

Conservation Leadership Programme: Final Report

Project ID 02244015

Promoting Conservation of Amphibians at El Pedregal in Mexico City, Mexico.

Mexico, August 2015–February 2016



Institutions involved:

Centro de Educación Ambiental Ecoguardas (Secretaría de Medio Ambiente de la Ciudad de México), Centro de Educación Ambiental del Ajusco Medio (PRONATURA México A.C.) and Reserva Ecológica del Pedregal de San Ángel (UNAM)

Overall aim:

To generate baseline information about local amphibian species in urban areas of Mexico City.

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Date: May 30th 2017

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Project Partners & Collaborators

We wish to thank the Conservation Leadership Programme for supporting this Project, particularly it's job team who oriented us to conduct the Project properly. A special thank you to all volunteers because their invaluable assistance in the fieldwork: Roberto Lara Deras, Benjamin Flores Estrada, Diana Melina Munguía Moreno, Diego Gutiérrez, María Toledo, Alan Palacios, Diego Alonso, Eduardo Flores Gutiérrez, Paulina Vargas Luna, Brenda Sánchez, Luis Guillermo Ortiz Ramos, Francisco Alejandro Domínguez de la Rosa, Daniel Antonio Rangel, Iris Eneida Fuentes de la Rosa, Brenda Atziri García, Leonardo Varas Castillo, Marco Antonio Esteban Valera, Genoveva Trejo Macías, Claudia Elena del Valle Domínguez, Elizabeth García Baeza, Libo González and Carolina Rugeiro. We are grateful to María José Monteverde for acoustic analysis and to Claudia Moreno and Paulo Anaya who carried dozens of interviews out to obtain information about perception from Pedregal's neighbors.

We are very grateful to the Institutions involved in this Project: *Centro de Educación Ambiental "Ecoguardas"* belongs to *Secretaría de Medio Ambiente de la Ciudad de México* ("Ecoguardas" Environmental Education Center), *Parque Ecológico de la Ciudad de México/Centro de Educación Ambiental del Ajusco Medio* belongs to *PRONATURA México* (Ecological Park of Mexico City/Environmental Education Center of Ajusco Medio) and *Reserva Ecológica del Pedregal de San Ángel managed by UNAM* (Ecological Reserve of Pedregal of San Angel). Also, we want to express our gratitude to people of those Institutions who helped and gave us all the facilities and permission to carry out this work, particularly to Andrés Ocampo Palacios, Elvira A. Ramírez Ramírez, Martha Edith Caballero García, Nadia Cortés and Hilda Marcela Pérez Escobedo.

Finally, we have special thanks to designers Anni Pérez and Iridiana Guevara for donating special designs to promoting the project and, Astrid Domínguez who help us with flyers and posters design about the project.

Section 1:

1.1 Summary

Our study focused on amphibian species which live in Pedregal ecosystem, in the middle of Mexico City, one of the biggest cities of the world with high population growth rates. The Pedregal represents a unique ecosystem dominated by shrubs and oak forest growing on lava spill, where levels of biodiversity and endemism are high as well. Unfortunately, the unplanned and fast expansion of urban areas over this ecosystem could put on threat many little-known species, like the amphibians from the area. We sampled three reserves of Pedregal ecosystem between 2015 and 2016, investing ≈ 242 person-hours of sampling effort, and found 63 individuals of four species: *Pseudoeurycea leprosa*, *Chiropterotriton orculus*, *Aquiloerycea cephalica* and *Eleutherodactylus grandis*. Additionally, we evaluated the perception of neighbors about the Pedregal by applying interviews. Finally, we launched a diffusion campaign through social media networks, based on a short documentary video and informative flyers and posters, promoting in the community the importance of the Pedregal and their amphibians. These results allow established an ecological base-line to monitoring the amphibian populations in Pedregal and set the first step with the community to awareness and understanding the conservation needs into the Pedregal.

1.2 Introduction

Urbanization is affecting many ecosystems and a lot of species around the world, because it changes hydrology, increases runoff, sedimentation and pollution of streams and wetlands, also modifies the soil composition, climatic conditions, promotes fragmentations and habitat loss and facilitates the establishment of exotic species (Hamer & McDonnell, 2008).

The fast and unplanned expansion of urban areas, makes the cities (mainly urban forest remnants) play an increasingly vital role preserving the world's species (Turner *et al.*, 2003). The study about how many species are inside the cities, ecology aspects and what is their conservation status and threats have increased considerably in the recent years (Collins *et al.*, 2000), especially with the birth of Urban ecology as discipline of science. However, the majority of efforts in the diagnosis of biodiversity remains inside big cities, has being focused on figure out the effect of urbanization rates on biodiversity and on try to evaluate the wild areas replacement by an urban surface, especially in the case of birds and insects (Beninde *et al.*, 2015).

According to some authors (Beninde *et al.*, 2015; Hamer & McDonnell, 2008), the amphibians is the less studied group from the point of view of urban ecology, possibly because usually amphibians are not very abundant, they have very specific habits (Wells, 2010; Stebbins & Cohen, 1995) or amphibian species richness is lower within cities (Tsuji-Nishikido & Menin, 2011), as well as determinant biotic or abiotic factors

for this group as for example moisture, temperature, canopy cover or litter depth (Cunningham *et al.*, 2015; Sandoval-Comte *et al.*, 2012; Stebbins & Cohen, 1995).

In Mexico, there are few studies reporting the possible effects of urbanization over amphibian populations in big cities (MacGregor-Fors *et al.*, 2013; MacGregor-Fors *et al.*, 2015). Even though Mexico City is one of the biggest cities in the world, there is a big urban green space called “El Pedregal”, whose formation on lava fields began after volcano eruption 1,700 years ago. Currently, this ecosystem has been almost completely absorbed by urbanization leaving less than 15% of the spilled lava original area (Cano-Santana *et al.*, 2006). Fortunately, there are at least three reserves with some legal status preserving the Pedregal’s biodiversity (see Figure 1): A) Ecological Reserve of Pedregal of San Angel (REPSA), B) “Ecoguardas” Environmental Education Center and C) Ecological Park of Mexico City/Environmental Education Center of Ajusco Medio (PECM).

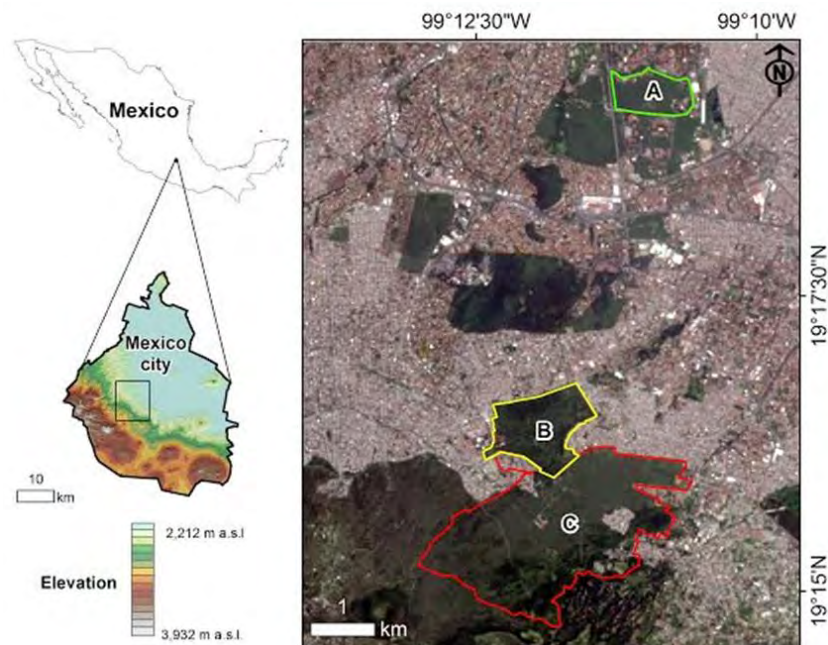


Figura 1. Location of the three reserves of the Pedregal area in Mexico City, involved in this Project: A) REPSA, B) Ecoguardas and C) PECM.

