Final Evaluation Report

Your Details	
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Project Title	Temporal and spatial changes of ecosystem health: case of Los Chanchos basin, Uruguay
Application ID	39566-1
Date of this Report	2 July 2024

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Evaluate the abundance and presence of faecal coliforms and zoonotic pathogens respectively in water bodies.			x	
Sudie the richness and distribution of medium and large mammals' communities.			x	
Analysed the interaction between mammals' communities and water bodies considering land uses.			x	

2. Describe the three most important outcomes of your project.

The aim of this proposal was to assess the current state of the ecosystem health of the basin of Los Chanchos stream using different indicators of ecosystem health such as water quality and medium and large mammal communities. Quantification of faecal careiforms in water is a widely used indicator of water quality. Faecal contamination of water can carry zoonotic pathogenic bacteria, such as pathogenic *Escherichia coli*, which affect various dimensions of human and animal health. In this sense, the abundance of faecal coliforms in water bodies was quantified and the presence zoonotic pathogens in water and faecal samples was determined.

The present study was carried out in the locality of Villa Serrana located in the basin of the Arroyo Los Chanchos, department of Lavalleja. Six sampling campaigns were carried out for 1 year (2023-2024) covering high and low season to assess the impact of tourism. In each sampling campaign, 10 points distributed upstream, in and downstream the reservoir of Arroyo Los Chanchos were monitored (Figure 1). Camera traps were placed close to the water bodies where the water sample and

faecal sample were taken. In addition, land use analyses were carried out incorporating the information obtained on water quality and the distribution of medium and large mammals.

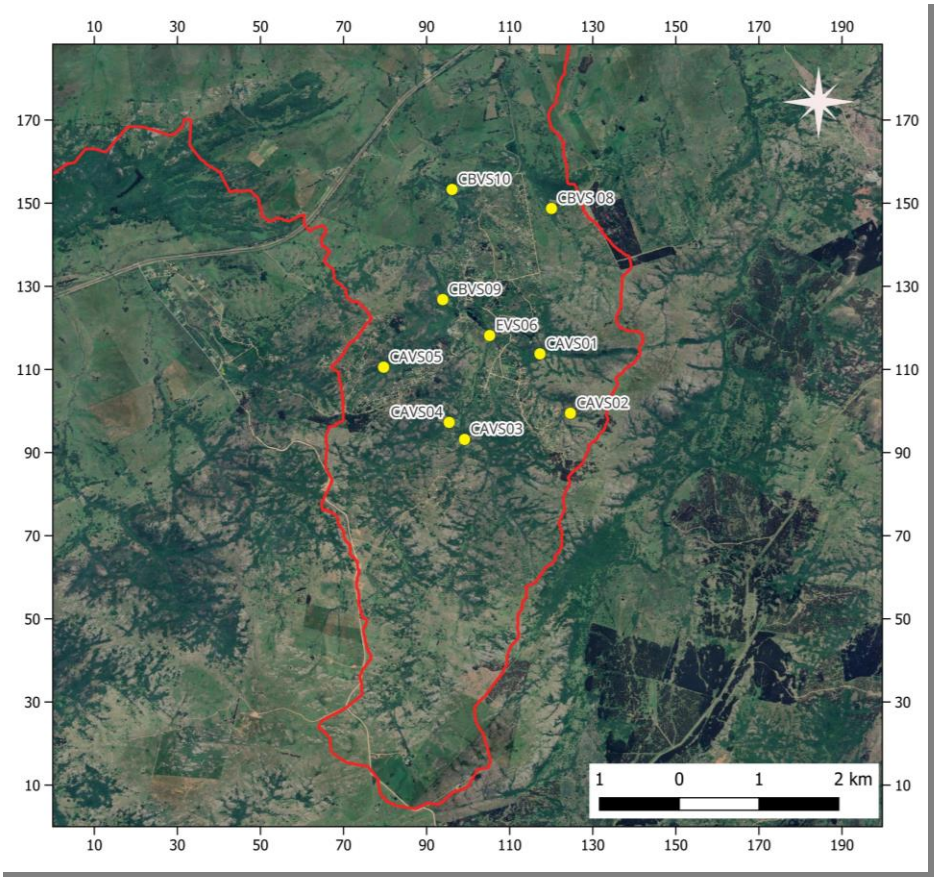


Figure 1: Map showing the sampling sites

The main results are described below:

a) <u>Water quality and mammal's biodiversity</u>

- <u>Water quality</u>

An increase in faecal contamination was found to be associated both with urbanisation and with livestock farming. In the low season months, the abundance of faecal coliforms was below the regulatory limit value for Level 2 watercourses (<1000 CFU/100ml) (Figure 2). In high season there was a significant increase in the abundance of faecal coliforms exceeding the value allowed by the regulations (1000 CFU/100ml) (Figure 2).

