous vegetation and cattle during these events.
- Area 2: Central Cajamarca. This area holds suitable habitat for the species because elevation varies from 1,000 to 3,500 m a.s.l., and include ecosystems such as Andean jalcas bisected by deep canyons and mountains from 800 to 4,000 m a.s.l. Andean condor absence here is probably related to severe habitat fragmentation and possibly persecution and poisoning from cattle ranchers.

Areas With and Without Expert Knowledge on Andean Condors in Peru

Areas with expert knowledge (Figure 23) are mainly located along the west side of the Andes, including areas along the coast from Illescas (Piura) in the north to Tacna in the south, adjacent to the Chilean border. In Cusco and Puno there are also areas with expert knowledge located along the Vilcabamba and Carabaya cordilleras, south to the Bolivian border.

Areas without expert knowledge of Andean condors in Peru (Figure 24) are mainly located east of the Andes in northern and central Peru where montane forest predominate, from San Martín, south to Junín Department. In northern Peru, these areas are located north and east of Tumbes, close to the border with Ecuador and in north-eastern Lambayeque and north-western Cajamarca. In the central and southern Andes areas without knowledge are located in Huancavelica and the eastern portions of Arequipa, Moquegua and Tacna. In Cusco and Puno, areas without knowledge are located east of the Vilcabamba and Carabaya cordilleras where the landscape is dominated by montane forests.

Priority Andean Condor Conservation Areas in Peru

At the workshop, experts identified four Priority Andean Condor Conservation Areas in Peru varying significantly in size, but also spread across the remaining distribution range in the country (Figure 25).

Figure 21. Andean Condor Historical Distribution in Peru

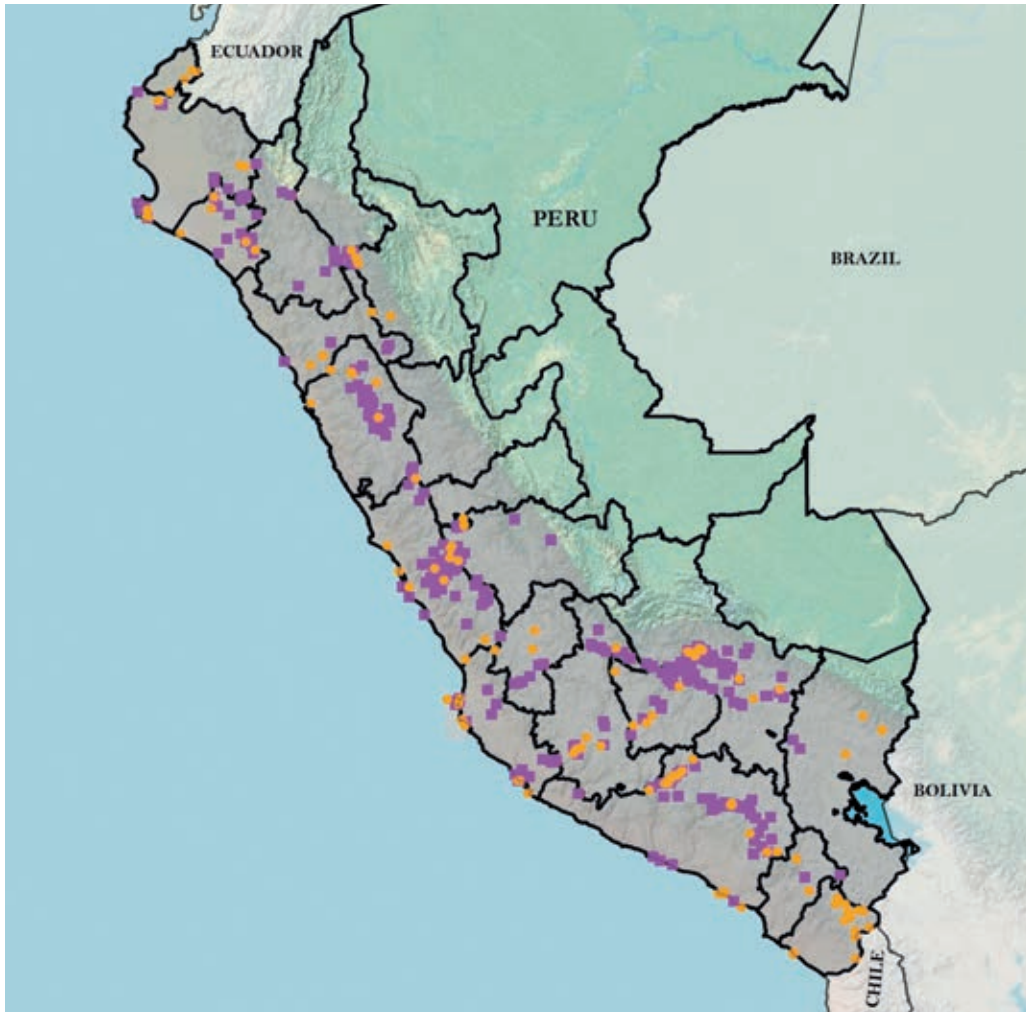


Figure 22. Areas Where Andean Condors No Longer Exist in Peru



Figure 23. Areas with Expert Knowledge on Andean Condors in Peru

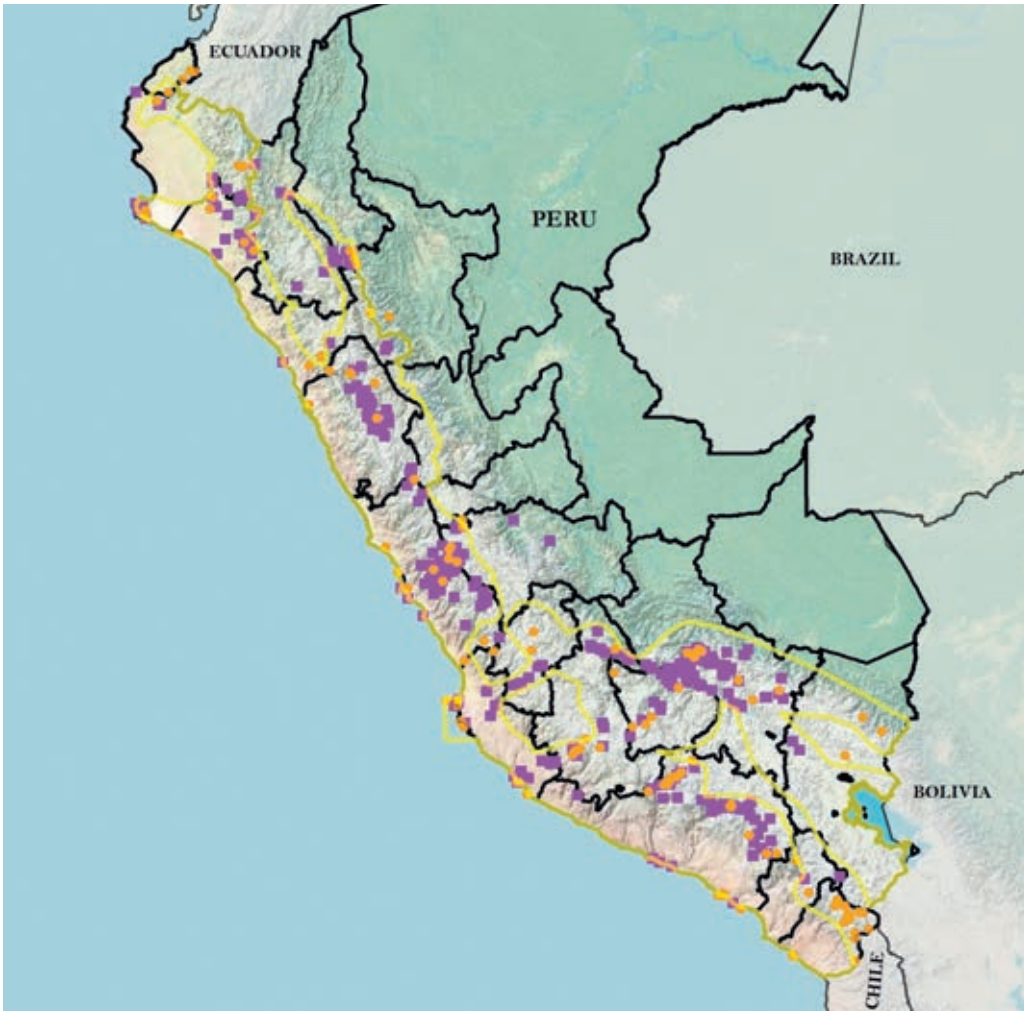


Figure 24. Areas without Expert Knowledge on Andean Condors in Peru

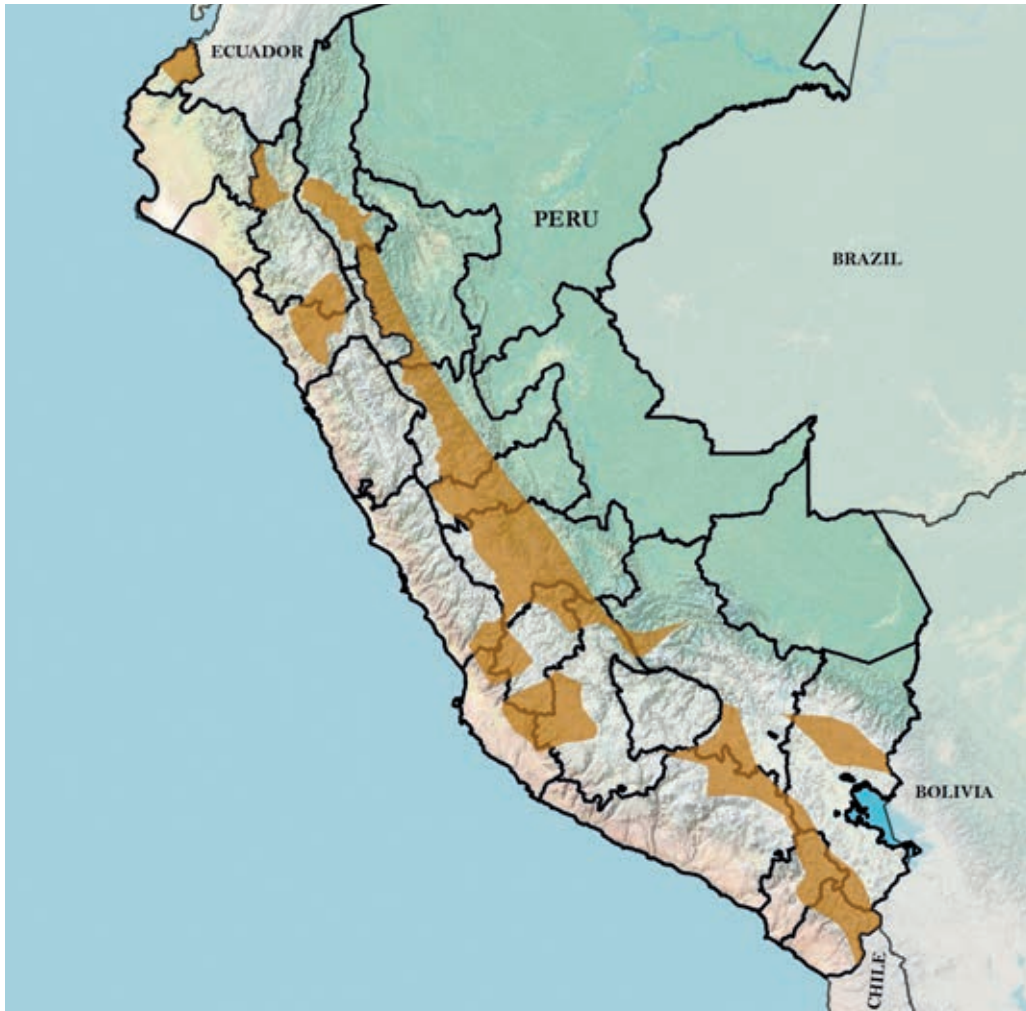


Figure 25. Priority Andean Condor Conservation Units in Peru



Description of Priority Andean Condor Conservation Units in Peru

Name: *Illescas Priority Andean Condor Conservation Unit (ACCU-PE-01: Type I)*

Description: Found in the Sechura Province of the Piura Region, this coastal peninsula has a maximum altitude of 490 m a.s.l., is about 40 x 20 km in size, and is mainly arid, with sandy beaches, streams, hills, and sparse shrubby vegetation. There are sea lion colonies at this site, and significant historical Andean condor records. The western part of the peninsula was declared as a reserve in 2009, and at the end of the 1970's and early 1980's an Andean condor reintroduction program was conducted (Temple & Wallace 1989). In 2013 an adult pair were observed feeding on marine turtles in the Virilla estuary (F. Suarez & M. Alzamora.), and in 2014 a nest was active in the reserve (Martinez 2016).

Name: *Paramos de Piura / Bosque Seco de Cajamarca Priority Andean Condor Conservation Unit (ACCU-PE-02: Type II)*

Description: This area in the Piura, Lambayeque and Cajamarca regions runs from the páramo mountain meadows of the upper Ayabaca and Huancabamba provinces (in Piura), south to the Cajamarca dry forests, through the upper Piura river, Cerro de Ñaupe, Huacrupe, Cerro Pumpurre, Laquipampa, Chalpon, Chaparri, Abra de Porculla and Abra Cruz Blanca. It is made up of páramo grasslands and humid cloud forests bordering the Tabaconas Namballe protected area in the north, and montane and lowland dry forests in the south, where it overlaps with the Laquipampa Wildlife Refuge. Elevations vary from 100 to 3,800 m a.s.l. There are recent Andean condor records from Yanta to the Reque River.

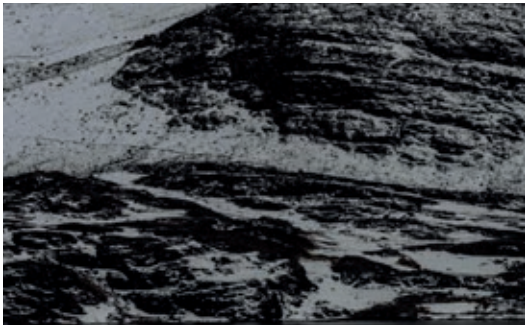
Name: *Pataz Rio Abiseo Celendín / Cordillera Blanca - Central Priority Andean Condor Conservation Unit (ACCU-PE-03: Type I)*

Description: With an elevational range between 800 and 3,300 m a.s.l. in the Amazonas, Cajamarca, San Martin and La Libertad departments, this conservation area runs along the Marañón River from the heights of Pataz in the south to Leymebamba in the north, where it also includes the upper Utcubamba River in the Amazonas department. It includes the Marañón dry forest, cloud forests, puna grasslands and desert scrub. It overlaps with Rio Abiseo National Park in the south. To the south, the Cordillera Blanca, east of the Santa River, in Ancash department, is also part of this conservation area. This is a High Andes area with snow, ice, glacial lakes and mountains that overlaps with the Huascarán National Park and has a large quantity and longstanding sequence of Andean condor records. The area also extends southward along the western cordillera of the Andes, including the Huallanca, Huayhuash, Raura and La Viuda cordilleras, and ends on the Cordillera Central including the Reserva Paisajística Nor Yauyos Cochas.

Name: *Southern Peru Priority Andean Condor Conservation Unit (ACCU-PE-04: Type I)*

Description: This area is a large unit, comprising arid coast, the western slope of the Western Andes, several inter-andean valleys, puna grassland, and montane scrub on the upper part of the eastern side of the Andes, facing lowland Amazonia. It comprises the departments of Ica, Arequipa, Moquegua, Apurimac, Cuzco and Puno. On the coast it includes the Paracas and San Fernando National Reserves. In the western part of the area it includes the

Pampa Galeras National Reserve in Ayacucho and further south, in Arequipa, it includes the Cotahuasi and Colca canyons. The center of this area includes the Sondondo canyon, and the inter-andean valleys of the Apurimac river and tributaries. The north-eastern portion of the area includes the upper part of the eastern side of the Andes. There are large numbers of Andean condor records along the area (Piana & Angulo 2015).



Robert Wallace / WCS



Robert Wallace / WCS

Distribution and Ecology

The Andean condor lives principally along the eastern Andes (Herzog *et al.* 2016), and is a frequent visitor in the Chaco (Martinez *et al.* 2010). Although these records are anecdotal observations (that is, they are not systematic observations designed specifically for the Andean condor), they do provide evidence for this species' rarity in the western Andes of Bolivia, given the low frequency of records in this region (Fjeldså & Krabbe 1990). Rather, the Andean condor is frequently observed in a variety of habitats on the eastern Andean slopes, from the humid zones (humid puna, treeline elfin forest, *yingas* to the semi-humid zones, like the Tucuman-Bolivian forest), dry regions (inter-Andean dry valleys, montane Chaco), and occasionally, the lowland Chaco, where large groups have been photographed (V. Villaseñor pers. comm.).

It is yet to be determined whether Andean condors in Bolivia have marked reproductive periods. In May 2010, a pair of adults and one immature individual were observed on an isolated, immense vertical rock on the transition between wet puna and humid montane forest (ca. 200 m high; -16.953S -66.238W; 3,400 m a.s.l.). These were the only individuals registered in the area and they demonstrated a clear fidelity to the site. The juvenile would only leave the presumed nest to cliffs within a 300 m range.

The published literature regarding the distribution and conservation status of this species has incremented significantly in recent years (Ríos-Uzeda & Wallace 2007; Balderrama *et al.* 2009; Wallace 2008, 2013; Wallace *et al.* 2015, in press; Herzog *et al.* 2016).

Population Size

The first Andean condor population study in Bolivia was carried out in the Apolobamba valley in the La Paz Department using temporary feeding stations to attract the largest quantity of individuals (Ríos-Uzeda & Wallace 2007). Identification of the male adults was done using digital photography and mark-recapture techniques. Minimum population estimates were found based on the proportion of males to females registered for each area. A minimum of 78 individuals was estimated for Apolobamba (Ríos-Uzeda & Wallace 2007). This study was part of the Wildlife Conservation Society (WCS) Greater Madidi-Tambopata Landscape Program, where the Andean condor is one of the umbrella species for this transboundary conservation program (Coppolillo *et al.* 2004; Painter *et al.* 2006; Wallace *et al.* 2011, in press; Wallace 2013a). This program also documented and carried out conservation actions to find non-lethal solutions for conflict between local people and native wildlife, including the Andean condor (Nallar *et al.* 2008; Aliaga *et al.* 2012; Zapata *et al.* 2012).

Ríos-Uzeda & Wallace (2007) inspired Armonía and its partner, The Peregrine Fund, to carry out the first population study at a regional scale. The objective of this study was to estimate the size and structure of the Andean condor populations along the Bolivian eastern Andes from the Tunari range to the Sama range, covering approximately 520

km in a direct transect (Méndez *et al.* 2015). Preliminary results suggest abundant populations in Omereque (n=99; interandean dry valley), and in the Sama mountain range (n=83; dry puna and transitional interandean dry valleys) (Méndez *et al.* 2015). Estimates for the Tunari (n=39; dry puna), Mandinga (n=37; transition from sub-humid puna to interandean dry valleys), and Tarachaca (n=26; transition from sub-humid puna to interandean dry valleys) mountain ranges are low. However, the last three areas were affected by the presence of feral dogs, which competed with condors for the food placed at the stations (Aliaga *et al.* 2012). Overall, a minimum total population size of 254 was estimated for the five areas. This project also reported interesting results, such as the presence of leucitic individuals (Méndez 2013a), and notes of general and conservation interest (Méndez *et al.* 2013, Méndez 2013b).