Inside these reserves inhabit four species of amphibians with a singular terrestrial life history and different conservation status: *Pseudoeurycea leprosa*, *Chiropterotriton orculus*, *Aquiloerycea cephalica* and *Eleutherodactylus grandis*. The last one, is a microendemic species and has been considered priority by the Alliance for Zero Extinction and listed as critically endangered, while the others ranging between vulnerable and near threatened species by the IUCN red-list (2016). However, the population statuses of almost all these species are unknown until now mainly in the Pedregal reservations, where fragmentation represents a

relatively recent phenomenon after the fast urbanization processes occurring in Mexico City in the last 60 years.

Monitoring amphibian populations is still a pending task within the Pedregal reserves. We performed this project with the motivation to promote the conservation of the Pedregal's amphibian biodiversity. After increase and update the information about amphibians in the Pedregal area, the present project pointed out the necessity in activating the participation of local institutions (REPSA-UNAM, Ecoguardas, PECM with PRONATURA), as well as neighbors and the people in general, whose could contribute in ensuring the conditions to conserve this particular ecosystem and their unique amphibian species.

1.3 Project members

José Manuel Serrano, the project leader, is a biologist expert in ecology, specifically in communication and behavioral ecology of anurans with female vocalization. Currently, is a Ph.D. student at the University of Chile, where is working to understand how the social behavior and signal recognition could be applied to the conservation of the Darwin's frog.

Gloria Tapia Ramírez is a biologist whose expertise area is ecology and wildlife monitoring. She has a lot of experience collecting animals in wildlife, organizing party fields, experience in items of diversity and communities and experience writing and revising scientific texts. During the Project she was mainly in charge of amphibian surveys, logistical support for the operation, as well as in writing and reviewing reports and publications.

Adriana Sandoval Comte is a biologist whose expertise area is ecology and geographic information system. She has a lot of experience working with threatened amphibians. Currently, she is working as technician at INECOL, A. C. into Biology and Conservation of Vertebrates area where she mainly helps assessing the conservations status of amphibians in the region Central of Veracruz. Also, she performs analysis using geographic information systems and ecological niche modelling focused on ecology and conservation of vertebrate's projects. Her role in the project was to help with sampling design in the field, to conduct part of amphibian surveys, to analyses vegetation using GIS and to write and review part of reports, manuscript and oral presentations.

Flor Gabriela Vázquez Corzas is a biologist expert in herpetology. Her fieldwork experience helped in planning the original design of fieldwork surveys as well as the elaboration of diffusion materials.

Miguel A. Sicilia-Manzo is a photographer and videographer expert in documenting the nature of Mexico after many years of self-training in the area and working at CONABIO in Mexico. His experience contributed in producing the diffusion materials of this project.

Section 2:

2.1 Aim and objectives

Considering the darkness about the knowledge of the conservation status of amphibians in the urban area of Mexico City, the importance of the Pedregal ecosystem and the risks of lack of knowledge about it by common people, the main goal of this project was to create the base-line for a monitoring and conservation program of amphibians inhabiting the Pedregal ecosystem. In order to achieve this major goal we established the following particular objectives:

1) Estimate amphibian species diversity, distribution and abundances of each species in three urban reserves. - *The objective was constrained to urban reserves from the Pedregal ecosystem.*

2) Evaluate urban factors affecting amphibian's ecological conditions and reproductive behavior. - *We replaced the term "reproductive phenology" by "reproductive behavior" from the original statement. We only consider the *Eleutherodactylus grandis* calling activity as reproductive feature for this objective, because the other species were less abundant and we never saw a reproductive behavior at field.*

3) Promote awareness and understanding the conservation needs of the Pedregal's amphibians among the university community and neighbors at Pedregal area. - *We changed the term "knowledge" by "understanding the conservation needs" since we tried to incorporate the opinion from other actors to generate a desirable working process for the future of the area. Originally, we referred "the South Valley of Mexico". However the name of the area was replaced by Pedregal area, to be more specifics.*

2.2 Changes to original project plan

- Amphibian's ecology from this area is poorly understood, including their abundance and habits. For instance, collecting just one amphibian in the Pedregal area could be a really hard duty and take all night long. Most of the fieldwork samplings were carried out by non-expert volunteers. Fortunately, this support represented a positive trade-off among the success in capturing salamanders and frogs, and the outreach of the project.

- Originally, we planned to develop workshops for integrating the participation of residents from the Pedregal area, whose should contribute with the completion of protection measures. However, we decided to train environmental educators actually working in the Pedregal reservation areas, since they are permanently closer with neighbors and have all experience in environmental education. We provided these decision-makers with outreach materials and updated on Pedregal's amphibians information, its importance and tools for their identification.

- We had problems to carry out samplings during dry season and only one sampling was developed in March 2016.

2.3 Methodology

In order to estimate diversity, distribution and abundance of amphibians in three urban reserves (REPSA, Ecoguardas and PECM), we carried out nocturnal field trips (between 8pm to 3am) during the rainy season. We established four permanent transect 100m long and approximately 4m wide per reserve. On survey nights, two transect was searched (previously randomly selected) by 2-4 persons for approximately 2 hours looking carefully in microhabitats preferred by amphibians. Each individual was photographed and its size and mass were measured before to be returned to the point of capture. Temperature, humidity, georeference and vegetation density within a radius of 50cm around each collection point were registered. Additionally, we marked individuals of *Eleutherodactylus grandis* using a subdermal individually-numbered tag, to identify recaptures in future monitoring.

For evaluate urban factors affecting amphibian's ecological conditions and reproductive behavior, we installed four automatic recorders SM3 (Wildlife Acoustics) during the summer of 2015 in the three reserves. The SM3 were mounted in trees with DBH > 40cm at different heights (60-140cm) above the ground. Pedregal frog's (*E. grandis*) calling activity was recorded every half hour during five minutes at a frequency rate of 2kHz, without any type of filter and WAV format. The analysis of call recordings were conducted in Audacity 2.1.0 software, adding visual and auditory counts of *E. grandis* calls based in the temporal and spectral characteristics reported by Serrano (2016). The quantity of Pedregal's frog calls in each recording was determined to provide information about the variation in the level of activity throughout the day and along the rainy season. Additionally, we placed four recorders per reserve to analyze the noise condition, two at 150m from the edge of the reserve with high exposure to urban noise (~70dB) and the other two inside the reserve at least 500m from the edge with less noise exposure (~56dB).

To promote awareness and understanding the conservation needs and to know local perception of the Pedregal and its amphibians, we made interviews to neighbors, students and workers about the knowledge of ecosystem, its fauna and the importance of conservation (Appendix 1 and 2). Finally, we carried out a continuous campaign of diffusion through social networks using Facebook page, making a documentary (going round YouTube and Facebook) and other digital and printed materials (postcards, photographs, posters, flyers, stickers) to disseminate information about Pedregal amphibians. We conducted two training workshops for environmental educators and participated in a scientific conference focused on the Pedregal's preservation issues.

