

# **The Mexican Jaguar in the 21<sup>st</sup> Century: Present Situation and Management (Symposium in 2005; Proceedings Published November 2006)**

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**Title and Contents:** Skipped (pages 1-12)

## **Chapter 1 Priority Conservation Areas:** (pages 13-19)

### **Introduction:**

Habitat destruction is probably the greatest threat for the conservation of the jaguar. This species can be the cornerstone for conservation plans on a region or national scale, because they are already widely distributed and require large areas to survive and inhabit a great variety of ecosystems. Still, although the jaguar is the major predator of tropical America, few studies have looked at populations throughout the entire range. In 1989 it was estimated to have lost 66% of its distribution. Recent studies have confirmed the jaguar has disappeared from large parts of its historic range.

### **Objectives:**

The main objective is to identify the current distribution and priority areas for jaguar conservation in Mexico.

1. Determine the actual distribution
2. Determine priority areas
3. Outline boundaries for conservation areas

### **Goals:**

1. Effectively protect the jaguar habitat through implementation of various conservation measures.
2. Diminish the impact of direct threats to the jaguar like poaching and habitat destruction
3. Achieve a high percentage of community participation in conservation actions for the species.
4. Promote alternative sustainable activities that favor jaguar conservation in priority areas.

### **Current Distribution of the Jaguar in Mexico**

The historical distribution of the jaguar in Mexico included most tropical and subtropical regions from Sonora to Tamaulipas. Current distribution is greatly reduced. Models have been used to approximate the distribution.

### **Priority Conservation Areas**

One fundamental task in species conservation is to determine the priority areas for conservation. Selection of these areas is based on presence of populations, adequate habitat, and the level of threat due to human activities. The priority areas are divided into three groups: Priority I areas

are those regions are those regions in which it has been established that the jaguar still exists. Priority II areas are areas with large tract of jaguar habitat but for which no formal evaluation has been conducted for the persistence of jaguars. Finally, Priority III areas are regions where isolated sighting of jaguars have occurred but which don't have considerable natural vegetation needed to maintain a population of jaguars.

### **Priority Areas**

*Priority I Areas:* In these areas groups of researchers have developed jaguar research and conservation projects. In general they are sufficiently big to hold 100 or more animals. *Priority II Areas:* Some of these areas are big enough to hold 100 jaguars. Evaluate in a systematic manner the presence of jaguars in these areas.

*Priority III Areas:* These are sites where jaguars occasionally occur or where the landscape has been altered such that these populations will probably go extinct. We recommend that an evaluation be made of the jaguar in these areas.

### **Recommendations:**

1. Carry out a complete national jaguar census in all priority areas in order to determine the national conservation strategy.
2. Reinforce, consolidate and amplify research and conservation projects that are making significant impacts.
3. Apply standardized methods to the census and monitoring efforts for the jaguar and its prey.
4. Develop a GIS map of each of the priority areas
5. Identify the strengths of groups already in existence to help or train groups now being formed
6. Carry out workshops for the formation of regional groups and the design of medium term strategies.
7. Create community watch groups along with government authorities at city, state and federal levels.
8. Continue with environmental education and awareness campaigns in the priority conservation areas.
9. Establish an effective way to communicate with the local communities and deliver them information related to the conservation strategy
10. Evaluate sustainable use alternatives, and the commercial channels for natural products that are compatible with jaguar conservation.

## **Chapter 2**

### **Population and Habitat Viability Assessment: (pages 20-24)**

#### **Introduction:**

To have effective conservation actions it is necessary to determine the factors that are leading the species toward extinction. Tools are also needed to estimate the influence of these factors. Population and Habitat Viability Assessment (PHVA) is one of the most used tools for evaluating the extinction risk of a species.

**Objective:**

Reduce the probability of jaguar extinction in Mexico by identifying, prioritizing and carrying out management actions and conservation policies, which lead us to a management plan for the species.

