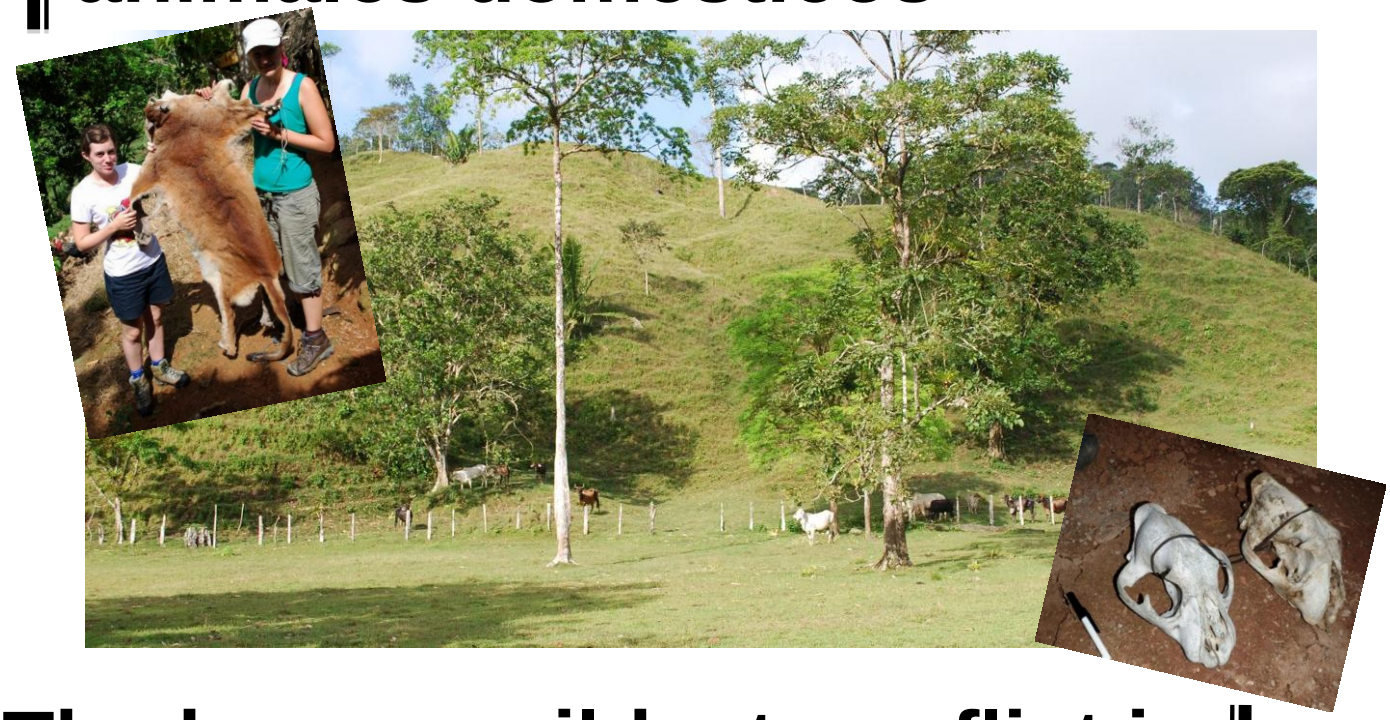
Caracterización de fincas ganaderas con eventos de ataques de felinos a animales domésticos



The human-wildcat conflict in Panama: characterization of farms with varying levels of livestock predation

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Workload

Number of equivalent full days spent on the project in Panama:	33 days
Number of equivalent full days spent in the "field":	14 days

Rezumado executivo

Aunque el establecimiento de áreas protegidas es esencial, globalmente y localmente, a la conservación de la biodiversidad, su creación puede causar perdidas de propiedad o de oportunidades económicas para los humanos viviendo a sus alrededores. Uno de los conflictos engendrados en América Central y globalmente es por la depredación de grandes felinos, como los jaguares y pumas, sobre el ganado, causando perdidas económicas a muchos finqueros. Objetivos de conservación son entonces peligrados cuándo los ganaderos empiezan a matar los felinos en represalia. Para disminuir ese tipo de conflicto y asegurar una buena coexistencia entre los felinos et ser humanos, soluciones adaptadas a cada área protegida deben ser encontradas.

Ese tipo de conflicto existe en el área del Alto Chagres, localizado en la provincia de Colón, del lado de la costa caribe de Panamá. Esa área es un vinculo importante del Corredor Biológico Mesoamericano y el corredor biológico del jaguar, que sirve a conservar la conectividad del hábitat de grandes felinos como el jaguar y el puma. Un gran aumento de actividad de ganadería durante los últimos treinta años ha acentuado la frecuencia de conflicto entre humanos y felinos porque la depredación del ganado ha devenido un problema frecuente.

El objetivo de este estudio fue caracterizar las fincas con y sin ataques de felinos, recopilar datos sobre la frecuencia y las circunstancias de estos ataques y sobre los casos de cacería

del jaguar por ganaderos. Se ha hecho la hipótesis que algunos factores específicos encontrados en estudios anteriores permitiendo la disminución de los ataques de felinos serían tanto aplicables a los fincas de la región del Alto Chagres.

Entrevistas preliminares fueron conducidas con representantes de organizaciones gubernamentales como ANAM, PRONAT and MIDA, con ganaderos, organizaciones ganaderas y otra gente de la comunidad. La mayoría de las entrevistas preliminares fueron en Nuevo Tonosí pero las fincas visitadas están ubicadas en cuatro diferentes comunidades: Nuevo Tonosí, San Antonio, Nombre de Dios y Playa Chiquita. Veinte-una encuestas se hicieron entre el mes de enero y abril 2011, en el área de conservación del Alto Chagres en diferentes fincas que tuvieron ataques de jaguares y que no tuvieron ataque para caracterizarlas y intentar de determinar cuáles son los factores permitiendo evitar esos ataques. Esa determinación puede servir a hacer recomendaciones de manejo a los ganaderos para disminuir el conflicto con los felinos. Factores ecológicos, económicos, sociales y de manejo fueron tenidos en cuenta.

Tendencias preliminares relacionadas a esos factores fueron determinadas con las encuestas. Primeramente, la fincas con menos ternero en el hato no han tenido ataque. Esas fincas tienen también la más pequeñas superficies de bosque. Esas tendencias fueron mostradas de manera descriptiva pero no tuvieron ninguna significancia estadística a causa de la alta variación de los datos y del pequeño muestreo. Eso sugiere que esas tendencias podrían ser verificadas por futuras investigaciones más detalladas. Factores económicos como el numero de personas encargadas en la finca, la superficie de la finca y el uso de veterinario no parecen correlacionados con la cantidad de ataques al ganado. Muchos factores de manejo eran constantes entre las fincas, específicamente el tipo de cerca, la ubicación del ganado por la noche y fuente de agua por el ganado. Entonces, porque no había muchas diferencia entre las fincas, esos factores no pudieron ser comparados.

Se determinó que el único correlacionado significativamente con la incidencia de ataques de jaguar es la distancia de otros asentamientos humanos; las fincas menos aisladas en áreas de potrero eran las que no tuvieron ningún ataque. Las opiniones de los ganaderos sobre los jaguares, y los felinos en general, fueron muy negativas, con un 86% de los entrevistados pensando que los jaguares son estrictamente dañinos en la región. Diez de los veintiún entrevistados habían matado a un jaguar en represalia. Estas tendencias alarmantes sugieren que la educación pública y ayuda financiera y técnica para ganaderos son necesarios para resolver el conflicto.

Aparte de los cambios de manejo como posibles métodos para mitigar el problema de los ataques, nuevas recomendaciones incluyen la colaboración con las autoridades y un papel más importante que deben tomar los administradores del área de conservación Alto Chagres en encargándose de indemnizar los ganaderos por los ataques. La biodiversidad conservada por esta Área de Conservación es deseable y los conflictos entre ganaderos y la vida silvestre en el área pueden ser inevitables, hasta cierto punto. Entonces, una compensación adecuada es necesaria para mantener las buenas relaciones entre el parque y sus habitantes y para aliviar la pobreza.

Executive summary

While the creation of protected areas is essential to biodiversity conservation on both global and local scales, it can lead to losses of property and economic opportunities for humans living in the area in question. One such conflict occurring in Central America and elsewhere is between felids and agriculturalists such as cattle ranchers, whereby felids prey on livestock leading to substantial economic losses. Conservation goals are then jeopardized as ranchers engage in retaliation hunting of jaguars and other felids. In order to allow for successful conflict-free conservation, solutions need to be found for the coexistence of humans and felids in protected areas.

This conflict has been noted in the Alto Chagres conservation area of Panama. This area is located on the Caribbean coast of the country, and forms linking point of the Mesoamerican Biological Corridor, which aims to preserve habitat connectivity of large mammals such as jaguars. An influx of cattle ranching activity in the past thirty years has lead to an increased incidence of human-jaguar conflict as predation on livestock has become a common problem.

The objective of this study was to characterize farms with and without felid attacks and to gather data on the frequency and circumstances of these attacks and on the cases of jaguar retaliation hunting by the farmers to better understand the conflict. It was hypothesized that specific factors outlined by previous studies lead to attack avoidance and that these same factors would be applicable to farms in the Alto Chagres region.

Preliminary interviews were conducted with important stakeholders, such as representatives of government organizations ANAM, PRONAT and MIDA, cattle ranchers and organizations representing them, and other members of communities surveyed. Specifically four communities: Nuevo Tonosí, San Antonio, Nombre de Dios and Playa Chiquita, but most of the preliminary interviews took place in Nuevo Tonosí. Twenty-one farm surveys were carried out between January and April 2011 in the Alto Chagres conservation area on farms that had experienced jaguar predation to varying degrees as well as those that had not experienced any attacks. This was done to collect information about farm characteristics with the aim of isolating factors that lead to avoidance of jaguar attacks, so that management recommendations could be made for farmers to avoid such attacks. Management, economic, ecological and social factors were taken into consideration.

Preliminary trends relating to the above mentioned factors were determined through these surveys. Firstly, it was noted that farms that had the lowest

amount of calves in the herd were those that had not suffered any attacks. These farms also had the lowest amount of forested area within the farm area. These trends were shown in a descriptive manner but had no statistical significance due to high variation and small sample size, suggesting that they could be verified in more robust future studies. Indirect economic indices such as number of people employed by the farm, farm size, and access to a veterinarian did not seem to be correlated with the number of attacks suffered by farm livestock. Many management factors were the same across all farms, specifically the type of fencing, night time location of cattle, and water source for livestock. Thus this uniformity dictated that these factors could not be compared between farms.

It was determined that the only factor with significant correlation to jaguar attack incidence was the distance from other human settlements, with less isolated farms in predominantly pasture areas as those that avoided attacks entirely. Farmers' opinions regarding jaguars and felids on the whole were very negative, with 86% of interviewees stating that jaguars are a strictly damaging force in the region. Ten of the twenty-one interviewees had themselves killed a jaguar in retaliation. These alarming trends would suggest that public education and financial and technical help for cattle ranchers are needed to resolve the conflict.

Apart from farm management changes as possible methods for attack mitigation, further recommendations include collaboration with authorities and a greater role to be taken by the Alto Chagres conservation area administrators in compensating farmers for attacks. The biodiversity preserved by this Conservation Area is desirable and conflicts between cattle ranchers and wildlife in the area may be unavoidable to a certain extent; thus proper prevention, compensation and public education is needed to maintain good relations between the park and its inhabitants and to alleviate poverty.

List of abbreviations used in this document

ACP	Autoridad del Canal de Panamá
ANAM	Autoridad nacional del Ambiente
ANAGAN	Asociación Nacional de Ganaderos
BDA	Banco de Desarrollo Agropecuario
MIDA	Ministerio de Desarrollo Agropecuario de Panamá
NGO	Non-Governmental Organization
PNP	Parque Nacional de Portobelo
PRONAT	Programa Nacional de Administración de Tierras
SOMASPA	Sociedad Mastozoológica de Panamá

Table of content

1. Host institution

The *Sociedad Mastozoológica de Panamá* (SOMASPA) is a non-profit NGO founded in 2000. Its main mission is to promote scientific research and education regarding the ecology and conservation of biodiversity in Panama, with an emphasis on mammalian species. SOMASPA works to improve and increase the knowledge on national biodiversity and collaborates with many other governmental and non-governmental organisations to develop better biodiversity conservation strategies in the country, without compromising the livelihood of its inhabitants. Another objective of the institution is to contribute to the capacitation of specialized human resources by sharing scientific information trough workshops, courses and conferences on biodiversity.

SOMASPA runs research projects in many protected areas of the country such as Parque Natural Metropolitano, Parque Nacional Chagres, Portobelo, Soberanía, Reserva and the Forestal Fortuna among others. Some of the research interests of SOMASPA include behavioural studies on small mammals, like shrews, some marsupials and rodents, as well as large mammals, like sloths, tapirs and felids. SOMASPA also runs special programs on bats and on monkeys, as well as environmental studies and researches such as environmental impact assessment, fauna rescue and protected area management (SOMASPA 2007). Following a conservation project initiated in 2002 in the context of the program *Parques en peligro* (*Endangered Parks*) in the conservation area of the Alto Chagres, SOMASPA has been participating a important biodiversity monitoring project, which includes determining the status of jaguar populations as well as aquatic insects, amphibians, birds, bees and orchids (SOMASPA 2007).

2. Introduction

It is currently estimated that the Earth is experiencing its sixth mass extinction, with the loss of species at one thousand times the normal background extinction rate (Rodrigues et al. 2004). With this in mind the global community has responded in a variety of ways; the creation of protected areas has arisen as a valuable tool in large-scale biodiversity conservation. As extinctions of species increase the cordoning-off of key territories helps to ensure that threatened species have access to essential resources so that they may persist. While this action benefits the global community in maintaining genetic resources and preserving species valued for their existence, the losses are disproportionately shouldered by populations living nearby to the protected zones (West and Brockington 2006). Often the majority of these local inhabitants are very poor and may become cut off from resources needed for their subsistence or experience other threats to their livelihoods (Naughton-Treeves 1998). This debate between preserving biodiversity for global benefit and possibly compromising human welfare is currently thought to be the most controversial issue in conservation policy to date (Andam et al. 2010).

2.1 Parks vs people debate in Panama

One of the most obvious threats to livelihoods for populations living near protected areas is through property loss; the predation of felids on livestock is a common problem (Inskip and Zimmerman 2009). As feline population numbers within the protected area rise due to effective conservation and as human inhabitation encroachment continues, the seemingly inevitable consequence is that contact and conflict between humans and animals also increases. This is the case with pumas and jaguars in Panama. For many years, these near-threatened felids (Caso et al. 2008) have been known to attack

livestock of farmers living near forested areas as well as near protected areas. Jaguars are thought to be dangerous for humans as well as to be responsible for most of these cattle kills, resulting in retaliation attacks from farmers (Falke and Ocampo 2008). This is a negative outcome for all parties, as it does not directly solve the problem faced by ranchers and it furthermore worsens jaguars' endangerment. In fact it has been noted that jaguars who receive injuries from humans are more likely to attack cattle as they have lost their capacity to hunt more challenging wild prey (Hoogensteijn 2010). Studies are needed to fully understand the factors that lead to felid attacks on livestock, in order to be able to improve farm management and therefore decrease felid-livestock encounters.

2.2 Situation of the jaguar

The jaguar (*Panthera onca*) is the largest feline in the Americas and is found in a variety of habitats from Northern Mexico to Argentina (Caso et al. 2008). It is found more specifically in rainforests, floodable lowlands, pampas grasslands, thorn scrub woodland and deciduous forest (Ibid). The jaguar plays a very important role in tropical forest ecosystems as it is considered an umbrella species (Caro 2003). Noss (1990) first defined umbrella species as 'species with large area requirements, which if given sufficient protected habitat area, will bring many other species under protection'. Jaguars also hold an important place in Latin American culture, where they represent a dominant symbol and religious icon (Rabinowitz 1999).

There are currently three main threats to jaguars: destruction and fragmentation of their habitat by human activity, hunting by poachers or in retaliation to livestock predation, and disappearance of natural prey species due to overhunting (Panthera 2011).

According to Sanderson et al. (2002), jaguar conservation across its range has been impeded by national and linguistic barriers, missing knowledge on the overall status of the species and disagreement on the conservation priorities. For all these reasons, the jaguar has now disappeared from El Salvador, Uruguay, the pampas scrubs grasslands of Uruguay as well as from Northern Brazil and South-Western United States (Caso et al. 2008). Its current global distribution corresponds to only 46% of its original range (Sanderson et al. 2002). It has disappeared from a large part of Panama; in 1989 it was only found in 33% of its original range in Central America specifically (Hoogesteijn 2003). The species is now considered 'near threatened' and figures on the IUCN Red List (Caso et al. 2008).

It is important to specify that jaguars are not the only felines for cattle predation in Central America. Pumas (*Puma concolor*), who are also carnivores but generally select smaller preys, are sympatric with jaguars over the latter's range in the Neotropics (Scognamillo et al. 2003) and also prey on cattle (Hoogesteijn and Hoogesteijn 2010). Pumas are classified as Least Concern under the IUCN RedList (Caso et al. 2008).

