Pantanal Giant Armadillo Project

Progress Report for

Natural Research

Project Coordinator: Dr Arnaud Desbiez

Funds awarded in 2013: £ 1,000

January 2014

Executive Summary

The giant armadillo (*Priodontes maximus*) is the largest of the armadillo species and can reach up to 150 cm and weigh up to 50 kilograms. Although giant armadillos range over much of South America little is known about them and most information is anecdotal. Due to its cryptic behavior and low population densities, this animal is very rarely seen. The giant armadillo is threatened with extinction and is currently classified as Vulnerable (A2cd) by the IUCN/SSC Red List of Threatened Species. This project is successfully establishing the first long-term ecological study of giant armadillos in the Brazilian Pantanal wetland. The main goal of the project is to investigate the ecology and biology of the species and understand its function in the ecosystem using radio transmitters, camera traps, burrow surveys, resource monitoring, resource mapping and interviews. The project has now expanded to other species of Xenarthra.

Natural Research has been funding this project since 2012.

The project was initiated in June 2011. Project methodologies have been tested successfully, staff trained and many excellent preliminary results obtained. This includes documenting the role of giant armadillos as Ecosystem engineers, 5 preliminary home ranges and habitat selection results, new details on their diet and reproduction. The project expanded to other Xenarthrans. In 2012 epidemiological study was extended to other species of armadillos in the study area and an ecological study on the Southern naked tail armadillo (*Cabassous unicinctus*) started, in 2013 a pilot ecological study of giant anteaters and nine banded armadillos was successfully initiated.

The research objective for 2013 was to expand and consolidate the giant armadillo research, continue expand the epidemiology study to other armadillos, consolidate the southern naked tail armadillo, and begin a pilot study on giant anteaters as well as publishing initial project results. The objective for environmental education and outreach was to introduce the project to the variety of stakeholders in the Pantanal, liaise with the media and launch media campaigns , seek partnerships with private companies start preparing for a campaign in 2014 using the world cup mascot to promote armadillos. The objectives for training and capacity building were to train 5 national scientists. All objectives for 2013 have been successfully met and surpassed.

In 2014, work will continue in the Pantanal, but we will begin exploring potential new sites to expand the project to the neighboring Cerrado biome. We will continue liaising with national and international media, publishing both scientific and mainstream publications, offer training to Brazilian Nationals, welcome visitors to our field site, continue integrating the project to local and National initiatives and continue liaising with local and national authorities on project results and implications.

Main Achievements: Research

The research objective for 2013 was to expand and consolidate the giant armadillo research, continue expand the epidemiology study to other armadillos, consolidate the southern naked tail armadillo, and begin a pilot study on giant anteaters as well as publishing initial project results. Our team includes a full time veterinarian (Danilo Kluyber) a full time biologist (Gabriel Massocato) as well as some consultants and trainees. In general a team of 3 to 5 people are in the field together in two teams one using the truck and the other the quad bike. Due to the different species and study designs there is work around the clock.

The giant armadillo work has made a lot of exciting progress this year. However, locating giant armadillos in their burrows continues to be very difficult, simply because these animals are so rare and have huge home ranges. We do not have a technique that can help us locate them easily, however with our experience and almost constant presence in the field 5 giant armadillos have been captured this year during a total of 13 two week expeditions in 2013. In 2014 we plan on testing the use of detection dogs to see if it can help us locate giant armadillos in the field. Since April 2013 we have been sending fresh scents of giant armadillos to a trainer from Rio Grande do Sul (a state in the South of Brazil).

This year we captured 4 males and 1 female. Up until now we had more data on females than males and we were very happy to finally catch some male giant armadillos. This year we saw a dramatic improvement in our data collection through the use of GPS tags (also developed in partnership with Telonics). The GPS tags battery life is limited, but since the tags fall off this is not a problem and they give us very accurate and detailed data about giant armadillo movements through the landscape. This was a major breakthrough for the project, however the GPS tags are extremely expensive and we are very grateful to the different institutions who helped to fund them.

