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Ecological niche assessment and conservation status of colocolo pampas cat *Leopardus colocola* (Molina 1782)

Evaluación del nicho ecológico y estado de conservación del gato colocolo *Leopardus colocola* (Molina 1782)

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Abstract
Until 2021, *Leopardus colocola* was considered a species distributed across much of South America. However, recent studies have shown that it is a monotypic species, apparently restricted in its distribution to the central-northern region of Chile, distinct from other felines of the same genus. This change in its classification and distribution has sparked debate regarding its conservation status, which now requires a detailed assessment. In this study, we analyzed the species' geographic distribution using ecological niche modeling and evaluated its conservation status according to the guidelines of the International Union for Conservation of Nature, considering the impact of mining concessions and Chile's road network. Presence records of the species were systematized, and a new ecological niche model was developed. Additionally, the Extent of Occurrence (EOO) and the Area of Occupancy (AOO) were calculated. The fragmentation and projected reduction of the niche model, along with the EOO and AOO, place the species under the Criteria B2ab (i, ii, iii), leading to its classification as "Endangered." This study provides an updated view of the species' geographic distribution and conservation status in Chile. The results are crucial for future conservation efforts and offer a solid foundation for effective management strategies.

Resumen
Hasta el año 2021, *Leopardus colocola* era considerada una especie distribuida en gran parte de Sudamérica. Sin embargo, estudios recientes demostraron que es una especie monotípica aparentemente restringida en su distribución al centro-norte de Chile, separándose de otras especies de felinos del mismo género. Este cambio en su clasificación y distribución conllevó a un debate sobre el estado de su conservación, la cual requiere una evaluación detallada. En este estudio, se analizó la delimitación de su distribución geográfica a través del nicho ecológico y el estado de conservación de acuerdo con los lineamientos de la Unión Internacional para la Conservación de la Naturaleza, tomando en consideración el impacto que generan las concesiones mineras y la red vial de Chile. Se sistematizaron los registros de presencia de la especie y se elaboró un nuevo modelo de nicho ecológico. Además, se calcularon el Área de Extensión de Presencia y el Área de Ocupación. La fragmentación y la disminución proyectada del modelo de nicho, las Áreas de Extensión y Ocupación ubican a la especie bajo los Criterios B2ab (i, ii, iii), lo que conduce a clasificarla en un estado de conservación de "En Peligro". Este estudio brinda una visión actualizada de la distribución geográfica y el estado de conservación de la especie en Chile. Los resultados son fundamentales para futuras acciones de conservación y proporcionan una base sólida para estrategias de manejo efectivas.

Keywords.
Climate niche, Endemic felids, Felids conservation, Pampas' cat, South American felids.

Palabras clave.
Conservación de felinos, Felinos endémicos, Felinos sudamericanos, Gato de las pampas, Nicho climático.

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Introduction

Delimiting the geographic distribution of a species is crucial, as it plays a essential role in conservation efforts (Lamoureux et al. 2006, Mota-Vargas & Rojas-Soto 2012, IUCN 2012). In fact, the area occupied by a species is one of the criteria used to establish its conservation status on a global scale (IUCN 2012). However, distribution boundaries are not static; they expand and contract, making them highly dynamic (Maciel-Mata et al. 2015) due to the influence of biotic and abiotic factors (Wiens & Graham 2005, Mota-Vargas & Rojas-Soto 2012, Petrosyan et al. 2019).

Since its description by Abbe Molina in 1782, *Leopardus colocola* (colocolo pampas cat) has undergone numerous changes in both scientific nomenclature and geographic distribution. Recent studies based on physical and genetic analyses, niche modeling, and coarse-grained occurrence data have redefined *L. colocola* as a monotypic species endemic to the central-northern region of Chile (Nascimento et al. 2021, Castro-Pastene et al. 2023). The endemic status is particularly significant, as endemic species face a considerable risk of extinction in the coming decades due to the drastic reduction of their distribution ranges caused by anthropogenic activities and climate change (Sekercioglu et al. 2004, Thomas et al. 2004, McKelvey 2013, Meiri et al. 2018). Given the limited available information on L. colocola, it is critical to update its distribution and conservation status (Guzmán-Marín et al. 2022).

The first attempt to establish the potential distribution of *L. colocola* through ecological niche modeling was conducted by Nascimento et al. (2021), using the maximum entropy method. This model was based on 18 occurrence coordinates, altitude, and 12 of the 19 bioclimatic variables available in WorldClim (Fick & Hijmans 2017), which were selected following a correlation analysis. Later, Castro-Pastene et al. (2023) provided a second approximation of the species' geographic distribution, considering *L. colocola* colocola as a genetic unit. They used 102 occurrence coordinates and the methodology of Franklin (2010) and McPherson et al. (2006), which employs coarse-grained occurrence data to establish species distributions. However, this study did not include predictor variables that could explain the proposed distribution. As with other methods, this approach has advantages and limitations, and its effectiveness may vary depending on the scale of the data (Gábor et al. 2022).

Another critical aspect of the species is its current "Near Threatened" conservation status, as classified by the International Union for Conservation of Nature (IUCN) (Lucherini et al. 2016) and Chile's Species Classification Regulation (Ministry of the Environment 2011). This status was established under the assumption that L. colocola was distributed across much of South America. With its recent reclassification as a monotypic species distinct from others within the genus Leopardus, its conservation status needs to be reviewed and reconsidered (Guzmán-Marín et al. 2022). The IUCN (2012) and the IUCN Standards and Petitions Committee (2022) provide guidelines for applying conservation categories and criteria. These criteria range from population size reductions (Criteria A, C, and D) to threats to a species' geographic range (Criteria A, B, and D). Furthermore, the IUCN (2012) states that the absence of high-quality data does not justify disregarding the criteria, allowing the use of estimation, inference, and projection methods when supported by evidence. In this context, current and potential threats to the species play a key role in its classification.

Before the classification of *L. colocola* as a monotypic species endemic to Chile, Lucherini et al. (2016) had already identified key threats, including commercial and residential development (housing and urban areas), agriculture and aquaculture (annual and non-timber perennial crops, and livestock), transportation corridors (roads and railways), and the exploitation of biological resources (hunting and trapping of terrestrial animals). However, these threats were identified before L. colocola was distinguished from other species within the genus. In the Metropolitan Region of Santiago, Guzmán-Marín et al. (2022) identified specific threats to *L. colocola* sensu stricto, such as the presence of domestic dogs, forest fires, vehicle collisions, domestic waste, and prolonged drought. Additionally, Castro-Pastene et al. (2023) suggested that urban and rural expansion is the primary threat to the species.

Given that information on the species' distribution is still in its early stages, that its conservation status is under review (Nascimento et al. 2021, Guzmán-Marín et al. 2022, Castro-Pastene et al. 2023), and that there are occurrence records not yet used for distribution modeling, this study aims to: (i) systematize the occurrence records of the species to develop a new ecological niche model and predict its potential distribution, (ii) calculate the Extent of Occurrence (EOO) and Area of Occupancy (AOO), and (iii) assess threats related to mining (not considered in previous studies) and the road network to assign a conservation status category for the species according to IUCN (2022) criteria.

Material and methods

Data collection. In January 2022, a search for the presence coordinates of the species was conducted in peer-reviewed articles available in the Web of Science, Scopus, Scielo, Latindex, and Google Scholar databases. The search terms used were "Leopardus colocola" and all known synonyms of the species (*Lynchailurus pajeros*, *Lynchailurus colocolus*, *Felis colocolo*, *Felis colocola*, *Lynchailurus braccatus*, *Leopardus pajeros, Leopardus garleppi, Leopardus braccatus, Leopardus munoai*) combined with the words "distribución," "presencia", and their English translations. This search was complemented with the records reported in the GBIF (Global Biodiversity Information Facility 2021) and iNaturalist (iNaturalist 2023) databases. Sources lacking geographic coordinates were not considered. Coordinates accompanied by unequivocal photographic evidence of species identification were considered valid, while duplicate or questionable coordinates were excluded from the analysis. This ensured a good fit of the species' ecological niche model (Phillips et al. 2006). Additionally, a field survey was conducted between March 2022 and February 2023, during which 18 camera traps were placed in the Tarapacá and Coquimbo regions. The camera traps were strategically placed in areas where no previous records of the species existed but were selected based on local reports of sightings. The collected data from these camera traps were reviewed every quarter (Table 1, Figure 1). After the camera traps review, the initial databases used for the study were revisited to include any new record.