3. Antecedents

3.1 Previous studies - Global context

Human-felid conflicts associated with cattle ranching are not exclusive to Panama. Studies have been conducted on this subject in other parts of the jaguar's range, such as in Belize, Bolivia, Argentina, Mexico, Venezuela, Brazil, and Costa Rica (Rabinowitz 1986; Ayala and Wallace 2008; Falke and Ocampo 2008; Rosas-Rosas et al. 2008; Torres Zerpa 2008; Marchini 2009; Gordillo Chavez 2010; respectively). Hoogesteijn and Hoogesteijn (2010) identified three main components of this conflict in Latin-

America. Firstly, hunting jaguars is illegal in every country except in Belize, where it is allowed in cases of predation on domestic animals. Secondly, legal mechanisms to prevent the poaching of jaguars, pumas and their natural preys are inexistent; therefore these species can be under strong hunting pressure, forcing jaguars to seek alternative ways to feed themselves. Finally, farmers often get no answer of help from the authorities when they report predation problems, and as a result they are obligated to solve the problem themselves. In response to these issues, the authors propose four criteria for an effective jaguar conservation strategy:

- The creation and extension of protected areas, of adequate size for the species;
- The implementation of mechanisms to dissuade people from poaching jaguars, pumas and their natural prey species;
- The establishment of essential governmental assistance to farmers with felid predation problems, and
- The inclusion of ecotourism and organic meat production in partnership with private conservation organisations (Hoogesteijn and Hoogesteijn 2010).

Hoogesteijn (2003) highlights that there are currently main types of reactions to this conflict: intent to eliminate the problematic felines, changes in management to reduce predation and compensation mechanisms for losses to felid predation. Many authors studying the question have come up with recommendations in terms of management practices to avoid jaguar attacks (see Annex IX for review of published recommendations).

3.2 Implications in Panama

A project to create a biological corridor to facilitate jaguar movement through the Americas has been initiated by the NGO Panthera, which works for wild cat conservation

globally. This corridor intends to link jaguars' population from Mexico to Argentina and mitigate threats to these populations in improving land management (Annex X). The greatest threat to wide-ranging mammals like jaguars is population isolation, where subpopulations become isolated due to habitat conversion, decreasing genetic diversity and health of the species as a whole (Hogg et al.2006). A corridor like this intents to improve land management in order to mitigate this problem. Furthermore, it provides habitat for other plants and animals, whereby the jaguar acts as a charismatic umbrella species to make conservation more robust in the region as a whole. Up to now, 13 of the 18 countries within the jaguars' range have endorsed the project and over 20,000 square kilometers encompassed in 10 corridors have been surveyed (Panthera 2011). Panama provides habitat to a large number of jaguars and is an important part of this large-scale biological corridor as it is the critical link between jaguar populations all across the Americas. However, because of the high rate of habitat loss due to the development around the Panama Canal, the portion of the corridor that falls within Panama's borders is one of most endangered (Panthera 2011).

3.3 Previous and current studies in Panama

In Panama, since 2008, both SOMASPA and Panthera have been working together in a coordination project to improve connectivity with this urgency in mind (SOMASPA 2007). SOMASPA continues to run different research projects on the national abundance and distribution of the jaguar, its general ecology such as diet and behaviour, as well as the major threats affecting jaguars all over the country (SOMASPA 2007).

In the Alto Chagres area, jaguar monitoring was conducted as part of an overall biodiversity assessment. In this study, jaguar density, prey abundance, diet, mortality

and habitat forest cover were surveyed. In 2010, SOMASPA conducted studies concerning the jaguars' conservation status in the Alto Chagres in relation to hunting-induced mortality, with specific emphasis on cattle ranchers as stakeholders in conflict with conservation efforts. In the same year, the organization conducted another research on the wildlife hunting activities of communities within the conservation area to gather information on the hunting pressure on jaguar prey species. This pressure was seen as an indirect threat to jaguar populations and as a second possible driver of human-jaguar conflicts in the Alto Chagres area (SOMASPA 2010).

In 2009 and 2010, SOMASPA organized workshops centered on the cattle rancher-jaguar conflict and on farm management to facilitate coexistence between cattle ranching activities and jaguar conservation in the Alto Chagres conservation area. These workshops were intended to increase awareness of the conflict and the importance of conservation, and to facilitate dialogue about possible mitigation measures with representatives of the farming sector (Ibid).

4. Relevance of the project

The jaguar monitoring conducted by SOMASPA has underlined an important relationship between the proximity of jaguar conservation areas to cattle ranching zones and the consequent degree of jaguar mortality. Indeed, jaguar mortality greatly increases with proximity to cattle ranching areas (SOMASPA 2010). Some information has unofficially been gathered about jaguar presence near farms and events of jaguar predation on cattle in previous studies. Nevertheless, more information is needed on these themes. The characteristics of farms with more of less predation events have not yet been studied in a quantifiable manner. Furthermore, the reactions of local authorities

and inhabitants of the Chagres Conservation Area have not been officially recorded with regards to human-jaguar conflicts. A more thorough analysis of the situation in the Alto Chagres conservation area will help the organisation to potentially make recommendations for mitigating measures in order to minimise conflicts between human activities and the conservation of jaguars. This proactive approach is consistent with best management in protected areas. It is not enough to punish violators of conservation laws, such as people who hunt jaguars in retaliation for cattle predation. Rather, preventative measures to prevent these conflicts from occurring in the first place are essential to maintaining good community relations as well as meeting conservation goals (Lewis 1996). This pilot project is thus a preliminary step in obtaining more assiduously the knowledge necessary to develop better conservation policies and to improve the situation of the large wildcats in this imperilled Atlantic Biological corridor of Panama by decreasing the incidence of retaliation hunting.

5. Objectives

The main goal of this project is to study jaguar and puma attacks on domestic livestock in farms of the Alto Chagres conservation area. The main objective was:

> To characterize farms with and without felid attacks and to gather data on the frequency and circumstances of these attacks and on the cases of jaguar retaliation hunting by the farmers to better understand the conflict.

This project was part of a wider effort to monitor the jaguar population in the North East of the Alto Chagres area, and more globally of the Mesoamerican Biological Corridor, in

order to determine the threats faced by this species. Our part consisted in conducting a preliminary assessment of the conflict between cattle ranchers and felids.

Specific objectives included:

- To conduct interviews with cattle ranchers and official representatives in order to characterize the farms and the region by identifying and gathering ecological, geographic, managerial and economic factors related to the conflict.
- To analyze the data collected and to find significant trends between some factors specific to farms and the number of felid attacks on the cattle.
- To analyze the data and the results in relation with the existing international literature on the subject.
- To come up with preliminary recommendations regarding the improvement and the modification of the management practices of the farms of the area.

5.1 Final products

The main final product provided to our host institution SOMASPA consists of a written comprehensive report of the farms' characterisation. This report includes all data compiled in the field and through our literature review, as well as maps, table, graphs and photos. We also created an informative poster in the context of our participation to Nuevo Tonosí farmer's market. Finally we created an informative pamphlet about our project, including preliminary recommendations that will be distributed to cattle ranchers in the area of the study (Annex XI).

6. Hypothesis

The hypothesis underlying the field work and the analysis of this report is that farms that follow the recommendations of Marchini and Luciano (2009) and of Hoogesteijn and Hoogesteijn (2010), or that are managed in a similar way, will have a lower cattle predation rate than those that do not display such characteristics. These recommendations are reproduced in Annex IX. Examples could be to exclude forested areas found within pastures, to maintain calves in corrals and have well-maintained fences.

7. Study site

The Alto Chagres conservation area is located in the province of Colón. It includes Chagres National Park, the Southern portion of Portobelo National Park (PNP), the Area Silvestre Narganá of the Kuna Yala Comarca, and the Chagres National Park buffer zone (Figure 1).

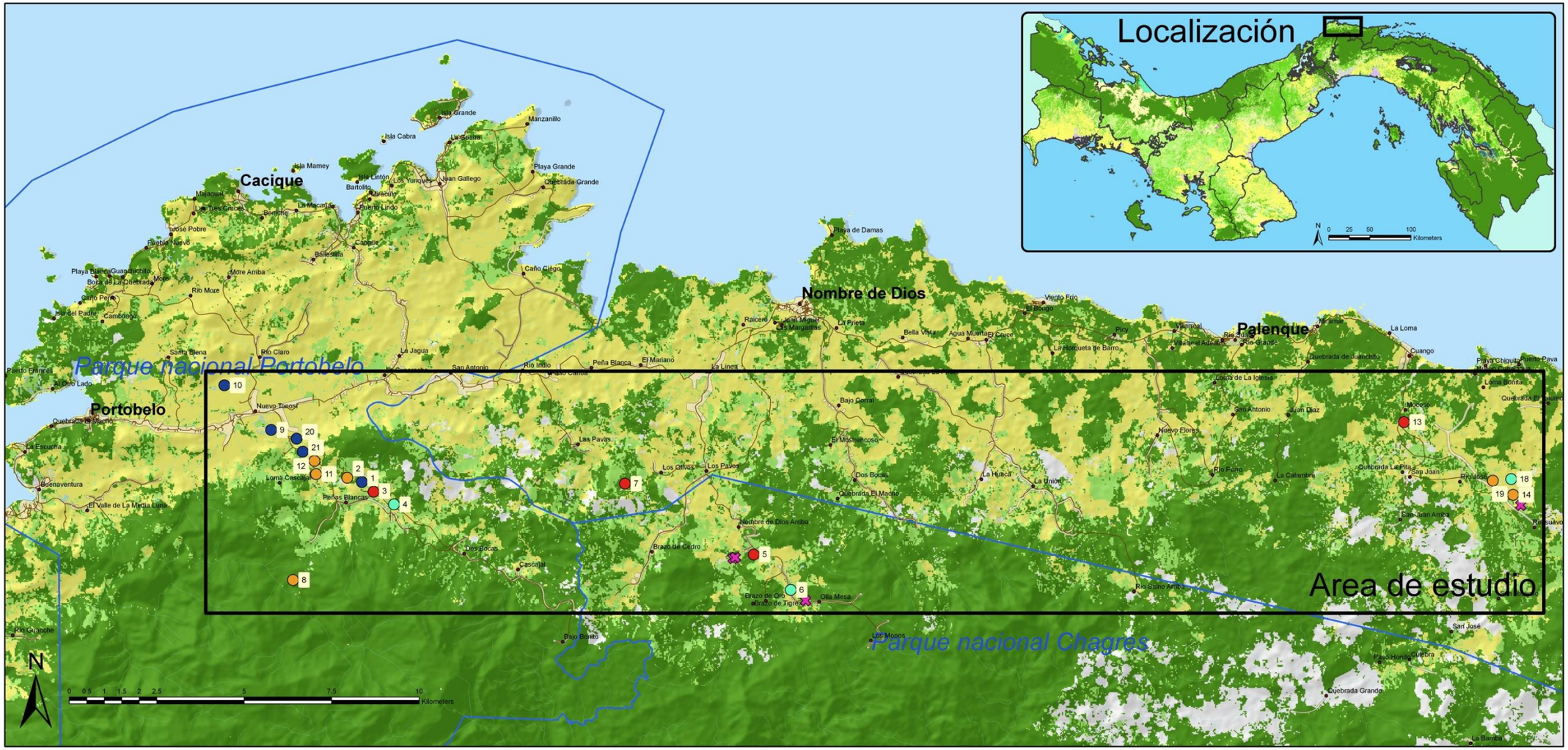
7.1 Environmental profile: Alto Chagres conservation area

Located on the Caribbean coast of Panama, this area is heavily influenced by the migration of the Intertropical Convergence Zone, whose migration over the area causes a prolonged rainy season characterized by high precipitation and low windspeeds, from May to January (Carrion de Samudio et al. 2003; Marciaga and de Maria Ramírez 2010). Recent climatic estimates state that this zone receives 3,000 mm of rain per year with an average temperature that varies from 22 to 32 °C and relative humidity of 92.45% (Carrion de Samudio et al. 2003).

Land use in the province of Colón on the whole is estimated at 90.5% forest cover (Marciaga and de Maria Ramírez 2010); this amount of forest cover or greater can be

Figure 1

Localización de las fincas visitadas con usos de tierra



Leyenda

- Lugares poblados
- Carreteras
- Rios
- Areas protegidas
- Limites de lugares poblados
- Agua
- Bosques
- Matorrales
- Potreros
- No Data
- Fincas sin ataque
- Fincas con 1-5 ataques
- Fincas con 6-30 ataques
- Fincas con más de 31 ataques
- Lugares de ataques de felinos

Los números de fincas en el mapa corresponden a los números de entrevistas realisadas

SOMASPA · Smithsonian Tropical Research Institute · McGill

Fuentes:
- Areas Protegidas de la República de Panamá, ANAM y STRI, 2008.
- Carreteras, rios, y limites poblados, ACP, 2011.
- Central America and Mexico, STRI, 2009.
- Cobertura Boscosa de Panamá - Año 2000, ANAM, 2008.
- Mapa Dinámico del Relieve de Panamá, STRI, 2008.
- Poblados de la República de Panamá - version 2011, STRI, 2011.
- Programa de monitoreo de la cuenca del canal - PMCC 2000, ACP, 2011.
- Provincias de la República de Panamá, STRI, 2008.

Mapa realizado por Laurent S. Christin, 2011

assumed for our study site as it is far from the urban center of Colón. The Chagres River is the largest in the area and flows into the Canal Zone (The Nature Conservancy 2007); most other rivers flow into the Caribbean Sea (Marciaga and de Maria Ramírez 2010). The Costa Arriba region's rivers are all relatively short, ranging from 5 to 25 kilometers in length. Topographically this zone is characterized by a very irregular terrain, dominated by hills with a 45° incline or greater (Carrion de Samudio et al. 2003).

7.2 Socio-economic profile: Colón

The Province of Colón has a population of around 204,208 inhabitants (Marciaga and Ramirez 2010). One of the major sources of income of the province is coffee, employing approximately five hundred producers, and cacao production (Ibid). In terms of animal production, Colón has a well-developed pork and egg industry; furthermore extensive cattle-ranching is an important economic activity which occupies 130,539 ha, roughly one sixth of the province's land area (Ibid). There are approximately eighteen hundred cattle farms and 7,300 animals in the province (Ministerio de Desarrollo Agropecuario 2009, cited in Marciaga and Ramirez 2010).

Farmers are mainly supported by two institutions. The BDA (Banco de Desarrollo Agropecuario) is in charge of providing financial support to farmers through bank loans for cattle purchase and farm improvements. However, Marciaga and Ramirez (2010) showed that 55% of the producers were not benefiting from any BDA support because the process of getting loans was deemed too complicated. The second institution, MIDA (Ministerio de Desarrollo Agropecuario), provides complimentary help to farmers as it brings them information, engages in capacitation training and is currently conducting research to help eliminate animal and plant diseases in farms (MIDA 2011).

7.3 Protected areas

The North and North-Eastern portion of the Alto Chagres conservation area are bisected by a road that links many villages located along the PNP and continues to Nuevo Tonosí village, where PNP administrative office is located. The road ends at the village of Santa Isabel, where it flanks Parque Nacional Chagres. This road, and consequent developments around it, represents a human presence in an otherwise largely wild area, making human-wildlife interactions more common than in other more developed areas of Panama. In this context, the threat to wildcats due to hunting as a response to livestock predation has been explicitly stated as a problem in the area (The Nature Conservancy 2007). Our study explores the extend of this conflict in farms located in the *Costa Arriba* area of the province of Colón: in the Portobelo district along the Cascajal river in Nuevo Tonosí, along the Nombre de Dios river in Nombre de Dios, in San Antonio, as well as in the Santa Isabel district along Cuango river in Playa Chiquita.

7.4 Portobelo National Park

This study is intended to collect information for this entire conservation area; however most interviews and anecdotal information is concentrated in the PNP section of the Alto Chagres conservation area, in the district of Portobelo. This park was established in 1976 as a way to protect the historically important ruins of Spanish forts, a prominent trade center for gold in the 18th century, as well as to conserve forest and marine resources, watershed quality, and scenic value of beaches. It represents 35,929 ha of protected area, one quarter of which is marine (Carrion de Samudio et al. 2003). This area hosts very high biodiversity; for example it is home to seventeen species of endemic plants and over one hundred mammals (Ibid). The villages in this area are

relatively small, with 100 to 300 inhabitants each, and are characterized by high indices of poverty (Alba and Carrion de Samudio 2003).

7.5 Chagres National Park

The second principal area of study is located within the buffer zone of the Chagres National Park in the district of Santa Isabel. The park's ecozone has been classified as an upland tropical forest and contains both cloud and semi-deciduous forest communities (Candanedo and Samudio 2005). This area is crucial in maintaining the Panama Canal watershed, as it comprises the Chagres river, the largest in the area; it is for this reason that the park was created in 1985 (The Nature Conservancy 2007). Activities relating to land use in this community affect the effectiveness of the park as a conservation area by creating either a favourable or hostile matrix for flora and fauna of the park. Similarly to the community surveyed in the Portobelo region, it hosts a rural population living in small villages.

7.6 Land tenure and demographic change: Alto Chagres conservation area

The soils in this area are poor and clayey, with readily leached nutrients and high acidity making it an unfavourable area for agriculture. Nevertheless, there has been a high development of cattle-raising in the area even if the pasture is not as high in nutrients as would be ideal for this type of agriculture. Historically, rotational subsistence agriculture has been practiced in this area by coastal inhabitants (Alba and Carrion de Samudio 2003). This is thought to be a sustainable practice on small scales. Conservationists are currently worried about the increases in cattle-raising that have occurred in this region in the past thirty years. Since the 1950s, on a national scale, Panama has been increasing cattle production. In the early years of this phenomenon the centers of cattle-raising were the arid Western provinces of Chiriquí, Veraguas, Herrera, and Los Santos

(Kaimowitz 1996). When land became scarce in these provinces following this boom, migration to Panama and Colon provinces began, leading to expansion in cattle production in these areas beginning in the 1960s. By the early 1990s 1.5 million hectares were dedicated to cattle pasture, up from 0.5 million in the 1950s, with the majority of this new development taking place in Panama and Colón provinces (Ibid). This expansion has been named a main cause of the 37.9% loss in forest cover seen in the PNP between 1975 and 1991 (Alba and Carrion de Samudio 2003).

