Tracking re-introduced, California condors in the wild.

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Due to the California condor population decline, in 1987 the remaining 27 individuals were captured and brought to the Los Angeles and the San Diego Zoo's Wild Animal Park, for captive breeding with the first young produced in 1988 and releases to the wild beginning in 1992. Today there are nearly 260 individuals in the world with over 100 in the wild that have been reintroduced in California, Arizona and Baja California, México. We attached to the wing of some of the birds lightweight, GPS receivers interfaced with transmitters communicating with ARGOS space-based satellites. Through daily e-mail messages since May 2004, project managers receive position, altitude, speed and bearing information to track them in the wild. The case of the condors released in Baja California, México is presented, how GPS/satellite communications and GIS has assisted to the recovery of this highly endangered species in the San Pedro Martir sierra.

Only a few hundred years ago, the California condor ranged from British Columbia to Baja California, Mexico. As European pioneers settled within its range, this large and impressive species declined dramatically to near extinction in the mid-1980s. As an addition to standard field investigation, the radio-transmitters were critical for our early investigations into the reasons for the California condor's population decline. Among other mortality factors, several condors were discovered dead or dying from lead poisoning by the use of radio tracking that would have otherwise gone undetected. The realization of the extent and variety of mortality factors by the mid 1980's led to the controversial decision to capture the remaining flock of condors in 1987 and bring them to the relative safety of the Los Angeles Zoo and the San Diego Zoo's Wild Animal Park.

Our captive management techniques of inducing more eggs out of pairs by removing the first and sometimes the second egg and later raising them using puppets has made the critical difference in this otherwise slow breeder. Contrary to the critic's predictions, the success of the breeding program has been on schedule with the first breeding beginning in 1988 and releases back to the wild beginning in 1992. Today we have over 260 condors in the world - steadily approaching our goal of 450 before the species can be down listed to "threatened".

The U.S. Fish and Wildlife Service California Condor Recovery Plan calls for the establishment of condors wherever feasible and practical in their former range. The first releases in 1992 occurred in the general area they were last captured in southern California in the late 1980's and a few years later in the Big Sur area of central California. As these two groups have merged, over 50 condors fly in central and southern California. Another population of just over 50 condors has been established in the Grand Canyon area of Arizona. The Sierra San Pedro Martir in Baja California, Norte is the southern most portion of the species range with the last condors dying out in the area throughout the 1940's. US and Mexican partners have embarked on a long-term program to restore the critically endangered California condor to the Sierra San Pedro Martir of northern Baja California.

After nearly a decade of reconnaissance and political negotiations on both sides of the border, we began construction of the condor release pen in early summer of 2002. Over 50 volunteers helped build the pen, consisting of a large 60 ft long by 60 ft wide by 30 ft tall pen with a "spacious" 112ft^2 adjacent blind from which field biologists can observe the birds from behind one-way glass. Also, to one side we constructed a 400 ft^2 pen with remotely controlled, sliding wire mesh doors to allow birds to move between the two pens or to the outside if desired by biologists.

Beginning in 2002, we reintroduced the first group of five condors to Baja, where they continue to thrive in their natural habitat. Last year, this group was supplemented with a second group of four more juveniles and six more condors were released this year making a total of 15 condors flying free in Baja to date . We plan to reintroduce five to seven condors per year until the anticipated carrying capacity of 20 pairs is reached. Our work involves 1) long-term monitoring of released birds using radio-telemetry and satellite GPS technology, 2) in-depth behavioral research to help us produce the most successful and socially-adept release candidates, and 3) educational outreach in local ranchers, including the development of ecotourism for long-term economic sustainability in the region. Training Mexican biologists and students is an integral and ongoing component of our work, and our field crew is comprised of Mexican nationals.

Once released, the first step was to encourage the birds to feed and roost near the pen. From this "home base" of food, water and safety they can make exploratory flights in different directions as they perfect their flying skills over the first few months. Even before release, food in the form of large animal parts was placed in 3 places; right beside the pen, on a large rock 15m to the west of the pen, and 100m to the north west of the release pen. A chain embedded in the rock is used to secure the carrion from removal by nighttime scavengers such as coyotes and pumas. Water is provided in a large tub placed near the release pen and changed every few days when food is put out at night. As the birds become more proficient flyers the food is placed at greater distances in order to give them more options to feed at different sites and better occupy their time with more natural activities. Ultimately reliable food will be placed at specific sites several kilometers apart in order to simulate a more natural feeding pattern so appropriate feeding traditions can be slowly built over the years.

