

Conservation of the critically endangered Copper-lizard (*Pristidactylus casuhatiensis*) in Ventana hills, Argentina.

Project 12738-1: Final Report.

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Introduction

This report shows the results for 17 months of continuous work. The period was higher than usual because a large fire destroyed the study area and greatly complicated the fieldwork.

Investigation

The study area corresponds to the southern sector of the mountain cord of Ventana hill system which is located in the south of the province of Buenos Aires, Argentina (Figure 1). In that area, search of Copper Lizard (*Pristidactylus casuhatiensis*) campaigns were performed. Each search round was georeferenced through the use of GPS. A total of 55 kilometers of intensive search was completed. A total of 300 hours/man was reached in the search of the species.

Between 14 and 18 of October 2013 we surveyed the Bahía Blanca, La Carpa and Ventana hills, which by their characteristics may have populations of the Copper Lizard. The search rounds were on foot, and intensive searches by direct observation were performed without removal of rocks or alteration of landscape.

Based on preliminary data, between 15 and 18 of January 2014 search campaigns in the Cerro Ventana, where most of the records occurred, were intensified. This hill is one of the most important tourist destinations in the region and receives thousands of visitors every year. To cross the hill, it has a trail that runs all levels of vegetation and reaches "La Ventana" located more than 1100 mamsl. A total of 10 references, locally known as "Postas" are placed throughout its journey.

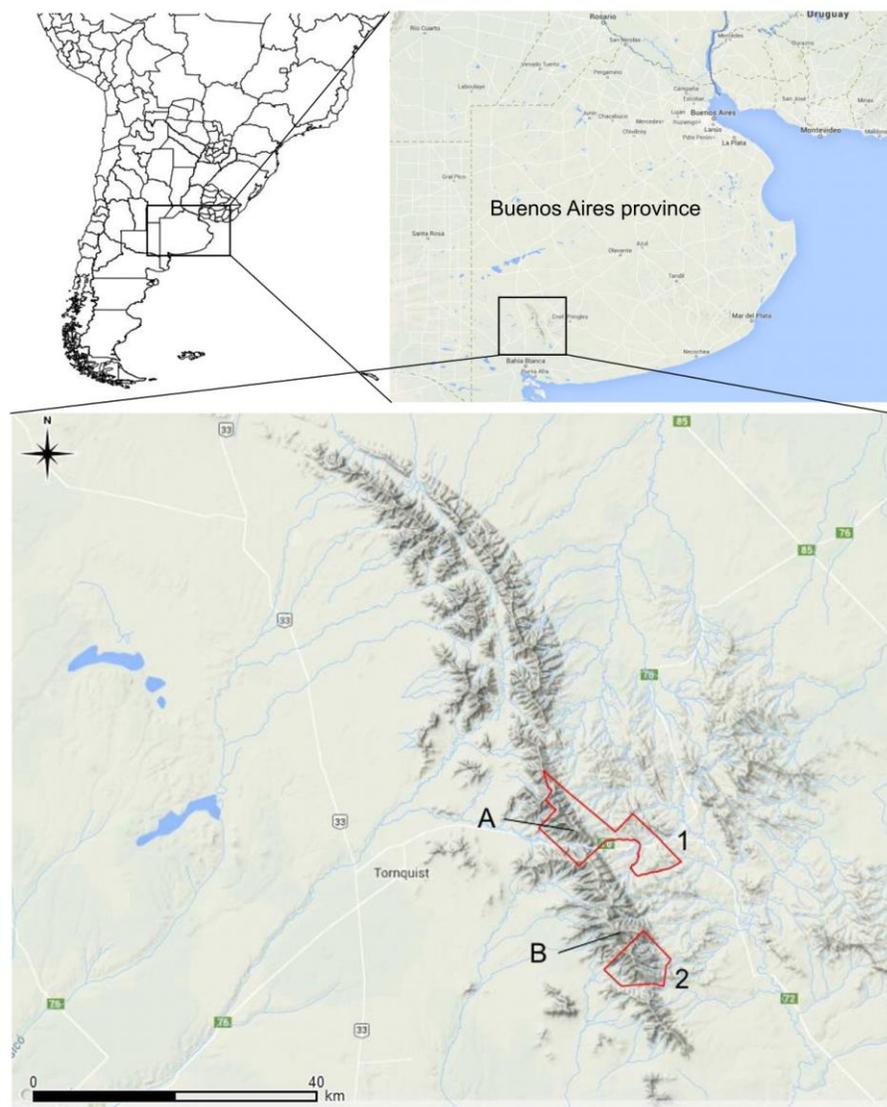
No records of the species were obtained in these first two search campaigns. This result, in the first campaign, may be due to the date which is prior to when the species becomes active. For the second campaign, one of the factors that may have influenced the species appearance was the extensive fire that affected the entire area of Ventana hill system and changed the face of the mountains significantly. Details of the consequences of this