2.4 Outputs and Results

We carried out a total of 26 nocturnal surveys from June to August 2015, with the participation of 24 field volunteers. Across all surveys with a cumulative sampling effort of 241.5 person-hours we registered a total amphibian abundance of 63 individuals of four species; one anuran (*Eleutherodactylus grandis*) and three salamanders (*Aquiloemycea cephalica*, *Chiropterotriton orculus* and *Pseudoeurycea leprosa*). In general, the most abundant was *C. orculus* with 35 individuals and the least abundant was *A. cephalica* with two individuals (Fig. 2A).

The diversity of species among reserves were different. All species were represented in Ecoguardas while PECM and REPSA only had two species, respectively. The Pedregal's frog (*E. grandis*) was the only species found in the three reserves while *A. cephalica* was found only in Ecoguardas (Fig. 2B).

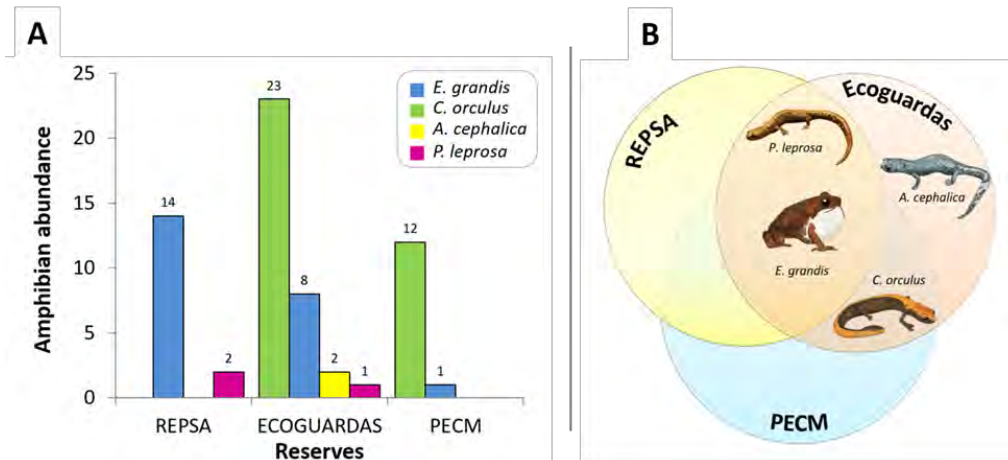


Figura 2. A) Amphibian abundance found in the reserves. B) Venn diagram that represent the diversity per reserve

During the fieldwork we registered amphibians in four different microhabitats: rocks, leaf litter, trees and *Agave* sp. plant. *Chiropterotriton orculus* was found in all of microhabitats registered but exhibited a notable preference by rocks, *E. grandis* and *P. leprosa* were found only on rocks and *A. cephalica* was found in leaf litter (Fig. 3).

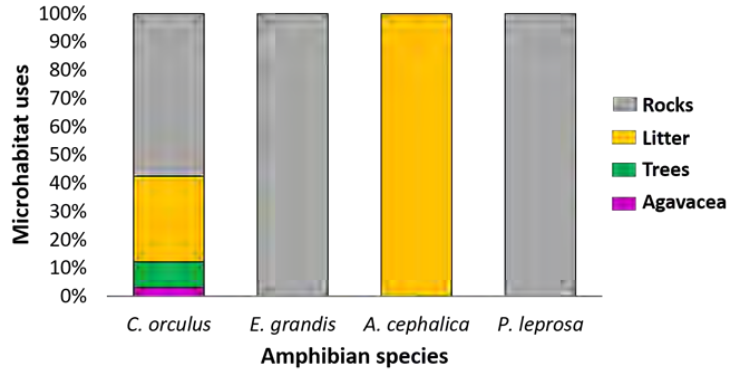


Figure 3. Microhabitats occupied by amphibians in the Pedregal area.

We could observe at least three urban factors that may affect the amphibians and their habitat. Although, we identified the same stressful elements in each reserve as acoustic pollution (*i.e.* noise produced by cars), light pollution (*i.e.* street or car lights) and garbage, the intensity or expositions to each element were different in each reserve, as we had expected earlier. REPSA was the most urbanized reserve, then Ecoguardas and finally PECM the least urbanized reserve.

One way to evaluate the noise affecting amphibian vocal activity (hereinafter calling activity), as response to ecological facing urbanization, was developing an acoustic monitoring for each reserve based in *E. grandis* calling activity. The results show a higher calling activity in Ecoguardas in comparison with the other sites; however, calls of the Pedregal's frog were produced continuously in PECM. Regarding the calling activity inside the sites, we didn't found differences between samples in Ecoguardas and PECM, only among the two sites monitored in REPSA, the western site registered a higher number of calls along the sampling (Fig.4).

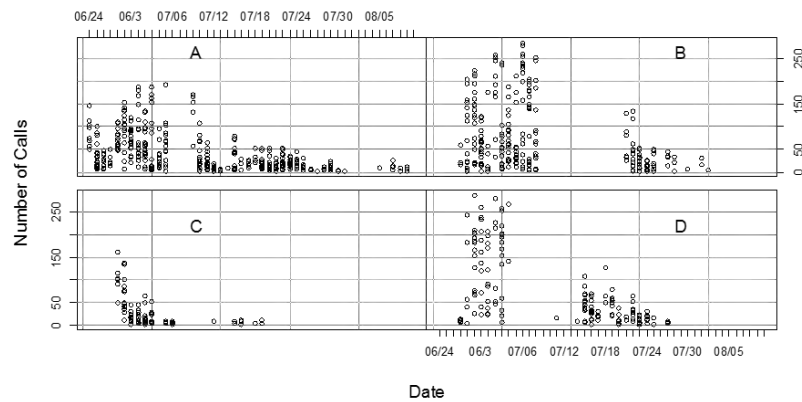


Figure 4. Number of calls registered from June to August 2015 in (A) Ecoguardas, (B) PECM, (C) Eastern REPSA and, (D) Western REPSA.

To establish a link between the community and the Pedregal we follow several routes. The first was to approach the reserves and public universities, where we showed the importance of preserving amphibians

affected by urbanization through conferences (at universities) and workshops for environmental educators (at environmental centers of Ecoguardas and PECM). The conferences allowed us to attract more than 20 volunteers to participate into the project. For most of them, this participation represented a first approximation to the conservation and deep knowledge of the Pedregal ecosystem.

The second route of promotion was to launch a massive campaign through our Facebook page named “Anfibios del Pedregal”, where we share information about amphibians and Pedregal ecosystem, including scientific and general public oriented news, to raise awareness about its importance and conservation status. The page reached 1, 725 followers mainly young adults (between 25 and 34 years old) from Mexico (Table 1).

Table 1. Basic statistics of Facebook page “Anfibios del Pedregal” since it was opened in September 2015 until April 2017.

Page Statistics		
1, 725 followers		
Public Structure	Age	
	45% women	18-24 años (17%)
		25-34 años (20%)
	54% men	18-24 años (19%)
		25-34 años (21%)
	Number of people reached	
Principal origin	Mexico City	876 persons
Principal language	Spanish	1267 persons

We made diverse material to share information (See Appendix): 14 informative cards posted at the “Anfibios del Pedregal” page to show results of the project and one big poster with information about Pedregal ecosystem and the amphibian’s. This poster will potentially reach 20,000 children annually, such number of visitors have the three public centers of education and reserves involved (REPSA, Ecoguardas and PECM) every year. Also, we created a documentary video ~6 minutes long showing the presence and the important role of amphibians at Pedregal’s ecosystem (link: <https://youtu.be/cmufw5upErs>). Currently, this video counts with more than 50,800 views and very positive response of the Facebook community (Table 2).

Table 2. “Guardianes del Agua” documentary statistics.