Ecological Niche Modelling. The maximum entropy method was employed using MaxEnt 3.4.3 software (Phillips et al. 2006). This software is suitable when absent data are not reliably obtained (Stryszowska et al. 2016, Galante et al. 2018). The model was developed by delimiting South America as the area of accessibility or "area M," even though the occurrence data points were limited to Chile. This enabled exploring niche connectivity with species previously classified as *L. colocola* (Nascimento et al. 2021). Based on the number of occurrences (171 coordinates. Appendix 1), the feature type "threshold features" (Elith et al. 2010) and the regularization multiplier RM=1 (Morales et al. 2017, Galante et

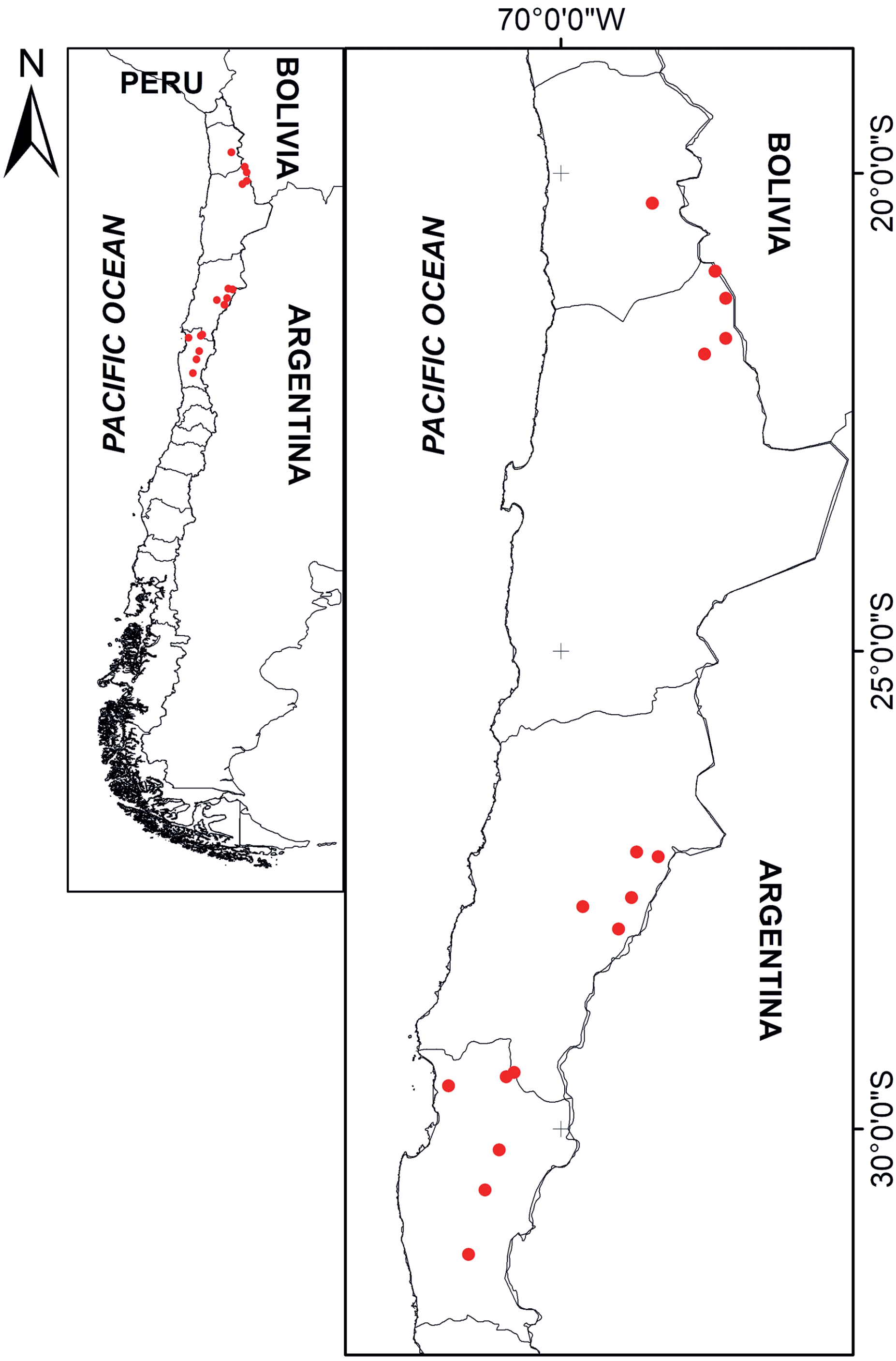

Figure 1. Arrangement of the camera traps used in this study (red points), located between Tarapaca and Coquimbo in the central-northern region of Chile. Coordinates are shown in Appendix 1.

Table 1. Location coordinates (from north to south) of the camera traps used in this study.

Region	Site	Latitude	Longitude	Altitude (m)
Tarapacá	Salar Huasco 1	-20.3113185	-69.0401909	4064
Tarapacá	Salar Huasco 2	-20.3120449	-69.0399371	4075
Antofagasta	Yuma 1	-21.0229703	-68.3816698	4173
Antofagasta	Yuma 2	-21.0230918	-68.3826855	4183
Antofagasta	Ollague	-21.3056837	-68.2732707	3812
Antofagasta	Ascotan	-21.7287182	-68.2727735	4048
Antofagasta	Poruña	-21.8930646	-68.4941345	3473
Atacama	National Park Nevado Tres Cruces 1	-27.0992905	-69.203676	3930
Atacama	National Park Nevado Tres Cruces 2	-27.150976	-68.980009	4041
Atacama	Maricunga	-27.576955	-69.260476	4334
Atacama	Punta Gorda	-27.671214	-69.76746	2557
Atacama	Tambería	-27.9055006	-69.3956549	3272
Coquimbo	Route to Pascualama 1	-29.4062917	-70.4871111	3252
Coquimbo	Route to Pascualama 2	-29.4506648	-70.5700537	2647
Coquimbo	El Maray	-29.5458787	-71.1767085	856
Coquimbo	Pangue	-30.2172278	-70.646168	2100
Coquimbo	Ponio River	-30.6371064	-70.7918733	1684
Coquimbo	Combarbalá	-31.3130155	-70.9658064	1749

al. 2018) were used. A detailed description of the feature types and the resulting models can be found in Phillips et al. (2006) and Phillips & Dudik (2008). A total of 50 replicates were used to obtain a robust mean model (Stryszowska et al. 2016), and the type of replicate run was bootstrap (Phillips et al. 2006). The randomized test percentage was 25. The model was developed using 100% of the records to take advantage of all available occurrence data to provide the best estimate of the ecological niche of the species and to have a better visual interpretation (Phillips et al. 2006).

The predictive variables used in this study included the data from the 19 bioclimatic layers available in WorldClim (Fick & Hijmans 2017) and the elevation layer, following a similar approach to Nascimento et al. (2021). These variables were extracted from the coordinates of the occurrences of the species (Cuervo-Robayo et al. 2017), which allowed for characterizing the climatic or ecological niche (Mota-Vargas et al. 2019). The variables that contributed the most to the spatial-environmental variation of the species were selected using a variable clustering analysis, which helped to eliminate strongly correlated variables. This variable selection was performed with the ClustOfVar package (Chavent et al. 2012) run from R (R Core Team 2023). This analysis reduced the 19 variables to only eight: Bio1 = Annual Mean Temperature, Bio 2 = Mean Diurnal Range (Mean of monthly (max temp - min temp)), Bio 3 = Isothermality (BIO2/BIO7) (×100), Bio 4 = Temperature Seasonality (standard deviation ×100), Bio 10 = Mean Temperature of Warmest Quarter, Bio 15 = Precipitation Seasonality (Coefficient of Variation), Bio16 = Precipitation of Wettest Quarter. The resulting logistic model provided a predicted spatial probability of occurrence ranging from 0 (low) to 1 (high). The reliability of the model was evaluated using the area Under the Curve (AUC) of the receiver operating characteristic (ROC) curve (Fielding & Bell 1997). The AUC ranges from 0.5 (low discrimination) to 1 (perfect discrimination), and the general rule states that AUC values above 0.75 are considered informative (Eskildsen et al. 2013). The threshold of the ecological niche model was established with the value that allowed the incorporation of all the coordinates of the presence of the species to deal with the underestimation (Loiselle et al. 2003).

