Final Evaluation Report

Your Details	
Full Name	Ana Clara Mazzolari
Project Title	Following visitors to new places: Exotic plant invasions along recreational trails in mountain protected areas
Application ID	27160-1
Grant Amount	£4,924
Email Address	anamazzolari@gmail.com
Date of this Report	October 2020

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

Objective	Not achieve	Partially achieve	Fully achieve	Comments
Increasing the knowledge about the effects of trails, on exotic plant distribution and abundance along elevation gradients.				
Identifying exotic species' functional strategies				
Developing management strategies that include stakeholders' knowledge and attitudes about exotic plant species				We designed a structured survey to assess and understand how people value different landscape attributes of natural areas, their sense of place with mountain protected areas and their knowledge and perceptions of exotic species. The on-site surveys were conducted during high-visitation periods in three mountain protected areas: Aconcagua Provincial Park -IUCN II-, Cordon del Plata Provincial Park -IUCN II- and Portillo de Piuquenes Natural Reserve -IUCN VI-. Most questionnaires were collected in Aconcagua P.P. (n =124) followed by Cordon del Plata P.P. (n =64) and Portillo de Piuquenes N.R. (n=41).
Providing national and international conservation agencies grounded theory and tools to more effectively manage and minimize IES impacts.				We provided national grounded theory and tools contributing with part of the data collected in this project as well as delivering a report to the main government conservation agency of Mendoza province. This information was used to collaborate in the planning and zonation of Manzano-

				Portillo de Piuquenes protected area. In addition, we designed a field guide to identify the main plant species in the area. This guide was shared with park rangers and other local and national stakeholders, helping them to inform visitors about native and non-native vegetation. We also contributed with data to the global MIREN network, this data combined with that of other mountain regions in the world will be used to produce academic manuscripts of international interest. Although the team planned to conduct workshops or meetings to share our results, these were not possible yet due to COVID-19 restrictions. However, we plan to do it as soon as these types of events are allowed by the government.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

We did not find any major difficulties, other than the novel COVID-19 which forced us to reschedule every planned activity for the project. At the moment our national government has declared the quarantine without a certain end date. This has directly affected some dimensions of the project including the stakeholders' survey. The aim was to collect over 400 responses, however due to COVID-19 fieldwork was cancelled as visitation to protected areas in Mendoza is banned since March 2020. Up to March 2020, we collected a total of 229 questionnaires with over 38,000 individual data points. Despite the COVID-19 restrictions, we continued working on data processing and analysis, and we have already obtained important results about social perceptions of invasive species.

3. Briefly describe the three most important outcomes of your project.

- Presence and distribution patterns of exotic plants in the Andes of Mendoza, and the effects of disturbances, such as trekking trails.

We surveyed six trails covering an elevation gradient from 2400 to 3600 m asl We found 199 native and 39 non-native plant species. This constitutes the most updated

floristic database for the region and is now available for future studies. The most abundant exotic species were *Taraxacum officinale*, *Cerastium arvense*, *Trifolium repens*, *Convolvulus arvensis* and *Rumex acetosella*. *T. officinale* and *C. arvensis* are present throughout the elevation gradient studied. It should be noted that *T. officinale* had the second highest coverage of all species (including both native and non-native ones). In our study, we identified six exotic species that had not been previously reported in the area: *Arenaria serpyllifolia*, *Avena sativa*, *Camelina microcarpa*, *Sinapis arvensis*, *Malva neglecta* and *Veronica peregrina*, while nine exotic species were found at higher elevations than previously documented. Our results showed that the richness and cover of non-native species decreased as elevation increased, with environmental severity associated with elevation being the main determinant. At the same time, non-native cover decreased as the distance to the trail increased and with the presence of exotic herbivores.

- Functional strategies of the most abundant exotic species.

We selected the most abundant and frequent exotic and native species to analyse and compare their functional strategies. We built a functional traits database, with information of more than 70 plant species. We collected samples and recorded the following plant traits in native and exotic species: plant height, leaf area, specific leaf area, and leaf dry matter content. We found that exotic species have more acquisitive strategies of the resources, like rapid uptake of water and higher growth rates, while natives are more conservative, being able to grow in more stressful conditions. When we analysed the intraspecific variation of each of the exotic species, we found that although they are present in a wide altitudinal range, they do not show plasticity in their traits.