The main driver of land use change in the area is thought to be immigration. While official censuses state the majority of the population being of Afrocaribbean descent (Alba and Carrion de Samudio 2003), in a 2010 study 51% of farm owners interviewed in the Costa Arriba region were recent immigrants from Los Santos Province (Marciaga and Ramirez 2010). The increased numbers of inhabitants from the interior has changed the area significantly. This can be observed in many cultural factors such as the prominence of Santeño dress, for example the woven cowboy hats, as well as cultural events where traditional *murga* and *ranchera* music are prominent components of festivities. This demographic shift and its ensuing land use changes are prominent factors in the increased contact between humans and jaguars as cattle ranch development continues to encroach on jaguar habitat.

The parks vs. people debate is particularly interesting in this area of study due to the timing of migrations. It is argued that conservation areas are unethical such that they threaten the livelihoods of inhabitants previously occupying the area in question. While the area encompassed by the PNP has hosted inhabitants for the past four hundred years, only half of the population in the area was present before the park's

establishment in 1976 (Carrion de Samudio et al.2003). Furthermore, the majority of the migrations to this area were from the prospective cattle ranchers, who are the current focus of this study. Thus, as the areas within the park were settled in the supposed assumption that the park regulations would be followed it is crucial that a way is found for *ganaderos* to comply with park regulations, the main objective in this case being peaceful coexistence with jaguars whom the park is intended to protect.

8. Method

Before starting the project, meetings with the host institution SOMASPA were organized in order to understand and internalize the proposed research project. One of these meetings was dedicated to a detailed review of the questionnaire prepared by and revised with SOMASPA. Prior to any kind of on-site investigation, a thorough secondary data review was also performed. This literature review comprised suggested readings provided by the host organization as well as other documents found through individual research. Maps of the study site were obtained through the help of ANAM, PRONAT and ACP offices. Following this, the data collection pertaining to the conflict between cattle ranchers and wildcats was performed through meetings, interviews and surveys in the study area.

8.1 Preliminary meetings and informal interviews

Preliminary meetings were first organized with several institutions and government authorities in order to introduce our research project and seek collaboration. We introduced ourselves to the local ANAM, PRONAT and MIDA offices as they were thought to have the most access to cattle ranchers and related information; they also served as a link to the community of our study site. We also conducted informal

interviews with local people, ranchers or otherwise. Furthermore we interviewed community-based organizations representatives, such as a farmers' organization ANAGAN ex-representative, a highly influential person in the community with regards to cattle ranching policy. These meetings involved prior preparation of introductory remarks for the interviews to ensure that all parties are aware of SOMASPA's objectives and of the final expected products of these interviews (Annex II). We also prepared general questions to ask, but these informal interviews were conducted as semi-structured interviews or, sometimes, as simple conversations (Annex V). These preliminary interviews and meetings allowed us to get a general sense of the history of the conflicts in the region, as well as the general opinion of the local people on the topic. Additionally, it allowed us to collect some names of potential interviewees.

8.2 Farm surveys

We then conducted 21 farm surveys, interviewing farm owners, managers or employees depending on availability and with preference for highest-level administrators, and we visited 15 of these farms to make direct observations in the form of notes and photographs of the factors of interest. We interviewed ranchers that have had in the past or continue to have problems with jaguars as well as other ranchers that have not had such problems. Having information from both types of farms, those with and without attacks, allowed for the potential identification of which factors favoured felid attacks on cattle as possible comparisons could be made. Attacks that took place as far back as 2005 were considered for our analysis and thus only these attacks were discussed in the questionnaire (Annex III).

Because we did not have a complete map of the farms located in our study site, and because the farms were difficult to access, we used a snowball sampling technique in order to select potential interviewees. We started with a list of some potential interviewees compiled by our informant and guides. By talking to these originally-named *ganaderos* and other people of the region, we were able to gather more and more names. As the farms were located far into the mountains, at long walking-distances from the main road, we collaborated with a local guides to travel to the farms of interest. These guides also facilitated the process of making interview arrangements by contacting some of the interviewees in advance. We also interviewed some ranchers met on our way to visit the predetermined farms.

In order to meet more potential interviewees, we participated in the annual feria of Nuevo Tonosí. This allowed us to make our project better known in the community and spread environmental education about jaguar-farmers' conflict (Annex VII).

Each interview lasted between 25 and 45 minutes using the questionnaire provided by SOMASPA. When an interviewee was encountered, the interviewers presented themselves and the objectives of the project. The interviewee's rights with respect to free prior and informed consent were reviewed in a comprehensible way in accordance with McGill University ethics policies. The cattle rancher being interviewed was asked questions orally as not all interviewees were literate; similarly the consent form was read aloud. Direct observations of the farm were also recorded by a student who was not conducting the interview. GPS coordinates were recorded and pictures of the physical characteristics of the farm were taken. This system allowed for maximum efficiency upon arrival at the farm so that the most possible farms could be surveyed on a given day.

8.3 Factors related to felid predation on cattle

Farm surveys were based on five factors to determine their relation to wildcat livestock predation rate. These include management, economic, ecological, social and political factors (see **Error! Reference source not found.**Table 1 for complete list).

a) Management and Economic factors

Other studies have shown that higher level of feline predation on cattle was correlated to management practices and economic factors. We looked at farm characteristics such as herd size, number of calves farm size, type of ranching and type and quality of fences. Management and economic factors are intrinsically linked as financial capital determines the possibility of management improvement, such as the ability to install new fences. Similarly, conflict with jaguars and other wildcats due to poor management directly affects the economic gains of ranchers, as loss of cattle can lead to economic losses and debt problems.

b) Ecological factors

The availability of wild prey species for large felines is a determinant ecological variable in the management of predation conflict. Hunting activities in and around the farm can considerably affect the availability of these prey species. Moreover, landscape characteristics such as forested area and rivers into the farm or topography are ecological variables that could influence the quantity of attacks.

c) Social and Political factors

Understanding the perception of the communities and cattle-ranchers affected by the problem of felines predation is essential in the resolution of this conflict. Locals' attitude and perception can however be hard to predict and also depend on their

knowledge of the animal and by the level of conflict in their farms. As ranchers are a key part in the management of situation, it is important to make sure to take their perception into consideration.

Moreover, ranchers' opinions about political institutions that are involved in the conflict or that could be involved in the management of the conflict were recorded. Attitude towards institutions such as ANAM, MIDA or BDA is an important factor to take into consideration in order to evaluate how well such institutions are serving stakeholders' needs and to come up with future opportunities for conflict resolution (Gordillo Chávez 2010).

8.4 Data compilation and analysis

Data was compiled in an Excel spreadsheet and analysis was performed with the JMP 8 statistical analysis program in order to determine which factors favoured the felids attacks in farms. In the Excel file, each row corresponded to one farm, and each column corresponded to a question or one choice from a multiple-choice question. Numeric answers as well as developed answers and comments were entered in the file as they were, while multiple-choice answers and yes/no answers were entered in a binominal form (1 for yes and 0 for no). Descriptive data was compiled using Excel.

We based the analysis on the five factors described above. For the purpose of analysis, farm characteristics were first plotted as a function of number of attacks in relation to quantitative characteristics, for example number of attacks was plotted against farm size. This was done as a preliminary step to identify trends. Second, farms were grouped according to degree of attack frequency. Four categories were used: farms with

no attacks, those with 1-5 attacks, those with 6-30 attacks, and those with 31 attacks or more. This second data compilation method was used for statistical analysis.

A single factor ANOVA test, with $\alpha = 0.05$, was performed to determine the variation between and within groups in order to determine whether there was a statistically significant difference between farm characteristics for farms belonging to each group.

Those results are then intended to serve SOMASPA in making recommendations for farm management techniques that would reduce attacks on livestock.

8.5 Ethical considerations

Ethical considerations were seriously taken into account in the development and application of our research project. We followed McGill code of conduct as stated in the *Policy on the ethical conduct of research involving human subjects* (McGill 2008). Before each interview, the objectives of the study were stated, and each participant was asked to read and sign a written consent form if they agreed to be interviewed (Annex I). In addition to the consent form, the interviewers informed orally the participant about their rights: their rights to ask questions before, after and during the interview; to withdraw from the interview at any moment during the interview and to decline to answer any of the questions. Contact information of the interviewers and the host institution were provided to the participants in case they had additional questions, wanted to provide more information, or wanted to withdraw from the research. Moreover, we made sure the information provide by the interviews, and interviewees' identity, would stay confidential.

8.6 Working time involved for the project

We spent 33 days in total working on the project. We were in the field, doing formal or informal interviews and meetings (including the time spent at the feria) a total of 14 days.

The other 19 days were spent either at SOMASPA office, at STRI library or at home doing research. The chronogram of the activities gives more detail on the schedule of our research work (Annex XII).

9. Results

9.1 Characterization of farms

Through collaboration with cattle ranchers to fill out the questionnaire for each farm visited, it was possible to characterize 21 farms in the Alto Chagres region (Table 1).

In the area surveyed, 16 out of the 21 farms had experienced livestock predation by a wildcat of some kind (Figure 2 and Figure 3). Of these attacks, 87% were attributed to jaguars (Figure 4).

Felid attacks on the whole were shown to be relatively uniformly distributed through time, with the most attacks taking place in December and 60% of attacks occurring during the dry season (Figure 5). The most commonly preyed upon animal was the calf (Figure 6). Also, the majority of farmers report attacks occurring at night (personal communications, Nombre de Dios March 3, Playa Chiquita April 15 and 16 2011).

9.1.1 Management factors

Farm size was extremely variable, the smallest farm being 3 ha and the largest being 1450 ha. There was no relationship between farm size and number of attacks.

Fence height was relatively uniform across all farms, at 1.5 m on the whole. No effect was seen on attack frequency in relation to fence height. Type of fencing was also uniform, with all farmers using barbed wire fencing. Only two farms had electric fencing; they both experienced jaguar attacks.

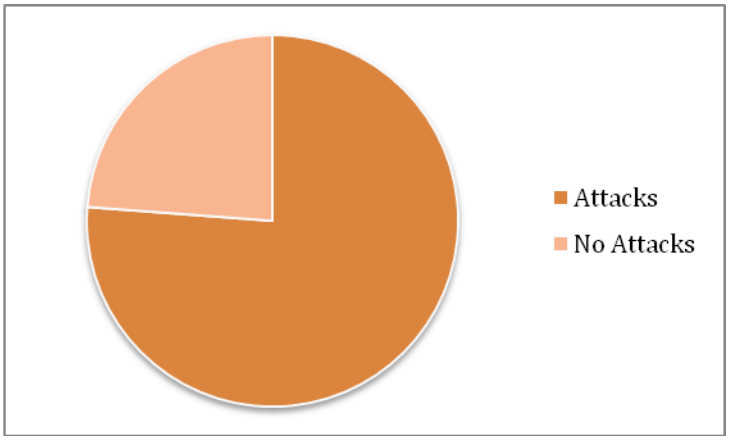


Figure 2. Proportion of farms experiencing felid attacks in the Alto Chagres area in Panama

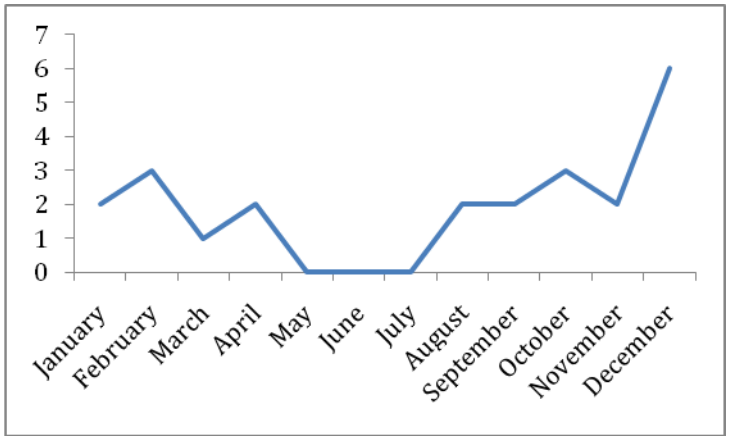


Figure 5. Frequency of felid attack per month in the Alto Chagres area in Panama

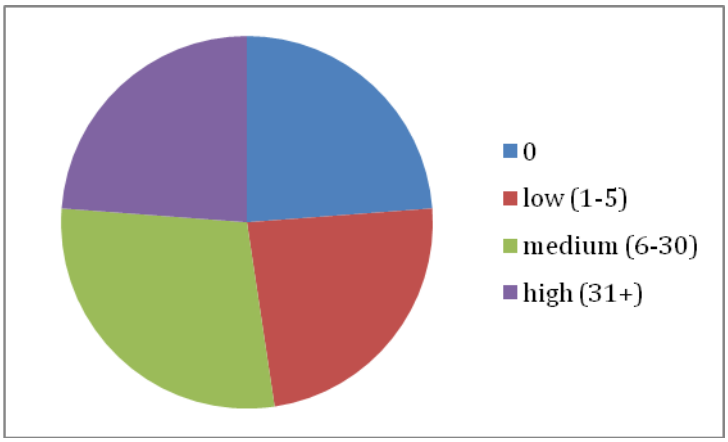


Figure 3. Proportion of farms experiencing varying degrees of felid attacks in the Alto Chagres area in Panama

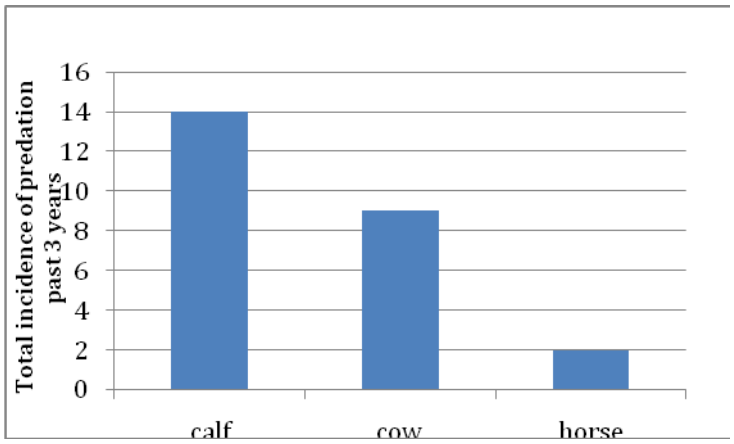


Figure 6. Incidence of felid predation on different animals in the Alto Chagres area in Panama

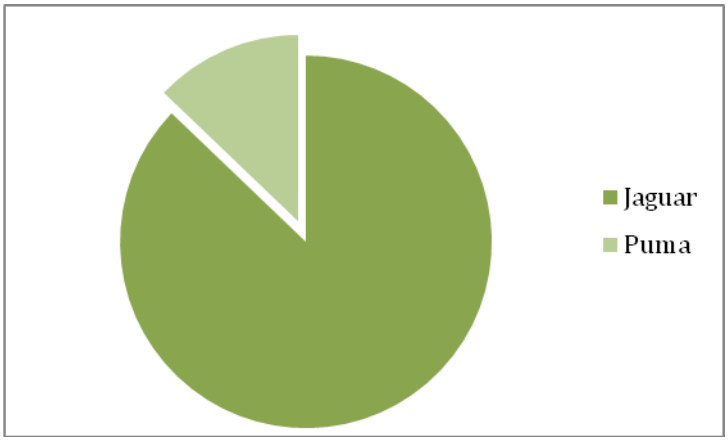


Figure 4. Proportion of livestock attacks attributed to jaguars vs pumas in the Alto Chagres area in Panama

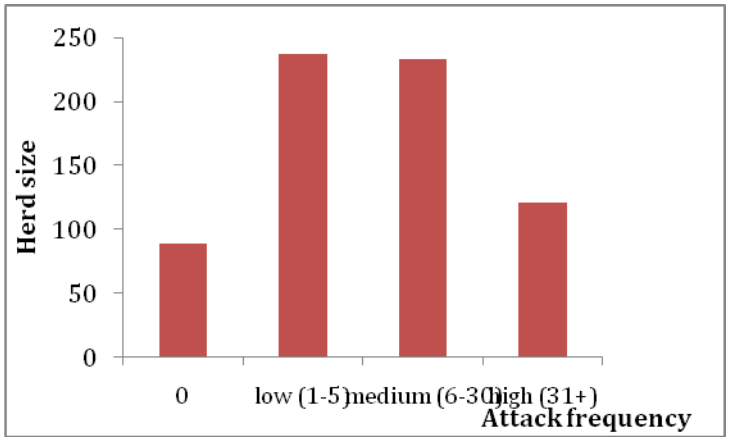


Figure 7. Average frequency of jaguar attacks in relation to herd size in the Alto Chagres area in Panama