The EOO is "the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy" (IUCN Standards and Petitions Committee 2022). It was calculated using the alpha hull method (a generalization of a convex hull), which describes the distribution area's external shape by dividing it into several differentiated polygons (IUCN Standards and Petitions Committee 2022). Using the QGIS 3.28 software, a Delaunay triangulation was constructed using the species' occurrence coordinates. Then, the mean length of all lines was calculated. Next, lines with lengths greater than a multiple (alpha) of the mean line length were deleted (where the product of alpha and the mean line length represents a "discontinuity distance"). The alpha value was two, as the IUCN Standards and Petitions Committee (2022) recommends. This process eliminated the lines connecting points that were relatively distant from each other. Finally, the EOO was calculated by summing the remaining triangles' areas. This alpha hull method allows for assessing reductions in continuous declines of the EOO, reducing biases resulting from the spatial arrangement of habitat (Burgman & Fox 2003).

The AOO is a scaled metric that represents the area of suitable habitat currently occupied by the taxon. It was calculated through the occupancy of 2x2 km grids (4 km^2) (IUCN Standards and Petitions Committee 2022). This ensured that the AOO estimation corresponded to the implicit scale of IUCN thresholds (IUCN Standards and Petitions Committee 2022). The formula is AOO = (number of occupied cells) x (cell area).

Threats and conservation status. To assess the impact of mining activity, the resulting area was calculated by subtracting the mining concessions layer of Chile (codes 1932 and 1983) from the niche model, EOO, and AOO. These data were obtained from the National Geology and Mining Service (2022). Furthermore, the road network layer of Chile (National Congress Library of Chile 2018) was overlaid with the niche model, EOO, and AOO to assess the potential for roadkill incidents. Finally, following the criteria set by the IUCN Standards and Petitions Committee (2022), a new conservation status was proposed for the species.

Results

The camera traps used in this study did not record the occurrence of the species. From the reviewed databases, 171 occurrence coordinates were collected (Appendix 1). The ecological niche model of *L. colocola* showed an area of 157310 km^2 (Table 2, Figure 2). The mean training AUC for the replicate runs was 0.991 (SD = 0.00), indicating good performance. The variables that best explained the model were Bio 15 with a contribution of 41.9% (Figure 3), Bio 3 with 26.2%, and Bio 10 with 17.1%. The cut-off threshold, including all the presence coordinates, was determined using the Maximum Training Sensitivity plus Specificity Logistic Threshold, corresponding to 9.73%. The model also predicted ecological niche presence along the central-northern coast of Peru, the northern cordillera of Chile, part of Bolivia, and Argentina, Overlapping with the climatic niche models of *Leopardus garleppi* proposed by Nascimento et al. (2021) (Figure 2). The EOO of the species was estimated to be 46985.5 km^2 (Table 2. Figure 2), while the AOO was calculated to be 630.8 km^2 (Table 2).

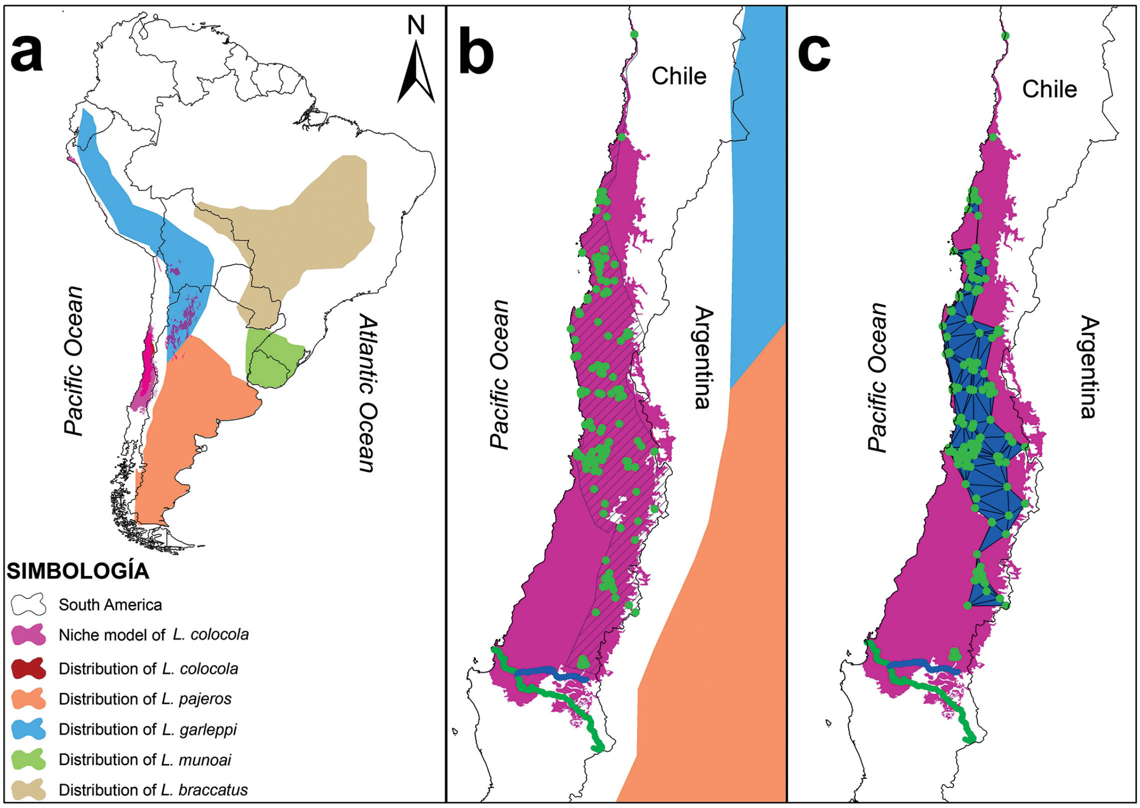

Figure 2. (a) Niche model of *Leopardus colocola* compared to the distribution of other species in the "pampas cat" group according to Nascimento et al. (2022). (b) Niche model of *Leopardus colocola*, occurrence points, and distribution proposal outlined by Castro-Pastene et al. (2023), in shaded polygon. (c) Extent of Occurrence (EOO) in blue polygon within the context of the niche model of *Leopardus colocola*. (b) and (c) show the Laja (blue line) and BíoBío (green line) rivers.

Table 2. Areas of the ecological niche model, area of Extent of Presence (EOO), and area of Occupation (AOO), resulting after subtracting mining concessions. Additionally, the length of the road network is shown.

Parameter	Area (km^2)	Mining concessions (km^2)	Resulting area (km^2)	Road network (km)
Niche model	157310.0	54100.6	103209.4	33213.3
EOO	46985.5	22387.1	24598.4	9765.4
AOO	630.8	274.3	356.5	176.0

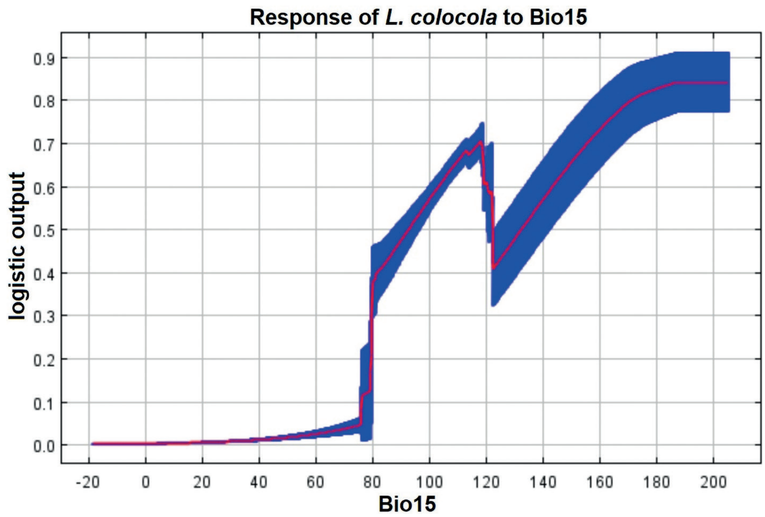

Figure 3. Predicted probability variation and mean response of the 50 replicate Maxent runs (in red), with mean values and +/- one standard deviation (in blue), depicting Bio15 (Precipitation Seasonality- Coefficient of Variation).