In the most recent population study, conducted in five areas of the eastern Andes of the country, 456 different individuals were registered and a mark-recapture analysis estimated a population of 1,388 individuals, representing approximately 20% of the global Andean condor population (6,700 individuals) (Méndez *et al.* 2019, BirdLife International 2019).

Implemented Conservation Actions

The Bolivian National Protected Areas System (SNAP) has 22 national protected areas, representing almost 17% of the national territory. To date, there are Andean condor records in 14 of the national protected areas: ANMIN Apolobamba, PNANMI Madidi, PNANMI Cotapata, PN Sajama, PN Tunari, PN Carrasco, PNANMI Amboró, PNANMI Kaa-Iya, ANMI El Palmar, PN Torotoro, RNFA Eduardo Avaroa, RNFF Tariquía, PNANMI Aguaregüe, and RB Cordillera de Sama.

It is fundamental to note that in the last national classification of threatened vertebrates in Bolivia, the Andean condor was classified as Vulnerable (Balderrama *et al.* 2009), and not Near Threatened as the global classification considers the species (BirdLife International 2012). This means that in Bolivia, the species is recognized as a threatened species and requires conservation efforts to assure its future. Additionally, the Andean condor is officially the national bird of Bolivia and is a national symbol. Culturally, the condor – also known as Kuntur in Quechua and Kunturi in Aymara – is compared with the Mallku figure (Quechua and Aymara for leader). The symbol of the Mallku is the condor and many times the words are used interchangeably in the high Andes.

At a national level, Armonía runs a conservation program focused on population censuses for the Andean condor (Méndez 2013a, 2013b; Méndez *et al.* 2013). Currently, there is an initiative to carry out a population census throughout the Bolivian Andes and Chaco, which is also searching for roosting, resting, and nesting sites. WCS also recognizes the Andean condor as a landscape species and has developed a monitoring program and conservation actions in benefit of the species in the Bolivian northwest (Coppolillo *et al.* 2004; Painter *et al.* 2006; Rios-Uzeda & Wallace 2007;

Nallar *et al.* 2008; Wallace *et al.* 2011, in press; Aliaga *et al.* 2012; Zapata *et al.* 2012; Wallace 2013a). This interest at a landscape level developed into a transboundary effort to characterize the Andean condor's distribution in Bolivia and Peru (Wallace *et al.* 2015), which culminated in a regional database with 3,750 distribution points through the Americas.

Andean Condor Historical Range in Bolivia

In Bolivia the Andean condor historical range is almost continuous in a rather broad swathe including the High Andes, the grasslands, cloud forests, and dry inter-Andean valleys of the eastern Andes, and even the Chaco lowlands, though the latter maybe intermittent and related to drought related die-offs (Figure 27). However, there is a large hole in the historical distribution covering the flattest portion of the Bolivian altiplano, or High Andean plain, including the immense Salar de Uyuni salt plain, Lake Poopó and the enormous Lake Titicaca, but also the significant portions of flat Andean plain in between. Whilst Andean condors are presumed to be able to fly over these landscapes, it seems they may not be able to feed safely on very flat plains at extremely high altitudes (+4,000 m a.s.l.). To a large extent the distribution points for Bolivia seem to confirm this hypothesis (Figure 26).

Areas Where Andean Condors No Longer Exist in Bolivia

At the workshop, Andean condor experts identified the area around Sajama National Park in Bolivia, as an area where populations had historically occurred, but were no longer present (Figure 27). Recent unconfirmed reports may indicate a return that warrants further research.

Areas With and Without Expert Knowledge on Andean Condors in Bolivia

In Bolivia the areas with knowledge about Andean condor are found in the west, northwest and the central southern portion of the country within the eastern Andes, known as the Eastern Cordillera (Figure 28). Existing information in these areas were mainly obtained from studies to estimate populations in the Eastern Cordillera (Ríos-Uzeda & Wallace 2007; Méndez *et al.* 2015), which spans approximately 45,000 km² (Montes de Oca 2005) and represents the largest continual extension of habitat for Andean condors in Bolivia. Understandably research to date has concentrated in this region.

The extreme southwest of Bolivia, specifically the Eduardo Avaroa national protected area, as well as the western extreme of the Gran Chaco, represent other areas with knowledge about Andean condor derived from ornithological studies (Martínez *et al.* 2010).

Areas without knowledge include some small Eastern Cordillera, most of the western Andes in the country known as the Western Cordillera, as well as the Gran Chaco (Figure 29) where sporadic observations exist, but no systematic studies exist.

Generally, there is reasonable data on population status along the Eastern Cordillera and more widespread data on distribution across the historical range, although data on nests and roosts are scarce. Research priorities include: 1) systematize population estimates across the Eastern Cordillera, 2) document roosts and nests across the Bolivian range and 3) evaluate connectivity between populations in the Eastern Cordillera, as well as study individual movement patterns to and from and along the Eastern Cordillera.

Priority Andean Condor Conservation Units in Bolivia

In Bolivia we identified three Priority Andean Condor Conservation Units that actually cover the majority of original Andean condor distribution in the country (Figure 30). Two of these areas border southern Peru and northern Argentina respectively.



Víctor Escobar

Figure 26. Andean Condor Historical Range in Bolivia

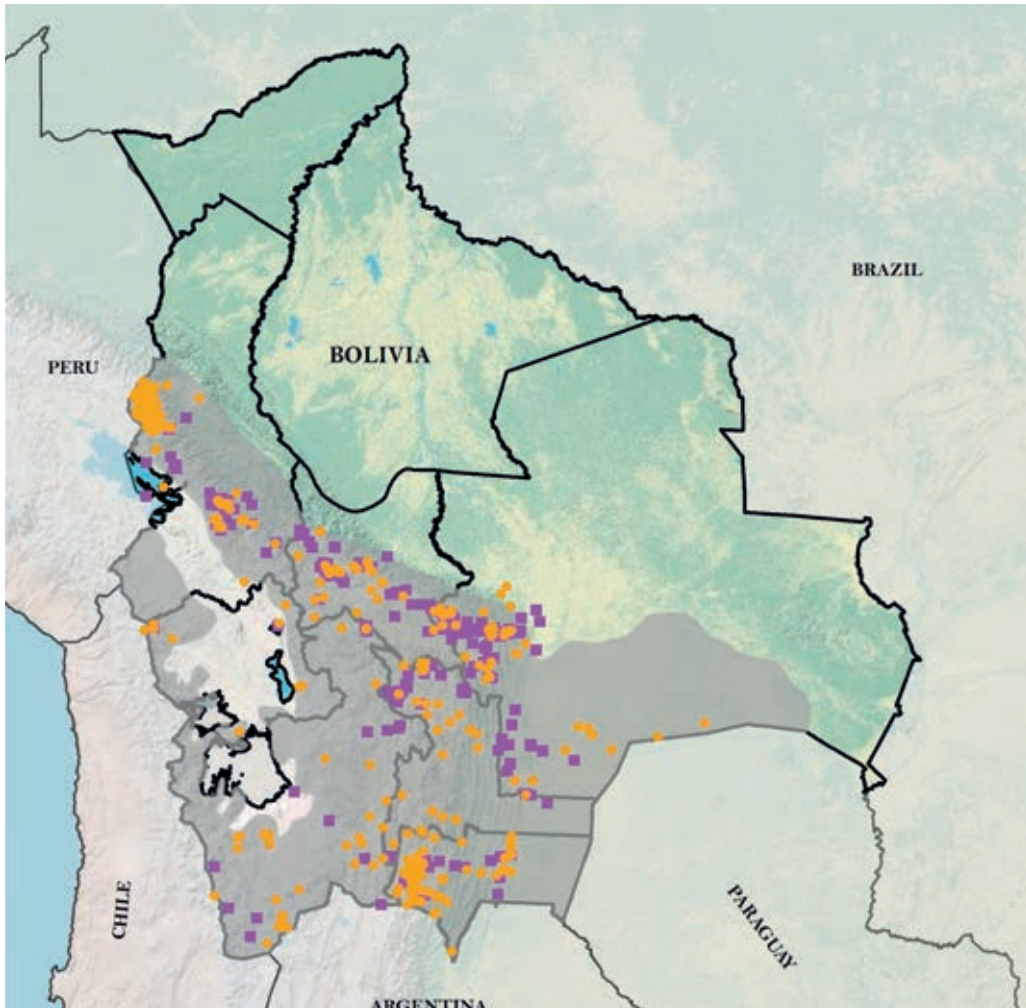


Figure 27. Areas Where Andean Condors No Longer Exist in Bolivia

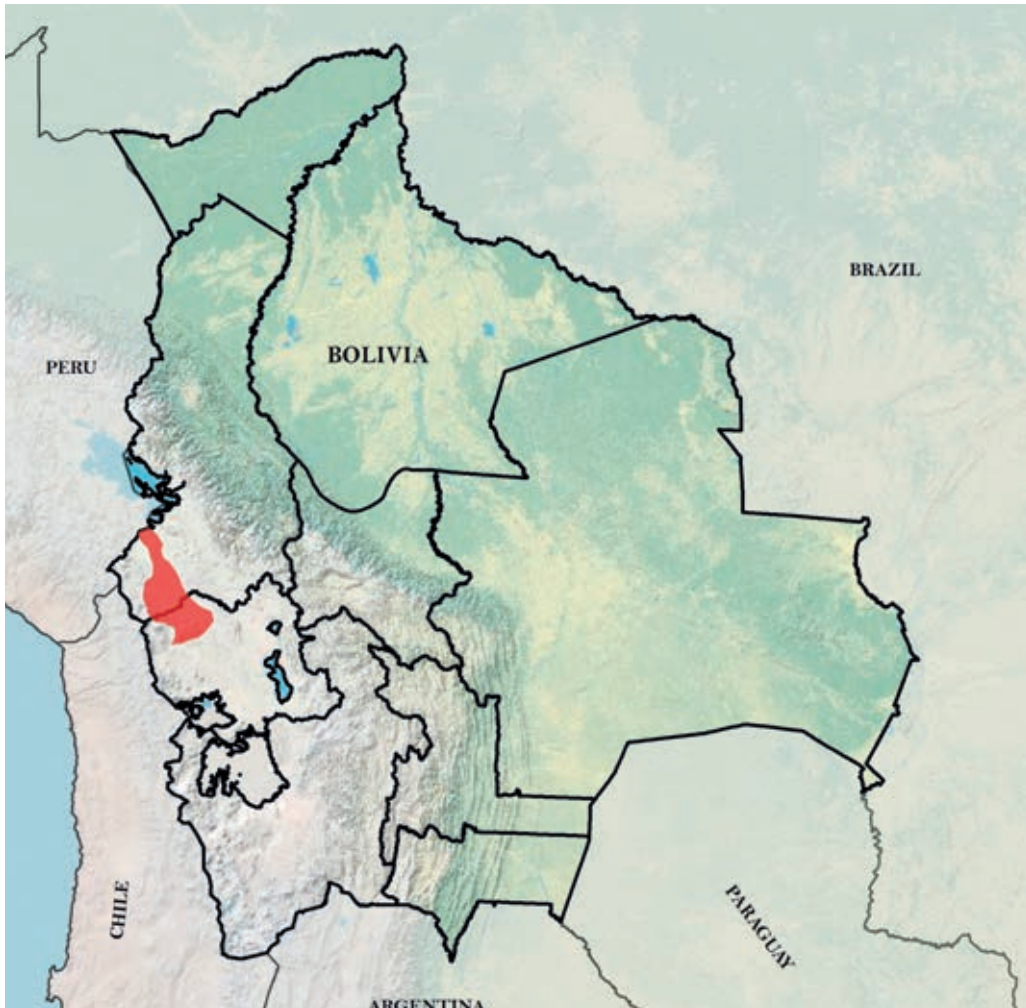


Figure 28. Areas With Expert Knowledge on Andean Condors in Bolivia

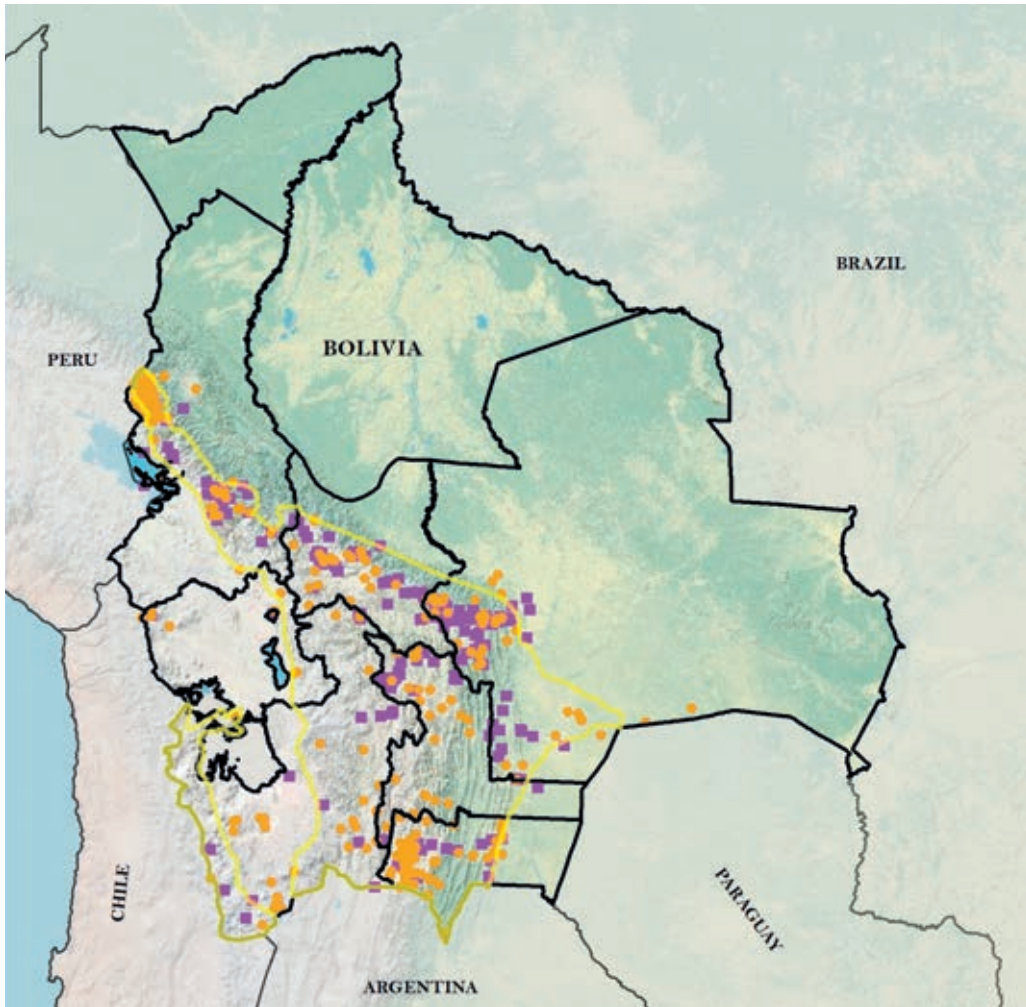


Figure 29. Areas Without Expert Knowledge on Andean Condors in Bolivia

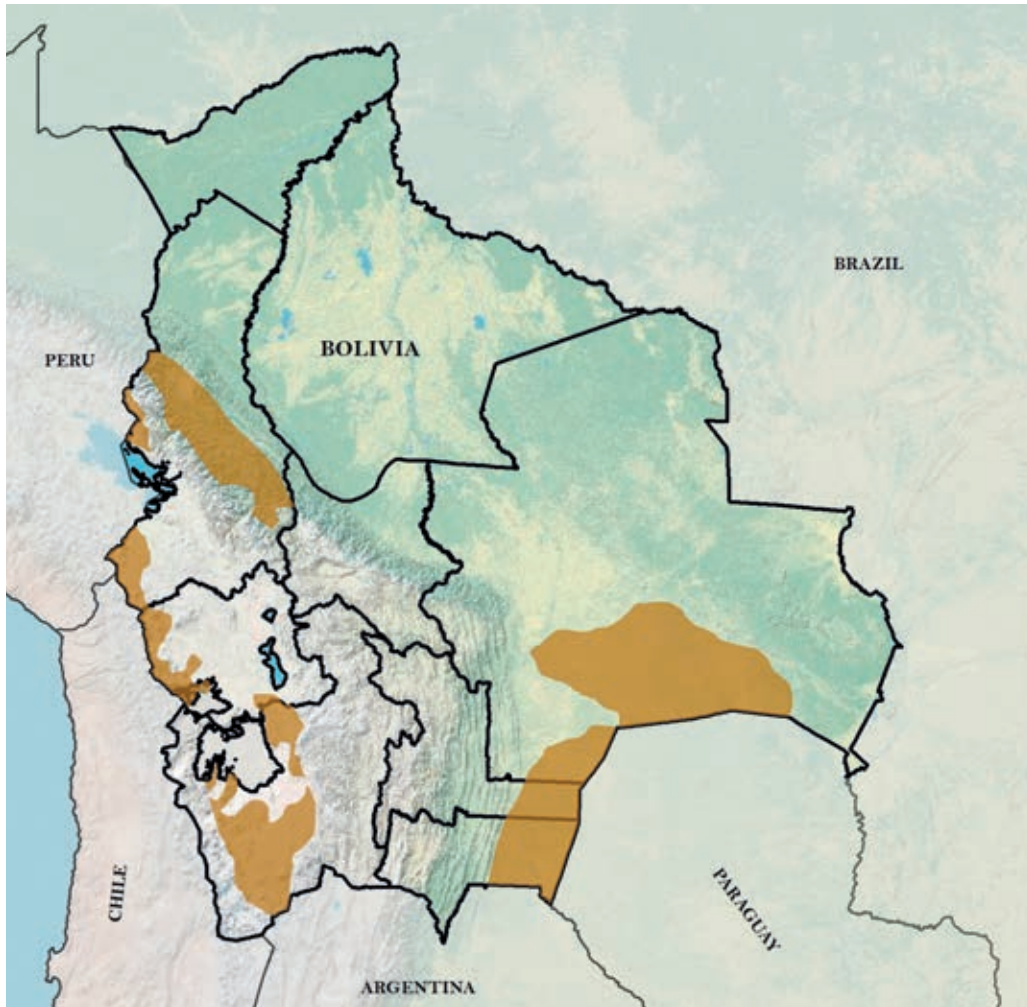
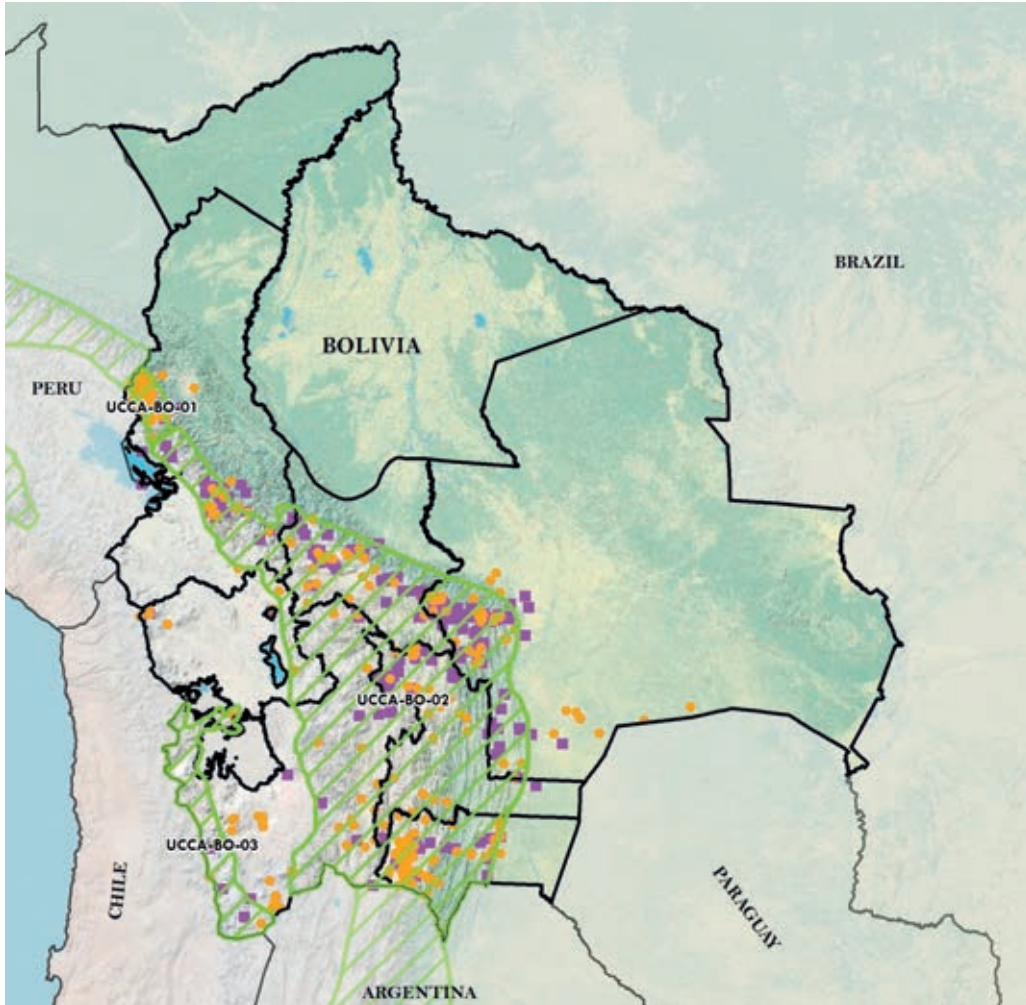