Table 1. Characterization of the 21 visited farms

Caracterización de las fincas ganaderas							
	finca 1	**finca 2**	**finca 3**	**finca 4**	**finca 5**	**finca 6**	**finca 7**
Número de ataques	0	3	65	20	78	13	109
por Jaguar o Puma	n/a	jaguar	jaguar	jaguar	los dos	jaguar	los dos
Factores economícos y de manejo							
Caracteristicas de la finca							
Número de personas encargadas	2	5	4	2	5	1	1
Superficie de la finca (ha)	35	73	81	53	120	85	242
Typo de ganadería	cría y carne	cría y carne*	cría y carne	cría y carne	cría y carne	cría y carne	carne y leche
Tamaño del hato	30	63	161	50	75	34	202
Número de ternero	6	12	40	12 o13	24	10	60
Cerca de púas							
material	poste/viva	poste	poste/viva	poste/viva	poste/viva	poste/viva	poste/viva
Altura (m)	1.2	1.8	1.5	1.8	1.2	1.2	1.4
Condición de las cercas	buena	regular	regular	regular	regular	regular	buena
Manejo							
Ganado duerme en potrero/corrales	potrero	corrales	potrero	potrero	potrero	potrero	potrero
Ganado entra el bosque	no	no	si	si	si	no	si
Uso del veterinario	no	si	si/anual	si/anual	si /anual	si	si
Crías nacien en potrero/corrales	potrero	corrales	potrero	potrero	potrero**	potrero	potrero
Meses con más nacimientos	variable	agost.-novi.	diciem.-enero	marzo-mayo	todo el año	septiembre	enero-marzo
Factores ecologícos							
Superficie de bosque (ha)	15	65	34	25	5	60	35
Topografía	ondulada	ondulada	ondulada	ond. y plana	ondulada	ondulada	ondulada
Quebrada a dentro de la finca	si	si	si	si	si	si	si
Cacería de presas silvestres	si / mensual	no	si / bianual	si / mensual	si/ a veces	si/ a veces	no
Factores sociales							
Opiniones sobre los felinos							
Beneficioso o dañinos	dañinos	dañinos	dañinos	dañinos	dañinos	dañinos	dañinos
Convervar o eliminar	conservar	conservar	eliminados	conservar	eliminados	conservar	conservar
Aprobación a cambiar manejo	si	no	no	si	no	si	si

*unica finca con chivos y no vacas

** potrero cerca de la casa

Caracterización de las fincas ganaderas (continuación)							
	finca 8	**finca 9**	**finca 10**	**finca 11**	**finca 12**	**finca 13**	**finca 14**
Número de ataques	1	0	0	2*	1	100	2
por Jaguar o Puma	jaguar	n/a	n/a	jaguar	jaguar	los dos	los dos
Factores economícos y de manejo							
Caracteristicas de la finca							
Número de personas encargadas	4	3	1	2	4	3	2
Superficie de la finca (ha)	34	160	36	8	98	250	192
Typo de ganadería	carne y leche	carne y leche	carne y leche	carne y leche	leche	cría y carne	cría y carne
Tamaño del hato	20	300	80	25	165	110	40
Número de ternero	0	70	16	10	2	20	10
Cerca de púas							
material	poste/viva	poste/viva	cerca viva	cerva viva	cerca viva	poste	poste/viva
Altura (m)	1.5	1.5	1.2	1.8	1.5	1.2-1.8	1.2
Condición de las cercas	buena	buena	regular	buena	buena	regular	buena
Manejo							
Ganado duerme en potrero/corrales	potrero	potrero	potrero	potrero	potrero	potrero	potrero
Ganado entra el bosque	si	no	si	si	potrero	si	si
Uso del veterinario	no	no	no	no	si/ mensual	si	no
Crías nacien en potrero/corrales	n/a	potrero	potrero	potrero	potrero	corrales	potrero
Meses con más nacimientos	n/a	todo el año	enero	enero	marzo	enero-marzo	todo el año
Factores ecologícos							
Superficie de bosque (ha)	10	10	1	5	12	150	110
Topografía	ondulada	ondulada	plana	ondulada	ondulada	ondulada	ondulada
Quebrada a dentro de la finca	no (a fuera)	si	si	si	si	si	si
Cacería de presas silvestres	si / a veces	si/ a veces	si/mensual	so/ a veces	si / a veces	si/quincenal	si / a veces
Factores sociales							
Opiniones sobre los felinos							
Beneficioso o dañinos	dañinos	dañinos	dañinos	dañinos	dañinos	dañinos	dañinos
Convervar o eliminar	conservar	eliminar	depende	conservar	depende	controlar	conservar
Aprobación a cambiar manejo	si	ind.	depende	si	si	si	si

* hace 8 años: finca considerada sin ataque

Caracterización de las fincas ganaderas (continuación)							
	finca 15	**finca 16**	**finca 17**	**finca 18**	**finca 19**	**finca 20**	**finca 21**
Número de ataques	17	23	38	30	4	0	0
por Jaguar o Puma	jaguar	los dos	los dos	los dos	los dos	n/a	n/a
Factores economícos y de manejo							
Caracteristicas de la finca							
Número de personas encargadas	2	3	2	2	5	1	1
Superficie de la finca (ha)	300	250	128	560	1450	16	36
Typo de ganadería	carne	carne	cría y carne	cría y carne	cría y carne	carne	cría
Tamaño del hato	350	46	58	270	1105	24	10
Número de ternero	60	6	20	65	167	5	3
Cerca de púas							
material	poste/viva	poste	poste	viva/electrica	poste/electrica	poste	poste
Altura (m)	1.7	1.5	1.3	1.5	1.5	1.5	1.3
Condición de las cercas	buena	buena	buena	buena/mala	buena	buena	buena
Manejo							
Ganado duerme en potrero/corrales	potrero	potrero	potrero	potrero	potrero	potrero	potrero
Ganado entra el bosque	no	no	si	no	si	no	si
Uso del veterinario	si / anual	si	no	si	si/semestral	no	no
Crías nacien en potrero/corrales	potrero	potrero	potrero	potrero	potrero	potrero	potrero
Meses con más nacimientos	todo el año	variable	todo el año	verano	todo el año	verano	todo el año
Factores ecologícos							
Superficie de bosque (ha)	50	100	30	400	720	0	20
Topografía	ondulada	ondulada	ondulada	ondulada	plana y ond.	ondulada	ondulada
Quebrada a dentro de la finca	si	si	si	si	si	si	si
Cacería de presas silvestres	no	si	si /mensuel	si/ a veces	si / a veces	no	si
Factores sociales							
Opiniones sobre los felinos							
Beneficioso o dañinos	dañinos	beneficiosos	dañinos	dañinos	dañinos	dañinos	dañinos
Convervar o eliminar	conservar	eliminar	conservar	conservar	conservar	eliminados	eliminados
Aprobación a cambiar manejo	si	si	si	si	si	ind.	si

Herd size was highly variable and showed a bell curve distribution in relation to amount of attacks (Figure 7). Also, it should be noted that farms with less calves at the time of attack were less likely to experience jaguar attacks, with the farms that experienced no attack having the lowest average amount of calves (Figure 8).

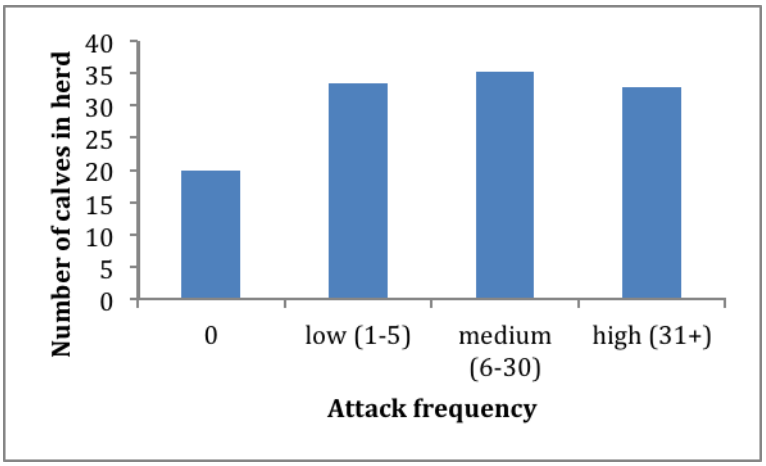


Figure 8. Frequency of jaguar attacks in relation to number of calves in herd

Bringing animals in from the pasture at night was not evaluated as this practice was not done on any of the farms visited. The method of having cattle give birth in a designated maternity pen was practiced on two of the farms visited and these both had suffered jaguar and puma attacks.

9.1.2 Ecological factors

It was noted that the presence of jaguar prey was not a determining factor in deterring jaguar attacks. In fact, farms with more intact prey populations tended to be those that experienced more attacks (Figure 9). Many farmers noted a decrease in *venado cola blanca* (white-tailed deer, *Odocoileus virginianus*) presence. According to them, this species was once plentiful in the region, and now has only been seen recently on 19% of farms surveyed.

It was found that hunting of jaguar prey by humans occurs on most farms and had no correlation with jaguar attack frequency (Figure 10).

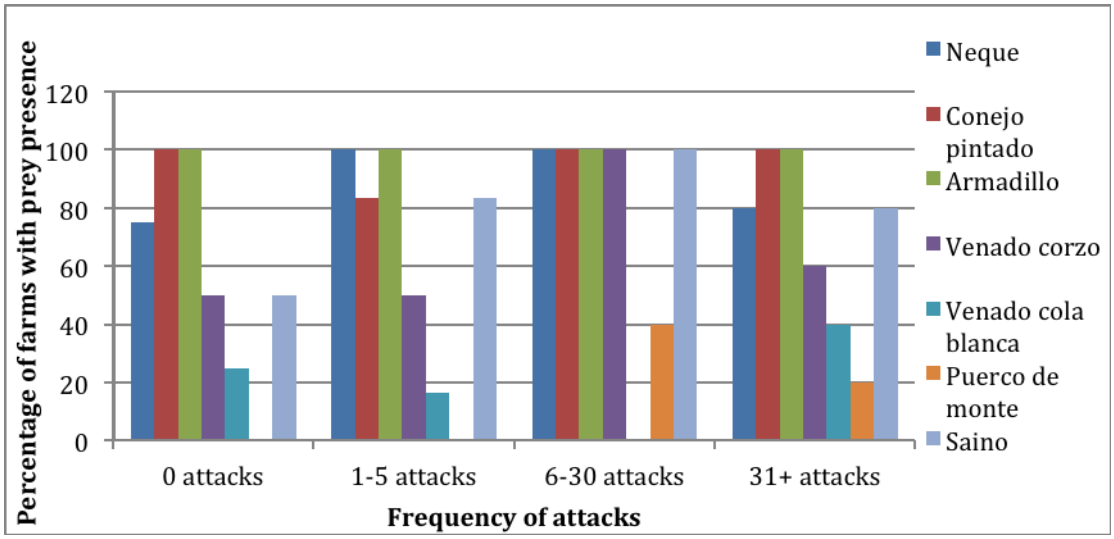


Figure 9. Presence of jaguar prey species near farms with varying degrees of attack frequency

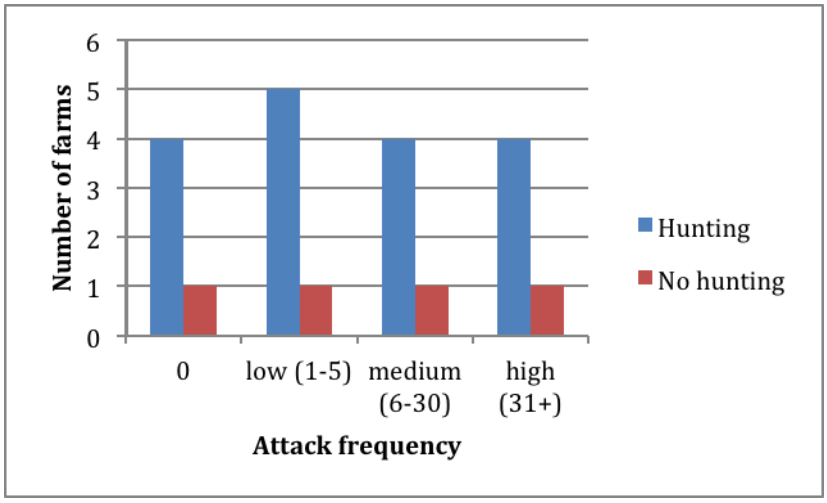


Figure 10. Incidence of hunting on farms of different degrees of predation

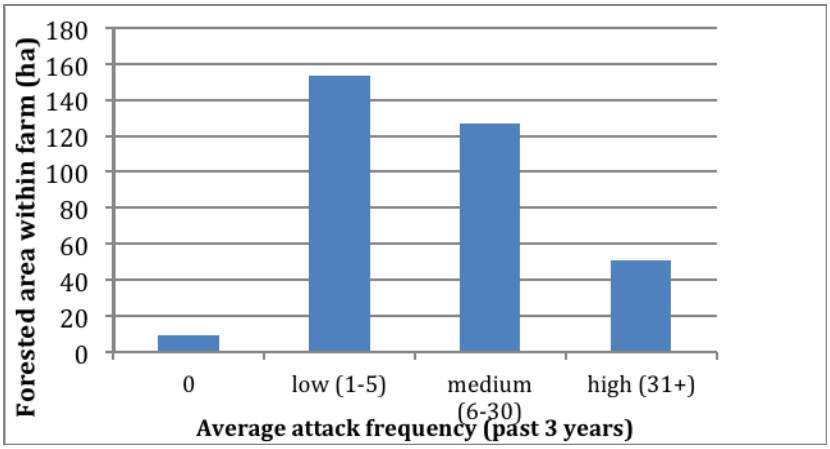


Figure 11. Incidence of jaguar attacks in relation to amount of forested area

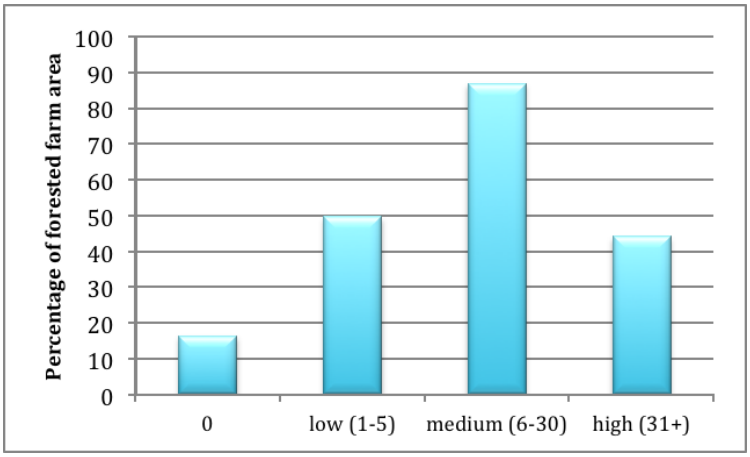


Figure 12. Incidence of jaguar attacks in relation to percentage of forested farm area

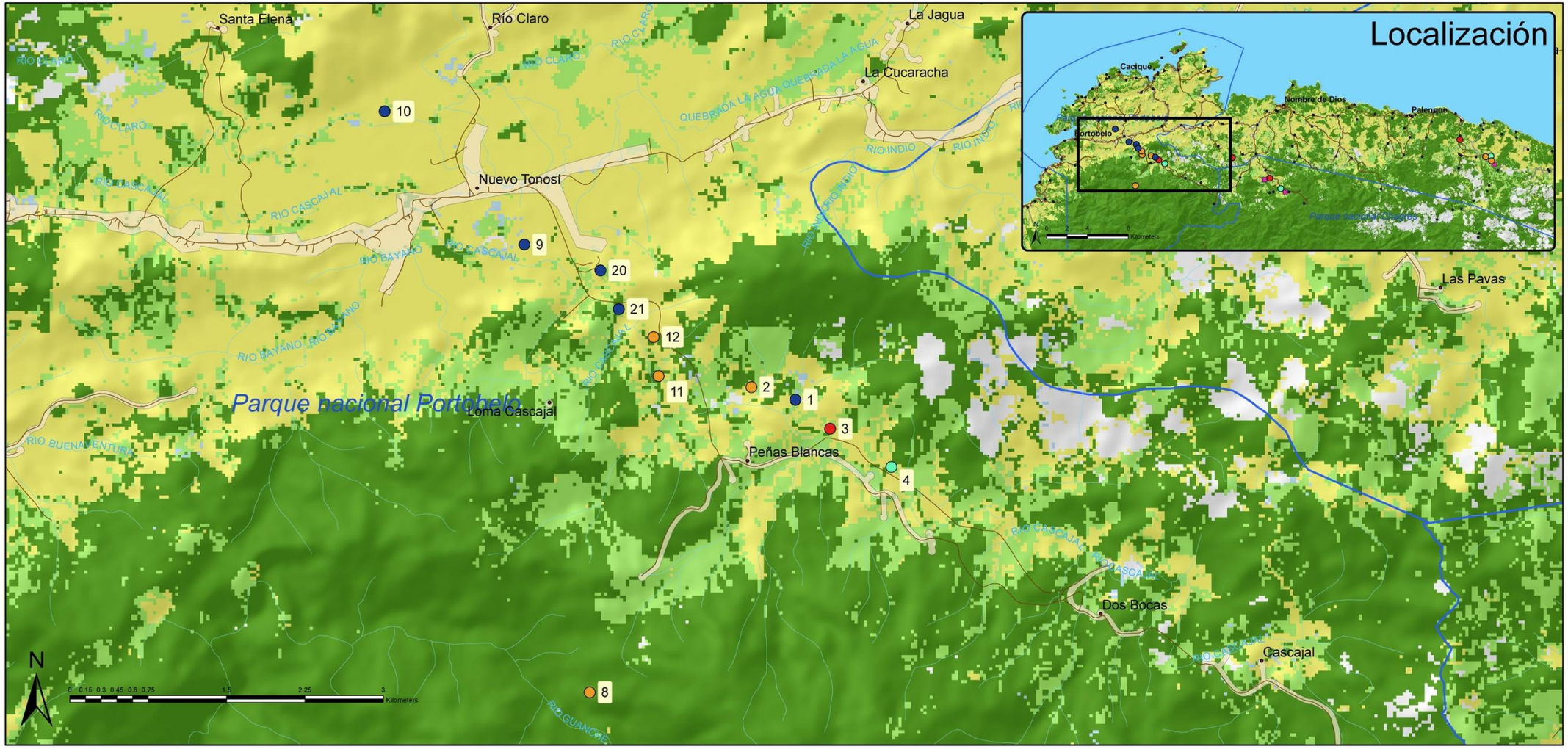
All farms were near a water source such as a stream or river, and this is where cattle obtained their water almost exclusively. Only two farms had troughs in addition to the natural water source, but it was stated that they were not used on a large scale.

