

Final Evaluation Report

Your Details	
Full Name	Paula Blanco
Project Title	Analysing the role of pesticide residues during marsh deer mortality events in wetlands of Argentina through a Participatory Surveillance Network
Application ID	37147-1
Date of this Report	8th February 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
Strengthen and optimise the surveillance network				We implemented citizen science practices by engaging local residents in preliminary reporting through a series of workshops conducted in both study areas, including a presentation at the local university in the province of Corrientes. These workshops underscored the significance of collecting samples essential for pesticide analysis and allowed for an exchange with local community stakeholders on pesticide issues at both study sites.
To Create an ecotoxicological database on pesticide residues for environmental samples and tissues of Marsh deer				Through opportunistic and systematic sampling, we were able to create a database of the pesticides present in both study areas for environmental matrices. Now, we are carrying out the pesticide analysis of marsh deer tissues. Due to the nature of the task, which involves processing time, and the complex health situation of one of the team members; we were unable to carry out both analyses within the project year.

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

a). Ecotoxicological database. We accomplished the execution of all planned field campaigns, carrying out two in the fall-winter season and two in the spring-summer season within the two protected areas under study: Iberá National Park and Marsh Deer National Park. For a total of 40 days in 2023, our team conducted sampling activities, spanning various locations in the field, collecting environmental samples and enhancing the robustness of the surveillance network. In these field campaigns we gathered information on a wide range of pesticide residues in all the environmental matrices studied, covering both the most conserved sites in the national parks and their surrounding productive areas. To date, there was no information on pesticides for any national park in Argentina, this being the first systematic record in our country. The high number of samples collected (n=148) has allowed us to create a statistically solid database that serves as a starting point for understanding general pesticide mobility patterns. This database proved to be a very important asset for dialogue with national park authorities and local community members by presenting them with quantifiable technical information on the presence

of areas with different levels of contamination that could affect the health of wild populations, including the marsh deer.

b). Sample Bank: Assessing Pesticide Contamination. In addition to scheduled surveys, we were able to make numerous trips to collect tissue samples from marsh deer, responding to alerts from members of the surveillance network when a mortality event occurred in the field. Necropsies were carried out in forestry fields, private housing areas, roadside locations and at different zones protected by national parks in Corrientes and Buenos Aires provinces. We were able to create a sample bank that includes more than 100 tissues (containing liver, kidney, spleen, muscle, tongue, hair and blood) from 30 deer. All of these samples were collected and aliquoted under strict biosafety standards and are currently stored refrigerated at -80°C, available for analysis.

Some of the samples of marsh deer tissues that were analysed by chromatography techniques have exhibited traces of commonly used agricultural pesticides such as Imidacloprid, Metolachlor and Tebuconazole, according to our preliminary hypothesis. Although we were able to partially extract these biological samples, the results obtained confirm the presence of pesticides in individual marsh deer. This data could be of great relevance when thinking about the threats to the species and designing strategies for its conservation. In the future months we will continue performing the extraction and analysis of these deer samples to fulfil our objective.

Subsequently, samples from various species were gathered through necropsies conducted in both scheduled campaigns and in response to mortality reports. To optimise resource utilisation, we extended our sampling efforts to include a diverse range of mammals, such as capybaras, different deer species, foxes, micro-rodents, and weasels. These specimens have been appropriately refrigerated within the sample bank and can be retrieved in the future for analysis of pesticide presence. This comprehensive approach will provide valuable insights into the impact of these contaminants on diverse species and the biodiversity of each location.

c). Strengthening of Participatory Surveillance Network: we expanded the network by incorporating new participants and reinforcing the training of local collaborators. We provide tools for people to report marsh deer mortality events and to accurately collect samples for toxicological studies. Conducting three workshops, one at Marsh Deer National Park and two at Ibera National Park, along with a presentation at the Faculty of Veterinary of the National University of the Northeast (UNNE) for students and authorities, has been instrumental in enhancing the capabilities of local stakeholders, training new participants, and disseminating project information within the local community.

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

One of the unforeseen difficulties aroused was related to the current economic situation in Argentina. Inflation in the last year in our country reached high percentages and resulted in instability at the time of budget implementation.

Fortunately, in situations where our needs did not match the original budget submitted, we were able to reformulate our purchases, in consultation with the foundation.

Another difficulty we encountered was getting national park personnel and the local community involved in the participatory surveillance network by reporting cases of dead animals consistently throughout the project year. In spite of the interest shown in each of the meetings with the members of the network, we had to invest significant effort in cultivating and maintaining a stable team to report deer mortality events in the field.

Despite our careful planning for the workshops and the intention to gather valuable insights through questionnaires related to pesticide usage, seasonality of application, resistance in pests, and more, we encountered challenges in obtaining the expected results. Unfortunately, individuals in the local community (especially timber producers who apply pesticides) showed reluctance to share such information, making it difficult to gather comprehensive data through the participatory and interdisciplinary approach we had envisioned.

Finally, progress on the analysis of pesticides in deer tissues was affected by two major factors: the high time demands involved in analysing and processing data from environmental samples and the complex health situation of my thesis Co-Director, Damián Marino, who passed away at the end of 2023. This sad situation changed the schedule set at the beginning of the project, especially in relation to the processing of the deer tissue samples. Damian was the head of the lab and the person who accompanied my learning of chromatographic techniques and the analysis of results from the field.