Figure 30. Priority Andean Condor Conservation Units in Bolivia



Description of Priority Andean Condor Conservation Units in Bolivia

Name: Puna – Apolobamba Priority Andean Condor Conservation Unit (ACCU-BO-01: Type II)

Description: Large, documented population of at least 78 Andean condors (Rios-Uzeda & Wallace 2007), with known nests, roosts, and feeding sites in La Paz Department and partially overlapping with two national protected areas: Apolobamba and Madidi. The Apolobamba cordillera is geographically separated from the Cordillera Real, which despite its proximity to the city of La Paz is relatively undocumented for Andean condors. It is possible that further studies establish a link between the Apolobamba Priority Andean Condor Conservation Area and the very large Puna-Tunari-Valles-Boliviano-Tucumano Priority Andean Condor Conservation Area.

Name: Puna-Tunari-Valles-Boliviano-Tucumano Priority Andean Condor Conservation Unit (ACCU-BO-02: Type I)

Description: Large documented Andean condor population across the bulk of the Bolivian Andes and within the Potosí, Chuquisaca, Cochabamba, Tarija and Santa Cruz Departments, estimated to be between 350-500 individuals, and including feeding sites, roosts and nests, and connected to the Chaco as an occasional feeding site. It also includes nine national protected areas: Tunari, Carrasco, Torotoro, Serranía del Iñaño, El Palmar, Cordillera de Sama, Tariquía, Amboró and Serranía del Aguarañe. This ACCU still needs further exploration, for example, Cocapata Municipality in Cochabamba.

Name: Southwestern Bolivia Priority Andean Condor Conservation Unit (ACCU-BO-03: Type II)

Description: This relatively undisturbed area in Potosí Department concentrates the Andean condor records and roosting sites from the western Cordillera of Bolivia and includes the Eduardo Avaroa national protected area.





Distribution and Ecology

In Chile the Andean condor mainly lives in high mountain habitats including the highest peaks, but usually over open grassland and alpine regions. Condors can descend to lowland desert regions, especially to forage along the shoreline for stranded whales, seals and seabirds, and is also found over southern-beech forests in Patagonia (del Hoyo *et al.* 1994; Campbell 2015). The condor is common in southern Tierra del Fuego and Wollaston Archipelago and less frequent in the forested regions of southern Chile (Couve *et al.* 2016). It can also be found in the channels and fiords of the Magallanes region (Kusch 2004, 2006).

Andean condors can travel more than 200 km a day in search of food (Lambertucci *et al.* 2014). Due to its weight and large size, Andean condors generally roost in elevated areas such as rock cliffs which allow take-off without much wing-flapping effort, and where thermals are easily available (Campbell 2015).

The little information about population structure, breeding and abundance for Andean condor comes from specific areas in the central mountains and southern Chile (Sarno *et al.* 2000; Kusch 2004, 2006; Escobar-Gimpel *et al.* 2015). Field observations suggest courtships and copulas begins between July and August in central and southern Chile. Incubation has been observed from September until November, and juveniles complete their flight plumage to leave the nest and fly between March and May, accompanying adults to foraging areas between June and August (Escobar-Gimpel *et al.* en prep.).

Population Size

Maximum population estimates in both Argentina and Chile are around 2.000 animales (Wallace *et al.* 2020), although given the geography of these neighboring elongated countries, it seems probable that there is significant overlap between these estimates.

Currently, anthropogenic impacts are contributing to a contraction of Andean condor range. The greatest declines appear to be in the north perhaps due to reductions in natural prey and predators related to the presence of livestock (Lambertucci *et al.* 2009). Other threats include habitat loss, poisoning of carcasses, and direct persecution due to the belief that Andean condors attack livestock.

Although scientific publications on Andean condors are scarce in Chile, some simultaneous census and population structure studies exist (Kusch 2004, 2006; Escobar 2013, 2014).

Recent advances in methodologies for estimating population size that were discussed at the Lima meeting in 2015 are being tested through sampling designs in the Magallanes region by WCS, Friends of Condor Corporation and the University of

Chile. This design is also being replicated in the Arica and Parinacota regions with the participation of the National Zoo of the Metropolitan Park, the University of Tarapacá and the University of Chile.

Implemented Conservation Actions

According to the Hunting Law (DS 5/1998 MINAGRI) the Andean condor is classified as *Vulnerable* in the central-north zone, *Rare* in the south, and *Not Threatened* in the extreme south.

The National Zoo and Rehabilitation Center for Birds of Prey (Aves Chile) maintains a recovery program and when possible returns damaged condors to the wild.

The NGO "Amigos del Condor" has a study program to locate nesting sites, roosts and foraging sites, complementing the *e-Bird* database (Cornell University) which is administered in Chile by the "Red de Observadores de Aves y Vida Silvestre de Chile (ROC)".

The Center for Zoological Acclimatization (CAZ) and Lo Barnechea Municipality installed an Andean condor feeding area within the Yerba Loca Nature Sanctuary, near Santiago city, with the objective of supplementing Andean condor diet and promoting environmental education.

Andean Condor Historical Range in Chile

El rango histórico del cóndor andino en Chile es casi continuo a lo largo de los Andes, desde Arica hasta Cabo de Hornos, alcanzando la costa en el extremo norte y sur del país (Goodall *et al.* 1946). Este rango ha sido corroborado por el "Atlas de Aves Nidificantes de Chile" (Medrano *et al.* 2018), aunque no hay registros de nidos confirmados en muchos sitios. Existe un vacío grande en la distribución histórica del Salar Atacama y en una porción del altiplano chileno (Figura 31).

Areas Where Andean Condors No Longer Exist in Chile

The Andean condor was still considered present in all of mainland Chile.

Areas With and Without Expert Knowledge on Andean Condors in Chile

Austral Chile Area With Expert Knowledge: Extending from the Cabo de Hornos (56° S) in the south, to the Golfo de Peñas (48° S) in the north, from the border of Argentina to the outer archipelago, this narrow area (300 km at widest point) is a gradient characterized by agricultural land on the eastern slopes, alongside mountain ranges in the central part, and archipelagos and fjords on the western slopes and south. This area has published expert knowledge due to terrestrial and aerial ornithological expeditions through the fjords for 14 years searching for roosts and nests. During this

period Andean condors were sporadically registered. Andean condor observations in the archipelagic zone are associated with marine mammals and reproductive colonies of seabirds, while the mainland distribution of the species is associated with domestic livestock and wild prey such as guanacos.

In this area, almost 90% of the archipelagic zone is within the national protected area system, whereas in the agricultural use areas a maximum of 20% is protected. Gaps in the knowledge polygon correspond to Patagonian ice fields and the archipelago in the extreme north.

Central Chile Area With Expert Knowledge: This area includes a mountain range from Chacabuco (32° 57'S) to Rancagua (34° 15'S). This zone is characterized by high mountains of the Andes mountain range to the east and hills in the central valley that connect the mountain range of the coast to the west. Extensive domestic livestock production dominates this area, especially in the spring and summer seasons. The central zone of Chile is characterized by the highest urban concentration in the country, where the city of Santiago, capital of Chile, is located.

This area is especially known due to recent studies of six condors born in captivity and released with satellite transmitters in the Binational Andean Condor Program (Chile - Argentina) in 2001. The Andean condor population was also studied with camera traps to determine age and sex structure (Escobar-Gimpel *et al.* 2015), as well as satellite tracking of wild individuals published in Doctorate and Magister theses and associated scientific articles.

Since 2005, Andean condor behavior and population structure are studied at feeding sites at a landfill located in the central valley near Santiago city, as well as natural carrion locations in the and known observation places and routes along the mountain range.

Biological Corridor Chillan-Laguna del Laja Area With Expert Knowledge: Situated in the Andes in the Biobío Region over a 5,600 km² area from 36° S and 73° W. The northern limit was at the Castro peak between the Ñuble river and Perquilauquen, along to Longaví and Guaquivilo to the limit with Argentina. This area has four protected areas: Los Huemules del Niblinto National Sanctuary, Los Huemules del Niblinto National Reserve, Ñuble National Reserve and Laguna de la Laja National Park together covering almost 18% of the area. The remaining area is private property (78%) and municipal land (4%), where different types of land use predominate: homes, agriculture, ranching, forestry, energy and tourism.

This area includes a series of threatened ecosystems representing a transitional vegetation between the central dry forests and the temperate Austral forests, and therefore contains a combination of fauna and flora from both ecoregions and a relatively high biodiversity. This area is also a migratory corridor for twelve species of diurnal raptors and four species of nocturnal species, for example, *Accipiter chilensis*,

Phalacrocorax magellanicus, *Strix rufipes*, *Pandion haliaetus*, *Falco peregrinus*, and *Buteo albigula*, as well *Circus buffoni*.

This area is a known Andean condor site but with scarce systematized data regarding abundance, feeding sites and roosts, and therefore in need of further research to quantify Andean condor populations.

Priority Andean Condor Conservation Units in Chile

Five relatively large Priority Andean Condor Conservation Units were identified in Chile (Figure 34).



Figure 31. Andean Condor Historical Range in Chile

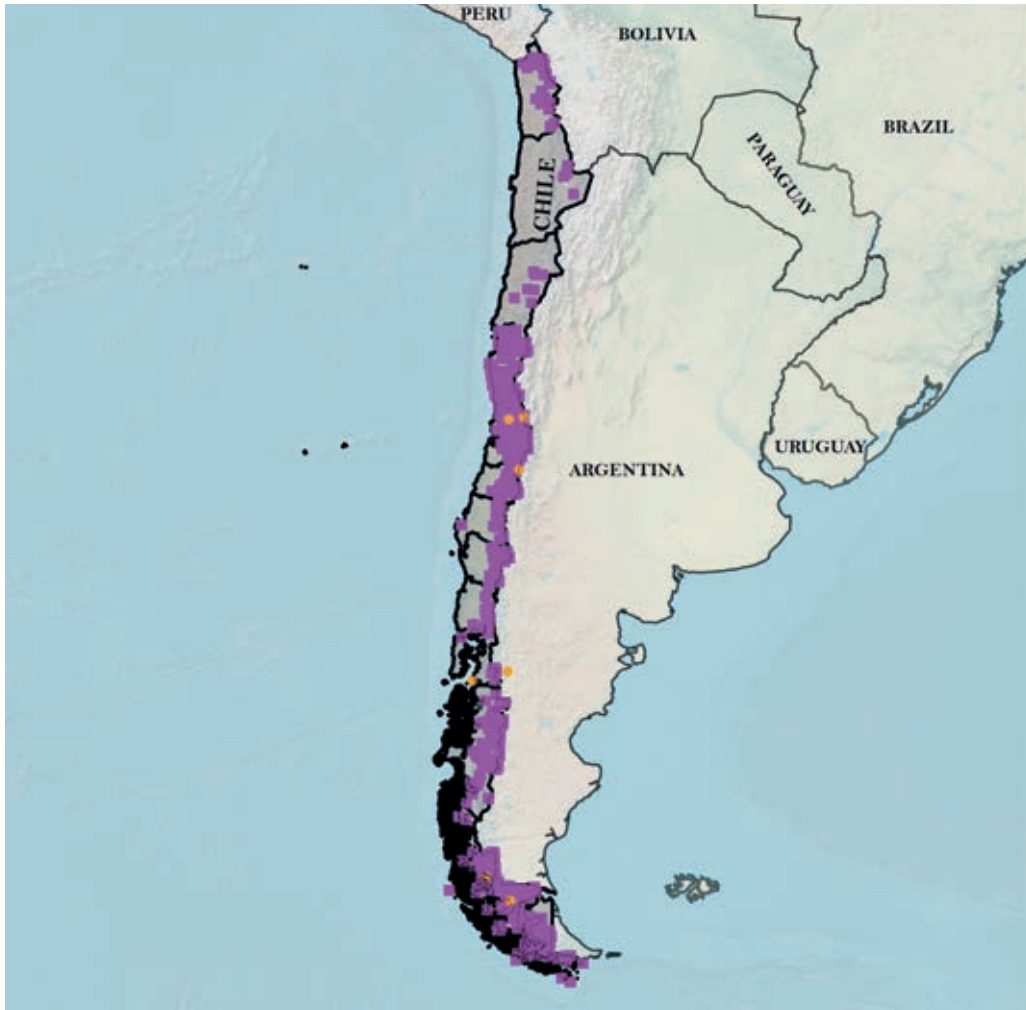


Figure 32. Areas With Expert Knowledge on Andean Condors in Chile

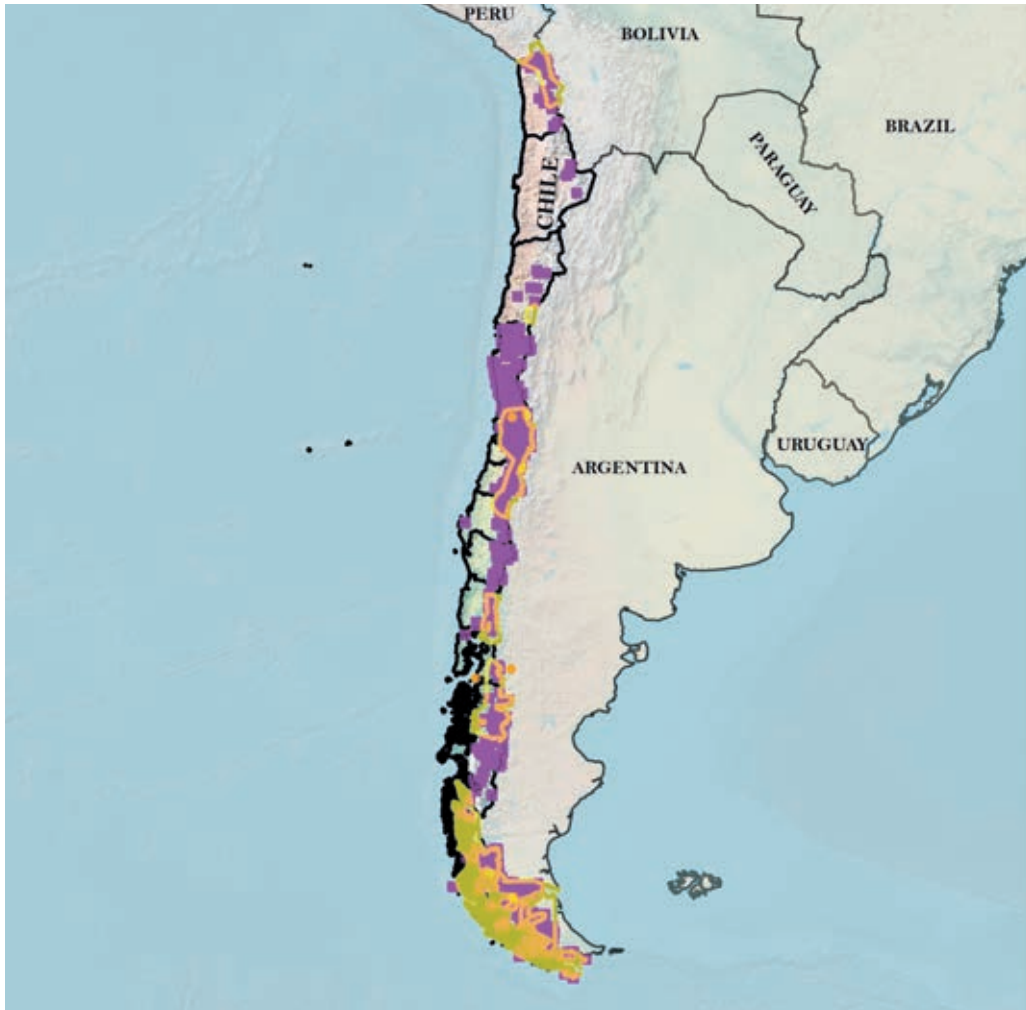
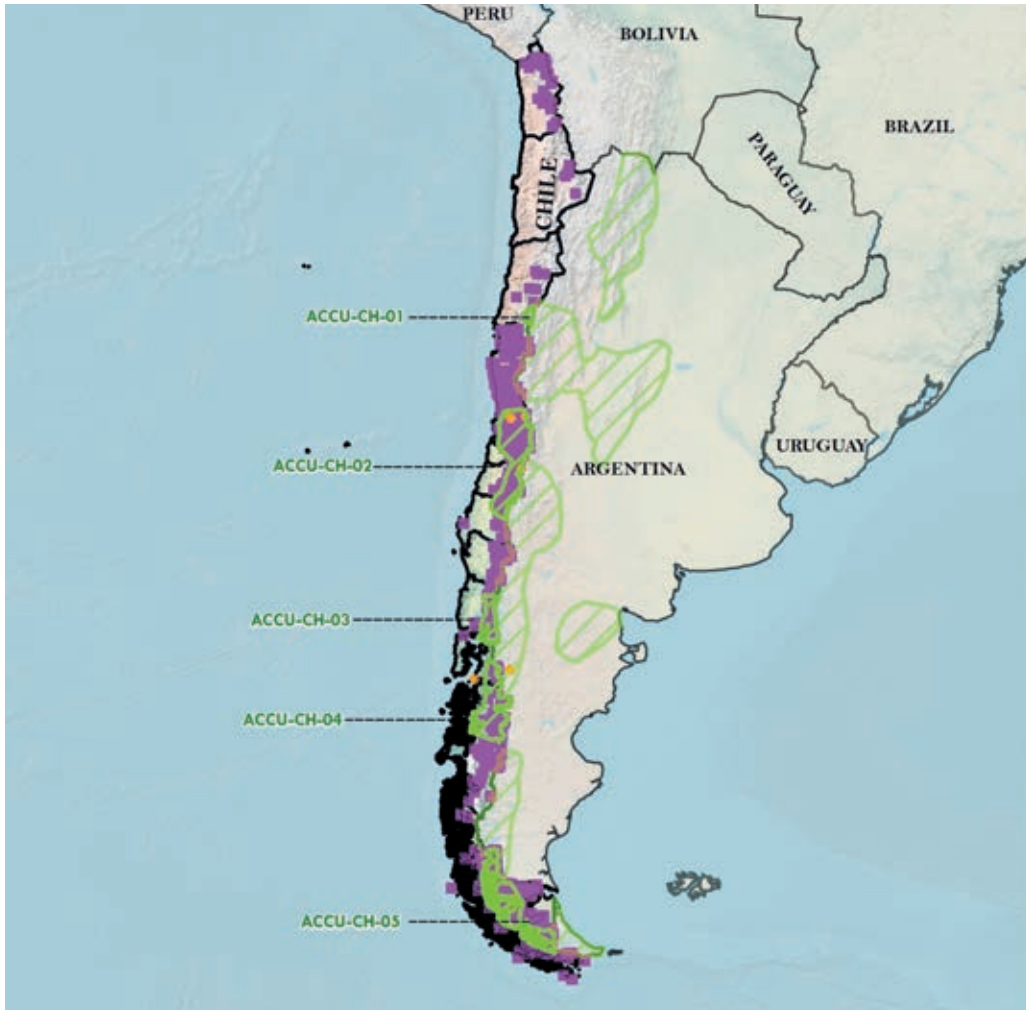