The amount of forested area in the farms varied greatly, as did the percentage of forested area (Figure 11 and Figure 12). It was shown that the farms with no attacks had the least forested area in total and in proportion to the total area of the farm on average.

The most important factor, indeed the only one that showed a clear relationship, was the land use surrounding the farms, a distinction being observed mainly between pasture lands and forested areas. As can be seen on the map of the study area (Figure 1), 4 out of the 5 farms that did not suffer attacks are located in the highly pastured area of Nuevo Tonosí, where almost no patches of forested areas or of bushes areas can be seen. It is also to be noted that farms 2, 11 and 12, which suffered a small number of attacks, are located close to this area, in a landscape still highly composed of pasture lands. The situation is different at the other farms of the study area: further South up the river, away from the road and other human settlements and closer to the core of the Conservation Area, farms experienced varying degrees of attacks but none had avoided attacks entirely (Figure 13). Similarly, in Nombre de Dios, the three farms visited were far up the river and far from other human settlements and all had experienced attacks (Figure 14a).

Figure 13

Localización de las fincas visitadas en el area de Nuevo Tonosí



Leyenda

- Lugares poblados
- Carreteras
- Rios
- Areas protegidas
- Limites de lugares poblados
- Agua
- Bosques
- Matorrales
- Potreros
- No Data
- Fincas sin ataque
- Fincas con 1-5 ataques
- Fincas con 6-30 ataques
- Fincas con más de 31 ataques

Los números de fincas en el mapa corresponden a los números de entrevistas realisadas

SOMASPA · Smithsonian Tropical Research Institute · McGill

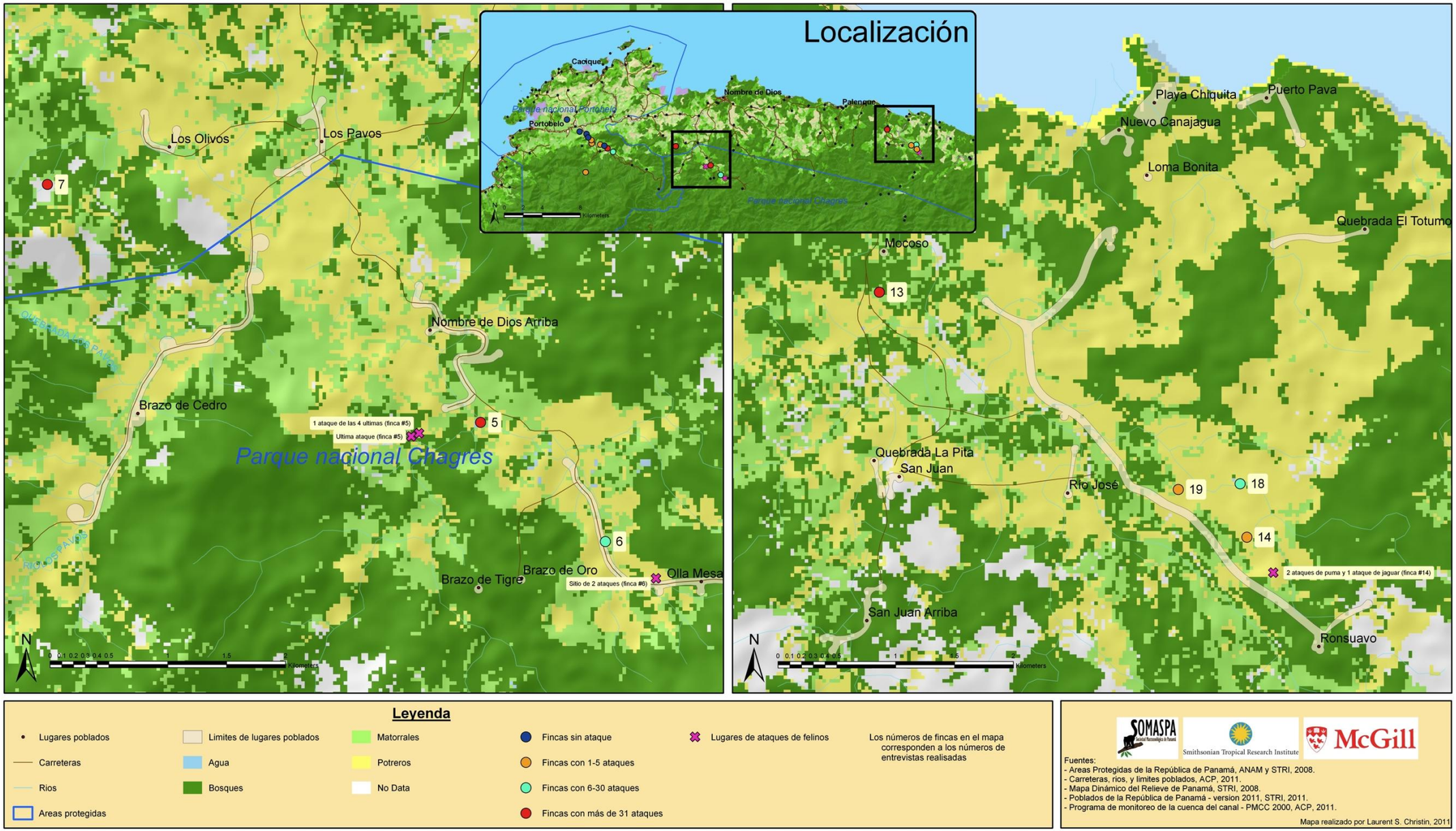
Fuentes:
- Areas Protegidas de la República de Panamá, ANAM y STRI, 2008.
- Carreteras, rios, y limites poblados, ACP, 2011.
- Mapa Dinámico del Relieve de Panamá, STRI, 2008.
- Poblados de la República de Panamá - version 2011, STRI, 2011.
- Programa de monitoreo de la cuenca del canal - PMCC 2000, ACP, 2011.

Mapa realizado por Laurent S. Christin, 2011

Figure 14 a & b

Localización de las fincas visitadas en el area de Nombre de Dios

Localización de las fincas visitadas en el area de Playa Chiquita



In Playa Chiquita, all four farms visited, as well as all three other farms where interviews were conducted but farms not visited, suffered wildcat attacks. These farms are located in a more remote area, where more patches of forest are present (Figure 14b), similar to the Nombre de Dios surveyed area.

9.1.3 Economic factors

Access to a veterinarian was set as a proxy for the support given to the farm from organizations such as MIDA, which provide these services. It was shown that farms with more support did not necessarily have a lesser likelihood of experiencing jaguar attacks on livestock. In fact, no farms that avoided attacks entirely had access to a vet (Figure 16).

The amount of people working on the farm was a proxy for wealth of the farm owner, whereby the ability to employ more help shows higher economic capital. The amount of people employed varied greatly between farms, ranging from 1 to 250, with an average of 15 employees per farm; this had no discernible effect on jaguar attack frequency (Figure 15).

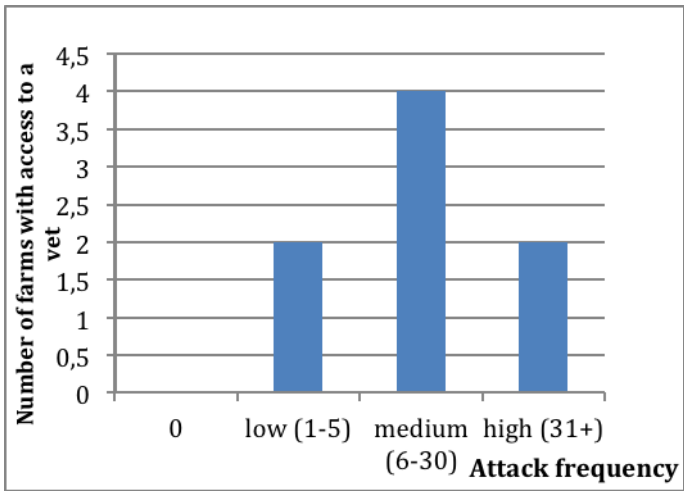


Figure 16. Incidence of jaguar attacks in relation to access to a veterinarian

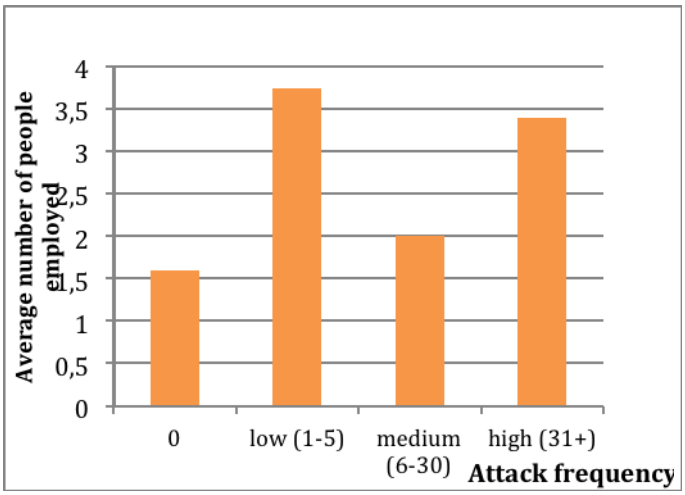


Figure 15. Incidence of jaguar attacks in relation to number of people employed by the farm

9.1.4 Statistical significance

The extreme irregularity of characteristics between farms was such that causal relationships could not be drawn between these management characteristics and frequency of felid attacks. ANOVA tests for all characteristics showed no significant difference in the frequency of attacks under different management techniques. The amount of forested area within the farm, for example, seemed to show a negative correlation to jaguar attack frequency (Figure 11). Upon further examination, it can be seen that the variance is extremely high within groups; with P=0.50803 the difference between groups of different attack frequency is not statistically significant (Table 2).

Table 2. ANOVA single factor - Forested area

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	6	922	153,6667	78662,67
Column 2	5	635	127	24020
Column 3	5	254	50,8	3225,7
Column 4	5	46	9,2	75,7

ANOVA

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	71440,21	3	23813,4	0,805469	0,50803	3,196777
Within Groups	502598,9	17	29564,64			
Total	574039,1	20				

9.2 Social factors

9.2.1 Perception of cattle ranchers

Cattle ranchers had a very negative view of jaguars and felids in general. Predation by jaguars on cattle and other domestic animals is a well-known problem in the community; nineteen of the twenty-one people interviewed either directly experienced attacks on

their livestock or had heard of such attacks occurring on nearby farms. Only one interviewee said that he perceived jaguars as beneficial to humans and ecosystems. Two people said that jaguars could be both beneficial and damaging. The remaining eighteen believed that jaguars are a strictly damaging force in the region. It made no difference in this perception whether the interviewee's livestock had suffered attacks or not. In fact the only cattle rancher who maintained that jaguars are beneficial had experienced twenty-three jaguar attacks on his livestock. All of the cattle ranchers who had never experienced jaguar attacks still believed jaguars to be damaging.

With regards to beliefs of actions that should be taken, a total of seven cattle ranchers said they felt that jaguars should be eliminated. Again, this had nothing to do with whether the attacks were experienced firsthand. Four out of the five interviewees with no attacks on their farm believed that jaguars should be eliminated, more than in any other group (Figure 17).

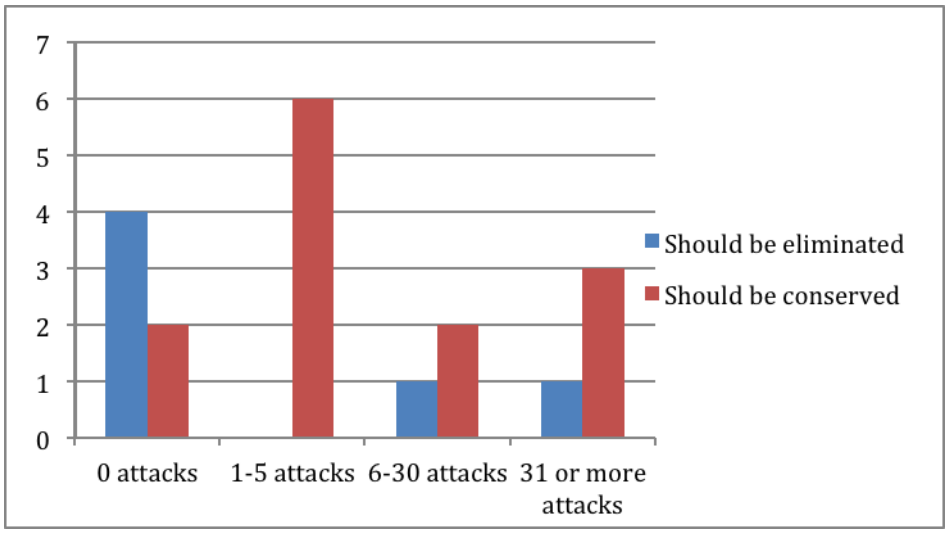


Figure 17. Cattle ranchers' opinion on whether jaguars should be conserved or eliminated in the Alto Chagres conservation area in Panama

When asked about direct action taken by farmers to mitigate the attacks, ten had killed at least one jaguar. Two of the ranchers who had never experienced an attack on their farm

had killed a jaguar in anticipation of the problem.

For a full list of opinions expressed by interviewees on this subject, please see Annex VI.

9.2.2 Cultural mythology related to jaguars

During the completion of the questionnaires, it became clear that there are several factors at play in the creation of a cultural mythology surrounding jaguars and other felids. Firstly, it was noted that there is a great variation in the knowledge possessed by cattle ranchers for felid identification. There are two words to describe jaguars and puma, these being *tigre* and *león*, respectively. These terms were taken to be relatively fixed, but at times cattle ranchers had heard only of *tigres* and called both puma and jaguars by this name. Most knew that pumas are smaller and tend to attack smaller animals, and still others knew a great deal about which parts of animals pumas attack as contrasted with jaguars, and that pumas tend to cover their prey with leaves.

Secondly, perceptions of the origins of jaguar populations in the region were often expressed during interviews. Many people believe that jaguar populations have increased to a problematic extent following their release from zoos. Others think that jaguars were intentionally released in the protected area as an environmental management technique. It is also thought that in recent decades jaguar populations in rural Panama on the whole have increased in times of conflict. It was expressed that as human food systems failed to meet demands in city centers more jaguar prey species were hunted for human subsistence, driving jaguar populations into the mountains (personal communication, Nuevo Tonosí February 10th, 2011).

Finally, the legitimacy of jaguars' presence in the protected area was a highly contested issue. Most people believe that since this is a nature preservation area the jaguars have a right to be there and ways need to be found to coexist with them. A small group believed that the jaguars should be relocated to another protected area; the worry was expressed by some of this group that this would simply be relocating the problem that they are currently experiencing. One person insisted that the jaguars should stay within the forest core, his farm was for human use and the jaguars have an entire forest to inhabit. Finally, many people reported that felids are not "rational", since they not only kill one of their cattle and eat all its meat, but rather kill many animals and only eat some of their meat. It was also suggested that livestock hunting by jaguars and other felids is done out of greed or malicious intent for this same reason.

10. Discussion

10.1 Management factors

In the scope of this project it was not possible to isolate any management factors as responsible for high incidence of jaguar attacks. We were able to identify three explanations for this: uniformity of certain management practices, small number of farms located in danger zones, and unexplored factors.

Firstly, it was not possible to verify best management practices recommended in the literature as these were uniformly not applied across all or most farms. For example, one recommendation for predation avoidance is to place cattle in pens or close to inhabited areas at night as jaguars tend to hunt nocturnally (Marchini and Luciano 2009). None of the farms visited followed this practice. Similarly, on 19 of the 21 farms visited the calves were born in the pasture, against previous recommendations that state that for safety

reasons they should be kept in maternity pens as they are at their more vulnerable stage (Marchini and Luciano 2009). Indeed, over half of the attacks were determined to be on calves and young cows rather than adults (Figure 6).

All animals were provided water through natural water sources such as streams and rivers. This is thought to increase likelihood of jaguar predation as these are often points of entry into farms by jaguars as they provide a flat terrain in contrast with steep slopes that are characteristic of the region (personal communication, Playa Chiquita April 16th, 2011). It is also thought that cows and other potential prey species are more vulnerable when bent over and drinking as they are less ready to escape should they be attacked (Sigfried and Underhill 1975). It would have been interesting to test whether this water source factor had an effect on jaguar predation frequency but again there were no farms that used troughs exclusively and thus the comparison could not be made.

Electric fences are often recommended as a method to control jaguars (Marchini and Luciano 2009; Hoogesteijn and Hoogesteijn 2010). This practice was followed on a very limited scale, with two farms using one strand of electric fence on an estimated 30 m of fencing. This small amount was disregarded as a factor, as over 90% of fencing was not electrified and provided ample other points of entry for felids and other animals. Furthermore, the electrified sections were design to prevent cattle exiting the pasture fields rather than to prevent felids entry; one strand of wire would not prevent any felid from passing underneath nor to jump it. Thus this factor was disregarded.

Since no farms followed the aforementioned recommendations, it was impossible to compare the management techniques across farms with different levels of jaguar attacks; we could not verify the validity of these recommendations for the region.