Unfortunately we continue to struggle with the use of external devices which fall off. However we have been working with Telonics to develop new models and several have been or will be tested. We still have ideas we would like to test.

Perhaps the highlight of the year for the giant armadillo project has been to document the birth and six months of parental care of a baby giant armadillo. Last year we had registered through our camera traps the death of our first baby giant armadillo at 4 weeks of age, so it was a huge relief for the team to be able to carefully document all aspects of the first six months of a baby giant armadillo. As of December 2013 the baby was still being nursed and only just started venturing at the entrance of the burrow. We also documented births with the Southern naked tailed and nine banded armadillos.

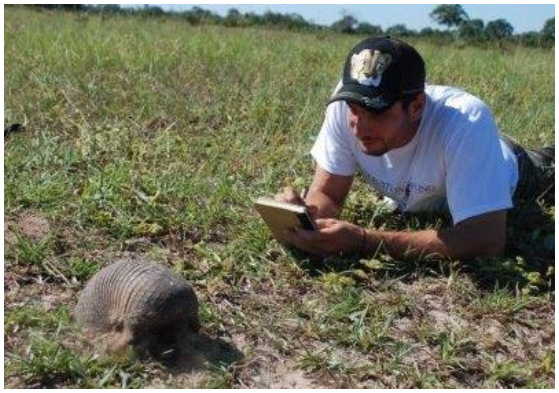
We finally have enough data to start a preliminary analysis of some of the data collected by the project. We were very happy to publish an article in Biotropica describing the role of giant armadillos as ecosystem engineers. In this article we describe the use of armadillo burrows by 24 other species revealing the importance of giant armadillos in the ecological community. We really hope this data and publication will help promote giant armadillo conservation. This year we also ran a preliminary analysis of home range, habitat selection for 5 giant aramdillos and some fecal samples. We are using several different analysis methods and trying to understand how to best use and represent the data collected by the GPS tags. As for fecal samples, we will be partnering with a university but I am still not sure which one and both are analyzing samples for us.

Our team also attended a total of 5 different conferences this year and a total of 7 presentations were made ranging from overviews of the project to a presentation on ticks or salmonella strains!

Our epidemiological study on armadillos continues to produce some exciting results and new discoveries as results slowly trickle in from the labs. Danilo Kluyber is starting a part-time Master's degree at the Sao Paulo University´s Institute of Tropical Medicine in a program focusing on human tropical diseases in the university´s medical department. Due to their low metabolism and low body temperature, armadillos are believed to be

reservoirs for some diseases that are important to human health. The objective of his study will be to analyze the prevalence of four Zoonosis that are important to human health and responsible for Chagas disease, Leishmaniosis, Hanseniase disease and Paracoccidiomicosis. The idea is to gain a better understanding of how conservation medicine can benefit human health.

Our Southern naked tail armadillo study is progressing well and five new animals have been captured this year. Unfortunately one of the males was killed by domestic dogs. We are going to continue the intensive study of Southern naked tailed armadillos in 2014. This is the first ecological study on species and due to their small home range, and diurnal habits it has been much less challenging than the giant armadillo work. Thanks to the quad bike donated by Association Beauval Nature pour la Conservation et la Recherche a team can be dedicated to this project. An interesting questions remains about whether the sub-species we have in the study area could in fact be a species. I am making several contacts to search for someone to help us answer this question.



The female nine banded armadillo was an interesting addition to our work. One of the reasons we are so interested in nine banded armadillos is that they were said to be plentiful in the study area in the past. However it seems that 15 years ago the population crashed and this armadillo has become rare in the area. There is talk amongst the local communities and experienced ranch hands that they were plagued by some disease and wiped out. We are therefore very interested in monitoring the health of this species. However since they are rare and nocturnal we have not been able to catch more nor dedicate the amount of time required for this work.