1. Estimate jaguar extinction in each of the regions given current conditions
2. Identify the factors that can reduce extinction risk in each of the regions
3. Prioritize actions for each population
4. Share the information to all workshop participants
5. Delineate the obligations that different regions have for the overall conservation of the jaguar. (Ex: Jaguar population in NE Mexico must be 200 animals).

**Methods:**

All data required to run a PHVA and the steps to carry out the PHVA (skipped)

**Recommendations:**

The fundamental recommendation is to carry out a national PHVA that uses models from the various regions.

**Chapter 3**  
**Inventory and Monitoring:** (pages 25-35)

**Introduction:**

The use of cameras with a motion sensor or heat sensors to evaluate the presence and abundance of jaguars and other mammals is a relatively new tool. This tool is especially helpful when studying rare species or species that are difficult to observe.

In the case of cats this technique has been used to estimate the population size and density. Camera trapping is a non-invasive way to produce statistically robust density estimates with as little as two or three months of trapping. In some cases it has been used to estimate the abundance of jaguars and their prey. In Mexico this method has been used with success in Sonora and several other locations. Nevertheless, no standardized methodology exists so that different studies can be compared.

**Objective:**

Develop a standardized protocol for the evaluation of presence/absence of jaguars in Mexico.

**Preliminary Evaluation of Presence/Absence:**

To initiate a presence/absence study for jaguars in a particular location it is necessary to first understand the environmental and social conditions of the region. These are the steps to follow:

*Preparation of information:* First locate the study area using vegetation and population maps. It is important to use maps that identify priority areas and political boundaries.

*Meetings before fieldwork:* Meeting should be held with federal state and local government officials as well as with academics in order to obtain permits and contacts for fieldwork. Depending on the location meetings should also be held with ranchers or hunting clubs.

*Interviews with locals:* Interviews should be focused on residents, local authorities, hunters, academics NGOs, and researchers that work in the field. These interviews should be carried out to obtain specific local knowledge as to the location, activities and habits of jaguars; obtain skins or skulls; register animals hunted; and to identify information about prey.

In these initial interviews you can also find out information about the general socioeconomic status of the local area, their knowledge about local and regional fauna, and a general idea about jaguar abundance. It is suggested that the questionnaire be tested first and then adjusted for the area. It is important to identify allies and learn from similar efforts that have been successful. At each site it will be important to find out the best way to initiate contact and ask for participants in such as way that a positive relationship is established with the community.

*Verification in the Field:* It is recommended to collect a few signs in the company of the local residents such as scat, prints, number of jaguar trails in a kilometer. As a minimum it is recommended that you walk 5 kilometers in jaguar habitat to obtain information about scat and tracks. Also you should record data about the presence of prey and the validity of habitat maps used. At the same time you should conduct a socioeconomic analysis, security logistics and the types of studies that could be carried out in the area.

*Standardization of results:* The results of these initial probings should be expressed in a uniform manner, this will allow for selection of areas for the second phase. Data should be in the following format:

The results should be organized, evaluated and analyzed by reflecting the number of positive answers regarding the possibility of jaguars in the region. The evidence that should be weighted highest should agree with the following scale: (i) direct observations of jaguars; (ii) prey that have been killed by jaguars; (iii) records such as scat or tracks; (iv) commentaries or verbal accounts, indirect or unconfirmed, in the community referring to the presence of jaguars but not an actual sighting.; (v) no observations. In evaluating the certainty of the answers, common sense should be used in regards to determining the truth of each report.

### **Estimation of Abundance:**

Once areas have been identified as having jaguars through interviews or field visits, and having decided that there exists the possibility of a population, there are various methods to evaluate the population including: (i) footprint analysis, (ii) scat analysis, (iii) and the use of camera traps. Given the limitations that field surveys can present we recommend the use of camera trapping.

**Camera trapping methods and techniques:** Skipped (pages 29-35)

## **Chapter 4**

### **Nutritional Ecology: (pages 36-42)**

#### **Introduction:**

One of the fundamental questions to be answered is what causes variation in the density of jaguar populations. In this sense it is indispensable to determine the species that make up the jaguar's diet and the availability of these prey items in relation to environmental factors like type of habitat and time of year, or anthropogenic factors such as fragmentation of habitat or subsistence hunting.