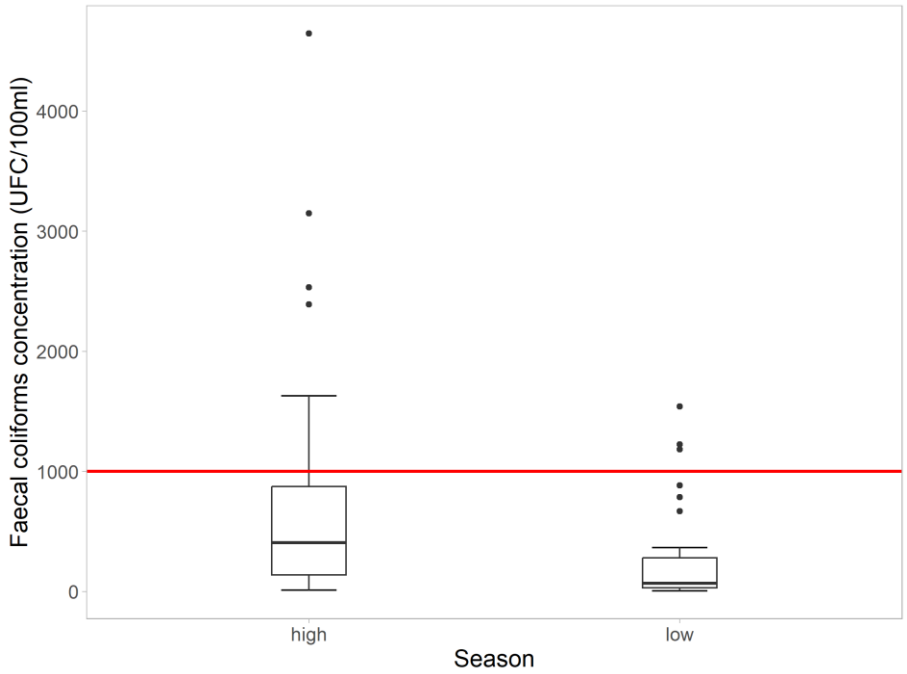


Figure 2: Boxplot of faecal coliforms concentration (UFC/100ml) in high and low seasons. Red line shows the value allowed by the national regulation for level 2 water courses (recreational waters, 1000 UFC/100ml).

Throughout the sampling year, watercourses near livestock farming areas showed high concentrations of faecal coliforms, in some cases exceeding the value allowed by the regulations (Figure 3).

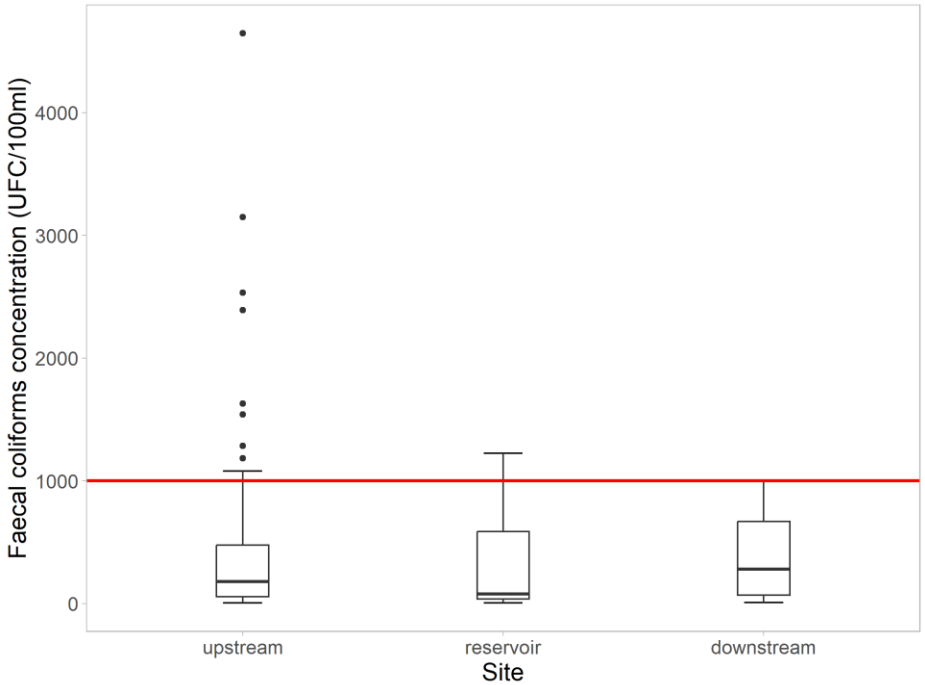


Figure 3: Boxplot of faecal coliforms concentration (UFC/100ml) in the different sites: upstream the reservoir, within the reservoir and downstream the reservoir. Red line shows the value allowed by the national regulation for level 2 water courses (recreational waters, 1000 UFC/100ml).