Secondly, there was a limited number of farms located far away from the road towards the park, what we deemed as the “danger zone” (see farms 1, 2, 3, 4,11,12 on Figure 13). Many farmers remarked that the further farms were located within the park and away from the town centers of Nuevo Tonosí, Palenque, Nombre de Dios and San Antonio, the more likely they were to experience predation by felids. Thus it would have been ideal to look only at farms located in this zone and to compare management techniques in the dangerous zone, to identify techniques that worked even in the face of high jaguar populations and isolation. However, all of the farms located in more isolated forested areas experienced attacks. It is therefore difficult to separate management techniques from farm location as factors responsible for different levels of predation.

Thirdly, there were some factors that were not analyzed that may have yielded relevant results. For example, one farmer noted that jaguars always enter the pasture under the fence. It would therefore have been interesting to take note of the distance between the ground and the first strand of barbed wire, rather looking at fence height, in order to assess the difficulty of entry for the jaguars. Also it was not asked how quickly animal cadavers were disposed of; doing this quickly has been seen to deter future attacks as the scent does not reach other potential predators (Hoogesteijn and Hoogesteijn 2010). The presence of dogs on the farm was similarly not noted and has been cited as a deterring factor for attacks (Ibid). Had these factors been recorded, identification of pertinent management techniques could have been possible. The questionnaire was designed to retrieve as much pertinent information as possible in a short amount of time in order to take up a reasonable amount of participants’ time and thus left out some

important information. In future studies we would recommend that the above information be taken into account.

10.2 Ecological factors

The availability of prey species was not a factor in decreasing the attacks; this was probably due to the location of the farms that had more intact prey species populations. It seems that the further into the core wilderness area the more there were of certain species. The *puerco de monte*, which was only seen in farms that had experienced moderate or high incidence of attacks, is the most obvious example of this. It is not that jaguars are more likely to hunt on farms with a high presence of this species; it is most probably that these isolated areas are the only ones in which this species can find a suitable habitat.

Surprisingly, there was no relationship between hunting intensity on jaguar prey and the incidence of attacks. One would think that this would be a defining factor; in fact many farmers stated the lack of prey animals as an explanation for jaguar attacks in the area (personal communications, Nombre de Dios March 1st, 2011 and Palenque April 16th, 2011). This lack of relationship can most likely be attributed to the high incidence of hunting in all areas studied. Only four farmers stated that there was no hunting in the area and thus little space was made for comparisons across farms. The frequency of hunting was also uniform, with most farmers saying hunting occurred sporadically, and only one saying that hunting took place on a weekly basis. It is interesting that the farm on which there was weekly hunting was one that had experienced no attacks, contrary to what would be expected.

The preliminary trend showing that farms without attacks had the least forested area could be due to the less hospitable matrix this provides for jaguars within the farm. As there are less places to hide and more cleared areas, this could be a less secure area for jaguars to hide when approaching prey.

The most important ecological factor, and the most significant seen in the study, was the proximity to the forest core area. This can be explained by the relative ecological intactness of more remote areas compared to those located closer to human settlements. Farms that are right next to the road are less hospitable to jaguars, as it provides little forest cover. Farms further away tend to be surrounded by intact forest, allowing jaguars to inhabit the entire surrounding area and increasing the likelihood of attack. It is far more likely for a jaguar or other wildcat to be passing through a farm located within the forest core as it travels from one habitat patch to another. This is far less likely when the surrounding area is occupied by rural developments and human presence.

10.3 Economic factors

Economic factors in this study had little to do with jaguar attack frequency. Economic indicators for wealth would be more relevant if increased wealth lead to differences in management techniques. For example, we could assume that farms with the ability to employ more people would follow safety measures requiring more man-hours of work such as bringing cattle into an enclosed area at night, or would have the disposable capital to set up electric fencing.

One issue to consider is that the land closer to the road might be more costly to purchase because its convenience and proximity to services in nearby towns is more

desirable to farmers and people in general. This would force poorer farmers to install their farm further into the forest, where the land is less desirable because of the distance from the village, the absence of running water and electricity, the larger deforestation work needed to set up pastureland and the general social isolation. Because of this the farmers with the less means to adapt their management to protect against felids are the ones who are more exposed to attacks due to their forced location deeper inside forested areas. It was observed that farms closer to the road had better infrastructure and more thoroughly cleared pastures, which indicated a higher wealth than farms further into the forest core.

As mentioned previously regular visits to the farms from a MIDA veterinary are a source of support and technical advice for the farmers. However, every farmer who was asked if MIDA had solution to offer to reduce attacks said they were of no help. Similarly, the only recommendation from the ANAM authorities reported by the interviewees is not to kill any jaguar. Thus such regular visits may not indicate the support they were intended to approximate and may be solely an indication of social connectivity.

10.4 Social and cultural factors

Commentaries gathered through informal encounters and farmer interviews revealed negative and at times inaccurate perceptions of the jaguars. The idea that jaguars are harmful and should be eliminated could naturally result from the importance of the cattle losses and their consequences on farmers' living. However, the fact that farmers who never had attacks had a similar opinion suggest that perceptions of the jaguar-human conflict in this region are culturally mediated rather than based on personal experience. It is enough to have heard of a jaguar attack nearby to form an opinion on the subject.

The idea expressed by certain people encountered that jaguars were released or pushed into the area from elsewhere carries the perception that these felines do not belong in the region and are not essential to its natural equilibrium. The existence of such deeply rooted misconceptions and negative opinions on jaguars and pumas suggest that a new view of this species and of felids in general is needed in order to find a permanent holistic solution to this conflict. Public education in this case is of high importance.

11. Limitations and recommendations for future study

Throughout our investigation, we encountered some limitations related to either our methodology or the context of this study.

11.1 Sampling method

Snowball sampling is generally used when a study site is difficult to access and/or the investigators do not have a lot of information about the statistical population of the project; it is especially useful when the populations are of a specialized nature such as cattle ranchers (Biernacki and Waldorf 1981). Such was the case for our study, and an informant who knew the population in question was chosen in order to find our interviewees. This sampling method is well known to cause bias as it is not a randomized sampling. For example, in our case, we interviewed friends, relative or other ranchers known by our hosts, guides and previous interviewees. Given that the time spent in the community was limited and that communication and access with ranchers was difficult, the bias caused by this snowball sampling technique was an affordable and necessary trade-off in relation to the scope of the project. Indeed, this research was a pilot project for further more detailed studies on a larger area of the Alto Chagres.

11.2 Sample size

Due to the aforementioned factors relating to difficulty of access to farmers in the area, as well as the short amount of time available for this study, it was only possible to visit 21 farms. Thus it is possible that since we have a small sample size the results were not significant and cannot be applied to a wider population.

In future studies, we would recommend that more time be spent in the area of study, and in a more intensive manner. When we were in Nuevo Tonosí it was possible to conduct up to seven interviews per day. Thus it could be assumed that many more farmers could be interviewed over a larger area if more time was dedicated to the study.

11.3 Formulation of questions

This study focused on the cumulative amount of attacks that have occurred relatively recently and thus ignores variation through time and the rate of attacks. While to a certain extent this was unavoidable, it made for less robust results. It would have been helpful to know if the intensity of attacks had increase, decreased or remained the same over a long time period, ideally from when the farm was established until now. This was not possible for a few reasons. Firstly, only twelve of the interviewees had been working on the ranch for more than twenty years and so nearly half of the people interviewed would probably not have been able to provided this information if asked. Secondly, it was decided that we would only consider the details of attacks that have occurred since 2005 due to the variability of human memory. It is questionable how reliable information given about events that occurred more than six years ago would be. Indeed, many interviewees could only recall information about attacks in the past two years in very little detail. Thus some details, such as exact date of occurrence, may be inaccurate. For this reason the questionnaire was divided into recent and older attacks, with corresponding

number of details requested such that older attacks required less detailed recall. Nevertheless, the simple questions asked may have received skewed responses. It would be helpful if incentive could be given to farmers to better record information about the timing of attacks, since this information could be used in future long term studies.

Little distinguishing information was obtained concerning fence quality and its relation to jaguar attack frequency. Most farmers, presumably as a matter of pride, stated that their fence was in good condition. This is a highly subjective answer and provides little concrete data to work with. It would have been better for the interviewers to analyze the fence condition themselves; in future studies it would be much more helpful to develop a list of criteria for what constitutes as a good, medium, or poor quality fence and then to diagnose the fence firsthand.

11.4 Interviewers

Being four in the research team was more than often beneficial and efficient, as we all had our different roles. We were able to share skills and ideas, which made the investigation and discussion richer. However, during the interview, this might have caused some discomfort for some of the interviewees, as the number of outsiders posing questions about this sensitive issue might have been intimidating. This was especially true when the farmers being questioned had killed a jaguar and may have feared legal action against themselves. We thought about dividing in groups of two, but as we had only one guide, it was impossible for the most part.

11.5 Transportation

Cattle ranchers sometimes live at their farms out of the communities, or in other villages than Nuevo Tonosí, do not always have access to a telephone and are not available

every day for interviews as they often have many different occupations and responsibilities. This made the organizational aspect of the project a real challenge and resulted in the fact that we were often dependent on the availability of other people to make the interviews happen. We also spent a considerable amount of time and money trying to figure out transportation from one farm to another. Thus, access to an all-terrain vehicle would have been key for time and money efficiency, and would have allowed for a larger sample size. This should be taken into consideration for future research.

11.6 Context of the study and bias

Finally, we had trouble to seek the participation of some farmers in our project since jaguar-related issues are a “hot topic” in the region. Indeed, killing jaguar is illegal and can be punished by the ANAM, but is still a common practice among farmers. Even if we specified we were not associated with any authorities and that interviews were confidential, some farmers were still scared to talk to us as we were not members of the community and were associated with SOMASPA, a conservation organization. Many of the questions asked may have received tempered answers for this reason. This is a challenge that was slightly mediated by the presence of our guides, who are local community members and made our interview team seem to be in a less intimidating position.

11.7 Implications for jaguar conservation - National and continental scale

Considering the near-threatened status of jaguar in Panama, the effort to minimize the conflict between jaguars and humans should continue, as retaliation hunting of jaguars by ranchers is one of the biggest threats to the species (Panthera 2011). Moreover, it has been shown that the first cause of mortality of large carnivores was conflict with population living around protection areas (Panthera 2011). The Alto Chagres area

provides one example where the protected area's borders could become a population sink for jaguar. As the species has a wide range and often comes into contact with the border of the park, where ranches are settled, this could even have a greater implication for jaguar overall population dynamics. Thus, more than jaguar population size, degree of conflict with ranchers is a better indicator of population extinction risks (Woodfroffe and Ginsberg 1998). Avoiding such population sinks is key to the successful development of the Atlantic Biological Corridor of Panama and of the International Jaguar Corridor.

11.8 Conservation versus avoidance of conflict

It seems that while this study has tried to bridge the gap between conservationists and local populations, namely cattle ranchers, within the park, it should be noted that some differences are irreconcilable. A trade-off is possibly being made between the mediation of the livestock predation problem and the achievement of conservation goals. The trend that farms with less forested area tend to avoid felid attacks, although not statistically significant but warranting further exploration, could give ranchers the incentive to cut down trees within their pasture area. Having hedgerows and more treed area within agricultural areas has been shown to increase biodiversity on a small scale as more habitat is provided for wildlife (Bowen and Ewaschuk 2001). Thus in stating this trend we may be compromising conservation goals. It seems that the most dangerous areas surveyed were those furthest from the road and other human settlements; these are the desirable core pristine wilderness areas that the Conservation Area seeks to preserve. Thus it can be stated that biodiversity and ecological intactness means danger to a certain extent. It follows that areas with high biodiversity will provide habitat for predators; in fact this is exactly what the biological corridor is intended to accomplish.

12. Recommendations and conclusion

12.1 Trends from this Study

Although we could not statistically show that some management solutions would help to mitigate against jaguar attacks, preliminary trends would suggest that the following are possible solutions for this conflict. More studies would be needed to assert that these are applicable over a wider range of farm circumstances. For a full list of solutions provided by the literature, please see Annex IX.

a) Keep calves in corrals

It was shown in our study that calves were the most frequently attacked animal, also that farms with the least calves are the most likely to avoid jaguar attacks. Thus special care should be given to protecting cattle in this life stage.

b) Avoid developing farms in wilderness core areas

The only farms that were able to avoid jaguar attacks were located close to human settlements. Thus if ranchers want to be sure to avoid jaguar attacks they should also avoid setting up farms in core wilderness areas far from other human settlements.

c) Limit forested area within the farm

Clearing trees may create a less hospitable habitat for jaguars and thus help to avoid jaguar attacks. Results show that the farms with the least forested area were those that avoided attacks.

d) Bring cattle in at night

As this is when jaguars are most likely to attack according to ranchers interviewed, it would be best to remove cattle from the pasture at night by moving them to corrals or under shelter.

12.2 Unexplored Recommendations

Some management techniques not analyzed in this study but that could be helpful are listed below. While we did not test these ourselves, they have been shown to be effective in other areas (see Annex IX) and would be worth analyzing in future studies or could be directly implemented on farms.

e) Keep dogs to intimidate jaguars

f) Use troughs to provide water to cattle

Cattle are more vulnerable when they drink as they cannot see predators approaching; it may be best to keep cattle away from rivers to prevent easy access for jaguars.

g) Place a greater emphasis on eco-tourism

To provide economic diversification and a source of profit, eco-tourism activities could be put in place to use jaguars as a resource rather than a nuisance. Bringing tourists onto the farm, setting up cabins and other infrastructure and exploiting the beauty of the park in this way could help to supplement income lost due to jaguar-induced casualties.

h) Use electric fencing

This extra protection on fences may prevent jaguars from entering pasture areas if implemented properly. Contact can be made with NGOs such as Ingeniería para un

Mundo Sostenible to provide technical support for the installation of power sources and electric fencing to accomplish this.

i) Use sensory disturbances such as light and noise to scare away jaguars

This was shown as a successful tactic in San Antonio with the use of firecrackers (personal communication, April 13th, 2011). The adaptability of jaguars to such noise and light inhibitors must be considered; it would be best to vary the type and intensity of noise to maintain its effectiveness as jaguars have been shown to get used to new conditions and continue attacks (personal communication, Nombre de Dios, March 3rd, 2011).

12.3 Feasibility of implementation of recommendations

Many of the recommendations from the literature and previous farm surveys in other countries, while appropriate for the regions in which they were developed, may not be feasible in the Alto Chagres conservation area due to regional environmental and social factors.

One such recommendation is the implementation of electric fencing. Many farmers had heard of this as a way to prevent jaguar attacks; three interviewees listed this as a possible solution when asked in the questionnaire. When asked about whether this would be a feasible mitigation measure, interviewees were divided on the topic. Most cattle ranchers felt that electric fencing is far too expensive to implement on a farm-wide scale. The farms are too extensive to surround entirely with electric fencing and maintenance would be difficult. Also the isolation of the farms from other human settlements is such that there is no centralized power source. Farmers would need the start-up capital and expertise needed to set up solar panels for electricity generation and

many feel it is not worth it as it isn't guaranteed to prevent livestock predation. Contrastingly, some felt that electric fencing is a good option and that it is in fact a more affordable than the barbed wire fencing that is currently employed by the vast majority of farms. They expressed that unlike barbed wire which degrades and must be replaced every few years, electric fencing is more durable and after the first year's installation costs it requires no further input.

Recommendations that require cattle to be moved to a centralized location, such as bringing cattle out of the pasture at night and birthing calves in maternity pens, is not feasible for many farmers. The terrain is very hilly in this region (see Figures M and O in Annex VIII) and most farms are very large; moving cattle therefore takes a lot of time and energy. The majority of farms employ two people or less, making this recommendation nearly impossible to follow. Furthermore, requiring that these corrals be lit leads to the aforementioned start-up capital problem for solar panels.

12.4 Perception and role of the authorities – Political factors

As discussed above, it is often impractical for farmers to implement recommendations on their own. If governmental organizations and cattle ranchers could collaborate, it is possible that solutions could be generated and implemented in an effective manner. Many farmers said during the interviews that they had asked for the authorities' help to no avail (Nuevo Tonosí, personal communication, April 2011). It is a general feeling among farmers in the area that the government is responsible for solving the problem as it is 'their' park, either by offering means of protecting livestock against attacks, or by offering compensation for cattle loss to feline predation. Faced with this absence of advice or help from the authorities, farmers are likely to feel alone facing the problem

and feel the need to solve it themselves, often by killing the wildcat in question as no other immediate solution is available. An important factor inhibiting the collaboration between ANAM and the farmers on this problem is fear of persecution. According to ANAM representative Elizabeth Castro, farmers do not report jaguar attacks to their offices as they are afraid of persecution for having killed the animal, or perhaps they fear a tighter surveillance in the future. This keeps ANAM in the dark about the true extent of the conflicts in the area (personal communication, Nuevo Tonosí February 10th, 2011).

12.5 Opportunities for collaboration between authorities and cattle ranchers

According to information gathered through formal and informal interviews, various actions could be taken by the authorities to help solve this conflict. First of all the government could give monetary compensation for the cattle losses. Marciaga and Ramirez (2010) refer to this as “the park paying for the jaguar’s food”. The government could also establish programs to help the farmers protect their farms against feline attacks. More than the loans already given by the bank, money could be lent or provisioned through these programs for specific management practices, such as building an electric fence. This kind of support could also be done through NGOs. Most farmers stated that they were willing to carry out management changes in their farm to avoid attacks, if they had enough money to do so and were assured that these changes would be effective. One farmer in particular explained how he felt the need to kill the jaguars because bank loans are insufficient to compensate for the problem and the interest they had to pay are too great of an expense. According to this farmer, if the bank gave out money to implement new management techniques, the farmers would not need to kill jaguars (Personal communication, Nuevo Tonosí, April 15th, 2011).