Figure 33. Areas Without Expert Knowledge on Andean Condors in Chile



Figure 34. Priority Andean Condor Conservation Units in Chile



Description of Priority Andean Condor Conservation Units in Chile

Name: *Huascoaltinos Priority Andean Condor Conservation Unit (ACCU-CH-01: Type II)*

Description: This area comprises a portion of the Andes mountain range, located in the III Region of Atacama, including the Huascoaltinos Private Nature Reserve, the only unit of the Region's Private Protected Areas network. It is located within the commune of Alto del Carmen, in the sector of the Valley of Transit, in the Province of Huasco, with a total area of 2,197.3 km². This is considered a Priority Conservation Unit mainly because of the continuity with the ACCU-AR-02 where movements of satellite-monitored condors have been recorded.

Name: *Chile Central Priority Andean Condor Conservation Unit (ACCU-CH-02: Type I)*

Description: Extending between the Andean cordillera and the border with Argentina towards the Central Valley, and containing the Santiago metropolitan area within the polygon, as well as O'Higgins Region and the Rancagua city, this polygon is centered at 33° 50' S and contains the greatest number of condor records in Chile, especially in the Chacabuco mountain chain. Condors use the Central Valley from the Andean cordillera to the coastal cordillera of the Altos de Cantillana. This polygon is populated by at least 8 million people and has intensive mining activity, agriculture, and hydro-electric dams and associated high voltage power lines. Andean condor food is now largely made up of domestic animals (cattle, horses, goats and sheep) and is concentrated in High Andean vegetation in spring and in the valleys in winter. An important supplementary food source is a huge landfill rubbish dump north of Santiago, where more than 350 condors have been registered feeding and using nearby areas.

Name: *Los Ríos-Los Lagos Priority Andean Condor Conservation Unit (ACCU-CH-03: Type I)*

Description: This area extends from north to south, from the volcanoes (40° 10' S) of the XV region (Los Ríos) to Puerto Montt in the X region (Los Lagos) (42° 16' S), east with Argentina and to the west with a chain of mountains, at the beginning of the archipelagos in the south and the lakes in the north.

This area is composed of portions to the north and south separated by a narrow continental strip at the base of the Andes, facing Chiloé Island, where there are a few records of the Andean condor and some identified resting places. Individuals who were captured and tagged with satellite trackers, in Argentina, while feeding, nest in the surroundings of the Seno de Reloncaví Breast, Cochamó, Chile.

Name: *Patagonia Priority Andean Condor Conservation Unit (ACCU-CH-04: Type I)*

Description: This area extends from north to south, from Palena (43° 20' S) of the XV region (Los Ríos) to the Aysén region (45° 47' S), to the east with Argentina and to the west with a chain of mountains, at the beginning of the archipelagos in the south and the lakes in the north.

The polygon is found between the Andes and the fjords of northern Patagonia where a few feeding records exist. Approximately 50% of this area is under legal protection. The main activity on private land is cattle and sheep ranching. The northern portion of this area is relatively heavily influenced by people who persecute native predators.

Name: *Magallanes Priority Andean Condor Conservation Unit (ACCU-CH-05: Type I)*

Description: A polygon comprised of the Andean foothills and massifs between the archipelago and the Patagonian steppe plains with systematic records of roosts and perches, and at least two nesting sites and observed reproduction events (synchronized flight and copulation). Aggregations of more than 100 individuals have been reported in this known feeding area, that may also be the origin of movements to the Patagonian steppe in Argentina and Chile, as well as to the coastal fjords and channels. More than 80% of the polygon is unprotected, but the Torres del Paine National Park and the Karukinka Park are found in this area. Almost the entire area has cattle and sheep, as well as important stronghold populations of the guanaco, and a full community of native predators.

Robert Wallace / WCS





Robert Wallace / WCS



Robert Wallace / WCS

Distribution and Ecology

In the western portion of Argentina, the Andean condor is found from the Jujuy Province in the north to Tierra del Fuego and the Islas de los Estados to the south, and including Central Argentina in the Córdoba, San Luis, La Rioja and San Juan provinces. Satellite telemetry studies since 1997 has clearly demonstrated that condors regularly cross province boundaries and indeed international boundaries between Argentina and Chile and Bolivia. For this analysis we are distinguishing four regions in Argentina: 1) Northern Argentina, 2) Central Argentina, 3) Northern Patagonia and 4) Southern Patagonia.

Andean condor distribution in northern Argentina includes the Catamarca, Tucumán, Salta and Jujuy provinces. Satellite telemetry information from Andean condors marked by the PCCA in the region shows that some individuals also range into central Argentina, as well as neighboring Chile and Bolivia. At the same time, geo-positioning data has detailed roosting sites in this region, as well as feeding sites (Lambertucci *et al.* 2014, 2018; Astore *et al.* 2016). Nevertheless, there is still no detailed information on foraging and nesting areas, with most work to date concentrated on the detection and description of roosting sites.

In central Argentina Andean condor distribution covers the Córdoba, San Luis, La Rioja and San Juan provinces. For Córdoba, the oldest available data consists of ornithological lists, brief comments and non-systematic information (Stempelmann & Schulz 1890; Ashaverus 1897; Castellanos 1923, 1928, 1931; Gardner 1931; Partridge 1953; Nores *et al.* 1983; Martínez 1986; Vidoz 1994a, 1994b; Nores 1995, 1996; Segreti 1998; Feijóo 1999; Miatello *et al.* 1999; Donázar & Feijóo 2002; Sferco & Nores 2003; Casañas 2005b; Miatello 2005a; 2005b).

In San Luis a study on the distribution of the species in specific sites occurred between 1985-1990 (Nellar 1990). Other Andean condor sightings occurred in the Sierra de las Quijadas National Park, San Luis Central Sierras and Comechingones Sierras (Casares 1944; Mayer 1944; Partridge 1953; Pascual 1960; Rex González 1960; Ochoa de Masramón 1983; Nores 1995; Gambier 1998; Haene 2007a; Laguens & Bonin 2009). La Rioja has poor ornithological knowledge in general (Casañas 2007a; Haene 2007b), although permanent populations of Andean condors are documented in the Sierra de Famatina (Castellanos 1928; Nores 1995), the Talampaya National Park (Decaro 2003; Casañas 200, in the Sierras de Velazco (Heredia com. pers) and the Laguna Brava Provincial Reserve (Moschione & Sureda 2007).

More recently in the Córdoba, San Luis and La Rioja provinces, Gargiulo (2014) collected new data on the distribution, nesting and abundance of Andean condors, as well as an analysis of historical information based on place names, indigenous artistic manifestations of Andean condors, and sightings prior to the 20th century, as compared to current (20th century until 2010) sighting, nest and roost information. The study concluded that current Andean condor distribution in

Córdoba, San Luis and La Rioja has not undergone significant modifications with respect to the past.

In San Juan, knowledge regarding Andean condors was scarce until recently when two doctoral theses were conducted. Cailly-Arnulphi and colleagues (2017) studied the threats, use of carrion and perception of local people regarding the species. In San Juan, an earlier study conducted between 2007 and 2008 in the Ischigualasto Provincial Natural Park described Andean condor population characteristics, daily activity, habitat use and social hierarchies (Cailly-Arnulphi 2009). Meanwhile, Perrig (2019) studied Andean condor movement patterns to spatially prioritize the region, also providing data on diet for this area.

Satellite telemetry information from Andean condors marked by the PCCA shows in this region shows that at least some individuals also range in northern Argentina and northern Patagonia, as well as Chile. Night geo-positioning data have revealed the main roosts in this region (Astore *et al.* 2016; Perrig 2019).

For central Argentina, most information on nesting comes from nest monitoring in Córdoba. One nest was found in 1996 in Quebrada del Condorito National Park (Feijóo 1999), where a chick feeding event was filmed inside a nest in 2014 (Ávila pers. comm.). Other nests were recently registered by Heredia (pers. comm.), in 2014 south of Los Gigantes in the Quebrada del Toro, another in 2015 at the Icho Cruz river springs, and a third nest in Ongamira in 2016. Data provided by Morales (pers. comm.), nesting was observed in Cerro del Cóndor, Pocho Department, between 2011-2018 with a total of 5 births in the area (2 males, 3 females). Flying youngsters were observed in the Quebrada de La Mermela.

Finally, the most exhaustive studies on condor nesting were carried out in the Quebrada del Río Yuspe within the Cerro Blanco Private Reserve, with successive nests registered between 2007-2018, where 6 chicks were born (3 males, 3 females) including failed attempts in 2010, 2016 and 2017 (Heredia pers. comm., Rocca pers. comm., Picco pers. comm., Heredia & Piedrabuena 2010; Gargiulo 2014).

In San Luis, known nesting sites are limited to the Sololosta Peak between 1985-1990 and the Quebrada de los Cóndores in 1945 (Nellar 1990). In La Rioja, was registered at 2800 m a.s.l. in 2011 in the Quebrada del Toro on the way to Laguna Brava (Heredia pers. comm.). There is no data on nesting for San Juan.

In northern Patagonia Andean condor distribution includes the Cordillera and pre-Cordillera of the Mendoza, Neuquén, Río Negro and Chubut provinces, and this region has the highest concentration of studies on the species in the world. Condors are distributed over the entire mountain range and enters the steppe to the east in certain areas that have high plateaus and mountains separated from the main Andes range such as Payunia in Mendoza, Auca Mahuida in Neuquén, and Cerro Anecón in Río Negro, with continual records over time. Adult and immature condors monitored

with satellite transmitters move across the entire area providing detailed data for the species in those areas (Lambertucci *et al.* 2014; 2018, Guido *et al.* 2019), as well as revealing movements to the Somuncurá plateau and the Patagonian Atlantic coast, and central Argentina and neighboring Chile. The geo-positioning data has also revealed roosting sites and feeding areas in this region (Lambertucci *et al.* 2014, 2018; Astore *et al.* 2016). Roosting sites are especially important refuges for the species, as well as other bird species (Lambertucci & Ruggiero 2013; 2016), and bring together many individuals at specific sites, including a high portion of the region's population. They are therefore key conservation sites, as well as for population studies (see below).

One nest and the behavior of the nest's adult couple were studied in detail for more than 2 years near the city of Bariloche in Río Negro (Lambertucci & Mastrantuoni 2008). The couple made courtship and intercourse for several months prior to laying the egg, then incubated for two months, and continued with the chick in the nest area up to 15 months after birth. Some threats to Andean condor nests were documented in both northern and southern Patagonia (Lambertucci & Speziale 2009), including anthropic disturbances related to tourism, as well as environmental threats such as fires. In this area more than twenty nests have been monitored by cameras (Sympson pers. com., Alarcón *et al.* unpubl. data), with data suggesting northern Patagonia is particularly important for the reproduction of the species, especially areas such as the Encantado Valley in the Río Negro and Neuquén provinces.

Since 2009, the PCCA has reported the birth of nine Andean condor chicks on the Somuncurá Plateau and the Patagonian Atlantic coast (Jácome 2010; Astore *et al.* 2016). The success of this reintroduction program has allowed the return of this species to an area where it was extinct for more than a century (Conway 2005; Jácome *et al.* 2005). The nests were monitored until the chicks became independent from their parents.

In southern Patagonia few studies have been conducted, but Andean condor distribution is continual over time and includes the of Santa Cruz and Tierra del Fuego provinces, as well as Isla de los Estados in the entire Cordillera and pre-Cordillera, even reaching the coastal areas. The species occupies much of the island of Tierra del Fuego. Satellite telemetry data from the PCCA shows the dispersion of these birds in the southern part of the province of Santa Cruz, including Los Glaciares National Park, and even Chile. Nocturnal geo-positioning data has documented their roosts in this region (De Martino *et al.* 2011). A recent study demonstrated how Andean condors select habitat in the area using transects and point counts to estimate Andean condor and herbivore abundance in the mountains and the plains. The distribution of Andean condors in Santa Cruz and Tierra del Fuego is determined by relatively scarce habitats like "mallines" (inundated lowlands, wetlands) where herbivores concentrate, as well as steep areas where condors can roost and nest (Pérez-García *et al.* 2018).

There is almost no information on nesting in this area, however, there is a high density of birds and nests, particularly in the extreme south. Nests are observed by tourists on cliffs along the coast of Lake Argentino, an area very visited every day by tourists on boats that visit the glaciers (Lambertucci & Speziale 2009).

Population Size

In northern Argentina there is still no detailed information on Andean condor population abundance. For central Argentina, available data on Andean condor population abundance in Córdoba recorded a maximum of 60 individuals in 1978 in Pampa de Achala (Nores *et al.* 1983). More specific observations in the Quebrada del Condorito National Park (Miatello *et al.* 1999), documented 58 individuals. Feijóo (1999) and Donázar & Feijóo (2002) provided seasonal quantitative data on the population abundance of the species and on annual and hierarchical use of communal roosts at the same site during 1996-1997, registering 117 animals. After the creation of the Quebrada del Condorito National Park, 113 condors were registered through systematic censuses between 2006 and 2010 (Gargiulo 2014).

Morales (pers. comm.) provided information regarding Los Túneles-Las Palmas-Taninga in the Pocho Department of Córdoba. Population censuses carried out between 2011-2018 in the Cerro del Cóndor counted 27 condors. A population of 30 individuals was recorded at the Quebrada de La Mermela between 2013-2018. In the Arreken roost, located between Cerro del Cóndor and Cerro Belis, between 2014-2018, 8 specimens were observed. On Cerro Belisentre, between 2015-2018, the maximum number of sightings was 12 animals.

Between 2016-2018 in Córdoba Heredia (pers. comm.) registered 48 individuals in the Sierras de Guasapampa, 20 individuals in the Quebrada del Chaguaral in the Los Chorrillos Private Reserve, 12 individuals at the Los Chorrillos waterfall, approximately 30 individuals in the Cerro Blanco Private Reserve, 50 individuals between Cerro Uritorco and Cerro Overo, 60 individuals in Los Terrones, Cerro Colchiqui and Ongamira, 10 individuals at the El Hueco cliffs in the Capilla del Monte, between 10-15 individuals in Cuchi Corral (La Cumbre), and between 30-40 birds at the three roosts in Cerro Characato on the Pinto River.

In northern Córdoba province, on Cerro Colorado, in December 2014, five condors (2 adults, 3 juveniles) were registered for the first time in 50 years (Córdoba Press 2014) and condors continue to be observed there (Gordillo & Heredia pers. comm.). In June 2018, seven condors were registered in flight (5 adults, 2 juveniles) near San Pedro Norte (Gordillo pers. comm.).

In San Luis province, 32 animals were counted in 1988 in the Quebrada del Río Luján in the Central Sierra de San Luis (Nellar 1990). Seasonal censuses conducted in the Sierra de las Quijadas National Park counted up to 36 condors between 2008-2010 (Gargiulo 2014).

In La Rioja province, seasonal Andean condor censuses were carried out between 2009-2010 in the Talampaya National Park, where 11 condors were registered (Gargiulo 2014). In the Sierras del Velazco, 10 gorges were studied from La Pampa de la Viuda (Sanagasta) in the towns of Chuquis, Aminga, Los Molinos, Anillaco, to Aimogasta with 10 to 15 individuals per gorge (Heredia pers. comm.). In Olta three roosts were monitored counting 10 individuals. Further west in the Sierras de Malazán, a large roost with lithographs in Guasamayo Park has 20 individuals (Heredia pers. comm.). La Posta de Los Cóndores south of La Rioja, 70 km from Olta, has three important roosts between 30 and 40 individuals (Heredia pers. comm.). Finally, in San Juan province there is a population of 62 individuals in the Ischigualasto Provincial Natural Park (Cailly-Arnulphi 2009).

In northern Patagonia population estimates are derived from censuses at roosts, as well as genetic studies. Roost censuses revealed 80 different individuals used 14 roosts (Alcaide *et al.* 2010). Nevertheless, continuous censuses at three roosts over three years showed significant fluctuations in the use of these sites with groups of individuals exceeding 100 on certain days (Lambertucci *et al.* 2008). It is important to highlight that Andean condor abundance at roosts is highly variable, and this variability is influenced by the specific roost, as well as the age classes that use them (Lambertucci 2013).