Their flights gradually became more distant and they were increasingly more likely to roost over night on cliffs several kilometers away from the home base as they encountered areas accommodating to their inherent condor lifestyle. The activity of other diurnal scavengers such as turkey vultures, ravens, golden eagles and coyotes attract their attention to "wild" carcasses of deer, cows, horses and burro that die in the area. Their inability to consistently find the natural food and the presence of other condors back at the release area keeps them returning on a regular basis to the release site where food is available most of the time.

Our ability to manage the birds as they expand their range and monitor their activities relies on remote sensing. From the first day of release we used radio telemetry to track and locate the birds throughout each day using standard tracking techniques. The field crew, using radio receivers are able to take a bearing on one of two unique frequencies from the right or left transmitters mounted on the wings of each condor. By taking several such vectors from two or more positions in the environment (triangulation) we can estimate the location of the transmitter (bird) in the landscape. The field crew takes condor location readings starting shortly after sunrise until sunset. Condors typically do not attempt to fly if there is no wind. Since the wind does not generally become strong enough for condors to effectively use until mid to late morning and abates by late afternoon in the Sierra San Pedro region we usually are able to locate their roosting position on most days.

As they become more proficient flyers and more adventurous it became increasingly difficult to determine accurately their daily movements, feeding and nightly roosting positions. In comparison to other release sites, the Sierra San Pedro Martir has far fewer roads from which to track the birds using conventional telemetry and the rugged terrain makes ground tracking less effective when the birds cover greater distances. In the emergency of a lost bird we attach radio antennas to the wing struts of a Cessna airplane and greatly increase tracking range but at a greater monetary cost to the program.

In 2004 we began using a new design of satellite/ GPS transmitter from Microwave Telemetry that gives us the ability to track the birds with much greater accuracy and at unlimited distances. A bird that is the most likely to travel with the group will also be so equipped to indicate the most likely movement and position of the group.

All released condors carry a 55gm to 65gm, radio transmitters on each wing that is combined to a vinyl, numbered ID tag that wraps around the wing allowing the number to be read whether the bird is flying or sitting at some distance using optics.

As a first test in 1997 I used a modified 40gr PTT (platform transmitter terminal) on the wing of a captive Andean condor at the Los Angeles Zoo. Seeing no apparent transmission issues, Microwave Telemetry produced the first 5 patagial, satellite transmitters that were tested on condors released to the wild in Argentina. Since then Luis Jacome and his staff working out of the Buenos Aries Zoo have released 38 Andean condors in Argentina, Bolivia, Chile and Venezuela with 29 of them wearing satellite PTTs.

On April 8, 2000 we placed the same design PTT tested in South America on the first California condor. AC8, a founder that had ceased to reproduce in captivity, was given her freedom in the hopes that some of her latent wild behavior would rub off on the growing population of captive produced condors released in Southern California. Several more PTTs have been placed on California condors since then particularly by the Ventana wilderness Society directed by Kelly Sorensen. The data collected has begun to piece together the development of the condor's new range in California. Yet, the quantity and accuracy (often within a kilometer or two) with the ARGOS based PTTs made it difficult to justify the expense on more than a few birds.

With the combination of GPS technology and the ARGOS satellite system came several improvements to the world of tracking and management of released condors. Solar powered, patagial GPS/PTTs were developed by Microwave Telemetry that weigh less than 70 gm after the vinyl ID tag is attached. The first GPS/PTT was tested on California condors released in the Grand Canyon by Chris Parish of the Peregrine Fund in 2002 and now several are in use throughout California and Baja.

Under exceptional flying conditions some exploratory flights of our released condors in Baja can be more than 200km over a day or two making it impossible to track their movements using conventional radio transmitters. Although still costly, the new GPS/PTTs are making it possible to track their activities in ways that could not otherwise be possible using conventional methods, a much needed development in the program that will be significant in helping us reach our recovery goal for the species (figure 1).