In Mexico few studies exist about the diet of the jaguar

#### **Objective:**

To design a standardized protocol for the study of diet and the availability of jaguar prey in the priority conservation areas.

1. Determine jaguar diet
2. Identify potential prey
3. Determine prey availability

#### **Determination of Diet:**

To determine diet composition a scat analysis is recommended. This method permits the identification of prey to the species level.

*Identification of scat:* The jaguar and the cougar are sympatric species and their scat share many morphological characteristics. For this reason the only way to differentiate their scats is in the lab. The methods to identify scat in the field are based on footprints, or on a mixture of footprints and radio telemetry. However, these methods are subjective and have low confidence. Using bile acids to identify scat is highly accurate. It has been used on wild cats in the Neotropics and in Mexico with excellent results. It requires a reference catalog of species that can be confused with the jaguar. The use of DNA to identify jaguar scat is the most used method, because other than just distinguishing between species it can identify individuals. The biggest problem with this method is the cost, and that few samples are desirable for the extraction of DNA.

*Scat collection:* Scat can be found in many places; trails, roads, edges of washes. In places with many fallen leaves it is important to look under the leaves. If DNA analysis is to follow, scat should be placed in plastic bags or containers and should be dried immediately using filter paper or silica gel. To prevent contamination gloves and a mouth covering should be used. It is recommended to collect the insect fauna associated with the scat. For every scat the following data should be collected: GPS location, date, tentative identification, site description including vegetation and proximity to water, a photo should be taken if possible, name of collector, and observations.

*Size of Sampling Area:* The minimum area should be 60 X 100km or an area that corresponds to less than five individuals. The sampling area will not be at random because the goal is to collect

as many samples as possible. Sampling of the area should be done to maximize the likelihood of collecting scat from different individuals. At least 30 samples per season (dry and wet) should be collected. Although collection can be done year-round, collecting at the beginning and end of each season will allow for differences in diet to be observed. In areas that are inhabited by the puma it is necessary to double the number of scat samples collected.

*Identification of scat components:* Identification of scat components should be done through an analysis of bones and other remains, and through a microscopic analysis of hairs. To identify bones, hairs and other remains it is necessary to have a reference collection. Analysis of these data will be as frequency and percent of occurrence.

**Potential Prey and Availability of Prey:**

Prey abundance should be estimated using the camera traps. The results should be recorded as number of occurrences/ per 100 trap nights. An occurrence is defined as a photo of the species within a 24 hour period. In cases where you can be sure it was different individual the number of individuals can also be recorded.

*Area of sampling effort:* The study area should be a minimum of 100km<sup>2</sup> and covering all different habitat types available. At least 20 cameras should be set at a minimum of 1 km apart, so that they cover the whole study area. The sampling period should be for 20 days each season.

**General Recommendations:**

1. Carry out systematic sampling, applying the same effort in each location and season.
2. Use only a single lab for the identification of bile acids from the scat.
3. Prepare part of the scat for analysis of DNA, parasites, bacteria, and blood. Even though the analysis of DNA is the best method to identify the scat of a jaguar, it is also the most expensive and there is not a standardized protocol in existence.
4. Develop a storage protocol for all samples.
5. Use Camratrakker cameras to monitor prey.
6. Where possible conduct transects or grids to be able to compare the estimates derived from camera traps and other methods for estimating prey.

**Chapter 5**

**Anesthesia, Evaluation of Health, and Genetics: (pages 43-50)**

**Introduction:**

An important factor in conservation, is the health of the wild populations, until recently this has been largely ignored for jaguars. The increase in human pressures has produced an increased risk of infection, especially those diseases transmitted by domestic animals. There is increasing worry about the effects that disease is having on wild populations. However little exists on the disease of wild cats in Mexico and almost none on the jaguar. It is urgent to understand the health of the wild populations to more fully identify the risks that face that jaguar.