In addition, the presence of pathogenic *E. coli* was detected in water samples from upstream, downstream and within the reservoir. When faecal coliform concentration was high, pathogenic *E. coli* was detected, however this relationship was not significant (Figure 4). Furthermore, pathogenic *E. coli* was also detected in mammal faeces, most frequently in cows, wild boar and guazubirá.

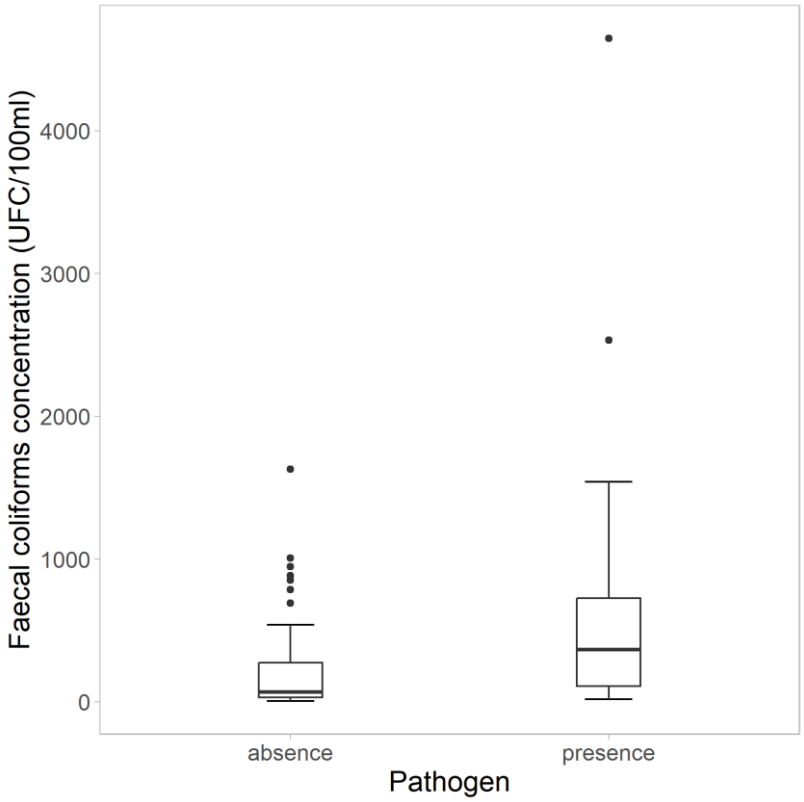


Figure 4: Boxplot of faecal coliforms concentration (UFC/100ml) in absence or presence of pathogenic *E. coli*. Red line shows the value allowed by the national regulation for level 2 water courses (recreational waters, 1000 UFC/100ml).

- Mammal biodiversity

In total, 14 species of medium to large wild native mammals, two wild exotics, and three domestic exotics were recorded (Table 1). Among the native species, three present conservation problems at national and international level: *Leopardus wiedii* (margay), *Dasypus hybridus* (mulita), and *Cabassous tatouay* (tatú de Rabo Molle) (Table 1).

Table 1: List of mammal species recorded at the camera trap.

			Conservation status	
Scientific name	**Common name**	**Native/exotic**	**National (SNAP)**	**International (UICN)**
Dasypus novemcinctus	Tatú	Native	NO	LC
Dasypus hybridus	Mulita	Native	NO	NT
Cabassous tatouay	Tatú de rabo molle	Native	Yes	LC
Subulo gouazoubira	Guazubira	Native	NO	LC
Leopardus wiedii	Margay	Native	Yes	NT
Leopardus geoffroyi	Gato montes	Native	NO	LC
Procyon cancrivorus	Mano pelada	Native	NO	LC
Cerdocyon thous	Zorro de monte	Native	NO	LC
Lycalopex gymnocercus	Zorro gris	Native	NO	LC
Galictis cuja	Huron	Native	NO	LC
Conepatus chinga	Zorrillo	Native	NO	LC
Didelphis albiventris	Comadreja mora	Native	NO	LC
Roedor sp.	Roedor pequeño	Native	NO	LC
Hydrochaerus hydrochaeris	Carpincho	Native	NO	LC
Sus scrofa	jabalí	Exotic/wild		
Axis axis	Ciervo Axis	Exotic/wild		
Bos taurus	Vaca	Exotic/domestic		
Felis catus	Gato domestico	Exotic/domestic		
Canis lupus familiaris	Perro	Exotic/domestic		

It was observed that the sites with the highest richness are in areas without urbanisation (Figure 5). In addition, the sites in the upper basin showed the highest richness, which are located far from urbanisation (Figure 5). The margay (*Leopardus wiedii*) was recorded at all points sampled and in all months. However, according to conversations with the local population, this species has not been seen in the last 5 years (approximately). This would indicate that the species, being very susceptible to human activity, is present in the area but had a change in its behaviour due to advancing urbanisation. Added to this is the presence of domestic cats and dogs due to increasing urbanisation have a very high impact mainly on wildlife. In this sense, during the project, a dog was recorded hunting a capybara puppy, which demonstrates the impact of exotic animals on wildlife.