Not only do we get meter-accurate positions several times a day, but, the newest parsing software provided by Microwave Telemetry makes transferring the coordinates sent by ARGOS relatively simple to import into Arcview projects and on to GIS based maps.

Each point on the map represents a bird (color coded) in the landscape positioned by either latitude and longitude or UTM when queried (figure 2.) The transmitter speed of any one point gives us an indication of some important activities. A speed of "0" tells us that the bird is perched while a speed of 20 – 30 km/hr indicates that the bird may be in a thermal. Speeds of 50 – 80 km/hr often indicate flights between thermals. A series of time/position points gives us a picture of their speed, altitude and direction of movements (Figure 3). Depending on the time of day, a cluster of positions with a speed of < 2 km/hr may indicate the use of an overnight roost or a feeding opportunity (figure 4).

Since there is a significant risk of lead poisoning when condors feed on "natural" carcasses that have been wounded or killed by hunting it is important for us to document the types of food they find on their own. When we observe a bird returning to the central roosts after a few days flight with a full crop of food we now can plug in to our hand held GPS the coordinates of a bird's previous days activity and push "GO TO" for a trail directly to the presumed feeding site.

As the oldest condors are approaching sexual maturity the increased time spent with a potential pair member is difficult to detect through direct observation since they tend to spend much of their time away from home base. Synchronized flying and roosting behavior and tightly overlapping ranges as seen by male #259 (green) and female #220 (red) indicated by the accurate and timely positional data can help us detect early pair formation as well as the future placement of territories and nests (Figure 5).

Over the next eight to ten years, we plan to reintroduce four to seven condors per year until we reach the anticipated carrying capacity of 10 pairs is reached. We anticipate that one day soon these magnificent birds will range from the Pacific coast, over the San Pedro Martir range, to the Gulf of California.

Acknowledgements:

Our work is carried out in close collaboration with the program partners; The Zoological Society of San Diego (ZSSD), Centro de Investigacion Cientifica y de Educacion Superior de Ensenada (CICESE), Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT), the Instituto Nacionial de Ecologia (INE) and the Los Angeles Zoo.

References:

California Condor Recovery Plan: 1995, US Fish and Wildlife Service, Portland Oregon. Edt. Lloyd Kiff , Robert Mesta and Mike Wallace

Wallace, M.P., M. Fuller, and J. Wiley. 1994. Patagial Transmitters for Large Vultures and Condors in B.U. Meyburg and R.D. Chancellor, Eds. Proc. of Raptor Conservation Today WWGBP/the Pica Press.

Wallace, M.P. 1991. Methods and Strategies for Releasing California condors to the Wild, in American Assoc. Zoological Parks and Aquariums Annual Conf. Proc. 1991, AAZPA, Wheeling, WV, pp. 121-128.

Wallace, M. P., P. G. Parker, and S. A. Temple. 1980, An evaluation of patagial markers for Cathartid vultures. J. Field Ornithol. 51:309-314.

Wallace, M.P. , and S.A. Temple. 1983 An evaluation of techniques for releasing hand-reared vultures to the wild. Pages 400-423 in Vulture Biology and Management. Sanford R. Wilbur and Jerome A. Jackson (eds.).

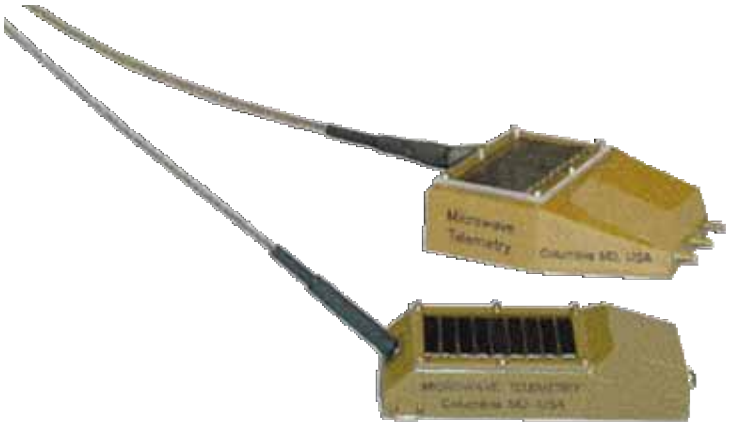

Figure1.