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

The local community and protected area personnel demonstrated a significant interest in the project, offering valuable insights into the local pesticide situation. They actively collaborated in designing the sampling based on the identification of sites bordering production areas and in reporting cases of deceased marsh deer within the surroundings, after the consistent effort we put in to make this sustainable. On multiple occasions, stakeholders participated in necropsies and collected samples. Through comprehensive training workshops and immersive field trips dedicated to the execution of necropsies, park rangers, and brigade members of the national park were not only equipped with the necessary skills to report cases but also gained proficiency in the collection of samples from both animals and the environment. Importantly, these educational initiatives emphasised the holistic "One Health" approach, fostering an understanding among participants about the interconnectedness of human, animal, and environmental health, thereby reinforcing the significance of species conservation efforts.

5. Are there any plans to continue this work?

Currently conducting pesticide analysis on marsh deer tissues, we have obtained positive results, and we expect to continue achieving similar results in the near future. With the data collected, we aim to extend the analysis to other mammals. This broader examination will help us understand how various mammal species are impacted by the surrounding productive activities. These insights will be instrumental in designing conservation management plans for protected areas and wildlife. Additionally, our team has developed a mobile application with the aim of improving the notification of dead or injured animals in remote areas. This application will be operational promptly and will specifically target local stakeholders, serving as a centralised information tool and facilitating outreach to a broader audience.

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

First, the results will be presented to the local collaborators and also at scientific national and international meetings. Recognising the importance of communicating the pesticide results to the local community, efforts will be made to organise informative sessions and workshops, fostering dialogue and understanding. Subsequently, the comprehensive results will be published in peer-reviewed journals, serving as a valuable contribution to the scientific literature. And finally, the complete body of work will be critically analysed within the framework of two PhD theses.

7. Looking ahead, what do you feel are the important next steps?

Throughout this study we have found several broad-spectrum pesticides, present in different matrices, which allowed us to generate a database to use as a framework for future studies and management plans. Now, we continue processing marsh deer tissues in the laboratory. We have a wide set of samples of muscle, liver, spleen, fat and hair that will be analysed within the period of 6 months. We will analyse the obtained tissue results within the specific environmental context where they were sampled, aiming to establish a comprehensive ecotoxicological database. Generalised linear mixed models will be used to investigate the association among health, environmental parameters and concentration of pesticides found in marsh deer. Furthermore, the next steps are to inform the results obtained so far by presenting a map of the different matrices contaminated with pesticides in both national parks and their surroundings, to all the local people involved in field sampling (e.g. park rangers, field technicians, authorities, and local community). Also, we are looking forward to presenting the results to the scientific community, as this is the first study of these characteristics in wetlands of Argentina.

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 logo was applied in various instances, including its exhibition in poster presentations during academic conferences such as the socio-environmental programme "PROSA" at the University of Buenos Aires (UBA), incorporation into oral

communications given at the National University of the Northeast (UNNE), and in the workshops held for the participatory surveillance network in the national parks.

Furthermore, explicit verbal acknowledgment was consistently made, highlighting the foundation's indispensable support in facilitating the realisation of the project. Importantly, this recognition will be perpetuated in forthcoming publications, wherein due credit to the support of The Rufford Foundation will be explicitly mentioned in journals or congress proceedings.

9. Provide a full list of all the members of your team and their role in the project.

Paula Blanco is a biologist and a doctoral fellow of CONICET, conducting her doctoral thesis "Characterisation of environmental exposure to pesticides and its potential relationship with mortality events in marsh deer (*Blastocerus dichotomus*)". She is the head of this particular project since it is part of her doctoral study. She's actively involved in field sampling (necropsies and environmental samples), conducting workshops and making contact with the community. She performs laboratory analyses for both environmental samples and marsh deer tissue samples. Paula also was in charge of communication with FUNDACEN, the organisation receiving the funds, and the Rufford Foundation, managing the grant obtained.

Marcela Orozco is veterinarian, doctor in Biology and a research member of the Scientific and Technological Researcher Career in the National Scientific and Technical Research Council (CONICET). She leads this research group and supervises the doctoral theses of the mentioned Ph.D. students. In this project, she guides the decision-making, further strengthening ties with long-time local collaborators involved in the network, and training students and local collaborators in the necropsy sampling process.

Damián José Marino, chemist and PhD, was an independent researcher at the CONICET. He was the head of a team studying the environmental pollution from agricultural and livestock activities in Argentina. He accompanied the whole process of sampling, processing and analysis of data for the environmental matrices. Sadly, he passed away during the development of this project.

Diana Arnica is a veterinarian and a doctoral fellow at CONICET and the National Parks Administration. Working in the Marsh Deer National Park, Diana is in permanent communication with the members of the participatory surveillance network and actively participates in field sampling, performing thorough necropsies, collecting environmental samples and conducting workshops. In addition, Diana is responsible for performing histopathological analysis on tissue samples.

Iara Figini, a biologist and doctoral fellow at CONICET, actively engages in field sampling, which includes necropsies and collecting environmental samples. She also conducts workshops and maintains contact with the local community.

Guillermo Wiemeyer is veterinarian and a postdoctoral fellow. He joined the project in its initial stages, actively participating in field necropsies and providing valuable ideas for the project's advancement.

Maria del Pilar Fernandez is a tenure-track assistant professor in Paul G. Allen School for Global Animal Health, Washington State University. Pilar has been engaged since the project's inception in ensuring statistically solid sampling and will remain actively involved in data analysis.

10. Any other comments?

We are so grateful for this funding that allowed us to start carrying out our project. Thanks to which we were able to buy equipment that otherwise would have been impossible given the situation in our country. We would also like to express our gratitude for the seamless communication you maintained with our team and for the valuable guidance you provided throughout the project's evolution, especially when adjustments to the initially submitted budget became necessary. Your support in ensuring the procurement of essential materials and equipment proved to be of utmost importance.

This is just the beginning of an unexplored area of research with great potential and much to discover and thanks to The Rufford Foundation we were able to begin to realise it.