catástrofe (Figures 2 and 3), which affected 95% of the mountain system, are reported in the local media:

<http://www.lanacion.com.ar/1657081-sierra-de-la-ventana-otra-vez-azotada-por-un-incendio-forestal>

<http://nuevo.admin.telam.com.ar/notas/201402/50189-bomberos-combaten-un-incendio-en-la-comarca-de-sierra-de-la-ventana.html>

Figure 1: Location of the study area in South America (top left), in the province of Buenos Aires, Argentina (top right) and in the Ventana hill system (below). In this last image the Ernesto Tornquist Provincial Park (1) and the Sierras Grandes Natural Reserve (2) stand out. Furthermore, the position of the Cerro de la Ventana (A) and the Cerro Tres Picos (B) is indicated.



In the research trips we have not been able to find the Copper Lizard, but we found several snails (*Plagiodontes patagonicus*) burned (figure 4). Previous studies say that the Copper Lizard eats mostly these snails.

Between 6 and 9 of November 2014 the last survey in the area was conducted. This time we focused our search on two of the ten postas that has the path of ascent to Cerro Ventana: the Posta 7 and 9. We made that decision because previously one of the guides of the Ernesto Tornquist Provincial Park had seen individuals of Copper Lizards in these postas.

On November 7 we could detect a single individual of the species near the Posta 9, at 1060 mamsl. The area is characterized by the presence of large blocks of solid rock with some cracks with narrow strips occupied by dry grasses, shrubs and ferns (Figure 5). The individual found remained under observation for over four hours and during that period we were able to register some patterns of behavior as the rest in the sun, movements and escape behavior. On November 8 we found five individuals in total that were observed simultaneously for more than 5 hours (Figure 6). During this time we joined some contributions to the knowledge of its natural history:

- *Food:* from direct observation, it was established that the species feeds on Calliphorid flies (Hexapoda, Diptera, Calliphoridae) (Figure 7), a large weevil associated to formations of *Eryngium* sp. (*Heiliopodus germari*, Hexapoda, Coleoptera, Curculionidae) (Figure 8) and a scorpion (*Bothriurus* sp., Arachnida, Scorpiones, Bothriuridae) (Figure 9). This observation was complemented with the analysis of a feces collected on November 8. In this material we were able to recognize the rests of three isopods (Crustacea, Malacostraca, Isopoda) and two weevils of the aforementioned species.
- *Territorial behavior:* According to these preliminary observations, it can be assumed that the species behaves territorially, watching and actively defending the space. One of the individuals (presumably male) performed on several occasions repeated movements that can be considered part of a territorial display. In two of these opportunities, it aggressively pursued other individual (presumably male also) over long distances exceeding 50 meters.
- *Color changes:* the continuous monitoring of the same individual enabled us to register a change in coloration as the period of sun exposure increased. Upon detection, the individual only exposed to the sun part of its head which showed a blackish brown color. Later, when the lizard was completely out of its shelter (in a crevice of a rock), we were able to appreciate that this modest coloration

extended along its entire back and flanks. However, after 30 minutes of direct exposure to the sun, the individual showed the typical coloration considered for the species which is more striking (Figure 10).