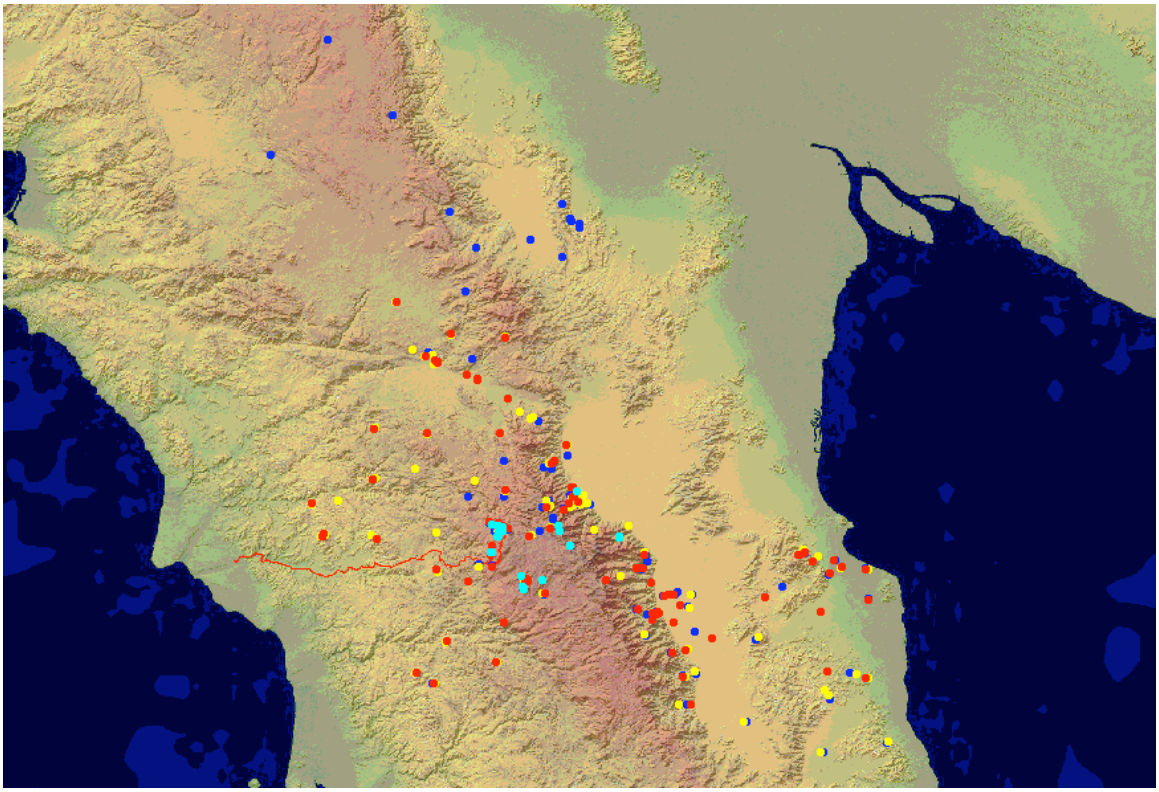

Figure 2. May positions of four released condors

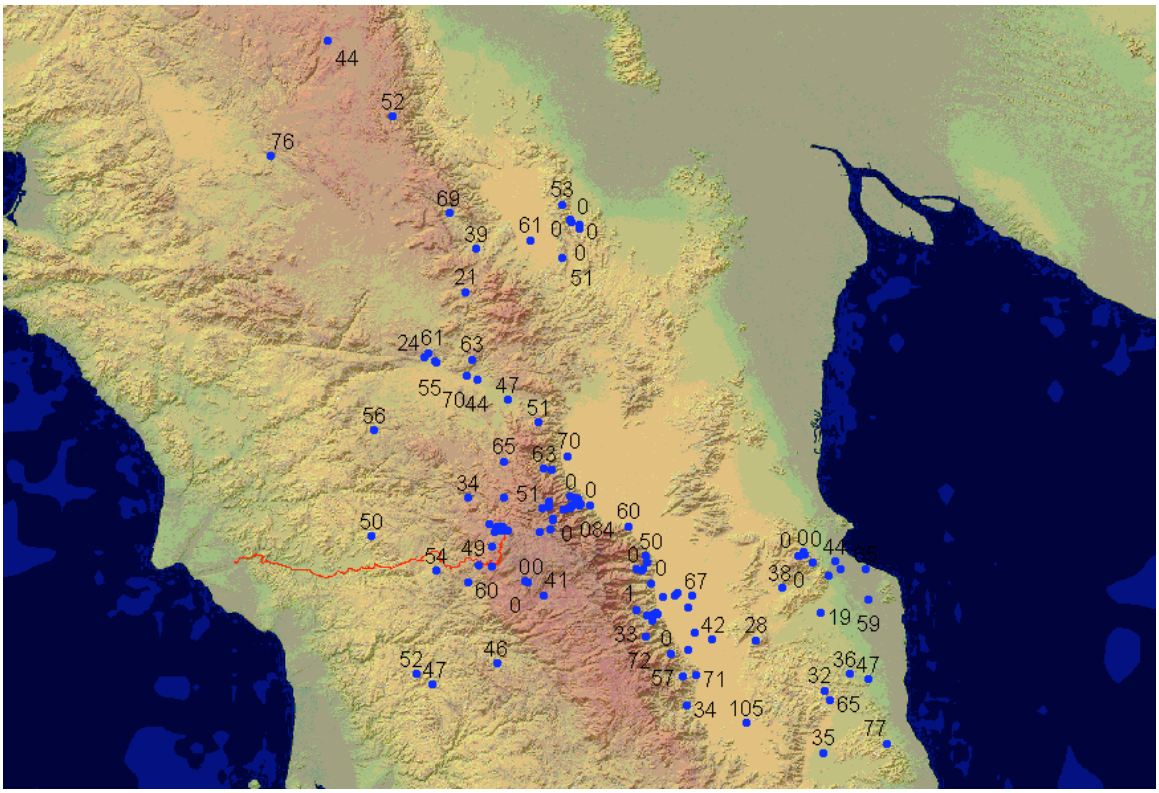

Figure 3. Flight speed of condor #261.