Simultaneous censuses at 10 roosts over three years and across seasons showed that populations can reach at least 246 individuals at roosts and up to an estimated 300 individuals (Lambertucci 2010). Of these, 68.5% were adults and 31.5% immature birds. It should be noted that this method only counts the population using communal roosts and does not consider adult pairs that were using their nesting areas. Subsequent censuses suggest similar abundances at these roosts (Alarcón *et al.* unpubl. data). The age/sex proportion is skewed towards a greater number of adult males, as is the case in other Andean condor studies across their distribution (Lambertucci *et al.* 2012).

In southern Patagonia there have been no population censuses. However, recently the results of point counts across both provinces (Pérez García *et al.* 2018) shows the importance of rocks and mountain meadows for the large-scale distribution of the species in Tierra del Fuego and Santa Cruz. The latter are very productive sites surrounded by an arid steppe with low vegetation production, and they allow the presence of herbivores as potential future carrion (Pérez García *et al.* 2018).

Implemented Conservation Actions

Rescues and Releases

Since 2000, the Andean Condor Rescue and Rehabilitation Center of the Andean Condor Conservation Program (PCCA), in association with the relevant environmental authorities, has intervened in the rescue of more than 80 Andean condors in northern Argentina, 60 condors in central Argentina, more than 100 condors in northern Patagonia, and 20 condors in southern Patagonia.

In 1997 in Valle Encantado, Río Negro Province, the first release of the PCCA was intended to develop satellite tracking technology for Andean condors (Astore 2001; Sestelo 2003). Since then, the PCCA has completed more than 40 releases of condors in northern Argentina, more than 30 releases of condors in the center of the country, more than 70 condors in northern Patagonia (51 of these on the Patagonian Atlantic coast), and 2 condors in southern Patagonia. All these individuals came from rescue actions and had been rehabilitated at the PCCA Rescue Center, which currently operates in the EcoPark of in Buenos Aires. All released animals were marked and some of them were followed through radio and satellite telemetry (De Martino *et al.* 2011; Astore *et al.* 2016).

Based on the PCCA driven Management Plan for the species, in August 2018 an adult female, unable to fly, moved to the Tatú Carreta Zoo, to form a new reproductive couple with a male lacking a wing. In November 2019, this couple had a male pigeon, even though these specimens cannot be released, they can still make significant contributions to the *ex situ* conservation program (Astore 2015).

The Ministry of Environment in the Córdoba Province released two male condors near the Padre Liqueno School in the Sierras Grandes de Córdoba, one in July 2015 and the other in February 2017, both approximately 1 year old and apparently victims of lead poisoning.

Protected Areas

In northern Argentina the natural protected areas of Jujuy Province were declared a Condor Sanctuary for the Conservation of Nature (Jácome & Lambertucci 2000), thanks to a collaboration agreement between the Province's Ministry of Environment and the Bioandina Foundation. Similarly, in northern Patagonia the protected natural areas of Mendoza Province were declared a Condor Sanctuary for the Conservation of Nature, thanks to a collaboration agreement between the Ministry of Environment and Territorial Planning, the Province's Directorate of Resources Natural Renewable and the Bioandina Foundation. The PCCA recognizes the ecological and cultural importance of Andean condors, and the need to work towards their conservation (Jácome & Lambertucci 2000).

Environmental Educational

As a comprehensive conservation plan, the PCCA carries out educational programs at all levels in all four regions, which include dissemination actions in mass media, work with local communities, surveys on livestock practices, and scientific, cultural and educational exhibitions, reaching thousands of people with a specific message of conservation. Before each release sacred ceremonies conducted by local communities to bless the return of the birds and their harmonious coexistence with all life forms (Jácome 2016).

To contribute to Andean condor conservation in central Argentina in Córdoba Province since 2000, extension, awareness and training activities such as talks, workshops and preparation of curriculum support material were carried out within the framework of formal (schools etc.) and non-formal education (community, interested persons), and as part of COPANACU Project (Condor as Natural and Cultural Heritage, CONICET-National University of Córdoba) declared a priority by the Province's Ministry of Education (Res. #588/02). Approximately 300 teachers and students participated, mainly at the primary level, and the project has achieved national (Gordillo 2000) and international reach (Gordillo 2002). Curriculum support material was also prepared for teachers and educators focused on the condor and two books were published: *Condors: Life of Heights* (Heredia 2011), and *The Magic of the Condor: Condor as Natural and Cultural Heritage* (Gordillo 2014). In 2008, two special television reports on the situation of the condor in the Sierras de Córdoba (Gargiulo pers. comm.) were produced for Channels 10 and 12 of Córdoba.

Between 2008 and 2009, three Andean condor biology and ecology workshops were held in the Cerro Blanco Reserve (Piedrabuena & Heredia pers. comm.). The *Secret of the Condors* documentary was released 2012 by Channel 12 concerning Andean condor nesting in the wild at a nest in the Quebrada del Río Yuspe of the Cerro Blanco Private Reserve, Córdoba. It has been projected in schools and towns in Córdoba. Throughout this time talks were given to students, teachers researchers, universities and local government offices on the biology and conservation status of the Andean (Heredia pers. comm.; Morales pers. comm.).

In northern Patagonia, innumerable educational activities have been carried out to revalue the species, reduce its threats and improve its knowledge by the general public, through talks to rural schools, schools in cities, general audiences, interviews in different media and graphic dissemination material. The dissemination work of the Conservation Biology Research Group (GRINBIC) reached dozens of schools in the city of Bariloche. In addition, this group generated a book for children in which the problem of the use of poisons is discussed. In addition, they created a digital condor, called Evaristo, who gives talks at institutions in the area about the conservation problems of condors and other scavengers. Similarly, in southern Patagonia, several educational and evaluation activities of the species have been carried out as a potential tourist resource (McNamara *et al.* 2002; Ferrari *et al.* 2010).

Andean Condor Historical Range in Argentina

The Andean condor was historically found in Argentina along the Andes mountain chain from Jujuy to Tierra del Fuego, as well as east to the central plains in the San Luis and Córdoba provinces (Lambertucci 2007). Historical records are also present along the Atlantic coast of Patagonia (BirdLife 2017), however the most recent of these were more than a century ago.

In central Argentina current information suggests that Andean condor has not changed from the historical distribution, for example, recent (2014 - present) observations from the northern hills of Córdoba (Cerro Colorado and San Pedro Norte) represent the first records for 50 years (Gargiulo 2014; Gordillo & Heredia com pers.). Thus, the current distribution reflects historical distribution apart from the coast of Chubut Province and northern Santa Cruz in Patagonia (Figure 35).

Areas Where Andean Condors No Longer Exist in Argentina

In Argentina Andean condors have been locally extirpated from the central zone of Río Negro and the coasts of Chubut and Santa Cruz (Figure 36). Although data is scarce it is believed that Andean condors were previously relatively abundant in these zones.

Areas With Expert Knowledge on Andean Condors in Argentina

On the basis of current and historical knowledge in Argentina we distinguished four areas (Figure 37): 1) Northern Argentina, 2) Central Argentina, 3) Northern Patagonia including northwestern arid Patagonia, northern Patagonia Andean forests and the Somuncurá plateau, and 4) Southern Patagonia including southern Patagonia Andean forests and Tierra del Fuego.

Areas Without Expert Knowledge on Andean Condors in Argentina

Andean condor expert knowledge is scarce in northern Argentina, especially Mendoza Province, as well as central Santa Cruz (Figure 38).

Priority Andean Condor Conservation Units in Argentina

In Argentina we identified six Priority Andean Condor Conservation Areas that actually cover the majority of original Andean condor distribution in the country (Figure 39). One of these areas (ACCU 1) border southern Bolivia, four other areas border eastern Chile (ACCUs 2, 3, 5 and 6), and only one (ACCU 4) is located in the eastern end without having a connection with bordering countries.

Argentina

Pablo Alarcón, Vanessa Astore, Carolina Gargiulo, Sandra Gordillo,
Javier Heredia, Rubén Morales, Sergio Lambertucci & Guillermo Wiemeier



Robert Wallace / WCS

Figure 35. Andean Condor Historical Range in Argentina

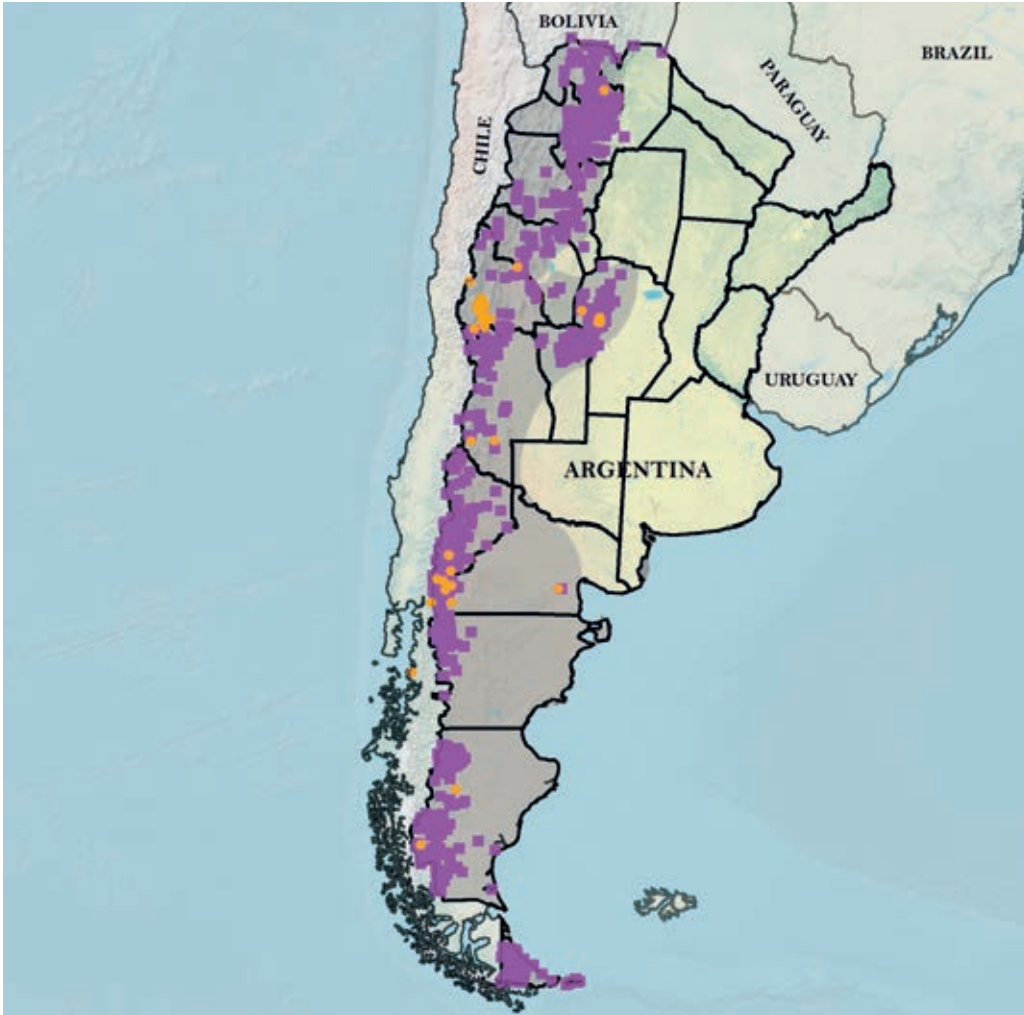


Figure 36. Areas Where Andean Condors No Longer Exist in Argentina



Figure 37. Areas With Expert Knowledge on Andean Condors in Argentina

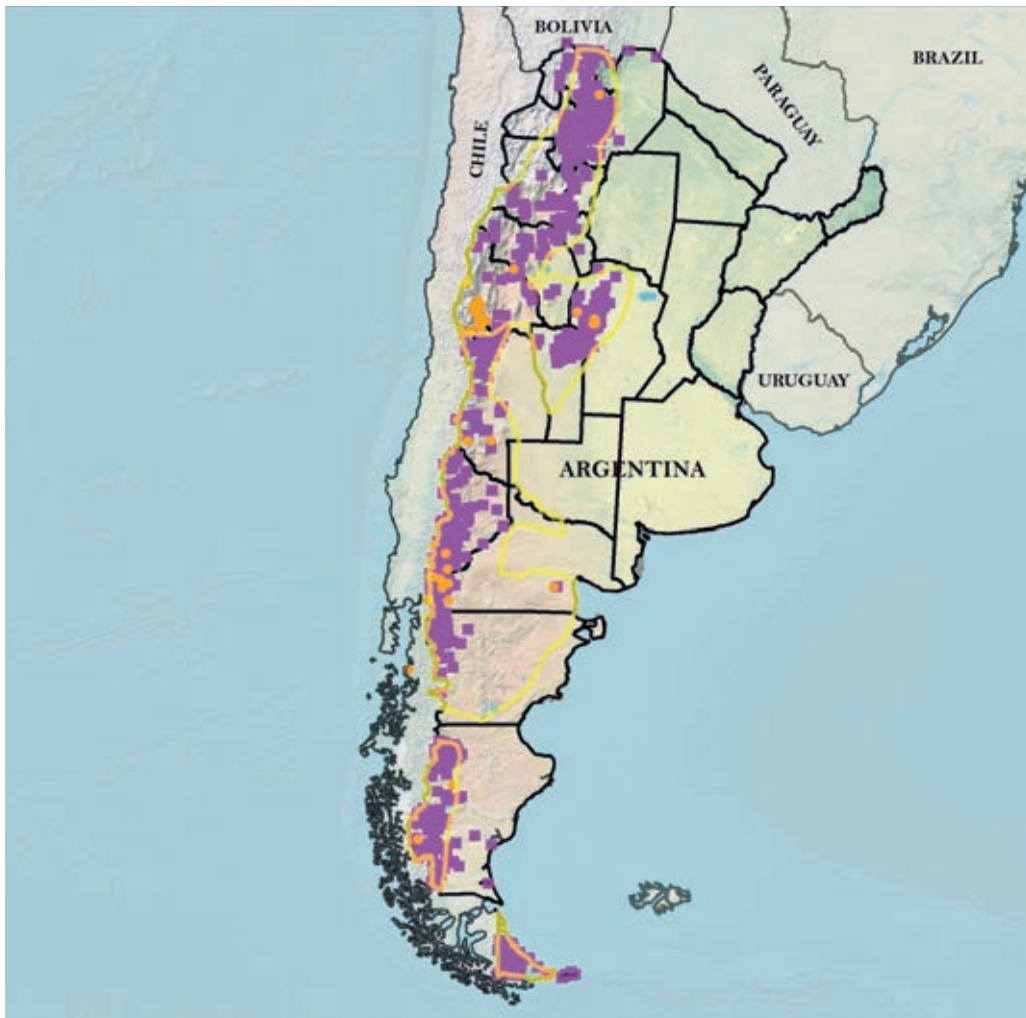


Figure 38. Areas Without Expert Knowledge on Andean Condors in Argentina



Figure 39. Priority Andean Condor Conservation Units in Argentina



Description of Priority Andean Condor Conservation Units in Argentina

Name: Northern Argentina Priority Andean Condor Conservation Unit (ACCU-AR-01: Type II)

Description: This area covers Jujuy, northern Catamarca (Belén, Santa Marta), northwestern Tucumán and central Salta, and is continuous with ACCU 2 in Bolivia. This ACCU features several national parks including Los Alisos, Los Cardones and Baritú, Calilegua, El Rey as well the Las Lancitas protected area.

Name: Central Argentina Priority Andean Condor Conservation Unit (ACCU-AR-02: Type I)

Description: The Andean condor is considered Endangered according to the #795/2017 resolution from the *Ministerio de Ambiente y Desarrollo Sustentable* (MAyDS 2017), the Córdoba, San Luis and La Rioja provinces do not have local threatened species lists. In San Juan the Andean condor is considered "Vulnerable" according to the #656/2011 Provincial Resolution of the *Secretaría de Estado de Ambiente y Desarrollo Sustentable* (SEAYDS 2011). According to data from central Argentina, Andean condor populations are resident and stable in this ACCU. Andean condor distribution in central Argentina includes the Córdoba, San Luis, La Rioja and San Juan provinces including several national, provincial and private protected areas where the species are present.

In Córdoba, Quebrada del Condorito National Park and National Reserve is surrounded by the Pampa de Achala Provincial Water Reserve. It is considered an Area of Importance for Bird Conservation (AICA). The region known as Pampa de Achala is a mountain formation belonging to the Pampean Sierras that runs north to south in central western Córdoba. These area of plains and canyons located above 1,500 m a.s.l. belong to the Chaco Serrano ecoregion, constituting a contact area of different floristic influences (Chaco, Andean and Patagonian) (Burkart *et al.* 1999; Chébez 2005a; Miatello 2007a).

The Sierras del Norte de Córdoba are located in northern Córdoba in the Chaco Serrano, and are relatively low mountains of just over 1,000 m a.s.l. running north-south with valleys and a high pampa in the central area. Here the Cerro Colorado Natural Cultural Provincial Reserve holds pictographs, including condor images, made by hunter-gatherer groups and the Comechingones indigenous people that inhabited the region until the arrival of the Spaniards in the 16th century (Photos 5 & 6; Chébez 2005a; Miatello 2007b; Recalde & Gordillo 2017).

The Chancaní, Pocho and Guasapampa mountains are located in the Chaco Seco and Chaco Serrano ecoregions, where the Chancaní Provincial Park stands out. To the east, the Pampa de Pocho (1,000 m a.s.l.) and its characteristic palm groves (*Trithrinax campestris*) are included (Chébez 2005a; Miatello 2007c). The Uritorco system is considered as an AICA in the Chaco Seco ecoregion in the Sierras Chicas (running north-south), with a highest peak of 1,950 m a.s.l., and in the northern Sierras Chicas the Andean condor is common (Casañas 2007b).

San Luis has national, provincial and private Protected Natural Areas, such as the Sierra de las Quijadas National Park and Provincial Reserve, the Bajo de Véliz Provincial Park, the Palmar de Papagayos Provincial Reserve and the Valle Escondido Private Reserve (Chébez 2005a). These areas occupy various ecoregions. For example, the Sierra

de las Quijadas National Park, Provincial Reserve, and AICA, are found in the Western Sierras of San Luis, running north-south covering an extension 35 km long and 15 km wide, integrate the Chaco Seco and Monte de Llanuras y Mesetas ecoregions. The cliffs of the Potrero de la Aguada are used as roosts by the Andean condor (Burkart *et al.* 1999; Chébez 2005a; Haene 2007a). The Provincial Park Bajo de Véliz includes the Chaco Seco and Chaco Serrano ecoregions and is an elongated (12 km long) and narrow depression (200 m to 2 km wide) running north-south. The Palmar de Papagayos Provincial Reserve is located at the foot of the Sierra de Comechingones mountain range in northeastern San Luis Province in the Chaco Serrano ecoregion, and is considered an area of special conservation interest due to significant endemism. Finally, the Valle Escondido Private Reserve is part of the Chaco Serrano ecoregion, situated at between 1,300 to 1,700 m a.s.l., and is located in the Central Sierras of San Luis (Chébez 2005a).