Documentary Statistics 		
People reached	Video views	Reactions, Comments, Shares
190,290 persons	50,819	7,859
Number of likes on post	Number of likes on shares	Number of comments
468	2,168	437

Finally, to approach neighbors and to know what they think about the Pedregal’s ecosystem and its fauna, we applied a total of 90 interviews (30 per reserve). The general result shows that people recognized that the principal problem affecting to the city parks is garbage, also recognized that Pedregal’s ecosystem is one of the sites threaten in Mexico City (Fig. 5) and for this reason they were agreed in conserved it (>90%).

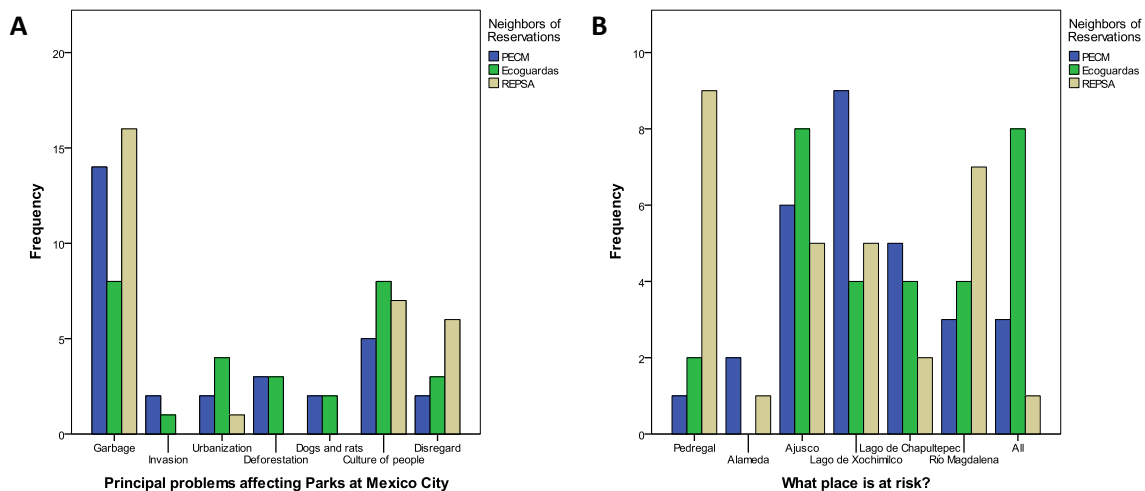


Figura 5. Results of interviews about: A) the principal problems affecting Parks at Mexico City and B) Parks and sites at risk in Mexico City.

Additionally, Jose Serrano was interviewed on the radio to talk about the project and we published a couple of divulgation articles (see Appendix 5 and 6). Actually, we are writing a scientific paper with the results of the project, waiting to be published next year.

2.5 Communication & Application of results

Our principal communication channels with stakeholders was the internet (Facebook and YouTube), magazines (Especies and Mexicanísimo) and radio. The documentary increased the followers in Facebook and generated interest by people.

The participation of volunteers, conferences and workshops were our way to link academy, reservation's decision makers, and college students. These stakeholders faced up the potential of Pedregal reservations to ensure the conservation of hidden species and little taken into account so far.

The different materials developed to promote and disseminate the risks of amphibians face urbanization worked well, as long as they were very visual (i.e. photographs or cartoons) and with short phrases.

We printed and handed over posters and flyers to the three reserves' centers of environmental education. These printed materials will provide information about Pedregal ecosystem and amphibian's characteristics, to potentially 20,000 children that visit the reserves every year.

2.6 Monitoring and Evaluation

Before this project, no information was available about amphibian's populations in the Pedregal area for the last 50 years. We settled a base-line on the status of amphibian abundances from systematic and repeatable design for monitoring amphibians along the time. This framework will contribute to the main aim project: creating a conservation program of amphibians inhabiting Pedregal Ecosystem in the future.

At the conferences performed we had the opportunity to approach to young people and transmit the aims of this project. All the time people showed an enthusiast answer. This project was better held for volunteers, who kept in touch closer with all this adventure, from spending all night long looking for amphibians in the middle of the scrubland, to knowing and learning the amphibian handling. We are certain that volunteers changed their perception of their city.

Moreover, we are building awareness about the importance of the Pedregal's ecosystem and their amphibians in the Facebook's Page, where every single day we received at least one or two comments for showing the presence of amphibians and concern for the habitat destruction.

2.7 Achievements and Impacts

Based on fieldwork information, we now have a better understanding of diversity, abundance and microhabitat preferences of amphibian species in three reserves of Pedregal ecosystem.

In this project, we implemented a multidisciplinary approach to focus the role of amphibians in Pedregal's protection. Using ecological, social networks and communicative tools we established a fruitful link between community (neighbors and visitors), reservations and threatened species. Afterwards people know more about the Pedregal amphibians and the threats affecting to this fauna.

A lot of volunteer requests showed us the potential to develop ecological studies and conservation planning based on citizen participation. Definitely, social networks resulted the best way to communicate our findings and to exchange opinions with the community. Facebook impacted positively in the scope of this project to reach stakeholders.

2.8 Capacity Development and Leadership capabilities

Pedregal ecosystem represents a big challenge, because the terrain results a very difficult experience, full of sharp stones and security risks. This required a lot of logistic planning to carry out our objectives safely and efficiently. After this project we have been willing to share our experiences with researchers and organizations currently working in the area.

The internship program was an extraordinary opportunity to work as a team, to know different methods for the field work and especially to exploit our creativity through the material of outreach. The training and the homework had a positive impact on our development as scientists, improving the way in which the research objectives should be addressed.

Along this project, besides we have grown up our research capabilities, we enhance our personality aptitude to communicate us better, reach to many other people, plan efficiently and to work in difficult terrains looking for conservation.

Section 3:

3.1 Conclusion

Quantitative information about amphibian abundances was produced for the first time. Such data will provide a basal reference for future monitoring and conservation efforts with amphibian species in particular and, with the ecosystem as a whole.

We managed to have more than 1,700 followers on the Facebook page "Anfibios del Pedregal". The short documentary video has been watched by at least 190,200 persons among our YouTube and Facebook web sites, since October 2015. Other digital materials were also spread in the Facebook page such as digital postal cards and ringtones produced by the teamwork.

We trained 14 officials from two environmental education centers. About 25 volunteers were trained in amphibian sampling techniques. Both training activities allowed the participants to gain a better appreciation of the species and help us spread our activities.

We detected that neighbors of the Pedregal area still have a lot to change their perspective about the Pedregal ecosystem, because they have an impoverished idea of the current richness of species. However, they are receptive and interested in improving it.

Undoubtedly, this project represents an area of opportunity to develop a broad-range project to establish a management and conservation plan that integrates the academic community, reserve workers, neighbors and NGOs and will also make this ecosystem as part of identity to local people.

3.2 Problems encountered and lessons learnt

- *Which project activities and outcomes went well and why?*

The scope of the video was much more than expected, it helped a lot the collaboration of other webpage managers that helped us to share it, thanks to that we achieved a wide reach.

- *Which project activities and outcomes have been problematic and in what way, and how has this been overcome?*

Fieldwork activities we initially programmed exceeded our effort capabilities as a team; so we had to resort in looking for volunteer citizens to help us to realize them. Volunteers accepted in exchange for learning and experience. At the end, this solution allowed us to expand the scope of diffusion of the project. Finding people for samplings was difficult at the begging of this project; however, after our talks in Universities we achieved the support of volunteers who helped us to perform the surveys.