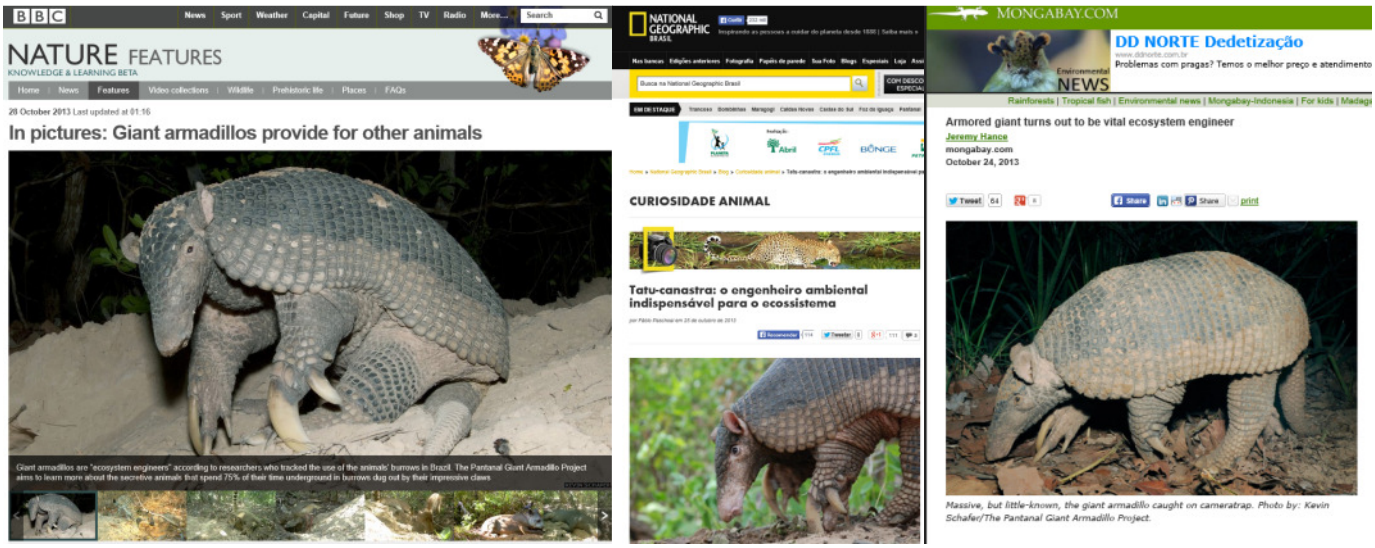
This year we ran a pilot study on giant anteaters to learn the logistics, optimal study design and evaluate the safety of the harness used to attach a transmitter to the animal. I am really pleased to report that we got all this information and the harness does work very well. In December we captured one of the males we had caught in July just to make sure there were no lesions or sores that we could not see. We were happy to see that he was fine and the harness does not seem to cause any problems. Next year we will expand this study and capture more giant anteaters in the area where we have most of our giant armadillos. Very excited to be monitoring and studying the overlap between these giants!