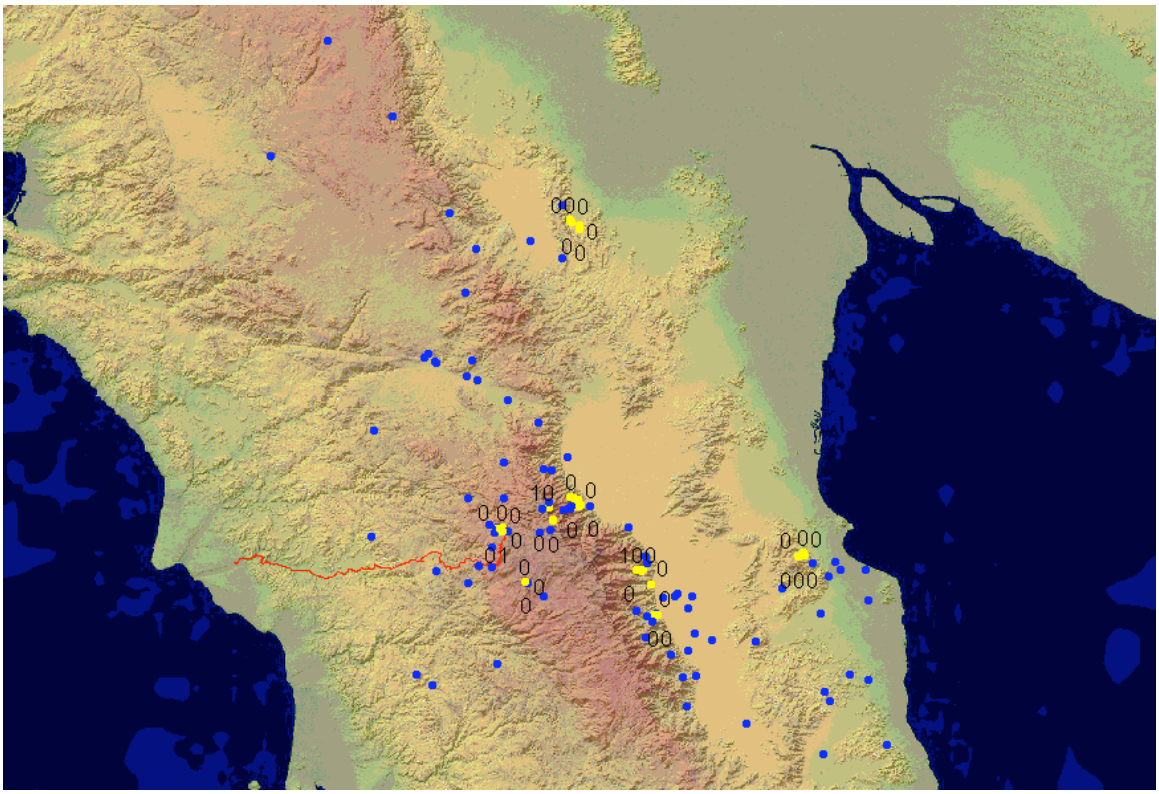

Figure 4. Sitting positions of condor #261