Biology of Pedregal's amphibians is linked to rocky habitats, for this reason, the efforts to looking for them should be exhaustive and so complex to walk. For instance, to collect just one specimen of Pedregal frog could be a really hard duty and take all night, instead, to collect one salamander less hours are required. Our effort was aimed at adding volunteers to the samplings to increase the success of sightings.

Furthermore, many times reserves could be dangerous on day and night times. Problems like robberies or attacks are common. Nevertheless, we were supported by local police in Ecoguardas reservation only. Actually, many times they were very helpful in the samplings too.

- *Briefly assess the specific project methodologies and conservation tools used.*

Most of our methods were focused in producing ecological information that until now was not available (*i.e.* abundance and distribution of the species). As a result, this project was more concerned with generating an information base for future management instead of conservation tasks. However, our outreach efforts had a broad scope, because we did not target communities directly related with the Pedregal area. We judged that the best way to involve to common citizens was to invite them to obtain directly the information. Such task required a great coordinating effort.

- *Please state important lessons which have been learnt through the course of the project and provide recommendations for future enhancement or modification to the project activities and outcomes.*

A major problem was the internal organization of the team, about how to define the roles of each member as well as providing tools to encourage collaborative work. This situation leaves us as a lesson that the functions of each team member should be established from the beginning, as well as the measures to be taken in case these are not conducted and, learn to value the effort of others.

We had problems to carry out samplings during dry season (March) and only one sampling was developed (we originally planned six). On one hand, this was mainly because we had fewer volunteers for samplings than in summer, because March is scholar time, on the other hand, dry season is not the best time to looking for these amphibians.

3.3. In the future

At this moment we have more than 1, 700 followers in the Facebook page, which gives us a leeway to continue inviting more people to get involved with the conservation of the Pedregal amphibians.

We are preparing two manuscripts to publish our results in journals of urban ecology and biodiversity topics, it may encourage to research in his interesting ecosystem by academic community. We are excited

about looking for more funds to more thoroughly study acoustic communication of Pedregal frog and generate more material, such as shirts, postcards and stickers, which allow us to involve the inhabitants of the different neighborhoods of Pedregal in the protection of the habitat and its species.

We are currently initiating a follow-up beyond this project to continue promoting amphibian observations realized by citizens in the Pedregal area, formalizing a project in naturalista.mx page and in conjunction with our Facebook page. This will allow us to maintain leadership to promote awareness of urban amphibians in Mexico City.

3.4 Financial Report

Itemized expenses	Total CLP Requested (USD)*	Total CLP Spent (USD)	% Difference	Details & Justification (Justification must be provided if figure in column D is +/- 25%)
PHASE I - PROJECT PREPARATION				
Communications (telephone/internet/postage)	80	77.01	-4%	The course initially planned to take, was canceled
Field guide books, maps, journal articles and other printed materials	120	122.25	2%	
Insurance	260	259.09	0%	
Visas and permits	0			
Team training	210		-100%	
Reconnaissance	0			
Other (Phase 1)	0			
EQUIPMENT				
Scientific/field equipment and supplies	5823	6235.24	7%	
Photographic equipment	639	668.23	5%	
Camping equipment	420	417.75	-1%	
Boat/engine/truck (including car hire)	170	129.68	-24%	
Other (Equipment)	0			
PHASE II - IMPLEMENTATION				
Accommodation for team members and local guides	600	618.64	3%	Transportation for some of the team members was not required Duties for some equipment were higher than expected. To cover this funds were re-allocated from Travel and local transportation
Food for team members and local guides	590	530.13	-10%	
Travel and local transportation (including fuel)	1329	649.16	-51%	
	860			
Customs and/or port duties		1392.85	62%	

Workshops	5	5.17	3%	
Outreach/Education activities and materials (brochures, posters, video, t-shirts, etc.)	630	625.37	-1%	
Other (Phase 2)	0.00			
PHASE III - POST-PROJECT EXPENSES				
Administration	100.00	97.40	-3%	
Report production and results dissemination	664.00	672.03	1%	
Other (Phase 3)	0.00			
Total	12,500.00	12,500.00		

Section 4:

4.1 Appendices

Output	Number	Additional Information
Number of CLP Partner Staff involved in mentoring the Project	1	Mauricio Akmentins from Argentina
Number of species assessments contributed to (E.g. IUCN assessments)	0	All species involved were already listed in IUCN and in Mexican assessments too.
Number of site assessments contributed to (E.g. IBA assessments)	0	
Number of NGOs established	0	
Amount of extra funding leveraged (\$)	0	
Number of species discovered/rediscovered	0	
Number of sites designated as important for biodiversity (e.g. IBA/Ramsar designation)	3	We verified the distribution for all the amphibians reported originally for REPSA but unknown in Ecoguardas and PECM.
Number of species/sites legally protected for biodiversity	3	REPSA, Ecoguardas and PECM.
Number of stakeholders actively engaged in species/site conservation management	4	Three institutions were strongly involved: REPSA-UNAM, ECOGUARDAS & CEA-PRONATURA. University students and volunteers.
Number of species/site management plans/strategies developed	0	
Number of stakeholders reached	>2,000	We considered the total amount of people reached in Facebook Page, University students attended in Conferences, volunteers, and neighbors.
Examples of stakeholder behaviour change brought about by the project.		After workshops, educators from Ecoguardas and CEA-PRONATURA included amphibians in their lectures.
Examples of policy change brought about by the project		
Number of jobs created	0	
Number of academic papers published	2	See Appendix
Number of conferences where project results have been presented	5	These conferences were addressed to University students and reserve managers.

APPENDICES

Appendix 1. Interview



La presente encuesta es para la realización de un proyecto de conservación patrocinado por Conservation Leadership Programme. La información que usted proporcione será manejada sin fines de lucro y por respeto a su privacidad se reservará el anonimato. Le pedimos por favor conteste honestamente. Agradecemos su participación.

Edad:_____ **Sexo:** _____ **Cuál es su profesión u oficio:** _____

Usted: vive_____, estudia _____ y/o trabaja _____ en el Pedregal

1. ¿Hace cuánto tiempo?

2. ¿Cuál es el parque o reserva de la ciudad que conoce y visita más frecuentemente? _____
3. ¿Cuál es el principal problema que afecta a las reservas ecológicas o parques de la CDMX? _____
4. ¿Cuál de estos lugares le gusta más? _____
5. ¿Cuáles de estos lugares son benéficos para usted? _____
6. ¿Cuál de estos ambientes cree usted que se encuentra en peligro de desaparecer? _____
7. ¿Le parecería importante conservar el Pedregal (mostrando imagen a)? _____
8. ¿Qué es un anfibio? _____

9. ¿En cuáles de estos lugares hay anfibios? _____
10. ¿Cuáles de estos animales son anfibios: _____
11. ¿Cuáles de estos animales habitan dentro de la ciudad de México? _____
12. ¿Cuáles de estos animales son benéficos para usted? _____
13. ¿Cuáles de estos animales son peligrosos? _____
14. ¿Sobre cuál de estos animales le gustaría saber más? _____
15. ¿De estos cuáles animales ha observado alguna vez en su jardín? _____
16. ¿Ha escuchado a la ranita del Pedregal? (poner audio) Si _____ No _____
17. ¿Qué tipos de productos químicos utiliza para el mantenimiento de su patio o jardín?
a. Cloro b. Insecticidas c. fertilizantes y herbicidas d. Otro: _____

Appendix 2a. Images of important Parks in Mexico City that were showed to interviewees while the interview, corresponding to 4th question.



1. Pedregal's ecosystem, 2. Alameda central, 3. Ajusco, 4. Xochimilco, 5. Chapultepec, Los Dinamos

Appendix 2b. Images of different animals that live in Mexico City, that were showed to interviewees while the interview, corresponding to 8th question.