Regarding the threat posed by the road network, it has a total length of 37927.7 km within the niche model, with a densely intertwined spatial configuration mainly concentrated in the western region, leading to pronounced landscape fragmentation (Table 2, Figure 4). The mining concessions exhibited a higher concentration in the central-northern region of the niche model, covering a total area of 54100.6 km^2. Exploiting these concessions implies severe fragmentation and a reduction of the niche model of 27.1%. The impact on the EOO involved severe fragmentation and a reduction of 47.7% and 43.5% on the AOO (Table 2. Figure 4). The EOO encompassed 9765.4 km of roads, with 176 km crossing the AOO.

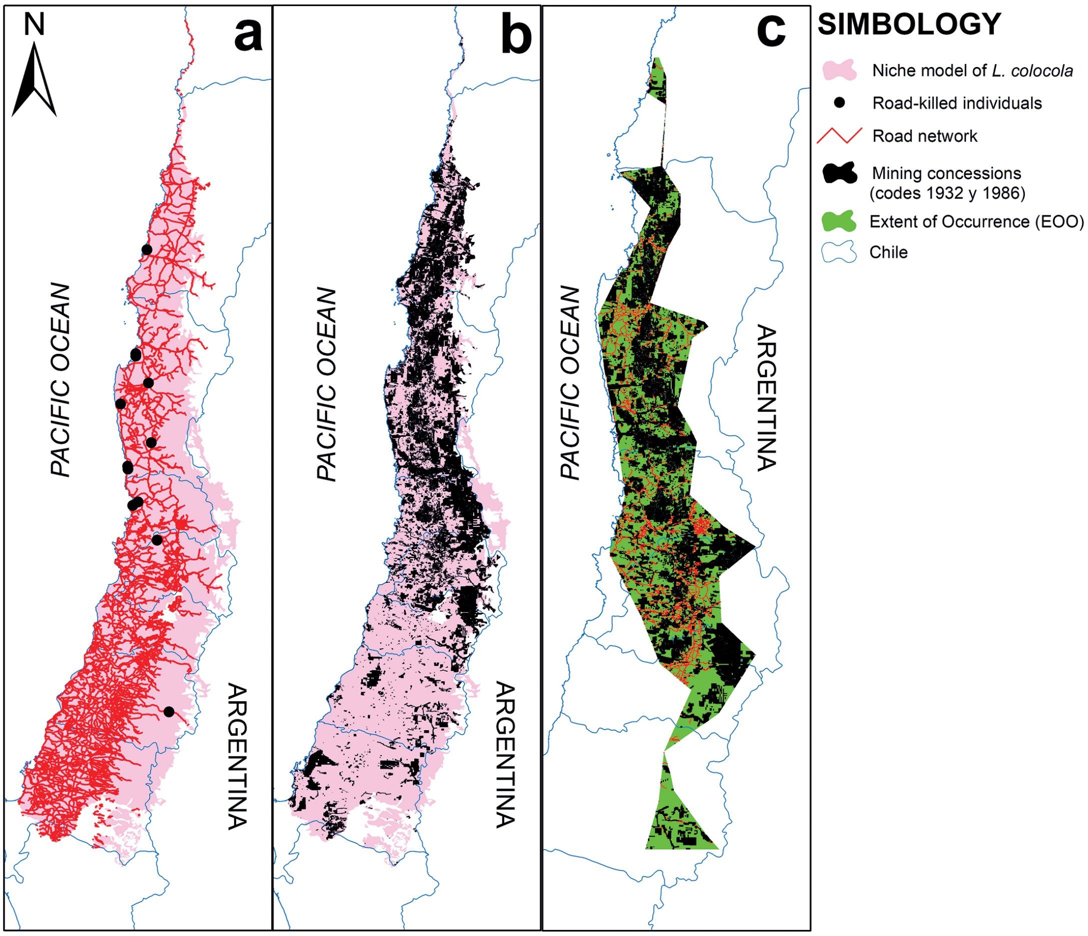

Figure 4. (a) Road network and roadkill points, (b) mining concessions, and (c) road network and mining concessions in the context of the *Leopardus colocola* Extent of Occurrence (EOO).

Discussion

Ecological niche model. The findings of this study put forth a novel ecological niche model proposal, along with the expected impact of mining activities and road networks. Compared to the Nascimento et al. (2021) model, the increased number of used coordinates enabled a more robust and expanded niche prediction (Figure 1a). The development of our model coincided with that presented by Nascimento et al. (2021) on five predictive variables (Bio2, Bio3, Bio10, Bio15, and Bio17), despite using different variable selection methods. Although Nascimento et al. (2021) did not specify which variable explained their model, the ecological niche, and the probability of the occurrence of *L. colocola,* in this study they were primarily explained positively by the seasonality of precipitation (Bio15), followed by variations in temperature (Bio3 and Bio10). The positive relationship of species occurrence with Bio15 (Fig. 2) contrasts with the relationship found by Tirelli et al. (2021) for *Leopardus munoai* (the sister species of *L. colocola*); that is, *L. munoai* responded negatively to Bio15. However, this alignment with the growth stages of trees in forest habitats and their maintenance (Brienen & Zuidema 2005) suggests that the species not only inhabits desert environments but also forested ones (Castro-Pastene et al. 2023). Nonetheless, it does not support Castro-Pastene et al. (2023) hypothesis that the species avoids the humid forests around the locality of Concepción.

A limitation in potential distribution studies or ecological niche modeling is that they do not consider geographic barriers in their predictions (Cuervo et al. 2023). According to the occurrence records and the findings of this study (Figure 2), it appears that the Laja River, in together with the BíoBío River, constitutes a geographical barrier, effectively demarcating the southern limit of the species distribution as proposed by Castro-Pastene et al. (2023), even though the resulting niche model minimally exceeds this limit. Indeed, we agree with Castro-Pastene et al. (2023) that it is necessary to increase sampling efforts, particularly in areas with gaps in records, to enhance our understanding of the distribution of this species.

Conservation Status. The Criteria A, C, and D of the IUCN Red List refer to the total number of mature individuals of the assessed taxon (IUCN 2012). However, in the case of *L. colocola*, determining the total number of individuals is challenging due to its elusive nature (Kinnaird et al. 2003, Linkie et al. 2006). Faced with this difficulty, the Criteria B of the IUCN Red List emerges, which relates to the size of the geographic distribution area and the threats that may lead to its reduction, fragmentation, or continuous observed, inferred, or projected decline (IUCN 2012). In a more precise approach, the application of Criterion B2 by the IUCN primarily focuses on the size of the Area of Occupancy (AOO) (IUCN Standards and Petitions Committee 2022). According to our results, the AOO measured at 630.8 Km^2 (Table 2) falls below one of the thresholds of Criteria B2 (AOO < 2000 km^2). However, the projection of mining concessions could reduce the AOO by 56.5% as implemented (Table 2). This scenario is critical because mining production in Chile is expected to increase by 20.7% by 2030 (Cifuentes & Garay 2019). The high fragmentation of the AOO is evident and could be aggravated if we consider the 176 km of roads that currently cross it (Figure 4a. Table 2). It is important to note that one of the major threats to the species is mortality due to roadkill incidents (Guzmán-Marín et al. 2022). In fact, 12 records from this study (7%) corresponded to roadkill incidents. As a result of the fragmentation and the projected reduction of the EOO from 46985.5 km^2 to 24598.4 km^2 (Table 2, Figure 4c), as well as the decrease in AOO from 630.8 km^2 to 356.5 km^2, the species meets the criteria specified in B2ab (i, ii, iii). Consequently, it is classified as 'Endangered' in terms of its conservation status.