The last fieldwork was conducted between 26 and 30 December 2014. During this last trip to the study area no records of the species were obtained.

Figure 2: rocky mountain completely burned after the fire.



Figure 3: signboard of main trail of Ernesto Tornquist Provincial Park burned after fire.



Figure 4: charred remains of a land snail (*Plagiodontes patagonicus*) burned by the fire.



Model of occupation

To estimate the occupancy and detectability of the species we attempted to develop occupation models in order to assess the existence of differences between sites based on the covariable "height". However, it was not possible to achieve due to the scarce amount of records which did not reach the statistical minimum.

In total we conducted four campaigns to the study area. Each campaign consisted of an average of 5 days in the field, between January, March and December 2014. We reviewed a total of 45 sites located in the hills Ventana, Bahía Blanca and La Carpa, along an altitudinal gradient ranging from 425 to 1100 mamsl (Figure 11). Each site was revisited on 3 occasions by a team of observers made up of at least 2 people. At each site intensive searches were conducted covering all potential microhabitats where individuals of this species may occur.

In the cases where individuals were observed, we recorded day, hour and GPS coordinates, and also registered microhabitat data and data associated with the individuals observed: sex, relative age (adult or juvenile) and activity (feeding, food, rest and escape behavior, others) .

Figure 5: Predominant landscape at the height of the Posta 9.



The total number of individuals detected was 8 and they all were observed in the same place (at a mean height of 850 mamsl), on two separate occasions. Based on these data, both the occupation and the detectability directly estimated were extremely low (occupation = 0.05; detectability = 0.03).

Potential distribution model

To predict the potential distribution of the Copper Lizard MaxEnt software version 3.3.3e was used. We employed a total of 14 recording locations coming from collected specimens, sightings of rangers and reports. We consulted the climate database and the elevation of South America database along with a layer of potential vegetation.

To estimate which are the most important variables in the model, Jackknife test was run by selecting "Do jackknife to measure variable important" in the checkbox. Thus, a set of models is created, each time a variable is excluded and a final model with the remaining variables is generated. Therefore, a model using each variable in isolation is generated and this way the importance of each variable used can be estimated. The results are

shown in Figure 12, where the light blue bars suggest that no variable contains a substantial amount of useful information that is not contained in the other variables.

Figure 6: Different individuals of the Copper Lizard observed during November 8.



The analysis was re-run disabling the variables that showed a gain score less than 3.0 ("ecoreg", "h_dem" and "pre6190_17"), which are not (each by itself) useful for estimating the distribution of *Pristidactylus casuhatiensis*.

Moreover, considering that the distance between each of the recording locations of the species is less than 5 km, a value of 0.01 was entered in the checkbox "Regularization multiplier", as suggested in such cases.

Figure 7: Calliphorid fly in front of an individual of Copper Lizard.



Figure 8: *Heiliopodus germari*, weevil that forms part of the species feeding (left). An individual of the Copper Lizard feeding on one of those weevils (right).