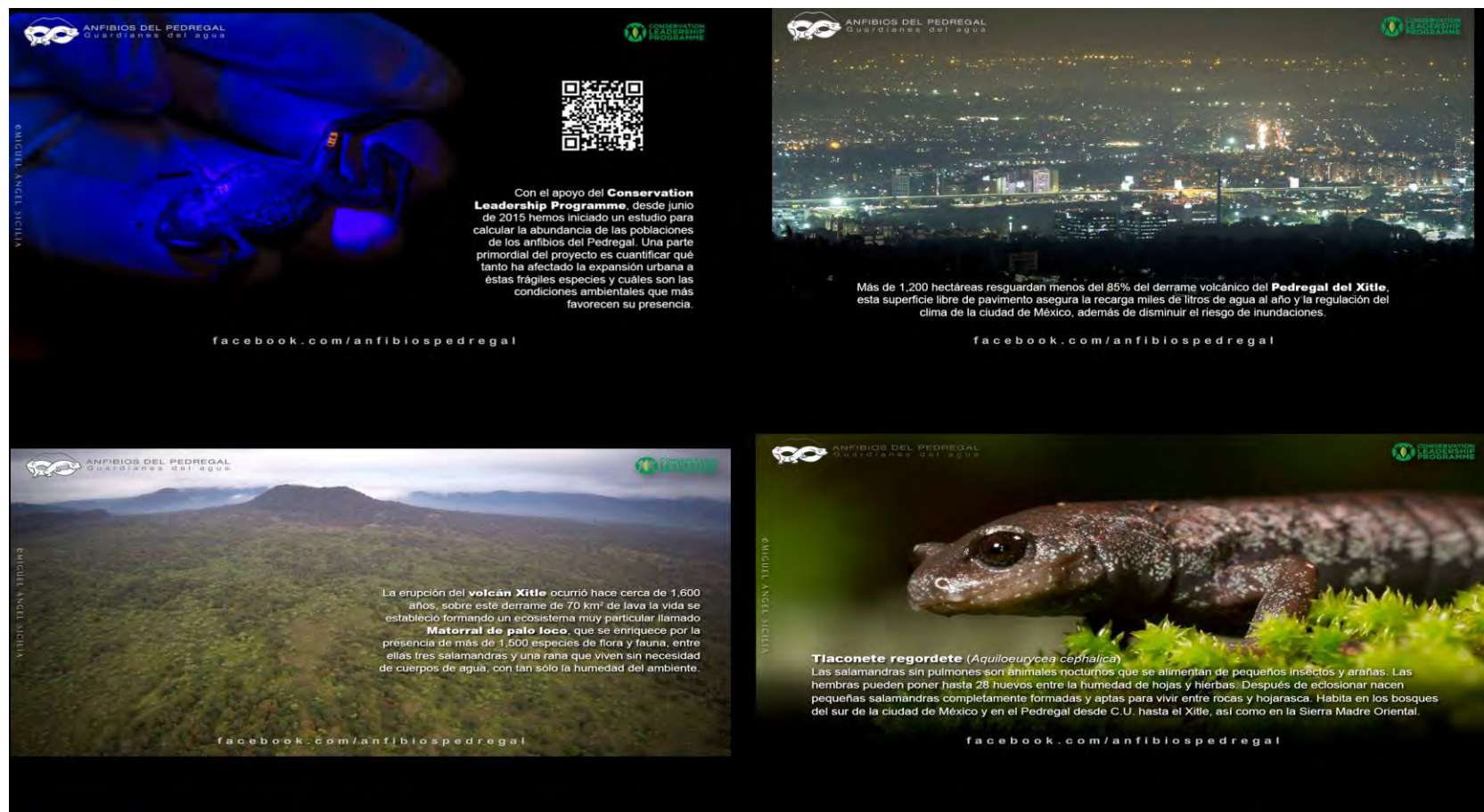


1.Snake, 2. Axolote, 3. Salamader, 4. Turtle, 5. Duck. 6. Frog

Appendix 3. Informative cards posted in Facebook page's Project showed in January and February 2016.

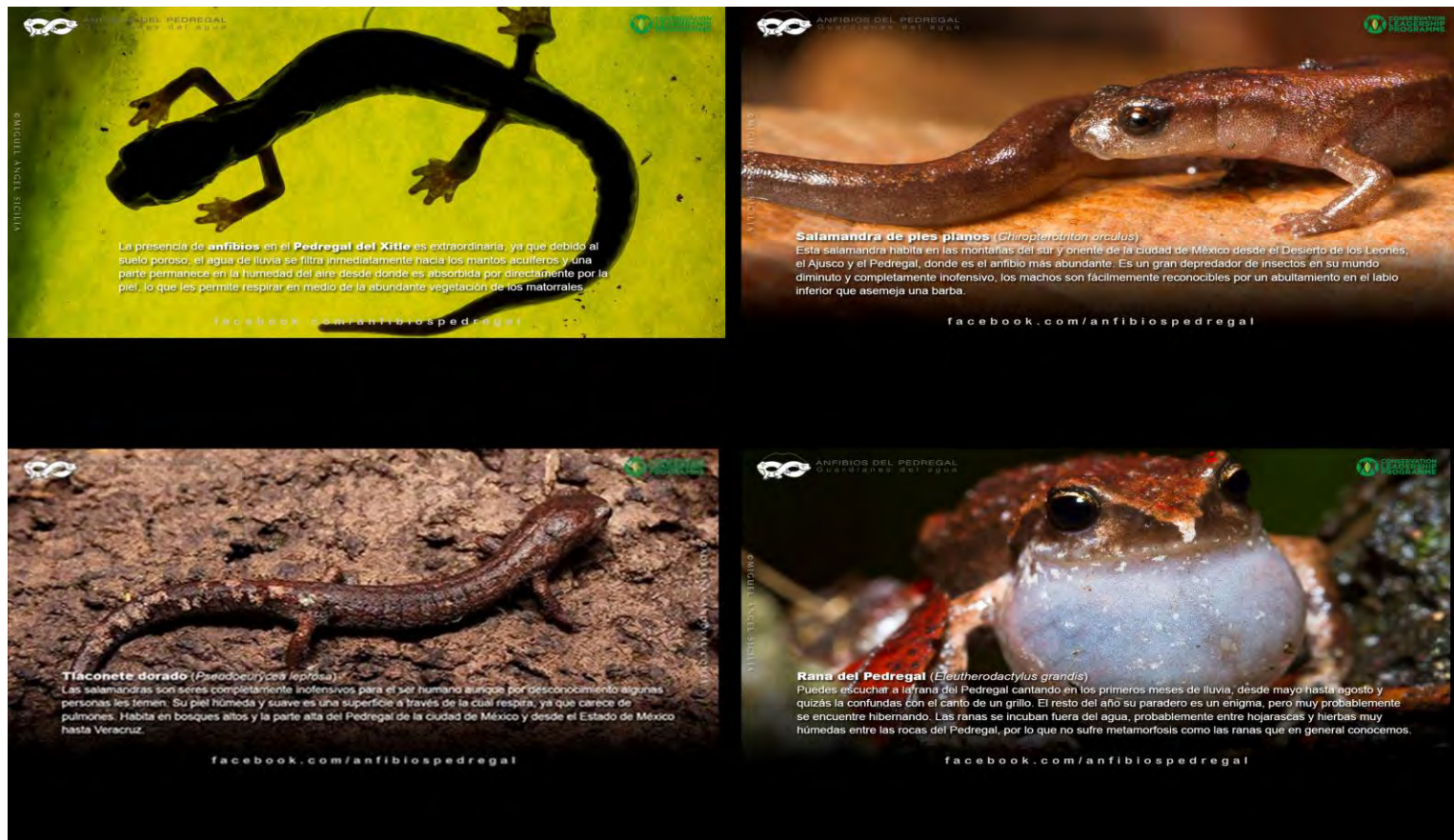
 Hola, mi nombre es Sesasi (que significa bonita en lengua purépecha), soy una salamandra que vive en el sur de la ciudad. Conóceme y juntos protejamos los Pedregales y bosques de la ciudad. www.facebook.com/anfibiospedregal @Anfibios_CdMx	 Hola, soy Grandis, una rana citadina que vive en el Pedregal. ¿SABÍAS QUE? Me llaman Grandis porque dicen que tengo una cabeza muy grande. Conóceme y cuida mi hábitat para proteger a mi especie. www.facebook.com/anfibiospedregal @Anfibios_CdMx
Informative card that talks about the presence of salamanders in Mexico City and it encourages people to protect Pedregal ecosystem.	Informative card that talks about the presence of Pedregal frog in Mexico City and it encourages people to protect Pedregal ecosystem.
 Comparemos RANAS - Piel blanda, lisa y suave - Glándulas Parótidas (segregan toxinas) - Se desplazan con grandes saltos, trepando o nadando - Cuerpo esbelto y estilizado SAPOS - Piel seca y áspera - Glándulas Parótidas (segregan toxinas) - Se desplazan caminando o por pequeños saltos - Cuerpo robusto y abombado www.facebook.com/anfibiospedregal @Anfibios_CdMx	 ¿Sabías que? En 2015 se describieron cuatro nuevas especies de anfibios para México a) <i>Eleutherodactylus grunwaldi</i>, b) <i>Eleutherodactylus wixarika</i>, c) <i>Chiropetrotriton cieloensis</i> y d) <i>Chiropetrotriton infernalis</i> www.facebook.com/anfibiospedregal @Anfibios_CdMx
Informative card that talks about differences between frogs and toads.	Informative card that talks about four new amphibians species described for Mexico in 2015.