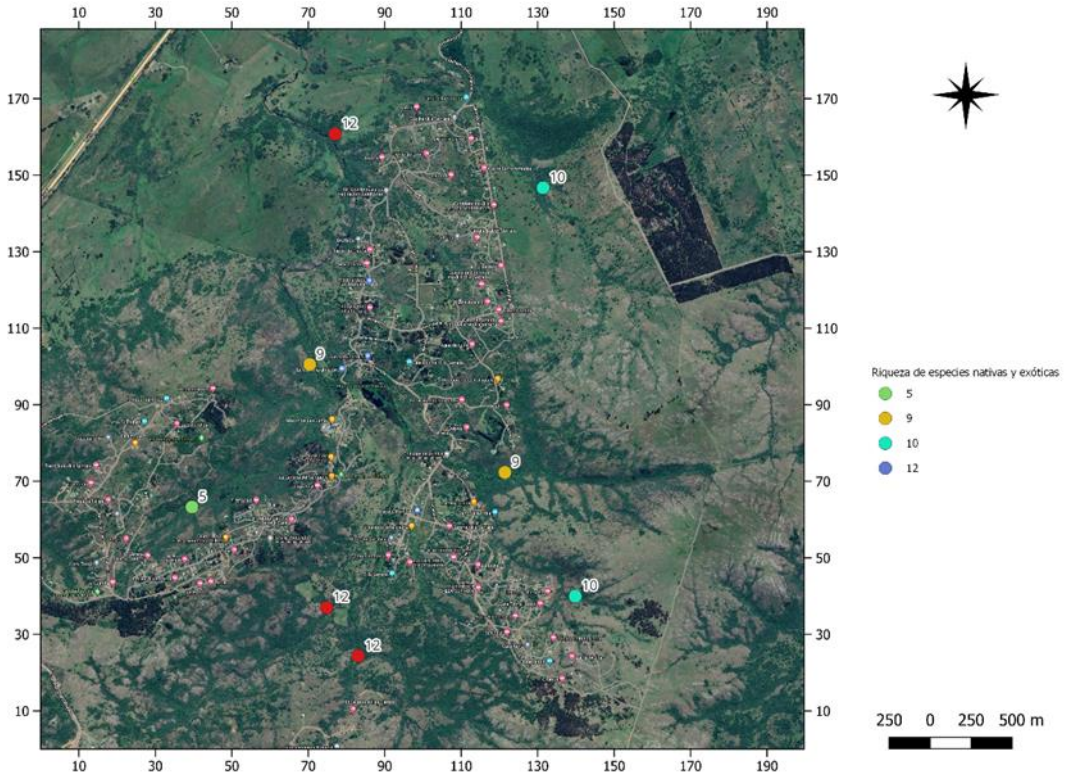


Figure 5: Map showing the distribution of species richness obtained with the camera traps during the project.

b) Land uses and biological corridors

- Land uses

The study area is characterised by natural grasslands, native woodland, and some small areas of wetlands (Figure 6).

- Grassland

Two main areas can be distinguished:

1. Urban area which has no livestock due to a governmental decision which prohibits livestock from circulating in the area. This has allowed the recovery of natural grassland which is fundamental for both biodiversity and ecosystem functions, especially CO_2 sequestration, preventing soil erosion and loss, and water quality.

Among the mammal species recorded in this grassland area, the mulita (*Dasypus hybridus*) stands out, which is listed as Near Threatened (NT) at the international level. However, urbanisation is fragmenting this ecosystem into smaller and smaller patches. This has a direct impact on fauna and flora as well as on ecosystem functions and ecological connectivity.

2. Area where livestock are allowed, within which overgrazed areas (area where points 9 and 10 are located), moderately grazed areas (area of points 1, 2, 3, 4 and 8) and ungrazed areas (area of point 5) are defined. One of the negative impacts faced by the grassland is the presence and advance of exotic species, mainly those with invasive behaviour, such as the senecio (*Senecio madagascariensis*), which is advancing over the grassland in the study area.

- Native woodland

This area is characterised by the presence of serrano woodlands which are habitat to a great richness of species of medium and large mammals, with the presence of endangered species such as the margay and the tatú de rabo molle standing out. However, like the grassland, the advance of urbanisation is increasingly fragmenting this ecosystem, affecting biodiversity and its ecosystem functions. Likewise, the woodland is strongly threatened by the presence of invasive exotic species such as pine (*Pinus* sp.), poplar (*Populus alba*), grateau (*Pyrcantha coccinea*), ligustrum (*Ligustrum lucidum*), blackberry (*Rubus ulmifolius*), among others, the latter three being the ones with the largest invasive surface area.