- Stakeholders' valuation of natural landscapes, knowledge and perceptions about exotic species.

Many visitors of protected areas (71%) reported knowing the definition of exotic species and most of them know how weeds are dispersed. In terms of ecological issues, many people (59%) think that exotic species are a problem in natural areas. Regarding social and economic implications, people reported that weeds are not a problem for recreation and tourism (63%), nor for the regional economy (55%). Also, people think that they pose no threat for people's personal safety (55%) and that weeds improve landscape beauty (59%). Furthermore, people think that weeds are not a 'new' productive source (43%), nor that they are useful for cattle grazing (42%). Finally, participants reported that some action should be taken to control weeds (71%) including providing education programmes and engaging visitors with the problem (86%). Most participants reported that they would take action to avoid introducing weeds in natural areas (81%) and that they would participate in on-site activities and campaigns to manage weeds (65%) but fewer participants indicated their willingness to pay a fee for weed management (48%). The results obtained here indicate that more work is needed to inform people about the risks of invasive species, but we observed that there is interest in the topic and good predisposition to collaborate and learn more about the problem of invasive plants in protected areas.

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

Stakeholders including the local community were consulted about some aspects of the project and involved. For instance, one of the experiments was conducted in a high altitude meadow located within a private property. To be able to conduct the project, the owners, local farmers, were contacted and actively involved in the project including using their muleteer services to transport the enclosures to the meadow. Also, park rangers were contacted at the starting stages of the project to get them involved, gaining local knowledge as well as bringing scientific information and practical management recommendations based on previous experiences. Furthermore, local communities including mountain refuge managers and employees were actively involved by collaborating with the survey data collection, and informing people about the project, its benefits and future outcomes.

5. Are there any plans to continue this work?

We plan to repeat the trail surveys in 5 years to evaluate long term changes in the distribution of non-native plants. Also, this project formed the basis for another two projects being conducted at the moment:

i) Interaction-facilitations of native shrubs

ii) High-altitude simulation of human impacts. The interaction-facilitation project aims to assess how *Azorella monantha* facilitates non-native plant establishment along an elevation gradient and how tourism trails disturbance affect those interactions.

The high altitude simulation project consists of an experiment in a high elevation meadow located at 2700 m. On this meadow we have simulated different types of disturbances including human trampling, herbivory and total removal of vegetation to evaluate the role of human activities in the establishment and performance of a non-native species abundant in the area.

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

We have planned three levels of communication including:

i) Scientific manuscripts to be published on high impact international journals.

ii) A workshop for the main conservation agency.

iii) Talks about the project results with the local mountaineer club members and general public.

iv) Graphical material including posters, brochures, fliers and pocket guides to spread the knowledge about the high Andean flora and the issues related to non-native species.

It is important to note that we already delivered some of these including:

i) A poster and a flyer publicly available.

ii) A collaboration with MIREN.

iii) A report with data to the government conservation agency.

iv) Working on a scientific manuscript.

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

Activities started in January 2019 and ended in September 2020. The funds were used to pay for the fieldwork carried out mainly during the plant's growth season and of greater tourism activity: January-May 2019 and November 2019-April 2020. We also used the funding for acquiring field material used for fieldwork such as GPS, iButtons, tags, office supplies including computer and stationery items and for printing material such as flyers about native and exotic plants in mountains. We planned to finish fieldwork in December 2020, but because of COVID-19 we have to reschedule or cancel some activities, such as visitor surveys. Despite this, we were able to work on the data collected until March 2020 obtaining the expected information and very interesting results.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
First aid kit	20		-20	IANIGLA provided it
Print materials and office supplies	250	217	-333	
Camping gear	600		-600	We stayed at refugees, so it was not necessary
IButtons (temperature sensors)	936	1109	+173	
Camping cool box	20		-20	IADIZA provided it
Paper bags	10	9	-1	
Office supplies	300		-300	
Notebook	700	563	-137	