In all research projects biologists and veterinarians participate in the capture of animals. However, different techniques or types of anesthetics are used. Also, different tissues are collected for genetic or disease analysis. There is no central database where all the data collected resides. The Wildlife Conservation Society created a manual that standardizes methods for anesthesia and the evaluation of health.

**Objective:**

To design a standardized protocol related to anesthesia, evaluation of health, and genetics of jaguars in Mexico. This should be applicable to jaguars in different situations (i) free ranging jaguars, (ii) jaguars that are to be relocated, (iii) that are temporarily in captivity, and (iv) that are to be maintained in captivity.

**Management Plan:**

*Jaguars in the wild*

Anesthesia:

- Know the experiences of previous field projects
- Guarantee the safety of humans and animals
- Have a veterinarian with experience in great cats for the chemical containment
- Consult and revise the WCS manual
- Have standardized data collection that includes data about, age, sex, hour, food consumption, temperature, location, date, manner of trapping( noose, box, dogs).
- Make a list of required equipment for capture and anesthesia
- The anesthesia protocol should have information on the drugs, doses, administration and antidote.
- Have protocol for emergencies that includes materials, equipment and procedures
- Permanently identify the animal with a photograph, microchip, or tattoo.
- Determine the conditions for recuperation and releasing of the animal. (Including under what conditions the animal should not be released, based on the clinical examination. For those not to be released, identify what will happen to the animals: moved to captivity temporarily, permanently, or euthanized.)
- Compile, analyze and distribute the results. Compare experiences with the different anesthesia protocols. Begin a database.

Samples:

- Know the experiences of previous field projects
- Consult and revise the WCS manual
- Make a list of required equipment to obtain, conserve and evaluate samples.
- Have standardized data collection that includes the findings of the physical exam.
- Develop a protocol that limits the taking of samples
- Develop a list of diseases and tests for them.
- Determine which samples are required, how to obtain them and conserve them.
- Identify the maximum time samples can be kept in the field without being processed
- Standardize the tests within the laboratories
- Have a protocol for the evaluation of health of animals used as bait

- Develop a standardized protocol for necropsy
- Develop a national bank of biological and genetic samples.
- Evaluate the health of other wildlife and domestic animals at the same time as the evaluation of the jaguar's health
- Incorporate the protocols necessary, specifically related to emerging diseases (type of sample, analysis)
- Compile, analyze and distribute the results. Compare the results in different locations, times, species, and times of year.

**Veterinarians:**

- Have a director of vets with experience working with jaguars and other wild cats and with field experience.
- Have a workshop to discuss the standardization of protocols. Include other professionals that have field experience.
- Implement training courses for biologists and veterinarians involved in fieldwork

**Jaguars to be relocated**

- Develop beforehand the plan and logistics of the translocation.
- Apply the protocols for anesthesia, evaluation of health and genetics at the moment of capture.
- Develop a protocol to move the animal: characteristics of the box, duration of the procedure, hour of the day, fast, dehydration etc...
- Permanently identify the animal and place a radio collar to evaluate its movements
- In the case of recaptures, repeat the protocol for evaluation of health to know the changes associated with the new location.
- Implement monitoring of the health of other wildlife and domestic animals in the new area.

**Jaguars temporarily in captivity:**

- Evaluate potential places for temporary captivity: (What is the risk of introduction of disease to the wild population or vice versa)
- Develop beforehand the plan and logistics
- Develop a protocol to move the animal: characteristics of the box, duration of the procedure, hour of the day, fast, dehydration etc...
- Apply the protocols for anesthesia, evaluation of health and genetics at the moment of capture or at arrival at the captive.
- Apply the protocols for anesthesia, evaluation of health and genetics at the before freeing the animal.
- After freeing the animal, in the case of recaptures, repeat the protocol for evaluation of health to know the changes associated with the new location.
- Implement monitoring of the health of other wildlife and domestic animals in the new area.
- Register the origin of the animal
- Permanently identify the animal