- Wetlands

This ecosystem has a smaller surface area compared to woodland and grassland. However, it is a crucial ecosystem for improving water quality. Flooded grasslands and wetlands dominated by reeds such as cattails (*Typha*) are found in the study area. Within the reservoir there is a wetland which plays an important role in the purification of the water coming down from the upper basin. The dominant species in this ecosystem is the capybara. The impacts facing this ecosystem are livestock and urbanisation, mainly in the floodplain grassland area.

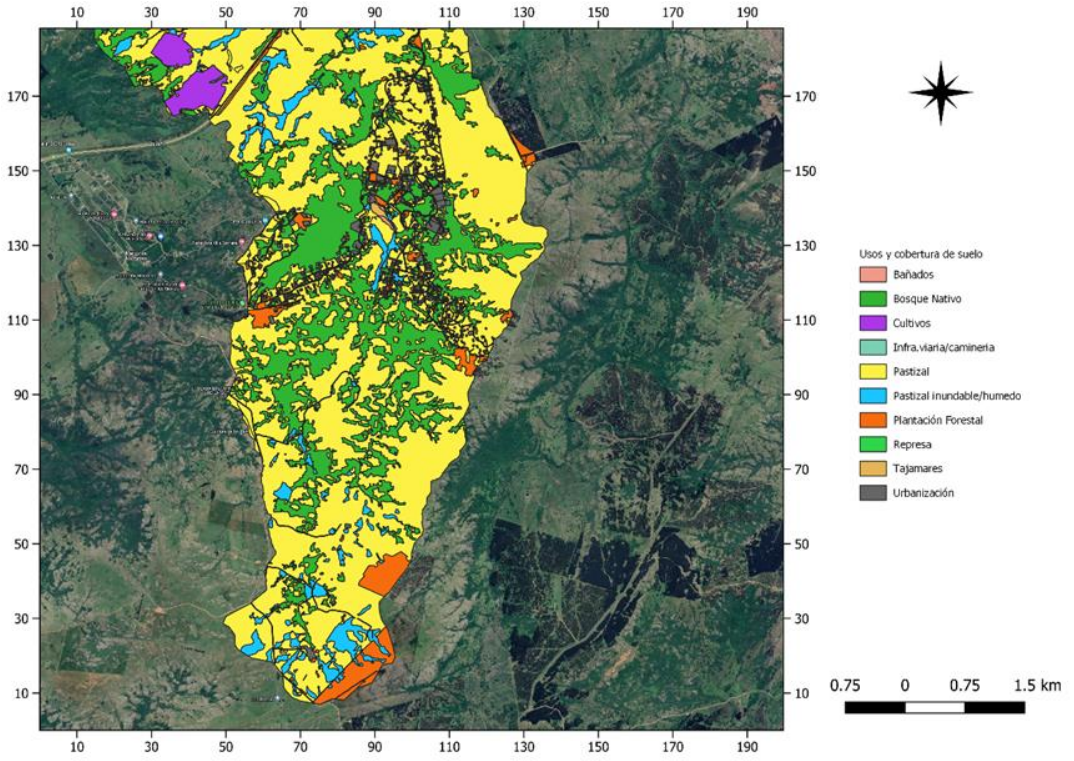


Figure 6: Land use and land cover map of the study area.

At the ecosystem level, it was determined that 1231 ha of the basin are classified as vulnerable and endangered ecosystems by the Ministry of Environment (Figure 7). It is also important to highlight that this area is within the IBAS (Important Bird Areas) with the presence of birds such as the rhea (*Rhea americana*), dwarf woodpecker (*Picumnus nebulosus*), great white widow (*Heteroxolmis dominicana*), straight-billed woodpecker (*Limnoctites rectirostris*), yellow cardinal (*Gubernatrix cristata*), white-breasted capuchin (*Sporophila palustris*), dragonbird (*Xanthopsar flavus*), ochreous curutié (*Cranioleuca sulphurifera*). Some of these bird species were recorded in the study area by camera traps.