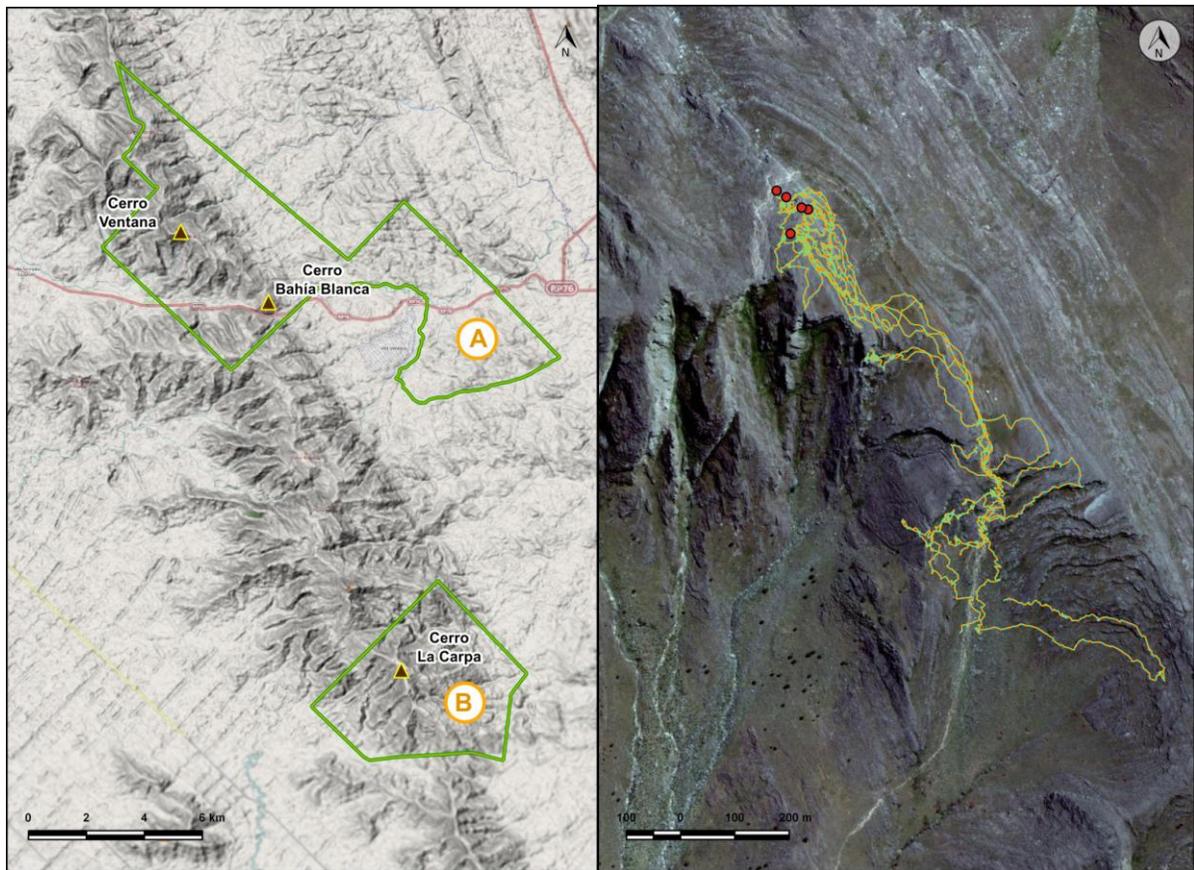
Figure 9: An individual of the Copper Lizard feeding on a scorpion *Bothriurus* sp.



Figure 10: Images of the same Copper Lizard individual at the time it becomes active and shows a dark coloration (left), and 30 minutes after exposure to sun when its coloration becomes much more striking (right).

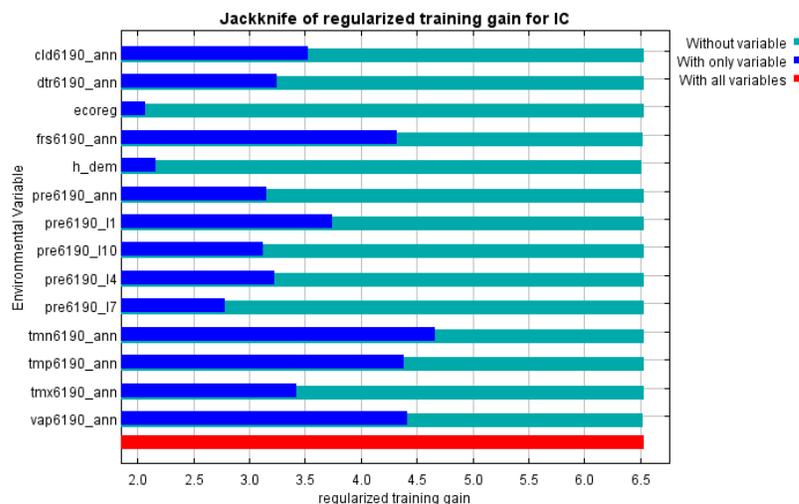


Figure 11: Location of the hills that were visited (left). Routes taken during search campaigns (yellow solid lines) and points where the findings of the species occurred in Ventana hill, the only hill where the species was found.