In western La Rioja Province the Andean Cordillera dominates, with a string of high peaks as well as high plains with shrub steppes. The pre-Cordillera mountain ranges include patches with high Andean wildlife. In central La Rioja Province, the desert landscape of the Monte de Sierras and Bolsones ecoregion dominates. La Rioja Province includes the Talampaya National Park, also considered an AICA, the Laguna Brava Provincial Reserve, AICA and RAMSAR Site, the Serranías del Famatina and the Quebrada del Cóndor provincial reserves and finally, the Cerros Bola Provincial Natural Monument, Loma Blanca and Loma Negra (Burkart *et al.* 1999; Chébez 2005b; Casañas 2007a; Haene 2007b; Moschione & Sureda 2007).

In western San Juan Province, the main Andes mountain chain includes major peaks such as Mercedario at 6,770 m a.s.l. In central San Juan Province Pre-Cordillera mountain range runs parallel to the Andes with altitudes up to 4,368 m a.s.l. at Pircas. Between the two mountain chains is the Iglesia-Calingasta valley. The eastern half of San Juan Province is dominated by plains between two Pampas Sierras or plateaus: Pie de Palo and Valle Fértil within the Puna, Chaco Serrano and Chaco Seco ecoregions, and a combination of high Andean steppe vegetation, as well as marshes in the backwaters of streams. In the eastern ravines of the Sierra de Valle Fértil there are Chaco Serrano forest relics that continue east with transitional plains with the Dry Chaco (Burkart *et al.* 1999; Haene 2007c).

In San Juan, the Protected Natural Areas located within the Andean condor distribution are: San Guillermo National Park, Provincial Reserve, Biosphere Reserve and AICA, El Leoncito National Park and AICA, Ischigualasto Valle de La Luna Provincial Park and Natural World Heritage of Humanity, the Valle Fértil Provincial Park, the Don Carmelo Private Reserve, and the Los Morrillos Private Reserve and Wildlife Refuge of the Argentine Wildlife Foundation (FVSA) (Chébez 2005a; Haene 2007d, 2007e).

Name: Northern Patagonia Priority Andean Condor Conservation Unit (ACCU-AR-03: Type I)

Description: This ACCU includes Northwestern Arid Patagonia including southern Mendoza, northern Neuquén, the Payunia region, Auca Mahuida, mid and upper Neuquén river, especially Chihuidos, and the Tromen, Domuyo, Copahue, Llancanello and Laguna de Epulauquen protected areas. The ACCU also includes the more humid Northern Patagonia Andean Forest, which holds a high density of nests and roosts in southern Neuquén (Lambertucci 2010). Feeding sites are also found in the Junín de los Andes down to Collón Curá, and to the east in the Anecón hills in northwestern Río Negro. The Limay watershed and the Encantado valley also have high densities of roosts and nests. Here the Nahuel Huapi, Lanín, Arrayanes and Lago Puelo National Parks and the Limay and Río Azul protected landscapes. This ACCU is continuous with ACCUs in Chile including Nevados del Chillán, Laguna del Laja, Paso de los Libertadores, Región 5, and the Región de los Lagos y Volcanes.

Name: *Somuncurá Plateau Priority Andean Condor Conservation Unit (ACCU-AR-04: Type II)*

Descripción: Se ubica en el extremo más oriental de la Argentina, en las provincias de Río Negro y Chubut, en el límite con el Océano Atlántico. Esta es una unidad donde el cóndor andino se había extinguido y que, a lo largo de 13 años, los programas de reintroducción lograron restablecer las poblaciones de la especie, como el nacimiento de crías en la zona y la conexión de antiguos corredores naturales.

Nombre: *Unidad de Conservación Prioritaria del Cóndor Andino Patagonia Sur (UCCA-AR-05: Tipo I)*

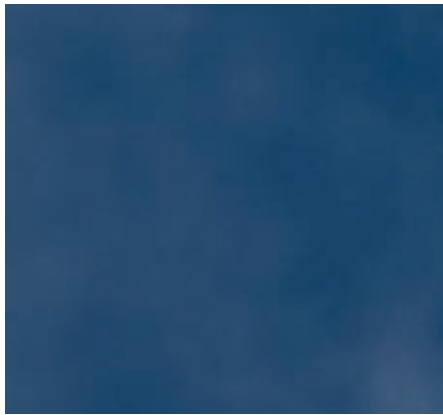
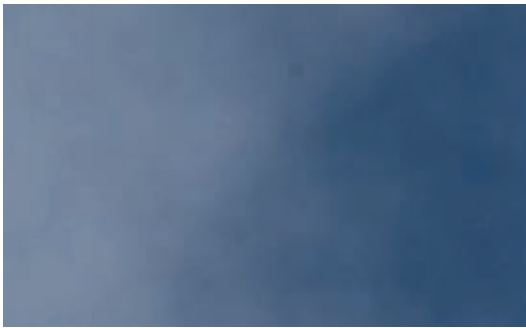
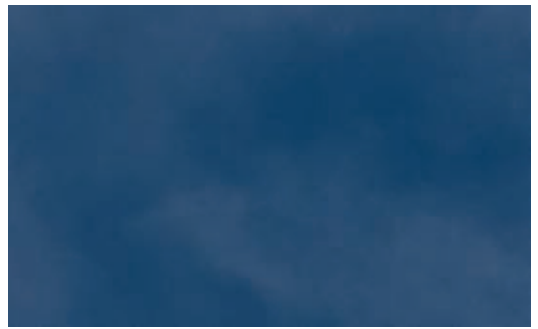
Description: Situated in the extreme east of Argentina in eastern Río Negro and Chubut provinces, limited by the Atlantic Ocean, this is an ACCU where Andean condors were extinct until, over the last 13 years, reintroduction programs re-established populations in the region, for example, successful reintroductions, wild births, and connection of natural corridors.

Name: *Southern Patagonia Priority Andean Condor Conservation Unit (ACCU-AR-01: Type I)*

Description: This ACCU includes the Perito Moreno and Los Glaciares national parks, the San Lorenzo protected area, and the Cueva de las Manos World Heritage Site, as well as a 70 km strip from the Andean mountain chain to the east and Río Turbio to the south, and includes important feeding, nesting and roosting sites.

Name: *Tierra del Fuego Priority Andean Condor Conservation Unit (ACCU-AR-01: Type I)*

Description: In Tierra del Fuego, Andean condors can be seen foraging along the coast in the Tierra del Fuego National Park and the Corazón de la Isla and Península Mitre protected areas. Feeding and roosting areas are also found near the Fagnano lake. It also includes the mouth of the Gallegos river in the Santa Cruz Province. This ACCU is continuous with other ACCUs in southern Chile.



Rob Wallace / WCS

Summary of Priority Andean Condor Conservation Units (ACCU)

In total, in the original workshop 31 Andean Condor Conservation Units (ACCUs) were proposed by Andean condor experts (Table 3) covering an area representing 37.3% of the adjusted historical range. More than half of the area prioritized as ACCUs are in Argentina (51.17%), slightly more than would be expected based on the portion of the historical range for Argentina (42.78%; see Table 1). Bolivia also prioritized a larger area than might be expected based on the percentage of the historical range, whereas Peru, and particularly Chile, prioritized less area than might be expected given historical range (Tables 1 & 3). Portions in the northern part of the Andean condor range (Venezuela, Colombia, Ecuador) were small, collectively less than 5%, and reflect small historical range portions accordingly (6.24%).

In Venezuela, two ACCUs were proposed based on historic data (Merida) and on the frontier with Colombia. In Colombia, eight small ACCUs were proposed. In Ecuador, three ACCUs were proposed. One of them, to the north, corresponds to the areas where condors have been monitored. A second is found in the central Andes of Ecuador. The third, to the south, is where the information on condors is the sparsest, but it is known that condors inhabit and even nest there.

In central and northern Peru, three ACCUs were proposed. In southern Peru, seven ACCUs were originally proposed by participants, including one on the Colca Canyon, the site most associated with the condor in the country, however we combined many of these into a larger ACCU as recent distribution points suggested connectivity between many of the smaller proposed areas.

In Chile and Bolivia, five and three ACCUs were proposed respectively in each country. Finally, in Argentina six ACCUs from the northern area to Tierra del Fuego were proposed. These ACCUs were coordinated with other countries since the northernmost ACCU is on the border with Bolivia, and the one in Bariloche is connected to Chile.

A detail of the 31 individual ACCUs originally identified reveal that they are of different sizes and reflect the differences in priorities, threats, and ecology of each region (Table 3). We also calculated the percentage of each Andean Condor Priority Conservation Unit that is currently found under protection using three different categories of protected areas: 1) National Protected Areas; 2) State or Regional Scale Protected Areas; and 3) Municipal or Private Protected Areas (Table 4).

Table 3. Size and Area Percentage of Andean Condor Conservation Units (ACCU) by Country

| Andean Condor Conservation Units (ACCU) | N | Area (km ²) | % Total Conservation Unit Area |
|---|----|-------------------------|--------------------------------|
| Total Area in Andean Condor Conservation Units (ACCU) | 31 | 1.203.702,93 | 100 |
| Andean Condor Conservation Units (ACCU) Venezuela | 2 | 12.447,15 | 1,03 |
| Andean Condor Conservation Units (ACCU) Colombia | 8 | 31.492,06 | 2,62 |
| Andean Condor Conservation Units (ACCU) Ecuador | 3 | 22.972,97 | 1,91 |
| Andean Condor Conservation Units (ACCU) Peru | 4 | 169.130,93 | 14,05 |
| Andean Condor Conservation Units (ACCU) Bolivia | 3 | 213.698,32 | 17,75 |
| Andean Condor Conservation Units (ACCU) Chile | 5 | 138.058,49 | 11,47 |
| Andean Condor Conservation Units (ACCU) Argentina | 6 | 615.903 | 51,17 |

Table 4. Size of Andean Condor Conservation Units (ACCUs) from North to South and Percentage Protected by Different Protected Area Types

| ACCU Name | Area km ² | UCCA Type | % ACCU in National Protection | % ACCU in Regional Protection | % ACCU in Municipal/ Private Protection |
|----------------------|----------------------|-----------|-------------------------------|-------------------------------|---|
| Venezuela UCCA-VE-01 | 11.869,95 | II | 38,74 | 0,22 | 0 |
| Venezuela UCCA-VE-02 | 577,2 | II | 84,28 | 0 | 0 |
| Colombia UCCA-CO-01 | 9.289,53 | II | 55,87 | 0 | 0 |
| Colombia UCCA-CO-02 | 2.490,87 | II | 2,33 | 0 | 0 |
| Colombia UCCA-CO-03 | 5.592,69 | II | 32,06 | 0 | 0 |
| Colombia UCCA-CO-04 | 836,5 | II | 0 | 0 | 7,69 |
| Colombia UCCA-CO-05 | 8.542 | II | 9,48 | 0 | 0 |
| Colombia UCCA-CO-06 | 1.380,6 | II | 57,75 | 0 | 0 |
| Colombia UCCA-CO-07 | 2.486,72 | II | 46,64 | 0 | 0 |
| Colombia UCCA-CO-08 | 873,15 | II | 0 | 0 | 0 |
| Ecuador UCCA-EC-01 | 12.475,52 | II | 22,03 | 13,93 | 0 |
| Ecuador UCCA-EC-02 | 3.219,9 | II | 55,63 | 0 | 0 |
| Ecuador UCCA-EC-03 | 7.277,54 | II | 3,7 | 0 | 0 |

| | | | | | |
|----------------------|---------------------|----|-------|------|-------|
| Peru UCCA-PE-01 | 8.124,8 | I | 0,05 | 0 | 0 |
| Peru UCCA-PE-02 | 1.813,19 | II | 0 | 0 | 0 |
| Peru UCCA-PE-03 | 66.130,54 | I | 5,04 | 3,23 | 0,97 |
| Peru UCCA-PE-04 | 93.062,4 | I | 1,11 | 7,04 | 0,1 |
| Bolivia UCCA-BO-01 | 3.954,35 | I | 72,39 | 0 | 0 |
| Bolivia UCCA-BO-02 | 192.205,83 | I | 9,9 | 4,42 | 0 |
| Bolivia UCCA-BO-03 | 17.538,15 | II | 30,5 | 0,05 | 0,03 |
| Chile UCCA-CH-01 | 2.205,36 | II | 0 | 0 | 3,17 |
| Chile UCCA-CH-02 | 43.698,34 | I | 2,81 | 0,06 | 0,11 |
| Chile UCCA-CH-03 | 12.366,42 | I | 38,51 | 0,19 | 0,06 |
| Chile UCCA-CH-04 | 33.802,89 | I | 15,26 | 0,01 | 0 |
| Chile UCCA-CH-05 | 45.985,48 | I | 16,25 | 0 | 0 |
| Argentina UCCA-AR-01 | 106.745,03 | I | 2,22 | 0 | 18,3 |
| Argentina UCCA-AR-02 | 212.873,55 | I | 2,53 | 0 | 9,69 |
| Argentina UCCA-AR-03 | 147.916,03 | I | 9,65 | 0,43 | 3,05 |
| Argentina UCCA-AR-04 | 53.186,61 | II | 23,01 | 0 | 30,08 |
| Argentina UCCA-AR-05 | 69.920,22 | I | 0 | 0 | 1,14 |
| Argentina UCCA-AR-06 | 25.261,56 | I | 3,1 | 0 | 4,54 |
| TOTAL | 1.203.702,93 | | | | |

However, there are several ACCUs in neighboring countries that are immediately adjacent to each other and so in the post-workshop analysis we combined several of the original ACCUs as detailed in Table 5, along with adjusted percentages protected by different protected area types.

Once these were combined (Figure 40), the number of Andean Condor Conservation Units was reduced to a total of 21 units (Table 6; Figure 41). These ACCUs range from several rather small areas of less than 20,000 km² in Venezuela, Colombia, Ecuador and northern Peru, to three enormous transboundary areas

of well over 200,000 km², one bridging Argentina and Bolivia and two running along the Argentina and Chile border. Particularly for these larger areas which are nothing short of immense, this situation highlights the need for an integrated approach for Andean condor conservation. Nevertheless, at least 30% of the area of seven of the final ACCUs is already protected, although that only includes one of the seven largest ACCUs (Table 6). Overall this scenario does not meet the new recommended protection criteria for nations and ecosystems that the IUCN is in the process of promoting as heralded in the recent Latin America and Caribbean Protected Area Congress in October 2019 in Lima, Peru.

Table 5. National Andean Condor Conservation Units to be combined into larger binational ACCUs

| Name | Combined ACCUs | Area km ² | % ACCU in National Protection | % ACCU in Regional Protection | % ACCU in Municipal/ Private Protection |
|--|----------------|----------------------|-------------------------------|-------------------------------|---|
| Serranía del Perijá | 577,2 | 577,2 | 86,6 | 0 | 0 |
| | 2.490,87 | 2.490,87 | | | |
| Chiles-Llanganates | 873,15 | 873,15 | 22 | 13,9 | 0 |
| | 12.475,52 | 12.475,52 | | | |
| Southern Peru-Northern Bolivia | 3.954,35 | 3.954,35 | 73,5 | 7 | 0,1 |
| | 93.062,4 | 93.062,4 | | | |
| Cordillera Oriental-Sierras Subandinas-Sierras Pampeanas | 192.205,83 | 192.205,83 | 12,1 | 4,4 | 18,3 |
| | 106.745,03 | 106.745,03 | | | |
| Andes Centrales-Sierras Pampeanas | 2.205,36 | 2.205,36 | 2,5 | 0 | 12,9 |
| | 212.873,55 | 212.873,55 | | | |
| Patagonia Norte | 43.698,34 | 43.698,34 | 66,2 | 0,7 | 3,2 |
| | 12.366,42 | 12.366,42 | | | |
| | 33.802,89 | 33.802,89 | | | |
| | 147.916,03 | 147.916,03 | | | |
| Patagonia Sur | 45.985,48 | 45.985,48 | 36,8 | 0 | 5,7 |
| | 25.261,56 | 25.261,56 | | | |
| | | 69.920,22 | | | |

Figure 40. Andean Condor Conservation Unit Transboundary Combinations

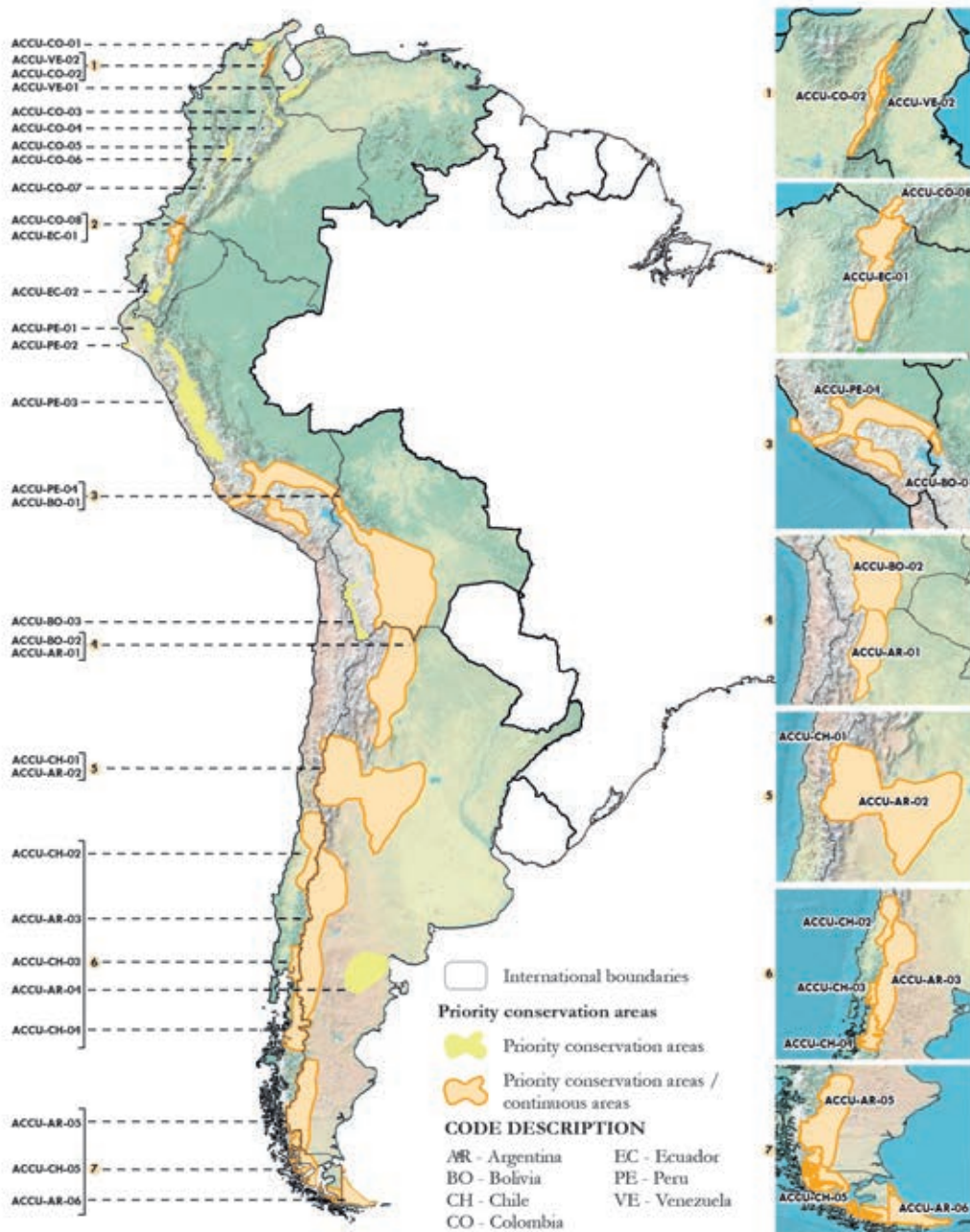


Table 6. Final List of Andean Condor Conservation Units (ACCUs)