Appendix 3. Informative cards posted in Facebook page's Project showed between June and July 2016 (continued).



a) An introduction to the Project, b) Comparison between Pedregal's ecosystem and the City, c) A Pedregal's description, d) A salamander description (*Aquiloerycea cephalica*).

Appendix 3. Informative cards posted in Facebook page's Project showed between June and July 2016 (continued).



e) Importance of Pedregal's amphibians, f) A salamander description (*Chiropterotriton orculus*), g) A salamander description (*Pseudoeurycea leprosa*), h) A Pedregal's frog description (*Elutherodactylus grandis*).

Appendix 3. Informative cards posted in Facebook page's Project showed between June and July (continued).



i



j

i.A Pedregal's frog description (*Eluterodactylus grandis*), j. Citizen science in Pedregal Project.

Los guardianes del agua

EL PEDREGAL DEL XITLÉ

Fotos Miguel Ángel Sicilia

Texto José Manuel Serrano / Miguel Ángel Sicilia

Al sur de la Ciudad de México se yergue el Xitle, un coloso a 3100 metros sobre el nivel del mar. Este volcán tuvo gran actividad hace poco más de dos mil años. Su última erupción fue hace 1600 años. Tiempo después, sobre la lava sólida, entre grietas y cuevas, la vida se abrió paso de nuevo y se estableció en ella un particular ecosistema, el matorral de palo loco, que se caracteriza por tener una mezcla de especies desérticas y templadas, llena de flora y fauna únicas en el mundo.

TLACONETE DORADO
(*Pseudoeurycea tlacote*)
Más de 1200 hectáreas resguardan menos del 85% del domo volcánico del Pedregal del Xitle, esta superficie libre de pavimento asegura la recarga de miles de litros de agua al año y la regulación del clima de la Ciudad de México, además de disminuir el riesgo de inundaciones.



▲ **LA ERUPCIÓN DEL VOLCÁN XITLÉ** ocurrió hace cerca de 1 600 años. Sobre este derrame de 70 km² de lava la vida se estableció formando un ecosistema muy particular.

▼ **EL PROYECTO ANFIBIOS DEL PEDEREGAL** se ha realizado con la participación de docenas de estudiantes de distintas universidades y carreras.

Este lugar y sus habitantes se encuentran en grave peligro. Afortunadamente aún podemos encontrar a unos seres pequeños: los guardianes del agua. Estos anfibios han evolucionado y son capaces de sobrevivir sin agua líquida, absorbiendo por su piel la humedad directamente del aire y la que existe entre la vegetación.

Tres de ellos pertenecen al grupo de las salamandras, conocidas como tlaconetes. La cuarta especie es particularmente especial, ya que aunque todas ellas son endémicas de México, esta habita exclusivamente en el pedregal del Xitle: la Rana Fisgona.



▲ **TLACONETE REGORDETE** (*Aquiloerycea cephalica*). Las salamandras sin pulmones son animales nocturnos que se alimentan de insectos y arañas. Las hembras pueden poner hasta 28 huevos entre la humedad de hojas y hierbas.



▲ **SALAMANDRA DE PIES PLANOS** (*Chiropterotriton arculus*). Esta salamandra habita en las montañas del sur y oriente de la Ciudad de México, desde el Desierto de los Leones, hasta el Ajusco y el Pedregal, donde es el anfibio más abundante.



▲ **TLACONETE REGORDETE** (*Pseudoeurycea cephalica*). Aunque por desconocimiento algunas personas les temen a los anfibios, en realidad son seres completamente inofensivos para el ser humano.

Normalmente es muy difícil de encontrar. Sin embargo, en la temporada de lluvias, cuando los machos están en busca de pareja, es posible escuchar su tímido pero constante silbido, que delata su presencia. Cuando son demasiados, el aire del matorral se inunda de un recital nocturno.

Otra característica es que tienen una estrategia de reproducción poco común: sus crías tienen desarrollo

directo, es decir, que al nacer son diminutas réplicas de sus padres ya que prescinden de la etapa de renacuajo.

La presencia de estos seres es un indicador fiel de que el ecosistema está aún saludable y que se capta correctamente el agua que abastecerá, no solo los hogares alrededor del pedregal, sino a los acuíferos de la Ciudad de México.

Acércate, conoce y cuida un espacio único en el mundo. [m](#)



▲ **RANA FISGONA** (*Eleutherodactylus grandis*). Puedes escuchar el canto de estas ranas en los primeros meses de lluvia. No hay que confundirlo con el de un grillo.



◀ **CON EL APOYO DEL CONSERVATION LEADERSHIP PROGRAMME**, desde junio de 2015 se ha iniciado un estudio para calcular la abundancia de las poblaciones de anfibios. Una parte primordial del proyecto es cuantificar qué tanto ha afectado la expansión urbana a estas especies y qué condiciones ambientales favorecen su presencia.