Given the proposed conservation status faced by the species, it is crucial to quantify its threats, such as dog attacks, roadkill, hunting, lack of wildlife crossings, absence of biological corridors in the face of mining development, etc. These quantifications will provide essential insights for developing a conservation plan following the Open Standards for the Practice of Conservation (Conservation Measures Partnerships 2020). This plan must be prioritized, including habitat protection, particularly regarding mining and road activities; establishing biological corridors with a medium-term vision to ensure connectivity between fragments; and emphasizing wildlife crossings to mitigate roadkill incidents. While human-wildlife conflicts involving the species remain unknown, evaluating and addressing them if they arise (coexistence) is crucial. Continued studies on the ecology and distribution of the species will also provide valuable information for making informed decisions for its protection and management. Finally, no conservation plan will be successful without working on education and awareness efforts to raise public consciousness. These general recommendations will contribute to conserving an endemic species part of Chile's natural heritage.

Supplementary material

- Supplementary material 1. Gráfico de los Componentes Principales de las Variables
- Supplementary material 2. Dendrograma del Clúster
- Supplementary material 3. Asignación de clústeres para cada variable
- Supplementary material 4. Cargas Cuadráticas y Correlaciones de Variables Dentro de Cada Clúster
- Supplementary material 5. Varianzas Explicadas por los Componentes Principales para Cada Clúster
- Supplementary material 6. Puntuaciones Sintéticas para las seis de Primeras Observaciones en Cada Clúster de 170

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Appendix 1. Systematization of *Leopardus colocola* occurrence coordinates from different sources of information used in this study. Abbreviations: N.P. = National Park; N.R. = National Reserve; N.S. = Nature Sanctuary.

Region	Site	Latitude	Longitude	Source
Antofagasta	Near to Paposo	25° 1' 49" S	70° 28' 8" W	Castro-Pastene et al. (2023)
Atacama	Los Leones Stream. Caldera	26° 59' 52" S	70° 42' 38" W	Castro-Pastene et al. (2023
Atacama	N.P. Llanos del Challe, Aguada Los Pajaritos	28° 2' 28" S	71° 4' 1" W	Espinoza et al. (2014)
Atacama	N.P. Llanos de Challe, La Higuera Stream	28° 2' 35" S	71° 6' 53" W	Espinoza et al. (2014)
Atacama	N.P. Llanos del Challe	28° 9' 48" S	71° 3' 25" W	Castro-Pastene et al. (2023)
Atacama	N.P. Llanos de Challe	28° 10' 4" S	71° 7' 18" W	Espinoza et al. (2014)
Atacama	N.P. Llanos de Challe, Aguada Rascamoños	28° 11' 36" S	71° 7' 46" W	Espinoza et al. (2014)
Atacama	N.P. Llanos del Challe	28° 12' 2" S	71° 4' 11" W	Castro-Pastene et al. (2023)
Atacama	N.P. Llanos de Challe, Quebrada Hualtatas	28° 12' 32" S	71° 7' 16" W	Espinoza et al. (2014)
Atacama	N.P. Llanos de Challe: Las Hualtatas	28° 12' 37" S	71° 8' 56" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Atacama	N.P. Llanos de Challe, Aguada Fundición	28° 14' 9" S	70° 59' 37" W	Espinoza et al. (2014)
Atacama	Tres Playitas	28° 24' 4" S	71° 11' 10" W	Fauna impactada en las carreteras y caminos de Chile: Fermín Alfaro (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Atacama	Km 21 C-46, Bodeguilla, Freirina	28° 31' 28" S	70° 59' 40" W	Vicky Sandoval (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Atacama	Cuesta Pajonales	29° 9' 0" S	71° 2' 0" W	Global Biodiversity Information Facility (2023)
Atacama	Cuesta Pajonales	29° 9' 0" S	71° 3' 0" W	Global Biodiversity Information Facility (2023)
Coquimbo	Punta de Choros	29° 12' 36" S	71° 28' 44" W	Castro-Pastene et al. (2023)
Coquimbo	Punta de Choros	29° 12' 37" S	71° 28' 44" W	Castro-Pastene et al. (2021)
Coquimbo	Los Choros, Salto del Molle	29° 16' 53" S	71° 9' 14" W	Castro-Pastene et al. (2023)
Coquimbo	Los Choros, Los Choros Stream	29° 18' 18" S	71° 12' 55" W	Castro-Pastene et al. (2023)
Coquimbo	Punta Colorada - El Pleito	29° 18' 44" S	71° 0' 52" W	Castro-Pastene et al. (2023)
Coquimbo	El Trapiche, Mine	29° 24' 22" S	71° 7' 14" W	Castro-Pastene et al. (2023)
Coquimbo	Batuco	29° 26' 6" S	70° 50' 55" W	Castro-Pastene et al. (2023)