| ACCU | Countries | Name | Area (km ²) | ACCU Type | Total % Protected |
|------|----------------------|--|-------------------------|-----------------|-------------------|
| 1 | Venezuela | Cordillera de Mérida | 11,869.95 | Individual (II) | 38,96 |
| 2 | Venezuela & Colombia | Serranía del Perijá | 3.068,07 | Combined (II) | 17,74 |
| 3 | Colombia | Sierra Nevada de Santa Marta | 9.289,44 | Individual (II) | 55,87 |
| 4 | Colombia | Páramos de los Andes Nororientales | 5.592,69 | Individual (II) | 32,06 |
| 5 | Colombia | Corredor de Páramos Guantiva-La Rusia-Iguaque | 836,5 | Individual (II) | 7,69 |
| 6 | Colombia | Chingaza | 1.380,6 | Individual (II) | 57,75 |
| 7 | Colombia | Los Nevados | 8.542 | Individual (II) | 9,48 |
| 8 | Colombia | Puracé | 2.486,72 | Individual (II) | 46,64 |
| 9 | Colombia y Ecuador | Chiles-Llanganates | 13.348,67 | Combined (II) | 33,6 |
| 10 | Ecuador | Sangay National Park | 3.219,9 | Individual (II) | 55,63 |
| 11 | Ecuador | Azuay-Loja-El Oro | 7.277,54 | Individual (II) | 3,70 |
| 12 | Peru | Andes de Piura-Lambayeque | 8.124,8 | Individual (I) | 0 |
| 13 | Peru | Illescas | 1.813,19 | Individual (II) | 0 |
| 14 | Peru | Andes Centrales de Perú | 66.130,54 | Individual (I) | 9,24 |
| 15 | Peru y Bolivia | Sur de Perú-Norte de Bolivia | 97.016,74 | Combined (I) | 10,9 |
| 16 | Bolivia | Lípez-Sillillica | 17.538,15 | Individual (II) | 30,59 |
| 17 | Argentina y Bolivia | Cordillera Oriental-Sierras Subandinas-Sierras Pampeanas | 298.950,86 | Combined (I) | 16,54 |
| 18 | Argentina y Chile | Andes Centrales-Sierras Pampeanas | 215.078,91 | Combined (I) | 12,13 |
| 19 | Argentina y Chile | Patagonia Norte | 237.783,68 | Combined (I) | 12,9 |
| 20 | Argentina | Somuncurá | 53.186,61 | Individual (II) | 30,08 |
| 21 | Argentina y Chile | Patagonia Sur | 141.167,26 | Combined (I) | 15,9 |

Figure 41. Priority Andean Condor Conservation Units



I Discussion

Andean Condor Historical Range

The historical range presented herein is considered an improvement on previously published versions (Fjeldsa & Krabbe 1999), in large part because of a major increase in the number of observations available, especially with the advent of large datasets such as eBird, as well as the fact that the spatial information used for this exercise is of considerably better quality with the advent of GIS technology and increased availability of satellite images. Overall our version of the historical range increased by 0.79% from the previously known area of approximately 3,204,897 km² (as derived from Fjeldsa & Krabbe 1999). The Andean condor historical range is an important perspective with which to set conservation targets in the future, as well as with which to measure the decline to date.

This updated version of the Andean condor historical range totals 3,230,061 km². Whilst impressive, this pales in comparison to the continental distribution of other large charismatic wildlife species in Latin America. The jaguar continental range was once around 19 million km² (Sanderson *et al.* 2002), and the puma's continental range was once at least double that. Thus, for a large charismatic wildlife species, the Andean condor has always been a relatively range-restricted species, with of course an extremely linear distribution along the Andes.





Expert Knowledge Coverage within the Andean Condor Historical Range

The Andean condor experts that participated in this exercise felt comfortable expressing opinion about Andean condor presence in 58.48% of the revised historical range and absence in 7.31% of the revised historical range, amounting to a total knowledge coverage of 65.79%, or almost two thirds of the historical range. Nevertheless, in all countries there were also significant areas without expert knowledge about Andean condors totaling 34.21% of the historical range, and particularly notable in Bolivia, Peru and Chile.

An expert knowledge coverage of 65.79% is lower than other iconic species previously considered in complete Range-Wide Priority Setting exercises in the region. For example, for the jaguar the original RWPS analysis revealed expert knowledge areas covered 83% of the historical range (Sanderson *et al.* 2002), which increased in 2006 to 96% (Marieb 2007). For less cryptic species, expert knowledge covered 99.1% of the historical range for white-lipped peccaries and 99.6% for lowland tapirs (Taber *et al.* 2009). However, expert knowledge coverage was just 57.7% for Andean bears in Bolivia and Peru (Wallace *et al.* 2014), which also have an exceptionally linear distribution, largely confined to the eastern slopes of the Andes mountain range from Venezuela to Bolivia.

In the northern and central portions of the range there was considerable overlap and agreement between expert driven knowledge and available data from the largest citizen science effort in the world: eBird (<https://ebird.org/home>). However, this was not the case for the southern portion of the range, where especially in Chile, large areas identified as areas without expert knowledge were populated with significant concentrations of Andean condor observations from eBird participants (see Figure 32). Future studies in Chile should prioritize verifying locations with high

densities of citizen science derived observations which are likely to be reliable for such a singular species as the Andean condor.

Andean Condor Actual Range

Workshop participants identified eight polygons where Andean condors are considered extirpated: two in central Colombia, one in southern-central Ecuador, two northern Peru, one in western Bolivia and two in southeastern Argentina, accounting for 7.31% of the revised historical range. It is important to stress that this total increases to 41.52% when areas where experts considered they could not reliably provide knowledge on Andean condor presence are considered. Thus, current knowledge suggests that Andean condors remain present in at least 58.48% of their historical range, but the threats outlined in this document in combinations with confirmed local extirpations herein underlines the need for species-specific conservation planning and actions. Given that 34.21% of the revised historical range has no knowledge coverage from participating experts, the need for further expert participation and/or fieldwork is evident and pressing.

Jaguars are considered extirpated in 39% of their historical range (Marieb 2007), and white-lipped peccaries and lowland tapirs in 20% and 14% of their historical ranges respectively (Taber *et al.* 2009). In Bolivia and Peru, Andean bears are considered extirpated from 3% of their range, although current and imminent major transport and infrastructure projects threaten to increase this significantly (Wallace *et al.* 2014). Thus, Andean condors are still present across more of their historical range than most of the charismatic terrestrial species that have benefitted from a Range-Wide Priority Setting analysis.

Currently, 13.5% of the Andean condor's historical range is under formal protection. This does not meet the 17% recommended by the Convention on Biological Diversity as a 2011-2020 goal in the Aichi targets. Here it is important to emphasize

that individual Andean condors travel huge distances (Lambertucci *et al.* 2014) and most individuals in the global population have ranges that include protected areas, but also large portions of other unprotected types of land management. The protected portions of the Andean Condor Conservation Units are especially important for specific nesting and roosting sites, but overall the Andean condor will need effective conservation measures that are geographically and conceptually relevant beyond the implementation of protected areas, especially because many foraging areas are found outside protected areas and this is where they fall victim to poisoning. Thus, the challenge into the future will be to secure the sustainable and effective management of the protected areas, and the broader areas within the Andean Condor Conservation Units.

Priority Andean Condor Conservation Units (ACCU)

In summary, the Andean condor experts propose a total of twenty-one Andean Condor Conservation Units from western Venezuela to Tierra del Fuego which represent the best hope for the long-term conservation of Andean condors across the actual range. The priority Andean Condor Conservation Units (ACCUs) cover 37.3% of the estimated actual range of the species.

Experts defined Andean Condor Conservation Units ranging from relatively small areas of just 836.5 km² (Corredor de Páramos Guantiva-La Rusia-Iguaque) to massive areas of up to 298,950.86 km² (Cordillera Oriental-Sierras Subandinas-Sierras Pampeanas). In general, ACCUs are relatively small in the northern portion of the Andean condor range (Venezuela, Colombia, Ecuador and northern Peru), and an order of magnitude larger in the central and southern portion of the range (central and southern Peru, Bolivia, Chile and Argentina). For the purposes of further analyses, we divided the ACCUs into three size classes:

- Relatively small ACCUs of less than 20,000 km²,
- ii) Medium-sized ACCUs of between 20,001 to 100,000 km²,
- iii) Relatively large ACCUs of more than 100,000 km².

Fourteen of the Andean Condor Conservation Units are relatively small ACCUs (Table 6), three are medium sized ACCUs, and four are relatively large ACCUs. Several of the smaller ACCUs are certainly not large enough to permanently hold viable populations of Andean condors given their exceptionally large ranging patterns (Lambertucci *et al.* 2014). However, within the framework of a regional analysis for an airborne and wide-ranging species these sites are important as they have known roosting, nesting and feeding sites. Thus, recognition of these sites is an important step forward in conservation planning for the species. The medium and large sized ACCUs in the central and southern portion of the historical range, may well be large enough to permanently hold meaningful populations of Andean condors in themselves, but their immense size underlines the need for integrated conservation approaches that embrace the importance of working beyond protected area limits and with a wide range of local actors.

As might be expected ACCUs have a greater percentage under protection than the overall historical range. Taken together a total of 15.6% of the ACCUs are under formal protection, although there is considerable variation between ACCUs with protected percentages varying between 0% to over 50% for the smaller areas, but mainly well below 20% protection for the medium-sized and largest ACCUs (Table 6).

Whether populations of this size are truly sustainable in the long-term is currently the subject of some debate in the minimum viable population literature (Reed *et al.* 2003; Traill *et al.* 2007). However, the total global populations of many of the most threatened vertebrates such as tigers, mountain gorillas, and

indeed Andean condors, do not reach this magic number for population viability, let alone individual populations. These arguments are particularly concerning for terrestrial species such as previously considered species for Range Wide Priority Setting exercises (Andean bears, jaguars, white-lipped peccaries, lowland tapirs) for whom connectivity can more easily be compromised. For the Andean condor that has huge flying capacity and extremely large home ranges (Lambertucci *et al.* 2014), the problem of connectivity maybe less relevant.

The results herein demonstrate a clear pattern reflected in terms of historical range, current range and identified Andean Condor Conservation Units (ACCUs), in which areas in the northern portion (Figure 42) of the historical range, which is a smaller and thinner strip running along the Andes, are significantly smaller and substantially more fragmented than in the central range (Figure 43),

and especially the southern portion of the range (Figure 44). This pattern is also reflected in terms of known data regarding Andean condor populations, with numbers in Venezuela, Colombia and Ecuador particularly low as compared to Peru, Bolivia, Chile and Argentina. It is also worth stressing that given the flying capacity of Andean condors, currently populations of many neighboring ACCUs are probably still connected and so establishing longer-term connectivity through strategic management activities should be considered, which in the longer term will be especially important for the smaller ACCUs.

In summary, this process resulted in maps on a) the historical distribution of the Andean condors, b) the current distribution of Andean condors, c) a systematized database of Andean condor distributional records, and d) a suite of Priority Andean Condor Conservation Areas.

Figure 42. Andean Condor Conservation Units in the Northern Historical Range



Figure 43. Andean Condor Conservation Units in the Central Historical Range



Figure 44. Andean Condor Conservation Units in the Southern Historical Range



Next Steps and Recommendations

A surprising result from workshop discussions was how the most significant threats for Andean condors varied across the range, with hunting and persecution of condors, competition with domestic dogs, and habitat conversion identified as the most pressing threats in the northern range, these same three threats along with ritualized use of condors in the Yagua Fiesta in Peru most pressing in the central range, and hunting and persecution of condors, and lead poisoning the most relevant in the southern range. Nevertheless, experts agreed that the emerging threat of carcass poisoning is the most dramatic, potentially devastating and urgent threat across the range requiring concerted action and attention from the Andean governments in collaboration with other conservation actors.

During the workshop, participants worked in groups to identify a series of priority actions to address the most serious and pressing identified threats for application in the 21 identified Andean Condor Conservation Units.

Habitat Conversion

Workshop participants prioritized the following strategic activities to address habitat conversion:

- Engage in the appropriate design and application of environmental education programs.
- Promote conservation and restoration action that involves the participation of local people and focused where there are frequent observations of the species.
- Conduct a review of the territorial laws and norms for each country where Andean condors occur.

Hunting

Workshop participants prioritized the following strategic activities to address the threat of hunting:

- Identify the causes for hunting and design strategies that diminish this threat, for example, education regarding better livestock management.
- Develop agreements with government agencies to better regulate and prosecute hunting.
- Quantify and monitor hunting and its effects on Andean condor populations, particularly the effect of lead poisoning.
- Educate people regarding the Andean condor protection regulations and law enforcement.

Carcass Poisoning

Workshop participants prioritized the following strategic activities to address the threat of carcass poisoning:

- Develop agreements with government agencies to better regulate and prosecute the poison market.
- Conduct a quantification and diagnostic regarding poison use for each event.
- Perform a long-term environmental education programs that use different types of communication.
- Improve livestock management practices to reduce losses to wildlife including Andean condors.

Competition with Free-ranging Dogs

Workshop participants prioritized the following strategic activities to address the threat of competition with free-ranging dogs:

- Design strategies that acknowledge the difference between stray and feral dogs.
- Develop educational programs that acknowledge attacks by dogs on livestock, and the need for specific actions such as responsible management of pets, sterilization, vaccination, and regulation of domestic dogs.
- Promote the control of feral populations through the framework of promoting responsible ownership of pets in order to diminish the feral population, as well as humanitarian euthanasia.
- Propose legislation to ban breeding and selling of dogs and to promote adoptions.
- Work with animal rights groups in order to underline the harm that feral dogs cause to wildlife.

Lack of Carcasses

Workshop participants prioritized the following strategic activities to address the threat of lack of carcasses:

- Quantify and describe the abundance dynamics of different prey to evaluate if the lack of carcasses is truly a threat, and if so, how?
- Examine if a relationship exists between carcass biomass availability and the reproductive success of the species.
- Characterize and quantify carcass availability, the preference between native prey and exotic prey, and its impact on health.
- Evaluate how supplementary feeding influences behavior changes, hierarchy structures, and intraspecific competition.

- Reintroduce native South American camelids to areas where domestic animals is the main food supply.

Use in Folkloric Rituals and Crafts

Workshop participants prioritized the following strategic activities to address the threat of use of folkloric rituals and crafts:

- Engage with communities to inform them on the laws and potential consequences of folkloric rituals and crafts.
- Implement environmental education at all formal and informal levels, working with content developed for this particular objective, based on a diagnostic of the perception of the local population.
- Promote political action for a lawful society, for example, citizen prosecution, petitions, etc.
- Implement livelihoods alternatives for local people in order to generate interest and motivation.

These should be considered as a preliminary suite of priority interventions and future expert meetings should concentrate on developing these concepts in more detail.

Finally, in general, based on the results of this Range Wide Priority Setting Exercise for the Andean condor we propose the following priority next steps and recommendations:

1. Use the results of the Range Wide Priority Setting Exercise to produce a scientific publication for an international audience, thereby raising the profile of the need for more intensive conservation efforts in favor of the Andean condor.
2. Formally propose the Andean condor as Vulnerable under the IUCN criteria based on the

IUCN status in all nation states and particularly considering recent documented losses due to poisoning events in Argentina, Colombia and other countries.

3. Produce a list of priority sites for developing population estimates for Andean condors that will provide a range of reliable values across the range with which to better inform future conservation decision making processes.
4. Hold future international meetings regarding the conservation of Andean condors to discuss, analyze, improve and evaluate priority interventions for the conservation of Andean condors.
5. Develop specific and comprehensive analyses and conservation plans with integrated and diverse conservation actions for the identified Andean Condor Conservation Units.
6. Perform evaluations regarding the presence of areas without knowledge about Andean condors, or with very poor knowledge within existing Andean Condor Conservation Units, especially areas where very little data exists.
7. Formalize a digital information exchange mechanism and library for Andean condor experts and conservation practitioners.
8. Design and apply a standardized Andean condor census methodology using examples from Bolivia, Chile, Ecuador, Argentina and Peru to be applied across the range in order to assess population size.
9. Encourage greater international collaboration and interaction between countries, as Andean condors do not recognize borders and require conservation actions across various jurisdictions, including countries.
10. Promote mixed conservation strategies that recognize the role that local communities and private landowners will play in Andean conservation across the entire distribution area, and the need to increase environmental education and outreach.
11. Work with the governments of the Andean nations to address the most pressing threats to Andean condor populations, especially including legislation regarding the use of poisons in carcasses directed at wildlife in general.