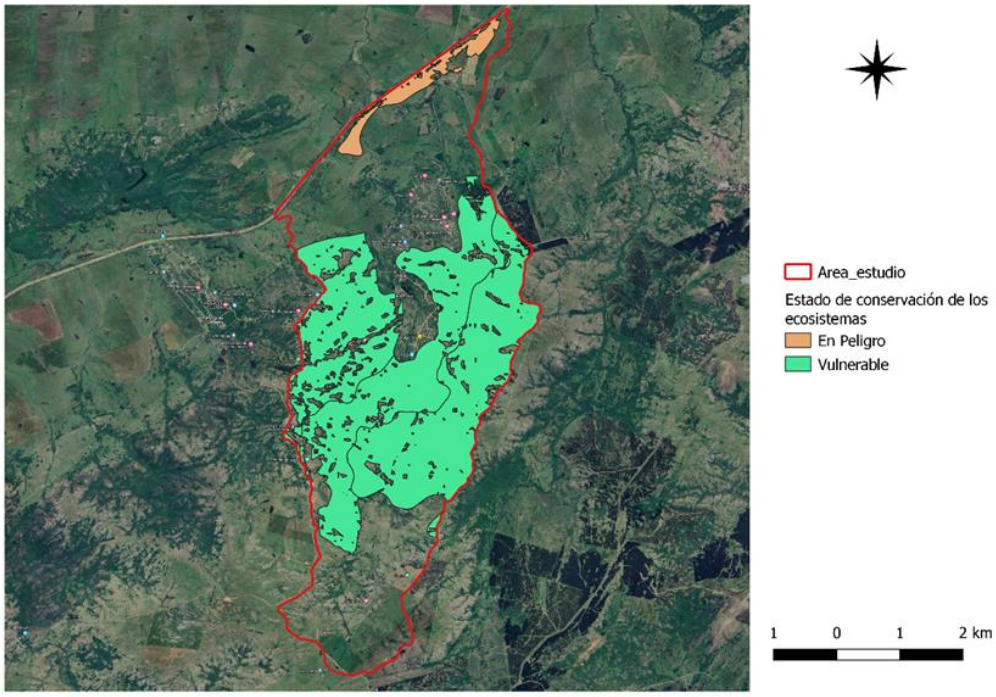
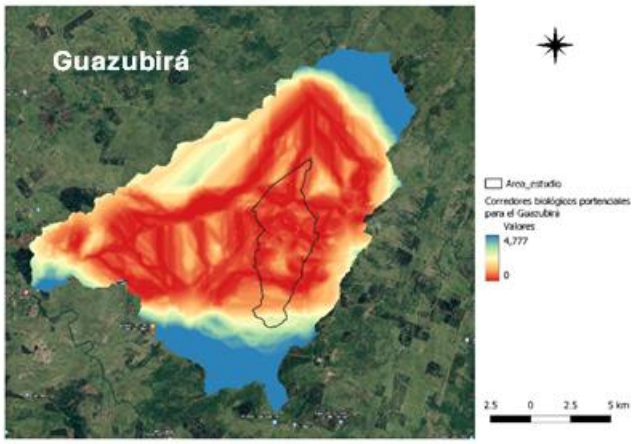


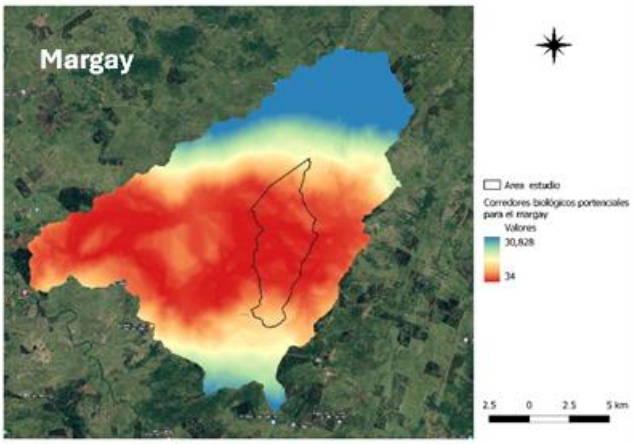
Figure 7: Map of threatened ecosystems present in the study area.