**Jaguars that will stay in captivity:**

- Use the preventative medicine protocol of zoos
- Include these animals in reproductive programs (higher value if origin is known)
- Keep genetic material and biological samples when the origin is known
- Register the origin of the animal
- Permanently identify the animal
- Maintain the offspring in captivity, and include them in reproductive programs when their origin is known.
- Rehabilitation is very expensive, with risks to behavior and health. The populations in Mexico are not in such a critical situation that rehabilitation is an option of conservation.
- Develop a list of Mexican jaguars of known origin in all collections, to create a stud book.
- Determine the space necessary in different systems of confinement (from the transport cage to the exhibit cage).

**Evaluation of Health:** Skipped (pages 48-50)

Specific steps and samples to be taken to carry out a health evaluation.

## **Chapter 6**

### **Community Surveillance/Law Enforcement: Organization and Instrumentation (pages 51-56)**

**Introduction:**

The principal causes of the disappearance of the jaguar are accelerated by the growth of human populations and the excessive use of natural resources. Human activities generate directly and indirectly an enormous impact on the populations of this cat through the loss of habitat, poaching, and the capture of young for pets. These factors along with the hunting of their prey and agricultural activities have produced a number of depredation events by jaguars. When this happens many more jaguars are killed as a reprisal.

**Objective:**

1. Develop an inspection program to verify compliance with the law in places where there are captive jaguars, or jaguar products.
2. Promote awareness of the law referring to the protection and prohibition of hunting of the jaguar in Mexico.
3. Promote the participation of local groups and property owners in the land where the jaguar is distributed through the establishment of local watch groups whose objective is to enforce the protection of the species.
4. Formulate a protocol for announcements regarding the depredation of cattle by jaguars
5. Reinforce the national environmental education in coordination with the government, academia, and others.

**Inspection:**

- Carry out a program of inspection and verification for the legal possession of jaguars and their products in places of captivity like zoos, farms, circuses, private collections, private homes, businesses, pet stores and tanners.
- Implement special operatives within in areas of jaguar distribution to detect hunting and capture of wild animals. At the same time give priority to problems and complaints related to the hunting of the jaguar and the destruction if its habitat
- Attend to reports and complaints about depredation by jaguars and follow up so as to eliminate the loss of jaguars sue to reprisal.

**Surveillance/Law Enforcement:**

*Actions:*

- Promote and form local community surveillance committees in priority regions of the jaguar. The budget for these actions will be decided annually by PROFEPA.
- It is hoped that in the long term these community groups will form a net of environmental promoters for the conservation of the jaguar and natural resources.
- Make sure that there is interaction between these community groups at all levels.

**Environmental education:**

*Actions:*

- Establish a communication strategy focused on environmental regulations and the importance of jaguar conservation and its habitat in rural and urban communities.
- Use the public education system to disseminate the information to rural teachers and other environmental promoters.
- Participate directly in the promotion of rural development in the communities near jaguar priority areas, for the promotion of sustainable development.
- Work with development programs in indigenous towns.

## **Chapter 7**

### **Human/Jaguar Conflicts (pages 57-61)**

**Introduction:**

Explosive population growth brings habitat destruction, degradation and fragmentation, factors that are the principal problem of the jaguars across their distribution. The jaguar has been slowly disappearing from across its range principally due to massive deforestation.

**Objective:**

Generate a strategy to document, classify and resolve conflicts between jaguars and humans:

1. Identify the conflicts
2. Determine possible solutions to the conflicts
3. Identify the responsible players and participants in each conflict.

### **Identification of Conflicts:**

*Ranching:* This is the principal conflict between jaguars and humans. It occurs principally in livestock areas where the habitat of the jaguar has been extirpated or converted to grazing areas. Problems most commonly occur in areas where ranching is extensive and management minimal. The decrease in habitat has an indirect effect, the disappearance or lower levels of prey, which provoke the jaguar to look for food causing jaguar /livestock conflicts.