The map of potential distribution of the Copper Lizard is shown in Figure 13. The prediction shows four potential presence points. Point 1 corresponds to Sierra de la Ventana, while point 2 is located in the hills of Córdoba Argentinean province (Pampa de Achala) and points 3 and 4 in highland systems in the center of Bolivia (located at 770, 2100 and 2200 kilometers respectively from the known localities for the species). The model, based on a range of environmental and climatic variables, indicates that these three potential locations should be dismissed because a) the history of the records of the species shows that since its discovery and description, all locations are from Sierra de la Ventana b) surveys of herpetofauna in these potential locations do not report the presence of the species (there is a species of this genus in the hills of Córdoba *P. achalensis*, but the same genus has not been reported in any point of the republic of Bolivia).

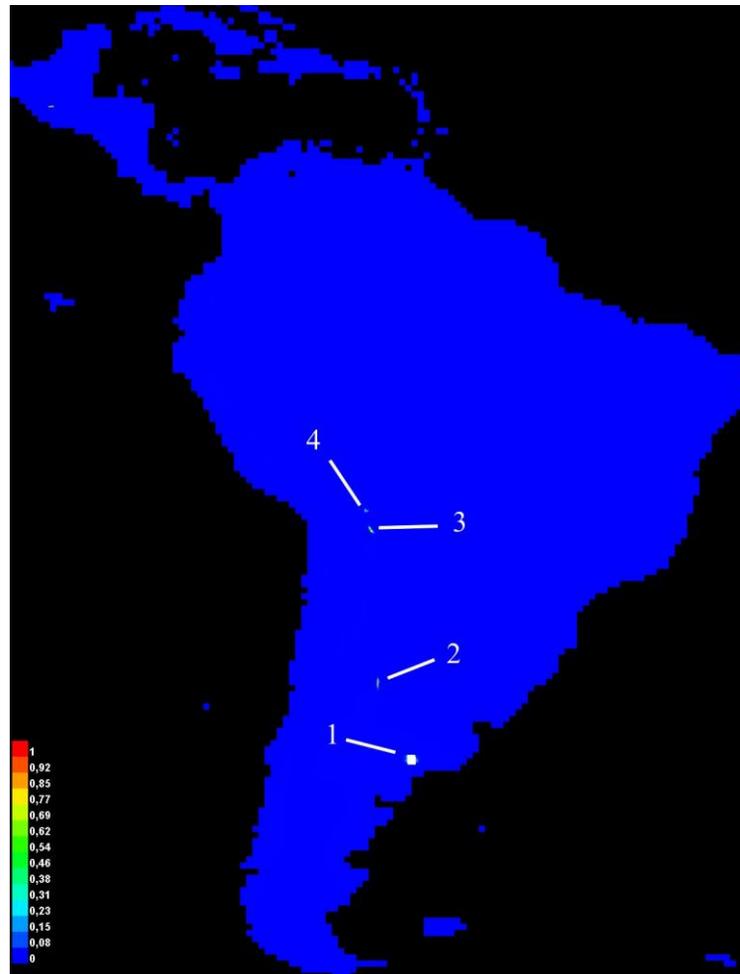
Figure 12: Analysis of the importance of each variable in the model after applying Jackknife test.



Therefore, the species continues to maintain its records restricted only to the Ventania hill system, particularly in two of its hills (Cerro Ventana and Cerro Tres Picos), with a single undocumented observation for Cerro Destierro Primero, always above 800 mamsl.

Given the scarcity of records and the narrow geographic distribution of the species, we resorted to set out a potential distribution map which considers only the Sistema Serrano de Ventania and those peaks above 600 mamsl. The result is shown in Figure 14.