Region	Site	Latitude	Longitude	Source
Coquimbo	Seca Stream, La Higuera	29° 26' 9" S	71° 10' 8" W	iNaturalist (2023)
Coquimbo	Seca Stream, La Higuera	29° 28' 10" S	71° 7' 21" W	iNaturalist (2023)
Coquimbo	Maray	29° 34' 33" S	71° 9' 0" W	Castro-Pastene et al. (2023)
Coquimbo	Maray	29° 35' 28" S	71° 8' 43" W	Castro-Pastene et al. (2023)
Coquimbo	Santa Gracia Forest	29° 43' 39" S	71° 6' 25" W	Castro-Pastene et al. (2023)
Coquimbo	Condoriaco	29° 44' 48.016" S	70° 50' 59" W	Castro-Pastene et al. (2023)
Coquimbo	San Antonio Stream	29° 45' 49" S	70° 59' 57" W	Castro-Pastene et al. (2023)
Coquimbo	La Florida	29° 54' 42" S	71° 11' 57" W	iNaturalist (2023)
Coquimbo	Marquesa (Elqui)	29° 57' 0" S	71° 0' 0" W	Global Biodiversity Information Facility (2023)
Coquimbo	Marquesa (Elqui)	29° 57' 56" S	70° 58' 22" W	In Nascimento et al. (2021)
Coquimbo	Talca	30° 0' 0" S	71° 3' 0" W	Global Biodiversity Information Facility (2023)
Coquimbo	Totoralillo	30° 4' 22" S	71° 21' 49" W	Fauna impactada en las carreteras y caminos de Chile (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	Las Tacas	30° 6' 37" S	71° 21' 50" W	Gestión Natural Consultores (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	El Tangue	30° 20' 45" S	71° 31' 46" W	Castro-Pastene et al. (2023)
Coquimbo	El Tangue	30° 22' 10" S	71° 31' 55" W	Castro-Pastene et al. (2023)
Coquimbo	El Tangue	30° 22' 26" S	71° 30' 58" W	Castro-Pastene et al. (2023)
Coquimbo	El Tangue	30° 23' 9" S	71° 30' 26" W	Castro-Pastene et al. (2023)
Coquimbo	El Tangue	30° 23' 10" S	71° 31' 15" W	Castro-Pastene et al. (2023)
Coquimbo	Ovalle	30° 32' 17" S	71° 9' 40" W	Fauna impactada en las carreteras y caminos de Chile: Dario Aguilera (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	N.P. Fray Jorge	30° 40' 29" S	71° 45' 5" W	Castro-Pastene et al. (2023)
Coquimbo	El Palomo	30° 43' 55" S	70° 36' 20" W	Castro-Pastene et al. (2023)
Coquimbo	El Palomo - Los Laureles	30° 44' 6" S	70° 36' 6" W	Castro-Pastene et al. (2023)
Coquimbo	Panguesillo. Sasso River	30° 46' 46" S	70° 33' 51" W	Castro-Pastene et al. (2023)
Coquimbo	San Miguel	30° 48' 31" S	70° 37' 37" W	Castro-Pastene et al. (2023)
Coquimbo	Monte Patria. El Tome	30° 48' 15" S	70° 58' 15" W	El Ovallino (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	Amolanas	30° 52' 37" S	71° 36' 18" W	Castro-Pastene et al. (2023)
Coquimbo	Las Mollacas, Chañaral de Carén	30° 53' 55" S	70° 43' 38" W	Castro-Pastene et al. (2023)
Coquimbo	Amolanas Farm, Agua El Maray	31° 10' 53" S	71° 33' 52" W	Castro-Pastene et al. (2023)
Coquimbo	Amolana Portezuelo Durazno	31° 11' 32" S	71° 33' 8" W	Castro-Pastene et al. (2023)
Coquimbo	Amolanas	31° 12' 31" S	71° 37' 22" W	Castro-Pastene et al. (2023)
Coquimbo	Quelón Alto	31° 21' 44" S	71° 10' 5" W	Castro-Pastene et al. (2023)
Coquimbo	Quelón alto	31° 22' 18" S	71° 10' 0" W	Castro-Pastene et al. (2023)
Coquimbo	Alcaparrosa	31° 23' 8" S	71° 1' 7" W	Castro-Pastene et al. (2023)
Coquimbo	Cuesta El Espino	31° 23' 36" S	71° 5' 49" W	Castro-Pastene et al. (2023)
Coquimbo	Cuesta El Espino	31° 24' 37" S	71° 6' 13" W	Castro-Pastene et al. (2023)
Coquimbo	Las Majadas	31° 25' 28" S	71° 16' 29" W	Castro-Pastene et al. (2023)
Coquimbo	Auco	31° 27' 20" S	71° 5' 35" W	Castro-Pastene et al. (2023)
Coquimbo	Cercano a la N.R. Las Chinchillas	31° 29' 48" S	71° 6' 54" W	Fauna impactada en las carreteras y caminos de Chile: Ian Araya (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	N.R. Las Chinchillas	31° 30' 36" S	71° 7' 15" W	Bóris Saavedra (com. pers)
Coquimbo	N.R. Las Chinchillas	31° 31' 39" S	71° 4' 34" W	Castro-Pastene et al. (2023)
Coquimbo	El Bato Dam	31° 35' 27" S	70° 52' 41" W	Castro-Pastene et al. (2023)
Coquimbo	Fundo El Manque, Chellepín	31° 49' 17" S	70° 44' 35" W	Castro-Pastene et al. (2023)
Coquimbo	Agua de Rincón Seco, Llimpo	31° 49' 51" S	70° 48' 53" W	Castro-Pastene et al. (2023)
Coquimbo	Los Vilos	31° 51' 1" S	71° 28' 34" W	iNaturalist (2023)
Coquimbo	Pupío. Los Vilos	31° 52' 4" S	71° 23' 8" W	Illanes y Asociados (EIA Minera Los Pelambres) (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	Conchalí Lagoon, Los Vilos	31° 52' 31" S	71° 29' 39" W	Fauna impactada en las carreteras y caminos de Chile (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	Túneles Caimanes. Illapel	31° 53' 52" S	71° 9' 8" W	Centro Veterinario Illapel (Chávez-Villavicencio & Tabilo-Valdivieso 2022)

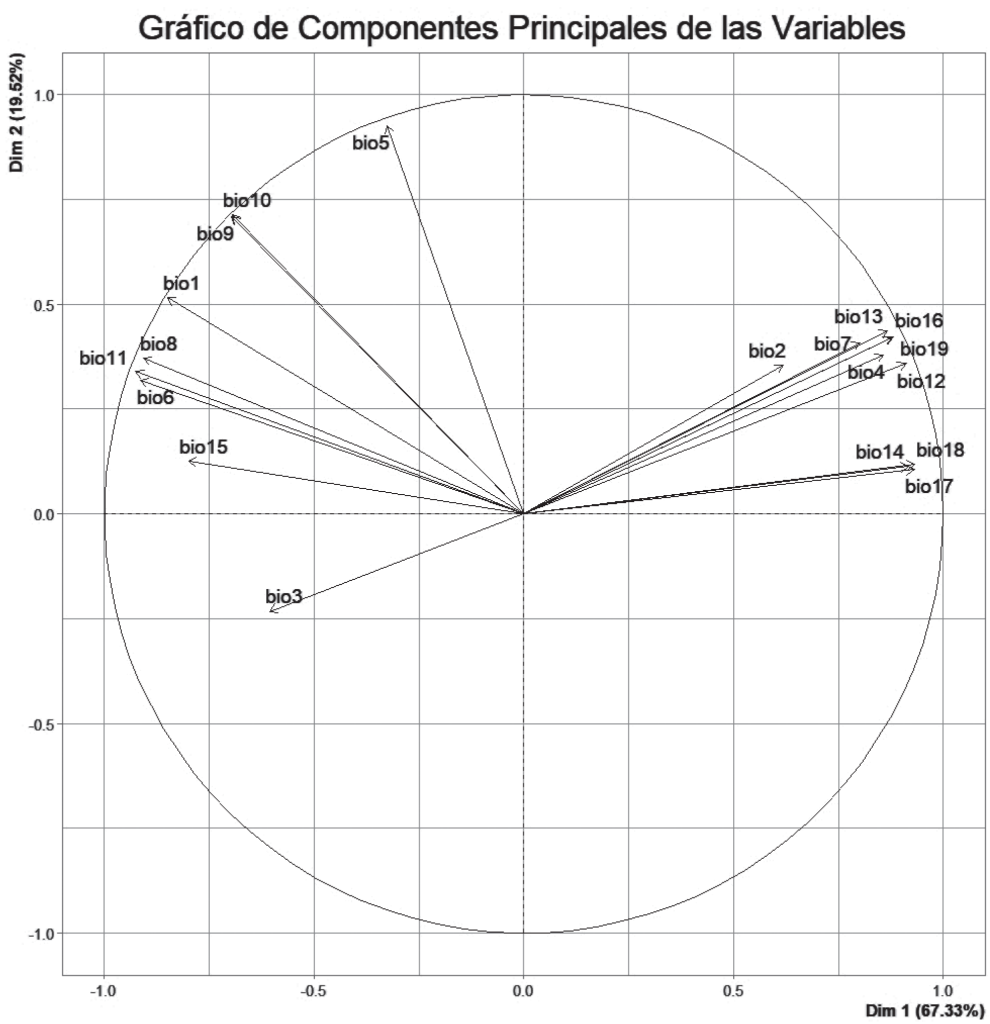
Region	Site	Latitude	Longitude	Source
Coquimbo	Corrales Dam	31° 54' 33" S	70° 54' 40" W	Carlos Santibañez (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	El Rincón, Los Caimanes	31° 54' 49" S	71° 5' 38" W	Castro-Pastene et al. (2023)
Coquimbo	Agua el Palqui, Chellepín	31° 55' 15" S	70° 44' 3" W	Castro-Pastene et al. (2023)
Coquimbo	Los Vilos	31° 55' 9" S	71° 29' 19" W	Por un Chile Sustentable: Jorge Toledo (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Coquimbo	Culenco Stream, Tranquilla	31° 57' 10" S	70° 41' 0" W	Castro-Pastene et al. (2023)
Coquimbo	Quelén Alto	31° 59' 5" S	70° 46' 3" W	Castro-Pastene et al. (2023)
Valparaíso	F30 Papudo Route close to 5 North Route	32° 27' 3" S	71° 19' 35" W	Luciano Porte (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	San Felipe	32° 29' 19" S	70° 45' 26" W	iNaturalist (2023)
Valparaíso	Papudo	32° 30' 18" S	71° 24' 44" W	Fauna impactada en las carreteras y caminos de Chile: Luciano Porte (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	Bellotos del Norte Forest. Nogales	32° 34' 6" S	71° 5' 20" W	Informe Tierra (Juan Luis Celi) (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	Catapilco	32° 34' 0" S	71° 17' 0" W	Nascimento et al. (2021)
Valparaíso	El Gallo Stream	32° 38' 15" S	71° 7' 2" W	Gestión Natural Consultores (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Metropolitana	Clarillo River	32° 48' 51.538" S	70° 24' 19" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	Llay Llay	32° 50' 0" S	70° 57' 0" W	In Nascimento et al. (2021)
Valparaíso	Llay Llay	32° 51' 0" S	70° 58' 0" W	In Nascimento et al. (2021)
Valparaíso	Riecillo. Los Andes	32° 55' 2" S	70° 19' 55" W	Servicio Agrícola Ganadero (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	N.P. La Campana	32° 57' 0" S	71° 8' 0" W	In Nascimento et al. (2021)
Valparaíso	N.P. La Campana	32° 57' 23" S	71° 0' 50" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	N.P. La Campana	32° 57' 22" S	71° 3' 0" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	N.P. La Campana	32° 58' 10" S	71° 4' 56" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	N.P. La Campana	32° 58' 22" S	71° 5' 21" W	Castro-Pastene et al. (2023)
Valparaíso	N.P. La Campana	32° 58' 22" S	71° 7' 18" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	N.P. La Campana	32° 58' 23" S	71° 6' 56" W	Castro-Pastene et al. (2023)
Valparaíso	N.P. La Campana	32° 58' 31" S	71° 4' 30" W	Castro-Pastene et al. (2023)
Valparaíso	N.P. La Campana	32° 58' 34" S	71° 7' 19" W	Castro-Pastene et al. (2023)
Valparaíso	N.P. La Campana	32° 58' 38" S	71° 6' 1" W	Castro-Pastene et al. (2023)
Valparaíso	N.P. La Campana	32° 59' 18" S	71° 2' 31" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	N.P. La Campana	32° 59' 17" S	71° 5' 12" W	Castro-Pastene et al. (2023)
Valparaíso	Casa Blanca	33° 0' 0" S	71° 0' 0" W	Beltrami et al. (2021)
Valparaíso	El Roble Mountain near to N.P. La Campana	33° 0' 0" S	71° 3' 0" W	Global Biodiversity Information Facility (2023)
Valparaíso	N.P. La Campana	33° 0' 0" S	71° 5' 0" W	In Nascimento et al. (2021)
Valparaíso	El Cajón near to N.P. La Campana	33° 0' 0" S	71° 6' 0" W	Global Biodiversity Information Facility (2023)
Valparaíso	Juncal Snowed	33° 1' 0" S	70° 5' 0" W	Global Biodiversity Information Facility (2023)
Valparaíso	La Campana	33° 0' 44" S	71° 6' 22" W	Castro-Pastene et al. (2023)
Valparaíso	Limache	33° 1' 0" S	71° 16' 0" W	In Nascimento et al. (2021)
Valparaíso	La Campana	33° 1' 38" S	71° 3' 49" W	Castro-Pastene et al. (2023)
Valparaíso	Viña del Mar	33° 1' 59" S	71° 34' 0" W	In Nascimento et al. (2021)
Valparaíso	El Duraznillo	33° 3' 0" S	71° 2' 0" W	Global Biodiversity Information Facility (2023)
Valparaíso	Cuesta La Dormida	33° 3' 44" S	71° 1' 24" W	Fauna impactada en las carreteras y caminos de Chile: Esperanza Beltrami (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	Caracha	33° 4’ 0” S	71° 2’ 0” W	Global Biodiversity Information Facility (2023)
Valparaíso	Caracha	33° 4’ 27” S	71° 1’ 43” W	Global Biodiversity Information Facility (2023)
Valparaíso	La Campana	33° 5' 28" S	71° 17' 24" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 5' 29" S	71° 18' 58" W	Beltrami et al. (2021)