*Poaching/Subsistence hunting:* Subsistence hunting can lead to a decrease in prey and that can worsen the jaguar/livestock conflict. Many of the species hunted for human use are the same taken by jaguars. The impact of poaching is difficult to quantify, but appear to have significant effects in some populations. Although data are lacking it appears to be a big problem in many areas of Mexico. The biggest part of the poaching problem occurs in areas where jaguars and cattle coexist. Poaching is justified because it is argued that the cat kills livestock.

*Fragmentation and Destruction of Habitat:* Habitat fragmentation occurs through the opening or modernization of roads with out considering the impacts that this has on fauna in general and to the jaguar in particular. Although no records exist about the impact of new roads to the jaguar, it is probably large as in other cats. The increased intensity of vehicle traffic and the gradual separation of individuals, in certain cases leads to the isolation of populations and diminishes the overall population viability. The loss of biological corridors and the consequent erosion of populations can also affect population viability.

Increased tourism and tourism development, be it in the jungle or on the beach, that lacks planning leads to the reduction in jaguar habitat. This also can affect prey and jaguars as thick forest is lost and replaced by exotic species.

### **Solutions to Conflicts:**

1. Compensatory pay to ranchers who can demonstrate loss due to a jaguar and promise to better their livestock management practices. Create livestock insurance with very specific rules.
2. Increase the quality of natural habitat. Pay ranchers who can demonstrate that on their property abundant wild species exist. This mechanism will reward abundance and foment the care of diversity that accompanies this cat.
3. It is important to find alternative products that are viable, limit the impact of human activities on the jaguar, and are economically viable for rural populations. One example is the Jaguar Town of Oaxaca, where ranchers stopped ranching and make mescal or chili paste that is “jaguar friendly”. Another is the Sierra de Vallejo where an ecotourism park is also a jaguar sanctuary.
4. We need to recognize that poaching is a common problem and that PROFEPA doesn't have the resources to tackle the problem. Additionally we recognize that illegal activities are difficult to detect and it is even more complicated to discover the hunters red-handed.
5. We should emphasize the importance of the first community watch groups receiving the equipment and training necessary to carry out the mission. We believe that these groups can play an important role in the detection of illegal activities.

6. It is necessary to develop a memorandum of understanding between the different secretaries that provide resources to rural communities, or that could have effect on jaguar conservation, principally those that provide resources for transformation of forests or incentives for the creation of infrastructure.
7. Consolidate the governmental platform for the conservation of the jaguar and remove the political conflicts in the interior or between government organizations that stop or slow the research or conservation activities.
8. Carry out mass media public awareness campaigns about the value of the species. Change public perception so that the animal is no longer seen as dangerous or as a decorative object.
9. Make known the current government programs for the conservation of priority species so that the general public knows of them and can use the resources of the different institutions.
10. Reconvene the jaguar subcommittee and make sure it is represented in decisions about habitat. This group can also give answers in case of emergencies and influence the design of politics for the conservation of the specie and its habitat.
11. Create a distribution map and a population viability analysis so that decision makers can make scientifically informed decisions.

### **Appendix 1**

#### **Priority Areas for Conservation** (pages 62-69) Skipped all but Sonora (pg 67)

##### **Northwestern Sonora**

In Sonora is found the northernmost population of the jaguar. This population has served as a source for individuals that have recently colonized Arizona and Sonora (New Mexico), in the southwestern USA. In this region the jaguar has adapted to living in arid regions, as long as water and prey are within its reach. The priority area of Sonora is known as the Aros-Yaqui because it is found between the valleys of these two great rivers. The population is estimated at 150 jaguars. In this region studies have been conducted on the presence and density of the jaguar as well as the abundance of its prey, primarily through camera trapping. The institutions that have participated are Naturalia, Queretaro University and New Mexico State University, among others.

### **Appendix 2**

#### **Questionnaire to determine jaguar presences/absence** (pages 70-72)

Skipped

### **References and Authors** (pages 73-83)

Skipped