Figure 13: Map of the potential distribution of Copper Lizard according to MaxEnt model. The gradient color bar shows the probability of occurrence of the species with the highest values around the red and the lowest values around the blue.



Management

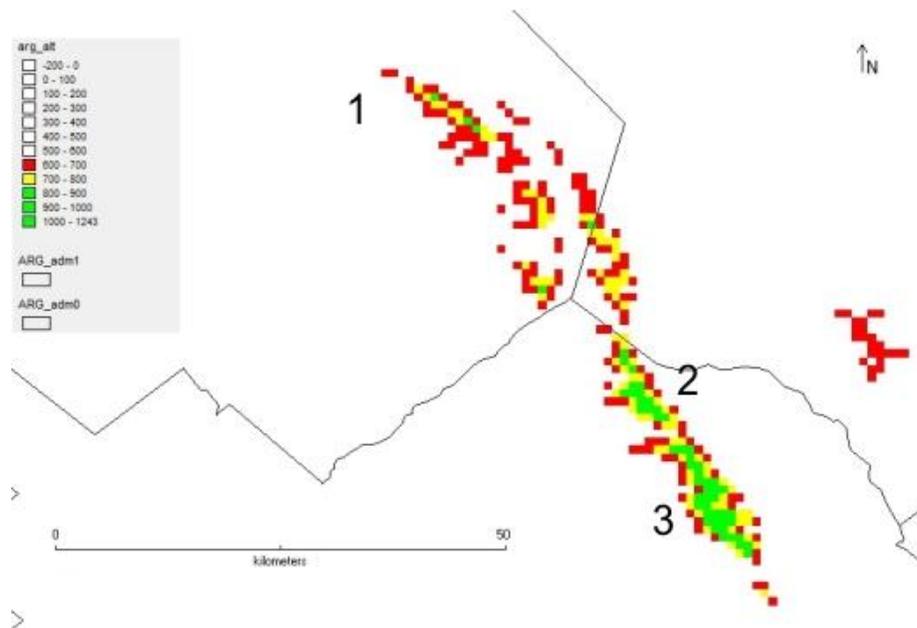
Categorization for IUCN

The low detectability and the small number of individuals observed each time are sufficient argument to consider the Copper Lizard as one of the most endangered reptiles of Argentina, and it deserves to be included among the globally threatened species, according to the criteria of the International Union for Conservation of Nature (IUCN).

This information was brought to the meeting of experts to determine the state of conservation of reptiles of Argentina, held in November 2014 in the city of Puerto Madryn in Chubut, Argentina.

In the meeting, the Copper Lizard was proposed as a globally threatened species, and currently the proposal to consider the species as Critically Endangered is being analyzed.

Figure 14: Map of the potential distribution of the Copper Lizard based on the height of the highest hills distribution. Those peaks between 600 and 700 mamsl are shown in red, those between 700 and 800 mamsl in yellow and those exceeding 800 mamsl in green. The Cerros Curamalal (1) are located at the north end of the Ventana hill system, the Cerros Ventana and Destierro (2) are near the center and the Cerro Tres Picos (3) is located in the south of the system.



Contributions to the management of Ernesto Tornquist Provincial Park

Ernesto Tornquist Provincial Park has the largest known population of the Copper Lizard. However, all findings of the species are from the Cerro Ventana, which represents the biggest tourist attraction in the region, and is visited by over 15,000 people each year.

The only enabled path of the hill passes through the sites where Copper Lizard inhabits, and this has meant that, on at least three occasions, visitors or tourists capture individuals of the species. Traditionally, visitors could climb the hill without the company of specialized guides.

Since the fire, and considering the fragility of the species, it has been proposed and accepted that all visits to Cerro Ventana must be made exclusively with the

accompaniment of an expert guide who permanently observes visitors and prohibits any attempts against the wildlife and environment.

Support for the creation of the Nature Reserve Sierras Grandes

The presence of the Copper Lizard in areas adjacent to the Estancia Sierras Grandes, was part of the technical arguments that justified its declaration as Natural Protected Area: Natural Reserve Sierras Grandes.