There is also work to do in terms of public education. Until now this has been provided by NGOs such as SOMASPA and Panthera, which have been distributing pamphlets and other documentations on the conflict. However institutions such as ANAM and MIDA, who are well established in the community, could give more information and technical training to farmers through workshops and information campaigns. Some farmers interviewed were well informed on the conflict and the possible solutions, as well as on the reasons why jaguars should be conserved. With public education more farmers are likely to change their opinion about felines and become more willing to change their own practices.

Through these interviews and informal discussions with people of the area, a general impression remained that there exists a lack of resources of the farmers, an absence of help from the government, and a low feasibility of effective management practices that could prevent attacks in the area. As the main factor for the frequency of attacks is how deep into a forested area a farm is located, perhaps ANAM should limit further farming development to a certain distance of the park's limits.

Regardless of what actions are taken to resolve this conflict, cattle ranchers should be involved in decision-making to provide them with a sense of involvement in this issue, rather than allowing them to feel like passive recipients of recommendations and regulations. Constant re-evaluation and adaptation of recommendations of policies are needed to ensure their effectiveness.

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Annexes

Annex I. Institutional written consent form

Proyecto de pasantía
Universidad McGill, Canadá

Caracterización de fincas ganaderas con eventos de ataques de felinos a animales domésticos – SOMASPA

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Somos estudiantes de la Universidad Mcgill, en Canadá, y estamos participando en un semestre estudios de campo en Panamá. Estudiamos las ciencias ambientales y estamos haciendo una pasantía de una duración de cuatro meses (de enero hasta abril) en colaboración con la ONG SOMASPA (Sociedad Mastozoológica de Panamá).

Estamos haciendo una investigación sobre la caracterización de las fincas ganaderas con eventos de ataques de felinos a los animales domésticos en el área de Alto Chagres. Necesitamos hacer entrevistas con ganaderos para entender mejor las características de la fincas que tuvieron ataques de felinos en comparación con ellas que no tuvieron ataques. Las informaciones colectadas serán utilizadas por nuestra reporte de curso y por la organización SOMASPA para hacer recomendaciones de manejo para intentar de disminuir los conflictos entre los ganaderos y jaguares.

Según las normas de ética de la Universidad McGill, tiene el derecho de parar la entrevista a cualquier momento y rechazar responder a cualquiera pregunta. Todas las informaciones colectadas pueden quedarse confidenciales si usted lo quiere. Además, ninguna información será utilizada sin su aceptación.

Puede hacernos preguntas antes, después o durante la entrevista, sin problema, y puede contactarnos o SOMASPA para conocer más de la investigación y sus avances.

Muchas gracias por su colaboración

He leído la información de la investigación y estoy de acepto participar a esta entrevista

Nombre _____

Firma _____ Fecha _____

Annex II. Introduction for interviews

Buenos días / Buenas tardes,

Somos estudiantes de la Universidad McGill en Canadá y estamos aquí en Panamá para hacer una pasantía para nuestra licenciatura. Trabajamos juntos a SOMASPA (la sociedad mastozoológica de Panamá), una ONG trabajando por la conservación de la naturaleza y la educación ambientale.

Estudiamos las características de las fincas del Alto Chagres que llevan a ataques de felinos al ganado. Nos interesan también las fincas que no tienen ataques de felinos porque son importantes para hacer comparaciones y encontrar a recomendaciones de manejo para evitar esas ataques.

Si está de acuerdo, quisiéramos hacer una encuesta al propósito. Sería una entrevista de 20 a 30 minutos. Sepan que la información que brindaran será confidencial y pueden parar la entrevista a cualquier momento que quiere, o no responder a cualquier pregunta. Además, no tenemos afiliación con ANAM, MIDA o el gobierno.

Annex III. Questionnaire with associated numbers for statistical analysis

Modificado del formulario CJG-02 – Versión 2 (McGill)

PROYECTO DE MONITOREO DE LA BIODIVERSIDAD DEL ALTO CHAGRES
ANAM-ACP-SOMASPA-TNC

DESCRIPCIÓN DE EVENTOS QUE INVOLUCREN LA PRESENCIA DE FELINOS

Entrevista No. _____ Fecha: _____/_____/_____

Nombre del entrevistador: _____

Institución u ONG a la que Pertenece: _____

Provincia: _____; Distrito: _____

Corregimiento: _____; Lugar Poblado: _____

Área Protegida: _____

Nombre de la Finca: _____; Coordenadas: _____ _____

Cargo de la Persona Entrevistada: _____ Años en la Finca: _____

A. Información sobre Eventos de Conflictos Jaguar-Ganadería

1.1 1. ¿Su ganado ha sufrido ataques de felinos?

a ☐ Si 1.2 Tipo de felino: a ☐ jaguar cantidad de ataques: _____

b ☐ No b ☐ puma cantidad de ataques: _____

B. Características de la Finca

2 2. Superficie de la finca: _____ha

3 3. Número de Personas Encargadas de la Finca: _____

4 4. Superficie de bosque dentro de la finca: _____ha

5 5. Actividad Económica: a ☐ Ganadería de carne b ☐ Ganadería de doble propósito (carne y leche)

c ☐ Ganadería de leche d ☐ Ganadería de pie de cría y carne e ☐ Ganadería y agricultura

f ☐ Ganadería y turismo g ☐ Ganadería y forestal

6 6. Tamaño del Hato (número de animales el día del ataque): _____

Vacas: a _____; Caballos: b _____; Cerdos: c _____; Otros: d _____

7 7. Número de terneros o juveniles en el hato: _____

8 8. Posee cerca: a ☐ Si b ☐ No

9. Características de la cerca:

9.1 Distancia entre los hilos de alambre: a ☐ púas _____cm b ☐ liso: _____cm

9.2 Altura de la cerca: _____m

9.3 Material: a ☐ Poste b ☐ Cerca viva c ☐ Electrificada

9.4 Condición de la Cerca: a ☐ Buena b ☐ Regular c ☐ Mala

10 10. Principales Causas de Mortalidad del Ganado: a ☐ Enfermedades b ☐ Depredación por felinos

c ☐ Mordeduras de serpientes d ☐ Falta de pasto e ☐ Robo de ganado f ☐ Problemas post parto

11.1 **11.** Tipo de Manejo: a ☐ Extensivo b ☐ Estabulado o Intensivo (encierro en edificaciones)
c ☐ Semiestabulado d ☐ Suplementación estratégica

11.2 Lugar donde Duermen los Animales: a ☐ Potrero b ☐ Corrales

Lugar de Nacimiento de las Crías: a ☐ Potrero b ☐ Corrales de maternidad c ☐ Nacen fuera de finca

11.3
11.4 ¿En qué meses hay más nacimientos de sus animales? a _____
b ☐ Todo el año c ☐ Variable d ☐ NS/NR

11.5 Fuente de Agua para los Animales:
a ☐ Cuerpos de agua natural (ríos, quebradas) b ☐ Abrevaderos artificiales c ☐ Ambos

Donde : d ☐ Dentro de la finca e ☐ Fuera de la finca

11.6 ¿Entra el ganado al bosque? a ☐ Si b ☐ No

11.7 Uso de Veterinario: a ☐ Si b ☐ No c ☐ Sólo cuando lo necesita

11.8 Con qué Frecuencia? a ☐ Semanal b ☐ Quincenal c ☐ Mensual d ☐ Bimestral
e ☐ Trimestral f ☐ Semestral g ☐ Anual

C. Información sobre Eventos Recientes de Ataques de Felinos al Ganado (≤ 1 mes)

12 **12.** Fecha del ataque: a _____/_____/_____ Hora (si se sabe): b _____

13 **13.** Sitio del ataque al ganado: **Coordenadas**

a ☐ dentro del bosque _____ - _____
b ☐ borde del bosque _____ - _____
c ☐ potrero con árboles _____ - _____
d ☐ potrero abierto _____ - _____
e ☐ corrales _____ - _____
f ☐ abrevadero _____ - _____
g ☐ cerca a cuerpo de agua _____ - _____
h ☐ cerca a la casa _____ - _____

13.2 Distancia aproximada del sitio del ataque a la finca: _____

D. Identificación del Felino Depredador

14.1 **14.** Examen de la Presa (< 3 días del ataque):

a ☐ Fractura del cráneo
b ☐ Tamaño y lugar de la mordedura
c ☐ Partes iniciales consumidas por el felino
d ☐ Tamaño de la presa

14.2 Indicios del Felino en los Alrededores (< 3 días del ataque):

a ☐ Huellas
b ☐ Heces
c ☐ Rasguños en troncos de árboles
d ☐ Olor a orina de felino

14.3 Evidencias de que la Presa fue Arrastrada

a ☐ Marcas o rastros en el suelo
b ☐ Partes de la presa dispersas por el área
c ☐ Ramas de arbustos quebradas
d ☐ Vegetación del suelo arrancada/aplastada

14.4
a ☐ Jaguar
b ☐ Puma
c ☐ Otro

14.5 Sexo:
a ☐ Hembra
b ☐ Macho

14.6 Edad:
a ☐ Adulto
b ☐ Subadulto
c ☐ Juvenil

15.1 **15.** Descripción Proporcionada por el Finquero (> 3 días del ataque):

a ☐ Avistamiento
b ☐ Heces
c ☐ Huellas
d ☐ Restos

15.2
a ☐ Jaguar
b ☐ Puma
c ☐ Otro

15.3 Sexo:
a ☐ Hembra
b ☐ Macho

15.4 Edad:
a ☐ Adulto
b ☐ Subadulto
c ☐ Juvenil

E. Características de los Animales Depredados

16 **16.** Tipo de Ganado:

a ☐ Vacuno (vaca)
b ☐ Porcino (cerdo)
c ☐ Equino (caballo)
d ☐ Otros: _____

17 **17.** Sexo:
a ☐ Macho
b ☐ Hembra

18 **18.** Edad:
a ☐ Ternero o Recién Nacido (< 12 meses)
b ☐ Toretes y Vaquillas o Juvenil (12 – 24 meses)
c ☐ Adulto (> 24 meses)

19 **19.** Costo Aproximado del Animal: _____

20 **20.** Partes del Cuerpo del Animal con Heridas de Ataque:

a ☐ Cuello (detrás de la oreja)
b ☐ Nuca
c ☐ Base del cráneo
d ☐ Garganta
e ☐ Costillas
f ☐ Extremidades

21 21. Partes del Animal Consumidas:

a ☐ Parte delantera (garganta, cuello, pecho, costillas)

b ☐ Parte trasera (costillas y el área detrás de éstas, hígado, corazón, pulmón, muslos y patas traseras)

22 22. Estado del Animal Atacado:

a ☐ Cubierto por hoja y material vegetal

b ☐ Bajo un árbol

c ☐ Sobre un árbol

d ☐ Expuesto sobre camino, trocha o potrero

e ☐ En una cueva

f ☐ Entre herbazales

F. Ataques Ocurridos en Meses o Años Anteriores (2005 – 2010)

22.5

	a Mes	b Año	c Felino	d Ganado	e Sitio del Ataque	f Evidencias
a)						
b)						
c)						
d)						
e)						
f)						
g)						
h)						
i)						

G. Presencia de Presas de Felinos

23 23. Ha visto Recientemente a estos Animales en los Alrededores de su Finca? **Mostrar Lamina**

a ☐ Saíno b ☐ Puerco de monte c ☐ Venado cola blanca d ☐ Venado corzo

e ☐ Armadilo f ☐ Conejo pintado g ☐ Ñeque h ☐ Otros: _____

H. Competencia por las Presas del Jaguar y del Puma

24 24. Se realiza actividad de cacería en los alrededores de su finca? a ☐ Si b ☐ No

25 25. Con qué fin realizan la cacería? a ☐ Alimentación b ☐ Comercio c ☐ Otro: _____

26 26. Son estas algunas especies de caza?

a ☐ Saíno b ☐ Puerco de monte c ☐ Venado cola blanca d ☐ Venado corzo

e ☐ Armadilo f ☐ Conejo pintado g ☐ Ñeque h ☐ Otros: _____

27 27. Con qué frecuencia salen de caza? a ☐ Semanal b ☐ Quincenal c ☐ Mensual d ☐ Esporádicamente

I. Conocimiento y Percepción de los Ganaderos Hacia los Felinos

28 28. Ha visto un jaguar o un puma en su finca? a☐ Si b☐ No

29 29. Ha escuchado de la presencia de estos felinos en su finca? a☐ Si b☐ No

30.1 30. Considera que los Felinos son: a☐ Beneficiosos o b☐ Dañinos

30.2 Porqué? _____

_____

31.1 31. El jaguar y el puma deben ser a☐ Conservados o b☐ Eliminados

31.2 Porqué? _____

_____

32 32. Qué Soluciones Recomendaría para Evitar los Problemas Ocasionados por los Felinos?

a) _____; b) _____

c) _____; d) _____

33 33. Estaría usted de acuerdo en realizar mejoras o cambios en el manejo de su finca para resolver el problema con los felinos? a☐ Si b☐ No

J. Eliminación de Felinos Problemas (2005-2011)

34. En los alrededores de su finca se ha cazado algún felino? ☐ Si ☐ No

34

	a Mes	b Año	c Felino	d Sitio de Ataque	e Evidencias
a)					
b)					
c)					
d)					
e)					
f)					

35 35. Ha oído de ataques de ganado por felinos en otras fincas? a☐ Si b☐ No

36 36. Ha oído de cacería de felinos en otras fincas? a☐ Si b☐ No

37 Observaciones:

_____

_____

_____

_____

Annex IV. Comments and suggested modifications to the questionnaire

Generally

- Jaguar and puma should also be referred to as *tigre* and *león*, respectively to be better understood.
- Numbering is quite confusing and makes analysis difficult. We added subsections (11.2, 11.3) to make it easier
- GPS points should be taken from a standardized position, e.g., next to main building on farm, most southern point, etc.
- Questions should be asked about economic and social factors on the farm to gather more robust information
    - Examples (direct): Is the farm profitable? Do you have any loans from the bank?
    - Examples (indirect): How many cars/vehicles, other wealth indicators?

Suggestions for specific questions

Q1. Should ask about total number of attacks by felids, often the specific animal causing the attack is not known, puma vs jaguar should be a subsection

Q2. Confusing vocabulary, should be “Tamaño de la finca” or “Cuantos hectarias”

Q3. Confusing vocabulary, should be “Cuantos personas trabajan en la finca”

Q4. Number 4 and 3 should be switched for a better flow of questions

Q5. “Cría” alone should be an option

Q7. Remove “juveniles” from question, no one uses that word

Q9. How many hilos de alambre would be a more relevant question

Q10. Should add vampire bat bites as an option
Culebra instead of serpiente

Q11. Consider removing: all farms are extensive

Q13.2 What are we considering as the “finca”? Is it the house, the buildings, any area that is fenced in?
Would it therefore be zero when the attack took place in the pasture?

Q14 & 15. We should diagnose what animal attacked it only once, at the end of the section. The two identifications are redundant.

Q20. It is difficult for ganaderos to determine “herida” vs “consumida”

Section D and E. It is rare that the evidences of attack remain unburied; it is wise to bury dead cattle early to avoid further attacks

Q23 and 26. Should be together. Maybe phrase it as, “have you seen these animals on your land? Are they hunted? Which are hunted?”

Q34. More questions needed. To avoid making recommendations already tried by farmers: Have you tried any solutions and how well did they work?

Have you reported the attacks to ANAM? Were they helpful?

Q35. Should be asked at the beginning of the survey

Annex V. Guide for informal interviews

Example of questions asked during informal interviews:

1. What is the mission of your organization (when applicable)?
2. What is your occupation?
3. Have you heard about jaguar attacks in farms in the region?
4. Are you aware of when this problem started in the region?
5. What do you think is the biggest problem in the conflict between ranchers and jaguars?
6. Do you think jaguars are important animal to conserve?
7. Do you think there are some improvements that can be made to diminish the problem?
8. If the person is a rancher: Would you agree to participate in a formal interview and allow us to visit your farm?

Annex VI. Cattle ranchers' opinions on jaguar conservation

These opinions have been collected during our interviews with cattle ranchers.

Jaguars should not be conserved

- They eat cattle and other domestic animals
- They don't let cattle ranchers do their work
- They reduce production
- They should be conserved only in cages for education but in the wild they cause too much damage
- Increased jaguar populations will only increase the problem

Jaguars should be conserved

- They are a Panamanian animal
- This is their habitat and they have the right to be here
- I would like to conserve them with government help
- To maintain a complete ecosystem
- They should be conserved but only in the park
- It is morally wrong to kill them
- Future generations should be able to know jaguars
- They are beautiful

Solutions for mitigating human-jaguar conflict

- Relocate jaguars, for example in a zoo
- Lock up domestic animals at night
- Be vigilant during the day
- Take trips around the pasture to survey
- Hunt jaguars
- Bring animals further away
- Remove trees from pasture
- The government should pay to replace cattle
- Use an electric fence with 2-3 strands
- Put up more barbed wire
- ANAM should put a big fence around the Chagres protected area
- There are no solutions to this problem

Annex VII. Summary of the feria of Nuevo Tonosí

Description of the event

The feria is a 4-day event which takes place every year in the free space behind the Nuevo Tonosí baseball field. This event gathers farmers of the region as well as local and national institutions, NGOs or banks. It provides farmers the opportunity to advertise and sell their produces (cattle, cereal, fruits and vegetables etc.) and offers publicity or educational campaign for the other institutions. It also provides the community a good occasion to celebrate.