Selected publications from the Pantanal Giant Armadillo Project in 2013

1. Desbiez, A.L.J. and Kluyber, D. 2013. The role of giant armadillos as ecosystem engineers. Biotropica. 45(5):537-540
2. Walfrido M. T., Campos Z., Desbiez, A. L. J., Kluyber, D., Lima Borges, P.A., & Mourão, M. (2013). Mating behavior of the six-banded armadillo *Euphractus sexcinctus* in the Pantanal wetland, Brazil. Edentata 14 (2013): 87-89
3. Santos, R. C. F. ; Kluyber, D. ; Massocato, G. F ; Desbiez, A. L. J. . Coproparasitologic Evaluation og Three Armadillo Species in the Brazlian Pantanal - Preliminary Results. In: I Congresso Lationo Americano de Tapires e II Congresso Equatoriano de Mastozoologia, 2013, Puyo, Pastaza, Equador.
4. Coutinho, S. Dall Acqua ; kluyber, danilo ; Desbiez, A . Leveduras do gênero Malassezia em microbiota cutânea de tatus de vida livre do Pantanal Mato-Grossense. In: Wildlife Disease Association Latin America - WDA, 2013, São Paulo. 1 Reunião da WDA Latin America, 2013.
5. Iovine, R. O. ; Paula, C. D ; Flávia R. Miranda ; Kluyber, D ; Desbiez, A ; Bueno, M. G ; carvalho, V. M. . Mamíferos selvagens de diferentes biomas brasileiros podem carrear e disseminar cepas resistentes de Salmonella spp. e Escherichia coli com potencial patogênico. In: Wildlife Disease Association Latin America - WDA, 2013, São Paulo. 1 Reunião da WDA Latin America, 2013.
6. Kluyber, Danilo ; Desbiez, A. L. J. . Tocas de Tatu-Canastra e seu Potencial para a Transmissão de Patógenos. In: Wildlife Disease Association Latin America - WDA, 2013, São Paulo. 1 Reunião da WDA Latin America, 2013.
7. Kluyber, D. ; Desbiez, A. L. J. ; Massocato, G. F ; Santos, R. C. F. ; Marinete Amorim ; Teixeira, R. H. F. ; Martins, T. F . Ocorrência de carrapatos (Acari: Ixodidae) em tatus de vida livre no Pantanal da Nhecolândia, Mato-Grosso do Sul, Brasil.. In: Wildlife Disease Association Latin America - WDA, 2013, São Paulo. 1 Reunião da WDA Latin America, 2013.

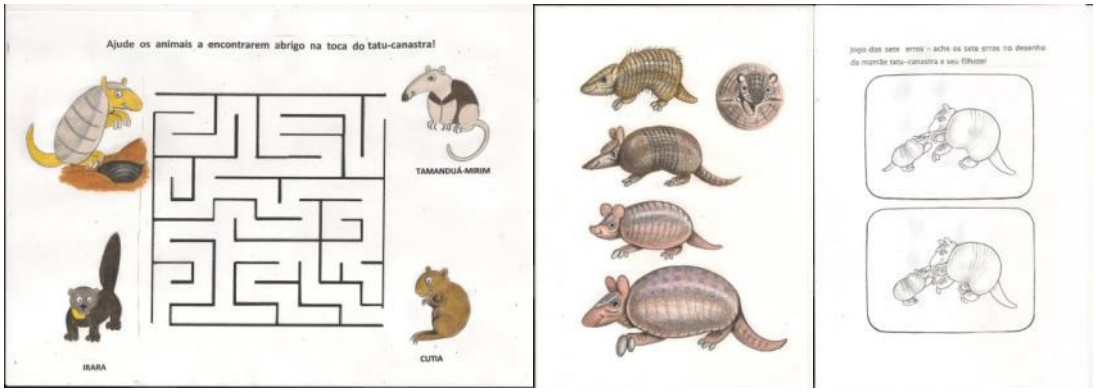
Main Achievements:
Environmental Education, Awareness campaigns, Outreach

The first objective of the environmental education program is to introduce the wider public to giant armadillos. Few people know the species exists or they believe it is already extinct. For this reason we launched 2 intensive and very successful media campaigns. The first one celebrated the first recoded birth of a giant armadillo and first picture and video taken in December 2013. The media attention was fantastic and in two weeks the video of the baby giant armadillo was viewed over 10,000 times. Many articles from around the world were published on internet news sites, magazines and the video was shown on national television. In October we launched another media campaign highlighting the role of giant armadillos as ecosystem engineers. Thanks to the numerous beautiful pictures we have taken in the past three years we had another very successful press coverage with articles in the BBC, National Geographic and Mongabay. I want to highlight the role several zoos have played in helping us reach out to the media. Several zoos sent out our press release to their contacts and really helped us increase the number of countries and news agencies we can work with.



In an effort to try to measure our impact in the media I checked on google and typed my name and giant armadillo and got over 2000 hits… Three years ago there would have been none! We have made media one an important tool in our communication strategy.

Since the beginning of the project we have tried to partner with private companies through the help of IPE (Insitute for Ecological Research) to promote giant armadillos in merchandise and other commercial activities. We had a successful campaign with Danone in 2011 -2012 and have been trying to get Havaianas to develop a flip-flop depecting giant armadillos. Although a design was recently produced in October 2013, it was not considered attractive enough for women who are their main consumers… We will keep trying!