Metric tape Keson 50 m	50		-50	IANIGLA provided it
GPS Garmin Gpsmap 64 S	400	383	-17	
Accommodation during field trips	240	18	-222	We stayed several days at the Andinist Club of Mendoza (CAM; https://www.facebook.com/clubandinistamendoza) refugee, with no cost.
Food during field trips (4 people)	828	349	-479	
Maintenance of the vehicle	200	30	-170	
Fuel for field trip	370	403	+33	
Sub Total	**4925**	**2,681**	**-2244**	
Transportation to congress and training courses		220	+220	
Field experiment materials		348	+348	See Question 12
Personal accident coverage		13	+13	Required to access to protected areas
Taxes		47	**+47**	This includes bank commissions
TOTALS	**4925**	**3309**		

*Notes to budget:

[1]The remaining money will be used to cover publication costs and activities related to the communication of results (workshops organization, print material, etc).

[2]Exchange rate: Because of the complexity of the Argentine economic situation, we decided to change the money received to US Dollars. After that, we change to Argentine Pesos as we needed, at this rates: 1 USD=42.89ARS (March 2019); 1 USD=58ARS (December 2019); 1 USD=74.75ARS (January 2020); 1 USD=74.67ARS (February 2020). For more clarity we registered our expenses in US Dollars and converted them to £ sterling at the rate indicated by the Bank of England at the date of this report (October 8th, 2020): £1= 1.2928 USD. https://www.bankofengland.co.uk/boeapps/database/Rates.asp?TD=25&TM=Mar&TY=2020&into=GBP&rateview=A

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

The important next steps are to produce and deliver the remaining forms of information packages and outcomes. For instance, we are currently working on a scientific manuscript about the functional strategies of exotic plants in the dry central Andes. Also, to be able to organise and deliver, after COVID-19 restrictions allow, workshops and talks to the management agency and relevant stakeholders.

Furthermore, two theses are being produced based on this project: an undergraduate thesis in 2020 (Miss Muriel Hellvig) and a doctoral thesis in 2021 (Ing. Maria Alisa Alvarez). Also, another important next step would be to more widely promote the already produced flora poster and flier. In addition, we aim to do the 5-year re-survey of MIREN roads next year to assess plant invasions patterns, as part of the regional project undertaken by our team and that is also shared with MIREN global research network.

10. 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?

Yes, The Rufford Foundation logo was used in the questionnaires, as well as in the presentation in the National Congress of Botany, in Argentina (XXVII Jornadas Argentinas de Botánica, Tucumán). Also, we produced a flier to inform people about the project which included the Rufford logo. The flier was spread in the mountain region as well as among some high-interest groups. Furthermore, the logo was used in the flora poster and in the first edition of the book: "Plants of Central Andes of Argentina", which is co-authored by one of our team members (Lorena Bonjour).

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Name	Filiation	Activities performed
Agustina Barros	Assistant Researcher at Argentine Institute of Nivology, Glaciology and Environmental Sciences (IANIGLA), CONICET	Field data collection and statistical analysis.
Valeria Aschero	Assistant Researcher at IANIGLA, CONICET	Data collection in the field. Data analysis.
Lorena Bonjour	Professional technician of the Herbarium Mendoza Ruiz Leal, Argentine Institute of Research in Arid Zones (IADIZA), CONICET Mendoza	Field data collection and species identification.
Sebastian Rossi	Assistant Researcher at IADIZA, CONICET	Survey design. Field data collection. Data analysis.
Alisa Alvarez	PhD student at IADIZA, CONICET	Data collection in the field. Data analysis. Presentation of results.

12. Any other comments?

Thanks to proper and careful administration of this grant funds, we were able to conduct an additional activity. This extra research activity, not originally planned, aimed to evaluate the effect of domestic cattle and human trampling on native vegetation and how this affects the establishment of the most abundant exotic species in the area. The experiment is being conducted in a high altitude meadow located in Cordon del Plata Provincial Park. The study commenced in summer 2020 and it is planned to finish in summer 2021. For this, we designed a specific experiment including five treatments: i) enclosure with only human trampling, equivalent to 800 steps, ii) herbivory without enclosure, iii) herbivory plus human trampling without enclosure, iv) superficial removal of vegetation and v) control with enclosure. After applying the treatments, we sow/transplanted *Taraxacum officinale* and control the seedlings establishment and survival. The enclosures used in this experiment were locally made of metal mesh, transported and installed in the area.