ESPECIES magazine in 2016.
nuestros desconocidos vecinos:
LOS ANFIBIOS DEL PEDREGAL

GLORIA TAPIA-RAMÍREZ
Conservation Leadership Programme

JOSÉ MANUEL SERRANO
Universidad de Chile



JOHN CLARE

El más emblemático anfibio de la Ciudad de México es el ajolote mexicano, pero aunque no es el único que habita en el sur de esta gran urbe, tal vez sea el más amenazado pues se encuentra al borde de la extinción

Las ranas, sapos, salamandras, ajolotes y cecilidos son los animales que conocemos como anfibios, llamados así porque, como hemos aprendido en los libros de ciencias naturales e incluso en los cuentos infantiles, algunas especies habitan dos ambientes a lo largo de su vida: agua y tierra. Sin embargo, existen especies que son exclusivamente acuáticas, como el ajolote mexicano (*Ambystoma mexicanum*) y otras que

son únicamente terrestres, esto es, pasan toda su vida en tierra: desde el huevo, puesto entre hojarasca o bajo rocas o troncos, hasta adultos, como ocurre en algunas salamandras. A pesar de su enorme diversidad de formas y colores, todos los anfibios poseen dos características en común: primero, que todos nacen de un huevo y segundo, poseen la piel más permeable de todos los vertebrados, cualidad que los vuelve

vulnerables, pues muchas sustancias contaminantes pueden traspasar su piel.

Desafortunadamente, los anfibios no sólo enfrentan esa amenaza; en todo el mundo la pérdida de hábitat, ya sea por urbanización o deforestación, ha diezmando sus poblaciones considerablemente. El caso del ajolote es un lamentable ejemplo de cómo la reducción acelerada del lago de Xochimilco, la contaminación, la captura indiscriminada y la introducción de especies exóticas, tienen hoy al borde de la extinción al anfibio mexicano más famoso del mundo.

Pero lagos y ríos no son el único escenario por investigar en materia anfibia; otros rincones de la Ciudad de México aún guardan sorpresas alentadoras. En otro extremo del sur de la ciudad, existen aún fragmentos de pedregal, un ecosistema peculiar formado sobre los derrames basálticos que dejó tras de sí la erupción del Xitle hace más de 1600 años. Aunque el crecimiento urbano de los últimos 60 años ha ido quitándole terreno al pedregal a pasos agigantados (más del 80% de los 80 km² originales de este ecosistema se han perdido), hoy se cuenta con alrededor de 13 km² de áreas protegidas a cargo de diferentes instancias públicas. Éstas están constituidas por matorrales y bosques someros, carentes de arroyos y lagos (indispensables para muchos anfibios) y están rodeadas de algunas de las avenidas con mayor circulación vehicular de la

ciudad: Insurgentes Sur, Anillo Periférico y la carretera Picacho-Ajusco.

Por su naturaleza xerófila y urbana, las reservas de pedregal podrían ser de los lugares menos pensados y propicios para encontrar anfibios. Sin embargo, registros históricos en la zona, señalaban que lo más probable de ubicar por las condiciones actuales podrían ser pequeñas salamandras y una ranita, todos ellos anfibios terrestres poco conocidos hasta ahora. Tristemente, estos anfibios están en algún estatus de riesgo de extinción. Por eso es importante y urgente obtener la mayor cantidad de información sobre ellos.

¡Manos y oídos a la búsqueda..!

En la primavera de 2015, un grupo de biólogos decidimos comenzar la búsqueda de estos habitantes ocultos del pedregal. Para tal efecto, recibimos el auspicio del



Grupo de biólogos estudiando a los habitantes del pedregal en una noche de verano de 2015

Conservation Leadership Programme, organización internacional sin fines de lucro que apoya proyectos de conservación de especies prioritarias. En el verano de ese mismo año, con la ayuda de más de 20 entusiastas voluntarios, y la colaboración de los encargados de las reservas, realizamos búsquedas nocturnas en la Reserva Ecológica del Pedregal de San Ángel en Ciudad Universitaria, el Centro de Educación Ambiental Ecoguardas y el Parque Ecológico de la Ciudad de México.



Registramos la presencia de anfibios, ya fuera viéndolos o escuchando sus cantos. Confirmamos que en estos relictos de pedregal viven tres especies de salamandras que carecen de pulmones, pues respiran completamente a través de la piel: *Pseudoeurycea leprosa* o tlaconete dorado, *Aquiloerycea cephalica* o tlaconete regordete y *Chiropterotriton orculus* o salamandra de pies planos; además de la rana *Eleutherodactylus grandis* o ranita del pedregal.

Las pequeñas salamandras, no miden más allá de 6 cm, fueron más abundantes en el Ajusco medio. Se sabe que se comunican mediante señales químicas, sus glándulas debajo de la nariz le ayudan a los machos para tal efecto. Verlas en época de secas es difícil, muy seguramente permanecen ocultas entre la hojarasca. Con respecto a la ranita del pedregal, mediante grabaciones de cantos emitidos por ésta, ubicamos indirectamente sus sitios de



La salamandra de pies planos, endémica de nuestro país, es un habitante poco conocido del Parque Ecológico en la Ciudad de México

mayor abundancia, encontrándonos con la grata sorpresa de que esta ranita es más abundante de lo que imaginábamos. Consideramos que la ranita es particularmente emblemática de estas áreas, pues aun cuando es difícil de ver, su canto –el cual podría ser confundido con el de los grillos– inunda las noches de verano de las reservas del pedregal. ¿La has escuchado? Quizá, sí.



La ranita del pedregal es una especie que sólo vive en el sur de la ciudad. Su canto para atraer pareja –que se puede escuchar en este audio– consiste en la repetición de un silbido corto de muy poca variación individual

Los anfibios, nuestros mejores vecinos

Que estos anfibios vivan en el pedregal es una buena señal de que estos sitios aún son saludables, pese a la urbanización alrededor de las áreas protegidas. La humedad que prevalece entre los recovecos de pedregal y la espesa vegetación que crece gracias a las lluvias de verano, son aparentemente adecuadas para que estos animales que requieren de humedad en su piel para respirar, sobrevivan. No es exagerado por ello, considerar al grupo de los anfibios como los guardianes del agua del sur de la Ciudad de México.

Aunque cada vez menos, vecinos de las colonias del sur de la ciudad comentan que han visto o escuchado a estos animales en sus jardines. Si tienes la fortuna de

encontrar uno en tu jardín o en tu próxima visita a estos u otros sitios, obsérvalos sin hacerles daño, pues un anfibio puede ser el mejor aliado de bosques y jardines, debido a que son de los mayores depredadores de insectos. Es importante que sepas que ningún anfibio en México es venenoso al contacto con el ser humano y son completamente inofensivos.

Ahora que sabes que existen, ayúdanos a seguir viendo y escuchando a estos peculiares habitantes del pedregal de la Ciudad de México. La participación de todos es importante para conservar los escasos espacios verdes que aún quedan en esta ciudad y conservar con ellos los bienes ambientales invaluable que nos proporcionan.



FOTOGRAFÍAS: MIGUEL ÁNGEL SICILIA

Te invitamos a conocer nuestra página de Facebook, Anfibios del Pedregal, donde podrás encontrar más información al respecto de este proyecto.

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4.3 Address list and web links useful

- Reserva Ecológica del Pedregal de San Ángel (UNAM)

<http://www.repsa.unam.mx/>

Website with information about Pedregal, biodiversity and bibliography

- IUCN red-list

<http://www.iucnredlist.org/>

Website where are the conservation status and distribution of plant and animal species.

- Naturalista

<http://www.naturalista.mx/>

Website very useful to know and to share distribution species data.

- Zero extinction

<http://www.zeroextinction.org/>

Website where non-governmental biodiversity conservation organizations working to prevent species extinctions by identifying and safeguarding the places where species evaluated to be Endangered or Critically Endangered under IUCN-World Conservation Union criteria are restricted to single remaining sites.

4.4 Distribution list

Final copies of this report will be sent to:

1. Centro de Educación Ambiental Ecoguardas (Secretaría de Medio Ambiente de la Ciudad de México)
2. Centro de Educación Ambiental del Ajusco Medio (PRONATURA México A.C.)
3. Reserva Ecológica del Pedregal de San Ángel (UNAM)