This year, the feria took place from March 17th to March 20th. As each year, ANAM – Parque National Portobello, MIDA, MOP (Ministerio de Obras Publicas), el Banco de Desarrollo and ANAGAN, were examples of organisations having information stands at the feria.

MIDA and ANAM were kind enough to accept sharing their respective space with SOMASPA in order to let us participate to the event on the Friday and Saturday. SOMASPA representatives shared stand with ANAM and were providing more information to the community and visitors about the NGO and its missions as well as educating people about the local fauna, particularly mammals. McGill students were sharing space with MIDA and had their own stand. We were in charge of presenting all educational material about felids and the conflict between jaguar and cattle ranching. Moreover, we made an additional poster specifically on our current project (see Figure D on next page).

General objectives of our presence at the feria:

- Environmental education about felids conservation and the Jaguars' International Corridor
- Increase population awareness about the possible mitigation measures

Specific objectives for our project:

- Meet local cattle-ranchers and discuss the issue with them
- Present our project and get known in the community
- Find other possible interviewees and organized future interviews

Results

This year's feria showed a lower attendance rate compared to the other years. This can be easily explained by the rainy weather experienced during the whole event. Nevertheless we met a dozen of college students and some farmers with whom we successfully discussed jaguar conservation, protected areas issues, and our project. However, we were expecting to collect 5 to 10 other potential interviewees, but collected only one. this seemingly deceiving result turned out to be much more conclusive as the contact we obtained allowed us to make a field trip in Playa Chiquita and interview seven other ranchers.

Figure A. Entrance of the farmers' market - publicity of the event

Figure B. Our team in front of SOMASPA's stand with educational material about jaguars/ranchers conflicts and biodiversity monitoring in the Alto Chagres area.

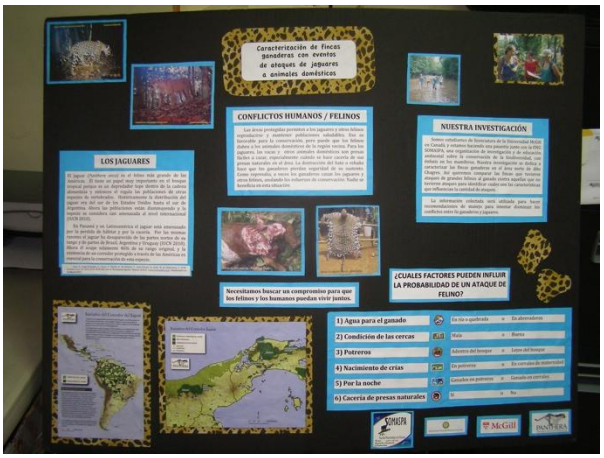


Figure D. Descriptive poster of our project made especially for the event of the feria.

Figure C. Our team discussing with a local in company of SOMASPA's representative Melva H. Olmos (extreme left) and Edilma Vasquez, a local collaborator (extreme right).

Annex VIII. Farms' characteristics in pictures

Figure A. Picket fence with barbed wire, in bad-regular condition (Farm 2).

Figure B. Picket fence with barbed wire, in good condition (Farm 4).

Figure C. Living fence with barbed wire (Farm 5).

Figure D. Example of other type fence (Farm 2).

Figure E. Living fence with larger number of barbed wires (Farm 12).

Figure F. Corral for cattle (Farm 1).

Figure G. Natural source of water for cattle: river running across pasture land (Farm 9).

Figure H. Natural source of water for cattle: stream running across pasture land (Farm 10).

Figure I. Natural source of water for cattle : stream running across pasture land with trees (Farm 18).

Figure J. 'Potrero sucio' : pasture land with trees and bushes (Farm 5).

Figure K. View of farm 18.

Figure L. Pasture land with few or no trees (Farm 19).

Figure M. Pasture land with little trees (Farm 14).

Figure N. Pasture land with trees and proximity of forest (Farm 12).

Figure O. Area of attacks by jaguars and pumas (Farm 14).

Figure P. Site of attack by jaguar on a female cow (Farm 5).

Figure R. Skin from puma killed by farmer in retaliation for predation on cattle (Farm 5).

Figure Q. Teeth from jaguar killed by farmer in retaliation for predation on cattle (Farm 5).

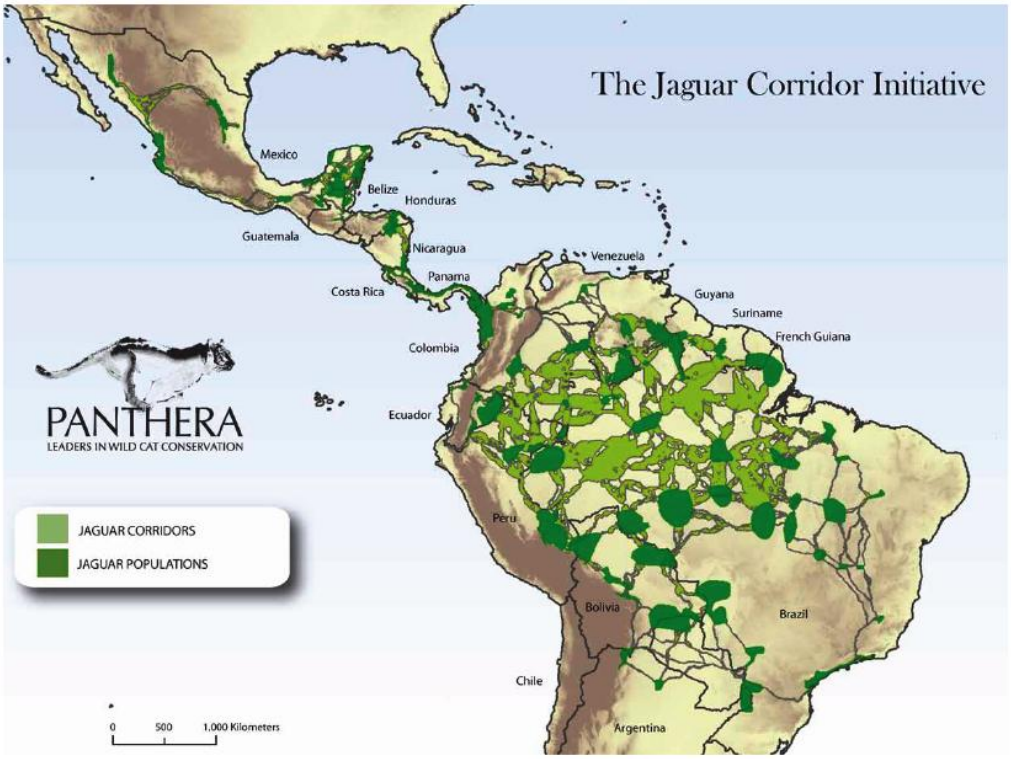
Figure S. Skulls from two jaguars killed by farmers in retaliation for predation on cattle (Farm 18).

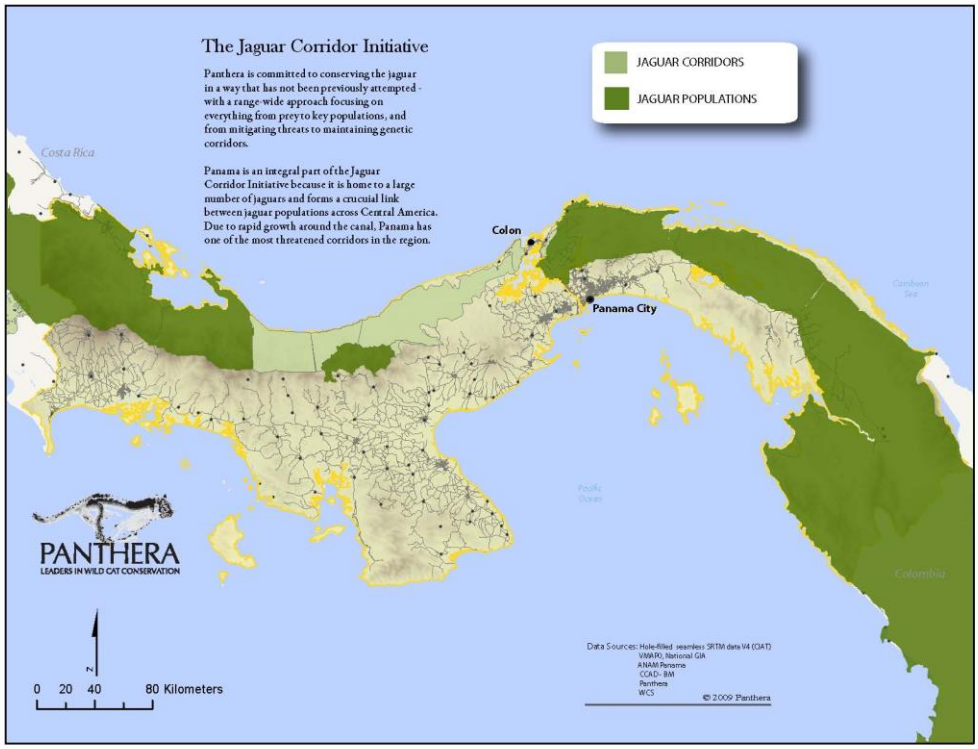
Annex IX. Management recommendations

- Forbid hunting of jaguars and pumas, reintroduce and protect their natural prey
- Put cattle in fenced and lit corrals at night
- Excavate water reservoirs for the animals and distribute these across the farm, away from forested areas
- Keep animals away from forested areas where there are jaguars, fence these areas to prevent cattle from entering the forest
- Establish periods for reproduction of 3-4 months
- Keep pregnant cows in open pastures away from forested areas, near human habitations, and maintain the vegetation low in these pastures
- Keep experienced animals rather than selling them so they can teach good grouping behaviour to younger individuals
- Only use areas of high predation incidence for animals of 1-2 years or older
- Move animals away from floodable areas because flooding makes cattle more vulnerable to attacks
- Dispose adequately of animal cadavers so felines do net get used to feed on their meat
- Use breeds of vacunos criollos (*Bos taurus*), which have better defense disposition
- Have good sanitary programs, since diseases and miscarriages are responsible for more deaths per year than jaguars
- Use the 'Rueda de Carreta' or 'Pizza' system: organizing the farm into sections that all converge toward a center place where the feeders are
- Identify individual cows and keep register of mortalities
- Use donkeys and shepherd dogs to scare off felines (dogs are especially effective with goats or sheep against puma attacks; not proven to work against jaguars)
- Physical measures: propane explosives, fireworks, visual and acoustic stimuli, Radio Activated Guard (RAG; necessitates installing a radio-telemetry collar or tag on the attacking animal)
- Installation of electric fences that are specially designed to prevent felines from entering the farm
- Use water buffalo in floodable savannahs, in junction with ecotourism, as water buffalo is less vulnerable to attacks

Source: Marchini and Luciano 2009; Hoogesteijn and Hoogesteijn 2010; Gamboa 2010; Soto et al. 2009

Annex X. The Jaguar Corridor Initiative





http://www.panthera.org/programs/jaguar/jaguar-corridor-initiative

Annex XI. Pamphlet – Product for host organization

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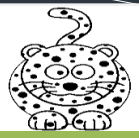


EL CONFLICTO ENTRE LOS FELINOS Y LA GANADERÍA

Las áreas protegidas permiten a los felinos reproducirse y mantener poblaciones saludables. Eso es favorable para la conservación, pero los felinos pueden ocasionar daños a los animales domésticos. Los felinos atacan al ganado especialmente cuando los humanos cazan sus presas naturales en el área. La depredación del hato hace que los ganaderos pierdan seguridad económica. Como represalia, a veces los ganaderos cazan los jaguares y otros felinos, negando los esfuerzos de la conservación. Nadie se beneficia en esta situación. Se necesita buscar un compromiso para que los felinos y los humanos puedan vivir juntos.

El cráneo de un jaguar y una vaca muerta: los resultados del conflicto

Aunque causan daños al ganado, debemos conservar los felinos como el jaguar y el puma porque son los grandes predadores del bosque y ¡son esenciales al mantenimiento del equilibrio de los ecosistemas!

SOMASPA
Sociedad Mastozoológica de Panamá

SI SU FINCA TUVO PROBLEMAS DE ATAQUES DE FELINOS, SI QUIERE PARTICIPAR EN EL ESTUDIO, O NECESITA MÁS INFORMACION, CONTÁCTENOS.

SOMASPA
TELEFAX: (507) 271-1812
somaspa@cwpanama.net

La lista de referencias completa está disponible en :
VAN VLIET, K., BEAUDRY-PILOTTE, J., S.CHRISTIN, L. LAGACE, M.2011.Caracterización de la fincas ganaderas con eventos de ataques de felinos a los animales domésticos. McGill University.

Los conflictos entre los felinos y el ganado
Analisar el problema para mejor resolverlo

SOMASPA
Sociedad Mastozoológica de Panamá

LA CARACTERISACIÓN DE LAS FINCAS GANADERAS

Actualmente, en el área del Alto Chagres, La Sociedad Mastozoológica de Panamá (SOMASPA) realiza un estudio sobre la caracterización de las fincas ganaderas. Caracterizar las fincas es una etapa primordial a la resolución del conflicto porque permite identificar cuáles son los factores que determinan la cantidad de ataques y encontrar soluciones más adaptadas. Esta caracterización se hace a través de entrevistas con ganaderos y visitas de sus fincas. La participación de los ganaderos es entonces fundamental por el estudio.

FACTORES ESTUDIADOS

Manejo	Económico	Ecológico	Socio-político
• Las cercas • Las corrales • La cacería	• La superficie de la fincas • El número de trabajadores • El tamaño del hato • Los préstamos bancales	• Las presas silvestres • La fuente de agua • El bosque • La topografía	• Las opiniones sobre las autoridades • Las opiniones sobre los felinos • Las Creencias y la cultura

RECOMANDACIONES PRELIMINARES

Otras investigaciones similares en otros países latinoamericanos (ej. Costa Rica) han desarrollado recomendaciones para los ganaderos para disminuir el problema. Algunas de ellas deberían ser aplicadas en el Alto Chagres:

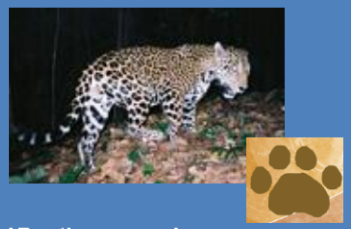
- Mantener los terneros más vulnerables a los ataques en corrales cerca de las habitaciones.
- Evitar que el ganado entre en las zonas forestales y limpiar los potreros.
- Si posible, reunir el ganado por la noche, cuando hayan más ataques.

En el Alto Chagres,
un freno a la realización de cambios de manejo frecuentemente es la falta de recursos económicos. Recomendamos…

- Contactar una ONG para ayuda técnica y financiera.
- Comunicarse con las autoridades para pedir compensaciones o que ellas tengan un papel más importante en la resolución del conflicto.
- Asociarse con organizaciones de ganaderos, para tener más poder de negociación frente a las autoridades.

EL JAGUAR Y EL PUMA

En el área de Alto Chagres viven los dos felinos usualmente implicados en el conflicto: el jaguar (tigre) y el puma (león). Las dos especies comen al ganado pero es posible distinguirlas porque tienen métodos de cacería diferentes.



El Jaguar (*Panthera onca*)

El jaguar es el felino más grande de las Américas. La cacería de represalia es una de sus amenazas más importantes.

Características de depredación por el jaguar:

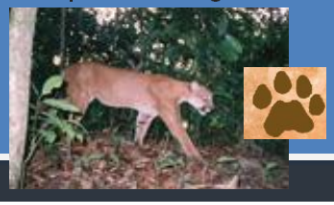
- **Prefiere las presas largas (adultas)**
- **Ataca a la base del cuelo o a la nuca**
- **Come pecho, cuelo y costillas**
- **Arrastra sus presas**

El Puma (*Puma concolor*)

A menudo, los ganaderos culpan el jaguar por un ataque, en vez del puma.

Características de depredación por el puma:

- **Prefiere las presas pequeñas**
- **Ataca a la garganta o a la nuca**
- **Come las partes detrás de la costillas**
- **Cubre su presa con vegetación**



Annex XII. Chronogram of activities

Date	Activity	Office (days)	Field (days)
January			
7th	Meeting SOMASPA and literature research	0.5	
27-28th	Meeting SOMASPA and literature research	2	
February			
3rd	Preliminary meeting with local institutions		1
4th	Meeting with SOMASPA and personal work	1	
8th	Preparation for field work	0.5	
10-11-12th	Preliminary interviews with local institutions and people		2.5
27th	Work on progress report	1	
28th	Information presentation	1	
March			
1-2-3rd	Interviews in Nuevo Tonosí and Nombre de Dios		2.5
14th	Meeting at SOMASPA's office and preparation of the poster	1	
15-16th	Preparation for the feria and research	2	
18-19th	Participation at the feria of Nuevo Tonosí		2
24th	Meeting at SOMASPA's office and personal work	1	
Abril			
11-12th	Data compilation, preparation for data analysis, research	1.5	
13-18th	Interviews and meeting in Nuevo Tonosí and Playa Chiquita		6
19-26th	Final research, meeting at SOMASPA, data compilation, data analysis, preparation of final report, presentation, and report	7.5	
Total		**19**	**14**

Annex XIII. Budget

Description	Unit cost	Total cost
Round trip transportation to Nuevo Tonosí, per trip for four people	$36	$126
Renting of a house in Nuevo Tonosí, per day	$10	$80
Service of a guide on the field, per day	$10-15	$70
Transportation to farms for interviews		
Pick-up truck taxi, per day	$40	$40
Round trip transportation to Playa Chiquita, per trip for four people	$24	$24
Cell phone minutes, batteries, printing, binding, etc.		$28
Total		**$368**