We have given many talks about the species and the importance of preserving the Pantanal to: tourists visiting the ranch, landowners, workers and children in the Pantanal. We continue to spread the word in several distant ranches and made presentations to the landowners and the staff. We have poster in local shops in the nearest small towns bordering the Pantanal. In Campo Grande we have given talks at schools, and local universities.

2014 should be our most active year yet in communication and awareness. We will be using the fact that an armadillo is the mascot of the world cup to celebrate armadillos through various campaigns in Zoos. We have been very busy preparing for 2014 throughout the year and establish many strategic partnerships. Emerging Wildlife Conservation Leaders has been very busy preparing a media packet and Educational activities for the campaign. We have also partnered with the Brazilian Society for Zoos and Aquariums so that they could launch the campaign in Brazilian Zoos. We are hoping that all our partners will engage in educational and media activities to promote giant armadillos in 2014.

Main Achievements: Training and Capacity building

A total of four Brazilian professionals (3 biologists and 3 veterinarians) have received training and experienced the different aspects of a field Conservation project in the past year. It is important that our experience and knowledge be shared with the next generation of conservationists. We also welcomed two international volunteers one from the Jacksonville Zoo who worked with us for 3 months and the Minnesota Zoo who participated in one expedition. The giant armadillo project is a great opportunity to provide firsthand experience and training. Arnaud Desbiez also gave a class at the ESCAS University in São Paulo about species research, action planning and population modeling.

Impact on Local Community

The project is fully supported by the local community in the study area. The project is being supported by Baía das Pedras ranch. Baía das Pedras is a 17,000 hectare privately owned traditional cattle ranch. They provide lodging and meals to the field team and are passionate about the project. In return, the team gives presentations and provide materials about the project to eco-tourists visiting the ranch. The entire community and neighboring ranches are involved in the project. Ranch workers participated actively in the search for giant armadillo tracks, burrows and other evidences. The project participates in the environmental education component for two local rural school. We visited and gave talks about the project in various neighboring ranches.

We are in the initial stages of trying to convince the authorities of the Mato Grosso do Sul state to use giant armadillos as an indicator species in the designation of protected areas. Demonstrating their important role in the ecological community as well as the fact that they are rare and need large protected areas we are using our work and this emblematic species to try to encourage habitat protection in the state.

Reporting and Fundraising

Five informal reports detailing the progress of the project were e-mailed in the past twelve months to supporting institutions. These communications continue to be very popular and several Zoos edited the information for their blogs. Each communication was accompanied by recent pictures from the field. We are always happy to send high resolution copies of the pictures when asked. We also sent out materials for two press releases which many institutions then forwarded to their media contacts really helping make these initiatives successful

During 2013, we continued to actively fundraised for the project. Since 2010 we have received funds from:

Association Beauval Nature pour la Conservation et la Recherche (France); Association Française des Parcs Zoologiques – AfdPZ (France); l´Association Jean-Marc Vichard pour la Conservation (France); Bergen County Zoo (USA); Brevard Zoo (USA); Cerza Zoo (France) ; Chester zoo (UK); Columbus Zoo (USA); Conservation des Espèces et des Populations Animales (CEPA) (France) ; Disney Worldwide Conservation Fund (DWCF)(USA); Fresno Chaffee Zoo Wildlife Conservation Fund (USA) ; Houston Zoo (USA) ; Idea Wild (USA); Oklahoma City Zoo (USA); Minnesota Zoo (USA) ; Nashville Zoo (USA), Natural Research (MMA) (UK); Papoose Conservation Wildlife Foundation (USA) ; Phoenix Zoo, (USA); Prins Bernhard fund for Nature (Holland); Riverbanks Zoo and Gardens (USA) ; Sea World Busch Gardens (USA); Taronga Zoo (Australia); Taiwan Forestry Bureau (Taiwan), private donation: George Rabb, Alexander Balkanski, Elias Sadalla and Jason Woolgar. Zoo Conservation Outreach Group (ZCOG) and its partners: the Chattanooga Zoo, Jacksonville Zoo, Naples Zoo and Caribbean Gardens, Salisbury Zoo-Chesapeake AAZK, Greenville Zoo and the San Antonio Zoo and Aquarium.