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Appendices

Appendix I. Agenda for the Andean Condor Workshop, Lima, Peru

Primer día: miércoles 6 de mayo de 2015

| Hora | Actividad | Responsable |
|-------|--|--|
| 09:00 | Palabras de bienvenida | Fabiola Muñoz Dodero - SERFOR José Álvarez Alonso - MINAM |
| 09:20 | Presentación de los productos esperados del Taller, metodología y acuerdos de convivencia | Robert Wallace |
| 09:40 | Presentación de los resultados del Congreso Internacional de Cóndores, Córdoba, octubre 2014 | Fausto Sáenz |
| 10:10 | Monitoreo y conservación del "Cóndor Andino" en las Áreas Naturales Protegidas de Perú | David Velarde - SERNANP |
| 10:40 | Refrigerio | |
| 11:00 | Estado de conocimiento del "Cóndor Andino" en Perú | Renzo Piana |
| 11:20 | Plan Nacional para la Conservación del "Cóndor Andino" en Perú | Jessica Gálvez - Durand |
| 11:40 | Estado del conocimiento y conservación del "Cóndor Andino" en Argentina | Sergio Lambertucci |
| 12:05 | Estado del conocimiento y conservación del "Cóndor Andino" en Chile | Víctor Escobar |
| 12:30 | Almuerzo | |
| 14:00 | Estado de conocimiento y conservación del "Cóndor Andino" en Bolivia | Robert Wallace |
| 14:25 | Estado de conocimiento y conservación del "Cóndor Andino" en Ecuador | Hernán Vargas |
| 14:50 | Estado de conocimiento y conservación del "Cóndor Andino" en Colombia | Francisco Ciri |
| 15:15 | Estado de conocimiento del "Cóndor Andino" en Venezuela, Paraguay y Brasil | Adrián Naveda- Rodriguez |
| 15:30 | Refrigerio | |
| 16:00 | Cría y liberación del "Cóndor Andino": ¿Qué hemos aprendido? Los casos de Colombia, Ecuador, Chile y Argentina | Vanessa Astore Víctor Escobar Andrés Ortega Germán Corredor |
| 17:20 | Trabajo en grupo: Lineamientos básicos comunes para la elaboración de un plan regional para la conservación del "Cóndor Andino". | Facilita: Renzo Piana, Hernán Vargas, y Yovana Murillo |
| 18:05 | Refrigerio | |
| 19:00 | Cena de bienvenida (Hotel Colón) | |

Segundo día: jueves 7 de mayo de 2015

| Hora | Actividad | Responsable |
|-------|--|--|
| 09:00 | Efectos de parásitos y contaminación por plomo en cóndores de Argentina | Guillermo Wiemeyer |
| 09:30 | Estado de conocimiento sobre la salud de poblaciones silvestres del "Cóndor Andino" | Luz Dary Acevedo |
| 10:00 | Diseño de método fotográfico estandarizado para estimar tamaño y estructura poblacional del "Cóndor Andino" | Diego Méndez |
| 10:20 | Monitoreo poblacional, biología y reproducción del "Cóndor Andino" en Ecuador | Sebastián Kohn |
| 10:40 | Refrigerio | |
| 11:00 | Charla Introductoria: Uso de la telemetría satelital para la conservación del "Cóndor Andino" a nivel regional: lo que se está haciendo y próximos pasos. Los casos de Argentina, Chile, Ecuador y Colombia (4 charlas de 20 minutos cada uno) | Sergio Lambertucci Pablo Alarcón Hernán Vargas Víctor Escobar Fausto Sáenz |
| 12:30 | El cóndor en las sierras centrales de Argentina | Carolina Gargiulo |
| 13:00 | Almuerzo | |
| 14:30 | Sistematización de metodología de censos para establecer el tamaño poblacional del "Cóndor Andino" a nivel nacional y regional. | Sergio Alvarado |
| 15:30 | Charla Introductoria: La educación ambiental como una estrategia para la conservación del "Cóndor Andino" a nivel regional | Sandra Gordillo |
| 15:55 | Refrigerio | |
| 16:15 | Grupos de Trabajo: Mensajes de comunicación y audiencias prioritarias | Sandra Gordillo y Celeste Cóndor |
| 17:00 | Trabajo en grupos por países: Análisis y priorización de amenazas | Facilita: Robert Wallace |
| 18:00 | Presentación de los resultados de los grupos | Facilita: Robert Wallace |
| 18:30 | Refrigerio | |

Tercer día: viernes 8 de mayo de 2015

| Hora | Actividad | Responsable |
|-------|--|--------------------------|
| 08:45 | Metodología para la elaboración de un ejercicio de "Range Wide Priority Setting" para el "Cóndor Andino" | Robert Wallace |
| 09:30 | Resultados preliminares de un ejercicio de "Range Wide Priority Setting" para el "Cóndor Andino" | Robert Wallace |
| 10:30 | Refrigerio | |
| 10:50 | TRABAJO EN GRUPOS POR PAÍSES: Mapas de distribución histórica y actual del "Cóndor Andino", áreas de conocimiento, áreas sin conocimiento y áreas de extirpación | Facilita: Robert Wallace |
| 12:30 | Almuerzo | |
| 14:00 | TRABAJO EN GRUPOS POR PAÍSES: Mapas de distribución histórica y actual del "Cóndor Andino", áreas de conocimiento, áreas sin conocimiento y áreas de extirpación | Facilita: Robert Wallace |
| 15:15 | PRESENTACIÓN DE LOS RESULTADOS DE LOS GRUPOS POR PAÍSES 15 minutos por grupo | Facilita: Robert Wallace |
| 16:00 | Refrigerio | |
| 16:20 | TRABAJO EN GRUPOS POR PAÍSES: Propuesta de áreas prioritarias para la conservación del "Cóndor Andino" a nivel regional, utilizando puntos de distribución generales, pero con énfasis en localidades con nidos, dormideros y sitios de alimentación | Facilita: Robert Wallace |
| 18:00 | Cierre de actividades | |

Cuarto día: sábado 9 de mayo de 2015

| Hora | Actividad | Responsable |
|-------|--|--------------------------|
| 09:00 | TRABAJO EN GRUPOS POR PAÍSES: Propuesta de áreas prioritarias para la conservación del "Cóndor Andino" a nivel regional, utilizando puntos de distribución generales, pero con énfasis en localidades con nidos, dormideros y sitios de alimentación | Facilita: Robert Wallace |
| 10:30 | Refrigerio | |
| 10:50 | Ranking de áreas prioritarias por país según criterios de conectividad, tamaño poblacional y amenazas | Facilita: Robert Wallace |
| 12:20 | Presentación de los resultados de los grupos de trabajo. | Facilita: Robert Wallace |
| 13:20 | Almuerzo | |
| 14:30 | Grupos de trabajo por países: Determinación de amenazas prioritarias y desarrollo de acciones para mitigarlas | Facilita: Robert Wallace |
| 16:00 | Refrigerio | |
| 16:15 | Presentación de resultados de grupos de trabajo | Facilita: Robert Wallace |
| 16:45 | Próximos pasos y cierre de taller | Facilita Hernán Vargas |

Appendix II. List of Participants

A total of 101 participants attended the workshop as detailed in the Table below.

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Appendix III. Guidelines for the Andean Condor Action Plan

Estructura de un Plan Regional para la Conservación del Cóndor Andino

1. Visión
2. Objetivos
3. Estructura de gobernanza regional.
 - 3.1 Mecanismos de sistematización de la información.
 - 3.2. Mecanismos de intercambio de información a nivel regional
4. Presupuesto e identificación de fuentes de financiamiento.
5. Marco normativo regional.
 - 5.1. Legislación por países.
 - 5.2. Legislación de alcance regional.
6. Introducción: Biología e historia natural e importancia de la especie.
 - 6.1. Descripción de la especie.
 - 6.2. Importancia biológica del cóndor andino en la región.
 - 6.3. Importancia cultural del cóndor andino en la región.
 - 6.4. Distribución histórica del cóndor andino.
 - 6.5. Distribución actual del cóndor andino.
7. Conservación In situ.
 - 7.1. Demografía
 - 7.1.1. Determinación del número de individuos a nivel regional.
 - 7.1.2. Estructura poblacional en la región.
 - 7.1.3. Movimientos poblacionales.
 - 7.1.4. Metodología estandarizada para un censo regional.
 - 7.2. Identificación de amenazas.
 - 7.3. Uso de hábitat.
 - 7.4. Caracterización de la dieta y oferta alimenticia.
 - 7.5. Localización de nidos, dormideros y zonas de alimentación a nivel regional.
 - 7.6. Identificación de áreas prioritarias para la conservación de la especie a nivel regional.
 - 7.7. Evaluación del estado de salud de las poblaciones.
 - 7.8. Monitoreo de poblaciones.
 - 7.9. Evaluación del estado de amenaza de la especie (Categorización UICN).

8. Conservación Ex situ.
 - 8.1. Identificación y establecimiento de centros de tenencia, reproducción en cautiverio, rescate y rehabilitación.
 - 8.2. Creación de una red de centros de rescate a nivel regional.
 - 8.3. Elaboración de protocolos de manejo *ex situ* (rescate y rehabilitación).
 - 8.4. Intercambio de información de stud books.
9. Prioridades de investigación (por país y a nivel regional)
10. Plan de fortalecimiento de capacidades e identificación de actores.
 - 10.1. Identificación de actores.
 - 10.2. Mecanismos para incorporación de pueblos originarios (enfoque de interculturalidad).
 - 10.3. Estrategia para la vinculación con actores públicos y privados.
11. Estrategia regional de sensibilización, educación ambiental, comunicación y difusión.
 - 11.1. Educación y sensibilización de los distintos autores.
 - 11.2. Difusión.

Appendix IV. Key Environmental Education Messages and Audiences for Andean Condor Conservation

Audiencias Prioritarias y Mensajes Clave para la Conservación del Cóndor Andino

Blga. Celeste Cóndor & Dra. Sandra Gordillo

Los pueblos originarios de la región percibían a los animales como deidades y respetaban la naturaleza, y en este contexto histórico-cultural creemos que es necesario revalorizar estos conceptos los cuales beneficiarían a la conservación del cóndor andino.

En la actualidad son pocos los científicos que realizan o colaboran en la educación y comunicación ambiental para la conservación, por lo que creemos que este paradigma debe cambiar. La información científica se tiene que socializar con la población para así tomar acción, utilizar la educación y comunicación ambiental como estrategia para la conservación de especies y ecosistemas; toda la población debe tener la oportunidad de conocer y sensibilizarse con información relevante y mensajes positivos en pro de la conservación.

Dentro del taller cada grupo trabajó en función a cinco amenazas que el cóndor andino enfrenta en la región para poder:

- Definir las audiencias prioritarias o actores principales que influyen en las problemáticas designadas.
- Generar mensajes clave que se utilizarán con esta audiencia prioritaria para la conservación de la especie.

Cada grupo contó con 40 minutos para socializar la problemática y delinear soluciones desde el ámbito de la educación y comunicación ambiental por audiencias. A continuación, las amenazas y su desarrollo:

a. ENVENENAMIENTO DIRECTO

Llamado también envenenamiento intencional de carroña para provocar la muerte del cóndor al comer cebos tóxicos, debido según los pobladores al “daño” causado a su ganado, ya que muchos afirman que el ave “se lleva a los animales domésticos con sus poderosas garras”.

El grupo eligió como actores principales o audiencias prioritarias: los (i) **pequeños ganaderos en áreas aisladas** por ser los que directamente producen los cebos envenenados y la (ii) **autoridad ambiental** (en todos sus niveles), ya que ellos deben ser los entes fiscalizadores.

Los **medios de comunicación** que se sugirieron fueron: charlas directas en escuelas, asambleas comunales con autoridades locales, así como también un bus educativo (móvil) que pueda ir de país en país, realizando educación ambiental para la conservación de la especie.

TEMAS CENTRALES QUE DEBERÍAN CONTENER LOS MENSAJES PARA LAS AUDIENCIAS PRIORITARIAS

1. La importancia ecológica del cóndor como carroñero.
2. Los beneficios en la salud y económicos para el ser humano.
3. La implementación de incentivos para la conservación.
4. La importancia cultural.

b. ENVENENAMIENTO ACCIDENTAL

El envenenamiento accidental o indirecto por uso de cebos tóxicos para controlar las “plagas” (animales como perros, zorros, ratas y aves) considerados así porque afectan los cultivos o la comunidad, a lo que los cóndores quedan expuestos. Otro tipo de envenenamiento ocurre por el uso de medicamentos para el ganado, la contaminación de agua por minería, los basureros con productos tóxicos y el uso de balas de plomo para la cacería, lo cual produce intoxicación por plomo. El grupo eligió a dos actores principales o audiencias prioritarias: (i) los **pobladores**, por ser quienes directamente producen los cebos envenenados y (ii) la **autoridad** ya que deben ser los entes fiscalizadores.

Los **medios de comunicación** que escogieron fueron distintos para cada audiencia prioritaria, y se resumen a continuación:

| Pobladores | Organismos oficiales |
|--|--|
| Talleres para conocer la problemática y proponer soluciones. | Generar talleres o cursos. |
| Difusión por radio (continuación de temas). | Planteo de soluciones, formas para mitigar el impacto. |
| Trabajo en escuelas. | Manuales de información. |
| Visitas personales (intercambio de ideas y posibles soluciones). | Regulación de venta de cebos tóxicos. |
| Formación de líderes. | |

c. CAZA

La caza es una amenaza para muchas especies. Dado que los cazadores buscan un trofeo, pueden escoger al cóndor andino por ser un ave de gran majestuosidad, convirtiéndose en blanco de estas personas; debido a esto el grupo destacó a cinco audiencias prioritarias las cuales son: población adulta, niños de la población, ganaderos, autoridades y los cazadores.

Dentro de estas audiencias se priorizó como audiencia al **poblador rural**. Los **medios de comunicación** que escogieron fueron la radio, debido a su llegada a muchos lugares y personas, y también posters y visitas a áreas de conservación para sensibilizar.

MENSAJES QUE SERAN COMUNICADOS EN LOS PROGRAMAS DE RADIO

- Salvando al cóndor ganan algo
- Servicios ecosistémicos
- Rescate cultural

"La riqueza está en tu tierra, en tu patrimonio"

d. YAWAR FIESTA

Esta fiesta, que se realiza en el departamento de Apurímac, Perú cada año, consiste en capturar un cóndor andino silvestre, el cual es amarrado al lomo de un toro. Según las creencias de los pobladores, en este ritual, el cóndor representa al mundo incaico y el toro al español, por lo cual los dos mundos luchan uno contra el otro para intentar sobrevivir.

La realidad es que los cóndores mueren o quedan en una condición deplorable la mayor parte de las veces. Los cóndores que no mueren inmediatamente son liberados y obligados a volar, por lo que no se tienen datos si finalmente consiguen sobrevivir a la brutal pelea.

El grupo eligió cuatro audiencias prioritarias, pero creyó conveniente priorizar a los **comuneros** compuestos por los **mayordomos y cargantes** de la ya mencionada Yawar Fiesta, debido a que son los que cazan al ave en búsqueda de concretar la festividad.

MENSAJES QUE SERAN COMUNICADOS EN LA FESTIVIDAD

"Cóndor andino antes venerado, hoy maltratado"
"Tayta condor ñampacc cayascacc cunan cricniscca"

e. TRÁFICO DE PARTES

El tráfico de partes, como la caza, se da en muchas especies; en el caso del cóndor andino es muy conocido por la venta ilegal de plumas. Al respecto, el grupo de trabajo clasificó tres tipos de uso de las partes: místico (espiritismo o medicina tradicional), coleccionismo (nacional e internacional) y turístico (artesanía).

La audiencia prioritaria elegida fueron **turistas nacionales e internacionales**. Debido a ello se consideró conveniente como lugares de difusión para la entrega del mensaje los **aeropuertos, terminales terrestres y mercados**.

Finalmente, los **medios de comunicación** elegidos fueron los escritos (volantes y afiches) y audiovisuales (spots). Cabe recalcar que los mensajes se diferenciaron de acuerdo al público objetivo (nacional e internacional), debido a que tendrían distintos motivos para no realizar la acción, como penas de privación de la libertad, por ejemplo.

FRASES CLAVE IMPARTIDAS POR MEDIOS ESCRITOS Y AUDIOVISUALES

El cóndor es sagrado...
...está prohibida su caza y comercialización
...no arriesgues tu libertad
...defiende su vida
...no lo dañes
...ayúdanos a que perdure para siempre
...puedes no verlo más
...te puedes condenar

Annex V. Andean Condor Conservation Environmental Education Committee

Comité de Educación Ambiental para la Conservación del Cóndor Andino

Este grupo de trabajo está integrado por un delegado de cada uno de los 7 países participantes en el Taller Regional para la Conservación del Cóndor Andino, realizado en la ciudad de Lima (Perú), en el mes de mayo de 2015.

Integrantes. Los integrantes (en orden alfabético) son: Celeste Cóndor (Perú), Belén Guarda (Chile), Sandra Gordillo (Argentina), Diego Méndez (Bolivia), Ximena Pazmiño (Ecuador) y Fausto Sáenz (Colombia). Queda pendiente la integrante de Venezuela.

Breve reseña de su creación y función. Entre el 6 y el 9 de mayo de 2015, se llevó a cabo en Lima (Perú), el Primer Taller Regional para la Conservación del Cóndor Andino, al cual asistieron representantes de las instituciones responsables de su conservación, expertos de los distintos países donde habita la especie, organizaciones de conservación e investigación y sociedad civil, entre otros. Al finalizar el evento, entre las conclusiones, se identificó a la educación ambiental como un eje transversal necesario de abordar para contribuir con la conservación del cóndor andino.

A partir de allí, y después de varios meses, quedó conformado el Comité por representantes propuestos en el mismo encuentro (Sandra Gordillo y Celeste Cóndor), a los que se sumaron los otros delegados sugeridos o elegidos por los participantes de los demás países, con la finalidad de desarrollar lineamientos sobre el tema, aplicables a nivel regional. La base de la propuesta consiste en replicar y consolidar, a través del rango de distribución del cóndor, un proyecto basado en la multiculturalidad dentro del espacio geográfico donde habita la especie. Dicho proyecto se recrea permanentemente sobre la base de las distintas experiencias en los distintos países.

*Palabras claves: comunicación intercultural – educación ambiental – identidad regional – especie emblemática.

ACUERDOS PRELIMINARES

1. ¿Por qué debemos conservar al cóndor andino?

Porque el cóndor es una especie emblemática (o especie biocultural) de Suramérica. Las especies emblemáticas son aquellas que por su valor biológico, ecológico, cultural o antrópico, pasan a formar parte del patrimonio ambiental común a todos los habitantes de un determinado territorio. La palabra emblema, involucra un símbolo, el cual representa un concepto moral y ético. En otras palabras, el cóndor es una especie biocultural.

2. ¿Quiénes serán nuestros destinatarios? (¿A quiénes tenemos que llegar?)

Mediante la transversalidad de la educación ambiental y la interdisciplinaridad que la conforma, nuestros destinatarios principales para sensibilizar y concientizar sobre la conservación de esta especie emblemática, corresponderían a todos los actores sociales (comunidad en general con diversas ocupaciones, rangos etarios, etc.). No obstante, el esfuerzo y la complejidad que significa abarcar todos los actores, trabajar en los primeros niveles del sector educacional nos permite formar una base de conciencia ambiental (enfocándonos precisamente en esta especie) y así se propaguen y promuevan estos conocimientos en el tiempo.

LINEAMIENTOS DE ACCIÓN (para esta primera etapa)

¿Cuáles serán los lineamientos de acción en esta primera etapa?

1. Avanzar en la comunicación entre los distintos países mediante redes sociales (internet, Facebook) a los fines de que la sociedad tome conciencia de las problemáticas comunes y regionales o locales asociadas al cóndor.

En este aspecto tenemos desde hace unos meses una página de Facebook para compartir noticias, comentarios, experiencias educativas, etc. provisto desde los distintos países por personas particulares, instituciones gubernamentales y no gubernamentales, etc.

Facebook: <https://www.facebook.com/Alas-del-Sur-326042987593672/?fref=ts>

TODAS LAS PERSONAS E INSTITUCIONES GUBERNAMENTALES Y NO GUBERNAMENTALES ESTÁN INVITADAS A SUMARSE Y COMPARTIR INFORMACIÓN ASÍ SE VA FORMANDO UNA RED

2. Recopilar y sistematizar la información existente sobre acciones o proyectos educativos vinculados al cóndor en los distintos países. Esta información se recopilará a través de una ficha a completar por cada responsable de propuesta educativa que exista. Cada delegado reunirá la información dispersa de cada país.

Esa información se reunirá en un único archivo con formato digital que será distribuido de manera gratuita.

3. Otra tarea de los delegados será recopilar la legislación que existe por país sobre el cóndor.
4. También se está considerando la posibilidad de realizar alguna propuesta concreta como por ejemplo un corto animado y algún otro material didáctico.

Finalmente, los avances del este grupo de trabajo serán presentados periódicamente en reuniones regionales que tengan lugar en los diferentes países.