Region	Site	Latitude	Longitude	Source
Valparaíso	Placilla	33° 6' 18" S	71° 33' 50" W	Fundación Coordinación de felinos silvestres Chile (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Valparaíso	Peñuelas Lake	33° 6' 50" S	71° 29' 20" W	Global Biodiversity Information Facility (2023)
Valparaíso	La Campana	33° 7' 53" S	71° 17' 43" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 8' 12" S	71° 6' 24" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 10' 49" S	71° 5' 1" W	Beltrami et al. (2021)
Valparaíso	Peñuelas Lake	33° 10' 43" S	71° 24' 16" W	Global Biodiversity Information Facility (2023)
Valparaíso	La Campana	33° 11' 19" S	71° 12' 0" W	Beltrami et al. (2021)
Metropolitana	Colina	33° 12' 0" S	70° 37' 39" W	Guzman et al. (2022)
Metropolitana	Dam, Colina	33° 12' 24" S	70° 35' 20" W	Guzman et al. (2022)
Valparaíso	La Campana	33° 11' 58" S	71° 15' 23" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 12' 13" S	71° 22' 4" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 12' 58" S	71° 19' 18" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 13' 4" S	71° 20' 49" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 14' 9" S	71° 17' 53" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 14' 23" S	71° 16' 24" W	Beltrami et al. (2021)
Valparaíso	La Campana	33° 14' 50" S	71° 23' 54" W	Beltrami et al. (2021)
Metropolitana	Melipilla	33° 15' 43" S	71° 13' 21" W	iNaturalist (2023)
Metropolitana	Juan Pablo II Av. Lo Barnechea	33° 18' 37" S	70° 35' 34" W	Guzman et al. (2022)
Metropolitana	N.S. El Arrayán. Lo Barnechea	33° 19' 1" S	70° 27' 21" W	Guzman et al. (2022)
Valparaíso	Viña Veramonte. Valle Casa de Blanca	33° 21' 19" S	71° 23' 26" W	Programa Vino y Cambio Climático Biodiversidad Chile (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Metropolitana	Melipilla	33° 22' 42" S	71° 13' 40" W	iNaturalist (2023)
Metropolitana	Curacaví	33° 23' 20" S	71° 14' 15" W	Guzman et al. (2022)
Metropolitana	Curacaví	33° 24' 0" S	71° 9' 0" W	In Nascimento et al. (2021)
Ohiggins	Peumo	33° 44' 19" S	71° 14' 27" W	Castro-Pastene et al. (2021)
Metropolitana	Clarillo River	33° 47' 19" S	70° 25' 50" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Metropolitana	El Asiento	34° 1' 0" S	71° 2' 0" W	Global Biodiversity Information Facility (2023)
Ohiggins	Alfalfalito	34° 7' 0" S	70° 5' 0" W	Global Biodiversity Information Facility (2023)
Ohiggins	Poqui Mountain	34° 12' 17" S	71° 3' 31" W	Castro-Pastene et al. (2023)
O´higgins	N.R. Río de los Cipreses	34° 20’ 52” S	70° 24’ 1” W	Francisca Aguirre (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
O´higgins	Claro River. Las Nieves. Rengo	34° 28’ 24” S	70° 44’ 10” W	Nicolás Miranda (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
O´higgins	Las Nieves on the road to Las Pulgas Mountain	34° 28’ 54” S	70° 43’ 49” W	Nicolás Arcos (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
O´higgins	N.S. Alto Huemul	34° 42’ 38” S	70° 27’ 26” W	iNaturalist (2023)
Maule	Upeo	35° 6’ 0” S	71° 1’ 0” W	Global Biodiversity Information Facility (2023)
Maule	N.P. Radar 7 Tazas	35° 20' 31" S	70° 56' 41" W	Castro-Pastene et al. (2021)
Maule	N.P. Radar 7 Tazas	35° 26' 7" S	71° 1' 25" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Maule	N.P. Radar 7 Tazas	35° 26' 58" S	71° 2' 1" W	Cooperativa: Corporación Nacional Forestal
Maule	N.P. Radar 7 Tazas	35° 27' 59" S	70° 58' 41" W	Castro-Pastene et al. (2021)
Maule	N.P. Radar 7 Tazas	35° 29' 13" S	70° 55' 14" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Maule	N.P. Radar 7 Tazas	35° 29' 13" S	70° 55' 34" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Maule	N.P. Radar 7 Tazas	35° 29' 45" S	70° 54' 55" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Maule	N.P. Radar 7 Tazas	35° 29' 45" S	70° 56' 15" W	Corporación Nacional Forestal (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Maule	N.R. Altos de Lircay	35° 34' 53" S	71° 0' 5" W	Castro-Pastene et al. (2021)
Maule	N.R. Altos de Lircay	35° 35' 39" S	70° 53' 50" W	Castro-Pastene et al. (2021)
Maule	N.R. Altos de Lircay	35° 35' 58" S	71° 1' 51" W	Castro-Pastene et al. (2023)
Maule	N.R. Altos de Lircay	35° 36' 22" S	71° 4' 12" W	Global Biodiversity Information Facility (2023)