Thus, the new Reserve complements the Provincial Park Ernesto Tornquist, and both begin to function as a single unit for the conservation of mountain pastures and biodiversity.

The details of this statement can be found in the following links:

http://www.gob.gba.gov.ar/dijl/DIJL_buscaid.php?var=121389

<http://www.gob.gba.gov.ar/intranet/digesto/PDF/D0526-13.pdf>

<http://www.tornquist.gov.ar/index.php/noticias-varias/1344-fuerte-respaldo-a-la-apertura-de-la-reserva-sierras-grandes.html>

Education and outreach

One of the priority actions of this project was to produce useful elements to conduct education and outreach activities on the issue of conservation of the Copper Lizard and the entire ecosystem of mountain pastures.

To this end, meetings with the staff responsible of the Ernesto Tornquist Provincial Park and the Natural Reserve Sierras Grandes were held with the aim of coordinating the editing of these products and determining its usage.

From the Provincial Park Ernesto Tornquist educational activities are permanently carried out (Figure 15). The materials generated in this project will be added to those activities.

The talented artist Carlos Montefusco was incorporated to develop graphic materials that address the problem: a poster and a cartoon strip in an audiovisual format (Figures 16 and 17). These materials are currently being used by the staff of protected areas to strengthen their environmental education campaigns in primary and secondary schools in the region and to raise awareness among visitors arriving every year.

Figure 15: Environmental education activities in the Ernesto Tornquist Provincial Park for children of primary school.



Figure 16: Some cartoon strip pictures in audiovisual format which chronicle the pursuit of the Copper Lizard that a scientist performs and the way the Lizard describes the conservation issues that faces along with its natural habitat and potential solutions.

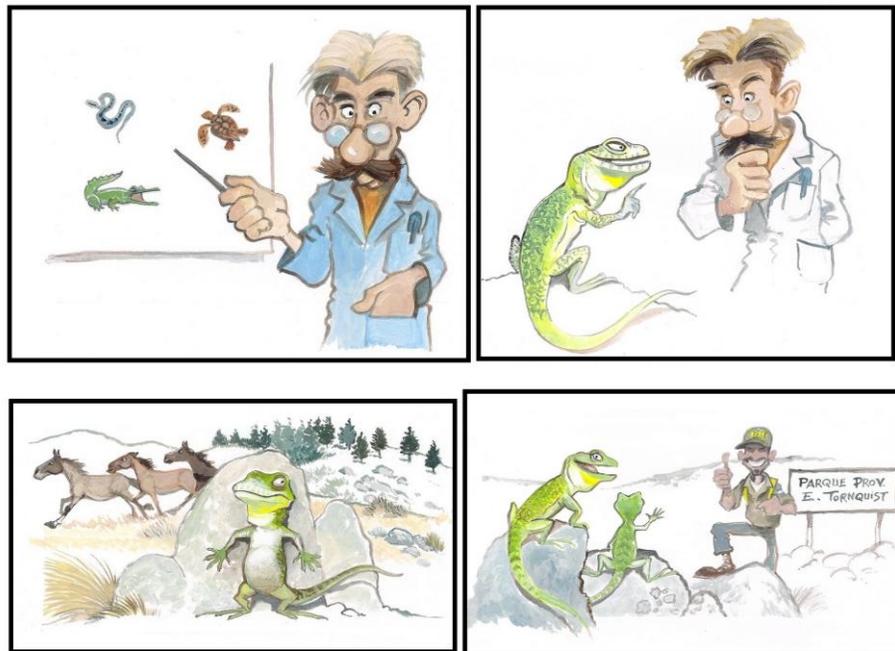


Figure 17: Poster showing some characteristics of the Copper Lizard and its main conservation problems. This poster is already being used in the Ernesto Tornquist Provincial Park and the Sierras Grandes Natural Reserve (left). The same poster at the base of Cerro Ventana during the visit of the public to the path where the species inhabits (right).