Many thanks to all these donors without whom none of this would have been possible. We also received in kind support for IPE, Baia das Pedras ranch and of course have partnered with several Brazilian laboratories and universities which analyze the epidemiological and genetic data we have collected.

Plans for 2014

We will pursue and consolidate the research on giant armadillos in the Panntanal using methodologies we previously established while continuing to test new ones. The plan is to capture and monitor more adult individuals. We will continue to test the GPS tags to compare with the results obtained through VHF monitoring. We aim to investigate all

methodologies and technologies which can be used to study giant armadillo. Ecological research on Southern naked tailed armadillos will be expanded. We will continue the epidemiological study of all armadillo species. We hope that in the future other researchers will begin to study armadillos so we can provide them the best advice and expand our knowledge on these species throughout South America..

We have demonstrated that giant armadillos are ecosystem engineers (Desbiez & Kluyber, 2014). We will continue documenting the use of burrows and reach out to collegues throughout South America to place camera traps in front of giant armadillo burrows to count how many species throughout their distribution make use of the burrows. A new study on the potential of giant armadillo burrows as hot spots for disease transmission has been initiated. Due to the high number of species from different ecological guilds it is possible that burrows may be a hotspot for transmission of diseases, through ticks, fleas, fungus, bacteria and viruses. Burrows may present new opportunities to bloodsuckers such as ticks and fleas. We were on numerous occasions infested by fleas while measuring older burrows. Many sequences of pictures taken showed mammals, such as the Southern tamandua, ocelot or tayras, scratching themselves on the sand mound after spending prolonged amounts of time in a burrow. In addition to the successive diversity of mammals remaining for prolonged periods, the dark, humid conditions with a constant temperature could potentially favor survival and proliferation of fungus, bacteria and viruses. A lot of questions regarding giant armadillo burrows remain to be addressed.

In 2014 we will be testing the use of a detection dog. A Labrador retriever named Gaia has been receiving training since April 2013. We have sent samples of urine, feces, and clothes rubbed on giant armadillos for scent. In January 2014 a ten day expedition will be run to test if the use of Gaia can increase our capture rates. Gaia and her trainer live in the South of Brazil and must be flown to Campo Grande. Although this will be expensive we hope it will have promising results.

We currently discussing with National Geographic the use of crittercams to better analyze the foraging behavior of giant anteaters. We are very excited about trying this out. It is easy to document giant armadillo foraging behaviours due to their deep excavations. Giant anteaters on the other hand forage sometimes for less than a minute in the same spot and it is much more difficult to recognize the evidence left by them. We are hoping to compare foraging behaviours between giant anteaters and giant armadillos through the use of these crittercams.

In 2014 we will search for a potential new study area in the cerrado biome with both conserved areas and areas with anthropogenic activity to try to understand the potential impacts of anthropogenic landscapes changes on giant armadillo populations. We hope to identify an area and start a pilot study with camera traps to see if we can establish a new project in 2015.

The symbol of the world cup in Brazil will be a three banded armadillo, this is a unique opportunity to advertise our cause. In May 2014 the project will be launching an extensive campaign in zoos throughout Brazil about armadillos and biodiversity conservation thanks to a partnership with the Brazilian Association for Zoos and Aquariums. Many educational materials are being created and will be available free of costs so that Brazilian Zoos can create their own campaign. We hope this initiative will help make Brazilian Zoos active players in in-situ conservation. This campaign and all materials will also be available to all our partners.

We will offer training to at least 5 more Brazilian Nationals in 2014. At the end of 2014 the first steps to evaluate and use data to evaluate the status of giant armadillos according to the IUCN/SCC red list criteria will be taken. Data will also be compiled for population viability analysis. An action plan for the species in the Pantanal biome will be created in 2015.