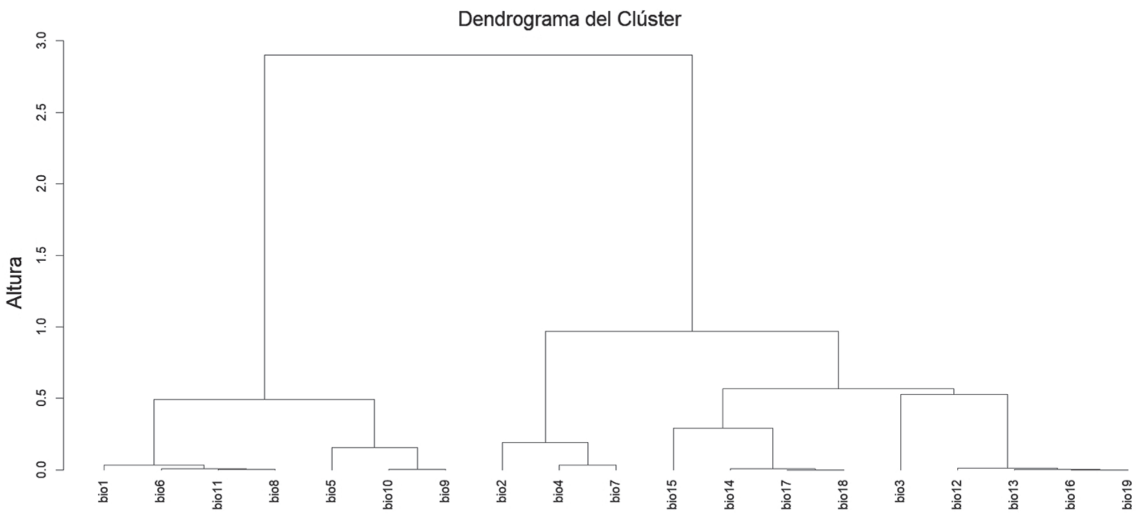
Region	Site	Latitude	Longitude	Source
Maule	N.R. Altos de Lircay	35° 39' 39" S	70° 51' 53" W	iNaturalist (2023)
Maule	Los Cipreses	35° 49' 0" S	70° 49' 57" W	Defensores del Alto Maule: Francisco Pulgar (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Maule	Internacional Pehuenche Pass km 125	35° 57' 25" S	70° 34' 30" W	Linares en Línea: Defensores Alto Maule (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Maule	Maule Lagoon	36° 5' 45" S	70° 27' 6" W	iNaturalist (2023)
Maule	Private Park Cordillera Los Quemados.	36° 5' 49" S	71° 12' 21" W	Agencia de medio el estratega: Funadación Hualo (Chávez-Villavicencio & Tabilo-Valdivieso 2022)
Ñuble	N.R. Ñuble	36° 59' 8" S	71° 26' 39" W	Castro-Pastene et al. (2023)
Ñuble	N.R. Ñuble	36° 59' 29" S	71° 28' 7" W	Castro-Pastene et al. (2023)
Ñuble	N.R. Ñuble	36° 59' 52" S	71° 26' 39" W	Castro-Pastene et al. (2023)
Ñuble	RN Ñuble	37° 2' 2" S	71° 26' 45" W	Castro-Pastene et al. (2023)
Ñuble	N.R. Ñuble	37° 3' 19" S	71° 25' 58" W	Castro-Pastene et al. (2023)
Ñuble	RN Ñuble	37° 5' 0" S	71° 26' 2" W	Castro-Pastene et al. (2023)
Ñuble	N.R. Ñuble	37° 5' 29" S	71° 23' 40" W	Castro-Pastene et al. (2023)
Ñuble	N.R. Ñuble	37° 5' 54" S	71° 29' 44" W	Castro-Pastene et al. (2023)
Ñuble	N.R. Ñuble	37° 6' 1" S	71° 26' 57" W	Castro-Pastene et al. (2023)

Supplementary material

Supplementary material 1. **Gráfico de los Componentes Principales de las Variables**



Supplementary material 2. **Dendrograma del Clúster**



Supplementary material 3. **Asignación de clústeres para cada variable**

Variable	Clúster
bio1	1
bio11	1
bio6	1
bio8	1
bio10	2
bio5	2
bio9	2
bio12	3
bio13	3
bio16	3
bio19	3
bio14	4
bio17	4
bio18	4
bio15	5
bio2	6
bio3	7
bio4	8
bio7	8

Supplementary material 4. **Cargas Cuadráticas y Correlaciones de Variables Dentro de Cada Clúster.** Permite visualizar la relación de cada variable **con su clúster correspondiente**.

Clúster	Carga Cuadrática	Correlación
Clúster 1		
bio8	0.9968673	-0.9984324
bio11	0.9961041	-0.9980501
bio6	0.9857242	-0.9928365
bio1	0.9750227	-0.9874324
Clúster 2		
bio10	0.9770394	-0.988453
bio9	0.9710396	-0.9854134
bio5	0.8933711	-0.9451831
Clúster 3		
bio16	0.999493	0.9997465
bio19	0.9987224	0.999361
bio13	0.9956272	0.9978112
bio12	0.9902898	0.995133
Clúster 4		
bio17	0.9988357	0.9994177
bio18	0.9974031	0.9987007
bio14	0.9939221	0.9969564
Clúster 5		
bio	1	1
Clúster 6		
bio2	1	1
Clúster 7		
bio3	1	1
Clúster 8		
bio4	0.983171	0.9915498
bio7	0.983171	0.9915498

Supplementary material 5. **Varianzas Explicadas por los Componentes Principales para Cada Clúster**

Clúster 1			
Comp.1	Comp.2	Comp.3	Comp.4
3.95371827	0.0371165	0.00670528	0.0025
Clúster 2			
Comp.1	Comp.2	Comp.3	
2.84145013	0.155724299	0.002825571	
Clúster 3			
Comp.1	Comp.2	Comp.3	Comp.4
3.984132386	0.014259885	0.001095663	0.0005
Clúster 4			
Comp.1	Comp.2	Comp.3	
2.990160952	0.009284966	0.000554082	
Clúster 5			
Comp.1			
1			
Clúster 6			
Comp.1			
1			
Clúster 7			
Comp.1			
1			
Clúster 8			
Comp.1	Comp.2		
1.96634209	0.03365791		

Supplementary material 6. **Puntuaciones Sintéticas para las seis de Primeras Observaciones en Cada Clúster de 170**

	Clúster 1	Clúster 2	Clúster 3	Clúster 4	Clúster 5	Clúster 6	Clúster 7	Clúster 8
1	-3.3720795	-1.91406875	-2.3753404	-1.06558814	-1.92674411	-2.80813798	-2.36059711	-2.19161086
2	-1.9754727	-0.71211219	-2.44113516	-1.06558814	-0.38602063	-1.337207	0.28111199	-1.75407552
3	-1.60196609	-0.15485058	-2.50644531	-1.0961247	-1.09950201	-1.11948826	0.98614643	-1.91821186
4	-2.09129691	-0.5793429	-2.44641591	-1.0961247	-0.39790633	-1.47527304	0.40044828	-1.98555881
5	-2.18947537	-0.97784141	-2.48127855	-1.0961247	-0.83967155	-1.01328366	0.66716952	-1.64881666
6	-1.59385626	0.01590314	-2.47388308	-1.0961247	-0.66368482	-1.16196937	1.07774355	-2.02735829