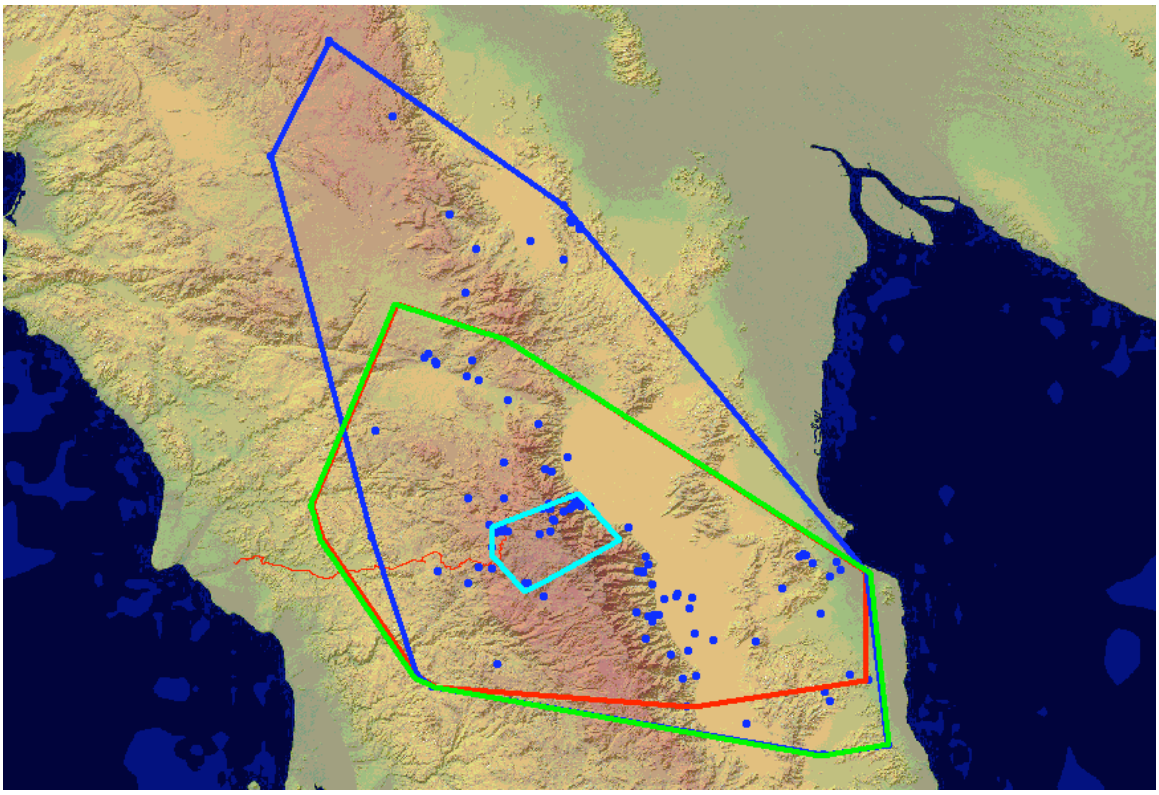

Figure 5. Area 4 condors fly over in May 2005