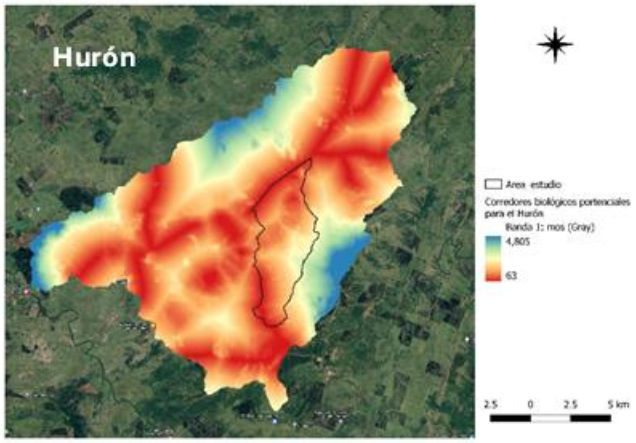
- Biological corridors

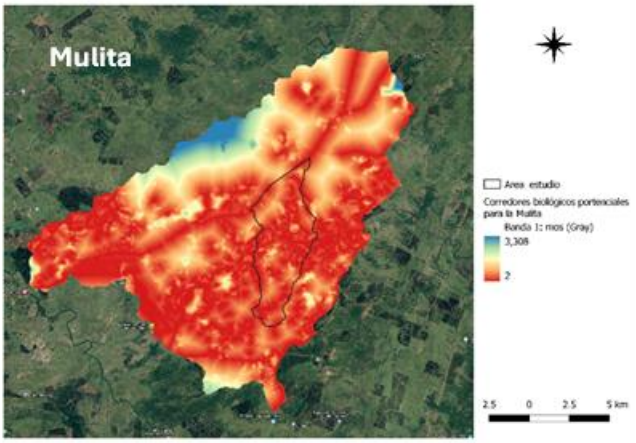
Once the species of medium and large mammals present in the study area had been identified, five representative species were selected for each ecosystem: two for native woodland (margay and guazubirá), two for grassland (mulita and ferret) and one for wetlands (capybara). For each of these species, biological corridors were modelled using the linkage mapper software for ARCGIS. For this purpose, an area larger than the Arroyo Los Chanchos basin was taken, allowing us to analyse how it connects with the surrounding ecosystems since the species move beyond the study area (Figure 8).

The model results show how the corridors for the five species overlap with the urbanised area negatively affecting them. In addition, these corridors intersect with sites of high faecal contamination, demonstrating a conflict between cattle ranching, tourism, and biodiversity conservation.









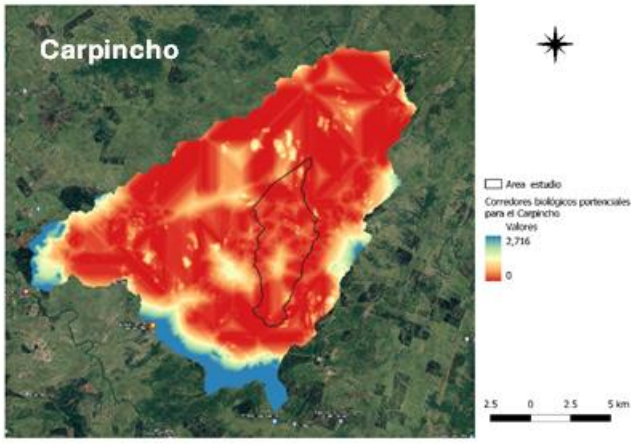


Figure 8: Maps of potential biological corridors for each selected mammal species present in the study area.

Joining all the results obtained (water quality, mammal monitoring and biological corridor modelling), a first approximation to spatial planning with an ecosystem health and Green Infrastructure approach was generated (Figure 9).

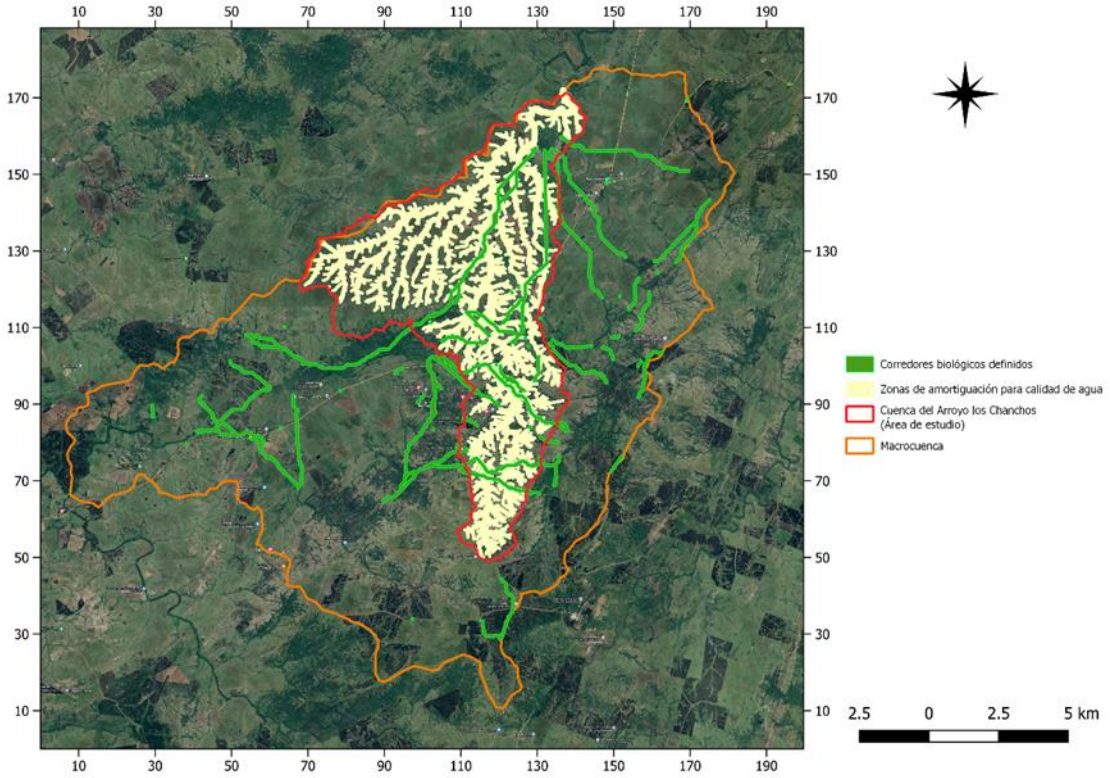


Figure 9: Map showing the spatial planning proposal for the study area integrating water quality improvement and the implementation of biological corridors.

1) **<u>Divulgation and education</u>**

To execute educational activities, we developed audiovisual and printed materials. We used social media of the NGO ECOBIO Uruguay and Instituto de Investigaciones Biológicas Clemente Estable (Twitter, Instagram, and Facebook) as the platform to deliver our educational audiovisual materials. Regarding workshops that aimed at the public, presential workshops were held in which many people participated. There were also press releases in newspapers and radio interviews in which the project was publicised and the importance of the subject was communicated.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

During the project there were minor difficulties such as the theft of camera traps and a drought that affected the whole country. These difficulties could easily be overcome by relocating the camera traps to less accessible points and reorganising the sampling sites to watercourses with more flow.

The main difficulty we had was working with the local community of Villa Serrana. Although we have finally managed to work with the community, it was a difficult and slow process to get people to listen to us and trust the team and the work we are doing. At the beginning there was a notorious rejection against us, but through different work strategies we have managed to generate a very valuable link with part of the local community of Villa Serrana.

4. Describe the involvement of local communities and how they have benefitted from the project.

We noticed interest on part of the local community in ecosystem conservation, for example through simple practices to be carried out in homes for the wastewater treatment, as well as interest in the implementation of biological corridors.

The project also succeeded in raising awareness of the presence of faecal coliforms in waterbodies and aquatic pathogenic bacteria. This was unknown to the local population prior to the project.

5. Are there any plans to continue this work?

Yes, there are. Once the main problems that generate the deterioration of the ecosystemic health of Villa Serrana have been detected, it is planned to evaluate the application of some mitigation measures (creation of buffer zones and treatment of domestic waste) in strategic areas. In addition, the sampling area will be extended to cover other land uses.

6. How do you plan to share the results of your work with others?

Partial results of this project were presented at various national and regional scientific congresses (VII National Congress of Natural Protected Areas of Uruguay 2023, 3rd ISME-Latin America Congress 2023) as well as to society through workshops, radio interviews and newspaper articles. We will soon present the full results of the project at a workshop in Villa Serrana where both locals and relevant government authorities will be invited. In addition, the results will be presented at national and regional congresses (XV National Congress of Microbiology 2024, II Symposium VTEC 2024) and the publication of a scientific article in a national and international journal is foreseen.

7. Looking ahead, what do you feel are the important next steps?
We would like to get the city government involved in the implementation of measures in favour of the conservation as well as an improvement in the current management plan for the area.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?
The Rufford Foundation logo was used in all the activities carried out as well as in the printed materials. In the interviews conducted throughout the project, Rufford was also mentioned, highlighting its importance in executing the project. Also, the logo will be present in the environmental education activities that will take place in 2024 and in the national and regional congresses in which the results of the project will be presented.

9. Provide a full list of all the members of your team and their role in the project.
Ana Umpiérrez: Participated in the detection of pathogens. Also collaborated in the discussion.
Carolina Croci: Participated in field trips and sample processing.
Claudia Piccini: Participated in data analysis and discussion.
Elis Montagne: Participated in field trips. She was in charge of the elaboration of divulgation, communication and educational materials. Also collaborated in the cameras trap analysis.
Facundo Lepillanca: Participated in field trips and sample processing.
Florencia Bertoglio: Participated in the planning and field trips sample processing. She collaborated in the elaboration of the divulgation, communication, and educational materials. Also participated in data analysis and preparation of the final report.
Hugo Coitiño: Participated in the planning and field trips, as well as cameras trap analysis. He collaborated in the elaboration of the divulgation, communication, and educational materials. Also participated in data analysis and preparation of the final report.
Yamila Figueroa: Participated in field trips and sample processing. She was in charge of the detection of pathogens.

10. Any other comments?
We would like to emphasise that the knowledge generated will contribute to the development of mitigation and land-use planning measures to restore the ecosystem health of Villa Serrana. As a next step, we propose to advance in the implementation of territorial planning, where the integration of the local population, the property companies and the departmental municipality is essential.

- **Proposal for spatial planning**

To advance in the proposal for spatial planning to generate biological corridors and improve water quality, we first identified those lots where biological corridors were observed. It was noted that there are urbanised and non-urbanised lots where the

biological corridors are located. Therefore, we started to work with owners of built-up lots that are located within biological corridors to generate a management of the property and strengthen these corridors as well as to contribute to the improvement of water quality. This strategy is being implemented within an integrative and holistic approach called Green Infrastructure which aims to balance human activities with the conservation of biodiversity, ecosystem functions and services.